STREAM INVENTORY REPORT

Bridge Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1992 on Bridge Creek to assess habitat conditions for anadromous salmonids. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Bridge 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 Bridge 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

Bridge Creek is a tributary to the Eel River, which drains to the Pacific Ocean. It is located in Humboldt County, California. Bridge Creek's legal description at the confluence with the Eel River is T1N R2E S34. Its location is 40.4253 degrees north latitude and 123.9361 degrees west longitude. Bridge Creek is a second order stream and has approximately 3.4 miles of blue line stream, according to the USGS Redcrest 7.5 minute quadrangle. Bridge Creek drains a watershed of approximately 2.2 square miles. Elevations range from about 400 feet at the mouth of the creek to 1,500 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 Shively Road near Scotia to Larabee Valley. The Eureka Southern Railroad crosses Bridge Creek approximately 450' above its mouth.

METHODS

The habitat inventory conducted in Bridge Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991). 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 May, 1992, 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.

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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 by David Rosgen (1985). 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 four measured parameters used to determine channel type: 1) water slope gradient, 2) channel confinement, 3) width/depth ratio, 4) substrate composition.

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.

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:

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 in both the right and left banks was selected from a list of eight options on 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 Habitat Runtime, a dBASE 4.1 data entry program developed by the 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

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- 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

HABITAT INVENTORY RESULTS

The habitat inventory of August 28, 1992 was conducted by Chris Coyle and John Crittenden (CCC). The total length of the stream surveyed was 434 feet.

Flow was not measured on Bridge Creek.

Bridge Creek is a C5 channel type for the entire 450 feet of stream reach surveyed. C5 channels are flat (less than 1 % gradient), unconfined streams often found in delta depositional zones.

The water temperature was 58 degrees Fahrenheit. The air temperature was 69 degrees Fahrenheit on the date of the survey.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, flatwater made up 44%, riffles 33%, and pools 22.2% (Graph 1). Flatwater habitat types made up 68% of the total survey length, riffles 24%, and pools 9% (Graph 2).

Four level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent occurrence were low gradient riffles 33%; and step runs, 33% (Graph 3). By percent total length, step runs made up 36%, low gradient riffles 24%, and runs 32%.

Two pools were identified and they were both main-channel pools and therefore were 100% 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. Both pools had a depth between one and two feet (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the two pool tail-outs measured, both had embeddedness values of 4. 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. Riffle habitat types had the highest shelter rating at 72. Flatwater habitats followed with a rating of 33 (Table 1). The pools had a mean shelter rating of 13.

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Bridge Creek. 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 all of the low gradient riffles (Graph 8).

Only nine percent of the survey reach lacked shade canopy. Of the 91% of the stream covered with canopy, 85% was composed of deciduous trees, and 15% 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 74%. The mean percent left bank vegetated was 54%. The dominant elements composing the structure of the stream banks consisted of 33% brush, 22% bare soil, and 11% bedrock. Additionally, 33% of the banks were covered with deciduous trees, and none with coniferous trees, including downed trees, logs, and root wads (Graph 10).

DISCUSSION

C5 channel types are generally not suitable for fish habitat improvement structures due to unstable stream banks.

The water temperature recorded on the survey day August 28, 1992 was 58 degrees Fahrenheit. The air temperature was 69 degrees Fahrenheit. This is a very good water temperature regime for salmonids, and Bridge 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 68% of the total length of this survey, riffles 24%, and pools 9%. The two pools are relatively shallow; neither of them has 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. Therefore, 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 threaten the relatively unstable banks.

Both of the pool tail-outs measured had embeddedness ratings of four. 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 taken.

The mean shelter rating for pools was low with a rating of 13. The shelter rating in the flatwater habitats was slightly better at 33. However, 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 and boulders in all habitat types. 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.

All three of the low gradient riffles had gravel as the dominant substrate. This is generally considered fair for the needs of spawning salmonids.

The mean percent canopy for the stream was 91%. This is a relatively high percentage of canopy, since 80% is generally considered optimum in these north coast streams. However, in areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

The overwhelming problem on Bridge Creek is the complete barrier to migrating salmon and steelhead created by the impassable railroad culvert installation. This culvert needs to be modified or, better, replaced with a bridge. Above this feature there are nearly three miles of what appears to be very good habitat for coho salmon and steelhead. Water temperatures are very favorable as well, based upon rather limited samples. Our survey ended at this culvert, so this report only describes the stream reach that flows through the Larabee Creek delta below the railroad, and is not representative of the stream. The balance of Bridge Creek has been informally surveyed to determine general habitat quality and the presence of anadromous fish. None were found. Historical accounts claim they were once common in the stream.

RECOMMENDATIONS

1) Bridge Creek should be managed as an anadromous, natural production stream.

2) The barrier to migration presented by the Eureka Southern railroad must be modified or replaced with a bridge before Bridge Creek can be utilized by salmon and steelhead. Until this is done, other instream treatments are of little value. However, watershed treatments are still important to water quality within the stream and the Eel River.

3) Temperatures should be measured through the summer to establish the value of the stream to salmonids. If they are favorable, the information should be used to promote the modification of the culvert.

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) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders and small wood. Adding high quality complexity with woody cover is desirable and in some areas the material is at hand.

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

7) Active and potential sediment sources related to the road drainage system in the upper watershed need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

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.

Position (ft):	Comments:
0'	Start of survey at the confluence with the Eel River. Habitat units #001 through #008 are within the influence of the Eel River.
434'	Impassible barrier to migration at railroad stream crossing. Passage prevented at inlet, outlet, and within the culvert. No fish observed above this feature. End of survey.

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