STREAM INVENTORY REPORT

BUTTE CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1993 on Butte 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 Butte 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 Butte 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

Butte Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Humboldt County, California. Butte Creek's legal description at the confluence with the South Fork Eel River is T3S R3E S10. Its location is 40°13'18" N. latitude and 123°49'15" W. longitude. Butte Creek is a first order stream and has approximately 1.6 miles of blue line stream, according to the USGS Miranda 7.5 minute quadrangle. Butte Creek drains a watershed of approximately 4.5 square miles. Summer base flow is approximately 0.5 cfs at the mouth. Elevations range from 200 feet at the mouth of the creek to 1,800 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via a State Highway 101 to Miranda. Exit at Miranda to Maple Hills Road. Butte Creek is located approximately 1 mile North on Maple Hills Road.

METHODS

The habitat inventory conducted in Butte Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991). The contract

seasonals that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Butte Creek personnel were trained in June, 1993, 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 Butte 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". Butte 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 Butte 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 Butte 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 Butte 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 Butte 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 Butte Creek to document the fish species composition and distribution. Two sites were electrofished in Butte 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.

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 0.85mm).

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 Butte 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 October 12 and 13, 1993, was conducted by Ruth Goodfield and Warren Mitchell (contract seasonals). The total length of the stream surveyed was 8,764 feet, with an additional 161 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.50 cfs on Oct. 12, 1993.

This section of Butte Creek has three channel types: from the mouth to 4,327 feet a C1, from 4,328 feet to 8,139 feet a B1, and from 8,140 to the end of the survey a B3. C1 channel types are slightly confined, gentle gradient (1.0-1.5%), streams with a cobble/ coarse gravel substrate. B1 channels are moderate gradient (2.5-4.0%), moderately confined, boulder/ large cobble channels. B3 types are moderate gradient (1.5-4.0%), well confined channels, with a cobble/ gravel substrate and unstable stream banks.

Water temperatures ranged from 56 to 61 degrees Fahrenheit. Air temperatures ranged from 57 to 71 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 35.6%, pools 35.6%, and flatwater types 26.9% (Graph 1). Riffle habitat types made up 37.5% of the total survey **length**, flatwater 32.9%, and pools 24.2% (Graph 2).

Sixteen 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, 27.7%; mid-channel pools, 21.7%; and step runs, 16.5% (Graph 3). By percent total **length**, low gradient riffles made up 34.0%, step runs 26.6%, and mid-channel pools 14.0%.

Ninety-five pools were identified (Table 3). Main-channel pools were most often encountered at 66.3%, and comprised 67.4% 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-one of the 95 pools (33%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 94 pool tail-outs measured, none had a value of 1 (0.0%); 1 had a value of 2 (1.2%); 38 had a value of 3 (40.4%); and 55 had a value of 4 (58.5%). 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. Pools habitat types had the highest shelter rating at 38.6. Flatwater habitat followed with a rating of 16.9 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 50.2, and main-channel pools rated 33.4 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Butte Creek and are extensive. Root mass and terrestrial vegetation are lacking in nearly all habitat types. Graph 7 describes the pool cover in Butte Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 71 of the 74 low gradient riffles (96%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 4% of the low gradient riffles (Graph 8).

Thirty-one percent of the survey reach lacked shade canopy. Of the 69% of the stream covered with canopy, 47% was composed of deciduous trees, and 21% was composed of coniferous trees. Graph 9 describes the canopy in Butte 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 64.6%. The mean percent left bank vegetated was 59.4%. The dominant elements composing the structure of the stream banks consisted of 10.7% bedrock, 7.8% boulder, 15.0% cobble/gravel,

12.6% bare soil, 1.6% grass, 15.5% brush. Additionally, 28.4% of the banks were covered with deciduous trees, and 8.4% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on October 18, 1993 in Butte Creek. The units were sampled by Ruth Goodfield and Warren Mitchell (contract seasonals). All measurements are fork lengths unless noted otherwise.

The first site sampled was habitat unit #09, a mid-channel pool, approximately 580 feet from the confluence with the South Fork Eel River. This site had an area of 84 sq ft, and a volume of 76 cu ft. The unit yielded 12 steelhead, ranging from 65 to 109mm FL. Total effort for three passes was 251 seconds.

The second site electrofished, located approximately 100 feet above the end of the survey at 8,764', was a step pool. This site had an area of 44 sq ft, and a volume of 101 cu ft. No steelhead were sampled. Total effort for three passes was 201.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Butte Creek.

DISCUSSION

Butte Creek has three channel types: C1, B1, and B3. The stable stream banks and low gradient of the C1 channel allows for many instream habitat improvement structures. Potential projects include bank-placed boulders and submerged shelters in straight reaches, low stage plunge weirs, single and double wing flow deflectors, and log cover installations. There are 4,327 feet of this channel type in Butte Creek.

B1 channels are also ideal for many types of these low and medium instream enhancement structures. Of the total length surveyed, 4,212 feet comprise this channel type.

The B3 channel type is generally not suitable for instream habitat improvement structures. The unstable stream banks, composed of cobble/ gravel, are an unlimited source of sediment and prone to erosion and lateral channel migration.

The water temperatures recorded on the survey days October 12 and 13, 1993 ranged from 56° F to 61° F. Air temperatures ranged

from 57° F to 71° F. This is a good water temperature regime for salmonids.

Flatwater habitat types comprised 32.9% of the total **length** of this survey, riffles 37.5%, and pools 24.2%. The pools are

relatively shallow with only 31 of the 95 pools having a maximum depth greater than 2 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. 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 the numerous log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravels. Any 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.

Ninety-three of the 94 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 Butte 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 38.6. The shelter rating in the flatwater habitats was lower at 16.9. 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.

All 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 69%. 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) Butte Creek should be managed as an anadromous, natural production stream.

2) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites, like the site at 5,343', should then be treated to reduce the amount of fine sediments entering the stream.

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) 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.

5) 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.

6) Increase the canopy on Butte 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.

7) There are several log debris accumulations present on Butte Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time to avoid excessive sediment loading in downstream reaches.

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. Channel type is a C1.
68'	Concrete culvert wings at lower end of habitat unit #2.
328'	Corrugated metal culvert 12' diameter under Maple Hills Road.
1007'	Dry tributary from left bank.
3043'	Confluence with Coon Creek. Flow of Coon Creek equals that of Butte.
3137'	Bridge crossing. Access to Ken Bowman's property.
3172'	Left bank slope failure 40' long x 25' high contributing fine sediments.
4327'	Channel type change from a C1 to a B1.
4643'	Log debris accumulation (LDA) 35' wide x 70' long x 7" high, retaining gravel.
4694'	Right bank failure 45' long X 30' high.
4809'	Dry tributary from left bank.
5260'	Old slide on left bank beginning to revegetate.
5318'	Small right bank failure 15' long x 20' high, contributing fines.
5343'	Left bank failure 60' long x 70' high, contributing mud, debris, and other fines.
5359'	Left bank failure 40' wide x 35' high, contributing fines and gravel into channel, constricting stream near closure. Right bank is also contributing sediment.
5656'	Right bank failure, 40' long x 55' high dumping debris into channel.
5669'	LDA 55' long x 30' wide x 6' high. Stream constricted. Potential barrier. Right bank contributing fines.

5826' Large LDA in channel, retaining gravel 26' long x 30' wide x 9' high. Potential barrier.

5895' LDA's interspersed throughout unit, retaining large quantities of gravel.

5942' LDA 30' long x 20' wide x 8' high.

5976' Left bank erosion 60' long x 6' high, bank caving into stream.

6161' Extensive gravel retention causing subsurface flow.

6346' LDA 25' long x 30' wide x 6' high, retaining gravel.

6647' Dry tributary from left bank.

6762' Left bank slope failure 225' long x 15' high, contributing fines, gravel, and mud.

6802' Left bank failure confining stream, directly contributing fines.

6967' LDA 30' long x 30' wide x 7' high, associated with right and left bank failures. Gravel retained by LDA.

7038' Springs on right bank causing slope to become unstable.

7096' Lateral erosion on right bank 90' long x 6' high.

7268' Unstable left bank slumping into stream. Young-of-the year (YOY) and 2+ steelhead observed.

7364' LDA 35' long x 25' wide x 5' high.

7512' Left and right bank slumping into channel constricting stream.

7960' Dry tributary from right bank.

7972' Left bank slumping into stream 80' long x 30' high. Springs on both banks.

8139' Channel type change from a B1 to a B3.

8149' Left bank failure 25' long x 15' high, contributing fines.

8320' Dry tributary from right bank.

8391' Dry tributary from left bank.

8764' Twelve foot bedrock waterfall. No fish observed above this point. 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
Dammed Pool	[DPL]	6.5