STREAM INVENTORY REPORT

Atwell Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on Atwell Creek, a stream in the Eel River drainage. 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 presence and distribution of juvenile salmonid species.

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. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Atwell Creek is a tributary to Howe Creek, a tributary to the Eel River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Atwell Creek's legal description at the confluence with Howe Creek is T02N R02E S03. Its location is 40.4958 degrees north latitude and 124.1681 degrees west 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. 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 primarily privately owned by the Pacific Lumber Company and is managed for timber production. Vehicle access is obtained via U.S. 101 at Rio Dell, then Blue Slide Road, then south along Howe Creek Road until it crosses Atwell Creek just above its confluence with Howe Creek.

METHODS

The habitat inventory conducted in Atwell Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al., 1998). The AmeriCorps Watershed Stewards Project (AmeriCorps/WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1995). All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth,

depth of pool tail crest, dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

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.

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 every tenth habitat unit. 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". 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. 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 sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were 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) and 76 - 100% (value 4). Additionally, a value 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 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 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. In addition the dominant substrate composing the pool tail outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Atwell 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. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

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 Atwell Creek, the dominant composition type and the dominant vegetation type 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.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Atwell Creek, fish presence was observed from the stream banks, and two sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

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 Quattro Pro. 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 the pool tail outs
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of August 19 through October 21, 1998 was conducted by John Wooster and Dana McCracken (AmeriCorps/WSP). The total length of the stream surveyed was 12,612 feet with an additional 53 feet of side channel.

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Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.4 cfs on August 19, 1998.

Atwell Creek is an F4 channel type for the entire 12,612 feet of stream reach surveyed. F4 channel types are entrenched, meandering, gravel riffle/pool channels on low gradients with a high width/depth ratio.

Water temperatures taken during the survey period ranged from 49 to 62 degrees Fahrenheit. Air temperatures ranged from 58 to 75 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% riffle units, 32% flatwater units, and 28% pool units (Graph 1). Based on total length of Level II habitat types there were 43% flatwater units, 39% riffle units, and 18% pool units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 40%; mid-channel pools, 26%; and step runs, 21% (Graph 3). Based on percent total length, low gradient riffles made up 39%, step runs 33%, and mid-channel pools 17%.

A total of sixty-one pools were identified (Table 3). Main channel pools were most frequently encountered Level III pool type at 93% (Graph 4) and comprised 96% of the total length of all pools (Table 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Forty-four of the 61 pools (72%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the sixty-one pool tail-outs measured, one had a value of 1 (2%); twenty had a value of 2 (33%); fifteen had a value of 3 (25%); nineteen had a value of 4 (31%) and six had a value of 5 (10%); (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning.

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 a mean shelter rating of 10, flatwater habitat types had a mean shelter rating of 18, and pool habitats had a mean shelter rating of 22 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 30. Main pools had a mean shelter rating of 22 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Atwell Creek. Large woody debris is lacking in nearly all habitat types. Graph 7 describes the pool cover in Atwell Creek.

Table 6 summarizes the dominant substrate in pool habitat types. Gravel was the dominant substrate observed in 37 of the 60 pool tail outs measured (61%). Small cobble was the next

most frequently observed dominant substrate type and occurred in 22% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 83%. The mean percentages of conifer and deciduous trees were 26% and 74%, respectively. Graph 9 describes the canopy in Atwell Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 85%. The mean percent left bank vegetated was 80%. The dominant elements composing the structure of the stream banks consisted of 65% cobble/gravel, 26% sand/silt/clay, 7% bedrock, and 2% boulders (Graph 10). Additionally, 57% of the units surveyed had deciduous trees as the dominant bank vegetation, and 19% had coniferous trees as the dominant bank vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on October 14 and 15, 1999 on Atwell Creek. The sites were sampled by Glenn Yoshioka, Jennifer Jenkins, and Jason Hadley (CDFG, AmeriCorps, and CCC).

The first site, sampled on October 14, 1999, began just upstream of the confluence of Atwell Creek with Howe Creek. One riffle, two runs, and one mid-channel pool were sampled in this F4 reach. This site yielded 48 juvenile steelhead/rainbow trout (SH/RT) and four sculpin (*Cottus sp.*). The breakdown of SH/RT age classes was 43 age 0+, four age 1+, and one age 2+.

The second site, sampled on October 15, 1999, was further upstream on this F4 reach, beginning at a log bridge that crosses the creek and extending up to Habitat Unit #128. The site yielded 113 juvenile SH/RT. The probable breakdown of SH/RT age classes was 87 age 0+, 21 age 1+, and five age 2+.

These data can be summarized as follows:

	SH/RT Age 0+	SH/RT Age 1+	SH/RT Age 2+	SH/RT Age 3+
Site 1	43	4	1	0
Site 2	87	21	5	0

DISCUSSION

Atwell Creek is an F4 channel type for the entire 12,612 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover; and poor for boulder clusters.

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The water temperatures recorded on the survey days August 19 through October 21, 1998 ranged from 49 to 62 degrees Fahrenheit. Air temperatures ranged from 58 to 75 degrees Fahrenheit. This is a good water temperature range for salmonids. Atwell 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 43% of the total length of this survey, riffles 39%, and pools 18%. The pools are relatively deep, with only 44 of the 61 (72%) pools having a maximum depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream 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 any needed modification of log debris accumulations (LDA's) in the stream.

One of the 61 (2%) pool tail-outs measured had an embeddedness rating of 1, 33% had a rating of 2, 56% had ratings of 3 or 4, and 10% had a rating of 5 and were considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In Atwell 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 22. The shelter rating in the flatwater habitats was slightly lower at 18. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders and small woody debris in most habitat types. Additionally, root masses contribute some cover. Log and root wad cover structures in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Instream cover created by small and large woody debris provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Fifty of the 60 (83%) pool tail outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 83%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 85% and 80%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting native species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

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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 should then be treated to reduce the amount of fine sediments entering the stream.

3) 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.

4) Primary pools only comprised 13% of the total stream length. 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. Large woody debris is scarce. Most of the existing cover is from small woody debris and boulders. Adding high quality complexity with woody cover is desirable.

6) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

7) Increase the canopy on Atwell Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

8) There are log debris accumulations present on Atwell Creek that are retaining sediment. The modification of these debris accumulations may be desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

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COMMENTS 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 Howe Creek. Channel type is an F4 (Reach 1).
17'	Bridge crosses stream 20' into unit.
1328'	Partially intact V-Weir structure at top of unit.
1849'	Downstream V-Weir log structure creating pool.
3398'	LDA measures 40' x 30' x 18'.
3950'	Blown out instream structure still partially in unit.
4090'	CCC Flag: 7-19-93 Hab unit #107.
5044'	Right bank slide measures 150' x 50' x 100' and is contributing fine sediment to the channel.
5225'	Left bank failure measures 300' x 50' 100' and is partially blocking stream channel with debris and fines for next seven units.
5829'	52' into unit stream is crossed by a log bridge.
7015'	Old railroad tracks cross stream.
7157'	Left bank armor double logs cabled together.
8402'	Left bank slide measures 130' x 60' x 120' and is contributing fine sediment to stream.
8551'	LDA measures 30' x 40' x 10' and is retaining sediment. Flow is almost subsurface.
8607'	Right bank slide measures 100' x 30' x 40'.
11300'	Dry left bank tributary.
12563'	End of survey. Unit ends in a 20' high LDA completely blocking channel. Logs that do not have open passage for fish. There is no jump pool below the LDA. Maximum depth of run directly below LDA is 0.2'. Due to size of logs and extent of LDA, no high flow channel can be found. Walked 800' above, no fish observed in the three

pools checked. Fish have been abundant up to this point.

REFERENCES

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California salmonid stream habitat restoration manual, 3rd edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, California.

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