STREAM INVENTORY REPORT

FISH CREEK (Near Benbow)

INTRODUCTION

A stream inventory was conducted during the summer of 1994 on Fish 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 Fish 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 Fish Creek. However, landowners report past observations of spawning salmonids in the lower reaches of the stream. 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

Fish Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Humboldt County, California. Fish Creek's legal description at the confluence with the South Fork Eel River is T5S R3E S01. Its location is 40°03'35" N. latitude and 123°46'42" W. longitude. Fish Creek is a first order stream and has approximately 1.5 miles of blue line stream according to the USGS Garberville 7.5 minute quadrangle. Fish Creek drains a watershed of approximately 2.0 square miles. Summer base runoff is approximately 0.42 cfs at the mouth. Elevations range from about 390 feet at the mouth of the creek to 2,400 feet in the headwater areas. Oak-grasslands, Redwood and Douglas fir forest dominate the watershed. The watershed is privately owned and is managed for forestry, grazing, and rural residence. Vehicle access exists via U.S. Highway 101 at the Benbow exit, thence south approximately 1/2 mile on Benbow Drive.

METHODS

The habitat inventory conducted in Fish Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991 rev. 1994). The California Conservation Corps (CCC) Technical Advisors that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game

(DFG). Fish Creek personnel were trained in June, 1994, 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 Fish 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 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, 5) sinuosity.

3. Temperatures:

Both water and air temperatures are measured 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. A year after the habitat survey, a recording thermograph was placed at a one foot depth in mixed, flowing water 300' above the confluence with the South Fork Eel River. It recorded temperatures on an hourly basis for 12 days from July 19 to August 1, 1995.

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". Fish 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 Fish 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 Fish 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 and recorded as a one and two respectively.

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 Fish 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 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 Fish Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) of both the right and left banks were selected from 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.

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, 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

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- 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 Fish 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 21 and 30 and July 7, 1994, was conducted by Ruth Goodfield and Will Abel (CCC). The total length of the stream surveyed was 6,830 feet with an additional 288 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.42 cfs on June 21, 1994.

Fish Creek is a B4 channel type for the first 3,119 feet of stream reach surveyed and an A4 channel type for the remaining 3,711 feet. B4 channels are moderately entrenched, moderate gradient, riffle-dominated channels with infrequently spaced pools, stable plan and profile, stable banks, and gravel substrates. A4 channels are steep, narrow, cascading, step/pool streams with gravel substrates and high energy/debris transport associated with depositional soils.

Water temperatures ranged from 61 to 78 degrees Fahrenheit. Air temperatures ranged from 61 to 84 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 45%, flatwater types 42%, and pools 13% (Graph 1). Riffle habitat types made up 48% of the total survey **length**, flatwater 45%, and pools 5% (Graph 2).

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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, 39%; runs, 26%; and step runs, 16% (Graph 3). By percent total **length**, low-gradient riffles made up 42%, step runs 28%, and runs 17%.

Twenty-nine pools were identified (Table 3). Main channel pools were most often encountered at 62% and comprised 66% 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. Seven of the 29 pools (24%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 26 pool tail-outs measured, none had a value of 1 (0%); 5 had a value of 2 (19%); 20 had a value of 3 (77%); and 1 had a value of 4 (4%). 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 34. Flatwater habitats followed with a rating of 19 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 43, and main channel pools rated 34 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Fish Creek and are extensive. Large and small woody debris contribute a small amount. Graph 7 describes the pool cover in Fish Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 70 of the 88 low gradient riffles (80%). Small cobble was the next most frequently observed dominant substrate type and occurred in 18% of the low gradient riffles (Graph 8).

Fifty-two percent of the survey reach lacked shade canopy. Of the 48% of the stream covered with canopy, 60% was composed of deciduous trees, and 35% was composed of coniferous trees. Graph 9 describes the canopy in Fish 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 48%. The mean percent left bank vegetated was 54%. The dominant elements composing the structure of the stream banks consisted of

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3.1% bedrock, 28% boulder, 47.6% cobble/gravel, 21.3% silt/clay. Additionally, 18% of the banks were covered with deciduous trees, and 13.3% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on June 21 and July 5, 1994, in Fish Creek. The units were sampled by Ruth Goodfield and Will Abel (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled was habitat unit 27, a mid-channel pool, approximately 956 feet from the confluence with the South Fork Eel River. This site had an area of 90 sq ft and a volume of 72 cu ft. The unit yielded 18 steelhead, ranging from 53 to 84mm FL; 3 coho, 58 to 64mm; 1 chinook, 72mm; and 2 Sacramento squawfish, 61 and 86mm.

The second site was habitat unit 206, a run located approximately 6,321 feet above the creek mouth. This site had an area of 160 sq ft and a volume of 64 cu ft. No fish were sampled.

The third site sampled was a plunge pool located approximately 7,430 feet above the creek mouth and 600 feet above the upper end of the 1994 habitat survey. No dimensions were given for this site. No fish were found.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Fish Creek.

DISCUSSION

Fish Creek has two channel types: A4 and B4. The high energy and steep gradient of the A4 channel type is generally not suitable for instream enhancement structures. However, in these reaches there are often sites where some treatments can be effective if carefully selected, designed and constructed. B4 channel types are excellent for many types of low and medium stage instream enhancement structures. There are 3,119 feet of B4 channel in Fish Creek. Many site specific projects can be

designed within these channel types, especially to increase pool frequency, volume, and pool cover.

The water temperatures recorded on the survey days June 21 and 30 and July 7, 1994, ranged from 61° F to 78° F. Air temperatures ranged from 61° F to 84° F. This is a poor water temperature range for salmonids; 78° F, if sustained, is above the threshold stress level for salmonids. Between July 20 and August 1, 1995 a recording thermograph was placed in Fish Creek 300' above the confluence with the South Fork Eel River. It recorded temperatures that ranged from a low of 65°F and a high of 75°F on an hourly basis during that period (1995 addenda).

Flatwater habitat types comprised 45% of the total **length** of this survey, riffles 48%, and pools 5%. The pools are relatively shallow with only 7 of the 29 pools having a maximum depth greater than 2 feet. 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. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy

Twenty-one of the 26 pool tail-outs measured had embeddedness ratings of 3 or 4. None 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 Fish 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 34. The shelter rating in flatwater habitats was lower at 19. 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 rootwad 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.

Eighty-six of the 88 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 48%. This is a moderate percentage of canopy, since 80 percent is generally considered optimum in these north coast streams. In areas where shade canopy is lacking, as well as in areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) Temperatures in this section of Fish 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 Fish 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, like the site at 2,553', 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.

9) One log debris accumulation is present on Fish Creek that is retaining large quantities of gravel. The modification of this debris accumulation is desirable, but must be done carefully over time to avoid excessive sediment loading in downstream reaches.

10) 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.

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 B4.

186' Braided channel for 15'.

251' Benbow Drive bridge crossing.

819' Left bank spring.

1064' Active blue schist clay slide on right bank, no dimensions given. Right bank springs.

2394' Failing blue schist clay left bank. Owner is mulching with straw.

2553' Failing 300' section of blue schist clay left bank.

2769' Log and debris accumulation 5' high x 40' wide x 15' long. Retaining gravel.

2957' Failing blue schist clay right bank 40' long x 30' high.

3119' Channel type changes to A4.

3690' Right bank tributary with residual surface flow. Not accessible to fish due to high gradient.

5220' Young-of-the-year salmonids observed.

6830' End of survey. Fill from new road crossing blocking stream. Approximately 600' upstream is a 22' falls.

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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

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Dammed Pool	[DPL]	6.5