STREAM INVENTORY REPORT

BROWN CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1991 on Brown 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 Brown 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 Brown Creek. The objective of this report is to document the current habitat conditions, and recommend options for the enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Brown Creek is tributary to the Van Duzen River, tributary to the Eel River, located in Humboldt County, California (Figure 1). Brown Creek's legal description at the confluence with the Van Duzen River is T1N R3E S12. Its location is 40°28'22" latitude and 123°47'35" longitude. Brown Creek is a first order stream. The total length of blue line stream, according to the USGS quadrangle is 2.5 miles.

Brown Creek drains a watershed of approximately 3.16 square miles. Douglas fir and hardwoods dominate the lower watershed, with grasslands comprising the higher elevations. The watershed is privately owned and is managed for timber production and rangeland. Vehicle access exists from State Highway 36 at Bridgeville, via Kneeland Road. Brown Creek flows through the Bridgeville Forest Fire Station grounds near Bridgeville

METHODS

The habitat inventory conducted in Brown Creek follows the methodology as presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds). The inventory was conducted by a two person team. The California Conservation

Corps (CCC), Technical Advisors conducting the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Brown Creek personnel were trained in May and June, 1991, by Gary Flosi and Scott Downie.

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 Brown 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 was 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 operations 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 each tenth unit typed. The time of the measurement is also recorded. 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 used 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". Brown 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

measurements were accomplished using hip chains, range finders, tape measures, and stadia rods. Unit measurements included mean length, mean width, mean depth, and maximum depth. Depth of the pool tail crest at each pool habitat unit was measured at 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 Brown 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 Brown 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 Brown Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The percentages of the total canopy area was then further analyzed and recorded according to whether it was composed of either coniferous or deciduous trees.

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 Brown 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.

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 Brown Creek to document the salmonid species composition and distribution. Three sites were electrofished in Brown Creek using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, measured, and returned to the stream.

DATA ANALYSIS:

Data from the habitat inventory form is entered into Habtype, a dBASE 3+ data entry program developed by the Department and Fish and Game. From Habtype, the data is summarized by Habtab a dBASE 4.1 program in development by DFG.

The Habtab program produces the following summary 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 Brown 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

HABITAT INVENTORY RESULTS:

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

The habitat inventory of July 25 and 26, 1991, was conducted by Jay Miller and Erick Elliot (CCC). The total length of the stream surveyed was 3,459 feet.

Brown Creek is an A1 channel type for the first 1,462 feet from the confluence with the Van Duzen River, then it changes to an A3 channel type for the remaining 1,997 feet of the survey. A1 channels are steep (4-10%), very well confined streams, with a deeply incised bedrock substrate. A3 channels are also steep and very well confined, but their substrate consists of small boulders, cobble and gravel.

Water temperatures ranged from 58 to 61 degrees Fahrenheit. Air temperatures ranged from 58 to 73 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, riffles made up 31.2%, flatwater types were 26.0%, and pools 42.9% (Graph 1). Flatwater habitat types made up 31.8% of the total length, riffles were 38.8%, and pools 29.4% (Graph 2).

Nine Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent occurrence were mid-channel pools, 31.2%; low gradient riffles, 24.7%; and step runs 18.2% (Graph 3). By percent total length, low gradient riffles made up 29.8%, step runs made up 27.3%, and mid-channel pools made up 18.2%.

Table 3 summarizes the pool habitat types. Main channel pools were most often encountered at 87.9% and comprised 94.8% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. The maximum depth for 25 of the 33 pools (75.8%) was less than two feet (Graph 5).

The depth of the embeddedness was estimated for the pool tail-outs. Of the 29 pool tail-outs measured, zero had a value of 1; 11 had a value of 2 (37.9%); 12 had a value of 3 (41.4%); and 6

had a value of 4 (20.7%). 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 28.5 (Table 1). For the pool types, the scour pools had a mean shelter rating of 41.3, and the main channel pools had a rating of 26.8 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders provided most of the cover for the pool habitat types (Graph 7).

Table 6 is a summary of the dominant substrate by habitat type. Boulders were the dominant substrate type observed in 42.1% of the 19 low gradient riffles. Small cobble was the next most common dominant substrate type, and occurred in 36.8% of the low gradient riffles (Graph 8).

The mean percent canopy was 56%. The canopy was composed of 93.0% deciduous trees and 7.0% coniferous trees. Graph 9 summarizes the total percent canopy.

Table 2 summarizes mean percent right and left bank vegetated by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 49.9%. The mean percent left bank vegetated was 40.9%. The stream bank composition consisted of 20.1% bedrock, 26.7% boulder, 2.6% cobble/gravel, 7.1% bare soil, 0.6% grass, 8.4% brush, 34.5% deciduous trees, and 0.0% coniferous trees (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three electrofishing sites were sampled on Brown Creek. The units were sampled on August 19 and 20, 1991 by Craig Mesman and Jay Miller (CCC).

The first unit sampled was habitat unit 017, a main channel pool, approximately 609 feet from the beginning of the survey. The unit had an area of 418.0 sq ft and a volume of 668.8 cubic feet. The unit yielded 69 steelhead, ranging from 46 to 167mm fork length.

The second unit was a habitat unit 047, a plunge pool, approximately 2,081 feet from the beginning of the survey and just below a 30 foot waterfall. The unit had an area of 110 sq ft and a volume of 132 cubic feet. Twenty steelhead were sampled, ranging from 55 to 83mm fork length.

The third unit was a series of three main channel and step pools approximately 2,351 feet from the confluence and just above the 30 foot waterfall. The sampled unit had an area of 297.0 sq ft and a volume of 235.8 cubic feet. No fish were found.

DISCUSSION

Both the A1 and A3 channel types are generally not suitable for fish habitat improvement structures. A1 and A3 channels are found in high energy, steep gradient stream reaches. Usually within the A1 and A3 channels, there are zones of lower gradient where structures designed to trap gravels can be constructed. This seems to be the case in Brown Creek, but any structure sites must be selected with care because of the high stream energy which can create problems with stream bank erosion and structure stability.

The water temperatures recorded on the survey days ranged from 58° F to 61° F. Air temperatures ranged from 58° F to 73° F. This is a good water temperature regime for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling conducted.

Flatwater habitat types comprised 31.8% of the total **length** of this survey, riffles 38.8%, and pools 29.4%. The pools are relatively shallow with only 8 of the 33 pools having a maximum depth greater than 2 feet. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. 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.

Seventeen of the 28 pool tail-outs measured had embeddedness ratings of 3 or 4. None had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Brown Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean shelter rating for riffles was low with a rating of 11.6. The shelter rating in the flatwater habitats was slightly better at 17.5. Pools rated highest at 28.5. However, 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. Large and small woody debris are scarce. 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.

Only seven of the 19 low gradient riffles had small cobble as the dominant substrate. None of the low gradient riffles had gravel as the dominant substrate. This is generally considered poor for spawning salmonids.

The mean percent canopy for the stream was 55%. This is a relatively high percentage of canopy, since 80 percent is generally considered desirable. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) The mouth of Brown Creek should have a fishway constructed that will allow passage of anadromous fish at all flows.

3) 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.

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) 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.

6) 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.

7) Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream. Fish passage should be monitored, and improved where possible.

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'	Brown Creek percolates into the Van Duzen River under a gravel bar; barrier to out migrant anadromous fish. Reach #1 channel type is A1.
142'	Concrete bridge 27' wide x 37' long x 20' high crosses the channel.
176'	Steep bedrock cliff on the left bank 35' high x 375' long.
412'	Right bank erosion 8' high x 10' long, contributing gravel and fines into the channel.
428'	Right bank erosion 10' high x 25' long, contributing boulders and fines into the channel. Several young of the year (YOY) salmonids observed.
540'	Right bank erosion 6' high x 25' long, contributing cobble and gravel into the channel.
609'	YOY and 1+ salmonids observed.
934'	Left bank erosion 10' high x 10' long, contributing gravel and fines into the channel.
1264'	Left bank erosion 8' high x 20' long, contributing cobble and gravel into the channel.
1367'	Left bank erosion 20' high x 25' long, contributing cobble and gravel into the channel.
1462'	Channel type changes to an A3 (reach #2).
1499'	Small tributary enters from the right bank. Barbed wire fence surrounds the tributary.
1669'	Log and debris accumulation (LDA) 50' wide x 3' long x 4' high. YOY salmonids observed.
1886'	Left bank "blue goo" slide 10' high x 30' long, contributing fines and gravel into the channel.
1942'	YOY salmonids observed.
2092'	Water falls 60-70' over 230' long section of channel;

probable barrier.

2436' Left bank bedrock cliff 25' high x 75' long.

2593' Left bank slide 40' high x 80' long, contributing coniferous trees, fines, and gravel into the channel.

2915' Left bank bare soil area 40' high.

3112' Right bank erosion 47' high x 45' long, contributing gravel and cobble into the channel.

3139' Series of 17 small step pools and plunge pools. High gradient channel with greater than 25' drop in water elevation.

3459' No fish observed. End of survey.