



## Salmon Protection And Watershed Network

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### **Summary of Relocation of Stranded Salmonids from Isolated Pools in the San Geronimo Creek Sub-Watershed, 2009**

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#### **Summary**

During the spring and summer months of 2009, a total of 55 steelhead in imminent danger of mortality were relocated from drying reaches on tributaries in the San Geronimo Creek sub-watershed to more stable creek habitat located downstream within the watershed, and no juvenile coho were observed during any surveys or relocation efforts. Extensive habitat surveys found fewer instances of juvenile salmonids in drying reaches than any previous year, likely due to the complete lack of spawning by adult coho in the San Geronimo Creek tributaries winter 2008/09. Fish were relocated from drying pools in Arroyo Creek, Larsen Creek, and North Fork of San Geronimo Creek. This was the eleventh year of SPAWN's salmonid rescue and relocation program, which began in 1999 under permits from the National Marine Fisheries Service (NMFS) and California Department of Fish and Game (DFG). To date, a total of 22,196 salmonids have been rescued and safely relocated by SPAWN.

#### **Introduction**

Coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) are found in the Lagunitas Creek Watershed, Marin County. California Coast coho salmon are listed as endangered under the State and Federal Endangered Species Act, while steelhead trout in this region are listed as threatened (Central California Evolutionary Significant Unit). The coho spawners that return to this watershed annually were considered to be the largest-remaining wild run along the Central Coast and one of the more stable populations in the state (Stillwater Sciences, 2008). Their current abundance in this watershed is estimated to be 90% of historical population numbers.

This report is a documentation of relocation efforts for the 2009 season within the San Geronimo Valley Sub-Watershed (Figure 1). Background and information on the populations and motivation for conducting this effort are described in previous reports (Walder and Steiner, 2001). The San Geronimo Valley (SGV) is the un-dammed headwaters of the Lagunitas Watershed, located in unincorporated west Marin County, California. The 9 square-miles of habitat in the SGV represent less than 10% of the total 102 square-miles of the entire Lagunitas Watershed, but provides coho spawning habitat

for up to 50% of the population<sup>1</sup> and an average of 40% of coho smolt rearing habitat (SPAWN, 2009).

The San Geronimo watershed has approximately 3,500 residents living on 1,500 parcels, and 40% of these parcels are directly within the 100-ft Stream Conservation Area. The creeks are very constrained by development and riparian habitat is quite degraded (Stillwater Sciences, 2009a). The current trend of development threatens to significantly increase destruction of riparian habitat, increase impervious surfaces and runoff that causes bank failures, sedimentation and other associated pollution of stream systems. Guidance for voluntary actions by landowners and Marin County Public Works officials has recently been published to reverse the trend of habitat degradation and work towards increased enhancement of salmon habitat (Stillwater Sciences, 2009b).

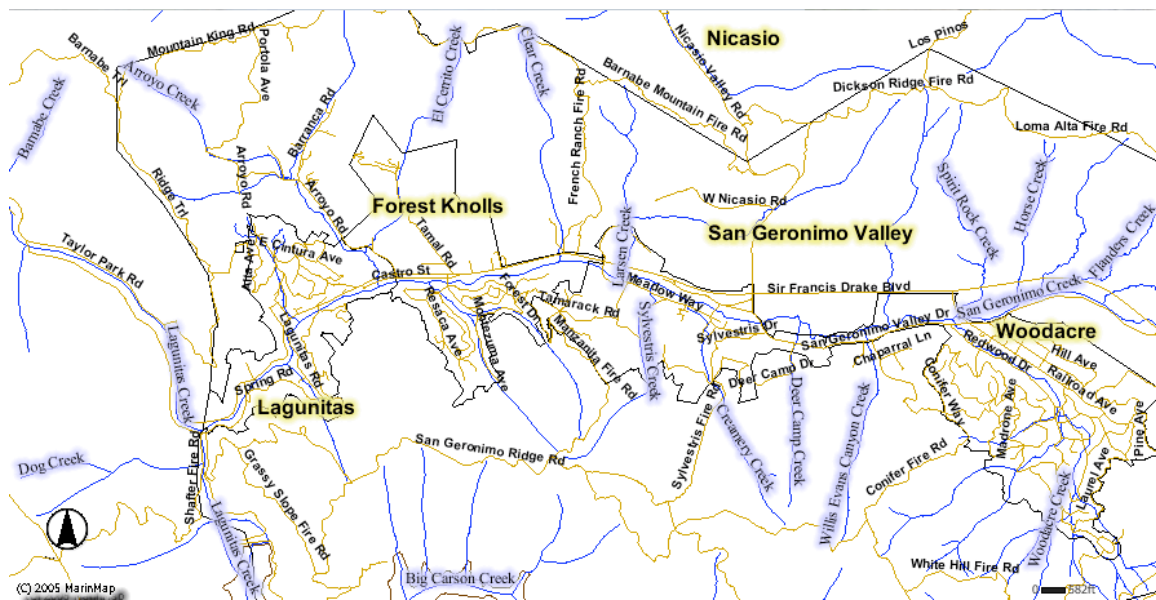


Figure 1. Creeks visually surveyed in 2009 include Arroyo, El Cerrito, Barranca, Larsen, Montezuma, Willis Evans Canyon, Woodacre, and the North Fork of San Geronimo Creek.

## Methods

San Geronimo Creek and tributaries were visually surveyed to determine presence and absence of salmonids and monitored to determine water flow, pool depth, and temperature in pools. Relocation efforts were launched when pools formed by decreasing spring and summer flows would become isolated from flow and were near drying completely. Relocation efforts were also planned based on current and previous years observations at known sites, then a survey was conducted to confirm the fish were in imminent danger of perishing. Rescue activities occurred under supervision of trained and experienced team leaders.

<sup>1</sup> Not including Olema Creek Watershed

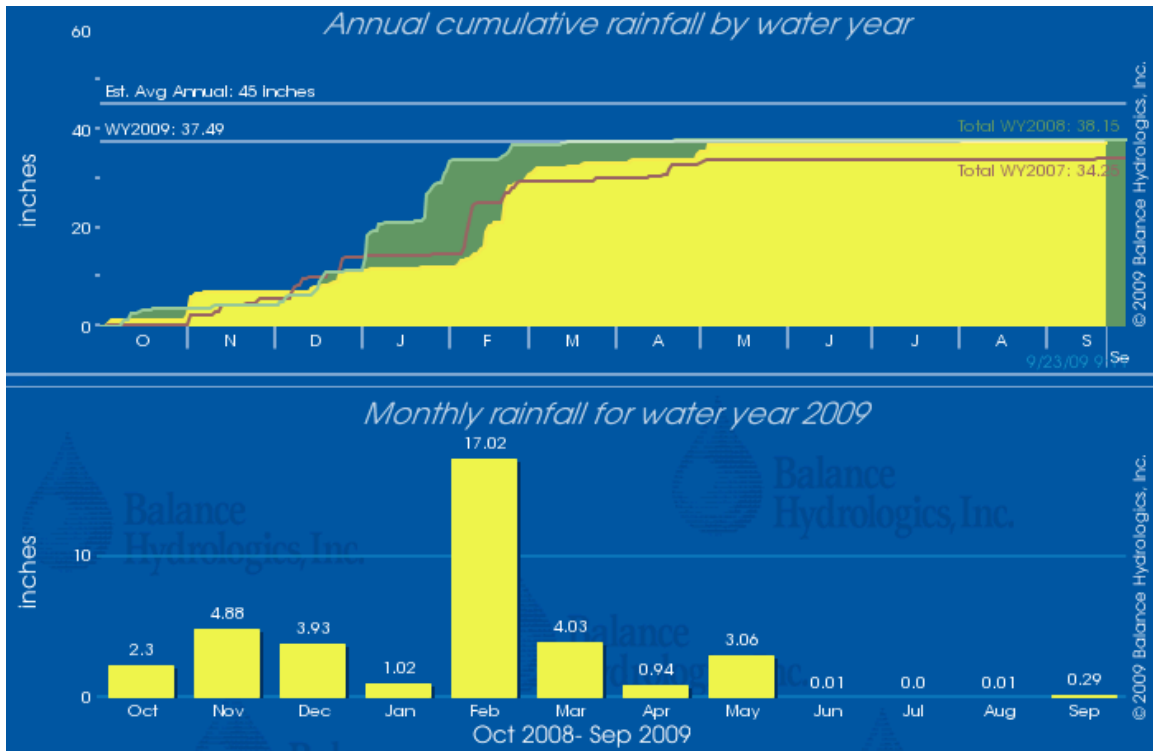


Figure 2. The 2009 rainfall measured along San Geronimo Creek at Lagunitas station (38.0114°N, 122.701°W).

Fish were dip-netted out of pools and placed in insulated coolers equipped with a battery-operated aerator. Approximately every 15-30 minutes, captured fish were transported to a perennial flow section downstream on their natal tributary or to San Geronimo Creek at or downstream of the confluence where they would have passed had they not become stranded. The exact release location was dictated by the availability of nearby pool habitat and issues of access on private property. To assure that pools where fish were relocated to were not overstocked, researchers relocated fish to several pools along stretches and made sure to release into pools where connectivity would allow fish to migrate both upstream and downstream.

Upon capture of fish, individuals were identified and lengths measured and stream conditions recorded. To further minimize disturbance and stress to fish, pools were netted for no more than 30 minutes. Netting was done by gently but swiftly sweeping a net through the water. If fish mortalities occurred, individuals were collected and frozen for delivery to NMFS.

## Results & Discussion

### *Habitat Surveying and Water Quality Measurements*

Eight tributaries to San Geronimo Creek were surveyed for salmonids and habitat conditions between April and September 2009 (Figure 1). Habitat surveying initially

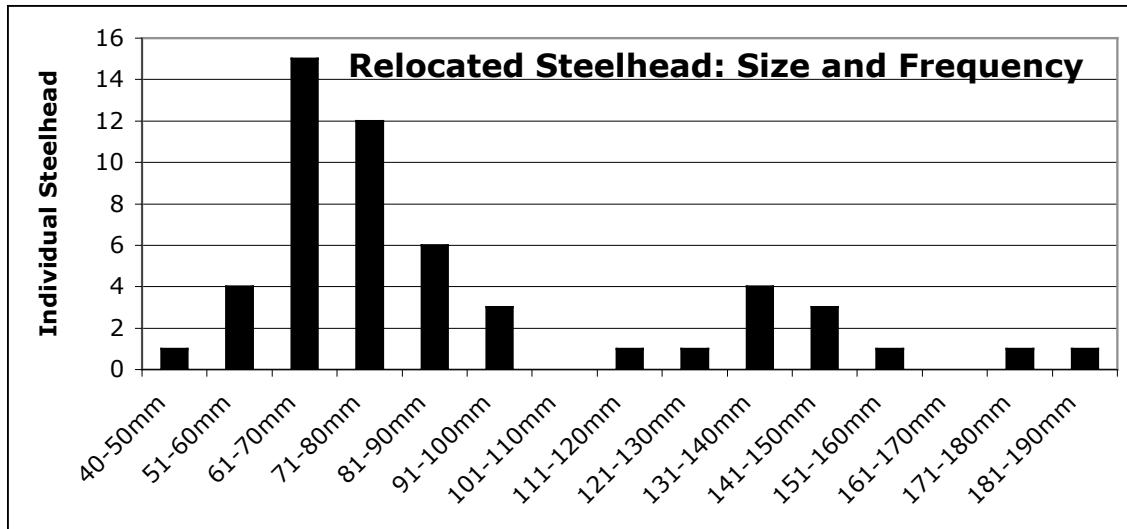


Figure 3. Size-frequency histogram of relocated steelhead. Young of the year fish were <94mm, while 1+ and 2+ year-old transitional parr were 114-181mm.

supported fish rescue efforts and continued in support of determining habitat connectivity, water quality conditions, and presence of stranded steelhead adult fish.

Rainfall as measured by Balance Hydrologics from the Lagunitas station shows annual cumulative rainfall by water year as 37 inches in 2009, 38 inches in 2008, and 34 inches in 2007, all well below the estimated annual average of 45 inches (Figure 2, Balance 2009). The low water year resulted in a deterioration of in-stream conditions for salmonids. Surveys began in April, but due to early May rains, relocation efforts did not begin until May 28 at Roys Pools when flow was disconnected and stagnant and July 24<sup>th</sup> in the tributary reaches, where fish occurred. Water quality measurements taken in late August show extremely low dissolved oxygen levels, from 1.8 – 7.5 mg/L, in isolated pools along San Geronimo Creek and tributaries moving from Woodacre Creek headwaters downstream to San Geronimo Creek at Castro St in Lagunitas (Table 1). Coho salmon and steelhead survival drops off dramatically when intra-gravel dissolved oxygen concentration falls below an average of about 8 mg/l (Reiser and Bjornn, 1979). Maximum growth for juvenile coho occurs at about 8.3 mg/l and mortality of coho is high at levels averaging 2.1 to 2.3 mg/l, with those surviving showing weight loss (Colt *et al.*, 1979).

#### *Salmonid Rescue and Relocation*

A total of 55 steelhead in imminent danger of mortality were relocated within the San Geronimo Creek Sub-Watershed between May 28<sup>th</sup> and September 2<sup>nd</sup>, 2009. Fish in need of relocation were rescued from drying pools in Arroyo Creek (23 steelhead), Larsen Creek (1 steelhead), North Fork San Geronimo Creek (21 steelhead) and Roy’s Pools (10 steelhead). The results of the salmonid rescues in 2009 are presented in Figure 3. There were no mortalities to steelhead fry during relocation efforts.

On May 28, 2009, SPAWN biologists joined MMWD biologists to rescue a total of 10 steelhead from Roy's Pools on San Geronimo Creek using electrofishing equipment. The lower pool rescue resulted 3 steelhead being rescued, consisting of 1 fry and 2 parr, and upper pool rescues resulted in 10 steelhead being rescued, 7 transitional parr >110mm.

Table 1. Water quality measurements August 31, 2009 along San Geronimo Creek and tributaries.			
Location	Temperature (°C)	Electrical Conductivity (µS)	Dissolved Oxygen (mg/L)
<b>Woodacre Creek at Carson culvert</b> 38 0'27.69"N 122 38'17.42"W	16.0	482	1.8
<b>Woodacre Creek at San Geronimo Creek</b> 38 0'46.91"N 122 38'46.63"W	16.0	413	7.5
<b>Larsen Creek</b> 38 0'57.41"N 122 40'27.39"W	15.4	415	4.2
<b>Arroyo Creek</b> 38 0'52.53"N 122 41'40.69"W	15.9	265	1.9
<b>San Geronimo Creek at Castro St. Pool</b> 38 050.49N 122 41'44.96"W	16.3	353	7.0

In 2009, all of juvenile salmonids relocated were steelhead, and Larsen Creek lacked any young of the year steelhead. No coho juveniles were observed in any creek surveys, which only focused on drying and disconnected reaches with approved access. A single coho juvenile was observed by MMWD Biologists during the summer of 2009 in San Geronimo Creek (Eric Ettlinger, 2009).

During relocation efforts, salmonids were relocated to several pools rather than depositing all individuals into one pool. This was done to minimize over-stocking pools with too many fish.

Roy's Pools is a large fish passage structure constructed in 1999, which replaced an impassable dam, with 3 large step-pools that fill and spill over copiously during high winter flows, an adjacent fish ladder which allows fish passage during low flows, and a large gravel bottom box culvert under San Geronimo Blvd. Roy's Pools had ceased flowing through the 3 large step-pools during the period of coho salmon smolt outmigration, and biologists from Stillwater Sciences were concerned that smolts had become stranded in these pools, hence the rescue effort (Frank Ligon, personal communication).

The occurrence of 9 large steelhead parr trapped in these pools suggests Roy's Pools is a migration barrier for juvenile fish. Over the last 3 years a total of 58 incidental takes of

endangered coho salmon have occurred at Roy's Pools due to the downstream migration conditions that this structure created. SPAWN hopes to work with NMFS to resolve this situation by designing and constructing improvements to the current fish passage structure at Roy's Pools.

In addition, the County culvert below Roy's Pools that runs under San Geronimo Valley Drive formed a migration barrier for both juvenile and adult salmonids when low flows went subsurface under a concrete barrier wall. The County was notified and they are studying outcomes of a design to fix this ongoing passage barrier.



Watershed Biologist Chris Pincetich, center, releasing rescued steelhead into San Geronimo Creek with SPAWN volunteers, where flow is continuous and habitat will support their survival. This photo accompanied an Associated Press story on the impact of California's drought on endangered salmon, and was featured in over 200 media outlets across the nation.

### **Acknowledgements**

We gratefully appreciate the dedicated assistance of many members of the community, including landowners who assisted us in gaining this valuable data. In particular we want to thank our volunteer Team Leaders and Valley residents Mel Wright and Al Pisciotta, as well as SPAWN's AmeriCorps Watershed Stewards Project Interns Blaine Vossler, Claire Go, and Andrew Griffin for helping to survey streams, ensure safe handling of all fish and accurate recording of field data.

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