STREAM INVENTORY REPORT

BRIDGE CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1994 on Bridge Creek to assess habitat conditions for anadromous salmonids. 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 Bridge Creek. The objective of the biological inventory was to document the salmonid species present and their distribution. 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 Bridge Creek. The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Bridge Creek is tributary to the North Fork Elk River, tributary to the Elk River, tributary to Humboldt Bay, located in Humboldt County, California. Bridge Creek's legal description at the confluence with North Fork Elk River is T04N R01E S33. Its location is 40°41'32" North latitude and 124°04'54" West longitude. Bridge Creek is a first order stream and has approximately 1.8 miles of blue line stream according to the USGS McWhinney Creek 7.5 minute quadrangle. Bridge Creek drains a watershed of approximately 2.31 square miles. Summer base runoff is approximately 0.1 cubic feet per second (cfs) at the mouth. Elevations range from about 150 feet at the mouth of the creek to 800 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via U.S. Highway 101 at the Elk River Road exit, thence east on Elk River Road approximately 3.5 miles to Wrigley Road, thence east on Wrigley Road approximately 3.5 miles to Bridge Creek.

METHODS

The habitat inventory conducted in Bridge 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 that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Bridge Creek personnel were trained in June, 1994, by Gary Flosi and Scott Downie. This inventory was conducted by a two-person team.

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 Bridge 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 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". Bridge 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. Unit measurements included mean length, mean width, mean depth, and maximum depth. 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 Bridge 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).

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 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 Bridge 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 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 Bridge Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results 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 Bridge Creek, the dominant composition type and the dominant vegetation type of both the right and left banks 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. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

Biological inventory was conducted in Bridge Creek to document the fish species composition and distribution. Three sites were electrofished in Bridge Creek using one Smith-Root Model 12 electrofisher. Each site was end-blocked with nets to contain the fish within the sample reach. Fish from each site were counted by species, measured, and returned to the stream.

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 Lotus 1,2,3. Graphics developed for Bridge 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

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of June 20, 1994, was conducted by Craig Mesman and Chris Coyle (CCC). The total length of the stream surveyed was 1,519 feet.

Flow was estimated to be approximately 0.1 cfs during the survey period.

Bridge Creek is a B4 channel type for the entire 1,519 feet of stream reach surveyed. B4 channels are moderately entrenched, moderate gradient, riffle-dominated channels with infrequently spaced pools, very stable plan and profile, stable banks, and gravel dominant substrate.

Water temperatures ranged from 54 to 56 degrees Fahrenheit. Air temperatures ranged from 59 to 63 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 53%, riffles 30%, and flatwater 15% (Graph 1). Pool habitat types made up 67% of the total survey **length**, riffles 18%, and flatwater 14% (Graph 2).

Nine Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were mid-channel pools, 40%; low gradient riffles, 30%; and step runs, 8% (Graph 3). By percent total **length**, mid-channel pools made up 54%, low gradient riffles, 18%, and step runs, 10%.

Twenty-one pools were identified (Table 3). Main channel pools were most often encountered at 81% and comprised 90% 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. Ten of the 21 pools (48%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 21 pool tail-outs measured, 4 had a value of 1 (19%); 6 had a value of 2 (29%); 0 had a value of 3 (0%); and 11 had a value of 4 (52%). On this scale, a value of one 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 109. Flatwater habitats followed with a rating of 37 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 127, and scour pools rated 37 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Bridge Creek and is extensive. Graph 7 describes the pool cover in Bridge Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 6 of the 12 low gradient riffles (50%). Silt was the next most frequently observed dominant substrate type and occurred in 25% of the low gradient riffles (Graph 8).

Twelve percent of the survey reach lacked shade canopy. Of the 88% of the stream covered with canopy, 26% was composed of deciduous trees, and 72% was composed of coniferous trees. Graph 9 describes the canopy in Bridge Creek.

Table 2 summarizes the mean percentage of the right and left stream banks covered with vegetation by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 82%. The mean percent left bank vegetated was 83%. The dominant elements composing the structure of the stream banks consisted of 2.5% bedrock, 5.0% cobble/gravel, and 92.5% sand/silt/clay. (Graph 10). Brush was the dominant vegetation type observed in 61% of the units surveyed. Additionally, 1.2% of the units surveyed had deciduous trees as the dominant vegetation type, and 21.2% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on June 22, 1994, in Bridge Creek. The units were sampled by Chris Coyle and Craig Mesman (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled was habitat unit 13, a plunge pool approximately 434 feet from the confluence with North Fork Elk River. This site had an area of 108 sq ft and a volume of 108 cu ft. The unit yielded one 79 mm steelhead, 20 coho between 40 and 63 mm, and one 102 mm coastal cutthroat trout.

The second site was habitat unit 20, a mid-channel pool located approximately 802 feet above the creek mouth and 221 feet upstream from the Wrigley Road culvert. This site had an area of 108 sq ft and a volume of 76 cu ft. The site yielded 19 coho between 41 and 51 mm.

The third site sampled was habitat unit 38, a mid-channel pool located approximately 1,446 feet above the creek mouth. The site had an area of 176 sq ft and a volume of 123 cu ft. The site yielded 15 coho between 37 and 55 mm, two coastal cutthroat trout between 84 and 93 mm, and one Pacific giant salamander.

DISCUSSION

Bridge Creek is a B4 channel type for the entire stream reach surveyed. The B4 channel type is considered excellent for low-stage weirs, random boulder placement, bank-placed boulders, single and opposing wing deflectors, channel constrictors, bank cover, and log cover structures; and good for medium-stage weirs.

The water temperatures recorded on the survey day June 20, 1994, ranged from 54 to 56° Fahrenheit. Air temperatures ranged from 59 to 63° Fahrenheit. This is an excellent 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 14% of the total **length** of this survey, riffles 18%, and pools 67%. The pools are relatively shallow, with ten of the 21 pools having a maximum depth greater than 2 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.

Eleven of the 21 pool tail-outs measured had embeddedness ratings of 4. Only 4 had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In Bridge 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 high with a rating of 109. The shelter rating in the flatwater habitats was much lower at 37. A pool shelter rating of approximately 100 is desirable. The relatively large amount of cover that now exists is being provided primarily by large woody

debris in pool habitat types. Additionally, undercut banks contribute a small amount. Log and root wad cover structures in the 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.

Eight of the twelve low gradient riffles 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 88%. This is a relatively high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams.

The percentage of right and left bank covered with vegetation was high at 82% and 83%, 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) Bridge Creek should be managed as an anadromous, natural production stream.

2) 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.

3) Increase woody cover in the flatwater habitat units. Adding high quality complexity with woody cover is desirable and in some areas the material is at hand.

4) There are several log debris accumulations present on Bridge Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

PROBLEM SITES AND LANDMARKS

The following landmarks and possible problem sites were noted. All the distances are approximate and taken from the beginning of the survey reach.

0' Begin survey at confluence with North Fork Elk River.

520' Corrugated pipe culvert 5' diameter x 61' long under Wrigley Road. No baffles. 2' plunge at downstream end.

677' Unconsolidated logs and debris in channel. Standing railroad trestle.

825' Unconsolidated logs and debris.

896' Unconsolidated logs and debris.

947' Unconsolidated logs and debris.

1050' Log and debris accumulation (LDA) 8' high x 20' wide x 40' long. Vegetated. West Fork Bridge Creek enters right bank. Mouth of West Fork is choked with logs and debris.

1092' Unconsolidated logs and debris.

1165' Vegetated LDA 7' high x 13' wide x 140' long. Possible barrier.

1338' Unconsolidated logs and debris. Logs from recent left bank timber harvest have fallen across channel.

1468' Unconsolidated logs and debris.

1489' Unconsolidated logs and debris. Vegetated.

1519' End of survey. Channel above this point is continuously clogged with silt, logs, and debris. Well-vegetated in places.

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