STREAM INVENTORY REPORT

Sweet Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1999 on Sweet Creek, a stream in the Eel River drainage. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Sweet 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

Sweet Creek is tributary to the Price Creek, tributary to the mainstem Eel River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Sweet Creek's legal description at the confluence with Price Creek is T01N R01W S05. Its location is 40°30′08.1″ north latitude and 124°12′09.6″ west longitude. Sweet Creek is a second order stream and has approximately 2.0 miles of blue line stream according to the USGS Fortuna and Taylor peak 7.5 minute quadrangle. Sweet Creek drains a watershed of approximately 2.2 square miles. Elevations range from about 340 feet at the mouth of the creek to 2,020 feet in the headwater areas. Redwood, mixed conifer, and oak grassland dominate the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via US 101 at Rio Dell to Blue Slide Road (west), travel 4.5 to 5.0 miles until you reach Price Creek Road. Turn left onto Price Creek Road. Proceed about 4 miles up Price Creek Road to the confluence of Price Creek and Sweet Creek.

METHODS

The habitat inventory conducted in Sweet Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al., 1998). The 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.

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SAMPLING STRATEGY

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 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 Sweet 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.

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". Sweet 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 Sweet 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 Sweet 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 Sweet 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 Sweet 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 Sweet Creek fish presence was observed from the stream banks. No biological sampling was conducted on Sweet Creek.

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

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Graphics are produced from the tables using Quattro Pro. Graphics developed for Sweet 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
- 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 November 5, 1999, was conducted by Donn Rehberg and Paul Ferns (WSP\AmeriCorps). The total length of the stream surveyed was 4,746 feet. There were no side channels.

Flows were not measured on Sweet Creek.

Sweet Creek is an B4 channel type for the entire 4,746 feet of stream reach surveyed. B4 channels 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 51° to 55° F. Air temperatures ranged from 55° to 67° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 49% riffle units, 12% flatwater units, and 39% pool units (Graph 1). Based on total length of Level II habitat types there were 90% riffle units, 4% flatwater units, and 6% pool units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 32%; mid-channel pools, 27%; and high gradient riffles, 17% (Graph 3). Based on percent total length, high gradient riffles made up 63%, low gradient riffles, 28%, and mid-channel pools, 4%.

A total of 23 pools were identified (Table 3). Main channel pools were the most

frequently encountered, at 70%, and comprised 74% 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. Four of the 23 pools (17%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 23 pool tail-outs measured, none had a value of 1; 20 had a value of 2 (87%); 2 had a value of 3 (8.7%); 1 had a value of 4 (4.3%) and none had a value of 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 5, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 43 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 55. Scour pools had a mean shelter rating of 5 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Sweet Creek. Graph 7 describes the pool cover in Sweet Creek.

Table 6 summarizes the dominant substrate in pool habitat types. Gravel was the dominant substrate observed in 22 of the 23 pool tail-outs measured (96%). Small cobble was the next most frequently observed dominant substrate type and occurred in 4% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 60%. The mean percentages of conifer and deciduous trees were 29% and 71%, respectively. Graph 9 describes the canopy in Sweet Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 64.1%. The mean percent left bank vegetated was 62.3%. The dominant elements composing the structure of the stream banks consisted of 5% bedrock, 10% boulder, 75% cobble/gravel, and 10% sand/silt/clay (Graph 10). Deciduous trees were the dominant bank vegetation type observed in 75% of the units surveyed. Additionally, 15% of the units surveyed had grass as the dominant bank vegetation, and 5% had coniferous trees as the dominant bank vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

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No biological sampling was conducted on Sweet Creek.

DISCUSSION

Sweet Creek was a B4 channel type for the entire 4,746 feet of stream surveyed. The suitability of B4 channels for fish habitat improvement structures is as follows: they are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover.
The water temperatures recorded on the survey of November 5, 1999, ranged from 51° to 55° F. Air temperatures ranged from 55° to 67° F. This is an good water temperature range for 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 4% of the total length of this survey, riffles 90%, and pools 6%. The pools are relatively shallow, with only 4 of the 23 (17.4%) 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.

None of the 23 pool tail-outs measured had an embeddedness rating of 1, 87% had a rating of 2, 13% had ratings of 3 or 4, and none had a rating of 5. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

Twenty-three of the 23 (100%) pool tail-outs measured had gravel or small cobble as the dominant substrate. This is good for spawning salmonids.

The mean shelter rating for pools was 43. The shelter rating in the flatwater habitats was 4. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in all 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.

The mean percent canopy density for the stream was 60%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 64% and 62%, 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) Sweet Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that autumn 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) Increase the canopy and bank vegetation on Sweet Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy or bank vegetation 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.

5) Where feasible, design and engineer pool enhancement structures to increase the number of pools or deepen existing 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 boulders. 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.

0' Begin survey at the confluence with Price Creek. Channel type is a B4.

2,607' Electric fence spans the creek. Both banks have exposed clay banks extending

up 35' high. Channel meanders through gravel, large cobble, and boulder deposits.

2,975' Eroding clay banks contributing sediment directly into channel.

3,493' Slide debris at the beginning of the unit causes the channel to narrow and steepen.

3,569' High velocity plunge over boulders.

3,578' Channel substrate is mud. Left and right bank slides narrow stream into a V-shaped channel only 3.25' wide at base. Slopes eroded up 30-60' high.

4,197' Plunge of 5.5'.

4,746' End of survey due to an increase in the stream gradient, obstructions, plunge pools, and lack of fish sightings in latter part of survey.

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.

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