STREAM INVENTORY REPORT

Bear Pen Canyon Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Bear Pen Canyon Creek to assess habitat conditions for anadromous salmonids. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Bear Pen Canyon Creek. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

There is no known record of adult spawning surveys having been conducted on Bear Pen Canyon Creek. 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.

WATERSHED OVERVIEW

Bear Pen Canyon Creek is a tributary to Burger Creek, a tributary to Outlet Creek, a tributary to the Eel River, which drains to the Pacific Ocean. It is located in Mendocino County, California. Bear Pen Canyon Creek's legal description at the confluence with Burger Creek is T21N R14W S03. Its location is 39.6944 degrees north latitude and 123.4122 degrees west longitude. Bear Pen Canyon Creek is a second order stream and has approximately 4.5 miles of blue line stream according to the USGS Laytonville 7.5 minute quadrangle. Bear Pen Canyon Creek drains a watershed of approximately 4.8 square miles. Elevations range from about 1,800 feet at the mouth of the creek to 2,600 feet in the headwater areas. Douglas fir forest and oak forest dominate the watershed. The watershed is privately owned and is managed for timber production and rural residence. Vehicle access exists via the Dos Rios road from Highway 101 in Laytonville to the Burger Creek bridge, approximately 2.5 miles west of Dos Rios.

METHODS

The habitat inventory conducted in Bear Pen Canyon Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The fishermen from the Northwest Economic Initiative Program that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). The two person Bear Pen Canyon survey team were trained in May, 1995, by Ruth Goodfield.

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 Bear Pen Canyon 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. Flows should also be measured or estimated at major tributary confluences.

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 each tenth unit typed. 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". Bear Pen Canyon 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 measured for mean width, mean depth, and maximum depth (*Sampling Levels for Fish Habitat Inventory*, Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken 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 Bear Pen Canyon 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), 76-100% (value 4). Additionally, a rating 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 Bear Pen Canyon 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 is estimated using handheld spherical densiometers and is a measure of the water surface shaded during periods of high sun. In Bear Pen Canyon Creek, 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. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results were recorded.

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 Bear Pen Canyon Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat7.3, 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 4. Graphics developed for Bear Pen Canyon 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 September 21 through September 27, 1995 was conducted by Dylan Brown and Ray Bevitori. The total length of the stream surveyed was 18,441 feet with an additional 2,020 feet of side channel.

Flow was not measured on Bear Pen Canyon Creek.

Bear Pen Canyon Creek is an A2 channel type for the first 3,965 feet (Reach 1), then changes to a B3 for the remaining 14,476 feet of stream reach surveyed (Reach 2). A2 channels are steep (4-10% gradient), very well confined streams, with stable stream banks. B3 channel types have a moderate slope (2-4% gradient), moderately entrenched, and have stable stream banks.

Water temperatures ranged from 54 to 59 degrees Fahrenheit. Air temperatures ranged from 54 to 82 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, pools made up 53%, flatwater types 27%, and riffles 20% (Graph 1). Flatwater habitat types made up 53% of the total survey length, pools 28%, and riffles 19% (Graph 2).

Four hundred Level IV habitat types were identified. These data are summarized in Table 2. The most frequent habitat types by percent occurrence were mid-channel pools, 30%; step runs, 24%; and plunge pools, 22% (Graph 3). By percent total length, step runs made up 50%, mid-channel pools 17%, and riffles 17%.

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Two hundred and ten pools were identified (Table 3). Main channel pools were most often encountered at 57% and comprised 61% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Forty-nine of the 210 pools (23%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 13 pool tail-outs measured, four had a value of 2 (31%); and nine had a value of 3 (69%). On this scale, a value of 1 is the best for fisheries (Graph 6).

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 the highest shelter rating at 30. Flatwater habitats followed with a rating of 15 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 33. Main channel pools had a mean shelter rating of 28 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Bear Pen Canyon Creek and are extensive. Large and small woody debris are lacking in most of the habitat types. Graph 7 describes the pool cover in Bear Pen Canyon Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in two of the five low gradient riffles measured (40%). Large cobble, boulders, and bedrock each were dominant in 20% of the low gradient riffles (Graph 8).

The mean percent canopy for the stream reach surveyed was 82%. The mean percentages of deciduous and coniferous trees were 65% and 15%, respectively. Graph 9 describes the canopy in Bear Pen Canyon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 77%. The mean percent left bank vegetated was 76%. The dominant elements composing the structure of the stream banks consisted of 57% boulders, 22% cobble/gravel, 17% bedrock, and 4% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation types observed in 86% of the units surveyed. Additionally, 6% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

DISCUSSION

Bear Pen Canyon Creek is an A2 channel type for the first 3,965 feet of stream surveyed and a B3 for the remaining 14,476 feet. A2 channel types are generally not suitable for instream habitat improvement structures. However, B3 channel types are excellent for low stage plunge weirs, boulder clusters and bank placed boulders, log cover, and single and opposing wing-deflectors. B3 channel types are good for medium stage plunge weirs.

The water temperatures recorded on the survey days September 21 through September 27, 1995 ranged from 54 to 59 degrees Fahrenheit. Air temperatures ranged from 54 to 83 degrees

Fahrenheit. This is an excellent water temperature range for salmonids. Bear Pen Canyon Creek seems to have temperatures favorable to salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 53% of the total length of this survey, riffles 20%, and pools 27%. The pools are relatively shallow, with only 49 of the 210 pools having a maximum depth greater than two feet. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total 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 for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravel. Any necessary modifications to them should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

Nine of the 13 pool tail-outs measured had embeddedness ratings of 3 or 4. None had an embeddedness rating of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In Bear Pen Canyon 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 30. The shelter rating in the flatwater habitats was slightly lower at 15. 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, bedrock ledges 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 structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

Two of the five 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 for the stream was 82%. This is a relatively high percentage of canopy, since 80% is generally considered optimum in these north coast streams.

The percentage of right and left bank covered with vegetation was high at 77% and 76%, 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.

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RECOMMENDATIONS

1) Bear Pen Canyon Creek should be managed as an anadromous, natural production stream.

2) Where feasible, design and engineer pool enhancement structures to increase the depth of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

3) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 1655', should then be treated to reduce the amount of fine sediments entering the stream.

4) 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 and in some areas the material is at hand.

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) Due to the high gradient of the lower section of the stream, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.

PROBLEM SITES 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 Burger Creek. Reach 1 is an A2 channel type.
1655'	Slide on the left bank measures 110' wide x 120' high.
1833'	Four and a half foot high waterfall.
1861'	A spring enters from the left bank; the water temperature was 59 degrees Fahrenheit. There is also a slide on the left bank measuring 50' wide x 50' high.
1910'	Slide on the right bank measures 120' wide x 100' high.
2224'	A spring enters the right bank; the water temperature was 58 degrees Fahrenheit.

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2236'	There is a log jam in the stream; it measures 50' long x 8' high x 70' wide.
2297'	Seven foot high waterfall.
2419'	Seven foot high waterfall.
2584'	Slide on the left bank measures 200' wide x 125' high.
3089'	Rock slide measures 200' long x 85' high.
3130'	Slide measures 130' wide x 70' high.
3965'	Channel type changes from an A2 to a B3 (Reach 2).
4216'	Spring on the right bank; the water temperature was 58 degrees Fahrenheit.
4706'	Slide on the left bank measures 60' wide x 70' high.
4813'	Erosion site on the left bank measures 60' wide x 60' high.
5046'	Spring on the right bank. Garbage has been dumped on the left bank.
8097'	An unnamed tributary enters from the left bank. County bridge over Bear Pen Canyon Creek.
10242'	Private bridge crosses the creek.
17057'	A major tributary enters the left bank, it is contributes approximately 30% to the flow of Bear Pen Canyon Creek.
17467'	Rock work for road stabilization on the left bank.
17785'	Mid-channel debris accumulation is causing erosion on both banks, impassable to fish at low flows.
18011'	End of survey, fish no longer observed.

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