STREAM INVENTORY REPORT

South Fork Salmon Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on South Fork Salmon 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 South Fork Salmon Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. There is no known record of adult spawning surveys having been conducted on South Fork Salmon 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. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

South Fork Salmon Creek is tributary to Salmon Creek, tributary to the South Fork Eel River, located in Humboldt County, California. South Fork Salmon Creek's legal description at the confluence with Salmon Creek is T03S R02E S12. Its location is 40°12'53" North latitude and 123°53'29" West longitude. South Fork Salmon Creek is a third order stream and has approximately 5.6 miles of blue line stream according to the USGS Ettersburg 7.5 minute quadrangle. The stream drains a watershed of approximately 12.5 square miles. Summer base flow is estimated to be 0.5 cubic feet per second (cfs) at the mouth, but over 20 cfs is not unusual during winter storms. Elevations range from about 380 feet at the mouth of the creek to 2,000 feet in the headwater areas. Mixed conifer forest and grasslands dominate the watershed. The watershed is privately owned and is managed for rural subdivision. Vehicle access exists via Highway 101 to Salmon Creek Road approximately 2.5 miles to Thomas Road. Follow Thomas road to the first bridge. The mouth of South Fork Salmon Creek is approximately 1,000 feet downstream.

METHODS

The habitat inventory conducted in South Fork Salmon Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The 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 Salmon Creek personnel were trained in May, 1996, by Scott Downie and Ruth Goodfield. This inventory was conducted by a two-person team.

South Fork Salmon Creek

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

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 Salmon 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.

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. Additionally, a recording thermograph was deployed in South Fork Salmon Creek from June 10 - October 3, 1996 to record temperatures on a 24 hour basis during warm summer months.

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 Salmon 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 South Fork Salmon 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). Additionally, a rating of "not suitable" (value 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 South Fork Salmon 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 (1) and sub-dominant (2) substrate elements were

ocularly estimated and recorded from a list of seven size classes.

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. The percentage of the habitat unit covered by canopy was estimated from the center of 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 Salmon Creek, 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 Salmon Creek fish presence was observed from the stream banks. This sampling technique is discussed in the DFG 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, DFG. This program processes and summarizes the data, and produces the following six tables:

South Fork Salmon Creek

- 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 Salmon 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
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

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

The habitat inventory of October 28 to November 15, 1996, was conducted by Todd Schaible and Donna Miller (WSP/AmeriCorps). The total length of the stream surveyed was 20,773 feet with an additional 176 feet of side channel.

Flow was estimated to be 0.5 cfs during the survey period.

South Fork Salmon Creek is an F4 channel type for the first 3,547 feet of stream reach surveyed, and an F3 for the remaining 17,226 feet of stream surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. F3 channel types are very similar to F2 types, but with cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 47 to 57 degrees Fahrenheit.

South Fork Salmon Creek

Air temperatures ranged from 44 to 67 degrees Fahrenheit. Water temperatures taken with a recording thermograph deployed from June 10 to October 3, 1996, ranged from a low of 53° to a high of 83° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 42% flatwater units, 33% pool units, and 25% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 59% flatwater units, 23% pool units, and 18% riffle units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 29%; step runs, 22%; and low gradient riffles, 19% (Graph 3). Based on percent total **length**, step runs made up 38%, step runs 20%, and runs 19%.

A total of ninety pools were identified (Table 3). Main channel pools were most frequently encountered at 93% and comprised 94% 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. Seventy-two of the 90 pools (80%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 90 pool tail-outs measured, nine had a value of 1 (10%); 39 had a value of 2 (43%); 22 had a value of 3 (24%); two had a value of 4 (3%); and 18 had a value of 5 (20%) (Graph 6). On this scale, a value of 1 reflects the best 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 13, and pool habitats had a mean shelter rating of 12 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 12. Scour pools had a mean shelter rating of 10 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in South Fork Salmon Creek and are extensive. Large and small woody debris are lacking in nearly all habitat types (Graph 7).

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in two of the five low gradient riffles measured (40%). Large cobble was also observed dominant substrate type and occurred in 40% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 15%. The mean

percentages of deciduous and coniferous trees were 69% and 31%, respectively. Graph 9 describes the canopy in South Fork Salmon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 40%. The mean percent left bank vegetated was 40%. The dominant elements composing the structure of the stream banks consisted of 33.7% bedrock, 21.7% boulder, 32.6% cobble/gravel, and 12.0% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 22% of the units surveyed. Additionally, 51.1% of the units surveyed had deciduous trees as the dominant vegetation type, and 15.2% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Young-of-the-year (YOY) salmonids were observed from the streambanks during the survey of South Fork Salmon Creek.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on South Fork Salmon Creek.

DISCUSSION

South Fork Salmon Creek is an F4 channel type for the first 3,547 feet of stream surveyed and an F2 for the remaining 17,226 feet. The suitability of F4 channel types for fish habitat improvement structures is described as good for bank-placed boulders; fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors, and log cover; and poor for medium-stage weirs and boulder clusters. The suitability of F3 channel types for fish habitat improvement structures is fair for low-stage weirs, single and opposing wing-deflectors, and log cover; and poor for medium-stage weirs.

The water temperatures recorded on the survey days October 28, to November 15, 1996, ranged from 47 to 57 degrees Fahrenheit. Air temperatures ranged from 44 to 67 degrees Fahrenheit. Further

samples from a recording thermograph deployed during the summer of 1996 measured low water temperatures of 53° to highs of 83° Fahrenheit. A temperature of 83°F is above

acceptable ranges for salmonids, and if sustained is likely lethal. Regardless, South Fork Salmon Creek is supporting salmonids at this time.

Flatwater habitat types comprised 59% of the total **length** of this survey, riffles 18%, and pools 23%. The pools are relatively shallow, with only 28 of the 90 (31.1%) pools having a maximum depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum depth of at least three 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.

Twenty-four of the 90 pool tail-outs measured had embeddedness ratings of 3 or 4. Only nine 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 Salmon 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 12. The shelter rating in the flatwater habitats was slightly lower at 10. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, bedrock ledges contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Three of the five 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 15%. This is a relatively low 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 moderate at 40% and 40%, 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.

South Fork Salmon Creek

RECOMMENDATIONS

1)South Fork Salmon Creek should be managed as an anadromous, natural production stream.

2)Increase the canopy on South Fork Salmon 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.

3)The limited water temperature data available suggest that maximum temperatures are above 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.

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 locally available.

PROBLEM SITES 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 Salmon Creek. Channel type is an F4 for the first 3547' of stream surveyed.

396'California roach observed from the streambanks by surveyors.

578'Young-of-the-year (YOY) salmonids observed from the streambanks.

South Fork Salmon Creek

1707' 24' diameter corrugated metal pipe (CMP) on right bank.

1913' Small tributary enters from left bank (LB).

2001'Large debris accumulation (LDA) in stream channel; not a barrier to salmonids.

2067'Thomas Road bridge crosses stream.

3322'Tributary enters from right bank (RB); temperature is 54°F.

3547'Channel type changes from an F4 to an F2 for the remaining 17226' surveyed.

4263'Failure on RB; contributing sediment directly to the stream.

5444'Failure on RB; 15' long x 70' high. Contributing fines directly to the stream.

5866'Concrete weir across stream channel; 30' wide x 5' high. Appears to be the walls of a flash-board dam.

6153'Old failure on RB; 220' long x 100' high. Appears to be re-vegetating nicely.

7291'Dry tributary on LB.

8250'Dry tributary on LB.

8448'YOY salmonids observed from the streambanks by the surveyors.

8965'Failure on LB; 150'x 50'. Contributing sediment directly to the stream.

9706'Railroad car bridge spans stream.

9970'Dry tributary enters from RB.

10023'LDA in stream channel; 62' long x 9' wide x 6' high. Not a fish barrier.

10409'Dry tributary enters from RB.

10630'Old failure on RB; 350' long x 60' high. Appears to be re-vegetating nicely.

11031'Vehicle bridge spans stream; good access from cooperative landowner.

South Fork Salmon Creek

11195' Dry tributary on LB.

11195' Failure on LB; 153' long x 20' high.

12753' Dry tributary on LB.

13068' Water pump in creek.

13320' LDA in stream channel; 25'x 5'x 2' high. Not a barrier to salmonids.

18376' Kinsey Creek enters from LB.

18622' Road ford crosses stream.

18877' Wooden walking bridge spans stream.

18982' Tosten Creek enters from the RB.

20023' Failure on RB; 45' long x 60' high.

20641' Hacker Creek enters from LB.

20773' Vehicle bridge spans stream. YOY salmonids observed from the streambanks. First storm of winter season raises flows on November 15. End of survey.

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