STREAM INVENTORY REPORT

Two Log Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on Two Log Creek and two unnamed tributaries. 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 Two Log 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 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

Two Log Creek is tributary to the Big River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Two Log Creek's legal description at the confluence with Big River is T17N R16W S23. Its location is 39°19′12″ north latitude and 123°36′46″ west longitude. Two Log Creek is a second order stream and has approximately 2.3 miles of blue line stream according to the USGS Comptche and Mathison Peak 7.5 minute quadrangles. Two Log Creek drains a watershed of approximately 5.2 square miles. Elevations range from about 300 feet at the mouth of the creek to 800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 20 on a logging road at the 14 mile marker.

METHODS

The habitat inventory conducted in Two Log 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, 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 Two Log 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". Two Log 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.

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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 Two Log 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 Two Log 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 Two Log 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 Two Log 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.

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BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Two Log Creek fish presence was observed from the stream banks, and **four** sites were 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 Two Log 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 the pool tail-outs
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of June 24 through July 1, 1998, was conducted by Andrew MacMillan (CCC), Casey Ralston (Louisiana-Pacific Corp.), and Paul Retherford (WSP\AmeriCorps). The total length of the stream surveyed was 23,309 feet, an additional 1,386 feet was not surveyed due to lack of access.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.38 cfs on June 25, 1998 and 1.16 cfs on July 2, 1995.

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Two Log Creek is a B4 channel type for the first 7,057 feet of stream reach surveyed. B4 channels are moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools, very stable plan and profile, stable banks and gravel-dominant substrates. The remaining 16,158 feet of the reach surveyed is an F4 channel type. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 55 to 61 degrees Fahrenheit. Air temperatures ranged from 59 to 68 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 25% riffle units, 30% flatwater units, and 43% pool units (Graph 1). Based on total **length** of Level II habitat types there were 14% riffle units, 56% flatwater units, and 29% pool units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 27%; low gradient riffles, 23%; and step-runs, 16% (Graph 3). Based on percent total **length**, step runs made up 41%, mid-channel pools 18%, and low gradient riffles 12%.

A total of 183 pools were identified (Table 3). Main channel pools were most frequently encountered at 77% and comprised 79% 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. One- hundred-thirty-one of the 183 pools (71%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 184 pool tail-outs measured, 2 had a value of 1 (1.1%); 46 had a value of 2 (25.0%); 74 had a value of 3 (40.2%); 22 had a value of 4 (12.0%) and 39 had a value of 5 (21.2%) (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. In Two Log Creek, 30 of the 40 pool tail-outs which were valued at 5 had silt/clay/sand or gravel too small to be suitable for spawning as the substrate. The other tail-outs were unsuitable for spawning due to the tail-outs being comprised of large cobble, boulder, bedrock or wood.

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 28, flatwater habitat types had a mean shelter rating of 34, and pool habitats had a mean shelter rating of 47 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 51. Scour pools had a mean shelter rating of 40 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in Two Log Creek. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Two Log Creek.

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Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 118 of the 184 pool tail-outs measured (64%). Silt was the next most frequently observed dominant substrate type and occurred in 15% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 79%. The mean percentages of deciduous and coniferous trees were 32% and 68%, respectively. Graph 9 describes the canopy in Two Log Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 57%. The mean percent left bank vegetated was 58%. The dominant elements composing the structure of the stream banks consisted of 18.7% bedrock, 0.8% boulder, 12.7% cobble/gravel, and 67.9% sand/silt/clay (Graph 10). Coniferous trees was the dominant vegetation type observed in 54% of the units surveyed. Additionally, 29.9% of the units surveyed had deciduous trees as the dominant vegetation type(Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished on July 13,1998, in Two Log Creek. The sites were sampled by Andrew MacMillan and Paul Retherford.

The first site sampled included habitat units 11-15, a pool, run, pool, run, pool series approximately 280 feet from the confluence with Big River. This site had an area of 11,830 sq ft and a volume of 57,967 cu ft. The site yielded 1 coho, 8 steelhead and 7 Pacific giant salamanders.

The second site included habitat units 186-189, a riffle, run, pool, riffle series located approximately 9,969 feet above the creek mouth. This site had an area of 3,999 sq ft and a volume of 14,396 cu ft. The site yielded 1 coho, 3 steelhead, 1 sculpin and 5 Pacific giant salamanders.

The third site sampled included habitat units 366-367, a run and pool series located approximately 17,658 feet above the creek mouth. The site had an area of 424 sq ft and a volume of 721 cu ft. The site yielded 2 coho and 2 steelhead.

The fourth site sampled was above the culvert located approximately 21,449 feet above the creek mouth. The site did not yield any fish.

DISCUSSION

Two Log Creek is a B4 channel type for the first 7,057 feet of stream surveyed and an F4 for the remaining 16,158 feet. The suitability of B4 and F4 channel types for fish habitat improvement structures is as follows:

The water temperatures recorded on the survey days June 24, 25, 26, 29, 30, and July 1, 1998, ranged from 55 to 61 degrees Fahrenheit. Air temperatures ranged from 59 to 68 degrees

Fahrenheit. This is an acceptable 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 56% of the total **length** of this survey, riffles 14%, and pools 29%. The pools are relatively deep, with 130 of the 183 (71.0%) pools having a maximum depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. 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. Installing structures that will increase or deepen pool habitat is recommended.

Two of the 184 pool tail-outs measured had an embeddedness rating of 1. Ninety-six of the pool tail-outs had embeddedness ratings of 3 or 4. Forty of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. Thirty of the 40 were unsuitable for spawning due to the dominant substrate being silt/sand/clay or gravel being too small to be suitable. 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 Two Log 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 47. The shelter rating in the flatwater habitats was 34. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by undercut banks in all habitat types. Additionally, terrestrial vegetation contributes a small amount. 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-forty of the 183 pool tail outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 79%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was low at 57% and 58%, 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) Two Log 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) 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) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from undercut banks. Adding high quality complexity with woody cover is desirable.

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.

Position (ft):	Comments:
0'	Begin survey at confluence with Big River. Channel type is a B4.
255'	Right bank seep from road culvert.
462'	Log stringer bridge, 30' long x 50' wide x 8' high.
2,791'	Right bank tributary approximately 0.2 cfs and 55 degrees F.
3,557'	Left bank tributary approximately 0.1 cfs and 55 degrees F.
4,139'	Right bank tributary approximately 0.2 cfs.
5,681'	Right bank tributary approximately 0.3 cfs and 55 degrees F.
6,481'	Log debris accumulation (LDA) 15' long x 40' wide x 15' high, not a barrier, with associated left bank slide 100' long x 200' high including fine sediment and large woody debris, previously retaining 10' of gravel but clear now.
7,144'	Channel change to F4.
7,327'	Left bank tributary.
8,173'	Right bank fish accessible tributary, 55 degrees F, with a cascade approximately 100 feet upstream.

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8,683'	Left bank “Timber Harvest Boundary” flagging begins.
9,750'	Right bank tributary.
10,089’	Flat car bridge with access to main right bank road 15' long x 50' wide x 7' high.
10,740’	End of left bank “Timber Harvest Boundary” flagging.
10,951’	Left bank seep.
11,244’	Old road crossing.
12,029’	Left bank tributary with good flow and fish habitat upstream but a culvert 30' upstream from the confluence with Two Log Creek with an 8' jump and steep gradient, combine to create a probable barrier to salmonids.
12,514’	Left bank seep enters.
12,582’	Left bank small tributary.
12,838’	Left bank dry tributary enters.
13,683’	Left bank small tributary enters.
13,892’	Log debris accumulation, not a barrier, 8' long x 20' wide x 4' high.
14,538’	Right bank tributary with good flow and access to fish enters. Habitat inventoried as “1st Right Bank Tributary” (see subsection report).
14,934’	Old bridge crossing.
15,328’	Log debris accumulation, 8' long x 20' wide x 8' high.
15,443’	Three foot jump.
15,507’	Entire channel is backed up gravel and silt with the highway right next to the creek.
18,961’	Right bank tributary less than 0.1 cfs enters.
18,969’	Not surveyed due to choked channel and inaccessibility.
19,280’	Right bank small tributary enters.
19,469’	Continue survey at log debris accumulation, 15' long x 30' wide x 7' high, not a barrier.

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19,570’	Log debris accumulation covering entire creek and holding 2' of sediment.
19,567’	Right bank tributary with a shallow gradient. There is a 5' jump into the Highway 20 culvert, with a 3' jump pool. This tributary contributes approximately one-half of Two Log Creek flow. Habitat inventoried as “2nd Right Bank Tributary” (see subsection report).
20,020’	Log debris accumulation, 40' long x 25' wide x 8' high, not a barrier.
20,220’	Right bank small tributary enters.
20,605’	Right bank culvert from Highway 20.
21,185’	Right bank culvert 20' up bank draining Highway 20.
22,607’	Old road crossing.
22,737’	Right bank seep.
22,769’	Creek becomes very small with lots of mud, large woody debris and sections where flow runs subsurface.
23,337’	Marsh not surveyed due to inaccessibility. Result of road crossing, backing up sediment and woody debris in marshy pools.
24,591’	CMP culvert under access road at mile mark 15.84 on Highway 20. End of survey. Stream bed has become a marsh.

REFERENCES

Flosi, Gary, S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California salmonid stream habitat restoration manual, 3rd edition. California Department of Fish and Game, Sacramento, California.

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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