STREAM INVENTORY REPORT

Beer Bottle Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Beer Bottle 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 Beer Bottle 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

Beer Bottle Creek is a tributary to Bear River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Beer Bottle Creek's legal description at the confluence with Bear River is T01S R01W S12. Its location is 40.3986 degrees north latitude and 124.1369 degrees west longitude. Beer Bottle Creek is a second order stream and has approximately 1.2 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. Beer Bottle Creek drains a watershed of approximately 1.2 square miles. Elevations range from about 920 feet at the mouth of the creek to 2,040 feet in the headwater areas. Coniferous forest dominates the watershed. The watershed is entirely privately owned and is managed for timber harvest.

METHODS

The habitat inventory conducted in Beer Bottle 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 the AmeriCorps Watershed Stewards Project (AmeriCorps WSP) Members who 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 Beer Bottle 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. Additionally, a recording thermograph was deployed in Beer Bottle Creek from July 24 to October 21, 1996 to record temperatures on a 24 hour basis during warm summer months.

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". Beer Bottle 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:

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 Beer Bottle 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 not suitable 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 Beer Bottle 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 Beer Bottle 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 approximately a 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 Beer Bottle 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 Beer Bottle Creek fish presence was observed from the stream banks, and one site 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 Beer Bottle 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

HABITAT INVENTORY RESULTS

The habitat inventory of July, 30 1996 was conducted by Bill Malinowski (WSP\AmeriCorps) and Craig Mesman (CCC). The total length of the stream surveyed was 1,044 feet with an additional 215 feet of side channel.

Beer Bottle Creek

Flow was measured approximately 50 feet from the confluence with Bear River, using a Marsh-McBirney Model 2000 flowmeter, at 0.32 cfs on July 30, 1996.

Beer Bottle Creek is an A2 channel type for the entire 1,044 feet of stream reach surveyed. A2 channels are steep, narrow cascading, step-pool streams, with high energy/debris transport, associated with depositional soils, and a boulder channel.

Water temperatures taken during the survey period ranged from 60 to 61 degrees Fahrenheit. Air temperatures ranged from 68 to 80 degrees Fahrenheit. The recording thermograph deployed in Beer Bottle Creek from July 24 to October 21, 1996 recorded temperatures ranging from 47 to 62 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 43% pool units, 31% riffle units, and 23% flatwater units (Graph 1). Based on total length of Level II habitat types, there were 46% riffle units, 26% flatwater units, and 23% pool units (Graph 2).

Four Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were plunge pools, 34%; cascades 31% and step runs, 23% (Graph 3). Based on percent total length, cascades made up 46%, step runs at 26% and plunge pools 18%.

A total of fifteen pools were identified (Table 3). Scour pools were most frequently encountered at 80% and comprised 77% 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. Six of the 15 pools (40%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the fifteen pool tail-outs measured, five had a value of 1 (33%); nine had a value of 2 (60%); one had a value of 3 (7%); (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. Riffle habitat types had a mean shelter rating of 40, flatwater habitats had a mean shelter rating of 65, and pool habitats had a mean shelter rating of 43 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 50. Main channel pools had a mean shelter rating of 20 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Beer Bottle Creek and are extensive. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Beer Bottle Creek.

Table 6 summarizes the dominant substrate by habitat type. Boulders were the dominant substrate observed in the two step runs measured (Graph 8).

The mean percent canopy density for the stream reach surveyed was 86%. The mean percentages of deciduous and coniferous trees were 79% and 21%, respectively. Graph 9 describes the

canopy in Beer Bottle Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 57%. The mean percent left bank vegetated was 61%. The dominant element composing the structure of the stream banks consisted of 100% boulders (Graph 10). Deciduous trees were the dominant vegetation type observed in 50% of the units surveyed and 14% had coniferous trees as the dominant vegetation, including downed trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on September 8, 1996 in Beer Bottle Creek. The site was sampled by Bill Malinowski and Dave Jones (CCC).

The site sampled was Habitat Unit #004, a mid-channel pool approximately 102 feet from the confluence with Bear River. This site had an area of 126 square feet and a volume of 882 cubic feet. The site yielded 26 steelhead/rainbow trout and one Pacific giant salamander.

DISCUSSION

Beer Bottle Creek is an A2 channel type for the entire 1,044 feet of stream surveyed. A2 channels are generally not suitable for fish habitat improvement structures. A2 channels are high energy streams with stable stream banks, and poor gravel retention capabilities.

The water temperatures recorded on the survey day July 30,1996 ranged from 60 to 61 degrees Fahrenheit. Air temperatures ranged from 68 to 80 degrees Fahrenheit. The recording thermograph deployed in Beer Bottle Creek from July 24 to October 21, 1996 recorded water temperatures ranging from 47 to 62 degrees Fahrenheit. This is a good water temperature range for salmonids.

Flatwater habitat types comprised 26% of the total length of this survey, riffles 46%, and pools 23%. The pools are relatively shallow, with only six of the 15 (40%) pools having a maximum depth greater than two 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 three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Due to the A2 channel type, installing structures that will increase or deepen pool habitat is not recommended.

One of the 15 pool tail-outs measured had embeddedness rating of 3. Five had an embeddedness rating of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

The mean shelter rating for pools was moderate with a rating of 43. The shelter rating in the flatwater habitats was slightly better at 65. 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. Log and root wad cover structure in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and divide territorial units to reduce density related competition.

None of the two step-runs measured had gravel or small cobble as the dominant substrate. This is generally considered not good for spawning salmonids.

The mean percent canopy density for the stream was 86%. This is a relatively good 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 57% and 61%, respectively. In areas of stream bank erosion or where bank vegetation is at unacceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Beer Bottle 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 boulders. Adding high quality complexity with woody cover is desirable.

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'	Start of survey at confluence with Bear River. Channel type is an A2.
196'	Thermograph site.
335'	Five foot jump created by logs and boulders across the channel may impede passage.
397'	Steelhead observed.
1,044'	End of survey. Survey ended due to a 10' jump and continuous high gradient. The cascade habitat continues at least 400' above the end of the survey. No young-of-the-year fish have been seen since the observation at 397'. Very little to no spawning

substrate observed up to and above the end of the survey.

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

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