STREAM INVENTORY REPORT

Gulch Sixteen

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Gulch Sixteen and an unnamed tributary to Gulch Sixteen. 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 Gulch Sixteen. 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

Gulch Sixteen is tributary to West Chamberlain Creek, tributary to Chamberlain Creek, tributary to North Fork Big River, tributary to Big River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Gulch Sixteen's legal description at the confluence with West Chamberlain Creek is T18N R15W S31. Its location is 39°22′42″ north latitude and 123°34'37" west longitude. Gulch Sixteen is a first order stream and has approximately 6.75 miles of intermittent stream, including tributaries, according to the USGS Northspur 7.5 minute quadrangle. Gulch Sixteen drains a watershed of approximately 0.97 square miles. Elevations range from about 480 feet at the mouth of the creek to 1640 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely within Jackson Demonstration State Forest and is managed for timber production. Vehicle access exists via State Route 20 to Road 200.

METHODS

The habitat inventory conducted in Gulch Sixteen 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 Gulch Sixteen 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". Gulch Sixteen 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 Gulch Sixteen, 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 Gulch Sixteen, 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 Gulch Sixteen, 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 Gulch Sixteen, 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 Gulch Sixteen fish presence was observed from the stream banks, and two sites were 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 Gulch Sixteen 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 following results and discussion are for main stem Gulch Sixteen. Results and discussion for the unnamed tributary are presented as a subsection following the main body of this report.

The habitat inventory of July 1 and 2, 1997, was conducted by Craig Mesman (CCC) and Lisa Campbell (AmeriCorps \ Watershed Stewards Project). The total length of the stream surveyed was 4,653 feet with an additional 217 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.34 cfs on June 20, 1997.

Gulch Sixteen is an F4 channel type for the first 4,015 feet of stream surveyed and an A3 channel type for the remaining 638 feet of stream surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients. F4 channel types have high width/depth ratios and gravel-dominant substrates. A3 channels are steep, narrow, cascading step-pool streams with high energy/debris transport associated with depositional soils. A3 channels have cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 54 degrees Fahrenheit. Air temperatures ranged from 56 to 70 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 26% riffle units, 30% flatwater units, 38% pool units, and 6% dry units (Graph 1). Based on total **length** of Level II habitat types there were 22% riffle units, 50% flatwater units, 22% pool units, and 6% dry units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffles, 24%; step runs, 21%; and mid-channel pools, 21% (Graph 3). Based on percent total **length**, low gradient riffles made up 21%, step runs 44%, and mid-channel pools 13%.

A total of 62 pools were identified (Table 3). Main channel pools were most frequently encountered at 61% and comprised 68% 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. Nine of the 62 pools (15%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 62 pool tail-outs measured, 4 had a value of 1 (6.5%); 27 had a value of 2 (43.5%); 18 had a value of 3 (29.0%); 1 had a value of 4 (1.6%) and 12 had a value of 5 (19.4%) (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 Gulch Sixteen, 9 of the 12 pool tail-outs which were valued at 5 had silt/clay/sand or gravel too small to be suitable for spawning as the substrate. The other tail-outs were unsuitable for spawning due to the tail-outs being comprised of large cobble, boulder, bedrock or wood.

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 6, flatwater habitat types had a mean shelter rating of 17, and pool habitats had a mean shelter rating of 40 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 48. Scour pools had a mean shelter rating of 42, and main channel pools had a rating of 35 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris, large woody debris and undercut bank comprised the majority of the cover in all the habitat types in Gulch Sixteen. Graph 7 describes the pool cover in Gulch Sixteen.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate in the five low gradient riffles measured. Gravel was also the dominant substrate observed in 49 of the 62 pool tail-outs measured (79%). Silt/clay was the next most frequently observed dominant substrate type and occurred in 7% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 94%. The mean percentages of deciduous and coniferous trees were 1% and 99%, respectively. Graph 9 describes the canopy in Gulch Sixteen.

For the stream reach surveyed, the mean percent right bank vegetated was 89%. The mean percent left bank vegetated was 88%. The dominant elements composing the structure of the stream banks

consisted of 13.8% bedrock, 1.7% boulder, 48.3% cobble/gravel, and 36.2% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 53.5% of the units surveyed. Additionally, 27.6% of the units surveyed had grass as the dominant vegetation type, and 17.2% had brush as the dominant vegetation.

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on August 20,1997, in Gulch Sixteen. The sites were sampled by Craig Mesman and Tara Cooper (CCC).

The first site sampled included habitat units 51 through 54, a run/riffle/pool combination approximately 1,606 feet from the confluence with West Chamberlain Creek. The site yielded two steelhead and four salamanders.

The second site included habitat units 140 through 143, a step run/pool combination located approximately 3,717 feet above the creek mouth. The site yielded eight salamanders.

DISCUSSION

Gulch Sixteen is an F4 channel type for the first 4,015 feet of stream surveyed and an A3 for the remaining 638 feet. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for weirs, single and opposing wing-deflectors, channel constrictors, and log cover; and poor for boulder clusters.
The suitability of A3 channel types for improvement structures is as follows: good for bank-placed boulders; fair for weirs, opposing wing-deflectors, and log cover; and poor for boulder clusters, and single wing-deflectors.

The water temperatures recorded on the survey days July 1 and 2, 1997, ranged from 52 to 54 degrees Fahrenheit. Air temperatures ranged from 56 to 70 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 50% of the total **length** of this survey, riffles 22%, and pools 22%. The pools are relatively shallow, with only 9 of the 62 (15%) 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 structure that will increase or deepen pool habitat is recommended.

Four of the 62 pool tail-outs measured had an embeddedness rating of 1. Nineteen of the pool tail-outs had embeddedness ratings of 3 or 4. Twelve of the pool tail-outs had a rating of 5 or were considered

unsuitable for spawning. Nine of the pool tail-outs were 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 Gulch Sixteen, 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 40. The shelter rating in the flatwater habitats was even lower at 17. 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, large woody debris and undercut banks 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.

Fifty-two of the 62 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 94%. This is a relatively high amount 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 89% and 88%, 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) Gulch Sixteen should be managed as an anadromous, natural production stream.

2) 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.

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

4) 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.

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.

0'	Begin survey at confluence with West Chamberlain Creek. Channel type is F4.
99'	Old road on left bank.
447'	Confluence with left bank tributary, see subsection report. Tributary flows through a 3' culvert. Some loss of flow due to holes in the culvert. No baffles, low gradient. Culvert is impassible.
525'	Flow taken 6/20/97, 0.34 cfs.
1,332'	Right bank tributary, flow 0.10cfs. Accessible to fish.
1,606'	First electrofishing site.
2,827'	Right bank ravine.
3,008'	Left bank tributary, flow less than 0.05 cfs.
3,185'	Log debris accumulation (LDA), 35' long x 16' wide x 5' high. Not a barrier.

3,214'	Left bank tributary. Wet but not flowing. Channel is steep with a boulder dominant substrate.
3,717'	Second electrofishing site.
4,015'	Channel type changes to an A3.
4,019'	Right bank tributary, flow less 0.10cfs.
4,653'	End of survey at dry left bank tributary. Approximately 100' upstream channel forks and becomes either dry or forest floor.

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