STREAM INVENTORY REPORT

BAKER CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1994 on Baker 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 Baker 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.

Adult carcass surveys were conducted in Baker Creek from 1991 through 1995. In December 1994, two live unknown fish and one redd were observed in the lower 3,500' of the stream. Five redds were also observed in January 1995. No other survey found adults or redds, although steelhead fry were sampled during 1994 summer electrofishing (DFG file data). 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

Baker Creek is tributary to the Mattole River, located in Humboldt County, California. Baker Creek's legal description at the confluence with the Mattole River is T5S R2E. Its location is 40°00'29" N. latitude and 123°55'46" W. longitude. Baker Creek is a second order stream and has approximately 3.1 miles of blue line stream, according to the USGS Briceland 7.5 minute quadrangle. Baker Creek drains a watershed of approximately 1.6 square miles. Elevations range from about 1,020 feet at the mouth of the creek to 1,600 feet in the headwater areas. Douglas fir forest dominates the watershed. Approximately 90 percent of the watershed is privately owned and is managed for timber harvest. The lower ten percent is owned by California State Parks and Recreation, and is presently undeveloped. Vehicle access exists via the Briceland - Whitethorn Road. Turn left at Thorn Junction onto Whitethorn Road, and travel approximately five miles, or 1.2 miles past the town of Whitethorn. A State Parks road parallels the north side of the creek. Foot access to the mouth of Baker Creek is available from Barnum Grove, on the east side of Whitethorn Road.

METHODS

The habitat inventory conducted in Baker 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). Baker 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 Baker 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". Baker 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 Baker 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 Baker 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 Baker 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 Baker 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 Baker Creek to document the fish species composition and distribution. One site was electrofished in Baker Creek using one Smith Root Model 12 electrofisher. The 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 Baker 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 August 18 through 30, 1994, was conducted by Ruth Goodfield and Will Abel (CCC). The total length of the stream surveyed was 11,852 feet, with an additional 303 feet of side channel.

Flow was measured 1,639 feet from the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.05 cfs on Aug. 23, 1994.

Baker Creek

Baker Creek is an F4 channel type for the entire 11,852 feet of stream reach surveyed. F4 channels are entrenched meandering riffle/pool channels on low gradients (< 2%) with high width/depth ratios. The substrate is predominantly gravel.

Water temperatures ranged from 54 to 64 degrees Fahrenheit. Air temperatures ranged from 54 to 82 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 34%, flatwater types 33%, and riffles 29% (Graph 1). Flatwater habitat types made up 45% of the total survey **length**, pools 27%, and riffles 17% (Graph 2).

Fifteen 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, 29%; runs, 24%; and mid-channel pools, 19% (Graph 3). By percent total **length**, low gradient riffles made up 17%, runs 23%, and mid-channel pools 16%.

One hundred-twenty pools were identified (Table 3). Main-channel pools were most often encountered at 57%, and comprised 61% 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-four of the 120 pools (28%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 119 pool tail-outs measured, 47 had a value of 1 (39%); 57 had a value of 2 (48%); 13 had a value of 3 (11%); and 2 had a value of 4 (2%). 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 67. Flatwater habitats followed with a rating of 37 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 86, and backwater pools rated 62 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut

banks are the dominant cover type in Baker Creek. Large and small woody debris are found in nearly all habitat types. Graph 7 describes the pool cover in Baker Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 98 of the 104 low gradient riffles (94%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 3% of the low gradient riffles (Graph 8).

One percent of the survey reach lacked shade canopy. Of the 99% of the stream covered with canopy, 81.3% was composed of deciduous trees, and 17.5% was composed of coniferous trees. Graph 9 describes the canopy in Baker 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 79.7%. The mean percent left bank vegetated was 76.2%. The dominant elements composing the structure of the stream banks consisted of 10.3% bedrock, 0.6% boulder, 33.8% cobble/gravel, and 55.3% bare soil. Additionally, 100% of the banks were covered with 2.2% grass, 41.5% brush, 47% deciduous trees, and 9.3% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on August 24, 1994 in Baker Creek. The units were sampled by Ruth Goodfield and Will Abel (CCC). All measurements are fork lengths (FL) unless noted otherwise.

The site sampled was habitat unit 035, a mid-channel pool, approximately 1,133 feet from the confluence with the Mattole River. This site had an area of 182 sq ft, and a volume of 110 cu ft. The unit yielded 22 steelhead, ranging from 43 to 106mm FL.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Baker Creek.

DISCUSSION

The F4 channel type is generally suitable for fish habitat improvement structures. F4 channels are found in low energy, low gradient stream reaches. They have channels dominated by gravels, and have moderately stable stream banks. F4 channels are suitable for bank placed boulders. They are fairly suited for low-stage weirs; single and opposing wing-deflectors; channel constrictors; and log cover structures. This seems to be the case in Baker Creek, but any structure sites must be selected with care because of the bank composition of fine material, which can create problems with lateral stream bank erosion and structure stability.

The water temperatures recorded on the survey days August 18-30, 1994 ranged from 54° F to 64° F. Air temperatures ranged from 54° F to 82° F. This is a very good water temperature regime for salmonids. However, 64° F, if sustained, is near the threshold stress level for salmonids. This does not seem to be the case here, and Baker Creek seems to have temperatures favorable to 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 45% of the total **length** of this survey, riffles 17%, and pools 27%. The pools are relatively shallow with only 34 of the 120 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 cause lateral streambank erosion.

Fifteen of the 119 pool tail-outs measured had embeddedness ratings of 3 or 4. Forty-seven 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.

The mean shelter rating for pools was fair with a rating of 67. The shelter rating in the flatwater habitats was slightly lower at 37. However, a pool shelter rating of approximately 100 is

desirable. The amount of cover that now exists is being provided primarily by undercut-banks in all habitat types. Additionally, large and small woody debris combine to contribute a significant amount. Log and root wad cover structures in the pool and flatwater habitats would 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.

One hundred-one of the 104 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 99%. 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 efforts, is recommended.

RECOMMENDATIONS

1) Baker 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 undercut banks. Adding high quality complexity with woody cover is desirable and in some areas the material is at hand.

4) Spawning gravels on Baker Creek are limited to relatively few reaches. Crowding and/or superimposition of redds have

been observed during winter surveys. Projects should be designed at suitable sites to trap and sort spawning gravels in order to expand redd site distribution in the stream.

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 Mattole River. Baker Creek is classified as an F4 channel type for the entire survey reach.
1133'	Bioinventory site #1.
1240'	Whitethorn Road bridge crosses creek. Thirteen-foot head clearance.
1639'	Flow measured at 0.05 cfs.
2369'	Tributary enters right bank (RB).
3701'	Log debris accumulation (LDA), retaining fines and gravels. Dimensions are approximately 18' long x 7' high x 30' wide.
4189'	Rip-rap work observed on RB.
4505'	LDA retaining gravels - 12' long x 17' wide x 2' high.
4661'	Beginning of DFG bioinventory index reach. End of reach was either unmarked or indiscernible.
4791'	Tributary enters left bank (LB). Water temperature in the tributary = 56°F.
4913'	LDA retaining fines - 15' long x 15' wide x 7' high.
6982'	Stream forks - almost no flow entering from the northwest branch. Survey continues up the east branch.
7610'	Dry tributary enters RB.

Baker Creek

7807'	Quarry road owned by Barnum Timber Co. on LB.
8960'	Tributary enters RB. Flow is approximately half of the flow in mainstem.
9439'	Dry tributary enters LB.
10048'	Dry tributary enters LB.
10145'	Dry tributary enters LB.
10898'	Bee nest in an old stump on the RB. Active!!
11153'	Old Humboldt crossing; debris in stream.
11549'	Dry tributary enters LB.
11612'	Dry tributary enters from RB.
11852'	Fish observed throughout survey. There is no more water in the streambed. End of survey.

SEE NEXT PAGE (PAGE DOWN) FOR HABITAT TYPE KEY

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