

Tideline



Don Edwards / Antioch Dunes / Ellicott Slough / Farallon Island / Marin Islands / Salinas River / San Pablo Bay

California Streamin': Steelhead Attempts a Comeback in California

by Cheryl L. Davis

In February 2008, two adult steelhead trout nicknamed Bonnie and Clyde made headlines when they were sighted, captured, and released by the Alameda Creek Alliance. The charge: the first pair of adult steelhead to attempt to spawn in the Alameda Creek

family, Salmonidae, which includes all salmon, trout and chars. Unlike its more famous family member, the king or chinook salmon, steelhead do not die upon spawning and are capable of returning more than once to spawn or reproduce.

If you've fished a stream or river in

large, strong fish can travel hundreds of miles to spawn in their streams of origin.

Members of this species are not locked into one form or the other but can shift forms as environmental pressures dictate. If drought conditions or manmade barriers prevent steelhead from reaching the ocean, they can remain rainbow trout. Conversely, resident rainbow trout can become steelhead and engage in anadromy if ocean access becomes available. This ability to live either life history pattern helps this species adapt to unpredictable environmental conditions. Also aiding this species in its evolutionary process is its chromosome number. Trout like other salmon family members have four sets of chromosomes rather than the normal two sets of most vertebrates. The design gives them increased diversity and hence survival.

Steelhead themselves have two individual life history forms, winter and summer. Winter-run steelhead or migration is made up of adults who have lived approximately two to three years in the ocean, migrating or entering streams when winter rains make passage to spawning grounds possible.

Populations of both run types occur in California coastal rivers and streams from Malibu Creek to north of the Oregon/California border. In California, coastal streams are dominated by winter-run steelhead, which return to spawn as soon as streams are high, mostly from December through early April.

Females make several nests or redds in



Adult steelhead

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(located in Union City) watershed in four decades. Once abundant in coastal and Central Valley rivers, the California population is presently less than half the population 30 years ago. Despite its incredible instinct for survival and complex life cycle, steelhead trout populations are federally listed as threatened along the central California coast, and as endangered on the southern California coast.

Steelhead are members of the salmon

California, it's likely you've angled for coastal rainbow trout (*Oncorhynchus mykiss irideus*). Unbeknownst to many, there are two forms of this one species: rainbow trout and steelhead trout. Rainbow trout are homebodies, living their entire lives in their natal streams while traveling steelhead trout spend most of their adult lives in the ocean. Steelhead are anadromous; born in fresh water they emigrate to the ocean to mature, returning to fresh water to spawn. These

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the gravel of the streambed and lay between 200-2,000 eggs. The larger the female, the more eggs she tends to produce. Gravel roughly the size of quarters (though gravel composition varies) is the preferred substrate. Using her strong tail to sweep away the gravel, she lays her eggs in the depression of a shallow pool or riffle. The stream's flowing water passes dissolved oxygen to the eggs, allowing them to thrive.

After the eggs are laid in the redd, a male quickly deposits his sperm or milt on the eggs, thereby fertilizing them. The female covers the nest with gravel from the next redd she excavates upstream. To become successful in passing its genes to the next generation male steelhead must be vigilant and alert. Oftentimes a sneaker male, an immature steelhead, is hovering nearby for the opportunity to sneak in and spawn with the female. Sneaker males can be steelhead that have not yet gone to sea or smaller males returning early from the sea. Sometimes these little guys are lucky to catch a female spawning in the absence of larger males so it seems a successful evolutionary strategy.



Juvenile steelhead with parr marks

Courtesy of UCSC

After three to four weeks, depending on water temperature, the eggs hatch. The newly hatched alevins (pronounced like the name Alvin) stay buried under the gravel and are nourished by a connected yolk sac. After two to three weeks juvenile steelhead called fry emerge and become parr, so named for the dark ovals which are present in a lateral line along their body.

Juvenile steelhead begin to stake out feeding stations where they will feed facing upstream, waiting for prey in the forms of drifting aquatic organisms and terrestrial insects. As the steelhead mature they



Rainbow trout, Kern River

Courtesy of CDFG

become more aggressive and often defend their feeding stations, nipping and moving aggressively towards other fish that make the mistake of coming too close.

Eventually, steelhead trout migrate to sea at one to three years of age at approximately six to 10 inches fork length (measure from the tip of the snout to the middle of the fork of the tail). After one to two years at sea they return at approximately 14-26 inches and three to 12 pounds. Steelhead can become quite large, weighing up to 55 pounds and measuring 45 inches.

Until steelhead trout migrate to the sea, they look identical to rainbow trout; they appear as greenish, silvery trout with numerous black spots on the tail fins and back and a pink or reddish lateral band. As the fish mature, the appearance of steelhead changes as they begin to go through smoltification, the process of becoming smolts. This process is a combination of physiological, morphological, biochemical and behavioral changes, including development of color changes and a tolerance for seawater, that take place in steelhead as well as other anadromous members of the salmon family in preparation for ocean survival. Steelhead trout generally develop a more pointed head, grow larger than rainbow trout and the reddish lateral band sometimes fades or disappears.

Out migrating steelhead generally leave the streams in spring or early summer depending on flows. Those migrating from their home streams to the sea feed on estuarine invertebrates and marine krill but consume smaller fish as they increase in size. Several studies have emphasized the importance of lagoons (areas where fresh-

water streams and rivers meet the sea) in young steelhead growth. At sea, fish, squid, crustaceans, and other small fish including other trout are all part of the diet. Steelhead can live as long as 11 years but six to seven years is more common.

Steelhead were once abundant in California's coastal and Central Valley rivers and streams. Because most streams and rivers in California have been dammed multiple times, steelhead runs to and from the ocean have been blocked. In addition, water diversions from dams and pumping have dried many streams which formerly provided deep pool summer habitat for fish. Water temperature is also a factor. Diversions and sediment from roads, logging, urbanization and construction coat spawning gravel, often smothering developing eggs.

The central California coast steelhead and south-central coast steelhead have been designated as Evolutionary Significant Units (ESU). An Evolutionary Significant Unit is a population of organisms that is considered distinct for purposes of conservation. The Endangered Species Act not only protects a species from extinction, it also protects populations of a troubled species. For instance, mountain lions, also known as pumas are federally listed as threatened in Florida, but not in California.

Both ESUs identified above were listed as threatened under the Endangered Species Act in 1997 by the National Marine Fisheries Service (NMFS); an agency administered by the National Oceanic and Atmospheric Administration (NOAA), a federal agency. NOAA also has designated many streams in California as

Critical Habitat for steelhead, determining that streams or sections of streams where steelhead reside are essential habitat to the survival of the species and require extra protection.

Though conservation efforts in the salmon family have focused heavily on salmon due to its commercial and recreational importance, in the last 10 years steelhead conservation and restoration has been receiving increasing attention. Conservation efforts have occurred and are on-going at the federal, state, tribal, regional, and local levels.

At the federal level, the Pacific Coast Salmon Recovery Fund was established by Congress in 2000 to support the restoration of all salmon species. The fund is overseen by NMFS and carried out by state and tribal governments. At the state level, California Department of Fish and Game developed the Steelhead Restoration and Management Plan in 1996 and have initiated steelhead monitoring and the restoration of stream habitat for this species.

At a local level the Salinas River Basin has been designated as Critical Habitat

for steelhead. The Salinas River National Wildlife Refuge encompasses the Salinas River Lagoon, an area identified as likely to contain small numbers of steelhead. Additionally, the Alameda Creek Fisheries Restoration Workgroup established in 1999 to restore steelhead to the Alameda Creek watershed released a January 2008 document which provides a conceptual recovery strategy for steelhead in Alameda Creek. Alameda Creek empties to the Bay near the Don Edwards San Francisco Bay National Wildlife Refuge and historically had yearly runs of steelhead. And a remnant run still exists. However the main barrier to upstream migration is the 10-foot drop structure between the Union Pacific Railroad and the Bay Area Rapid Transit (BART) tracks sometimes referred to as the BART Weir.

The Alliance has been organizing rescues of migrating salmon species, including steelhead for several years at this site. Bonnie and Clyde, the most recent example, had been radio-tagged and moved above the barrier to Stonybrook Creek. One month later, they were seen engaging in spawning behavior.

The growing evidence on how the BART Weir impacts steelhead populations resulted in the Alameda Flood Control District and Alameda County Water District announcing their goal to construct a fish ladder for steelhead and other fish by 2010.

Still, successes are small in the face of the devastating impact human activities have had on this magnificent species. On-going conservation and restoration efforts must continue and be intensified in the future with particular focus on the goals of removal or modification of existing dams that obstruct salmon migration, restoration of degraded habitat, acquisition of prime habitat, and improved water quality and stream flows.

Cheryl L. Davis is an Environmental Planner for the City of San Francisco and a Research Associate at California State University East Bay where she received her M.S. in Biology. Her thesis research identified two previously unrecorded aquatic snail species in restored marshes in southern Suisun Bay. She has also contributed to an upcoming report on the current and historical status of steelhead in streams from San Mateo County to Malibu County, California.

Volunteers – The Backbone of Our Refuges

This quarter's Refuge Reflections is written by Deputy Project Leader John Bradley.

The San Francisco Bay National Wildlife Refuge Complex is fortunate for its many dedicated volunteers who contribute thousands of hours each year. During Fiscal Year 2007, volunteers contributed 108,652 hours of their time for a savings in labor costs to the Complex of \$2,229,800. Incredibly, each of our volunteers contributed an equal or greater number of hours in FY07 as they did during the previous year. Annually these volunteers assist the Complex in meeting its goals to protect sensitive species, provide wildlife habitat, and educate the public about the importance of its role in the environment. They are the backbone of our agency and are truly appreciated.

A member of the volunteering community passed away recently and left a legacy of environmental advocacy and stewardship not only in regard to the San Francisco



Refuge Reflections

by John Bradley

Bay National Wildlife Refuge Complex but in the greater San Francisco Bay Area. Janice Delfino will be profoundly missed. Janice was one of the founding members of the Citizens Committee to Complete the Refuge. The Committee's mission is to "save the Bay's remaining wetlands by working to place them under the protection of the Don Edwards San Francisco Bay National Wildlife Refuge, and to foster world-wide education regarding the value of all wetlands."

Janice, her husband Frank, and other Committee members passionately promoted and pursued the public acquisition, preservation and restoration of the San Francisco baylands, tidal sloughs, mudflats and marshes, vernal pools and other critical wildlife habitats that are essential to the integrity and sustainability of the San

Francisco Bay estuarine ecosystem. In the field, Janice was tireless in her efforts to help protect endangered species like the California least terns at Alameda Point and assisted in administrative tasks such as affixing mailing labels onto thousands of copies of the *Tideline* newsletter every quarter.

I will always remember Janice as a loving individual who, in her unassuming manner, mentored staff and volunteers alike. She demonstrated the volunteer ideal of helping others.

Speaking for the staff of the San Francisco Bay National Wildlife Refuge Complex, let me share our gratitude for the time that Janice and ***all our volunteers***, have given toward protecting wildlife and the local landscape on which we all depend. ***Thank you! Your help has been invaluable. You are much appreciated.***