STREAM INVENTORY REPORT

CORNER CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1991 on Corner 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 Corner 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 being conducted on Corner Creek. The objective of this report is to document the current habitat conditions, and recommend options for the enhancement of habitat for Chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Corner Creek is tributary to Lawrence Creek, tributary to Yager Creek, tributary to the Van Duzen River, tributary to the Eel River, located in Humboldt County, California (Figure 1). Corner Creek's legal description at the confluence with Lawrence Creek is T3N R2E S30. Its location is $40^0$37'07" N. latitude and $123^0$59'22" W. longitude. Corner Creek is a first order stream. The total length of blue line stream, according to the USGS Owl Creek and Hydesville quadrangles is 2.2 miles.

Corner Creek drains a watershed of approximately 2.03 square miles. Redwood and Douglas fir forest dominate the watershed. The watershed is owned by the Pacific Lumber Company and is managed for timber production. Year round vehicle access exists from State Highway 36 near Carlotta, via Fisher Road, to Pacific Lumber Company's Yager Camp. The main Yager-Lawrence Haul Road leads to Road Nine and Corner Creek, 9 miles from Yager Camp.

METHODS

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

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 Corner 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 was 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. 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 used 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". Corner 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 measurements were accomplished 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 Corner 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 Corner 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 Corner Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The percentages 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 Corner 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 Corner Creek to document the salmonid species composition and distribution. Three sites were electrofished in Corner Creek using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, measured, and returned to the stream.

SUBSTRATE SAMPLING

Gravel sampling is conducted using either a 6 or 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 0.85 mm). During field analysis, fine sediment suspended in the liquid portion of the sample is settled in Imhoff cones for one hour, measured, and recorded on a standard field form. The remainder of the sample is sealed in plastic bags with an identification and information ribbon, then taken to the laboratory for final processing.

In the laboratory, the samples are wet sieved using standard Tyler screens. All particles greater than 0.85 mm diameter are measured by displacement in graduated cylinders. The volume of fine sediment less than 0.85 mm is measured following one hour of settling in graduated cylinders or Imhoff cones. The fines measured in the field are added to these results.

Gravel sampling is conducted to determine the percentage of fine sediment present in probable fish spawning areas. These areas are generally found in low gradient riffles, at the tail-out of a pool, in the thalweg. The higher the percent of fine sediment, the lower the probability for eggs to survive to hatch. This is due to the reduced quantity of oxygenated water able to be percolated through the gravel, or because of the fine sediment capping the redd and preventing fry from emerging from the gravel.

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 Habtab a dBASE 4.1 program in development by DFG.

The Habtab 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 Corner 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 RESULTS *

The habitat inventory of June 3 and 4, 1991, was conducted by Tony Sartori, John Crittenden, and Brian Humphrey (CCC). The total length of the stream surveyed was 2,339 feet, with an additional 195 feet of side channel.

Flow was not measured in Corner Creek.

Corner Creek is a B1 channel type for the first 1783 feet from the confluence with Lawrence Creek, then it changes to an A2 channel for the remaining 556 feet of the survey. B1 channels are moderate gradient (2.5-4.0%), moderately confined streams, with stable stream banks. A3 channels are steep (4-10% gradient), very well confined channels, with erodible stream banks. A2 channels are steep, very well confined boulder channels.

Water temperatures ranged from 49 to 51 degrees Fahrenheit. Air temperatures ranged from 56 to 66 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 40.4%; flatwater types were 38.6%; and pools 21.1% (Graph 1). Flatwater habitat types made up 45.5% of the total survey **length**, riffles were 44.0%, and pools 10.5% (Graph 2).

Nine 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, 26.3%, step runs, 24.6%, high gradient riffles, 14.0%, and runs, 14.0% (Graph 3). By percent total **length**, step runs made up 39.2%, low gradient riffles made up 30.6%, high gradient riffles made up 13.5%, and runs made up 6.4%.

Table 3 summarizes the pool habitat types. By percent **occurrence**, scour pools made up 58.3% and main channel pools made up 41.7%. Scour pools and main channel pools comprised 50.9% and 49.1%, respectively, of the total pool **length** (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Eight of the 12 pools (67%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 11 pool tail-outs measured, zero had a value of 1 (0.0%); 2 had a value of 2 (18.2%); 7 had a value of 3 (63.6%); and 2 had a value of 4 (18.2%). 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. Flatwater habitat types had the highest shelter rating at 43.4. Pool habitats followed with a rating of 37.5 (Table 1). For the pool types, the scour pools had the highest mean shelter rating at 45.0, and main channel pools had a rating of 27.0 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Corner Creek and are extensive. Graph 7 describes the pool cover in Corner Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 6 of the 15 low gradient riffles (40.0%). Boulder was also the dominant substrate in 40.0% of the low gradient riffles (Graph 8).

Eleven percent of the survey reach lacked shade canopy. Of the 89% of the stream covered with canopy, 85% was composed of deciduous trees, and 15% was composed of coniferous trees. Graph 9 describes the canopy in Corner 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 71.2%. The mean percent left bank vegetated was 75.2%. The dominant elements composing the structure of the stream banks consisted of 1.6% bedrock, 26.2% boulder, and 11.5% cobble/gravel. Additionally, 39.3% of the banks were covered with deciduous trees, and 21.3% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three electrofishing sites were sampled on Corner Creek. The units were sampled on August 15, 1991 by Craig Mesman and Jay Miller (CCC). The results are as follows:

The first site sampled was habitat unit 008, a mid-channel pool, approximately 351 feet from the confluence with Lawrence Creek. This site had an area of 270 sq ft and a volume of 270 cu ft. Fourteen steelhead were sampled, ranging from 39 to 63 mm fork length.

The second site was habitat units 032 and 033, a combination step run and plunge pool, approximately 1,438 feet from the confluence of Lawrence Creek. Five steelhead were sampled: 50, 100, 104, 109, and 121 mm fork length.

The third site was habitat unit 038, a mid-channel pool, approximately 1,571 feet from the confluence. This site had an area of 350 sq ft and a volume of 595 cu ft. One steelhead approximately 170 mm fork length was observed in the upstream seine while shocking.

GRAVEL SAMPLING RESULTS

No gravel samples were collected on Corner Creek.

DISCUSSION

Corner Creek has two channel types: A2 and B1. The high energy and steep gradients of the A2 and A3 channel types are generally not suitable for instream enhancement structures. The B1 channel type is excellent for many types of low and medium stage instream enhancement structures. There are 688 feet of this type of channel in Corner Creek. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and pool cover.

The water temperatures recorded on the survey days June 3-4, 1991 ranged from 49 degrees Fahrenheit to 51 degrees Fahrenheit. Air temperatures ranged from 56 degrees Fahrenheit to 66 degrees Fahrenheit. This is a very good water temperature regime for salmonids. However, 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 45.5% of the total **length** of this survey, riffles 44.0%, and pools 10.5%. The pools are relatively deep with 8 of the 12 pools having a maximum depth of two feet or greater. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. 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.

Nine of the 11 pool tail-outs measured had embeddedness ratings of 3 or 4. None had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Corner 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 moderate with a rating of 37.5. The shelter rating in the flatwater habitats was slightly better at 43.4. However, a pool shelter rating of approximately 100 is desirable. The 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.

Seven of the 15 low gradient riffles had gravel or small cobble as the dominant substrate. The remainder had boulder or large cobble as the dominant substrate. This is generally considered fair for spawning salmonids.

The mean percent canopy for the stream was 89%. This is a very high percentage of canopy, since 80 percent is generally considered desirable.

RECOMMENDATIONS

1) Corner 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 Corner 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.

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) Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored, and improved where and when needed.

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'	Survey begins at the confluence with Lawrence Creek. Reach #1 is a B1 channel type.
93'	Log bridge 20' wide x 45' long crosses the channel.
254'	Large organic debris (LOD) 3' wide x 25' long on the left bank.
688'	Left bank debris slide 100' long.
779'	Log jam retaining cobble.
903'	Log and debris accumulation (LDA) 50' wide x 10' long x 10' high, retaining gravel.

1217'	LDA 35' wide x 15' long. Left bank slide, 15' high x 12' long.
1438'	Left bank slide 100' high behind a 20' wide vegetation barrier.
1452'	Plunge 15' high through LDA.
1528'	Plunge 4' high over log jam.
1783'	Channel type changes from a B1 to an A2 (reach #2).
1969'	Plunge 5' high over boulders.
2213'	Stream flow percolates through a log jam. Gradient increases to 30%, no fish observed.
2339'	End of survey.