STREAM INVENTORY REPORT

Laurel Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Laurel 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 Laurel 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

Laurel Creek is tributary to Tomki Creek, tributary to the Eel River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Laurel Creek's legal description at the confluence with Tomki Creek is T20N R14N S36. Its location is 39°32′56″ north latitude and 123°21′20″ west longitude. Laurel Creek is a first order stream and has approximately 1.02 miles of intermittent stream according to the USGS Willis Ridge 7.5 minute quadrangle. Laurel Creek drains a watershed of approximately 0.82 square miles. Elevations range from about 2200 feet at the mouth of the creek to 2880 feet in the headwater areas. Douglas fir and mixed hardwood dominate the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via Highway 101 to Shimmins Ridge Road. Access beyond this point is controlled by private gated roads.

METHODS

The habitat inventory conducted in Laurel 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 Laurel 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". Laurel 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 Laurel 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 Laurel 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 Laurel 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 Laurel 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

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Laurel Creek, 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 Laurel 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 June 25, and 26, 1997, was conducted by Jessie Robertson and David Jones (CCC). The total length of the stream surveyed was 6,127 feet.

Flows were not measured on Laurel Creek.

Laurel Creek is an B3 channel type for the entire 6,127 feet of stream reach surveyed. B3 channels are moderately entrenched, moderate gradient, riffle dominated cobble channels with infrequently spaced pools, very stable plan and profile, and stable.

Water temperatures taken during the survey period ranged from 54° to 73° F. Air temperatures ranged from 65° to 86° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 13% riffle units, 34% flatwater units, and 49% pool units (Graph 1). Based on total **length** of Level II habitat types there were 7% riffle units, 76% flatwater units, and 16% pool units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 45%; step runs , 33%; and low gradient riffles, 12% (Graph 3). Based on percent total **length**, step runs made up 75%, mid-channel pools 14%,

and low gradient riffles 7%.

A total of 41 pools were identified (Table 3). Main channel pools were most frequently encountered at 93% and comprised 92% 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. Seven of the 41 pools (17%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the forty-one pool tail-outs measured, seventeen had a value of 1 (41%); eleven had a value of 2 (27%); five had a value of 3 (12%); none had a value of 4 (0%) and eight had a value of 5 (20%) (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 5, flatwater habitat types had a mean shelter rating of 8, and pool habitats had a mean shelter rating of 13 (Table 1). Both main channel pools and scour pools had a mean shelter rating of 13 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Laurel Creek. Undercut banks are lacking in nearly all habitat types. Graph 7 describes the pool cover in Laurel Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in sixteen of the forty-one pool tail outs measured (39%). Small cobble was the next most frequently observed dominant substrate type and occurred in 22% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 72%. The mean percentages of deciduous and coniferous trees were 62% and 38%, respectively. Graph 9 describes the canopy in Laurel Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 56.4%. The mean percent left bank vegetated was 55%. The dominant elements composing the structure of the stream banks consisted of 19.2% bedrock, 7.7% boulder, 53.8% cobble/gravel, and 19.2% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 42.3% of the units surveyed. Additionally, 23.1% of the units surveyed had deciduous trees as the dominant vegetation type, and 34.6% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on July 14, 1997, in Laurel Creek. The site was sampled by Jessie Robertson (WSP) and Allan Renger (CCC).

The sample site included habitat unit 2, a mid-channel pool approximately 25 feet from the confluence with Tomki Creek. The site yielded 10 young of the year steelhead/rainbow trout, and one rough skinned newt.

DISCUSSION

Laurel Creek is a B3 channel type for the entire 6,127 feet of stream surveyed. The suitability of B3 channel types for fish habitat improvement structures is excellent for plunge weirs; boulder clusters and bank placed boulder; single and opposing wing-deflectors; and log cover.

The water temperatures recorded on the survey days June 25, and 26, 1997, ranged from 54° to 73° F. Air temperatures ranged from 65° to 86° F. A water temperature 73° F, is above the threshold stress level 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 76% of the total **length** of this survey, riffles 7%, and pools 16%. The pools are relatively shallow, with only 7 of the 41 (17%) pools having a maximum depth greater than 2 feet. Primary pools comprised less than 3% of the total length of stream habitat surveyed. 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.

Seventeen (41%) of the forty-one pool tail-outs measured had an embeddedness rating of 1, 27% had an embeddedness value of 2, 12% had a ratings of 3 or 4, and 20% had a rating of 5 and were considered unsuitable for spawning. All of the pool tail-outs that were unsuitable for spawning due to the dominant substrate being large cobble, boulders or bedrock too large. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

The mean shelter rating for pools was 13. The shelter rating in the flatwater habitats was 8. 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. Additionally, aquatic 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.

Twenty-five of the forty-one (61%) 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 72%. 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 56% and 55%, 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) Laurel 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 Laurel Creek by planting willow, alder, redwood, and Douglas fir 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) Primary pools comprised less than 3% of total length of habitat surveyed. Where feasible, design and engineer pool enhancement structures to increase the number of and depth of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

5) 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.

6) Evaluate damaged concrete culvert at 6,127' and recommend any needed repair

modification, or replacement.

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 Tomki Creek. Channel type is a B3.

44' Electrofishing site.

1,396' A small tributary enters from the right bank, dry.

2,564' A small tributary enters from the right bank.

3,818' A trail fords the creek.

4,040' An old road fords the creek.

4,992' A tributary enters from the right bank.

6,127' End of survey. A damaged round concrete culvert is a fish barrier. The culvert is partially plugged with debris and the concrete sections of the culvert have separated dividing and diverting the flow.

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]**		