STREAM INVENTORY REPORT

HOLLOW TREE CREEK, 1992 SURVEY REACH

INTRODUCTION

A stream inventory was conducted during the summer of 1992 on a 14.8 mile section of Hollow Tree Creek to assess habitat conditions for anadromous salmonids. The reach extends from the mouth upstream to the confluence with Redwood 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 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.

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. Additional biological information has been collected during adult spawning surveys in December, 1987; January, 1988; and December, 1988. These surveys documented both chinook and coho salmon, as well as steelhead, in Hollow Tree 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

Hollow Tree Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Mendocino County, California (Figure 1). The legal description at the confluence with the South Fork Eel River is T23N R17W S10. Its location is 39°51'28" N. latitude and 123°43'35" W. longitude. Hollow Tree Creek is a third order stream and has approximately 19.5 miles of blue line stream, according to the USGS Lincoln Ridge, Leggett, Hales Grove, and Westport 7.5 minute quadrangles. Hollow Tree Creek and its tributaries drain a basin of approximately 41.9 square miles. Elevations range from about 720 feet at the mouth of the creek to 2,000 feet in the headwater areas. Second growth redwood forest dominates the watershed. The watershed is owned primarily by the Louisiana-Pacific Corporation and the Georgia-Pacific Corporation and is managed for timber production. Year round vehicle access exists from State Highway 1 at Leggett.

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 California Conservation Corps (CCC) and contract seasonal Technical Advisors that conducted 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, 1992, 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 Hollow Tree 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 taken and recorded at 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 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". 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 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. 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 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 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.

Biological inventory was conducted in Hollow Tree Creek to document the fish species composition and distribution. Three sites were electrofished in Hollow Tree 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.

DATA ANALYSIS

Data from the habitat inventory form are entered into Runtime, a dBASE 4.1 data entry program developed by the Department of Fish and Game. This program processes and summarizes the data.
The Runtime 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 this reach of Hollow Tree Creek include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence

Hollow Tree Creek

- 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 July 6-7, 9, 13-16, 20-23, and 27, 1992 was conducted by Brian Humphrey and Aaron Nadig (CCC and contract seasonal). The survey began at the confluence with the South Fork Eel River and extended up Hollow Tree Creek to the confluence with Redwood Creek. The total length of the stream surveyed was 78,241 feet, with an additional 4,820 feet of side channel.

Flow was not measured during the survey period.

This section of Hollow Tree Creek is a C2 channel type for the entire 78,241 feet of stream reach surveyed. C2 streams have low gradient, moderately confined, cobble channels.

Water temperatures ranged from 60 to 73 degrees fahrenheit. Air temperatures ranged from 60 to 92 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, flatwater habitats made up 42.4%, pools 32.8%, and riffles 23.3% (Graph 1). Flatwater habitat types made up 50.9% of the total survey **length**, pools 32.5%, and riffles 15.4% (Graph 2).

Seventeen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were lateral scour pools-bedrock formed, 21.4%; low gradient riffles, 20.9%; and runs, 18.8% (Graph 3). By percent total **length**, lateral scour pools-bedrock formed made up 22.7%, step runs 17.7%, and runs 17.4%.

Two hundred sixty-six pools were identified (Table 3). Scour pools were most often encountered at 70.7%, and comprised 73.8% 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. Two hundred twenty-seven of the 266 pools (85%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 261 pool tail-outs measured, 34 had a value of 1 (13.0%); 87 had a value of 2 (33.3%); 89 had a value of 3 (34.1%); and 51 had a value of 4 (19.5%). On this scale, a value of one is 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 37.4. Flatwater habitats were lower at 16.8 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 39.2, main channel pools rated 33.4, and backwater pools 20.0 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Hollow Tree Creek and are extensive. Bedrock ledges are the next most common cover type. Graph 7 describes the pool cover in Hollow Tree Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 70 of the 169 low gradient riffles (41.4%). Large cobble was the next most frequently observed dominant substrate type, and occurred in 26.0% of the low gradient riffles (Graph 8).

Nearly 66% of Hollow Tree Creek lacked shade canopy. Of the 34% of the stream that was covered with canopy, 95% was composed of deciduous trees, and 5% was composed of coniferous trees. Graph 9 describes the canopy in Hollow Tree 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 70.0%. The mean percent left bank vegetated was 71.3%. The dominant elements composing the structure of the stream banks consisted of 24.1% bedrock, 1.8% boulder, 15.8% cobble/gravel, 2.2% bare soil, 5.9% grass, 5.7% brush. Additionally, 43.8% of the banks were covered with deciduous trees, and 0.6% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Weldon Jones has electrofished three index sections in Hollow Tree Creek annually since 1986. The first index reach is located near the confluence with the South Fork Eel River, the second reach is just upstream of the hatchery, and the third reach is located

just downstream of the confluence with Huckleberry Creek. The results of the 1991 electrofishing data from the middle reach are presented.
Electrofishing at the middle index station on Hollow Tree Creek was completed on September 25, 1991 by Weldon Jones (DFG, R3). The sampled unit was 30 meters long. The flow was measured at 0.44 cfs. The combined total of fish for all three passes was 3 coho, ranging from 50 to 70 mm fork length; 70 steelhead, ranging from 45 to 159 mm fork length; 90 roach, 50 stickleback, and 13 Pacific lamprey ammocetes. The standing crop density for the coho was 0.03 fish/meter squared and the biomass was 0.98 kilograms/hectare. For steelhead, the standing crop density was 0.47 fish/meter squared, and the biomass was 20.9 kilograms/hectare.

DISCUSSION

The C2 channel type has suitable gradients and the stable stream banks that are necessary for the installation of instream structures designed to increase pool habitat, trap spawning gravel, and provide protective cover for fish. 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 this channel type.

The water temperatures recorded on the survey days July 6-27, 1992 ranged from 60° F to 73° F. Air temperatures ranged from 60° F to 92° F. These warmer water temperatures, if sustained, are above the threshold stress level for salmonids. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and more extensive biological sampling conducted.

Flatwater habitat types comprised 50.9% of the total **length** of this survey, riffles 15.4%, and pools 32.5%. The pools are relatively deep with 227 of the 266 pools having a maximum depth of three feet or greater.

One hundred forty of the 261 pool tail-outs measured had embeddedness ratings of 3 or 4. Thirty-four had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Hollow Tree 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 relatively low with a rating of 37.4. The shelter rating in the flatwater habitats was lower at 16.8. 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 and bedrock ledges 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.

One hundred-one of the 169 low gradient riffles had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy for the survey reach was only 34%. This is a low percentage of canopy, since 80 percent is generally considered desirable. Elevated water temperatures could be reduced by increasing stream canopy. Cooler water temperatures are desirable in Hollow Tree Creek.

RECOMMENDATIONS

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

2) Temperatures in this section of Hollow Tree Creek, as well as upstream, should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

3) Where feasible, increase woody cover in the pool and flatwater habitat units. Most of the existing cover is from boulders and bedrock ledges. Adding high quality complexity with woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations.

4) 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.

5) 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.

6) Increase the canopy on Hollow Tree Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this inventory section must be treated as well, since the water being delivered here is being warmed above. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

PROBLEM SITES AND LANDMARKS

Hollow Tree Creek

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 the South Fork Eel River. Channel type is C2 for the entire survey reach.

283' Left bank erosion 75' high x 100' long.

1534' Left bank erosion 150' high x 100' long.

2580' Left bank erosion 75' high x 60' long. Channel is braided.

3229' Left bank erosion 100' high x 225' long.

3621' Small tributary enters from the left bank, with very steep gradient.

6236' Right bank erosion 400' high x 750' long, partially revegetated by alders at the toe.

6655' Bridge crossing 12' wide x 64' long x 12' high.

9523' Tributary enters from the left bank.

14774' Right bank cut 100' high x 237' long, with alders at the toe.

16568' Road crosses the channel.

17709' Left bank erosion 300' high x 940' long, with alders at the toe.

22070' Left bank erosion 100' high x 200' long, with alders at the toe.

25164' Tributary enters from the right bank.

25588' Right bank erosion 250' high x 150' long, with alders at the toe.

26721' Right bank erosion 125' high x 100' long, contributing cobble and boulders into the channel.

29776' Right bank slide 125' high x 200' long, contributing fines into the channel.

30501' Left bank slide 300' high x 200' long, depositing fines into the channel.

31399' Right bank slide 300' high x 500' long, depositing fines into the channel.

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31534' Tributary enters from the right bank.

32705' Right bank slide 150' high x 400' long, depositing fines into the channel.

32835' Tributary enters from the right bank.

39902' Tributary enters from the right bank.

41076' Road crosses the creek.

42650' Tributary enters from the left bank via a bedrock sheet 20' high; not accessible to anadromous fish.

45146' Hollow Tree Hatchery on the left bank. Left bank is a concrete wall.

45236' Road access to creek from the left bank.

45979' Tributary enters from the left bank.

48159' Bank erosion 75' high x 10' wide, depositing large amount of cobble into the channel.

49046' South Fork Hollow Tree Creek enters from the left bank.

49245' Middle Creek enters from the left bank.

50659' Road access along the left bank.

54155' Left bank erosion 100' high x 200' long.

55717' Right bank slide 250' high x 300' long, depositing fines and cobble into the channel.

56880' Road access from the left bank.

57283' Right bank erosion 150' high x 375' long, depositing fines into the channel.

58001' Tributary enters from the left bank.

58980' Right bank slide 75' high x 300' long, with alders at the toe.

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59290'	Right bank erosion 100' high x 150' long, vegetated at the toe.
59627'	Left bank erosion 150' high x 100' long, vegetated at the toe.
62347'	Islam John Creek enters from the right bank.
62857'	Lost Man Creek enters from the right bank.
65565'	Right bank slide 50' high x 100' long, depositing cobble into the channel.
67481'	Right bank slide 100' high x 75' long, depositing fines into the channel.
67990'	Walters Creek enters from the right bank.
71776'	Right bank erosion 100' high x 500' long, depositing fines and cobble into the channel.
74512'	Bear Creek enters from the left bank.
75096'	Bridge crossing 30' wide x 50' long x 17' high.
78241'	Redwood Creek enters from the left bank. End of 1992 survey reach.