STREAM INVENTORY REPORT

LARABEE CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1992 on Larabee Creek to assess habitat conditions for anadromous salmonids. 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 Larabee 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.

Adult carcass surveys were conducted on Larabee Creek from 1987 through 1990. Chinook salmon were documented during surveys in December 1987, January 1988, and December 1990. No chinook were found in December 1989. The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of salmonid habitat.

WATERSHED OVERVIEW

Larabee Creek is tributary to the Eel River, located in Humboldt County, California (Figure 1). The legal description at the confluence with the Eel River is T1S R2E S2. Its location is 40° 24'33" N. latitude and 123°55'54" W. longitude. Larabee Creek is a fourth order stream and has approximately 24 miles of blue line stream, according to the USGS Redcrest, Myersflat, Bridgeville, Blocksburg, Larabee Valley, and Dinsmore 7.5 minute quadrangles. Larabee Creek and its tributaries drain a basin of approximately 81.5 square miles, and the system has a total of 75.5 miles of blue line stream. Elevations range from about 100 feet at the mouth of the creek to 1,800 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed, but there are zones of grassland and oak-woodland in the upper watershed. The watershed is owned by the Pacific Lumber Company and other private parties and is managed for timber production and grazing. Year round vehicle access exists from State Highway 101 via the Shively Road.

METHODS

The habitat inventory conducted in Larabee 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). Larabee Creek personnel were trained in May, 1992, by Gary Flosi and Scott Downie. This inventory was conducted by two person teams.

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 Larabee 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". Larabee 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. Pool tail crest depth at each pool unit was measured in 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 Larabee 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 Larabee 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 Larabee 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 Larabee 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 Larabee Creek to document the fish species composition and distribution. Two sites were electrofished in Larabee 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 Habitat Runtime, a dBASE 4.1 data entry program developed by the California Department of Fish and Game (DFG). This program also processes and summarizes the data.

The Habitat Runtime program produces the following 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 Larabee 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
- 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 September 2-4, 8-11, 14-16, and 21, 1992, was conducted by Chris Coyle, John Crittenden, John Cleckler, Michelle Rose and Russ Irvin (CCC and contract seasonal). The survey began at the confluence with the Eel River and extended up Larabee Creek

to the confluence of Boulder Creek. Above there access was denied. The total length of the stream surveyed was 48,110 feet, with an additional 4,439 feet of side channel.

This section of Larabee Creek has five channel types: from the mouth to 13,426' a C2; next 17,476' feet a F3; next 1,772' a B2; next 1,100' a B1; next 5,536' a A1; and the remaining 13,239' returns to a B2. C2 channels have a gentle gradient, with meandering, cobble/gravel channels. F3 channels are low gradient, totally confined, highly meandering, boulder bed streams with a high sediment supply. B2 channels are moderate gradient (1.0-2.5%), moderately confined, large cobble/boulder channels. B1 channels are moderate gradient (2.5-4.0%), moderately confined boulder/large cobble channels. A1 channels are steep (4-10% gradient), deeply incised bedrock/boulder mix.

Water temperatures ranged from 58 to 76 degrees fahrenheit. Air temperatures ranged from 57 to 91 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 39.7%, flatwater types 35.5%, and riffles 24.1% (Graph 1). Flatwater habitat types made up 46.6% of the total survey **length**, pools 29.1%, and riffles 24.0% (Graph 2).

Twenty Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were mid-channel pools, 24.3%; low gradient riffles, 19.4%; step runs, 14.5%; and glides, 11.8% (Graph 3). By percent total **length**, low gradient riffles made up 21.7%, glides 20.9%, step runs 20.1%, and mid-channel pools 18.9%.

One-hundred-seventy-eight pools were identified (Table 3). Main- channel pools were most often encountered at 69.7%, and comprised 70.2% 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. One-hundred thirty of the 178 pools (73%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 166 pool tail-outs measured, thirty-three had a value of 1 (19.9%); 99 had a value of 2 (59.6%); 17 had a value of 3 (10.2%); and 17 had a value of 4 (10.2%). 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. Riffle types had the highest shelter rating at 69.7. Pools had the lowest rating with 51.0 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 64.3, main channel pools rated 53.7, and scour pools 42.0 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Larabee Creek and are extensive. Large woody debris and bedrock ledges are the next most common cover type. Graph 7 describes the pool cover in Larabee Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 41 of the 87 low gradient riffles (47.1%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 35.6% of the low gradient riffles (Graph 8).

Eighty-seven percent of Larabee Creek lacked shade canopy. Of the 12.6% of the stream that was covered with canopy, 87% was composed of deciduous trees, and 13% was composed of coniferous trees. Graph 9 describes the canopy in Larabee 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 67.1%. The mean percent left bank vegetated was 57.9%. The dominant elements composing the structure of the stream banks consisted of 17.0% bedrock, 13.0% boulder, 19.1% cobble/gravel, 1.8% bare soil, 1.0% grass, 1.1% brush. Additionally, 44.5% of the banks were covered with deciduous trees, and 2.5% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on Sept. 23, 1992 in Larabee Creek. The units were sampled by Chris Coyle and John Cleckler (contract seasonals). All measurements are fork lengths unless noted otherwise.

The first site sampled was habitat units 53 and 54, a run, and mid-channel pool, approximately 7,475 feet from the confluence with the Eel River, and directly underneath a rail road bridge. The site had an area of 7,327 sq ft, and a volume of 17,740 cu ft. The sample included 1 steelhead, 86mm; 39 roach, ranging from 38 to 92mm; 12 sculpin, ranging from 47 to 125mm; 20 squawfish, ranging from 49 to 180mm; and 1 western sucker 59mm.

The second sample site was habitat units 200-201, a high gradient riffle and a step-run, approximately 32,674 above the confluence with the Eel River. This site had an area of 6,632sq ft, and a volume of 6,253 cu ft. The sample included 14 steelhead, ranging from 80 to 128mm; and 3 sculpin, ranging from 72 to 144mm.

DISCUSSION

Larabee Creek has five channel types: C2, F3, B2, B1 and A1. The high energy and steep gradient of the A1 channel and the flat, totally confined, highly meandering channel of a F3 type is generally not suitable for instream enhancement structures. The B1 and B2 channel types are excellent for low and medium stage instream enhancement structures. Combined, Larabee Creek has 16,111 feet of these channel type. Many site specific projects can be designed, to increase pool frequency, volume and pool cover within these reaches.

The lower 13,426 feet of Larabee Creek is a C2 channel type. C2 channels have suitable gradients and the stable stream banks that are necessary for the installation of instream structures

designed to increase pool habitat, trap spawning gravels, 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 these channel types.

The water temperatures recorded on the survey days September 2-4, 8-11, 14-16, and 21, 1992 ranged from 58° F to 76° F. Air temperatures ranged from 57° F to 91° F. The warmer water and air temperatures were recorded in the lower half of the survey reach. These warmer temperatures, if sustained, are above the threshold stress level for salmonids. It is unknown if this thermal regime is typical, but our electrofishing samples found steelhead more frequently in the upper, cooler sample sites. 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 46.6% of the total **length** of this survey, riffles 24.0%, and pools 29.1%. Of the 178 pools, 130 have a maximum depth greater than 3 feet. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. Therefore, installing structures that will increase pool habitat is recommended for locations where their installation will not jeopardize the unstable stream banks, or subject the structures to high stream energy.

Thirty-four of the 166 pool tail-outs measured had embeddedness ratings of 3 or 4. Thirty-three had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Larabee 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 low with a rating of 51.0. The shelter rating in the flatwater habitats was better at 56.4. Riffles rated highest at 69.7. 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 in all habitat types. Additionally, large and small woody debris contribute 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.

Seventy-two of the 87 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 12.6%. This is a very 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 Larabee Creek. The large trees required to contribute shade to the wide channel typical of this reach would also eventually provide a long term source of large woody debris needed for instream structure.

RECOMMENDATIONS

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

2) Temperatures in this section of Larabee 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) Increase the canopy on Larabee 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) 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) Where feasible, increase woody cover in the pool and flatwater habitat units. Most of the existing cover is from boulders. 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. In some areas the material is at hand.

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.

PROBLEM SITES AND LANDMARKS

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 Eel River. Channel type is C2.
1441'	Bridge mid-unit 24' high x 250' wide x 20' long. In good shape.
1561'	Rail road bridge 36' high x 25' wide x 25' long spanning creek.
7614'	Old Humboldt crossing right bank.

8416'	Old Humboldt crossing right bank.
9034'	Left bank slide 350' long x 75' high contributing fines.
9521'	Left bank slide 10' wide x 40' long contributing fines.
10201'	Right bank (RB) slide 680' long x 65' high contributing fines and gravel. Slide begins in unit 66 and ends in this unit, unit 69.
10656'	Left bank slide 350' long x 75' high extending over three units. Contributing fines.
11469'	Balcom Creek (dry) entering from left bank.
11709'	Old bridge crossing, pillar remain.
13426'	Channel type changes from a C2 to a F3.
14049'	Log bridge 17' long x 35' wide x 5.5 high.
20271'	Spring on left bank.
20361'	Exposed left bank 250' long x 20' high contributing fines and gravel.
22892'	Road entering on left bank. Small tributary on right bank 1' wide at mouth.
23265'	Spring entering from right bank.
26158'	Right bank slide 150' high x 250' long contributing fines and gravel.
27455'	Scott Creek entering from left bank.
28548'	Right bank erosion 150' high x 450' long.
28701'	Left bank cut 15' high x 100' long.
29299'	Right bank cut 10' high x 100' long, contributing fines, cobble, and gravel.
30267'	Right bank erosion from habitat units 180-183 50' high x 150' long.
30755'	Boulder roughs.
30902'	Tributary entering from left bank. Channel type changes from a F3 to a B2.
32674'	Channel type changes from a B2 to a B1.

32903'	Left bank cut 15' high x 150' long, contributing fines and boulders.
33774'	Channel type changes from a B1 to an A1.
36165'	Right bank erosion, units 252-253, 40' high x 100' long contributing fines and gravel.
36344'	Right bank rock slide 150' long x 150' high.
37877'	Right bank erosion 75' high x 175' long contributing fines.
38011'	Left bank rock slide 75' high x 125' long contributing fines and gravel.
38710'	Tributary entering from left bank.
39128'	Tributary entering from right bank over a series of 5-6' bedrock cascades.
39310'	Channel type changes from an A1 to a B2.
39921'	Right bank erosion over units 302-308 100' high x 700' long. Contributing fines, gravel, and boulder shards.
40991'	Right bank erosion 10' high x 80' long contributing fines.
41255'	Left bank erosion 50' high x 100' long contributing fines.
42425'	Old slide on right bank 200' high x 300' long, approximately 80% is now revegetated. Remaining 20% contributing fines.
43469'	Left bank erosion 30' high x 125' long contributing fines. Unnamed tributary entering from left bank.
44492'	Right bank erosion over unit 335-338, 100' high x 690' long contributing fines.
45614'	Tributary enters from left bank. Right bank erosion 75' high x 125' long contributing fines.
46477'	Tributary entering from right bank. Flow is intermittent, channel type is an A1.
47389'	Right bank gully 100' high contributing fines.
47656'	Left bank erosion 25' high x 30' long, contributing fines and boulders.
48037'	Right bank erosion 100' high x 200' long contributing fines.

48815' Old slide on left bank 250' high x 350' long, contributing fines.

52044' Right bank slide 150' high x 100' long contributing fines and gravel.

52424' Right bank cut 5' high x 50' long, contributing cobble.

52549' Boulder Creek enters from left bank. Channel type for the tributary is an A2. Young-of-the year (YOY) observed. Access permission denied from this point on. END OF SURVEY.