STREAM INVENTORY REPORT

Berry Gulch

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Berry Gulch and an unnamed left bank tributary to Berry 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 Berry 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

Berry Gulch is tributary to Little North Fork Big River, tributary to Big River, located in Mendocino County, California (Map 1). Berry Gulch's legal description at the confluence with Little North Fork Big River is T17N R16W S8. Its location is 39°20′53″ north latitude and 123°40′19″ west longitude. Berry Gulch is a first order stream with approximately 2.6 miles of blue line designation according to the USGS Mathison Peak 7.5 minute quadrangle. Berry Gulch drains a watershed of approximately 2.8 square miles. Elevations range from about 190 feet at the mouth of the creek to 900 feet in the headwater areas. Redwood/Douglas fir forest dominates the watershed. The watershed is primarily owned by Jackson Demonstration State Forest and is managed for timber production. Vehicle access exists via Highway 20 to Road 560.

METHODS

The habitat inventory conducted in Berry 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 Berry 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". Berry 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 (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 Berry 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 Berry 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 hand held 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 Berry 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 Berry 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.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Berry Gulch fish presence was observed from the stream banks, and four 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 Berry 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 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 June 11 through 19, 1997 was conducted by Shelly Dunn (CCC) and Lisa Campbell (AmeriCorps/WSP). The total length of the stream surveyed was 12,918 feet with an additional 293 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.0 cfs on June 10, 1997 and above the left bank tributary at 0.27 cfs on June 19,

1997.

Berry Gulch is an F3 channel type for the first 436 feet, an F4 channel type for the next 6,985 feet, a B2 for the following 1,051 feet and returns to an F4 channel type for the remaining 3,078 feet of stream reach surveyed. F3 and F4 type channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and have cobble and gravel dominant substrates respectively. B2 channel types are: moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks and boulder dominant substrate.

Water temperatures taken during the survey period ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 57 to 76 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 27% riffle units, 34% flatwater units, and 38% pool units (Graph 1). Based on total **length** of Level II habitat types there were 18% riffle units, 51% flatwater units, and 30% pool units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 27%; low gradient riffles, 25%; and runs, 18% (Graph 3). Based on percent total **length**, step runs made up 27% and mid-channel pools 19%.

A total of 151 pools were identified (Table 3). Main channel pools were most frequently encountered at 74% and comprised 73% 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. Fifty of the 151 pools (33%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 151 pool tail-outs measured, none had a value of 1; 64 had a value of 2 (42.4%); 70 had a value of 3 (46.4%); 10 had a value of 4 (6.6%); and 7 had a value of 5 (4.6%) (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 Berry Gulch, one of the 7 pool tail-outs which were valued at 5 had silt as the substrate. The other 6 tail-outs were unsuitable for spawning due to the tail-outs being comprised of boulders or bedrock.

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 23, flatwater habitat types had a mean shelter rating of 28, and pool habitats had a mean shelter rating of 24 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 60. Main channel pools had a mean shelter rating of 11 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Berry Gulch. Graph 7 describes the pool cover types in Berry Gulch. Large woody debris and undercut banks make up the majority of the cover at 54.5% combined.

Table 6 summarizes the dominant substrate by habitat type. Nine low gradient riffles were fully

measured. Of those nine, gravel was the dominant substrate in six and small cobble was the dominant substrate in two. Gravel was the dominant substrate observed in 83 of the 151 pool tail-outs measured (55.0%). Small cobble was the next most frequently observed dominant substrate type and occurred in 27.8% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 93%. The mean percentages of deciduous and coniferous trees were 8.4% and 84.6%, respectively. Graph 9 describes the canopy in Berry Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 94%. The mean percent left bank vegetated was 94%. The dominant elements composing the structure of the stream banks consisted of 10.4% bedrock, 0.9% boulder, 32.1% cobble/gravel, and 56.6% sand/silt/clay (Graph 10). Coniferous trees was the dominant vegetation type observed in 63.3% of the units surveyed. Additionally, 15.1% of the units surveyed had deciduous trees as the dominant vegetation type, and 17.9% had brush as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished on September 11 and 12, 1997, in Berry Gulch. The sites were sampled by Tara Cooper and Craig Mesman (CCC).

The first site sampled included habitat units 14 through 17, a riffle/run/pool combination approximately 304 feet from the confluence with Little North Fork Big River. The site yielded five steelhead and one coho.

The second site included habitat units 19 through 22, a riffle/run/pool combination located approximately 436 feet above the creek mouth. The site yielded two steelhead and two coho.

The third site sampled included habitat units 241 through 248, a riffle/run/pool combination located approximately 7,164 feet above the creek mouth. The site yielded two steelhead.

The fourth site sampled included habitat units 354 through 373, a riffle/run/pool combination located approximately 10,703 feet above the creek mouth. The site yielded 1 stickleback.

DISCUSSION

Berry Gulch is an F3 channel type for the first 436 feet of stream surveyed, an F4 channel type for the next 6,985 feet, a B2 channel type for the next 1,051 feet and an F4 channel type for the remaining 3,078 feet. The suitability of F3 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders, and single and opposing wing-deflectors; fair for weirs, boulder clusters, channel constrictors, and log cover. 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 B2 channel types for fish habitat improvement structures is as

follows: excellent for plunge weirs, single and opposing wing deflectors, and bank cover.

The water temperatures recorded on the survey days June 11 through 19, 1997, ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 57 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 51% of the total **length** of this survey, riffles 18%, and pools 30%. The pools are relatively shallow, with only 50 of the 151 (33.1%) 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 pool tail-outs measured had an embeddedness rating of 1. Eighty of the pool tail-outs had embeddedness ratings of 3 or 4 (53%). Seven of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. Six of the seven were unsuitable for spawning due to the dominant substrate being bedrock or boulder. 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 Berry 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 24. The shelter rating in the flatwater habitats was slightly better at 28. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, large woody debris and undercut banks contribute 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.

One-hundred-twenty-five of the 151 (82.8%) 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 93%. 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 94.0% and 94.4%, 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) Berry Gulch should be managed as an anadromous, natural production stream.

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

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.

0'	Begin survey at confluence with Little North Fork Big River. Channel type is F3.
304'	Electrofishing site #1.
424'	Log debris accumulation (LDA), 12' long x 10' wide x 10' high.
436'	Electrofishing site #2. Channel type changes to an F4.
1,285'	Left bank trail leading up to road.
1,544'	Left bank ATV trail leading to road.
2,214'	Left bank erosion, 48' long x 30' high.
2,872'	Left bank culvert.
3,350'	Right bank erosion, 34' long x 15' high.
3,352'	Ten foot diameter log covering channel.
4,028'	Unnamed left bank tributary (See subsection report).

4,092'	Possible barrier, 28% slope bedrock sheet.
4,132'	Right bank erosion, 6' long x 12' high.
4,211'	LDA, 5' long x 10' wide x 6' high with a five foot jump and associated right bank erosion, 15' long x 15' high.
4,750'	LDA, 5' long x 8' wide x 3' high.
6,134'	Left bank erosion, 31' long x 6' high.
6,354'	LDA, 24' long x 15' wide x 6' high, with associated left bank erosion, 29' long x 15' high.
7,164'	Electrofishing site #3.
7,249'	LDA, 39' long x 25' wide x 10' high retaining 10' of sediment.
7,477'	Channel changes to B2.
8,035'	LDA, 48' long x 30' wide x 10' high, possible barrier.
8,243'	LDA, 10' long x 10' wide x 6' high with a 6' jump.
8,417'	LDA, 55' long x 30' wide x 7' high, possible barrier, with associated right bank erosion 55' long x 20' high.
8,528'	Channel changes to F4.
8,714'	Left bank dry tributary.
8,759'	Left bank gully from road run-off.
9,743'	Right bank dry tributary.
9,913'	LDA, 5' long x 15' wide x 5' high retaining sediment.
10,116'	Left bank dry tributary coming from 1' diameter culvert.
10,703'	Electrofishing site #4.
10,754'	Right bank tributary, <0.1 cfs, mostly dry.
11,554'	Berry Gulch runs through 7' diameter culvert under road crossing.
11,800'	Beginning of marsh. Not surveyed.

12,918' End of survey. Two foot diameter culvert with no baffles. The creek is dry above the culvert.

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