STREAM INVENTORY REPORT

CANOE CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1992 on Canoe Creek to assess habitat conditions for anadromous salmonids. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Canoe Creek. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

An adult carcasses survey was conducted on Canoe Creek in January 1988. One skeleton was found, and one live salmonid (unidentified) was observed. The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of salmonid habitat.

WATERSHED OVERVIEW

Canoe Creek is tributary to South Fork Eel River, tributary to the Eel River, located in Humboldt County, California (Figure 1). The legal description at the confluence with South Fork Eel River is T2S R2E S13. Its location is 40°17'41" N. latitude and 123°52'42" W. longitude. Canoe Creek is a fourth order stream and has approximately 9.8 miles of blue line stream, according to the USGS Weott 7.5 minute quadrangle. Canoe Creek and its tributaries drain a basin of approximately 10.5 square miles. Elevations range from about 160 feet at the mouth of the creek to 2,200 feet in the headwater areas. The watershed, dominated by redwoods is owned by the California State Parks Department and is managed as a wilderness area. Summer seasonal access exists from State Highway 101 to 11.7 miles south on Avenue of the Giants then via foot bridge across the Eel River to the mouth.

METHODS

The habitat inventory conducted in Canoe 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). Canoe 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 Canoe 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". Canoe 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 Canoe 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 Canoe 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 Canoe 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 Canoe 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.

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 Canoe 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 June 1-5, 8-12, 15-18, 24 and 25, 1992, was conducted by Erick Elliot, Russ Irvin, and Arron Nadig, (CCC and contract seasonals). The survey began at the confluence with the South Fork Eel River and extended to the headwaters. The total length of the stream surveyed was 18,217 feet, with an additional 940 feet of side channel.

A flow of 7.0 cfs was measured 6-1-92 at the confluence of South Fork Eel River with a Marsh-McBirney Model 2000 flowmeter.

This section of Canoe Creek has two channel types: from the mouth to 6,372' is a B2 channel, from 6,373' to 13,967' a B1 channel, and from 13,968' to end of the survey a back to a B2. 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.

Water temperatures ranged from 54 to 63 degrees fahrenheit. Air temperatures ranged from 57 to 82 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 39.7%, riffles 34.6%, and flatwater types 25.7% (Graph 1). Riffle habitat types made up 44.3% of the total survey **length**, flatwater 30.3%, and pools 25.4% (Graph 2).

Sixteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were low gradient riffles, 21.8%; mid-channel pools, 16.7%; step runs, 13.5%; and runs, 11.3% (Graph 3). By percent total **length**, low gradient riffles made up 32.8%, step runs 19.1%, high gradient riffles 9.6%, and runs 9.5%.

One-hundred-sixty-two pools were identified (Table 3). Main-channel pool were most often encountered at 56.2%, and comprised 61.4% 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. Thirty-two of the 162 pools (20%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 162 pool tail-outs measured, sixty-six had a value of 1 (40.7%); 67 had a value of 2 (41.4%); 29 had a value of 3 (17.9%); and none had a value of 4 (0.0%). 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 93.5. Pools had the lowest rating with 85.7 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 91.3, backwater pools rated 82.5, and main-channel pools 81.5 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Boulder was the dominant substrate observed in 29 of the 89 low gradient riffles (32.6%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 30.3% of the low gradient riffles (Graph 8).

Twenty percent of Canoe Creek lacked shade canopy. Of the 80% of the stream that was covered with canopy, 32% was composed of deciduous trees, and 48% was composed of coniferous trees. Graph 9 describes the canopy in Canoe 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 31.8%. The mean percent left bank vegetated was 33.7%. The dominant elements composing the structure of the stream banks consisted of 5.5% bedrock, 37.9% boulder, 16.9% cobble/gravel, 1.4% bare soil, 16.2% grass, 6.4% brush. Additionally, 7.5% of the banks were covered with deciduous trees, and 8.2% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

DISCUSSION

Canoe Creek has two channel types: B2 and B1. The B2 channel type is excellent for many types of low stage instream enhancement structures such as plunge weirs, in-channel and bank boulder placement, single and double wing deflectors, channel constrictors and submerged shelters in straight reaches to name only a few. There are 11,559 feet of this type of channel in Canoe Creek, along with a plenitude of LOD either in or nearby the stream. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and pool cover.

B1 channel types are also ideal for many types of low and medium instream enhancement structures; single and double wing deflector, bank cover, overhead log cover, and "V" and straight spawning weirs. Of the total length surveyed, 7,641 feet comprises this channel type.

The water temperatures recorded on the survey days June 1-5, 8-12, 15-18, 24, and 25 ranged from 54° F to 63° F. Air temperatures ranged from 57° F to 82° 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. 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 30.3% of the total **length** of this survey, riffles 44.3%, and pools 25.4%. The pools are relatively shallow with only 32 of the 162 pools having 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 any unstable stream banks.

Twenty-nine of the 162 pool tail-outs measured had embeddedness ratings of 3 or 4. Sixty-six had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Canoe 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 moderate with a rating of 85.7. The shelter rating in the flatwater habitats was slightly better at 89.6. Riffles rated highest at 93.5. A pool shelter rating of approximately 100 is desirable. The 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. Fifty-three of the 89 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 80%. This is a very good percentage of canopy, since 80 percent is generally considered desirable.

RECOMMENDATIONS

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

2) Temperatures in this section of Canoe 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) 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) 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.

5) 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.

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 South Fork Eel River Channel type is B2.
1316'	Left bank erosion 20' high x 30' long contributing fines.
2309'	Left bank erosion 15' high x 40' long.
3377'	Log debris accumulation (LDA) 7' high x 30' wide. Not a barrier.
3440'	Left bank erosion 100' long x 100' high contributing fines and gravel.
4379'	Right bank erosion 100' wide x 50' high.
4565'	LDA 90' wide x 10' long x 8' high retaining gravel 70' wide x 19' long x 6' deep. Young-of-the-year (YOY) observed above LDA.
6372'	Channel changes from a B2 type to a B1.

6574' LDA 17' high x 39' long x 7' deep.

6600' Left bank erosion 60' high contributing fines, gravel, and woody debris.

7035' LDA 50' high x 20' wide x 85' deep. YOY observed above.

7146' Left bank erosion, beginning in habitat unit 101, 827' long. Source is a 300 yard U-shaped landslide that spreads over three units.

7414' Small LDA at top of unit 107 2' high x 1.5' wide by 15' long. YOY observed above.

8584' Left bank slide highly eroded 40' long x 50' high.

8713' Tributary entering from right bank. Small boulders partially damming entrance.

8790' Eight to ten large downed redwoods creating a 100' high x 100' long LDA. Retaining some gravel but majority of the water is flowing under.

9131' Small LDA 10' high x 10' wide by 23' long.

9452' LDA 25' long x 5' high x 10' wide.

9741' Tributary entering from right bank.

9883' LDA in middle of unit 153, 30' long x 15' high x 10' wide.

10518' LDA blocking main channel 12' high x 30' wide by 45' long.

10711' Tributary entering from left bank half way into unit 172.11.

10748' LDA across creek 50' long x 15' high x 42' wide, retaining gravel. YOY and 1+ observed above jam.

11622' Left bank erosion 20' long x 30' high at bank full contributing gravel and fines.

11669' Channel begins to narrow and steepen.

11692' LDA 25' long x 16' wide x 27' high. Some fines and gravel trapped. Not a barrier.

11767' Small LDA 33' long x 12' wide by 15' high between habitat units 202 and 203. YOY observed above.

12095' Tributary entering from left bank. Mouth very steep.

12160' LDA 35' long x 11' wide x 9' high running parallel to creek. Not a barrier but retaining some gravel.

12716' Left bank slide 60' wide x 125' high contributing fines and gravel. Foliage is being established.

12993' Twelve or so 4" salmonids observed in habitat unit 224, a channel confluence pool.

13423' North Fork Canoe Creek entering from left bank.

13825' LDA 35' long x 10' wide x 6' high spanning creek. Not a barrier.

13861' LDA completely covering unit 38' long x 11' wide x 13' high. Not a barrier.

13968' Channel changes from a B2 to a B1.

14232' Left bank erosion 25' long x 65' high, contributing fines.

15045' LDA on right bank extending across channel 65' long x 40' wide x 20' high.

15123' LDA covering unit 56' long x 55' wide x 11' high. Not a barrier but retaining gravel and small cobble.

15704' Tributary entering from left bank.

16147' LDA 65' long x 6' wide x 5' high.

16831' Slide on left bank 25' long x 50' high, contributing fines.

13191' LDA 20' long x 35' wide x 11' high.

17397' LDA 40' long x 8' wide x 12' high between units 318 and 319.

17488' Canoe Creek forks to right, survey continuing up second right tributary.

17658' Bedrock erosion 40' long x 50' high contributing fines.

17926' LDA at top of unit, 35' long x 3' wide x 4' high.

18119' No fish observed in this reach, gradient dramatically increasing. End of survey for right bank tributary #2.

18136' Canoe Creek fork, survey continued up right trib. SDA 16' long x 2' wide x 3' high.

18236' Several 4" salmonids observed.

18267' LDA 9' long x 2' wide x 4' high.

18650' Right bank erosion 15' long x 32' high contributing fines.

18664' Left bank erosion 10' long x 15' high contributing fines, gravel, and small cobble.

18678' LDA at top of unit 18' long, x 8' wide x 6' high.

18742' LDA at top of unit 10' long x 15' wide x 3' high.

18767' LDA at top of unit 18' long x 20' wide x 8' high.

18890' LDA at top of unit and bottom of following unit, 16' long x 20' wide x 15' high.

18967' LDA at bottom of unit, 15' long x 20' wide x 7' high.

19058' LDA at top of unit, 18' long x 24' wide x 6' high.

19157' No fish observed for last 921 feet, gradient increasing rapidly, many LDA's. END OF SURVEY.