STREAM INVENTORY REPORT

Red Mountain Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Red Mountain Creek. 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 Red Mountain Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. A DFG spawning survey conducted in 1988 found chinook salmon in Red Mountain Creek.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for chinook salmon, 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

Red Mountain Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Mendocino County, California. Red Mountain Creek's legal description at the confluence with South Fork Eel River is T24N, R17W, S17. Its location is 39°55'40" North latitude and 123° 45'42" West longitude. Red Mountain Creek is a second order stream and has approximately 11.2 miles of blue line stream according to the USGS Piercy 7.5 minute quadrangle. Red Mountain Creek drains a watershed of approximately 12.4 square miles. Summer base flow is approximately 11 cubic feet per second (cfs) at the mouth, but over 100 cfs is not unusual during winter storms. Elevations range from about 550 feet at the mouth of the creek to 3,800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production and private rural residence. Vehicle access exists from Highway 101 via Highway 271 south to the cul-de-sac at its southern end. Follow the dirt road to the mouth of Red Mountain Creek.

METHODS

The habitat inventory conducted in Red Mountain Creek 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). Red Mountain Creek personnel were trained in May, 1997, by Scott Downie and Ruth Goodfield. 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 Red Mountain Creek 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. Additionally, two recording thermographs were deployed in Red Mountain Creek from July 1,1997 to the present to record

temperatures on a 24 hour basis during warm summer months.

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". Red Mountain Creek 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, range finders, 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 Red Mountain Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4). Additionally, a rating of "not suitable" (value 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 Red Mountain Creek, 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*, 1994. Canopy density relates to the amount of stream shaded from the sun. In Red Mountain Creek, 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 Red Mountain Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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 distribution in the stream. In Red Mountain Creek fish presence was observed from the stream banks, and two sites were electrofished using one Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes: 25.4, 12.5, 4.7, 2.37, and 0.85 mm (Valentine, 1995).

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 Red Mountain Creek 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 July 1 to July 9, 1997, was conducted by Ruth Goodfield (DFG), Jesse Robertson (WSP/AmeriCorps), and Alan Renger (CCC). The total length of the stream surveyed was 23,234 feet with approximately an additional 6,000 feet that was not surveyed because the landowner denied survey crews access.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 11.4 cfs on July 1, 1997.

Red Mountain Creek is a B3 channel type for the first 7,416 feet of stream reach surveyed, and an F3 type for the next 2,693 feet of stream surveyed. The next reach was not surveyed due to lack of landowner cooperation, but was estimated to be approximately 6,000 feet in length from USGS 7.5 minute topographic maps. The fourth stream reach is an F3 channel type for 8,244 feet, and the fifth stream reach is a B2 channel type. B2 channels are moderately entrenched, moderate gradient, riffle dominated channels with stable banks and predominantly cobble substrate. B2 channels are similar to B3, but with boulder as the dominant substrate. F3

channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 60 to 72 degrees Fahrenheit. Air temperatures ranged from 66 to 83 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 50% riffle units, 28% pool units, and 22% flatwater units (Graph 1). Based on total **length** of Level II habitat types there were 76% riffle units, 13% flatwater units, 9% pool units, and 2% culvert units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffles, 43%; mid-channel pools, 25%; and runs, 18% (Graph 3). Based on percent total **length**, low gradient riffles made up 56%, runs 7%, and mid-channel pools 6%.

A total of sixty-five pools were identified (Table 3). Main channel pools were most frequently encountered at 88% and comprised 88% 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. Fifty-seven of the 65 pools (88%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 65 pool tail-outs measured, one had a value of 1 (0.5%); 22 had a value of 2 (35%); 29 had a value of 3 (45%); two had a value of 4 (4%); and 10 had a value of 5 (15.5%) (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. Riffle habitat types had a mean shelter rating of 35, and pool habitats had a mean shelter rating of 19 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 23. Main channel pools had a mean shelter rating of 21 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Red Mountain Creek and are extensive. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Red Mountain Creek.

Table 6 summarizes the dominant substrate by habitat type. Boulder was the dominant substrate observed in six of the thirteen low gradient riffles measured (46%). Large cobble was the next most frequently observed dominant substrate type and occurred in 23% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 28%. The mean percentages of deciduous and coniferous trees were 87% and 13%, respectively. Graph 9 describes the canopy in Red Mountain Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 32%. The mean percent left bank vegetated was 45%. The dominant elements composing the structure of the stream banks consisted of 15.6% bedrock, 35.4% boulder, 49.0% cobble/gravel, and 0% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 14.6% of the units surveyed. Additionally, 61.5% of the units surveyed had deciduous trees as the dominant vegetation type, and 4.2% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on July 1, 1997, in Red Mountain Creek. The sites were sampled by Ruth Goodfield (DFG) and Jesse Robertson (CCC).

The first site sampled included habitat units 0001-0003, a riffle/run/pool sequence approximately 96 feet from the confluence with South Fork Eel River. This site had an area of 780 sq ft and a volume of 1,560 cu ft. The site yielded 29 young-of-the-year (YOY) steelhead rainbow trout (SHRT); six one-year+ (SHRT); one two-year+ SHRT; nine Sacramento suckers; and two California roach.

Site two included habitat units 0029-0031, a riffle/pool/riffle sequence located approximately 3,825 feet above the creek mouth. This site had an area of 990 sq ft and a volume of 2,425 cu ft. The site yielded 11 YOY SHRT, and one-year+ SHRT.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Red Mountain Creek.

DISCUSSION

Red Mountain Creek is a B3 channel type for the first 7,416 feet of stream surveyed, and an F3 type for the next 2,693 feet. The following 6,000 feet of stream were not surveyed due to access denial by the landowner. Stream reach #4 is an F3 channel type for 8,244 feet, and a B2 for the remaining 4,881 feet. The suitability of F3 channel types for fish habitat improvement structures is good for bank-placed boulders, single and opposing wing-deflectors; fair for low-stage weirs, boulder clusters, channel constrictors, and log cover; and poor for medium-stage weirs. The

suitability of B2 and B3 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, single and opposing wing-deflectors, and log cover; and good for medium-stage plunge weirs.

The water temperatures recorded on the survey days July 1 to 9, 1997, ranged from 60 to 72 degrees Fahrenheit. Air temperatures ranged from 66 to 88 degrees Fahrenheit. This is an acceptable water temperature range for salmonids. However, 72° F, if sustained, is near the threshold stress level for salmonids. This does not seem to be the case here, and Red Mountain Creek seems to have temperatures tolerable to salmonids. 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. DFG deployed three continuous recording thermographs on July 8, 1997, and the results are forthcoming.

Flatwater habitat types comprised 13% of the total **length** of this survey, riffles 76%, and pools 9%. The pools are relatively deep, with 57 of the 65 (88%) 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 for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

The LDA's in the system are retaining needed gravel. Any necessary modifications to them should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

Thirty-one of the 65 pool tail-outs measured had embeddedness ratings of 3 or 4. Only one 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 Red Mountain Creek, 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 19. The shelter rating in the flatwater habitats was the same at 19. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, bedrock ledges contribute a small amount. Log and root wad cover structures 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.

Nine of the 13 low gradient riffles fully measured had large cobble or boulders as the dominant substrate. This is generally considered unfavorable for spawning salmonids.

The mean percent canopy density for the stream was 28%. This is a relatively low percentage of canopy. Generally, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 32% and 45%, 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) Red Mountain Creek should be managed as an anadromous, natural production stream.

2) 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.

3) 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.

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

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 6976', should then be treated, if feasible, to reduce the amount of fine sediments entering the stream.

6) Increase the canopy on Red Mountain Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

PROBLEM SITES 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 South Fork Eel River. Channel type is a B3 for the next 7416'.
96'	Bioinventory site #1.
403'	Beginning of arch culvert under Hwy 101. Culvert is 555' in length. Outlet is in good condition; approximately 15' high X 15' wide. In its present condition the culvert poses no problem for upstream or downstream fish migration.
425'	Thermograph deployed; June 25, 1997.
958'	End of arch culvert. Evidence of significant ponding at the culvert inlet.
1031'	Slide on right bank (RB); approximately 90' long X 40' high. Contributing fines to the stream channel.
1103'	Two Sacramento squawfish, approximately 8" in length, observed from the streambanks by surveyors.
1235'	Old trash rack for culvert. End of ponding effect upstream of culvert.
3825'	Residence on LB.
3830'	Bioinventory site #2.
4087'	Failure on right bank (RB); approximately 150' long X 150' high. Contributing fines to stream channel.
4698'	Old road crosses stream.
4980'	Tributary enters from LB.
5713'	Small, spring-fed tributary enters from LB.
5783'	Thermograph deployed; July 1, 1997.
5813'	Fish skeleton, approximately 500mm, observed by surveyors.

5883' Lamprey eel redd observed in unit.

5915' Road on RB, approximately 50' above the stream.

6093' Two small tributaries enter from LB.

6976' Failure on RB; approximately 100' high X 60' long. Contributing fines to the stream channel.

7033' Failure on RB; approximately 80' high X 120' long. Contributing fines to the stream channel.

7413' Railroad car bridge crosses stream. Appears to be in good condition.

7417' Channel type changes from a B3 to an F3 fro the next 2693'.

8176' Failure on RB; approximately 40' high X 100' long. Contributing fines to the stream channel.

8350' Small tributary enters from LB.

9917' Holohan Gulch enters from RB.

10109' Access denied by landowner for the next 6000'. Channel type appears to be the same as the downstream reach. This section is identified as reach #3 in the data tables.

16109' Channel type is an F3 for the next 8244' of stream surveyed.

16908' Large failure on RB; approximately 100' high X 700' long. Talus slope at bottom of slide. Contributing fines and trees to the floodplain.

17801' Tributary enters from LB.

19302' Tributary enters from RB.

19942' Large debris accumulation (LDA) in stream channel; causing a plunge of 3'. Not a barrier to fish migration.

19974' Failure on LB; approximately 100' high X 60' long. Contributing fines to the stream channel.

21740' Failure on RB; approximately 200' high X 100' long. Contributing fines to the stream

channel.

21763' Failure on LB; approximately 70' high X 50' long. Contributing fines to the stream channel.

22713' Failure on RB; approximately 120' high X 200' long. Contributing fines to the stream. Stream flow is almost subsurface at through the slide area.

23542' Tributary enters from LB.

24353' Channel type changes from an F3 to a B2 for the remaining 4881' of stream surveyed.

25502' LDA blocking stream channel; approximately 8' high X 30' wide X 15' long. Not a barrier to fish migration.

25915' Failure on RB; approximately 80' high X 180' long. Contributing fines and wood to the stream channel.

26102' Tributary enters from the LB; approximately 50% of the streamflow. YOY steelhead rainbow trout observed in this tributary by surveyors. Channel is steep A-type. Not surveyed due to high gradient.

28102' Old dirt road crosses stream.

27356' YOY steelhead rainbow trout observed by surveyors.

27791' Failure on RB; approximately 80' high X 150' long. Contributing willows and fines to the stream channel.

28017' Stream gradient is increasing to about 4% - almost an A-type channel.

28040' Tributary enters from RB.

28759' Failure on RB; approximately 40' high X 100' long. Contributing fines to the stream channel.

28840' Failure on LB; approximately 20' high X 40' long. Contributing fines to stream channel.

29234' Channel gradient steepens to greater than 5%. Waterfall with 18' plunge is end of anadromy. End of survey.

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, CA.

Valentine, B. 1995.Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, 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