

## STREAM INVENTORY REPORT

### SONOMA CREEK, EEL RIVER

#### INTRODUCTION

A stream inventory was conducted during the summer of 1999 on Sonoma 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 Sonoma 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, 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

Sonoma Creek is tributary to the Mainstem Eel River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Sonoma Creek's legal description at the confluence with Mainstem Eel River is T02S R03E S02. Its location is 40°18'50" North latitude and 123°48'09" West longitude. Sonoma Creek is a second order stream and has approximately 1.1 miles of blue line stream according to the USGS Myers Flat 7.5 minute quadrangle. Sonoma Creek drains a watershed of approximately 5.6 square miles. Elevations range from about 150 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is partially managed for timber production. Vehicle access exists via Highway 101 to the Dyerville exit, follow the Dyerville Loop Road past McCann Rd., turn left on Whitlow Road, which runs along Sonoma Creek.

#### METHODS

The habitat inventory conducted in Sonoma 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 Sonoma 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". Sonoma 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 Sonoma 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 Sonoma 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 Sonoma 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 Sonoma 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 Sonoma 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*.

### 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 Sonoma 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

## HABITAT INVENTORY RESULTS

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

The habitat inventory of July 13, 14, and 15, 1998, was conducted by Ruth Goodfield (DFG) and Curtis Ihle (HCRCD). The total length of the stream surveyed was 9,188 feet with an additional 203 feet of side channel.

Flows were measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.61 cfs on July 13, 1998.

Sonoma Creek is a B3 channel type for the entire 9,188 feet of stream reach surveyed. B3 channel types are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; cobble channel.

Water temperatures taken during the survey period ranged from 63° to 64° F. Air temperatures ranged from 70° to 79° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% riffle units, 26% flatwater units, and 34% pool units (Graph 1). Based on total length of Level II habitat types there were 41% riffle units, 31% flatwater units, and 27% pool units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle, 39%; mid-channel pools, 30%; and run, 18% (Graph 3). Based on percent total length, low gradient riffle made up 41%, mid-channel pool 23%, and run 18%.

A total of sixty-eight pools were identified (Table 3). Main channel pools were most frequently encountered at 90% and comprised 89% 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. Thirty-five of the 68 pools (52%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the sixty-seven pool tail-outs measured, two had a value of 1 (2.9%); twenty had a value of 2 (29.9%); forty-two had a value of 3 (62.7%); three had a value of 4 (4.5%) and zero had a value of 5 (0%) (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 11, flatwater habitat types had a mean shelter rating of 12, and pool habitats had a mean shelter rating of 26 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 34. Main channel pools had a mean shelter rating of 25 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Root masses are the dominant cover type in Sonoma Creek. Graph 7 describes the pool cover in Sonoma Creek.

Table 6 summarizes the dominant substrate in pool habitat types. Gravel was the dominant substrate observed in 53 of the 66 pool tail outs measured (80.3%). Small cobble was the next most frequently observed dominant substrate type and occurred in 18.2% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 79%. The mean percentages of conifer and deciduous trees were 49% and 51%, respectively. Graph 9 describes the canopy in Sonoma Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 78.4%. The mean percent left bank vegetated was 77.1%. The dominant elements composing the structure of the stream banks consisted of 5.70% bedrock, 0% boulder, 62.90% cobble/gravel, and 31.40% sand/silt/clay (Graph 10). Coniferous trees were the dominant bank vegetation type observed in 51.4% of the units surveyed. Additionally, 41.4% of the units surveyed had deciduous trees as the dominant bank vegetation, and 51.4% 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 August 20, 1998 in Sonoma Creek. The site was sampled by Ruth Goodfield and Stu McMorrow (DFG and AmeriCorps/WSP).

The site sampled included habitat units 0063-0066, located approximately 3,728 feet from the confluence with the Eel River. The site yielded forty-two juvenile steelhead rainbow trout (SHRT).

### GRAVEL SAMPLING RESULTS

No gravel samples were taken on Sonoma Creek.

### DISCUSSION

Sonoma Creek is a B3 channel type for the entire 9,188 feet of stream surveyed. The suitability of B3 channel types for fish habitat improvement structures is as follows: excellent for plunge weirs; boulder clusters and bank placed boulder; single and opposing wing-deflectors; log cover.

The water temperatures recorded on the survey days July 13 to 15, 1998, ranged from 63° to 64° F. Air temperatures ranged from 70° to 79° F. This is a fair water temperature range for salmonids. Sonoma Creek 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 31% of the total length of this survey, riffles 41%, and pools 27%. The pools are relatively deep, with 35 of the 68 (51.4%) 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. Primary pools comprise 14% of the total length of stream surveyed. 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.

Two of the 67 pool tail-outs measured had an embeddedness rating of 1. Twenty of the pool tail-outs had embeddedness ratings of 2. Forty-five of the pool tail-outs had embeddedness ratings of 3 or 4. Zero of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. 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 Sonoma 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 26. The shelter rating in the flatwater habitats was slightly lower at 12. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by root mass in most habitat types. Additionally, large woody debris contribute 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.

Fifty-three of the 67 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 79%. This is a moderate 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 78% and 77%, 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) Sonoma 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 woody cover in the pools and flatwater habitat units. Most of the existing cover is from root mass. Adding high quality complexity with woody cover is desirable.
- 4) 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.

- 5) 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.
- 6) Primary pools comprise 14% 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.

### 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 the mainstem Eel River. Channel type is B3 for the entire stream reach surveyed
- 309' Backwater pool; log enhanced
- 367' Railroad trestle 28' into unit
- 703' Lateral scour log enhanced. Small, dry tributary on right bank (RB)
- 1036' Out of influence of influence of receiving stream.
- 1076' Pocket water.
- 1961' Bridge 14' into unit.
- 2275' Dirt road parallels stream on left bank (LB).
- 2366' Dry tributary enters LB.
- 3264' Lateral scour root enhanced.
- 3525' Young-of-the-year (YOY) observed from the streambanks.
- 4571' Bridge at top of unit, 13' in width.
- 4992' Dry tributary enters top of unit, 3' culvert 40' up the tributary.
- 6358' Bridge, 12' wide
- 6452' Tributary enters RB
- 6530' Old car in streambed.

6625' Confluence of Sonoma and Sequoia creeks. Sequoia is on the LB.

7015' Log debris accumulation (LDA) 20' x 35' x 10'

8066' LDA at top of unit. 15' x 35' x 9'

9088' YOY observed.

9188' End 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.

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
<b>RIFFLE</b>		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
<b>CASCADE</b>		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
<b>FLATWATER</b>		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
<b>MAIN CHANNEL POOLS</b>		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
<b>SCOUR POOLS</b>		
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
<b>BACKWATER POOLS</b>		
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