STREAM INVENTORY REPORT

Big Rock Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1994 on Big 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 Big 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 Big Rock Creek. 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.

WATERSHED OVERVIEW

Big Rock Creek is a tributary to Ten Mile Creek, a tributary to the South Fork Eel River, a tributary to the Eel River, which drains to the Pacific Ocean. It is located in Mendocino County, California. Big Rock Creek's legal description at the confluence with Ten Mile Creek is T22N R15W S27. Its location is 39.7364 degrees north latitude and 123.5158 degrees west longitude. Big Rock Creek is a second order stream and has approximately 4.6 miles of blue line stream, according to the USGS Cahto Peak 7.5 minute quadrangle. Big Rock Creek drains a watershed of approximately 3.1 square miles. Elevations range from about 1,470 feet at the mouth of the creek to 3,460 feet in the headwater areas. Grassland, oak woodland, and Douglas fir forest dominate the watershed. The watershed is privately owned and is managed primarily for rangeland. The nearest vehicle access exists via U.S. Highway 101, approximately 3.8 miles north of Laytonville. Foot access is available from Highway 101 by crossing Ten Mile Creek to the mouth of Big Rock Creek.

METHODS

The habitat inventory conducted in Big Rock Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991). The California Conservation Corps (CCC) Technical Advisors that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Big Rock Creek personnel were trained in May, 1994, by Gary Flosi and Scott Downie. This inventory was conducted by a two person team.

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 Big 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 measured 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". Big 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 Big 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 Big 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 Big 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 Big 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 Big Rock Creek to document the fish species composition and distribution. Three sites were electrofished in Big 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. 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 Lotus 1,2,3. Graphics developed for Big 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

The habitat inventory of July 14 through August 2, 1994 was conducted by Ruth Goodfield and Will Abel (CCC). The total length of the stream surveyed was 20,803 feet, with an additional 566 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.19 cfs on July 15, 1994.

Big Rock Creek is an F4 channel type for the lower 9,710 feet of stream reach surveyed (Reach 1). The remaining 11,093 feet of stream surveyed is a B4 channel type (Reach 2). F4 channels are flat (<2% gradient), entrenched and meandering streams, with gravel as the dominant substrate. B4 channels are moderately entrenched and moderately sloped (2-4% gradient), with stable banks and predominantly gravel substrate.

Water temperatures ranged from 66 to 83 degrees Fahrenheit. Air temperatures ranged from 72 to 97 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, riffles made up 34%, pools 33%, and flatwater types 32% (Graph 1). Flatwater habitat types made up 42% of the total survey length, pools 32%, and riffles 26% (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, 32%; runs, 23%; and mid-channel pools, 19% (Graph 3). By percent total length, low gradient riffles made up 24%, runs 22%, low gradient riffles 24%, and mid-channel pools 20%.

One hundred seventy-nine pools were identified (Table 3). Main-channel pools were most often encountered at 57%, and comprised 63% 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. Ninety-six of the 179 pools (54%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 179 pool tail-outs measured, twelve had a value of 1 (7%); seven had a value of 2 (4%); 140 had a value of three (78%); and 20 had a value of 4 (11%). 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. Pool habitat types had the highest shelter rating at 36. Flatwater habitats followed with a rating of 18 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 41. Main channel pools had a mean shelter rating of 36 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 124 of the 171 low gradient riffles (73%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 23% of the low gradient riffles (Graph 8).

Twenty percent of the survey reach lacked shade canopy. Of the 80% of the stream covered with canopy, 88% was composed of deciduous trees, and 12% was composed of coniferous trees. Graph 9 describes the canopy in Big 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 52%. The mean percent left bank vegetated was 48%. The dominant elements composing the structure of the stream banks consisted of 42% cobble/gravel, 31% bare soil, 22% boulders, and 5% bedrock. Additionally, 44% of the banks were covered with deciduous trees, 35% with grass, 17% with brush, and 3% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on July 8, 1994 in Big Rock Creek. The units were sampled by Ruth Goodfield and Will Abel (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled was Habitat Unit #045, a mid-channel pool, approximately 1,488 feet from the confluence with Ten Mile Creek. This site had an area of 495 square feet, and a volume of 347 cubic feet. The unit yielded 14 steelhead/rainbow trout, ranging from 52 mm to 146 mm long, five coho salmon, ranging from 48 mm to 65 mm long; and 298 California roach, which were not measured.

The second site sampled was Habitat Unit #204, a rootwad enhanced lateral scour pool, located approximately 226 feet below a railroad flatcar road crossing, and 10,526 feet above the creek mouth. This site had an area of 420 square feet, and a volume of 210 cubic feet. Sixteen steelhead/rainbow trout were collected. They ranged from 56 mm to 110 mm long. Five coho salmon were collected, ranging from 51 mm to 67 mm long. Forty-two California roach were sampled, but not measured.

The third site sampled was upstream from a natural barrier, 200 feet above the end of survey. The barrier observed is a waterfall, 15 feet in height. The habitat unit was a rootwad enhanced lateral scour pool. The site had an area of 126 square feet, and a volume of 63 cubic feet. Three resident steelhead/rainbow trout were sampled, ranging from 45 mm to 174 mm long.

DISCUSSION

The lower reach of Big Rock Creek is classified as an F4 channel. F4 channels are suitable for certain types of fish habitat improvement structures. They are good for bank-placed boulders, fair for channel constrictors and log cover structures, and poor for medium-stage weirs and boulder clusters. The upper 11,093 feet of stream surveyed is a B4 channel type. B4 channels are excellent for low-stage plunge weirs, boulder clusters,wing deflectors and log cover structures. Any structure sites must be selected with care, so that problems with stream bank erosion and structure stability are not created.

The water temperatures recorded on the survey days July 7 to August 2, 1994 ranged from 63 to 83 degrees Fahrenheit. Air temperatures ranged from 72 to 97 degrees Fahrenheit. The warm water temperatures were recorded throughout the survey. These warmer temperatures, if sustained, are above the threshold stress level for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 42% of the total length of this survey, riffles 26%, and pools 32%. The pools are relatively deep with 96 of the 179 pools having a maximum depth greater than two feet. 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.

One hundred sixty-six of the 179 pool tail-outs measured had embeddedness ratings of 3 or 4. Only twelve had embeddedness ratings of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In Big 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 36. The shelter rating in the flatwater habitats was slightly lower at 18. 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, root mass and undercut banks 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 structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

One hundred forty-four of the 171 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 80%. This is a high percentage of canopy, since 80% 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) Big Rock Creek should be managed as an anadromous, natural production stream.

2) Temperatures in this section of Big Rock Creek, as well as upstream, should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

3) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites, like the site at 17,781', should then be treated to reduce the amount of fine sediments entering the stream.

4) 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.

5) Increase the canopy on Big Rock Creek by planting willow, alder, 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.

6) 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.

7) 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.

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.

Position (ft):	Comments:
0'	Start of survey at confluence with Ten Mile Creek. The first 9,710 feet of stream surveyed is an F4 channel type. Flow measured at 0.19 cfs.
1079'	Dead coho (54mm) found in bottom of pool.
1488'	Bioinventory site #1.
1880'	Dry Tributary enters right bank.
2015'	More than seven dead young-of-the-year fish in a 300' reach. Water temperatures are high.
3525'	Spring on the right bank.
5407'	Road fords creek - no longer in use.
8804'	Bioinventory site #2.
9070'	Railroad flatcar bridge crosses creek. Dry tributary enters left bank.
9711'	Channel type changes to a B4 for remaining 11,093 feet of survey.
11073'	Dry tributary enters left bank.
12548'	Flatcar bridge crosses stream. Landowner calls this Greenbridge Road.
12738'	Dry tributary enters left bank.

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15877' Road fords creek. The ford appears to be unused.

17781' Slope failure on both banks, large boulders cut loose from banks. Significant lateral bank erosion.

20011' Jeep trail fords creek, still active.

20172' Dry tributary enters left bank.

21369' End of survey. Fifteen foot waterfall at the base of Big Rock; appears to be a natural barrier.

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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