STREAM INVENTORY REPORT

REDWOOD CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1991 on Redwood 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 Redwood 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 spawning surveys in December 1987, January 1988, and December 1988 documented both chinook and coho salmon in Redwood 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

Redwood Creek is a tributary to Hollow Tree Creek, a tributary to the South Fork Eel River, located in Mendocino County, California (Figure 1). The legal description at the confluence with Hollow Tree Creek is T22N R17W S09. Redwood Creek is a first order stream. The total length of blue line stream, according to the Hales Grove USGS quadrangle is 1.0 mile.

The Redwood Creek drains a watershed of approximately 3.45 square miles. Redwood forest dominates the watershed. The watershed is owned by the Louisiana-Pacific Corporation and is managed for timber production. Vehicle access exists from State Highway 1, via the Hales Grove Road approximately five miles south of the locked Louisiana-Pacific Corporation gate.

METHODS

The habitat inventory conducted in Redwood Creek follows the methodology as presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds). The inventory was conducted by a two 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). Redwood 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 Redwood Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow was not measured in Redwood Creek.

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". Redwood 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 Redwood 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 Redwood 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 Redwood 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 Redwood 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 Redwood Creek to document the salmonid species composition and distribution. Four sites were electrofished in Redwood Creek using one Smith

Root Model 12 electrofisher. Fish from each site were counted by species and measured.

DATA ANALYSIS:

Data from the habitat inventory form is entered into Habtype, a dBASE 3+ data entry program developed by the Department of 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
- Mean percent cover by habitat type
- Dominant substrates by habitat types

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Redwood Creek include:

- Habitat types by percent occurrence
- Habitats types by percent total length
- Total habitat types by percent occurrence
- Pool habitat types by percent occurrence
- Maximum depth of pools
- Percent embeddedness
- Mean percent cover types in pools
- Substrate composition in low gradient riffles
- Percent canopy
- Percent bank composition
- Total number of fish per sample site
- Fish species by length

HABITAT INVENTORY RESULTS:

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE RESULTS *

The habitat inventory of July 9, 10, 17, 18, 19, 22 and 23, 1991, was conducted by Shea Monroe and John Crittenden (CCC). The total length of the stream surveyed was 14,518 feet. With 155 feet of side channel.

Redwood Creek is a C2 channel type for approximately the first 13,900 feet, it then changes to a C6 for the remainder of the survey. C2 channels are low gradient (< 1%), well confined streams,

with stable stream banks. C6 channels are narrow, deep, meandering streams with a low gradient (< 1.5%).

Water temperatures ranged from 52 to 57 degrees fahrenheit. Air temperatures ranged from 54 to 77 degrees fahrenheit.

Table 1 summarizes the riffle, flatwater, and pool habitat types. By percent occurrence, riffles make up 23.87%, flatwater types make up 41.15%, and pools make up 32.92% (Graph 1). Flatwater habitat types make up 59.87% of the total length, riffles make up 11.91%, and pools make up 25.95% (Graph 2).

Fourteen habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent occurrence were glides, 26.34%, low gradient riffles, 23.46%, and mid-channel pools 23.05% (Graph 3). By percent total length, glides made up 46.30%, mid-channel pools made up 20.31%, and low gradient riffles made up 11.67%.

Table 3 summarizes the pool habitat types. Main channel pools were most often encountered at 75.00% and comprised 81.98% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. The maximum depth for 74 of the 80 pools (92.5%) was greater than 2 feet (Graph 5).

The depth of the embeddedness was estimated for 76 of the pool tail-outs. Of the 76 pool tail outs, 1 or 1.3% had a value of 1, 18 or 23.7% had a value of 2, 36 or 47.4% had a value of 3, and 21 or 27.6% had a value of 4 (Graph 6). On this scale, a value of one is the best for fisheries.

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 30.44 (Table 1). For the pool types, the backwater pools had the highest mean shelter rating at 75.00, scour pools had a mean shelter rating of 31.39, and main-channel pools had a rating of 28.67 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large and small woody debris provided most of the cover for the pool habitat types. Graph 7 is a summary of mean percent cover for the pool habitat types.

Table 6 is a summary of the dominant substrate by habitat type. Gravel was the estimated dominant substrate in 71.93% of the low gradient riffles (Graph 8).

The mean percent canopy was 87.95%. The canopy was composed of 66.3% deciduous trees and 33.7% coniferous trees. Graph 9 summarizes the total percent canopy.

Table 2 summarizes mean percent right and left bank vegetated by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 78.4%. The mean percent left bank vegetated was 79.9%. The stream bank composition consisted of 7.8% bedrock, 0% boulder,

1.2% cobble/gravel, 7.8% bare soil, 38.6% grass, 19.6% brush, 11.8% deciduous trees, and 13.2% coniferous trees (Graph 10).

The following landmarks and possible problem sites were noted. All the distances are approximate and taken from the beginning of the survey reach.

* 2210' Bridge crossing with some erosion on the left bank side of the bridge.

* 3090' Bedrock cascade, possible barrier.

* 3690' Log debris accumulation (LDA) 15' wide x 10' long x 6' high.

* 4995' LDA 25' wide x 70' long x 3' high, retaining gravel.

* 5905' Tributary enters from the left bank.

* 6435' LDA 10' wide x 15' long x 5' high, retaining fines.

* 6800' LDA 20' wide x 10' long x 5' high, retaining fines.

* 7690' LDA 15' wide x 10' long x 6' high, retaining gravel.

* 8430' LDA 15' wide x 15' long x 6' high, retaining fines.

* 8580' LDA 8' wide x 6' long x 2.5' high.

* 9320' Tributary enters from the right bank.

* 9820' LDA 17' wide x 15' long x 5' high, retaining fines.

* 13160' LDA 12' wide x 10' long x 7' high.

* 13415' Tributary enters from the left bank.

* 13490' Bank erosion 30' long x 15' high.

* 13760' LDA 10' wide x 20' long x 6' high.

* 14518' End of survey.

BIOLOGICAL INVENTORY RESULTS

Four electrofishing sites were sampled on Redwood Creek. The units were sampled on October 28, 1991 by Erick Elliot and Brian Humphrey (CCC). The results are as follows:

The first unit sampled was a step run, approximately 1415 feet from the confluence of Hollow Tree Creek. The combined total of fish was 17 steelhead, ranging from 38 to 114 mm fork length, and 24 coho, ranging from 44 to 74 mm fork length (Graph 11 & 12).

The second unit was a step run, approximately 3000 feet from the confluence and just below the bedrock cascade. The total fish were 2 steelhead 56 and 64 mm fork length and 27 coho ranging from 52 to 81 mm fork length (Graph 11 & 12).

The third unit was a step run, approximately 3500 feet from the confluence and just above the bedrock cascade. No fish were found.

The fourth unit was a step run, approximately 7330 feet from the confluence. No fish were found.

DISCUSSION

The C2 channel type is suitable for many stream enhancement structures. For the most part C2 channels are found in stable, low gradient stream reaches. Well placed and engineered structures that constrict the channel to form pool habitat or cover structures are usually appropriate and have a good chance of success in these channel types. Habitat improvement structures are generally not appropriate in C6 channel types.

The water temperatures recorded on the sample days were within the range of tolerance for salmonids. To make any further conclusions, temperatures would need to be sampled for a longer period of time through the critical summer months.

Flatwater habitat types make up 59.87% of the total length of Redwood Creek, with pools making up 25.95%. It is desirable to have pool habitat comprise approximately 50% of the total stream. The pools are relatively deep with 74 of the 80 pools having a maximum depth of greater than 2 feet. Structures designed to increase the number of pools are not recommended at this time due to the numerous log debris accumulations.

Fifty-seven of the 76 pool tail outs had an embeddedness rating of 3 or 4. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality. The high degree of embeddedness in Redwood Creek is probably due to the low gradient, lack of flushing flows in the past several years, and the numerous LDA's that are preventing the fine sediment from flushing out of the system.

The mean shelter rating for pools is relatively low with a rating of 30.44. A shelter rating of approximately 100 for pool habitat is desirable. The majority of the cover is being provided by large and small woody debris which is good. The shelter rating in the flatwater habitat was 28.30. Log cover structures in the flatwater habitat would be desirable to improve both summer and winter habitat. The log cover structures provide salmonids protection from predation and

also separates territorial units to reduce density related competition.

Forty-one of the fifty-seven low gradient riffles had gravel as the dominant substrate. Gravel is defined as 0.08 to 2.5" in diameter. This is generally on the low end of the size substrate considered good for spawning salmonids.

The mean percent canopy for the stream was 87.95%. This high percentage of canopy is generally desirable.

The bedrock cascade at 3090' from the confluence is blocking fish passage at least during some flows. This cascade needs to be modified to provide fish passage over a wide range of flows.

The numerous log debris accumulations present on Redwood Creek are not only preventing fish passage but they are retaining a large quantity of fine sediment. The modification of these barriers over a period of years is desirable, but must be done in a manner that will not release an overabundance of fine sediment into the system.

RECOMMENDATIONS

1) The Redwood Creek should be managed as an anadromous, natural production stream.

2) Modify the bedrock cascade at 3090' feet from the confluence to provide fish passage. This can be accomplished by constructing a series of boulder weirs.

3) Modify the log debris accumulation to provide fish passage. This may need to be completed over a number of years to prevent the fine sediments being retained by the LDA's from impacting the habitat downstream.

4) Increase woody cover in the pools and flatwater habitat units. Although the majority of the cover is composed of large and small woody debris, increasing the complexity and amount of woody cover would be desirable.

5) Stabilize the stream bank at 13,415' from the confluence to reduce the amount of fine sediments entering the stream.