STREAM INVENTORY REPORT

Hollow Tree Creek

INTRODUCTION

A stream inventory was conducted during the fall of 2002 on Hollow Tree Creek. The survey began at the confluence with Waldron Creek and extended upstream 2.6 miles. The objective of the habitat inventory was to document the habitat available to anadromous salmonids 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. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Hollow Tree Creek is a tributary to the South Fork Eel River, a tributary to the Eel River, located in Mendocino County, California (Map 1). Hollow Tree Creek's legal description at the confluence with Waldron Creek is T22 R17 S14. Its location is 39°45′22.67″ north latitude and 123°43′26.9″ west longitude. Hollow Tree Creek is a third order stream and has approximately 3.5 miles of blue line stream according to the USGS Leggett 7.5 minute quadrangle. Hollow Tree Creek drains a watershed of approximately 8.8 square miles. Elevations range from about 1,388 feet at the mouth of the creek to 1,597 feet in the headwater areas. Redwood/Douglas fir and mixed hardwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists through a locked gate located on Hales Grove Road off of Highway 1.

METHODS

The habitat inventory conducted in Hollow Tree Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

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 a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). 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 five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees 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. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas 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) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, bedrock, or other considerations.

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 fully-described 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 fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Hollow Tree Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

9. Bank Composition and Vegetation:

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 and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

BIOLOGICAL INVENTORY

Fish presence was observed from the stream banks in Hollow Tree Creek.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, 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 Quattro Pro. Graphics developed for Hollow Tree 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
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

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

The habitat inventory of October and 16-17 and 23-24, 2002, was conducted by Janelle Breton (WSP) and Daniel Resnik (CCC). The total length of the stream surveyed was 13,584 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.06 cfs on October 16, 2002.

Hollow Tree Creek is an F3 channel type for the first 9,409 feet of the stream surveyed, an F2 channel type for the next 1,093 feet, and an F4 channel type for the remaining 3,082 feet. F channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. F3 channels have cobble dominant substrates, F2 channel types have boulder-dominant substrates and F4 channels have gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 48° to 50° degrees Fahrenheit. Air temperatures ranged from 48° to 59° degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 31% riffle units, 31% flatwater units, and 37% pool units (Graph 1). Based on total **length** of Level II habitat types there were 20% riffle units, 27% flatwater units, and 53% pool units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 34%; low-gradient riffles, 29%; and runs, 29% (Graph 3). Based on percent total **length**, mid-channel pools made up 49%, runs 25%, and low-gradient riffles 19%.

A total of 93 pools were identified (Table 3). Mid-channel pools were the most frequently encountered, at 96%, and comprised 98% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Eighteen of the 93 pools (19%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 91 pool tail-outs measured, 25 had a value of 1 (27.5%); 38 had a value of 2 (41.8%); 6 had a value of 3 (7%); none had a value of 4; and 22 had a value of 5 (24%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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. Riffle habitat types had a mean shelter rating of 12, flatwater habitat types had a mean shelter rating of 14, and pool habitats had a mean shelter rating of 34 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 42. Main channel pools had a mean shelter rating of 34 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types

in Hollow Tree Creek. Graph 7 describes the pool cover in Hollow Tree Creek. Large woody debris is the dominant pool cover type followed by boulders.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Small cobble was the dominant substrate observed in 36% of pool tail-outs while gravel was the next most frequently observed substrate type, at 35%.

The mean percent canopy density for the surveyed length of Hollow Tree Creek was 88%. The mean percentages of deciduous and coniferous trees were 83% and 17%, respectively. Graph 9 describes the mean percent canopy in Hollow Tree Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 88%. The mean percent left bank vegetated was 85.5%. The dominant elements composing the structure of the stream banks consisted of 33% bedrock, 32% boulder, 19% cobble/gravel, and 15% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 74.8% of the units surveyed. Additionally, 20.6% of the units surveyed had coniferous trees as the dominant vegetation type (Graph 11).

DISCUSSION

Hollow Tree Creek is an F3 channel type for the first 9,409 feet of stream surveyed, an F2 channel type for the next 1,093 feet and an F4 channel type for the remaining 3,082 feet. The suitability of F3 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders, and single and opposing wing-deflectors; fair for plunge weirs, boulder clusters, channel constrictors, and log cover. The suitability of F2 channel types is as follows: fair for plunge weirs, single and opposing wing-deflectors and log cover. The suitability of F4 channel types is as follows: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors and log cover; poor for boulder clusters.

The water temperatures recorded on the survey days October 16-17 and 23-24, 2002, ranged from 48° to 50° Fahrenheit. Air temperatures ranged from 48° to 59° Fahrenheit. This is a good water temperature range for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 27% of the total **length** of this survey, riffles 20%, and pools 53%. The pools are relatively shallow, with only 18 of the 93 (19.4%) pools having a maximum depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth 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.

Sixty-three of the 91 pool tail-outs measured had embeddedness ratings of 1 or 2. Six of the pool tail-outs had embeddedness ratings of 3 or 4. Twenty-two of the pool tail-outs had a rating of 5,

which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Hollow Tree Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Sixty-five of the 91 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 34. The shelter rating in the flatwater habitats was 14. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, large and small woody debris contributes a small amount. Log and root wad cover structures in the pool and flatwater habitats would enhance 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.

The mean percent canopy density for the stream was 88%. Reach 1 had a canopy density of 89% while Reaches 2 and 3 had canopy densities of 88% and 88%, respectively. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 88.2% and 85.5%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting 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) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

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.

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.

COMMENTS AND LANDMARKS

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

0'	Begin survey at confluence with Waldron Creek. Channel type is F3.
1,095'	Left bank erosion, 30' high x 60' high.
1,216'	Location of F3 channel type X-section.
2,112'	Juvenile salmonids observed.
2,328'	Right bank erosion, 40' high x 15' wide.
2,548'	Right bank erosion, 15' high x 25' wide.
2,843'	Tributary enters on left bank with a water temperature of 48°F. No fish were observed near the mouth of the tributary.
3,434'	Log debris accumulation (LDA) of 4 pieces: 9' high x 30' wide x 15' long. Stored sediment 30' wide x 50' long x 2' deep. Left bank erosion actively contributing sediment, 30' wide x 50' long.
3,725'	Right bank erosion, 20' high x 10' wide.
3,862'	Tributary enters on left bank, barely flowing.
3,917'	Tributary enters on right bank with a water temperature of 49° F. No fish were observed near the mouth of the creek.
6,001'	Tributary enters on right bank and was dry at the time of survey.
6,204'	Juvenile salmonids observed.
6,665'	Bear Pen Creek enters on left bank with a water temperature of 58° F. No fish were observed near the mouth of the creek.
7,777'	Right bank erosion actively contributing sediment, 40' high x 40' wide.
8,341'	Right bank erosion actively contributing sediment, 30' high x 20' wide.
8,658'	Right bank erosion, 25' high x 20' wide.

9,209'	Huckleberry Creek enters on left bank with a water temperature of 47° F. Juvenile salmonids were observed near the mouth of the creek. Bridge crosses 17 feet over Hollow Tree Creek and is 12' wide x 17' wide.
9,448'	Left bank erosion, 19' high x 19' wide. Channel type changes from F3 to F2.
10,423'	Left bank erosion actively contributing sediment, 40' high x 50' wide.
10,502'	Channel type changes from F2 to F4.
10,688'	Juvenile salmonids observed.
11,280'	Tributary enters on right bank and was dry at the time of survey.
11,392'	Left bank erosion, 10' high x 26' wide.
12,307'	LDA of 11 pieces: 10' high x 60' wide x 20' long. Stored sediment 20' wide x 40' wide x 3' deep. Right bank erosion actively contributing sediment, 17' high x 5' wide x 7'deep.
12,355'	Left bank erosion actively contributing sediment, 15' high x 32' wide.
12,602'	Left bank erosion, 15' high x 32' wide.
13,317'	Tributary enters on right bank and was dry at the time of survey.
13,584'	Left bank erosion, 10' high x 15' wide. Butler Creek enters on right bank. End of survey due to dry channel.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8}
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9}
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4}
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5}
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6}
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7}
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	