STREAM INVENTORY REPORT

FOX CREEK

INTRODUCTION

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

There is no known record of adult spawning surveys having been conducted on Fox Creek. The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Fox Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Mendocino County, California (Figure 1). Fox Creek's legal description at the confluence with South Fork Eel River is T22N R16W S21. Its location is 39°44'25" N. latitude and 123°11'55" W. longitude. Fox Creek is a first order stream and has approximately 1.5 miles of blue line stream, according to the USGS Lincoln Ridge 7.5 minute quadrangle. Fox Creek drains a watershed of approximately 1.2 square miles. Douglas fir and oak forest dominate the watershed with some areas of open grassland. The watershed is privately owned and is managed for wilderness. Vehicle access exists via State Highway 101 to Laytonville, then west on Branscomb Road to Wilderness Lodge Rd.

METHODS

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

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 Fox 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. Both 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". Fox 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 Fox 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 Fox 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 Fox 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 Fox 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 Fox 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 5 and 6, 1992, was conducted by Judah Sanders and Warren Mitchell (contract seasonals). The total length of the stream surveyed was 3,752 feet, with an additional 101 feet of side channel.

Flows were not measured on Fox Creek.

Fox Creek is an A3 channel type for the entire 3,752 feet of stream reach surveyed. A3 channels are steep (4-10% gradient), well confined streams, with steep, erodible stream banks.

Water temperatures ranged from 56 to 59 degrees fahrenheit. Air temperatures ranged from 56 to 73 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 47.2%, flatwater types 26.4%, and pools 26.4% (Graph 1). Riffle habitat types made up 55.8% of the total survey **length**, flatwater 26.6%, and pools 17.6% (Graph 2).

Ten 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, 22.6%; high gradient riffles, 20.8%; and mid-channel pools, 17% (Graph 3). By percent total **length**, low gradient riffles made up 23.4%, high gradient riffles 22.2%, and step runs 19.8%.

Twenty-eight pools were identified (Table 3). Main-channel pools were most often encountered at 89.3%, and comprised 94.7% 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. Three of the 28 pools (11%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 19 pool tail-outs measured, none had a value of 1 (0.0%); 26 H4 had a value of 2 (21.1%); 13 had a value of 3 (68.4%); and 2 had a value of 4 (10.5%). On this scale, a value of one is the 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. Pool habitat types had the highest shelter rating at 45.9. Flatwater habitats followed with a rating of 33.8 (Table 1). Of the pool types, the backwater had the highest mean shelter rating at 90.0, and scour pools rated 47.5 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Fox Creek and are extensive. Graph 7 describes the pool cover in Fox Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 10 of the 24 low gradient riffles (41.7%). Large cobble was the next most

frequently observed dominant substrate type, and occurred in 25.0% of the low gradient riffles (Graph 8).

Fourteen percent of the survey reach lacked shade canopy. Of the 86% of the stream covered with canopy, 34% was composed of deciduous trees, and 52% was composed of coniferous trees. Graph 9 describes the canopy in Fox 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 11.4%. The mean percent left bank vegetated was 12.9%. The dominant elements composing the structure of the stream banks consisted of 73.6% coniferous trees, 13.8% cobble/gravel, 8.8% boulder, 2.5% bare soil, and 1.3% bedrock (Graph 10).

DISCUSSION

The A3 channel type is generally not suitable for fish habitat improvement structures. A3 channels are found in high energy, steep gradient stream reaches. They have channels dominated by small boulders, cobble, coarse gravel and some sand. Their steep erodible banks are a constant source of high sediment supply. Usually within the A3 channel there are zones of lower gradient where structures designed to trap gravel can be constructed. This seems to be the case in Fox Creek, but any structure sites must be selected with care because of the high stream energy which can create problems with stream bank erosion and structure stability.

The water temperatures recorded on the survey days June 5 and 6, 1992 ranged from 56° F to 59° F. Air temperatures ranged from 56° F to 73° F. This is a very good water temperature regime for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling conducted.

Flatwater habitat types comprised 26.6% of the total **length** of this survey, riffles 55.8%, and pools 17.6%. The pools are relatively shallow with only 3 of the 28 pools having a maximum depth greater than 2 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 or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream. The LDA's in the

system are retaining needed gravel. Any necessary modifications to them should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

Fifteen of the 19 pool tail-outs measured had embeddedness ratings of 3 or 4. None had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Fox 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 relatively low with a rating of 45.9. The shelter rating in the flatwater habitats was slightly lower at 33.8. 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.

Fourteen of the 24 low gradient riffles had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy for the stream was 86%. This is a high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) There are several log debris accumulations present on Fox Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time to avoid excessive sediment loading in downstream reaches.

3) Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Fish passage should be monitored, and improved where possible.

4) 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.

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 and in some areas the material is at hand.

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. Water percolating through boulders and grass into South Fork Eel.
254'	Small log jam 2' high.
893'	No fish observed, major sediment problem in stream.
1209'	Terraced channel. Water barely flowing through woody debris and boulders.
1234'	Large woody debris accumulation (LDA) interrupting flow.
1494'	Small woody debris accumulation (SDA) interrupting flow. No fish observed.
1940'	Braided channel.
2008'	Dry tributary entering from left bank.
2105'	Boulder rough section.
2454'	Large downed redwood obstructing flows. Stagnate pools immediately under log.
2501'	Small tributary entering from left bank. Estimated gradient 30°.

3055' LDA obstructing flows.

3161' Braided channel.

3853' End of survey. Gradient is approximately 25°, stream is intermittent above this unit.