STREAM INVENTORY REPORT

Fish Creek

INTRODUCTION

A stream inventory was conducted during the spring of 1998 on Fish Creek, tributary to Lawrence Creek in the Van Duzen River drainage. 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 presence and distribution of juvenile salmonid species.

Adult carcass surveys were conducted on Fish Creek by the California Department of Fish and Game (DFG), AmeriCorps*USA Watershed Stewards Project (AmeriCorps/WSP), and The California Conservation Corps (CCC) from 1992 through 1998. The table below describes the results of those surveys:

Fish Creek Carcass Surveys 1993 to 1998

		Chinook Salmon				Other	
Year	# of Surveys	Live Fish	# of Carcass	AdiposeClipCWT	Redds seen	Coho seen	SH/RT seen
1993	1	3	0	0	2	0	0
1994	2	3	0	0	9	0	0
1995	1	1	1	0	0	0	0
1996	3	0	1	0	15	0	0
1998	1	3	0	0	0	0	0

The objective of this report is to document the current habitat conditions in Fish Creek, and recommend options for the enhancement of habitat for chinook salmon, coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Fish Creek is a tributary to the Lawrence Creek, tributary to Yager Creek, tributary to the Van Duzen River, tributary to the Eel River, located in Humboldt County, California (Map 1). Fish

Fish Creek (Lawrence), 1998

Creek's legal description at the confluence with Lawrence Creek is T3N R2E S19. Its location is 40°37′55″ North latitude and 123°59′28″ West longitude. Fish Creek is a first order stream and has approximately 1.0 miles of blue line stream according to the USGS Iaqua Buttes and McWhinney Creek 7.5 minute quadrangles. Fish Creek drains a watershed of approximately 1.89 square miles. Elevations range from about 630 feet at the mouth of the creek to 1800 feet in the headwater areas. Redwood and Douglas fir forest dominate the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via State Highway 36 near Carlotta, via Fisher Road, to Pacific Lumber Company's Yager Camp. The main Yager- Lawrence haul road leads past Road 9 to Fish Creek, 10 miles from Yager Camp.

METHODS

The habitat inventory conducted in Fish Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al., 1998). The AmeriCorps Watershed Stewards Project (AmeriCorps/WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1995). All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest, dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory methodology and data sheet have been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This protocol was used in Fish Creek to record measurements and observations. There are nine components to the inventory data sheet.

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.

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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, and 5) sinuosity.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees 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. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were 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) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, or other considerations.

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 fully-described 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 fully-described 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. In addition the dominant substrate composing the pool tail outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Fish Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

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 and the dominant vegetation type of both the right and left banks for each fully-described unit 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. In Fish Creek fish presence was observed via streambank observation, carcass surveys, and electrofishing. Previously, one site had been electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

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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 0.85 mm; Valentine, 1995).

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
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Quattro Pro. 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 the pool tail outs
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

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HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of June 2 and 3, 1998, was conducted by Paul Retherford, Jennifer Jenkins, and Janet Lester (AmeriCorps/WSP) and Kevin McKernan (AmeriCorps). The total length of the stream surveyed was 3,548 feet with an additional 173 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.83 cfs on June 3, 1998.

Fish Creek is an F4 channel type for the first 1,533 feet and a F3 channel for the remaining 2,005 feet of stream surveyed. F4 channels are entrenched, meandering gravel dominated riffle/pool channels on low gradients with high width/depth ratios. F3 channel types are entrenched meandering cobble dominated riffle/pool channels on low gradients with high width/depth ratios.

Water temperatures taken during the survey period ranged from 52° to 54° F. Air temperatures ranged from 52° to 67° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 33% riffle units, 30% flatwater units, and 36% pool units (Graph 1). Based on total length of Level II habitat types there were 31% riffle units, 42% flatwater units, and 27% pool units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle, 28%; runs, 21%; and mid-channel pools, 16% (Graph 3). Based on percent total length, low gradient riffles made up 27%, runs, 24%, and step runs, 19%.

A total of 38 pools were identified (Table 3). Scour pools were the most frequently encountered Level III pool type at 50% (Graph 4) and comprised 44% of the total length of all pools (Table 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Eighteen of the 38 pools (47%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 37 pool tail-outs measured, 1 had a value of 1 (3%); 9 had a value of 2 (24%); 13 had a value of 3 (35%); 11 had a value of 4 (30%) and 3 had a value of 5 (8%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for

spawning. In Fish Creek, two of the three (67%) pool tail-outs which were valued at 5 had silt/clay/sand or gravel too small to be suitable for spawning as the substrate. The other tail-out were unsuitable for spawning due to the tail-out being comprised of boulder.

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 habitat types had a mean shelter rating of 16, flatwater habitat types had a mean shelter rating of 36, and pool habitats had a mean shelter rating of 19 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 21. Backwater pools had a mean shelter rating of 20 (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 is absent or scarce in all habitat 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 28 of the 38 (74%) pool tail outs measured. Sand and small cobble were the next most frequently observed dominant substrate types; each occurred in 8% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 83%. The mean percentages of conifer and deciduous trees were 59% and 41%, respectively. Graph 9 describes the canopy in Fish Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 64.1%. The mean percent left bank vegetated was 59.5%. The dominant elements composing the structure of the stream banks consisted of 3.2% bedrock, 17.7% boulder, 11.3% cobble/gravel, and 67.7% sand/silt/clay (Graph 10). Coniferous trees was the dominant bank vegetation type observed in 35.5% of the units surveyed. Additionally, 33.9% of the units surveyed had deciduous trees as the dominant bank vegetation, and 35.5% had coniferous trees as the dominant bank vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on June 28, 1996, in Fish Creek by Craig Mesman and Andrew MacMillan (CCC). The site included habitat units 0035-0037, a riffle/run/pool sequence approximately 1,319 feet from the confluence with Lawrence Creek. This site had an area of 760 sq ft and a volume of 580 cu ft. The units yielded 18 young-of-the-year (YOY) steelhead rainbow trout and four Pacific giant salamanders.

Fish Creek (Lawrence), 1998

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Fish Creek.

DISCUSSION

Fish Creek is a F4 channel type for the first 1,533 feet and a F3 channel for the remaining 2,005 feet of stream surveyed. The suitability of F4 and F3 channel typess for structures is: F4 channels are good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover; and poor for boulder clusters. F3 channels are good for bank-placed boulders and single and opposing wing-deflectors and fair for plunge weirs, boulder clusters, channel constrictors, and log cover.

The water temperatures recorded on the survey days June 2 to 3, 1998, ranged from 52° to 54° F. Air temperatures ranged from 52° to 67° F. This is an excellent water temperature range for salmonids. Fish Creek seems to have temperatures favorable to salmonids. However, to make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 42% of the total length of this survey, riffles 31%, and pools 27%. The pools are relatively shallow, with only 18 of the 38 (47%) pools having a maximum depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream 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. Primary pools comprise 13% of the total stream length on Fish Creek. 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 any needed modification of log debris accumulations (LDA's) in the stream. The LDA's in the system may be 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.

One of the 37 (3%) pool tail-outs measured had an embeddedness rating of 1, 24% had a rating of 2, 65% had ratings of 3 or 4, and 8% had a rating of 5 and were considered unsuitable for spawning. Two of the three (67%) pool tail-outs with a rating of 5 were unsuitable for spawning due to the dominant substrate being silt/sand/clay or gravel being too small to be suitable. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In Fish Creek, sediment sources should be

mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was low with a rating of 19. The shelter rating in the flatwater habitats was better at 36. 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 most habitat types. Additionally, small woody debris contributes a small amount. Log and root wad cover structures in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Instream cover created by small and large woody debris provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Thirty-one of the 38 (82%) pool tail outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 83%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 64% and 60%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting native 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) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) 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.

4) 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.

5) The surveyors reported that a fishway at the mouth of the creek did not appear to be functional at the time of the survey. The fishway should be checked to insure that it is functioning properly. Also, the LDA's in this stream that should be checked to determine if they are barriers or impediments to fish passage.

6) Primary pools comprise 13% of the total stream length surveyed. 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.

7) 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.

8) There are several log debris accumulations present on Fish Creek that may be retaining sediment. The modification of these debris accumulations might be desirable in order to meter gravel downstream to spawning sites. However, this potential benefit must be balanced against the risk of mobilizing stored fine sediments and thereby exacerbating downstream siltation problems.

9) The stream banks along Fish Creek are dominated by fine sediments. Therefore, increase bank vegetation, by planting willow, alder, or other appropriate species, along the stream, where vegetation is sparse in order to maintain bank stability and limit bank erosion. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

0' Begin survey at confluence with Lawrence Creek. Non- functioning fishway at mouth, 4' high jump to entrance with no jump pool at this time.

14' Man made step pool with 1' - 2' high jumps. Marginal spawning tail outs.

76' Failing root wad and log structure.

207' Man made root wad structure on bank, out of water.

350' CCC site 350' - structure forming pool.

524' Right bank boulder/log deflector cutting off side channel, working well.

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610' LDA 3' L x 12' W x 3' H, does not appear to be a barrier, creating cover.

938' At 23' into unit, Railroad bridge, 8' L x 25' W x 10' H
973' Not surveyed due to log bridge 45' L x 10' W x 3' H on main road.

1183' LDA 12' L x 10' W x 4' H

1334' CCC site 1420' - double digger logs

1396' Man made plunge pool.

1519' CCC site 1600' - bank protection.

1582' CCC site 1675' - cover log.

1719' CCC site 1810' - cover/scour. Channel type changes to an F3

1869' Two left bank seeps.

1909' CCC site 1985'

2046' CCC site 2170' - LDA 10' L x 20' W x 6' H

2196' CCC site 2280'

2239' Four logging cables straddling the stream, not in wetted channel.

2343' Structure not in channel.

2453' At 31' into the unit, LDA 10' L x 8' W x 5' H

2873' CCC site 2950' - plunge pool.

3115' At 70' into the unit, LDA 15' L x 7' W x 4' H

3212' LDA 28' L x 25' W x 8' H - doesn't appear to be a barrier

3233' Tail crest is not available for spawning due to large log laying across stream bed.

3242' LDA from HAB Unit # 89 extends through this unit.

Fish Creek (Lawrence), 1998

3408' LDA 15' L x 20' W x 5' H - doesn't appear to be a barrier.

3548' End of survey - LDA 17' L x 25' W x 7' H, 7' jump with a 1.5' h jump pool, sediment trapped above the LDA. No fish observed for 1000' above the LDA, but good spawning habitat above it.

REFERENCES

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California salmonid stream habitat restoration manual, 3rd edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, California.

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