

STREAM INVENTORY REPORT

SODA CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on Soda 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 Soda 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

Soda Creek is tributary to the Eel River, located in Mendocino County, California (Map 1). Soda Creek's legal description at the confluence with the Eel River is T18N R10W S15. Its location is 39°24'37" north latitude and 122°58'41" west longitude. Soda Creek is a third order stream and has approximately 2.4 miles of blue line stream according to the USGS Lake Pillsbury 7.5 minute quadrangle. Soda Creek drains a watershed of approximately 13.8 square miles. Elevations range from about 1700 feet at the mouth of the creek to 3000 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily national forest timber production, rangeland, and recreation. Vehicle access exists via Mendocino National Forest road M-8 off Highway 20.

METHODS

The habitat inventory conducted in Soda Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 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). 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, 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

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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 Soda 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". Soda 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:

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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 Soda 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 Soda 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Soda 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 Soda 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 Soda Creek fish presence was observed from the stream banks, and three sites were 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 Soda 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 September 15 and 16, 1998, was conducted by Janet Lester and Paul Retherford (WSP). The total length of the stream surveyed was 9905 feet with an additional 572 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.10 cfs on September 16, 1995.

Soda Creek is an F4 channel type for the first 9183 feet of stream reach surveyed and a B4 channel for the remaining 722 feet. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. B4 channel types are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plane and profile and stable banks with gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 62 to 82 degrees Fahrenheit. Air temperatures ranged from 60 to 85 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 0% riffle units, 44% flatwater units, 33% pool units, and 24% dry units (Graph 1). Based on total **length** of Level II habitat types there were 0% riffle units, 40% flatwater units, 6% pool units, and 54% dry units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 31%; dry, 24%; and glides, runs and step-runs, all 15% (Graph 3). Based on percent total **length**, dry made up 54%, runs 19%, and step-runs 16%.

A total of 18 pools were identified (Table 3). Main channel pools were most frequently encountered at 94% and comprised 92% 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. Ten of the 18 pools (56%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 18 pool tail-outs measured, 1 had a value of 1 (5.6%); 6 had a value of 2 (33.3%); 8 had a value of 3 (44.4%); 2 had a value of 4 (11.1%) and 1 had a value of 5 (5.6%) (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. In Soda Creek, the 1 pool tail-out which was valued at 5 had sand too small to be suitable for spawning as the substrate.

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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. Dry habitat types had a mean shelter rating of 0, flatwater habitat types had a mean shelter rating of 8, and pool habitats had a mean shelter rating of 11 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 13. Scour pools had a mean shelter rating of 5 (Table 3).

Table 5 summarizes mean percent cover by habitat type. -----are the dominant cover type in Soda Creek AND ARE EXTENSIVE. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Soda Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 10 of the 18 pool tail outs measured (56%). Small cobble was the next most frequently observed dominant substrate type and occurred in 22% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 23%. The mean percentages of deciduous and coniferous trees were 91% and 9%, respectively. Graph 9 describes the canopy in Soda Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 87%. The mean percent left bank vegetated was 76%. The dominant elements composing the structure of the stream banks 100% sand/silt/clay (Graph 10). Deciduous trees was the dominant vegetation type observed in 65.4% of the units surveyed. Additionally, 30.8% of the units surveyed had brush as the dominant vegetation type, and 3.85% had grass as the dominant vegetation(Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on October 6, 1998, in Soda Creek. The sites were sampled by Paul Retherford and Chris Ramsey (CCC).

The first site sampled included habitat units 39-40, a glide and step-run approximately 8670 feet from the confluence with the Eel River. This site had an area of 1485 sq ft and a volume of 742.5 cu ft. The site yielded 20 young of the year steelhead and 5 frogs.

The second site included habitat units 48-51, a series of mid-channel pools located approximately 9822 feet above the creek mouth, at the confluence with Panther and Welch Creeks. This site had an area of 980 sq ft and a volume of 588 cu ft. The site yielded.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Soda Creek.

DISCUSSION

Soda Creek is an F4 channel type for the first 9183 feet of stream surveyed and a B4 channel for the remaining 722 feet. The suitability of F4 and B4 channel types for fish habitat improvement structures is as follows:

The water temperatures recorded on the survey days September 15 and 16, 1998, ranged from 62 to 82 degrees Fahrenheit. Air temperatures ranged from 60 to 85 degrees Fahrenheit. This is an unacceptable water temperature range for salmonids. Eighty-two degrees Fahrenheit, if sustained, is well above the threshold stress level for 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 40% of the total **length** of this survey, dry 54%, and pools 6%. The pools are relatively deep, with only 10 of the 18 (55.6%) 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.

One of the 18 pool tail-outs measured had an embeddedness rating of 1. Ten of the pool tail-outs had embeddedness ratings of 3 or 4. One of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. The tail-out unsuitable for spawning was due to the dominant substrate being sand and being too small to be suitable. 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 Soda 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 11. The shelter rating in the flatwater habitats was slightly lower at 8. A pool shelter rating of approximately 100 is desirable. The relatively large amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, aquatic vegetation contributes 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.

Fourteen of the 18 pool tail outs measured had gravel or small cobble as the dominant substrate.

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This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 23%. This is a relatively low 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 87% and 75%, 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) Soda Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within/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) 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.
- 4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulder. Adding high quality complexity with woody cover is desirable.
- 5) 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.
- 6) 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.
- 7) Increase the canopy on Soda 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 affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.
- 8) Suitable size spawning substrate on Soda Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.
- 9) There are several log debris accumulations present on Soda Creek that are retaining large

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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.

- 10) There are sections where the stream is being impacted from cattle trampling the riparian zone. Alternatives should be explored with the grazier and developed if possible.
- 11) Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.

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 Eel River. Channel type is F4. |
| 1522' | Algal bloom on entire unit making it difficult to even see in the water. |
| 3234' | Concrete bridge 10' high x 45' wide x 30' long. |
| 4074' | Right bank failure 250' long x 50' high. |
| 5871' | Boulder weir at top of unit creating pool. |
| 5943' | Boulder weir at top of unit creating scour. |
| 6011' | Boulder weir at top of unit creating pool. |
| 6054' | Digger logs left bank. |
| 6076' | Boulder weir, no water. |
| 6159' | Boulder weir with less than .4' water. |
| 6215' | Boulder weir, no water. |
| 6306' | Failed wire gabion right bank. |
| 6573' | Left bank rip-rap 150'L x 12'H. |
| 6746' | Functional off-road trail crossing. |

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- 8158' Functioning digger log.
- 8244' Functioning boulder weir.
- 9280' Left bank failure 50'L x 65'H.
- 9905' End of survey. Welch Creek and Panther Creek take off from Soda Creek here.

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