STREAM INVENTORY REPORT

Jug Handle Creek

INTRODUCTION

A stream inventory was conducted during the fall of 1996 on Jug Handle Creek. The survey began at the confluence with an intermittent left bank tributary in the center of section 5; 55 minutes walking distance downstream from the rock quarry. 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 Jug Handle 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 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

Jug Handle Creek is a tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Jug Handle Creek's legal description at the confluence with the Pacific Ocean is T18N R18W S36. Its location is 39°22'37" north latitude and 123°48'55" west longitude. Jug Handle Creek is a first order stream and has approximately 4.3 miles of blue line stream according to the USGS Fort Bragg, Mathison Peak, and Mendocino 7.5 minute quadrangles. Jug Handle Creek drains a watershed of approximately 3.1 square miles. Elevations range from sea level at the mouth of the creek to 800 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is primarily owned by the Jackson Demonstration State Forest and is managed by the California Department of Forestry and Fire Protection for timber production. Vehicle access exists via Road 530. Foot access is available from the rock quarry at the bottom of the road.

METHODS

The habitat inventory conducted in Jug Handle 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. 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 Jug Handle 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". Jug Handle 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, 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 Jug Handle 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 Jug Handle 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.

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 Jug Handle Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the end 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 Jug Handle 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 Jug Handle Creek fish presence was observed from the stream banks, and three sites were electrofished using one 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 Jug Handle 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 low gradient riffles
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

Jug Handle Creek

HABITAT INVENTORY RESULTS

The habitat inventory of October 28, 29, and 30, 1996, was conducted by Craig Mesman (CCC) and Dionne Wrights (WSP/AmeriCorps). The total length of the stream surveyed was 8,327 feet with an additional 265 feet of side channel.

Flow was estimated to be 0.35 cfs during the survey period with a Marsh-McBirney Model 2000 flowmeter on October 30, 1996.

Jug Handle Creek is an F4 channel type for 8,028 feet and an A4 channel type for 299 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. A4 channel types are steep, narrow, cascading, step pool streams with high energy/debris transport associated with depositional soils and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 48 to 50 degrees Fahrenheit. Air temperatures ranged from 42 to 56 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 38% pool units, 31% riffle units, 29% flatwater units, and 2% was dry (Graph 1). Based on total **length** of Level II habitat types there were 44% flatwater units, 32% pool units, 22% riffle units, and 1% was dry (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffle units, 30%; mid-channel pool units, 25%; and step run units, 17% (Graph 3). Based on percent total **length**, step run units made up 34%, mid-channel pool units 22%, and low gradient riffle units 21%.

A total of 127 pools were identified (Table 3). Main channel pools were most frequently encountered at 69% and comprised 76% 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-four of one hundred and twenty-seven pools (26.8%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 127 pool tail-outs measured, 6 had a value of 1 (5%); 27 had a value of 2 (21%); 29 had a value of 3 (23%); 30 had a value of 4 (24%); and 35 had a value of 5 (27%), or were not suitable for spawning (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. Pool habitat types had a mean shelter rating of 37, and flatwater habitats had a mean shelter rating of 32 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 48. Main channel pools had a mean shelter rating of 37 (Table 3).

Jug Handle Creek

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Jug Handle Creek. Boulders are the next most common cover type. Graph 7 describes the pool cover in Jug Handle Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 82% of the low gradient riffles measured. Small cobble was the next most frequently observed dominant substrate type and occurred in 18% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 98%. The mean percentages of deciduous and coniferous trees were 64% and 36%, respectively. Graph 9 describes the canopy in Jug Handle Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 93.8%. The mean percent left bank vegetated was 93.2%. The dominant elements composing the structure of the stream banks consisted of 3.3% bedrock, 3.3% boulder, 45.6% cobble/gravel, and 45.6% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 53.3% of the units surveyed. Additionally, 6.5% of the units surveyed had deciduous trees as the dominant vegetation type, and 13.0% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on October 24, 1996, in Jug Handle Creek. The sites were sampled by Craig Mesman and Dionne Wrights.

The first site sampled included habitat units 243 through 251, a step run, low gradient riffle, step run, lateral scour pool - root wad enhanced, low gradient riffle, mid-channel pool, low gradient riffle and step run, approximately 6,869 feet from the beginning of the survey and above an LDA approximately 134 feet long. The site yielded a total of 5 steelhead.

The second site included habitat units 292 through 298, a plunge pool, low gradient riffle, run, mid-channel pool, step run, low gradient riffle and plunge pool, approximately 7,866 feet from the beginning of the survey. The site yielded a total of 7 steelhead.

The third site sampled was the mid-channel pool at the end of the survey 8,327 feet from the beginning, and 275 feet above the confluence with a left bank tributary that enters Jug Handle Creek at the upper end. The site yielded 1 steelhead.

DISCUSSION

Jug Handle Creek is an F4 channel type for the first 8,028 feet of stream surveyed and an A4 for the remaining 299 feet. The suitability of F4 and A4 channel types for fish habitat improvement structures is as follows: F4 channels are good for bank placed boulders, single and opposing

wing deflectors, channel constrictors and log cover. A4 channels are good for bank-placed boulders, fair for low stage weirs, opposing wing deflectors and log cover and poor for medium stage weirs, boulder clusters, single wing deflectors and log cover.

The water temperatures recorded on the survey days October 28 through 30, 1996, ranged from 48 to 50 degrees Fahrenheit. Air temperatures ranged from 42 to 56 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 44% of the total **length** of this survey, riffles 22%, and pools 32%. The pools are relatively shallow, with only 34 of the 127 (27%) 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.

Ninety-four of the 127 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Only 6 had a 1 rating. 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 Jug Handle 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 37. The shelter rating in the flatwater habitats was slightly lower at 32. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by small woody debris in all habitat types. Additionally, boulders contribute a small amount. 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.

All of the low gradient riffles 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 98%. 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 high at 93.8% and 93.2%, 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.

Jug Handle Creek

RECOMMENDATIONS

1) Jug Handle Creek should be managed as an anadromous, natural production stream.

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from small woody debris. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

3) 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.

4) 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.

5) 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.

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 intermittent left bank tributary (center of section 5). This is a 55 minute walk downstream from the "rock pit." Channel type is an F4.
61'	Flow in tributary is <0.10 cubic feet per second (cfs). Accessible to fish.
1,259'	Flowing right bank tributary <0.10 cfs. Very steep and full of wood. Not accessible to anadromous fish.
1,727'	Stump on right bank with a sign: "State Park Boundary."
2,256'	Left bank tributary, <0.10 cfs. Small, narrow, steep. Not accessible to anadromous fish.
2,755'	Log debris accumulation (LDA), 15' long x 15' wide x 4' high retains approximately 3' deep gravel. Not a barrier.

3,326'	Left bank tributary at top of unit, <0.10 cfs. Small, no distinct channel. Not accessible to anadromous fish. Large ravine.
4,009'	Four logs parallel to flow catching small woody debris and filling the channel. Retaining little sediment. Right bank tributary comes into top of unit. Flow is <0.10 cfs. Narrow, steep, with no distinct channel.
4,748'	Garbage in the stream and on left bank.
4,855'	Left bank tributary, <0.10 cfs. Flows through a rock pit. Not accessible to anadromous fish. Lined with garbage.
4,957'	Garbage ends here.
5,184'	Right bank tributary <0.10 cfs. Narrow with no distinct channel. Not accessible to anadromous fish.
5,533'	Small woody debris (SWD) accumulation clogs channel.
5,642'	Left bank tributary, <0.10 cfs. Narrow, steep, and not accessible to anadromous fish. Tributary flows through a large ravine.
5,710'	Corrugated metal pipe under old road crossing, 8' wide x 8' high. Good condition.
6,025'	LDA, 15' long x 25' wide x 5' high. Retaining sediment 4' high.
6,227'	Three logs parallel to flow retaining gravel approximately 3' deep. Not a barrier.
6,380'	Root wad retaining 4.5' of sediment.
6,443'	Gradient begins increasing here.
6,692'	Water percolates through woody debris and gravel. Debris retains 5' of gravel.
6,706'	LDA retaining 4.5' of sediment creating a 4.5' high jump.
6,734'	LDA retaining 3' of sediment and creating a 3.5 high jump.
6,784'	LDA across channel. The material came from a slide and fallen trees.
6,869'	First electrofishing site.
6,897'	Channel back to low gradient with gravel dominant.
7,130'	Right bank tributary.

7,798' LDA, 8' long x 15' wide x 4' high. Retaining sediment, may hinder passage.

7,866' Second electrofishing site.

8,052' Channel type changes to A4.

8,056' Left bank tributary, <0.10 cfs. Steep, narrow, not accessible to anadromous fish.

8,232' LDA, retaining sediment 5' deep and creating a 5' high jump.

8,327' End of Survey. Last electrofishing site and the highest fish observation. The channel above here becomes narrow and choked with vegetation. The channel is also steep (4-10%). The stream flow is also becoming intermittent.

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.

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