STREAM INVENTORY REPORT

HARPER CREEK, 1991

INTRODUCTION

A stream inventory was conducted during the summer of 1991 on Harper 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 Harper 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 Harper 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

Harper Creek is a tributary to Bull Creek, a tributary to the Eel River, located in Humboldt County, California (Figure 1). Harper Creek's legal description at the confluence with Bull Creek is T01N R02E S29. Its location is 40°21'02" latitude and 123°59'09" longitude. Harper Creek is a first order stream and has approximately 2.8 miles of blue line stream, according to the USGS Bull Creek, Weott and Redcrest 7.5 minute quadrangles. Harper Creek drains a watershed of approximately 1.48 square miles. Elevations range from about 230 feet at the mouth of the creek to 1,800 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is owned by the State of California and is managed by Humboldt Redwoods State Parks. Vehicle access exists from U.S. Highway 101 at Dyerville, via the Bull Creek Road.

METHODS

The habitat inventory conducted in Harper 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). Harper Creek personnel were trained in May and June, 1991, 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 Harper 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 taken and recorded 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". Harper 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. 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 Harper 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 Harper 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 Harper 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 Harper 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 Harper Creek to document the fish species composition and distribution. Four sites were electrofished in Harper 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.

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 and Fish and Game. This program also processes and summarizes the data.

The Habitat Runtime program produces the following 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 Harper 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 22, 23, and 24, 1991, was conducted by Erick Elliott and Jay Miller (CCC). The total length of the stream surveyed was 4,815 feet.

Flow was not measured in Harper Creek.

Harper Creek is a B3 channel type for the first 1,318 feet of stream reach surveyed and an A3 channel for the remaining 3,497 feet of the survey. B3 channels are a moderate (1.5-4%) gradient, well confined streams with unstable stream banks. A3 channels are steep (4-10%) gradient, very well confined streams, with unstable stream banks.

Water temperatures ranged from 56 to 61 degrees fahrenheit. Air temperatures ranged from 60 to 78 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 41.2%; pools were 31.1%; and flatwater types 27.7% (Graph 1). Flatwater habitat types made up 43.0% of the total survey **length**, riffles were 42.7%, and pools 14.3% (Graph 2).

Ten 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, 33.6%, step runs, 20.2%, and mid-channel pools, 16.0% (Graph 3). By percent total **length**, step runs made up 38.4%, low gradient riffles 33.0%, and mid-channel pools 6.0% (Table 2).

Thirty-seven pools were identified (Table 3). Main-channel pools were most often encountered at 70.3%, and comprised 79.9% 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. Seven of the 37 pools (19%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 25 pool tail-outs measured, 5 had a value of 1 (20.0%); 15 had a value of 2 (60.0%); 5 had a value of 3

(20.0%); and zero had a value 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. Pool habitat types had the highest shelter rating at 64.2. Flatwater habitats followed with a rating of 39.9 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 80.5, and main-channel pools rated 58.1 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Boulders were the dominant substrate observed in 17 of the 40 low gradient riffles (42.5%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 32.5% of the low gradient riffles (Graph 8).

Nearly 28% of the survey reach lacked shade canopy. Of the 72% of the stream covered with canopy, 46% was composed of deciduous trees, and 54% was composed of coniferous trees. Graph 9 describes the canopy in Harper 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 49.7%. The mean percent left bank vegetated was 58.2%. The dominant elements composing the structure of the stream banks consisted of 0.4% bedrock, 5.1% boulder, 0.9% cobble/gravel, 23.8% bare soil, 16.2% grass, 14.5% brush. Additionally, 14.5% of the banks were covered with deciduous trees, and 24.7% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Four electrofishing sites were sampled on Harper Creek. The units were sampled on October 21, 1991 by Erick Elliott and Brian Humphrey (CCC). All measurements are fork lengths unless noted otherwise.
The first unit sampled was habitat unit 012, a mid-channel pool, approximately 372 feet from the confluence with Bull Creek. This site had an area of 174 sq ft, and a volume of 157 cu ft. The unit yielded 31 steelhead, ranging from 46 to 85mm.

The second sample unit was habitat unit 024, a corner pool, approximately 881 feet above the creek mouth. This site had an area of 85 sq ft, and a volume of 85 cu ft. Thirteen steelhead were sampled. They ranged from 43 to 135mm.

The third unit sampled was habitat unit 080, a mid-channel pool, located approximately 3,130 feet above the creek mouth. The site had an area of 104 sq ft, and a volume of 114 cu ft. One steelhead was sampled which measured 154mm.

The fourth unit sampled was habitat unit 117, a mid-channel pool, located approximately 3,871 feet above the creek mouth and 48 feet above a suspected fish barrier. The site had an area of 168 sq ft, and a volume of 235 cu ft. No fish were sampled.

DISCUSSION

Harper Creek has two channel types: A3 and B3. The A3 channel type is generally not suitable for fish habitat improvement structures. A3 channels are found in high energy, steep gradient stream reaches. They have channels dominated by coarse-grained materials and have unstable stream banks. B3 channels have moderate gradients, but they also have unstable stream banks which make them unsuitable for instream enhancement structures.

The water temperatures recorded on the survey days ranged from 56° F to 61° F. Air temperatures ranged from 60° F to 78° 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 43.0% of the total **length** of this survey, riffles 42.7%, and pools 14.3%. The pools are relatively shallow with only 7 of the 37 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, or where their installation will not conflict with the unstable stream banks.
Five of the 25 pool tail-outs measured had embeddedness ratings of 3 or 4. Five had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Harper 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 moderate with a rating of 64.2. The shelter rating in the flatwater habitats was lower at 39.9. However, a pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by boulders in all habitat types. Additionally, large woody debris contributes a small amount. Log and root wad cover structures in the 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.

Nineteen of the 40 low gradient riffles had gravel or small cobble as the dominant substrate. This is generally considered fair for spawning salmonids.

The mean percent canopy for the stream was 68%. 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) Harper Creek should be managed as an anadromous, natural production stream.

2) 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.

3) Increase woody cover in the 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) There are several log debris accumulations present on Harper Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done in a manner that will not release an overabundance of fine sediment into the system.

5) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites, like the site at 740', should then be treated to reduce the amount of fine sediments entering the stream.

6) Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. 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'	Begin survey at confluence with Bull Creek. Steep gradient (24%) for length of first unit. Channel type is a B3 (reach #1).
105'	Redwood walking bridge at upper end of unit.
393'	Concrete bridge.
563'	Two fallen redwoods across stream. Young-of-the-year steelhead (YOY) observed.
740'	Left bank erosion contributing silt and gravel.
826'	Three fallen conifers across stream. YOY observed.
1233'	Log debris accumulation (LDA), 15' long x 8' wide x 5' high, retaining gravel, 5' long x 5' wide x 1.5' high.
1318'	Channel type changes from a B3 to an A3 (reach #2).
1536'	Right bank highly unstable.
1576'	Left bank erosion, 15' long x 8' high.
1679'	LDA and 3 fallen redwoods across stream. Dry tributary from left bank.
1739'	LDA retaining sand, 8' long X 3' wide. Both banks held together by roots.
1892'	LDA creating a 4' high waterfall. Fallen conifers in unit and root wads on banks.
2457'	LDA, 20' long x 10' wide x 7' high.
2843'	Left bank erosion, 15' high x 15' long, contributing silt.

2895'	Three fallen redwoods across stream.
3688'	Three successive LDA's create 2 pools.
3811'	LDA covers unit in a steep gradient area; possible fish barrier.
3871'	LDA, 25' long x 40' wide x 12' high, forming the first in a series of barriers.
4242'	Stream forks.
4425'	LDA with water flowing over it.
4747'	Right bank erosion, 20' long x 30' high, contributing silt and gravel.
4815'	End of survey.