South Fork Eel River Headwaters, 1996

STREAM INVENTORY REPORT

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INTRODUCTION

A stream inventory was conducted during the summer of 1996 on South Fork Eel River above its confluence with Mud Creek. 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 the South Fork Eel River. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

Adult carcass surveys were conducted on South Fork Eel River by the California Department of Fish and Game (DFG) from 1988 through 1996. The table below describes the results of those surveys:

South Fork Eel River Carcass Surveys 1988-1996

		Chinook Salmon				Other	
Year	# of Surveys	Live Fish	# of Carcass	Adipose Clip CWT	Redds seen	Coho seen	SH/RT seen
1987-88	1	51	21	0	38	10	0
1988-89	5	37	58	0	109	2	0
1990-91	3	127	0	0	25	0	0
1991-92	1	11	1	0	5	0	0
1995-96	3	0	0	0	39	17	2

Adult carcass surveys were conducted in South Fork Eel River from 1988 through 1996. None of the fish observed had either coded wire tags or clipped adipose fins. The objective of this report is to document the current habitat conditions, and recommend options for the potential improvement of habitat for Chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

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South Fork Eel River is a tributary to the Eel River in Mendocino County, California. South Fork Eel's legal description at the confluence with Mud Creek is T21N R16W S26. Its location is 39°38'41" North latitude and 123°36'53" West longitude. South Fork Eel is a second order stream and has approximately 8.3 miles of blue line stream according to the USGS Cahto Peak 7.5 minute quadrangle. South Fork Eel drains a watershed of approximately 15.4 square miles. Elevations range from about 1,580 feet at the mouth of the creek to 2,400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production, rangeland, dispersed recreation and rural residences. Vehicle access exists via U.S. Highway 101 from Laytonville. From Laytonville travel west to Branscomb. Approximately two miles before reaching Branscomb, at Mud Creek Bridge, follow Mud Creek downstream to the South Fork Eel Headwaters survey reach.

METHODS

The habitat inventory conducted in South Fork Eel River follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1994). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). South Fork Eel River personnel were trained in May, 1996, by Scott Downie and Ruth Goodfield. 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, 1994). 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. 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

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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 South Fork Eel River 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.

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". South Fork Eel River 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 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 South Fork Eel River, 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). Additionally, a rating of "not suitable" (NS) 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 South Fork Eel River, 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.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In South Fork Eel River, 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 South Fork Eel River, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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 South Fork Eel River fish presence was observed from the stream banks, and **one** site was electrofished using one Smith-Root Model 12 electrofisher. 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 0.85 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 Lotus 1,2,3. Graphics developed for South Fork Eel River include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length

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- 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
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

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

The habitat inventory of August 14, 15, 19, 20, and 21 1996, was conducted by Todd Kraemer and Kelley Garrett (WSP/AmeriCorps). The total length of the stream surveyed was 47,842 feet with an additional 524 feet of side channel.

Flows were not measured on South Fork Eel River.

South Fork Eel River is an F4 channel type for the entire 47,842 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 54 to 64 degrees Fahrenheit. Air temperatures ranged from 52 to 78 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 47% pool units, 23% flatwater units, 20% dry units, and 9% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 42% pool units, 27% flatwater units, 27% dry units, and 4% riffle units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 47%; dry units, 20%; and runs, 17% (Graph 3). Based on percent total **length**, mid-channel pools made up 41%, dry units 27%, and runs 19%.

A total of 274 pools were identified (Table 3). Main pools were most frequently encountered at 98% and comprised 2% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. One hundred and twenty-four of the 274 pools (45%)

had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 276 pool tail-outs measured, 5 had a value of 1 (1.9%); 83 had a value of 2 (30.2%); 23 had a value of 3 (8.4%); none had a value of 4, and 164 had a value of 5 (59.5%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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 59, and flatwater habitats had a mean shelter rating of 35 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 90. Main channel pools had a mean shelter rating of 12 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in South Fork Eel River. Bubble curtains and bedrock ledges are lacking in nearly all habitat types. Graph 7 describes the pool cover in South Fork Eel River.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 33 of the 53 low gradient riffles measured (63%). Small cobble was the next most frequently observed dominant substrate type and occurred in 25% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 83%. The mean percentages of deciduous and coniferous trees were 81% and 19%, respectively. Graph 9 describes the canopy in South Fork Eel River.

For the stream reach surveyed, the mean percent right bank vegetated was 28%. The mean percent left bank vegetated was 28%. The dominant elements composing the structure of the stream banks consisted of 8% bedrock, 2% boulder, 78% cobble/gravel, and 12% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 100% of the units surveyed. Additionally, 0% of the units surveyed had deciduous trees as the dominant vegetation type, and 100% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on Sept. 9, 1996, in South Fork Eel River. The sites were sampled by Ruth Goodfield (DFG) and Todd Kraemer (AmeriCorps/WSP).

The site sampled included habitat units 347-348, a low gradient riffle, run, and backwater pool boulder formed approximately 30,418 feet from the confluence with Mud

Creek. This site had an area of 2,200 sq ft and a volume of 1,415 cu ft. The site yielded fifteen young-of-the-year (YOY) steelhead rainbow trout, three one-year+ steelhead rainbow trout, and eight YOY coho salmon.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on South Fork Eel River.

DISCUSSION

South Fork Eel River is an F4 channel type for the entire 47,842 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows:

The water temperatures recorded on the survey days Aug. 14, 15, 19, 20, and 21, 1996, ranged from 54 to 64 degrees Fahrenheit. Air temperatures ranged from 52 to 78 degrees Fahrenheit. This is an acceptable water temperature range for salmonids. However, 65° F, if sustained, is near the threshold stress level for salmonids. This does not seem to be the case here, and South Fork Eel River seems to have temperatures favorable to salmonids. 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 27% of the total **length** of this survey, riffles 4%, dry units 20%, and pools 42%. The pools are relatively deep, with 124 of the 274 (45.3%) 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. 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.

Twenty-three of the 276 pool tail-outs measured had embeddedness ratings of 3 or 4. Only five had a 1 rating. 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 South Fork Eel River, 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 13. The shelter rating in the flatwater habitats was slightly better at 35. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by terrestrial vegetation in all habitat types. Additionally, undercut banks 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.

Seven of the eight low gradient riffles 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, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was low at 27.9% and 27.7%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) South Fork Eel River should be managed as an anadromous, natural production stream.

2) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 42,297', should then be treated to reduce the amount of fine sediments entering the stream.

3) 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.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from terrestrial vegetation. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

5) There are at least two sections where the stream is being impacted from cattle trampling the riparian zone and defecating in the water. Alternatives should be explored with the grazier and developed if possible.

6) 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) There are a few log debris accumulations present on South Fork Eel River 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.

8) 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.

PROBLEM SITES AND LANDMARKS

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

0'	Begin survey at confluence with Mud Creek. The channel type is F4.
1076'	90% exposed shade canopy.
2660'	Road on the right bank 50 feet.
5117'	Several logs block debris atop developed gravel bar.
5267'	Large debris accumulation (LDA), 79'x15'x15'.

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5624'	30% exposed shade canopy.
6477'	Road follows on the right bank, 50 feet distant through 7189' mark.
8424'	90% exposed shade canopy.
8905'	Road at right bank, 50 feet.
9076'	Failed Humboldt crossing 40'x40'x10'.
9297'	Road at 50 feet follows the right bank through 9657'.
13332'	Dirt road fords stream.
16567'	Dirt road fords stream.
17441'	Footbridge crossing.
18194'	Footbridge crossing.
19413'	Developed gravel bar extraction operation.
22097'	Cattle accessing stream from the left bank and trampling streambanks.
25876'	Cattle impacting both banks.
26547'	Cattle impacting both banks.
26910'	Grade increase.
28273'	Cattle impacting streambanks.
29387'	Gabion wall right bank, access road to stream.
30541'	Footbridge.
30651'	LDA 40'x20'x10'.
30803'	Cattle impacting streambanks.
33082'	Cattle impacting streambanks.

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33381' Tributary right bank box culvert.

33659' Road right bank at 50 feet through 33957'.

36250' Accumulations of small woody debris (SWD).

38256' Two large trees in the stream.

42297' Large slump on the left bank 60'x80'.

42309' Possible channel change to B2 though lack of water prevents accurate measurements.

42410' Grade increase through 42826'.

42718' Change in channel type to A2; 6% grade with large boulders.

43297' LDA comprised of four logs.

43684' Returns to B3 channel type.

46731' LDA 15'x20'x5'.

47430' Ten foot falls.

47455' LDA 20'x40'x15'.

47842' End of Survey due to high gradient and lack of fish observations.

REFERENCES

Flosi, G., and F. Reynolds. 1994. *California Salmonid Stream Habitat Restoration Manual*, 2nd 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
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5