STREAM INVENTORY REPORT

Railroad Gulch

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Railroad Gulch. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Railroad Gulch. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Railroad Gulch is tributary to the Big River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Railroad Gulch's legal description at the confluence with Big River is T17N R17W S24. Its location is 39°19'02" north latitude and 123°42'00" west longitude. Railroad Gulch is a second order stream and has approximately one mile of blue line stream according to the USGS Mathison Peak 7.5 minute quadrangle. Railroad Gulch drains a watershed of approximately 1.7 square miles. Elevations range from about 40 feet at the mouth of the creek to 1000 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is entirely within the Jackson Demonstration State Forest and is managed by the California Department of Forestry and Fire Protection for timber production and recreation. Vehicle access exists via Highway 1 to Caspar Little Lake Road to Jackson State Forest Road 772.

METHODS

The habitat inventory conducted in Railroad Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1994). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1994). All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth. Habitat unit types encountered for the first time are further measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Railroad Gulch to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Railroad Gulch habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. Channel dimensions were measured using hip chains, tape measures, and stadia

rods. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Railroad Gulch, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Railroad Gulch, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two respectively.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Railroad Gulch, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are

usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Railroad Gulch, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Railroad Gulch fish presence was observed from the stream banks, and four sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into *Habitat*, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Quattro Pro. Graphics developed for Railroad Gulch include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of October 17, 18, 22, and 23, 1996, was conducted by Mark Dombrowski and Craig Mesman (CCC). The total length of the stream surveyed was 5,683 feet with an additional 28 feet of side channel. Starting at 411 feet from the confluence with Big River, and extending upstream 1,526 feet, was a marshy area that was not surveyed.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.06 cfs on October 18, 1996.

Railroad Gulch is an F4 channel type for the entire 5,683 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 45 to 53 degrees Fahrenheit. Air temperatures ranged from 38 to 57 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 22% riffle units, 36% flatwater units, and 42% pool units (Graph 1). Based on total **length** of Level II habitat types there were 10% riffle units, 52% flatwater units, and 36% pool units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid- channel pools, 33%; step runs, 21%; and low gradient riffles, 20% (Graph 3). Based on percent total **length**, step runs made up 30%, mid-channel pools 20%, and runs 11%.

A total of 75 pools were identified (Table 3). Main channel pools were most frequently encountered at 87% and comprised 78% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-two of the seventy-five pools (29%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 75 pool tail-outs measured, 4 had a value of 1 (5.3%); 24 had a value of 2 (32%); 20 had a value of 3 (26.7%); 5 had a value of 4 (6.7%); and 22 had a value of 5 (29.3%) due to the substrate consisting of sand and gravel <0.5" (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Flatwater habitat types had a mean shelter rating of 33 and pool habitats had a mean shelter rating of 21 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 30. Main channel pools had a mean

shelter rating of 21 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Railroad Gulch. Graph 7 describes the pool cover in Railroad Gulch.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 3 of the 4 low gradient riffles measured (75%). Silt and clay was the next most frequently observed dominant substrate type and occurred in 25% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 93%. The mean percentages of deciduous and coniferous trees were 36% and 64%, respectively. Graph 9 describes the canopy in Railroad Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 86.2%. The mean percent left bank vegetated was 83.3%. The dominant elements composing the structure of the stream banks consisted of 3.5% bedrock, 0.0% boulder, 32.8% cobble/gravel, and 56.9% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 44.8% of the units surveyed. Additionally, 5.2% of the units surveyed had deciduous trees as the dominant vegetation type, and 15.5% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished on October 23,1996, in Railroad Gulch. The sites were sampled by Mark Dombrowski and Craig Mesman.

The first site sampled was habitat unit 113, a confluence pool approximately 5,595 feet from the confluence with Big River. This site had an area of 168 sq. ft. and a volume of 168 cu. ft. The site yielded 3 steelhead and 5 coho.

The second site included habitat units 162 through 167, a step run, mid-channel pool, run, riffle, run and mid-channel pool located approximately 6,943 feet above the creek mouth. The site yielded 6 coho and 1 salamander.

The third site sampled is located approximately 80 feet above the end of the survey. It is 140 feet long and consists of runs and pools. The site yielded no fish.

The fourth site sampled is located approximately 450 feet above the end of the survey. It is 300 feet long and consists of runs and pools. The site yielded no fish.

DISCUSSION

Railroad Gulch is a F4 channel type for the entire 5,683 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank placed boulders; fair for low stage weirs, single and opposing wing deflectors, channel constrictors and log cover; poor for medium stage weirs and boulder clusters.

The water temperatures recorded on the survey days October 17, 18, 22, 23, 1996 ranged from 45 to 53 degrees Fahrenheit. Air temperatures ranged from 38 to 57 degrees Fahrenheit. This is a good water temperature range for salmonids. However, to make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 52% of the total **length** of this survey, riffles 10%, and pools 36%. The pools are relatively shallow, with only 22 of the 75 (29.3%) pools having a maximum depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

Forty-seven of the seventy-five pool tail-outs measured had embeddedness ratings of 3, 4, or 5. Only 4 had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In Railroad Gulch, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was low with a rating of 21. The shelter rating in the flatwater habitats was slightly better at 33. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by small woody debris in all habitat types. Additionally, large woody debris contribute a small amount. Log and root wad cover structure in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Three of the 4 low gradient riffles measured had gravel as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 93%. This is a relatively high percentage of canopy. In general, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 86.2% and 83.3%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Railroad Gulch should be managed as an anadromous, natural production stream.

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from small woody debris. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

3) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

4) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

5) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and measured from the beginning of the survey reach.

0' Begin survey at confluence with Big River. Channel type is F4.

189' Corrugated metal culvert, 86' long x 6' wide.

411' Marshy pond habitat 1,526' long with no stream channel.

3,231' Right bank tributary.

3,351' Left bank trickling tributary.

4,361' Right bank dry tributary.

5,405' Left bank tributary.

5,572' Log debris accumulation, 15' long, 6' wide, and 3.5' high.

6,049' Log foot bridge.

6,311' Right bank flowing tributary.

6,421' Large woody debris is clogging channel and retaining 3' of sediment. Old log cribbing on the left bank.

7,011' Woody debris in channel retains 2' deep gravel.

7,397' End of survey. Right bank tributary contributes half of flow. The main stem becomes intermittent within the next several hundred feet. Two sites were electrofished above the end of survey and no fish were found.

7,432' A wooden footbridge crosses the creek.

References

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5