STREAM INVENTORY REPORT

Cooper Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2001 on Cooper Creek. The survey began at the confluence with Larabee Creek and extended upstream 1.16 miles.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for chinook 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

Cooper Creek is a tributary to Larabee Creek, a tributary to the Eel River, located in Humboldt County, California (Map 1). Cooper Creek's legal description at the confluence with Larabee Creek is T02S R04E S06. Its location is 40°18′12.3″ north latitude and 123°39′25.7″ west longitude. Cooper Creek is a first order stream and has approximately 2.56 miles of blue line stream according to the USGS Blocksburg 7.5 minute quadrangle. Cooper Creek drains a watershed of approximately 3.51 square miles. Elevations range from about 1,397 feet at the mouth of the creek to 4,011 feet in the headwater areas. Mixed hardwood and conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber rangeland. Vehicle access exists via Highway 36 to Alderpoint Road for approximately 17 miles until cross Cooper Creek bridge.

METHODS

The habitat inventory conducted in Cooper Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Game (DFG) Scientific Aid and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) 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. 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 (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are 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 Cooper 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 a Marsh-McBirney Model 2000 flow meter.

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. Channel characteristics are measured using a hand level, hip chain, tape measure, and a stadia rod.

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". Cooper 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. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Cooper 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 unsuited for spawning due to inappropriate substrate particle size, bedrock, 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 Cooper 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 Cooper 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 Cooper 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 (including downed trees, logs, and rootwads) was estimated and recorded.

BIOLOGICAL INVENTORY

There was no biological sampling for Cooper Creek.

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 Cooper 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
- Mean 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 November 5, 6, and 7, 2001, was conducted by Karen Bromley (DFG), Lori Schmitz and Morguine Flynn-Sousa (WSP/AmeriCorps). The total length of the stream surveyed was 6,222 feet.

Stream flow was not measured on Cooper Creek.

Cooper Creek is a B4 channel type for 5,922 feet of the stream surveyed and a F3 channel type for 300 feet of the stream surveyed. F3 channels are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and are cobble dominant. B4 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks, and gravel dominant channels.

Water temperatures taken during the survey period ranged from 46 to 49 degrees Fahrenheit. Air temperatures ranged from 46 to 55 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 35% flatwater units, 34% pool units, and 26% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 39% flatwater units, 23% dry units, 20% pool units, and 19% riffle units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were run, 32%; mid-channel pool, 30%; and low gradient riffle, 26% (Graph 3). Based on percent total **length**, runs made up 35%, mid-channel pools 17%, and low gradient riffles 19%.

A total of 37 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 92%, and comprised 93% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for

salmonids increases with depth. Thirteen of the 37 pools (35%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 37 pool tail-outs measured, 5 had a value of 1 (13.5%); 13 had a value of 2 (35.1%); 7 had a value of 3 (18.9%); 0 had a value of 4; and 12 had a value of 5 (32.4%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. The dominant substrate composition for the 12 pool tail-outs that had a embeddedness value of 5 was boulder.
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 24, flatwater habitat types had a mean shelter rating of 16, and pool habitats had a mean shelter rating of 36 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 39. Scour pools had a mean shelter rating of 10 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Cooper Creek. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Cooper Creek. Boulders are the dominant pool cover type followed by undercut banks.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 46% of pool tail-outs while boulder was the next most frequently observed substrate type, at 32%.

The mean percent canopy density for the surveyed length of Cooper Creek was 85%. The mean percentages of deciduous and coniferous trees were 84% and 16%, respectively. Graph 9 describes the mean percent canopy in Cooper Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 83.2%. The mean percent left bank vegetated was 82.6%. The dominant elements composing the structure of the stream banks consisted of 6% bedrock, 2% boulder, 78% cobble/gravel, and 14% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 90% of the units surveyed. Additionally, 6% of the units surveyed had coniferous trees, and 4% had grass as the dominant vegetation (Graph 11).

DISCUSSION

Cooper Creek is a B4 channel type for the first 6,222 feet of stream surveyed and a F3 channel type for the remaining 300 feet. The suitability of B4 channel types for fish

habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. The suitability of F3 channel types for fish habitat improvement structures is as follows: good for banked placed boulders, single and opposing wing-deflectors, fair for plunge weirs, boulder clusters, channel constrictors, and log cover.

The water temperatures recorded on the survey days November 5, 6, and 7, 2001, ranged from 46 to 49 degrees Fahrenheit. Air temperatures ranged from 46 to 55 degrees Fahrenheit. This is a good water temperature range 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 39% of the total **length** of this survey, pools 20%, and riffles 19%. The pools are relatively shallow, with only 13 of the 37 (35.1%) 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.

Eighteen of the 37 pool tail-outs measured had embeddedness ratings of 1 or 2. Seven of the pool tail-outs had embeddedness ratings of 3 or 4. Twelve pool tail-outs had a rating of 5, which is considered unsuitable for spawning. All of the 12 were unsuitable for spawning due to the dominant substrate being boulder. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Cooper Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Twenty-five of the 37 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 36. The shelter rating in the flatwater habitats was 16. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, undercut banks contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats would enhance 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.

The mean percent canopy density for the stream was 85%. Reach 1 had a canopy density of 85% while Reach 2 had canopy densities of 82%. In general, revegetation projects are considered when canopy density is less than 80% or when the canopy is

dominated by deciduous trees.

The percentage of right and left bank covered with vegetation was high at 83.2% and 82.6%, 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) Cooper Creek should be managed as an anadromous, natural production stream.

2) 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.

3) Where feasible, design and engineer pool enhancement structures to deepen existing pools or increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulder. Adding high quality complexity with woody cover is desirable.

5) 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.

6) 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.

7) Increase the canopy on Cooper Creek by planting Douglas fir or other native conifers within the riparian zone. 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.

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.

0'	Begin survey at confluence with Larabee Creek. Channel type is B4.
219'	Cattle exclusion crosses creek.
260'	Start of left bank stabilization work completed in the fall of 2001.
422'	End of left bank stabilization work.
620'	Start of right bank willow mattress and boulder deflectors.
694'	End of right bank stabilization work.
824'	Alderpoint Road bridge, 22' wide x 11.5' high x 32' long.
904'	Right bank erosion, approximately 70' high x 130' long, contributing sediment to the creek.
2,757'	Right bank slumping, approximately 100' long x 50' high.
3,508'	Right bank erosion, approximately 75' long x 30' high, contributing sediment.
4,291'	Road on left bank approximately 12' above creek. Runs parallel with creek for 949'.
5,152'	Left bank road turns from the creek.
5,600'	Right bank dry tributary enters. Channel type change from a B4 to a F3.
6,134'	Left bank dry tributary enters. Two jumps out of pool; one pool jump is 4.0' high. This pool is at the top of a high gradient area. Large (car size) boulders dominate, numerous jumps 4-6', low flow. Above this pool, gradient decreases and it appears to provide good habitat. End of survey due to possible end of anadromy.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE						
Low Gradient Riffle		(LGR)	[1.1]		{ 1}	
High Gradient Riffle	(HGR)	[1.2]		{ 2}		
CASCADE						
Cascade		(CAS)		[2.1]		{ 3}
Bedrock Sheet		(BRS)		[2.2]		{24}
FLATWATER						
Pocket Water		(POW)		[3.1]		{21}
Glide		(GLD)	[3.2]		{14}	
Run		(RUN)	[3.3]		{15}	
Step Run		(SRN)		[3.4]		{16}
Edgewater		(EDW)		[3.5]		{18}
MAIN CHANNEL POOLS						
Trench Pool		(TRP)		[4.1]		{ 8}
Mid-Channel Pool		(MCP)	[4.2]		{17}	
Channel Confluence Pool		(CCP)		[4.3]		{19}
Step Pool		(STP)		[4.4]		{23}
SCOUR POOLS						
Corner Pool		(CRP)		[5.1]		{22}
Lateral Scour Pool - Log Enhanced		(LSL)		[5.2]		{10}
Lateral Scour Pool - Root Wad Enhanced		(LSR)		[5.3]		{11}
Lateral Scour Pool - Bedrock Formed		(LSBk)		[5.4]		{12}
Lateral Scour Pool - Boulder Formed		(LSBo)		[5.5]		{20}
Plunge Pool		(PLP)		[5.6]		{ 9}
BACKWATER POOLS						
Secondary Channel Pool		(SCP)		[6.1]		{ 4}
Backwater Pool - Boulder Formed		(BPB)		[6.2]		{ 5}
Backwater Pool - Root Wad Formed		(BPR)		[6.3]		{ 6}
Backwater Pool - Log Formed		(BPL)		[6.4]		{ 7}
Dammed Pool		(DPL)		[6.5]		{13}
ADDITIONAL UNIT DESIGNATIONS						
Dry		(DRY)	[7.0]			
Culvert		(CUL)	[8.0]			
Not Surveyed		(NS)		[9.0]		
Not Surveyed due to a marsh		(MAR)	[9.1]			