STREAM INVENTORY REPORT

Haehl Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Haehl 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 Haehl 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.

Adult carcass surveys were conducted in Haehl Creek in January and February, 1988. On January 26, 1988, 19 chinook carcasses and one coho carcass were found in the lower two miles of the stream. Four redds were observed. On February 1, 1988, 17 chinook carcasses and five coho carcasses were found in the same lower two miles of Haehl Creek. Three redds were observed. No other survey found adults or redds, although steelhead fry were sampled during the 1995 summer electrofishing (DFG file data). 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

Haehl Creek is tributary to Outlet Creek, tributary to the Eel River, located in Humboldt County, California. Haehl Creek's legal description at the confluence with the Eel River is T18N R13W S18. Its location is 39°24'41" N. latitude and 123°20'22" W. longitude. Haehl Creek is a first order stream and has approximately 15.1 miles of intermittent stream according to the USGS Willits and Laughlin 7.5 minute quadrangles. Haehl Creek drains a watershed of approximately 6.2 square miles. Summer base runoff is approximately 0.2 cubic feet per second (cfs) at the mouth, but over 7 cfs is not unusual during winter storms. Elevations range from about 1,355 feet at the mouth of the creek to 1,800 feet in the headwater areas. Mixed hardwood and grassland dominate the watershed. The watershed is entirely privately owned and is managed primarily for urban residence and commercial development. Vehicle access exists in Willits via Center Valley Road to Baechtel Creek. Walk downstream approximately 1/4 mile to the confluence with Haehl Creek.

METHODS

The habitat inventory conducted in Haehl 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 and Watershed Stewards Project/AmeriCorps members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Haehl Creek personnel were trained in May, 1995, by Scott Downie and Ruth Goodfield. 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 Haehl 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 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". Haehl 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 measured for mean width, mean depth, and maximum depth (*Sampling Levels for Fish Habitat Inventory*, Hopelain, 1995). 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 Haehl 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). Additionally, a rating of "not suitable" (NS) was assigned to tail-outs deemed unsuited 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 Haehl 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.

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 Haehl 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. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results were 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 Haehl Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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.

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, or 3) electrofishing. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

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 (*Stream Substrate Quality for Salmonids: Guidelines for Sampling, Processing, and Analysis*, Valentine, 1995).

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat7.2, 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 QuattroPro 4. Graphics developed for Haehl 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 27 to July 7, 1995, was conducted by Brie Darr and Jennifer Terwilliger (CCC/AmeriCorps). The total length of the stream surveyed was 14,179 feet with an additional 18 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.2 cfs on July 20, 1995.

Haehl Creek is a G4 channel type for the entire 14,179 feet of stream reach surveyed. G4 channels are moderate gradient (2-4%), well entrenched streams, with a low width/depth ratio and predominantly gravel substrate.

Water temperatures ranged from 60 to 76° Fahrenheit. Air temperatures ranged from 64 to 81° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 39%, flatwater types 32%, and riffles 30% (Graph 1). Pool habitat types made up 55% of the total survey **length**, flatwater 30%, and riffles 15% (Graph 2).

Seven Level IV habitat types were identified. These data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were mid-channel pools, 38%; runs, 31%; and low gradient riffles, 29% (Graph 3). By percent total **length**, mid-channel pools made up 54%, runs 29%, and low gradient riffles 15%.

One hundred and twenty-one pools were identified (Table 3). Main channel pools were most often encountered at 99% and comprised 99% 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. Eighty-nine of the 121 pools (74%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 121 pool tail-outs measured, 10 had a value of 1 (0.8%); 33 had a value of 2 (28%); 6 had a value of 3 (0.5%); and 72 had a value of 4 (59%). On this scale, a value of 1 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. Flatwater habitat types had the highest shelter rating at 25. Riffle habitats followed with a rating of 18 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 16, and scour pools rated 10 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Aquatic vegetation is the dominant cover type in Haehl Creek and is extensive. Large woody debris is lacking in nearly all habitat types. Graph 7 describes the pool cover in Haehl Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in all of the nine low gradient riffles measured (Graph 8).

The mean percent canopy for the stream reach surveyed was 80%. The mean percentages of deciduous and coniferous trees were 79%

and 1%, respectively. Graph 9 describes the canopy in Haehl Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 74%. The mean percent left bank vegetated was 83%. The dominant elements composing the structure of the stream banks consisted of 2.4% bedrock, 2.4% boulder, 23.8% cobble/gravel, and 71.4% sand/silt/clay (Graph 10). Deciduous trees was the dominant vegetation type observed in 48% of the units surveyed. Additionally, 27% of the units surveyed had brush as the dominant vegetation type, and 25% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on July 20, 1995, in Haehl Creek. The units were sampled by Brie Darr and Ruth Goodfield (CCC and DFG).

The first site sampled was habitat unit 004, a run, approximately 118 feet from the confluence with Outlet Creek. This site had an area of 60 sq ft and a volume of 24 cu ft. The unit yielded one juvenile Sacramento squawfish; one California roach, 51mm FL; and four juvenile stickleback.

The second site was habitat unit 144, a run located approximately 7,922 feet above the creek mouth. This site had an area of 525 sq ft and a volume of 210 cu ft. The site yielded two steelhead, 61mm and 112mm fl; seven juvenile stickleback; three squawfish ranging from 52 - 73mm FL; and two juvenile roach.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Haehl Creek.

DISCUSSION

Haehl Creek is a G4 channel type for the entire 14,179 feet of stream surveyed. The suitability of G4 channel types for fish habitat improvement structures is good for bank-placed boulders; and fair for low-stage weirs,opposing wing-deflectors, and log cover structures.

The water temperatures recorded on the survey days June 27 to July 6, 1995, ranged from 60 to 76° Fahrenheit. Air temperatures ranged from 64 to 81° Fahrenheit. This is a marginal water

temperature range for salmonids. These warmer temperatures, if sustained, are at the threshold stress level 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 30% of the total **length** of this survey, riffles 15%, and pools 55%. The pools are relatively deep, with 89 of the 121 pools having a maximum depth greater than 2 feet. In coastal coho and steelhead streams where primary pools comprise less than approximately 40% of total habitat, projects to improve pool habitat are usually recommended. 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.

Seventy-eight of the 121 pool tail-outs measured had embeddedness ratings of 3 or 4. Only 10 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 Haehl 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 16. The shelter rating in the flatwater habitats was slightly better at 25. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by aquatic vegetation in all habitat types. Additionally, root mass contributes a small amount. 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.

All of the nine low gradient riffles measured 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 80%. 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 moderate at 74% 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) Haehl Creek should be managed as an anadromous, natural production stream.

2) Temperatures in this section of Haehl Creek, as well as upstream, should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

3) 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.

4) Increase the canopy on Haehl 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.

5) Spawning gravel sites on Haehl Creek are limited to relatively few reaches. Projects should be designed at suitable locations to trap and sort spawning gravel in order to expand redd site distribution in the stream.

6) There are at least two sections where the stream is being impacted from cattle trampling the riparian zone and defecating in the water. Alternatives should be explored with the grazier and developed if possible.

PROBLEM SITES AND LANDMARKS

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

0'	Begin survey at confluence with Outlet Creek. Haehl Creek is a G5 channel type for entire length of survey.
118'	Bioinventory site #1.
656'	Access to stream via bridge crossing on Center Valley Road.

1889'	Slide on right bank (RB), approximately 8' high X 20' wide. Contributing fines directly to stream.
2152'	Evidence of cattle - tracks and defecation. Also, an observed significant increase in algal growth.
3434'	Lateral erosion evident on both banks.
4280'	Bridge crosses creek. Access available via Shell Lane, through the Colli Ranch. Ask permission before entering.
4945'	Footbridge crosses creek - looks in very bad shape.
5167'	Small tributary enters from left bank (LB).
5665'	25 - 30 Sacramento squawfish/California roach observed, each approximately 4 inches in length.
5934'	Railroad trestle crosses stream.
7887'	East Hill Road bridge crosses stream - good access.
7922'	Bioinventory site #2.
10522'	Good access at Church of the Latter Day Saints.
12382'	Small tributary enters from LB.
12670'	Small tributary enters from LB.
13753'	No fish observed since 10522'(LDS Church).
13839'	Small tributary enters from LB.
14179'	Small tributary enters from LB. 100% of flow is from the tributary. Haehl Creek is dry. 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