STREAM INVENTORY REPORT

Salmon Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on 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 Salmon Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for Chinook 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

Salmon Creek is tributary to Tomki Creek, tributary to the Eel River, tributary to the Pacific Ocean, located in Humboldt County, California. Salmon Creek's legal description at the confluence with Tomki Creek is T8N R12W S15. Its location is 39°25′6″north latitude and 123°10′36″west longitude. Salmon Creek is a first order stream and has approximately 3.4 miles of blue line stream according to the USGS Foster Mountain 7.5 minute quadrangle. Salmon Creek drains a watershed of approximately 3 square miles. Elevations range from about 1,630 feet at the mouth of the creek to 2,000 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned, and is managed for rangeland and timber production. Vehicle access exists via 101 from Willits. Take Foster Mountain Road to the confluence of Salmon Creek and Tomki Creek.

METHODS

The habitat inventory conducted in Salmon Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1994). The California Conservation Corps (CCC) Technical Advisors and AmeriCorps Watershed Stewards Project (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

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The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. 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 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 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.

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". 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. 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 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) 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 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 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 Salmon 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 Salmon 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 Salmon Creek fish presence was observed from the stream banks, and one site was electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

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 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

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- Embeddedness
- Pool cover by cover type
- Dominant substrate in the pool tail outs
- Mean 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 July 17, 1997 and was conducted by J. Robertson (WSP) and A. Renger (CCC). The total length of the stream surveyed was 4,914 feet.

Flows were not measured on Salmon Creek.

Salmon Creek is a B4 channel type for the entire 4,914 feet of stream reach surveyed. B4 channel types are moderately entrenched, moderate gradient, riffle-dominated gravel channels with infrequently spaced pools; very stable plan and profile; and stable banks.

Water temperatures taken during the survey period ranged from 58° to 83° F. Air temperatures ranged from 73° to 83° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 27% riffle units, 17% flatwater units, 44% pool units, and 11% dry units (Graph 1). Based on total length of Level II habitat types there were 29% riffle units, 23% flatwater units, 31% pool units, and 17% dry units (Graph 2).

Five Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pools, 44%; low gradient riffles, 24%; and dry, 11% (Graph 3). Based on percent total length, mid-channel pools made up 31%, low gradient riffles 18%, and dry 17%.

A total of 31 pools were identified (Table 3). Main channel pools comprised 100% 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. Five of the thirty-one pools (16%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the twenty-nine pool tail-

outs measured, one had a value of 1 (3%); nine had a value of 2 (31%); thirteen had a value of 3 (45%); two had a value of 4 (7%) and four had a value of 5 (14%) (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.

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 4, flatwater habitat types had a mean shelter rating of 10, and pool habitats had a mean shelter rating of 13, (Table 1). Of the pool types, the main pools had the highest mean shelter rating at 13 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Aquatic vegetation is the dominant cover type in Salmon Creek. Large woody debris is lacking in nearly all habitat types. Graph 7 describes the pool cover in Salmon Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was dominant substrate observed in 52% of the pool tail-outs measured, small cobble comprised 34% and bedrock 14% (Graph 8).

The mean percent canopy density for the stream reach surveyed was 37%. The mean percentages of deciduous and coniferous trees were 85% and 15%, respectively. Graph 9 describes the canopy composition in Salmon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 53.3%. The mean percent left bank vegetated was 54.2%. The dominant elements composing the structure of the stream banks consisted of 45% bedrock, 30% cobble/gravel, and 25% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 55% of the units surveyed. Additionally, 30% of the units surveyed had deciduous trees as the dominant vegetation type, and 15% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on July 9, 1997, in Salmon Creek. The site was sampled by Todd Schaible, Donna Miller (WSP), and Ruth Goodfield (DFG). The site included habitat unit 1, approximately 20 feet from the confluence with Tomki Creek. The site yielded 11 Sacramento pike minnow, 9 roach, and 2 young-of-the-year steelhead rainbow trout.

DISCUSSION

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Salmon Creek is a B4 channel type for the entire 4,914 feet of stream surveyed. The suitability of B4 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, boulder structures, bank placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey day July 17, 1997, ranged from 58° to 83° F. Air temperatures ranged from 73° to 83° F. The upper end of this water temperature range is unsuitable for salmonids; 83° F, is near the lethal limit for steelhead. The high water temperatures found in Salmon Creek are unfavorable to salmonids. To make 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 23% of the total length of this survey, riffles 29%, pools 31%, and dry 17%. The pools are shallow, with only five of the thirty-one (16%) pools having a maximum depth greater than 2 feet. 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 only comprise 5% of the total length of the stream habitat surveyed. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. Installing structures that will increase or deepen pool habitat is recommended.

One of the twenty-nine (3%) pool tail-outs measured had an embeddedness rating of 1, 31% had a rating of 2, 52% had a ratings of 3 or 4, and 14% had a rating of 5 and were considered unsuitable for spawning. All of the pool tail-outs with a rating of 5 were unsuitable for spawning due to the dominant substrate being bedrock. 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 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 13. The shelter rating in the flatwater habitats was 10. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by aquatic vegetation 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.

Twenty-five of the twenty-nine (86%) 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 37%. This is a low percentage of canopy.

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In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 53.3% and 54.2%, 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) Salmon Creek should be managed as an anadromous, natural production stream.

2) 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.

3) Increase the canopy on Salmon Creek by planting willow, alder and other native riparian plant species along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

4) 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) Primary pools only comprise 5% of the 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.

6) 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.

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.

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0' Begin survey at confluence with Tomki Creek. Channel type is B4.

223' Out of the hydrologic influence of the receiving stream. Begin 100% sampling of habitat types by first occurrence.

1,653' Juvenile steelhead observed.

2,258' Tributary enters from the left bank, and is contributing substantial flow.

2,412' Spring on left bank.

4,914' End of survey due to limited flows.

REFERENCES

Flosi, G., and F. L. Reynolds,1994. *California Salmonid Stream Habitat Restoration Manual,* 2nd edition. California Department of Fish and Game, Sacramento, 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