STREAM INVENTORY REPORT

FISH CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1993 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. 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 T3S R3E S11. Its location is 40°13'17" N. latitude and 123°48'01" W. longitude. Fish Creek is a second order stream and has approximately 3.0 miles of blue line stream, according to the USGS Miranda and Myers Flat 7.5 minute quadrangles. Fish Creek drains a watershed of approximately 4.4 square miles. Elevations range from about 210 feet at the mouth of the creek to 1,800 feet in the headwater areas. Redwood forest dominates the watershed. The lower 0.5 miles of Fish Creek is owned by the State of California and is managed by Humboldt Redwoods State Parks. The remainder of the watershed is privately owned and is managed for timber production. Vehicle access exists from U.S. Highway 101 at Miranda, via Avenue of the Giants. This road accesses the mouth of Fish Creek approximately two miles south of Miranda.

METHODS

The habitat inventory conducted in Fish Creek follows the methodology presented in the California Salmonid Stream Habitat

Restoration Manual (Flosi and Reynolds, 1991). 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 May, 1993, by Gary Flosi and Scott Downie. This inventory was conducted by a three 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 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 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.

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.

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:

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 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 Fish Creek to document the fish species composition and distribution. Three sites were electrofished in Fish 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 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 15-24, 1993, was conducted by Craig Mesman, Ruth Goodfield, Jason Johnson, and Chris Coyle (CCC and contract seasonal). The total length of the stream surveyed was 12,987 feet, with an additional 465 feet of side channel.

Flows were not measured on Fish Creek.

Fish Creek is a C1 channel type for the first 1,751 feet of the stream reach surveyed, then it changes to a B6 channel type for the remaining 11,236 feet of the survey. C1 channels are low gradient (1.0-1.5%), slightly confined streams, with a developed floodplain. B6 channels are narrow and deep, meandering streams, with gravel beds.

Water temperatures ranged from 56 to 68 degrees Fahrenheit. Air temperatures ranged from 59 to 85 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 38.6%, pools 35.5%, and flatwater 25.9% (Graph 1). Riffle habitat types made up 51.2% of the total survey **length**, flatwater 27.0%, and pools 21.8% (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 low gradient riffles, 31.7%; runs, 13.5%; step runs, 11.2%; and mid-channel pools, also 11.2% (Graph 3). By percent total **length**, low gradient riffles made up 45.7%, step runs 16.8%, and runs 9.1%.

Ninety-two pools were identified (Table 3). Scour pools were most often encountered at 47.8%, and comprised 36.4% of the total length of pools. Main channel pools comprised 45.7% of total pool occurrence, and 58.5% of 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 92 pools (52%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 92 pool tail-outs measured, 21 had a value of 1 (22.8%); 45 had a value of 2 (48.9%); 21 had a value of 3 (22.8%); and 5 had a value of 4 (5.4%). 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 61.5. Flatwater habitats followed with a rating of 26.3 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 68.4, backwater pools had a rating of 58.3, and main channel pools rated 54.8 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Fish Creek and are extensive. White water and large woody debris are the next most common dominant cover types. 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 36 of the 82 low gradient riffles (43.9%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 42.7% of the low gradient riffles (Graph 8).

Forty percent of the survey reach lacked shade canopy. Of the 60% of the stream covered with canopy, 82% was composed of deciduous trees, and 18% 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 65.0%. The mean percent left bank vegetated was 67.1%. The dominant elements composing the structure of the stream banks consisted of 2.7% bedrock, 9.2% boulder, 5.0% cobble/gravel, 3.3% bare soil, 11.8% grass, 6.2% brush. Additionally, 42.5% of the banks were covered with deciduous trees, and 19.3% with

coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on June 28, 1993 in Fish 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 sampled was a culvert flume below the Avenue of the Giants culvert, approximately 427 feet from the confluence with the South Fork Eel River. The site was located at latitude 40°13'28" and longitude 123°48'12". Flow was measured at 1.7 cfs. This site had an area of 416 sq ft, and a volume of 458 cu ft. The unit yielded 16 steelhead, ranging from 39 to 260mm FL; 7 roach, ranging from 39 to 72mm FL; one chinook salmon, 82mm FL; and one coho salmon, 43mm FL.

The second site was habitat unit 121, a channel confluence pool, located at the forks 7,781 feet above the creek mouth. This site had an area of 270 sq ft, and a volume of 189 cu ft. Six steelhead were sampled. They ranged from 59 to 122mm FL.

The third site sampled was habitat unit 170, a step pool, located approximately 9,329 feet above the creek mouth. The site had an area of 153 sq ft, and a volume of 245 cu ft. No fish were found, and no fish had been observed above the cascades at 9,279 feet.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Fish Creek.

DISCUSSION

The surveyed reach of Fish Creek has two channel types: C1 and B6. The lower 1,751 feet of Fish Creek is a C1 channel type. C1 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.

There are 11,236 feet of B6 channel type in Fish Creek. The B6 channels are generally unsuitable for instream structures. They are dominated by fine-grained substrates and are susceptible to

stream bank disturbances. However, riparian vegetation provides stream bank armor and stability in these channels.

The water temperatures recorded on the survey days June 15-23, 1993 ranged from 56° F to 68° F. Air temperatures ranged from 59° F to 85° F. This is a fair water temperature regime for salmonids. However, 68° F, if sustained, is above the threshold stress level 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 27.0% of the total **length** of this survey, riffles 51.2%, and pools 21.8%. The pools are relatively deep with 48 of the 92 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 be threatened by high stream energy or cause streambank erosion.

Twenty-six of the 92 pool tail-outs measured had embeddedness ratings of 3 or 4. Twenty-one 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 moderate with a rating of 61.5. The shelter rating in the flatwater habitats was lower at 26.3. However, 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, white water and large woody debris contribute a small amount. Log and root wad cover structures in the 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-one of the 82 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 60%. This is a

relatively 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) 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) 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) Increase woody cover in the 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.

5) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites, like the one at 3,544, should then be treated to reduce the amount of fine sediments entering the stream.

6) 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.

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 the South Fork Eel

River. Delta plume at the mouth 40' wide x 60' long x 8' high. Channel type is a C1 for the first 1751' of stream surveyed

427' Active terrace 60' wide x 125' long x 4' high.

482' Avenue of the Giants crosses the channel. Square concrete culvert 6' wide x 7' high x 128' long. Culvert has baffles and wing walls; possible anadromous fish barrier.

706' Several young-of-the-year (YOY) salmonids observed.

1246' Tributary enters from the right bank (RB), no fish observed in the first 150'.

1751' Channel type changes to a B6 for the remaining 11236' of stream surveyed.

1777' Left bank (LB) slump 30' high x 30' long.

2811' Red legged frog observed.

3544' Rotational slide on LB, 150' high x 80', with large conifers down. Major sediment source to the channel.

3644' Log jam at upstream end of this unit. Slope failures on RB.

3668' Log and debris accumulation (LDA) 60' wide x 30' long x 11' high.

3698' RB slump 50' high x 100' long.

3846' LDA 45' wide x 15' long x 5.5' high; potential barrier.

4437' Five steelhead observed.

4711' Right bank exposed soil 25' high x 100' long.

4819' "Blue goo" grass covered outcrop with some slumping, 100-150' high x 200' long.

5534' LDA with potential for future barrier. Exposed bank 15' high.

5712' Large rotational slide 80' high x 200' long, contributing major sediment load into the channel.

5930' Six juvenile steelhead observed.

6069'	Right bank bare soil 45' high x 65' long, with no toe slope.
6362'	Right bank active "blue goo" slide 55' high x 75' long.
6547'	Old logging road 50' above left bank (LB).
7781'	Confluence of north and south branches; survey continues up the south fork.
8711'	Tributary enters from the LB; flow approximately 0.5 cfs. No fish observed, but mouth is open and accessible.
9158'	Plunge 5.5' high; possible fish barrier.
9279'	Series of two cascades forms possible fish barrier.
9399'	Cascade with 6' high drop.
9410'	Plunge 5' high.
11313'	Active slide on LB, 50' high x 30' long, contributing fines into the channel.
11813'	LB tributary; flow approximately 0.2 cfs.
12251'	Lateral erosion on LB; 12' high x 70' long.
12358'	LB tributary; flow approximately 0.3 cfs.
12987'	End of survey. High gradient; no fish observed.

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