STREAM INVENTORY REPORT

FOSTER CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1993 on Foster 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 Foster 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.

There is no known record of adult spawning surveys having been conducted on Foster 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

Foster Creek is tributary to Rattlesnake Creek, tributary to the South Fork Eel River, tributary to the Eel River, located in Mendocino County, California. Foster Creek's legal description at the confluence with Rattlesnake Creek is T23N R16W S22. Its location is 39°36'47" N. latitude and 123°49'52" W. longitude. Foster Creek is a second order stream and has approximately 3.3 miles of blue line stream, according to the USGS Tan Oak Park, Leggett, and Bell Springs 7.5 minute quadrangles. Foster Creek drains a watershed of approximately 9.0 square miles. Summer base runoff is approximately 1.5 cfs at the mouth. Elevations range from 1,180 feet at the mouth of the creek to 2,800 feet in the headwater areas. Oak and Douglas fir forest dominates the watershed. The watershed is privately owned and is managed for rural residential land use. Vehicle access exists from U.S. Highway 101, approximately one mile south of Cummings.

METHODS

The habitat inventory conducted in Foster Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991). The California Conservation Corps (CCC) Technical Advisor and the contract seasonal that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Foster Creek personnel were trained in May, 1993, 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 Foster Creek to record measurements and observations. There are nine components to the inventory form. For specific information on the methods used see the Rattlesnake Creek report.

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 Foster Creek to document the fish species composition and distribution. Two sites were electrofished in Foster 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.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes (25.4, 12.5, 4.7, 2.37, and 0.85mm).

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. 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 Lotus 1,2,3. Graphics developed for Foster 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 August 11, 12, and 16, 1993, was conducted by Ruth Goodfield and Warren Mitchell (CCC and contract seasonal). The total length of the stream surveyed was 16,790 feet, with an additional 196 feet of side channel.

Flow was measured 50 feet from the confluence with Rattlesnake Creek with a Marsh-McBirney Model 2000 flowmeter at 1.5 cfs on August 11, 1993.

This section of Foster Creek has four channel types: from the mouth to 2,744 a C2; next 2,190 feet a B2; next 9,502 feet a C3; and the upper 2,354 feet a D1. C2 streams have gentle gradient, meandering, cobble/gravel channels. B2 channels are moderate gradient (1.0-2.5%), moderately confined, cobble/gravel channels. C3 channels are low gradient (0.5-1.0%), slightly confined, gravel channels. D1 types have a gradient over 1%, cobble/gravel channels, and no valley confinement.

Water temperatures ranged from 61 to 84 degrees Fahrenheit. Air temperatures ranged from 67 to 80 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 37.2%, riffles 33.9%, and flatwater 28.9% (Graph 1). Flatwater habitat types made up 38.6% of the total survey **length**, riffles 33.5%, and pools 27.9% (Graph 2).

Foster Creek

Fourteen 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, 32.6%; step runs, 17.4%; and bedrock formed lateral scour pools, 16.5% (Graph 3). By

percent total **length**, low gradient riffles made up 32.8%, step runs 28.2%, and bedrock formed lateral scour pools 10.9%.

Eighty-one pools were identified (Table 3). Scour pools were most often encountered at 49.4%, and comprised 42.6% of the total length of pools. Main channel pools comprised 46.9% of pool occurrence and 55.7% of the total pool length (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Forty-eight of the 81 pools (59%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 62 pool tail-outs measured, zero had a value of 1 (0.0%); 14 had a value of 2 (22.6%); 39 had a value of 3 (62.9%); and 9 had a value of 4 (14.5%). 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 16.7. Flatwater habitats followed with a rating of 12.7 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 20.8, scour pools had a rating of 13.6, and backwater pools rated 5.0 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Foster Creek. Bedrock ledges are the next most common cover type. Graph 7 describes the pool cover in Foster Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 60 of the 71 low gradient riffles (84.5%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 14.1% of the low gradient riffles (Graph 8).

Forty-two percent of the survey reach lacked shade canopy. Of the 58% of the stream covered with canopy, 90% was composed of deciduous trees, and 10% was composed of coniferous trees. Graph 9 describes the canopy in Foster 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 55.9%. The mean percent left bank vegetated was 59.5%. The dominant elements composing the structure of the stream banks consisted of 34.2% bedrock, 14.7% boulder, 26.8% cobble/gravel, 5.3% bare soil, 3.4% grass, 2.1% brush. Additionally, 13.3% of

the banks were covered with deciduous trees, and 0.2% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on August 17, 1993 in Foster Creek. The units were sampled by Ruth Goodfield and Warren Mitchell (CCC and contract seasonal). All measurements are fork lengths (FL) unless noted otherwise.

The first site was habitat unit 030, a run, approximately 2,404 feet above the creek mouth. This site had an area of 384 sq ft, and a volume of 193 cu ft. Twenty-four steelhead were sampled. They ranged from 46 to 142mm FL. Three passes were performed, with a total effort of 653 seconds.

The second site sampled was habitat unit 099, a bedrock formed lateral scour pool, approximately 8,110 feet from the confluence with Rattlesnake Creek. This site had an area of 432 sq ft, and a volume of 475 cu ft. The unit yielded 128 steelhead, ranging from 44 to 164mm FL. Four passes were performed, with a total effort of 1,648 seconds.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Foster Creek.

DISCUSSION

Foster Creek has four channel types: B2, C2, C3, and D1. Both B2 and C2 channel types are excellent for many types of low and medium stage instream enhancement structures. There are 2,190 feet of B2 channels and 2,744 feet of C2 channels in Foster Creek. Many site specific projects can be designed within these channel types, especially to increase pool frequency, volume and pool cover.

The C3 channels are meandering stream types on noncohesive gravel beds which have poorly consolidated and unstable stream banks.

They are generally not suitable for instream enhancement structures. However, bank placed boulders, bank cover, overhead log cover and shelter structures in straight reaches are often appropriate. Any work considered will require careful design, placement, and construction that must include protection for the unstable banks.

The D1 channels are highly aggraded reaches, without any channel confinement. They are generally poorly suited for any type of instream structures.

The water temperatures recorded on the survey days August 11, 12, and 16, 1993 ranged from 61° F to 84° F. Air temperatures ranged from 67° F to 80° F. The warmer water temperatures were recorded in the upper 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 lower, 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 38.6% of the total **length** of this survey, riffles 33.5%, and pools 27.9%. The pools are relatively deep with 48 of the 81 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. 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. Therefore, installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not cause stream bank erosion.

Forty-eight of the 62 pool tail-outs measured had embeddedness ratings of 3 or 4. Zero had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In Foster 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 16.7. The shelter rating in the flatwater habitats was lower at 12.7. 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, bedrock ledges 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.

All of the 71 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 58%. This is a moderate 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) Foster Creek should be managed as an anadromous, natural production stream.

2) Temperatures in this section of Foster 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 Foster 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) 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.

6) 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.

7) 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.

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 Rattlesnake Creek. Reach #1 is a C2 channel type.

1811' Railroad car bridge 100' above the creek.

2744' Channel type changes to a B2 (reach #2).

2989' Tributary enters from the left bank; approximate flow 0.5 cfs.

4186' Tributary enters from the right bank.

4822' Left bank debris flow/slump 100' high x 80' long.

4934' Channel type changes to a C3 (reach #3).

7252' Tributary enters from the right bank. Young-of-the-year (YOY) salmonids observed.

8623' Dam 2' high x 23' wide.

10323' Small tributary enters from the right bank.

10434' Tributary enters from the right bank. YOY observed. Water temperature was 65°F in this tributary.

10747' Water temperature 84°F; no fish observed.

12237' Water temperature measured at 76°F in this section; however, salmonids observed.

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14049' Right bank active "blue goo" earth flow 100' high x 135' long.

14214' Left bank "blue goo" slide 45' high x 80' long.

14491' Intermittent tributary enters from the left bank; water temperature 67°F.

14436' Channel type changes to a D1 (reach #4).

15167' Left bank "blue goo" earthflow.

15859' Plunge 4' high into pool.

16699' Right bank "blue goo" earthflow 35' high x 80' long.

16790' Long, very steep gradient ends the range of salmonids. No fish observations beyond this point.
End of survey.

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