STREAM INVENTORY REPORT

HOLLOW TREE CREEK, 1991 SURVEY REACH

INTRODUCTION

A stream inventory was conducted during the summer of 1991 on a 4.7 mile section of Hollow Tree Creek; the reach extends from the confluence with Redwood Creek upstream to the confluence with Huckleberry Creek. 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 Hollow Tree Creek. The biological inventory was conducted for the purpose of monitoring juvenile salmonid population trends.

Hollow Tree Creek is an important producer of salmonids in the Eel River system. An egg taking station has been in operation in the creek for over ten years and fish counts conducted. Weldon Jones (DFG, R3) has electrofished three index sections in Hollow Tree Creek annually since 1986. One of Jones' index sections is within this 1991 habitat inventory reach. Additional biological information has been collected during adult spawning surveys in December, 1987; January, 1988; December, 1988; and January, 1992. These surveys documented both chinook and coho salmon, as well as steelhead, in this reach of Hollow Tree Creek.

In the summer of 1990 a stream habitat inventory was conducted on the portion of Hollow Tree Creek upstream of the confluence of Huckleberry Creek. Following the recommendations from that report, the California Conservation Corps crews completed stream enhancement, bank stabilization, barrier modification and tree planting projects. This current report documents existing habitat conditions in the section surveyed, and recommends options for the enhancement of habitat for chinook, coho, and steelhead trout in the survey reach.

WATERSHED OVERVIEW

Hollow Tree Creek is a tributary to the South Fork Eel River, located in Mendocino County, California (Figure 1). The legal description at the confluence of Hollow Tree Creek with Redwood Creek is T22N R17W S09. Hollow Tree Creek is a third order stream. The total length of blue line stream, according to the Hales Grove, Lincoln Ridge, Leggett, and Westport USGS quadrangles is 19.5 miles.

Hollow Tree Creek drains a watershed of approximately 42 square miles. Redwood forest dominates the watershed. The reach of stream inventoried is owned by the Louisiana-Pacific Corporation and is managed for timber production. Vehicle access to this Hollow Tree Creek survey reach exists from State Highway 1, via the Hales Grove Road, and is approximately five miles beyond a locked gate controlled by Louisiana-Pacific Corporation.

METHODS

The habitat inventory conducted in Hollow Tree Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991). 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). Hollow Tree 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 Hollow Tree Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow was measured using a pygmy flow meter during electrofishing operations at the upper biological index reach.

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". Hollow Tree 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 Hollow Tree 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 Hollow Tree 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 Hollow Tree 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 Hollow Tree 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.

Observation of fish is an ongoing activity during stream inventory procedures. The presence or absence of fish in stream reaches or habitat units can usually be determined. These observations are noted in the comments section of the inventory form. These observations are limited in their ability to accurately identify species or estimate numbers.

Diving is another technique for directly observing habitat utilization and fish behavior. This method works well in pool and flatwater units. Divers enter the sample site at the downstream end and proceed slowly through the unit counting fish by species as they go. Population estimates based on observations made by diving or from the stream bank should be calibrated with electrofishing.

Electrofishing operations should be scheduled either concurrently or shortly after the stream inventory. When electrofishing is used to calibrate and verify direct observation estimates, or to estimate fish populations, each end of the sample site must be blocked with nets. Accurate identification of fish in the unit

and estimates of their numbers can then be made with multiple pass electrofishing techniques.

Biological inventory was conducted as part of the DFG, R3 program to monitor juvenile salmonid populations in Hollow Tree Creek. No diving observations were made in Hollow Tree Creek. Three stations were electrofished in 1991. The upper station is located in the inventory reach and is the only section summarized in this report. The purpose of the electrofishing is to generate population estimates as well as identify fish species composition. A single Smith-Root Model 12 electrofisher was used on Hollow Tree Creek. Four passes were made. Fish from each pass were counted by species, measured and weighed.

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 Hollow Tree 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
- Fish species by length

Electrofishing data is entered and processed in the Microfish 3.0 database program.

HABITAT INVENTORY RESULTS:

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

The habitat inventory of July 9, 10, 11, 12, 15, 16, 17 and 18, 1991, was conducted by Brian Humphrey and Erick Elliott (CCC). The total length of the stream surveyed was 24,907 feet. There was and additional 577 feet of side channel.

The flow was measured on September 24, 1991 at 0.143 cfs.

This reach of Hollow Tree Creek is all of the F3 channel type. F3 channels have a low gradient (<1.0%), are totally confined, and have a cobble/gravel stream bed.

During the period of the inventory, water temperatures ranged from 57 to 59 degrees fahrenheit. Air temperatures ranged from 54 to 64 degrees fahrenheit.

Table 1 summarizes the riffle, flatwater, and pool habitat types. By **percent occurrence**, flatwater habitat types made up 49.1%, riffle types 30.6%, and pools 20% of the habitat (Graph 1). Flatwater habitat types made up 62% of the **total length**, riffles 22.5%, and pools 15.4% (Graph 2).

Eleven habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by **percent occurrence** were low gradient riffles, 30.6%; step runs, 18.9%; mid-channel pools 16.8%; and runs 16.2% (Graph 3). By percent **total length**, glides made up 24.7%; step runs, 23.9%; and low gradient riffles made up 22.5%.

Sixty-eight pools were identified. Table 3 summarizes the pool habitat types. Main channel pools were most often encountered at 92.6% and comprised 95.3% 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 41 of the 68 pools (60.3%) was greater than 3 feet (Graph 5).

The depth of the embeddedness was estimated for 67 of the pool tail-outs. Of the 67 pool tail outs, 6 (9.0%) had a value of 1; 25 (37.3%) had a value of 2; 27 (40.3%) had a value of 3; and 9 (13.4%) had a value of 4. On this scale, a value of one is the best for fisheries. Graph 6 describes embeddedness.

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 60.1 (Table 1). Of the pool types, the scour pools had a mean shelter rating of 75, main channel pools rated 59.5, and backwater pools rated 40 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Bedrock ledges, boulders, and undercut banks provided most of the cover for the pool habitat types. Large and small woody debris were lacking in all the 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. Small cobble was observed to be the dominant substrate in 35.6% of the low gradient riffles. Gravel was the dominant substrate in 27% of the low gradient riffles (Graph 8).

Over 40% of the survey reach lacked shade canopy. Of the 60% of the stream covered with canopy, 89% was composed of deciduous trees, and 11% was composed of coniferous trees. Graph 9 describes the canopy in Hollow Tree Creek.

Table 2 summarizes the mean percent of the right and left stream banks covered with vegetation by habitat unit type. For the stream reach surveyed, the mean percent right bank vegetated was 61.9%. The mean percent left bank vegetated was 59.5%. The elements composing the structure of the stream banks consisted of 13.7% bedrock, 2.3% cobble/gravel, 6.1% grass, 8.6% brush, 68.3%. Additionally, 68.3% of the banks were covered with deciduous trees, and 1.0% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

PROBLEM SITES AND LANDMARKS

The following landmarks and possible problem sites were noted. All the distances are approximate and were measured from the beginning of the survey. Asterisks (*) indicate erosion sites.

	0'	Confluence of Redwood Creek and Hollow Tree Creek.
	6440'	Tributary enters from the left bank. Partially collapsed log bridge.
	8585'	Bond Creek enters from the right bank.
	14745'	Michaels Creek enters from the right bank.
	18300'	Waldron Creek enters from the left bank.
*	19170'	Left bank erosion 20' high x 30' long.
*	20635'	Right bank erosion 50' high x 60' long.
	21390'	Tributary enters from the right bank.
	23215'	Tributary enters from the left bank.
*	24475'	Bank erosion 30' high x 40' long.
	24860'	Log bridge.
	24907'	Confluence of Huckleberry Creek. End of survey.

BIOLOGICAL INVENTORY RESULTS

Hollow Tree Creek

Electrofishing at the upper index station on Hollow Tree Creek was completed on September 24, 1991 by Weldon Jones (DFG, R3). The station is located just downstream of the confluence of Huckleberry Creek. The sampled unit was 30 meters long. The combined total of fish for all four passes was 21 coho ranging from 62 to 97 mm fork length; 169 steelhead, ranging from 29 to 123 mm fork length; and 24 amnocete. The standing crop density for the coho was 0.22 fish/meter squared and the biomass was 8.86 kilograms/hectare. For steelhead the standing crop density was 1.59 fish/meter squared and the biomass was 34.78 kilograms/hectare. Graph 11 summarizes the coho and steelhead sampled by length.

DISCUSSION

The F3 channel type is characterized by unstable stream banks; therefore, it is generally unsuitable for many stream enhancement structures. However, well engineered structures that constrict the channel to create and maintain needed pool habitat are appropriate in some carefully selected areas. Stream bank armor will likely be a necessary part of these structures in order to protect the unstable banks from scour. Cover structures composed of large or small wood and/or boulders should also be installed to add diversity to the pool and flatwater habitat types.

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

Flatwater habitat types comprised 62% of the total **length** of this survey, riffles 22.5%, and pools only 15.4%. The pools are relatively deep with 41 of the 68 pools having a maximum depth greater than 3 feet. However, in coastal coho and steelhead streams, it is generally desirable to have pools comprise approximately 50% of total habitat. Therefore, installing structures that will increase pool habitat is recommended for locations where their installation will not jeopardize the unstable stream banks. Bank armor may well be necessary.

Thirty-six of the 65 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 for fish habitat. Sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

Hollow Tree Creek

The mean shelter rating for pools was moderate with a rating of 60.1. The shelter rating in the flatwater habitat was lower at 28.3. A shelter rating of approximately 100 is desirable. The majority of the cover is now being provided by bedrock ledges, boulders, and undercut banks. Large and small woody debris are lacking as pool cover. Log 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.

Sixty-five 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 59.8%. This is a moderate percentage of canopy, since 80 percent is generally considered desirable. Planting of the riparian zone and upslope areas with endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1)Hollow Tree Creek should be managed as an anadromous, natural production stream.

2)Where feasible, increase woody cover in the pools and flatwater habitat units. Well designed cover structures will increase scour, and therefore deepen the existing pools. Increasing the complexity and amount of woody cover in both the pool and flatwater habitats is highly desirable considering the presence of rearing coho and steelhead.

3)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.

4)Stabilize the stream bank erosion sites identified in the survey. This will reduce the amount of fine sediments entering the stream.

5)In conjunction with the bank stabilization projects, trees native to the area should be planted in the riparian zone and upslope areas in order to improve the canopy and bank stability over the long term.