STREAM INVENTORY REPORT

ATWELL CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1993 on Atwell 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 Atwell 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 Atwell 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

Atwell Creek is tributary to Howe Creek, tributary to the Eel River, located in Humboldt County, California. Atwell Creek's legal description at the confluence with Howe Creek is T2N R2E S03. Its location is 40°29'45" N. latitude and 124°10'05" W. longitude. Atwell Creek is a first order stream and has approximately 3.8 miles of blue line stream, according to the USGS Taylor Peak 7.5 minute quadrangle. Atwell Creek drains a watershed of approximately 4.4 square miles. Summer base runoff is approximately 0.7 cfs at the mouth. Elevations range from about 160 feet at the mouth of the creek to 2,000 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is owned primarily by the Pacific Lumber Company and is managed for timber production. Vehicle access exists from U.S. Highway 101 at Rio Dell, via Blue Slide Road, and then south along Howe Creek Road to the mouth of Atwell Creek.

METHODS

The habitat inventory conducted in Atwell 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). Atwell Creek personnel were trained in May, 1993, by Gary Flosi and Scott Downie. This inventory was conducted by two person teams.

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 Atwell 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 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". Atwell 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 Atwell 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 Atwell 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 Atwell 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 Atwell 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 Atwell Creek to document the fish species composition and distribution. Three sites were electrofished in Atwell 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.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes (25.4, 12.5, 4.7, 2.37, and 0.85mm).

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 Atwell 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 REPORT *

The habitat inventory of July 16, 19, 20, and 22, 1993, was conducted by Craig Mesman, Chris Coyle, and Brian Humphrey (CCC). The total length of the stream surveyed was 8,359 feet, with an additional 571 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.70 cfs on July 15, 1993.

Atwell Creek is an F3 channel type for the first 4,382 feet of stream reach surveyed, then it changes to a B2 channel type for the remaining 3,977 feet of the survey. F3 channels are flat gradient (1% or less), totally confined streams with a high sediment supply. B2 channels are moderate gradient (1.0-2.5%), well confined, with unstable stream banks.

Water temperatures ranged from 55 to 59 degrees fahrenheit. Air temperatures ranged from 55 to 65 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 40.4%, flatwater types 30.8%, and pools 27.5% (Graph 1). Flatwater habitat types made up 42.4% of the total survey **length**, riffles 36.4%, and pools 20.4% (Graph 2).

Thirteen 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, 40.4%; runs, 16.7%; and step runs, 8.8% (Graph 3). By percent total **length**, low gradient riffles made up 36.4%, step runs 18.0%, and runs 15.8%.

Sixty-six pools were identified (Table 3). Scour pools were most often encountered at 74.2%, and comprised 78.4% 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. Thirty-five of the 66 pools (53%) had a depth of less than two feet (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 65 pool tail-outs measured, one had a value of 1 (1.5%); 27 had a value of 2 (41.5%); 28 had a value of 3 (43.1%); and 9 had a value of 4 (13.9%). 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 32.8. Riffle habitats followed with a rating of 16.7 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 60.8, backwater pools had a rating of 33.7, and scour pools rated 25.3 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Atwell Creek and is extensive. Boulders are the next most common cover type. Graph 7 describes the pool cover in Atwell Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 44 of the 97 low gradient riffles (45.4%). Small cobble was also dominant in an additional 44 low gradient riffles (Graph 8).

Five percent of the survey reach lacked shade canopy. Of the 95% of the stream covered with canopy, 89% was composed of deciduous trees, and 11% was composed of coniferous trees. Graph 9 describes the canopy in Atwell 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 80.0%. The mean percent left bank vegetated was 84.1%. The dominant elements composing the structure of the stream banks consisted of 1.5% bedrock, 1.0% boulder, 8.8% cobble/gravel, 6.0% bare soil, 8.7% grass, and 36.7% brush., 22.1% deciduous trees, and 15.2% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on July 23, 1993 in Atwell Creek. The units were sampled by Craig Mesman and Brian Humphrey (CCC). All measurements are fork lengths (FL) unless noted otherwise.

The first site sampled included habitat units 005-007, a run, low gradient riffle, and bedrock formed lateral scour pool, approximately 199 feet from the confluence with Howe Creek. This site had an area of 509 sq ft, and a volume of 362 cu ft. The unit yielded 24 steelhead, ranging from 39 to 162mm FL, two stickleback and one sculpin, which were not measured.

The second site included habitat units 207-211, a run/riffle/pool series, located below the debris slide approximately 7819 feet above the creek mouth. This site had an area of 1821 sq ft, and a volume of 1086 cu ft. The site yielded 45 steelhead, ranging from 30 to 185mm FL, and two Pacific lamprey ammocetes, 139 and 155mm FL.

The third site sampled was a plunge pool/run, located approximately 8509 feet above the creek mouth. This site is 150-200 feet above the slide at the end of the habitat survey. The site had an area of 480 sq ft, and a volume of 864 cu ft. Thirteen steelhead were sampled, ranging from 41 to 181mm FL.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Atwell Creek.

DISCUSSION

The surveyed reach of Atwell Creek has two channel types: F3 and B2. F3 channels are found in low gradient, entrenched stream reaches. They have channels dominated by cobble/gravel, and have stable stream banks. The F3 channel type in general is fairly suited for low profile fish habitat improvement structures, such as bank placed boulders or low-stage weirs. B2 channels are found in moderately entrenched, moderate gradient stream reaches. They have stable stream banks and a predominantly boulder substrate. The B2 channel type is excellent for many types of low and medium stage instream enhancement structures. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and pool cover.

The water temperatures recorded on the survey days July 16-22, 1993 ranged from 55° F to 59° F. Air temperatures ranged from 55° F to 65° F. This is a very good water temperature regime for salmonids. However, 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 42.4% of the total **length** of this survey, riffles 36.4%, and pools 20.4%. The pools are moderately deep with 31 of the 66 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. 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 cause stream bank erosion, or conflict with the modification of the numerous log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravels. Any necessary modifications to them should be done with the intent of metering the gravels 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.

Thirty-seven of the 65 pool tail-outs measured had embeddedness ratings of 3 or 4. Only one 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 Atwell 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 32.8. The shelter rating in the flatwater habitats was lower at 12.8. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by large 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Eighty-eight of the 97 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 94%. This is a very high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams.

RECOMMENDATIONS

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

2) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites, like the site at 8324', should then be treated to reduce the amount of fine sediments entering the stream.

3) There are several log debris accumulations present on Atwell 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.

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 large woody debris and boulders. Increasing high quality complexity with woody cover is desirable and in some areas the material is at hand.

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 Howe Creek. Reach #1 is an F3 channel type.

64' Howe Creek Road bridge 39' long x 13' wide x 10' high crosses the creek.

99' Flow measured at 0.70 cfs on July 15,1993.

691' Humboldt crossing 20' long x 22' wide x 9' high; PALCO road.

1450' Pool formed by K-dam with notched log, cabled together. Dam is in good condition and functioning well.

1806' Log and debris accumulation (LDA) 60' wide x 15' long x 5' high.

1931' Pool formed by plunge over two wing deflectors; structure is in good condition.

2051' Wing deflector structure, in good condition.

2841' Abundance of salmonid young-of-the-year (YOY) to 2+ observed throughout survey, but numbers are beginning to decrease at this point.

3187' LDA 45' wide x 15' long x 8' high, retaining gravel 5' high; possible low flow barrier. Unit is dry.

3295' LDA 50' wide x 50' long x 6' high.

3648' LDA 80' wide x 15' long x 7' high, with partially vegetated, densely packed matrix. LDA is retaining material and may be forming a barrier.

4139' Wing deflector structure in need of maintenance.

4383' Channel type changes to a B2 (reach #2) for the remaining 3,977' of stream surveyed.

4540' Numerous YOY, 1+, and 2+ salmonids observed.

4879' Small woody debris accumulation 25' wide x 25' long x 9' high, causing right bank side channel. No barrier due to the side channel.

5235' Blown out structure on left bank (LB); 3-4 logs cabled together.

5317' LDA 30' wide x 20' long x 7' high, retaining gravel 3' high.

5348' Both banks are eroding, with trees sliding into the channel.

5693' LDA 20' wide x 10' long x 5' high; no apparent barrier.

5826' Old Humboldt crossing 25' wide x 30' long x 5' high, in good condition.

5919' Small tributary enters from the LB; one 1-1/2" fish observed 45' upstream.

6131' LDA 40' wide x 20' long x 5' high, causing scour pool; not a passage problem.

7457' Blown out cabled logs on right bank (RB).

8324' Channel becomes constricted; beginning of massive debris slide.

8359' RB "blue goo" slide 13' high x 60' wide x 50' long, retaining 7-8' of material. Probable barrier. Channel continues to be pinched and obstructed upstream for 200', by debris falling off RB. Three YOY steelhead observed. 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