STREAM INVENTORY REPORT

Unnamed Tributary to North Fork Big River (Soda Gulch)

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on an unnamed tributary of North Fork Big River locally known as Soda Gulch. 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 Gulch. 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 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 Gulch is tributary to the North Fork Big River, tributary to the Big River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Soda Gulch's legal description at the confluence with North Fork Big River is T17N R15S S10. Its location is 39°20′50″ north latitude and 123°31′55″ west longitude. Soda Gulch is a first order stream and has approximately 1.12 miles of blue line stream according to the USGS Comptche 7.5 minute quadrangle. Soda Gulch drains a watershed of approximately 0.39 square miles. Elevations range from about 400 feet at the mouth of the creek to 1600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely within the Jackson Demonstration State Forest and is managed for timber production. Vehicle access exists via State Route 20.

METHODS

The habitat inventory conducted in Soda Gulch 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 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 Gulch 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 Gulch 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 Soda Gulch, 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 Gulch, 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 Soda Gulch, 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 Gulch, 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.

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BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Soda Gulch 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 Soda Gulch 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 pool tail-outs
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of September 04 through 10, 1997 was conducted by Tara Cooper and Craig Mesman (CCC). The total length of the stream surveyed was 3,563 feet.

On September 10, 1997 the flow was too low to be measured.

Soda Gulch is an G3 channel type for the entire 3,563 feet of stream reach surveyed. G3 channel characteristics include entrenched "gully" step pools and low width/depth ratios on moderate gradient with cobble dominant substrate.

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Water temperatures taken during the survey period ranged from 57 to 59 degrees Fahrenheit. Air temperatures ranged from 60 to 76 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 10% riffle units, 30% flatwater units, 37% pool units, and 22% dry units (Graph 1). Based on total **length** of Level II habitat types there were 7% riffle units, 40% flatwater units, 17% pool units and 34% was dry (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were step runs, 23%; mid-channel pools and dry channels at 22% each; and plunge pools, 15% (Graph 3). Based on percent total **length**, step runs made up 35%, dry channels made up 34%, mid-channel pools, 10%, and plunge pools, 6%.

A total of 56 pools were identified (Table 3). Main channel pools were most frequently encountered at 59% and comprised 62% 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. Three of the 56 pools had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 56 pool tail-outs measured, none had a value of 1; 11 had a value of 2 (19.6%); 26 had a value of 3 (46.4%); 9 had a value of 4 (16%) and 10 had a value of 5 (17.9%) (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 Gulch, all the 10 pool tail-outs which were valued at five had silt/clay/sand or gravel too small to be suitable for spawning as the 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 3, flatwater habitat types had a mean shelter rating of 9, and pool habitats had a mean shelter rating of 8 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 9. Scour pools had a mean shelter rating of 8 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large and small woody debris are the dominant cover type in Soda Gulch. Graph 7 describes the pool cover in Soda Gulch.

Table 6 summarizes the dominant substrate by habitat type. Of the two low gradient riffles fully measured small cobble was the dominant substrate in one and silt/clay was the dominant substrate in the other. Gravel were the dominant substrate observed in 44 of the 56 pool tail-outs (79%) measured. Small cobble and wood were the next most frequently observed substrate type each occurring in 5% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 95%. The mean percentages of deciduous and coniferous trees were 7% and 93%, respectively. Graph 9 describes the canopy in Soda Gulch.

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For the stream reach surveyed, the mean percent right bank vegetated was 91.5%. The mean percent left bank vegetated was 88.2%. The dominant elements composing the structure of the stream banks consisted of 0% bedrock, 0% boulder, 38.24% cobble/gravel, and 61.76% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 82.4% of the units surveyed including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on September 10, 1997 in Soda Gulch. The sites were sampled by Tara Cooper and Craig Mesman (CCC).

Three plunge pools were sampled which included habitat units 20, 45, and 47. The sites yielded a total of 12 Pacific giant salamanders.

DISCUSSION

Soda Gulch is a G3 channel type for the entire 3,563 feet of stream surveyed. The suitability of G3 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for weirs, opposing wing deflectors and log cover; and poor for boulder clusters, single wing deflectors, and log cover.

The water temperatures recorded on the survey days September 04 through 10, 1997, ranged from 57 to 59 degrees Fahrenheit. Air temperatures ranged from 60 to 76 degrees Fahrenheit. This is a good water temperature range 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, riffles 7%, and pools 17%. The pools are shallow, with only 3 of the 56 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.

None of the 56 pool tail-outs measured had embeddedness rating of 1. Thirty-five of the pool tail-outs had a rating of 3 or 4. Ten of the pool tail-outs had a rating of five or were considered unsuitable for spawning due to the dominant substrate being silt/sand/clay or gravel 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 Gulch, 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 8. The shelter rating in the flatwater habitats was slightly better at 9. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by large and small woody debris in all habitat types. Log and root wad cover structure 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.

Forty-four of the 56 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 95%. This is a relatively high 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 91.5 and 88.2%, 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) Soda Gulch should be managed as an anadromous, natural production stream.

2) Fish passage through the State Route 20 culvert located 114' from the confluence with the North Fork Big River needs to be improved. Alternatives need to be explored with the assistance of DFG.

3) The limited water temperature data available suggest that 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.

4) Increase woody cover in the pools and flatwater habitat units. Adding high quality complexity with woody cover is desirable.

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) There are several log debris accumulations present on Soda Gulch that are retaining large 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. Large woody debris removed from log debris accumulations shall be left within the riparian zone so as to provide a source for future recruitment of wood into the stream.

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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.

Position (ft):	Comments:
0'	Begin survey at confluence with North Fork Big River. Channel type is a G3.
114'	Culvert with a 5' drop onto boulders. The culvert is 6 feet in diameter and has no baffles.
371'	Right bank corrugated metal pipe (CMP) road drainage.
512'	Road 233A on left bank.
696'	Log debris accumulation (LDA), 6' wide X 10' long x 4.5' high.
740'	LDA, 10' wide X 11' long x 4' high.
915'	CMP, 1.5' diameter.
1,375'	Road 60' up from the channel.
1,430'	LDA, 7' high X 13' long X 10' wide, retaining gravel.
1,508'	Left bank tributary with a very steep, dry channel.
1,710'	LDA, 8' high X 24' long X 7' wide.
2,127'	LDA, 14' long x 15' wide x 8' high.
2,348'	LDA, 8' high X 11' long X 10' wide.
3,046'	Human-made wooden dam retaining 4' of gravel.
3,189'	Left bank access to the creek.
3,301'	Trail crosses the creek.
3,414'	End of survey. The channel remained dry, became narrow (3 to 4 feet wide), and steep.

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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.

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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