STREAM INVENTORY REPORT

Little Cave Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Little Cave 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 Little Cave Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for Chinook 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

Little Cave Creek is tributary to Cave Creek, tributary to Tomki Creek, tributary to the mainstem Eel River, located in Mendocino County, California (Map 1). Little Cave Creek's legal description at the confluence with Cave Creek is T18N R12W S19. Its location is 39°23′36″ North latitude and 123°13′52″ West longitude. Little Cave Creek is a first order stream and has approximately 1.9 miles of blue line stream according to the USGS Foster Mountain 7.5 minute quadrangle. Little Cave Creek drains a watershed of approximately 0.83 square miles. Elevations range from about 1820 feet at the mouth of the creek to 2500 feet in the headwater areas. Douglas forest dominates the watershed. The watershed is primarily privately owned. Vehicle access exists via Highway 101 south, go east on West Road. Head north on Tomki Road for 6 miles and take the second paved road on the left, then one-half mile to reach Little Cave Creek.

METHODS

The habitat inventory conducted in Little Cave Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1994). The California Conservation Corps (CCC) Technical Advisors and AmeriCorps Watershed Stewards Project (WSP) 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, dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further 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 Little Cave 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.

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.

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". Little Cave 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. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form. Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were 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 Little Cave 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, having a bedrock tail-out, 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 Little Cave 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 Little Cave 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 Little Cave 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 was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Little Cave Creek fish presence was observed from the stream banks, and one site was electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

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 Little Cave Creek include:

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

Little Cave Creek

- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in the pool tail outs
- 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 June 19 and 23, 1997, was conducted by Donna Miller and Todd Schaible (WSP). The total length of the stream surveyed was 3,162 feet.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.08 cfs on June 24, 1997.

Little Cave Creek is an F4 channel type for the first 1,031 feet and a B3 channel type for the remaining 2,131 feet surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. B3 channel types are moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools. Stable banks and cobble channels predominate.

Water temperatures taken during the survey period ranged from 56° to 78° F. Air temperatures ranged from 68° to 85° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 49% riffle units, 35% flatwater units, 13% pool units, and 2% dry units (Graph 1). Based on total length of Level II habitat types there were 39% riffle units, 45% flatwater units, 7% pool units, and 9% dry units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 28%; step run, 22%; and high gradient riffles, 18% (Graph 3). Based on percent total length, step run made up 34%, low gradient riffles 25%, and high gradient riffles 13%.

A total of 12 pools were identified (Table 3). Main channel pools comprised 100% 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. Eight of the twelve pools (66%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 12 pool tail-outs measured, zero had a value of 1; four had a value of 2 (33%); three had a value of 3 (25%); two had a value of 4 (17%) and three had a value of 5 (25%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning.

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 9, flatwater habitat types had a mean shelter rating of 9, and pool habitats had a mean shelter rating of 6 (Table 1). The main channel pools had the highest mean shelter rating at 6 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Little Cave Creek and are extensive. Small woody debris and large woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Little Cave Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in five of the 12 pool tail-outs measured (42%). Large cobble and boulders were the next most frequently observed dominant substrate types and each occurred in 17% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 75%. The mean percentages of deciduous and coniferous trees were 86% and 15%, respectively. Graph 9 describes the canopy composition in Little Cave Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 70%. The mean percent left bank vegetated was 63.5%. The dominant elements composing the structure of the stream banks consisted of 10% boulder, 52.5% cobble/gravel, and 37.5% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 67.5% of the units surveyed. Additionally, 20% of the units surveyed had brush as the dominant vegetation type, and 12.5% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on June 17, 1997, in Little Cave Creek. The site was sampled by Todd Schaible and Donna Miller (WSP), and Scott Downie (DFG).

The site sampled was habitat unit 13, approximately 500 feet from the confluence with Cave

Creek. This site had an area of 242 sq ft and a volume of 290 cu ft. The site yielded a total of four steelhead; three young-of-year and 1 one-plus year old.

DISCUSSION

Little Cave Creek is a F4 channel type for the first 1,031 feet of stream surveyed and a B3 for the remaining 2,131 feet. The suitability of F4 channel types for fish habitat improvement structures is good for bank placed boulder, fair for low-stage weir, single and opposing wing-deflectors; channel constrictors; and log cover, poor for medium-stage weir. The suitability of B3 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs; boulder clusters and bank placed boulders; single and opposing wing-deflectors; and log cover, good for medium-stage plunge weirs.

The water temperatures recorded on the survey days June 19 and 23, 1997, ranged from 56° to 78° F. Air temperatures ranged from 68° to 85° F. This is an unsuitable water temperature range for salmonids. Seventy-eight degrees Fahrenheit, if sustained, is near the lethal limit for salmonids. To obtain a more complete temperature profile, temperature monitoring should be performed for several additional years.

Flatwater habitat types comprised 45% of the total length of this survey, riffles 39%, pools 7%, and dry 9%. The pools are relatively deep, with 8 of the12 (66%) pools having a maximum depth greater than 2 feet. In first and second 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. Primary pool comprise less than 5% of the total length of the habitat surveyed. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy.

None of the twelve pool tail-outs measured had an embeddedness rating of 1, 33% had a rating of 2, 41% had ratings of 3 or 4, and 24% had a rating of 5 and were considered unsuitable for spawning. Two of the three (67%) pool tail-outs with a rating of 5 were unsuitable for spawning due to the dominant substrate being boulders and cobble too large 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. In Little Cave Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was 6. The shelter rating in the flatwater habitats was 9. A pool shelter rating of approximately 100 is desirable. The relatively small amount of 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.

Six of the twelve (50%) pool tail outs measured had gravel or small cobble as the dominant substrate. This is generally considered fair for spawning salmonids.

The mean percent canopy density for the stream was 75%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 70% and 63.5%, 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) Little Cave Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are above 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 the canopy on Little Cave Creek by planting willow, alder, and other native riparian tree species along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

4) 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.

5) Suitable size spawning substrate on Little Cave Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

6) 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.

7) 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.

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 Cave Creek. Channel type is F4.

205' Road fords stream.

312' Electrofishing site.

1,031' Channel type changes from F4 to B3.

1,256' Log debris accumulation (LDA), 10' wide x 2' high x 6' long.

1,521' Dry tributary enters from left bank.

1,804' Dry tributary enters from left bank. Juvenile steelhead observed.

2,474' Juvenile salmonids observed in pool

2,874' Tributary enters from right bank.

3,048' Left bank failure, 35' long x 80' high.

3,067' LDA, 30' long x 50' wide x 3' high, retaining gravel on right bank for 40 feet; possible fish barrier.

3,162' End of anadromy due to a stream gradient of 50%.

REFERENCES

Flosi, G., and F. L. Reynolds. 1994 *California Salmonid Stream Habitat Restoration Manual, 2nd edition*. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5