STREAM INVENTORY REPORT

ROCK CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1992 on Rock Creek to assess habitat conditions for anadromous salmonids. 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 Rock Creek. The objective of the biological inventory was to document the salmonid species present and their distribution. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

There is no known record of adult spawning surveys having been conducted on Rock 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.

WATERSHED OVERVIEW

Rock Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Mendocino County, California. Rock Creek's legal description at the confluence with the South Fork Eel River is T21N R16N S09. Its location is 39°40'55" N. latitude and 123°38'35" W. longitude. Rock Creek is a second order stream and has approximately 3.9 miles of blue line stream, according to the USGS Lincoln Ridge and Cahto Peak 7.5 minute quadrangles. Rock Creek drains a watershed of approximately 3.1 square miles. Elevations range from about 1,480 feet at the mouth of the creek to 3,000 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is privately owned and is managed for livestock and timber production. Vehicle access exists from Highway 101 at Laytonville, west on Highway 271 to a private road 2.3 west of Branscomb. The road is gated and is controlled by the Johnston Ranch.

METHODS

The habitat inventory conducted in Rock Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991). The California Conservation Corps (CCC) and contract seasonal Technical Advisors that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Rock Creek personnel were trained in May, 1992, by Gary Flosi and Scott Downie. This inventory was conducted by two

person teams.

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 Rock 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. Flows should also be measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed by David Rosgen (1985). 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 four measured parameters used to determine channel type: 1) water slope gradient, 2) channel confinement, 3) width/depth ratio, 4) substrate composition.

3. Temperatures:

Both water and air temperatures are taken and recorded at each tenth unit typed. The time of the measurement is also recorded. Both temperatures are taken in 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". Rock 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. Unit measurements included mean length, mean width, mean depth, and maximum depth. 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 Rock 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).

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 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 Rock 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 habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes.

8. Canopy:

Stream canopy is estimated using handheld spherical densiometers and is a measure of the water surface shaded during periods of high sun. In Rock Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results recorded.

9. Bank Composition:

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 Rock Creek, the dominant composition type in both the right and left banks was selected from a list of eight options on 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. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual. Biological inventory was conducted in Rock Creek to document the fish species composition and distribution. Two sites were electrofished in Rock Creek using one Smith Root Model 12 electrofisher. Each site was end-blocked with nets to contain the fish within the sample reach. Fish from each site were counted by species, measured, and returned to the stream.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat Runtime, a dBASE 4.1 data entry program developed by the California Department of Fish and Game (DFG). This program also processes and summarizes the data.

The Habitat Runtime program produces the following 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 Lotus 1,2,3. Graphics developed for Rock 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

HABITAT INVENTORY RESULTS

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

The habitat inventory of September 16-18, 28 and 29, 1992, was conducted by Ed Davis, John Cleckler, John Crittenden, and Warren Mitchell (CCC and contract seasonals). The total length of the stream surveyed was 13,223 feet, with an additional 982 feet of side channel.

Flows were not measured on Rock Creek.

Rock Creek consists of three channel types: from the mouth 3,589 feet a C2; next 7,291 feet a B1-1; and the upper 2,343 feet a B1. B1 channels are moderate gradient (2.5 -4.0%), moderately confined, boulder/cobble channels. B1-1 are moderate energy, bedrock controlled channels. C2 types are low energy, moderately confined channels with a mixture of large and small cobble as the dominate substrate.

Water temperatures ranged from 50 to 58 degrees fahrenheit. Air temperatures ranged from 46 to 81 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 35.4%, riffle types 33.5%, and flatwater 29.2% (Graph 1). Flatwater habitat types made up 35.4% of the total survey **length**, riffles 33.2%, and pools 26.2% (Graph 2).

Eighteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were low gradient riffles, 30.4%; mid-channel pools, 17.3%; and step runs, 16.2% (Graph 3). By percent total **length**, low gradient riffles made up 30.3%, step runs 25.7%, and mid-channel pools 12.6%.

Ninety-two pools were identified (Table 3). Main-channel pools were most often encountered at 62.0%, and comprised 67.1% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Twenty-nine of the 92 pools (32%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 84 pool tail-outs measured, one had a value of 1 (1.1%); 26 H34 had a value of 2 (37.0%); 43 had a value of 3 (46.7%); and 6 had a value of 4 (6.5%). On this scale, a value of one is the best for fisheries (Graph 6).

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 the highest shelter rating at 30.5. Flatwater habitats followed with a rating of 28.6 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 45.0, and scour pools rated 28.7 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Rock Creek and are extensive. Large and small woody debris are present but sparse in nearly all of the habitat types. Graph 7 describes the pool cover in Rock Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 37 of the 79 low gradient riffles (46.8%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 24.1% of the low gradient riffles (Graph 8).

Twenty-two percent of the survey reach lacked shade canopy. Of the 78% of the stream covered with canopy, 75% was composed of deciduous trees, and 25% was composed of coniferous trees. Graph 9 describes the canopy in Rock Creek.

Table 2 summarizes the mean percentage of the right and left stream banks covered with vegetation by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 68.0%. The mean percent left bank vegetated was 65.9%. The dominant elements composing the structure of the stream banks consisted of 6.2% bedrock, 19.6% boulder, 11.7% cobble/gravel, 2.9% bare soil, 16.0% grass, 6.2% brush. Additionally, 36.7% of the banks were covered with deciduous trees, and 0.7% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on Sept. 29, 1992 in Rock Creek. The units were sampled by John Crittenden and Warren Mitchell (CCC). All measurements are fork lengths (FL) unless noted otherwise.

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The first site sampled included habitat units 40-42, a run, low gradient riffle and step run, approximately 2,638 feet from the confluence with the South Fork Eel River. This site had an area of 1,445 sq ft, and a volume of 686 cu ft. The unit yielded 32 steelhead, ranging from 39 to 120mm FL.

The second site included habitat units 246-247, a step run and a mid-channel pool, located approximately 360 feet above below the end of the survey. This site had an area of 831 sq ft, and a volume of 644 cu ft. Twenty-nine steelhead were sampled. They ranged from 40 to 160mm FL.

DISCUSSION

Rock Creek has three channel types: C2, B1-1, and B1 respectively. The C2, B1-1, and B1 channel are all moderately suitable for some habitat improvement work. C2 channels are excellent for low stage plunge weirs, bank placed boulders, and various channel deflectors. B1-1 channels, susceptible to lateral migration, respond well to bank placed boulders and submerged shelters in straight reaches. B1 channel types are suitable for single and double wing deflectors, bank cover, overhead log cover, submerged shelters on meanders or straight reaches, and straight spawning weirs. Any structure site however, must be selected with care because of the possibility of stream bank erosion.

The water temperatures recorded on the survey days June 12-19, 1991 ranged from 50° F to 58° F. Air temperatures ranged from 49° F to 81° F. This is a very good water temperature regime for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling conducted.

Flatwater habitat types comprised 35.4% of the total **length** of this survey, riffles 33.2%, and pools 26.2%. The pools are relatively shallow with only 29 of the 92 pools having a maximum depth greater than 2 feet. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total 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. Therefore, 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 log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravels. Any necessary modifications to them should be done with the intent of metering the gravels 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.

Forty-nine of the 84 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 best for the needs of salmon and steelhead. In Rock Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean shelter rating for pools was low with a rating of 25.3. The shelter rating in the flatwater habitats was only slightly better at 28.5. However, 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, large and small woody debris 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.

Fifty-six of the 79 low gradient riffles had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy for the stream was 78%. This is a relatively high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Rock Creek should be managed as an anadromous, natural production stream.

2) 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.

3) 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 at hand.

4) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

5) 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.

PROBLEM SITES AND LANDMARKS

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

0' Begin survey at confluence with South Fork Eel River. This reach of Rock Creek is a C2 channel. There is an isolated pool .4' deep at mouth.

623' Young-of-the-year (YOY) salmonids observed.

2076' 3' diameter log retaining 2' of gravel and causing subsurface water flow.

2638' Vehicle bridge 10' long x 26' wide x 7' high.

3499' Channel type changes to a B1-1.

3899' Dry tributary enters from left bank. Many roach observed in main channel.

5015' Large woody debris (LWD) spans creek causing water diversion between units 82 and 83. YOY observed.

6161' Dry tributary enters from left bank.

6746' Dry braided channel units 117-123. YOY salmonids observed both above and below these units.

7058' Right bank erosion 20' high x 45' long contributing gravel and fines into the channel.

8045'Small woody debris accumulation 15' wide x 2.5' high.

8526'Log bridge 40' wide x 12' long x 9' high in good condition.

10799'Channel changes to a B1 channel type.

11716'Cascade through boulders and bedrock with steps up to 5' high, gradient > 20%.

11842'Old Humboldt crossing in very poor shape. Logs down in stream. YOY salmonids observed above this feature.

12704'Intermittent tributary enters from left bank.

13714'Gradient increases to approximately 40%, boulder and bedrock cascade up to 9' high. Above roughs stream gradient decreases with alternating step runs and riffles. No fish observed. End of survey.

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

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Dammed Pool	[DPL]	6.5