STREAM INVENTORY REPORT

COOPER MILL CREEK

INTRODUCTION

A stream inventory was conducted during the fall of 1990 on Cooper Mill 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 Cooper Mill 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 on Cooper Mill Creek by the California Department of Fish and Game (DFG) from 1988 through 1990. The table below describes the results of those surveys:

Cooper Mill Creek Carcass Surveys 1988 - 90

		Chinook Salmon				Other	
Year	# of Surveys	Live Fish	# of Carcass	Adipose ClipCWT	Redds seen	Coho seen	SH/RT seen
1987-88	1	0	41	0	20	0	0
1988-89	3	14	21	0	14	0	0
1989-90	1	0	0	0	1	0	0
1990-91	0	0	0	0	0	0	0
1991-92	0	0	0	0	0	0	0
1992-93	4	37	6	0	34	0	8

No carcasses with adipose fin clips or coded wire tags have been found on Cooper Mill Creek. The drought related low flows during prime migration periods from 1989 through spring 1992 made Cooper Mill Creek, typical of many Van Duzen tributaries, inaccessible to most chinook salmon. However, in 1992-93 plentiful access flows occurred. Additionally, a fishway was constructed at the mouth of the creek during the summer of 1990 to promote passage of fish at a wider range of flows. In January, 1991 three chinook were found in Cooper Mill Creek by

an employee of Pacific Lumber Company. A great deal of bank stabilization and barrier modification work has been carried out in Cooper Mill Creek during the past five years. The objective of this report is to document the current habitat conditions in Cooper Mill Creek, and recommend options for the enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Cooper Mill Creek is tributary to Yager Creek, tributary to the Van Duzen River, tributary to the Eel River, located in Humboldt County, California. Cooper Mill Creek's legal description at the confluence with Yager Creek is T2S R1E S15. Its location is 40°33'34" N. latitude and 124°03'23" W. longitude. Cooper Mill Creek is a first order stream and has approximately 3.0 miles of blue line stream, according to the USGS Hydesville 7.5 minute quadrangle. Cooper Mill Creek drains a watershed of approximately 6.0 square miles. Summer base runoff is approximately .25 cfs at the mouth, but over 300 cfs is not unusual during winter storms. Elevations range from about 240 feet at the mouth of the creek to 1,800 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is privately owned and is managed for timber production. Year round vehicle access exists from State Highway 36 near Carlotta, via Fisher Road, to Pacific Lumber's Yager Camp. Cooper Mill Creek flows through the camp.

METHODS

The habitat inventory conducted in Cooper Mill 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). Cooper Mill Creek personnel were trained by Gary Flosi.

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 Cooper Mill 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". Cooper Mill 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 Cooper Mill 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 Cooper Mill 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 Cooper Mill 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 Cooper Mill 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 Cooper Mill Creek to document the fish species composition and distribution. Two sites were electrofished in Cooper Mill 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 Cooper Mill 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 November 1, 2, and 19, 1990, was conducted by Gregg Moody and Steve Holzerland (CCC). The total length of the stream surveyed was 7,507 feet, with an additional 378 feet of side channel.

Flow was estimated to be 0.25 cfs during the survey period.

Cooper Mill Creek is a B5 channel type for first 2,715 feet of the survey, then it changes to a C3 channel for the next 1,324 feet, then it changes to a B3 channel for the remaining 3,468 feet of the survey reach. B5 channels are moderate gradient (1.5-4.0%), well confined streams, with silt/clay channels. C3 streams are low gradient (0.5-1.0%), slightly confined, with gravel bed channels. B3 streams are moderate gradient, well confined, cobble/gravel channels.

Water temperatures ranged from 44 to 49 degrees fahrenheit. Air temperatures ranged from 40 to 63 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 38.0%, flatwater types 31.9%, and riffles 29.0% (Graph 1). Flatwater habitat types made up 38.7% of the total survey **length**, pools 34.9%, and riffles 25.7% (Graph 2).

Sixteen 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, 27.2%; step runs, 11.8%; runs, 11.1%; and mid-channel pools, 10.4% (Graph 3). By percent total **length**, low gradient riffles made up 24.1%, step runs 20.7%, mid-channel pools 11.0%, and runs 10.1%.

One hundred-six pools were identified (Table 3). Scour pools were most often encountered at 63.2%, and comprised 59.0% 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. Seventy-five of the 106 pools (71%) had a depth of less than two feet (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 104 pool tail-outs measured, 33 had a value of 1 (31.7%); 34 had a value of 2 (32.7%); 13 had a value of 3 (12.5%); and 24 had a value of 4 (23.1%). 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. Riffle habitat types had the highest shelter rating at 73.6. Pool habitats followed with a rating of 65.4 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 91.7, scour pools had a rating of 81.0, and main channel pools rated 34.0 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 42 of the 76 low gradient riffles (55.3%). Gravel was the next most frequently observed dominant substrate type, and occurred in 31.6% of the low gradient riffles (Graph 8).

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 67.7%. The mean percent left bank vegetated was 69.4%. The dominant elements composing the structure of the stream banks consisted of 3.4% bedrock, 12.9% bare soil, 20.0% grass, 36.9% brush. Additionally, 5.4% of the banks were covered with deciduous trees, and 21.4% with coniferous trees, including downed trees, logs, and root wads (Graph 10). The mean percent canopy was 42%.

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on Nov. 20, 1990 in Cooper Mill Creek. The units were sampled by Greg Moody and Steve Holzerland (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled was a glide, approximately 995 feet from the confluence with Yager Creek. The unit yielded 12 steelhead, ranging from 50 to 85mm FL.

The second site was a step pool, approximately 2379 feet above the confluence with Yager Creek. Twenty-five steelhead were sampled. They ranged from 50 to 107mm FL.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Cooper Mill Creek.

DISCUSSION

Cooper Mill Creek has three channel types: B3, B5, and C3. Both the B3 and B5 channel types have moderate gradients; however, their unstable stream banks make them generally unsuitable for instream enhancement structures.

The middle 1,324 feet of the survey reach is a C3 channel. C3 channels are meandering steam types on noncohesive gravel beds which have poorly consolidated and unstable stream banks. They are generally not suitable for instream enhancement structures. However, bank placed boulders, bank cover, overhead log cover and shelter structures in straight reaches are often appropriate. Any work considered will require careful design, placement, and construction that must include protection for the unstable banks.

The water temperatures recorded on the survey days November 1, 2, and 19, 1990 ranged from 44° F to 49° F. Air temperatures ranged from 40° F to 63° F. This is a very good water temperature regime for salmonids. However, 63° F, if sustained, is near 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 conducted.

Flatwater habitat types comprised 38.7% of the total **length** of this survey, pools 34.9%, and riffles 25.7%. The pools are relatively shallow with only 31 of the 106 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.

Thirty-seven of the 104 pool tail-outs measured had embeddedness ratings of 3 or 4. Thirty-three had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Cooper Mill 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 65.4. The shelter rating in the flatwater habitats was lower at 51.3. However, a pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided

primarily by large woody debris and root wads in all habitat types. Additional 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.

Sixty-six of the 76 low gradient riffles had small cobble or gravel as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy for the stream was 42%. This is a relatively low percentage of canopy, since 80 percent is generally considered optimum in these north coast streams. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Cooper Mill 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) 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.

4) 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.

5) There are several log debris accumulations present on Cooper Mill 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.

6) Increase the canopy on Cooper Mill 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.

7) Increase woody cover in the pools and flatwater habitat units. Although large woody debris and root wads provide most of the existing cover, increasing the complexity and amount of 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'	Survey begins at confluence with Yager Creek. Cooper Mill Creek is a B5 channel.
1080'	Fish trap and site of PALCO hatchery.
2379'	Water diversion for Yager Camp hatchery. Possible barrier to chinook salmon.
2715'	Channel changes to a C3.
2996'	Tributary entering from the right bank.
3541'	Erosion on right bank 40' long and 20' high.
4039'	Channel changes to a B3.
4695'	Tributary entering from the right bank.
4713'	Log debris accumulation 7' high x 20' wide x 15' long, retaining gravel 7' high x 20' wide x 40' long.
4737'	Erosion on the left bank 12' long x 8' high.
5007'	Log debris accumulation 4.5' high x 20' wide x 10' long.
5050'	Erosion right bank 20' long x 15' high.
5660'	Erosion right bank 10' long x 25' high.

5727'	Log debris accumulation 12' high x 16' wide x 70' long, retaining gravel 10' high x 14' wide x 70' long.
6127'	Erosion on the right bank 5' high x 17' long.
6161'	Slump along the right bank 20' long x 15' high. Log in stream creating a 2.2' jump.
6406'	Log debris accumulation 10' high x 40' wide x 20' long, retaining gravel 10' high x 40' wide x 60' long and creating a side channel.
6439'	Erosion on the left bank 12' high x 20' long.
6653'	Erosion on the left bank 8' high x 65' long.
6736'	Log debris accumulation 4' high x 16' wide x 15' long.
6951'	Log debris accumulation 4' high x 27' wide x 5' long.
7223'	Log debris accumulation 10' high x 26' wide x 18' long.
7377'	Log debris accumulation 8' high x 20' wide x 12' long.
7507'	End of survey due to numerous log debris accumulations.

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