STREAM INVENTORY REPORT

BULL CREEK (MIDDLE REACH)

INTRODUCTION

A stream inventory was conducted during the summer of 1991 on Bull 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 Bull Creek. The objective of the biological inventory was to document the salmonid species present and their distribution in the stream. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

Adult spawning surveys conducted in December 1987, January 1988, December 1988, and January 1990, documented chinook salmon, coho salmon, and steelhead trout in Bull 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

Bull Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Humboldt County, California (Figure 1). The legal description at the confluence with the South Fork Eel River is T1S R2E S34. Bull Creek is a fourth order stream. The total length of blue line stream, according to the USGS Bull Creek and Weott 7.5 minute quadrangles is 21.2 miles. Bull Creek drains a watershed of approximately 38.1 square miles. Summer base flow is approximately 2-3 cfs at the mouth, but over 5,000 cfs is not unusual during winter storms. Elevations range from about 160 feet at the mouth of the creek to 3,000 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is owned by the State of California and is managed as a State Park. Vehicle access exists west from U.S. Highway 101 at Dyerville via Bull Creek Road. This road accesses the mouth of Bull Creek and parallels the stream channel, crossing the creek four times. The middle reach of the stream begins above the

confluence with Burns Creek.

METHODS

The habitat inventory conducted in Bull 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). Bull Creek personnel were trained in May and June, 1991, 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 Bull Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Discharge is measured in cubic feet per second using a current flow meter. Measurements are taken at the downstream end of the stream or reach being inventoried. Flows should also be measured at major tributary confluences. Flow was not measured in Bull Creek.

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 operations 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 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". Bull 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. Depth of the pool tail crest at each pool habitat unit was measured at 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 Bull 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 Bull 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 Bull Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The percentage of the total canopy area was then further analyzed and recorded according to whether it was composed of either coniferous or deciduous trees.

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 Bull 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. 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 Bull Creek to document the salmonid species composition and distribution. Three sites were electrofished in Bull Creek using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, measured, and returned to the stream.

DATA ANALYSIS:

Data from the habitat inventory form is entered into Habtype, a dBASE 3+ data entry program developed by the Department and Fish and Game. From Habtype, the data is summarized by Habtabs, a dBASE 4.1 program in development by DFG.

The Habtabs program produces the following summary 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 the middle reach of Bull 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 Middle Reach of Bull Creek inventory of July 3, and 8-11, 1991, was conducted by Shea Monroe, Craig Mesman, and Toni Sartori (CCC). The total length of this reach was 6,049 feet, with an additional 259 feet of side channel.

Bull Creek (middle reach) is an A2 channel type for its entire 6,049. A2 channels are steep (4-10% gradient), very well confined streams, with stable banks.

Bull Creek, Middle Reach

Water temperatures ranged from 55 to 71 degrees fahrenheit. Air temperatures ranged from 60 to 87 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 35.0%; flatwater types made up 33.3%; and pools 31.7% (Graph 1). Flatwater habitat types made up 44.5% of the total survey **length**, riffles were 33.3%, and pools 22.2% (Graph 2).

Thirteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were step runs, 20.8%, low gradient riffles, 15.0%, and high gradient riffles, 15.0% (Graph 3). By percent total **length**, step runs made up 31.3%, low gradient riffles, 17.6%, and high gradient riffles, 11.7% (Table 2).

Thirty-eight pools were identified (Table 3). Main channel pools were most often encountered at 71.0%, and comprised 75.0% 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. Thirty-seven of the 38 pools (97%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 36 pool tail-outs measured, zero had a value of 1, 9 had a value of 2 (25.0%); 13 had a value of 3 (36.1%); and 14 had a value of 4 (38.9%). On this scale, a value of one is 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 62.1. Flatwater habitats followed with a rating of 53.0, and pool habitats had a rating of 34.2 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 40.91, and main channel pools rated 31.5 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Boulder was the dominant substrate observed in eight of the 18 low gradient riffles (44.4%). Gravel was the next most frequently observed dominant substrate type, and occurred in 22.2% of the low gradient riffles (Graph 8).

Seventy-three percent of the survey reach lacked shade canopy. Of the 27% of the stream covered with canopy, 97% was composed of deciduous trees, and 3% was composed of coniferous trees. Graph 9 describes the canopy in middle reach of Bull 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 40.5%. The mean percent left bank vegetated was 47.1%. The dominant elements composing the structure of the stream banks consisted of 27.5% bedrock, 33.3% boulder, 5.8% cobble/gravel, 5.8% bare soil. Additionally, 27.5% of the banks were covered with deciduous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three electrofishing sites were sampled on Bull Creek. The objective was to identify fish species and distribution. The units were sampled on July 24 and 25, 1991, by Toni Sartori and Craig Mesman (CCC). Each unit was end-blocked with nets to contain the fish within the sample reach. The fork lengths were measured and recorded, and the fish returned to the stream.

The first unit sampled was habitat unit 157, a glide, approximately 20,450 feet from the confluence with the South Fork Eel River. This site had an area of 8,750 sq ft, and a volume of 7,875 cubic feet. The unit yielded six sculpin and two stickleback. One steelhead YOY was also observed but not caught.

The second sample unit was habitat unit 362, a mid-channel pool, located near the State Park shooting range approximately 49,614 feet (9.4 miles) above the creek mouth. This site had an area of 459 sq ft, and a volume of 688.5 cu ft. The unit yielded eleven steelhead, ranging from 40 to 160mm fork length, and four

sculpin.

The third unit sampled was habitat unit 644, a plunge pool, located approximately 64,820 feet (12.3 miles) above the creek mouth. The site had an area of 336 sq ft, and a volume of 168 cu ft. The unit yielded 27 steelhead, ranging from 35 to 126mm fork length, and one lamprey, 76mm in length.

DISCUSSION

The A2 channel type is generally not suitable for fish habitat improvement structures. A2 channels are found in high energy, steep gradient stream reaches. They have reaches dominated by boulders, and do not retain gravels very well, but do have stable stream banks. Usually within the A2 channel, there are zones of lower gradient where structures designed to trap gravels can be constructed. This seems to be the case in the middle reach of Bull Creek, but any structure sites must be selected with care because of the high stream energy which can create problems with stream bank erosion and structure stability.

The water temperatures recorded on the survey days ranged from 55 F to 71 F. Air temperatures ranged from 60 F to 87 F. These water temperatures, if sustained, are above the threshold stress level for salmonids. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and more extensive biological sampling conducted.

Flatwater habitat types comprised 44.5% of the total **length** of this survey, riffles 33.3%, and pools 22.2%. The pools are relatively deep with 37 of the 38 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 third and fourth order streams a primary pool is defined to have a maximum depth of at least three 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.

Bull Creek, Middle Reach

Twenty-seven of the 36 pool tail-outs measured had embeddedness ratings of 3 or 4. None 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 Bull 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 34.2. The shelter rating in the flatwater habitats was better at 53.0. 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. 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.

Eight of the 18 low gradient riffles had boulder as the dominant substrate. Only six of the low gradient riffles had gravel or small cobble as the dominant substrate. This is generally considered poor for spawning salmonids.

The mean percent canopy for the survey reach was only 27%. This is a very low percentage of canopy, since 80 percent is generally considered desirable. Elevated water temperatures could be reduced by increasing stream canopy. Cooler water temperatures are desirable in Bull Creek. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Bull 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) There are several log debris accumulations present on Bull Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done in a manner that will not release an overabundance of fine sediment into the system.

5) 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.

6) 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.

7) Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Fish passage should be monitored, and improved where possible.

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 of the middle reach of Bull Creek 45,583 feet from the confluence with the South Fork Eel River. Channel changes from a C2 to an A2 channel type.

342' 12' diameter boulders in the channel. Left bank slump, contributing alders into the channel.

475' Tributary enters from the left bank. Redds observed 100' upstream.

732' Log and debris accumulation (LDA) 30' wide x 15' long x 10 high, retaining gravel and cobble. Young-of-the-

year and 1+ salmonids observed above LDA.

1147' Right cutbank 20' high x 66' long. Dry overflow channel on right bank.

1228' YOY salmonids observed.

1520' Right bank is vertical bedrock 135' high x 330' long.

1645' Overflow channel 15' from main channel on the right bank.

1875' Overflow channel on the left bank. Bedrock outcrop on the right bank.

1957' 1+ salmonids observed.

2027' Overflow channel on right of main channel.

2235' Left bank erosion 40' high, contributing boulders and fines into the channel.

2613' Right bank erosion 200' high x 400' long.

3404' YOY salmonids observed.

3475' Right bank erosion 150' high x 130' long, contributing fines into the channel.

3835' Vehicle bridge crosses the channel 25' wide x 36' long x 30' high.

3923' Plunge over boulders, 3' high.

4736' Pool caused by 5' high plunge over boulders.

4776' Left bank erosion 100' high x 260' long.

5036' Right bank erosion between the channel and Bull Creek Road.

5383' Right bank erosion 60' high, below the road.

Bull Creek, Middle Reach

5512'	Pool caused by 9' high plunge.
5733'	Small tributary enters from the right bank.
6049'	End of middle survey reach. Channel changes from an A2 to a B1 channel type.

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