SALMON AND STEELHEAD RESTORATION AND ENHANCEMENT PROGRAM

NORTH COAST

WATERSHED PLANNING and COORDINATION PROJECT

STREAM INVENTORY REPORT

CAVE CREEK, EEL RIVER, 1997

CALIFORNIA DEPARTMENT OF FISH AND GAME

SPORT FISH RESTORATION ACT

1997

North Coast Watershed Planning and Coordination Project

NORTH COAST WATERSHED PLANNING and COORDINATION PROJECT

The North Coast Watershed Planning and Coordination Project (NCWPCP), formerly the Basin Planning Project (BPP), was begun in 1991 to develop salmon and steelhead restoration and enhancement programs in North Coast watersheds for the Department of Fish and Game (DFG). The objectives of the project conform with the goals of California's Salmon and Steelhead Restoration and Enhancement Program of 1988. The Restoration Program strives to enhance the status of anadromous salmonid populations and improve the fishing experience for Californians. The program intends to achieve a doubling of the population of salmon and steelhead by the year 2000. The project is supported by the Sport Fish Restoraion Act, which uses sport fishermen's funds to improve sport fisheries.

The NCWPCP conducts stream and habitat inventories according to the standart methodologies discussed in the California Salmonid stream Habitat Restoration Manual, (Flosi et.al., 1998). Biological sampling is conducted using electrofishbing and direct observation to determine species presence and distribution; selected streams are electrofished for population estimates. Some streams are also sampled for sediment composition. Collected information is used for base-line data, public cooperation development, restoraion program planning, specific project design and implementation, and for project evaluation.

The Eel River system was identified as the initial basin for project planning activities. Most anadromous tributaries to the Van Duzen, South Fork Eel, Mainstem Eel, Middle Fork Eel, and the North Fork Eel rivers have been inventoried since 1991. Initial field inventory of the Eel River system should be essentially complete in 1996. NCWPCP personnel have also worked in cooperation with the DFG Salmon Restoration Project's staff to inventory streams on the Mattole River, Mendocino Coast, and Humboldt Bay.

STREAM INVENTORY REPORT

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INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Cave Creek. 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 Cave 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 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

Cave Creek is tributary to Tomki Creek, tributary to the Eel River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Cave Creek's legal description at the confluence with Tomki Creek is T18N R12W S18. Its location is 39°25′52″ north latitude and 123°14′09″ west longitude. Cave Creek is a first order stream and has approximately 4.5 miles of blue line stream according to the USGS Foster Mt., Willits, and Redwood Valley 7.5 minute quadrangles. Cave Creek drains a watershed of approximately 7.80 square miles. Elevations range from about 1,680 feet at the mouth of the creek to 2,080 feet in the headwater areas. Douglas fir and mixed hardwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. Vehicle access exists via Willits, CA. Take Highway 101 to Willits head east towards fairgrounds (second stoplight heading south) and follow for approximately 1.5 miles. Turn left at a church and follow road for approximately 5 miles (the road will turn East and follow Berry Creek). Turn right onto paved road and one mile south (along Tomki Creek) the unimproved road provides parking space. Cave Creek is one eighth mile north east.

METHODS

The habitat inventory conducted in Cave Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors 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 Cave 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 clinometer, 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". Cave 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 clinometer, 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 Cave 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 Cave 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 Cave 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 Cave 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

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Cave Creek. In addition, five 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 Cave Creek include:

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- 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 June 05, to 17, 1997, was conducted by T. Schaible and Donna Miller (WSP). The total length of the stream surveyed was 16,162 feet.

Flow was estimated to be 0.26 cfs during the survey period.

Cave Creek is a B3 channel type for the first 10,770 feet; a F3 channel type for the next 5,273 feet; and a B4 channel type for the final 119 feet of stream reach surveyed. B3 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; cobble channel. F3 channels are entrenched meandering riffle/pool channel on low gradients with high width/depth ratio; cobble channel. B4 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; gravel channel.

Water temperatures taken during the survey period ranged from 60° to 86° F. Air temperatures ranged from 64° to 91° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 34% riffle units, 42% flatwater units, 17% pool units, and 7% dry units (Graph 1). Based on total **length** of Level II habitat types there were 26% riffle units, 56% flatwater units, 15% pool units, and 3% dry units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffle, 32%; run, 26%; and step run, 16% (Graph 3). Based on percent total **length**, step run made up 32%, low gradient riffle 24%, and run 23%.

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A total of fifty-seven pools were identified (Table 3). Main channel pools were most frequently encountered at 89% 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. Forty-eight of the 57 pools (84%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 55 pool tail-outs measured, eight had a value of 1 (15%); twenty-one had a value of 2 (38%); thirteen had a value of 3 (24%); one had a value of 4 (2%) and twelve had a value of 5 (22%) (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. In Cave Creek, seven of the twelve pool tail-outs which were valued at 5 had silt/clay/sand or gravel too small to be suitable for spawning as the substrate. The other tail-outs were unsuitable for spawning due to the tail-outs being comprised of large cobble, boulder, bedrock or wood.

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 23, flatwater habitat types had a mean shelter rating of 16, and pool habitats had a mean shelter rating of 24 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 60. Scour pools had a mean shelter rating of 34 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Cave Creek and are extensive. Graph 7 describes the pool cover in Cave Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 25 of the 55 pool tail outs measured (45.5%). Small cobble was the next most frequently observed dominant substrate type and occurred in 24% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 35%. The mean percentages of deciduous and coniferous trees were 89% and 11%, respectively. Graph 9 describes the canopy in Cave Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 69.6%. The mean percent left bank vegetated was 70.3%. The dominant elements composing the structure of the stream banks consisted of 6.5% bedrock, 12.0% boulder, 50.9% cobble/gravel, and 30.6% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 50.9% of the units surveyed. Additionally, 8.3% of the units surveyed had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Five sites were electrofished on June 17, 1997, in Cave Creek. The sites were sampled by T.

Schaible, Donna Miller (WSP), and Scott Downie (DFG).
The first site sampled included habitat units 0023-0024, a distance of approximately 50 feet from the Middleton Road crossing. This site had an area of 2,600 sq ft and a volume of 3,120 cu ft. The site yielded three roaches, less than 60mm; and one bullfrog.

The second site included habitat unit 0123, a distance of approximately 10 feet from the fourth Tomki Road crossing. This site had an area of 120 sq ft and a volume of 84 cu ft. The site yielded four steelhead/rainbow trout with fork lengths 50, 54, and 111mm; and one coho salmon with a fork length of 39mm.

The third site sampled included habitat units 0193-0195, a site located at the sixth Tomki Road crossing. The site had an area of 920 sq ft and a volume of 644 cu ft. The site yielded four steelhead which were all approximately 60mm in fork length.

The fourth site sampled included habitat units 0251-0252, a distance of approximately 450 feet from the road crossing below Little Cave Creek. The site had an area of 1,568 sq ft and a volume of 1,254 cu ft. The site yielded six steelhead young-of-the-year approximately 60mm in fork length; and two steelhead one year plus approximately 80mm in fork length.

The fifth site sampled included habitat unit 0262, a site located at the road crossing below Little Cave Creek. The site had an area of 162 sq ft and a volume of 146 cu ft. The site yielded no fish.

DISCUSSION

Cave Creek is a B3 channel type for the first 10,770 feet of stream surveyed, a F3 for the next 5,273 feet, and a B4 for the remaining 119 feet. The suitability of B3, F3, and B4 channel types for fish habitat improvement structures is as follows: B3 channels are excellent for plunge weirs, boulder clusters and bank placed boulder, single and opposing wing-deflectors, and log cover. F3 channels are good for bank-placed boulders and single and opposing wing-deflectors; fair for plunge weirs, boulder clusters, channel constrictors, and log cover. B4 channels are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover.

The water temperatures recorded on the survey days June 05, to 17, 1997, ranged from 60° to 86° F. Air temperatures ranged from 64° to 91° F. This is an high water temperature range for salmonids. However, 68° 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 would need to be conducted.

Flatwater habitat types comprised 56% of the total **length** of this survey, riffles 26%, and pools 15%. The pools are relatively deep, with only 48 of the 57 (84.2%) 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.

Eight of the 55 pool tail-outs measured had an embeddedness rating of 1. Twenty-one of the pool tail-outs had embeddedness ratings of 2. Fourteen of the pool tail-outs had embeddedness ratings of 3 or 4. Twelve of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. Nine of the 55 were unsuitable for spawning due to the dominant substrate being silt/sand/clay or gravel being too small to be suitable. 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 Cave 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 24. The shelter rating in the flatwater habitats was 16. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, terrestrial vegetation contribute 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.

Thirty-eight of the 55 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 35%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 69% and 70%, 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) Cave Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are above 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) Increase the canopy on Cave 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.

4) 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. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

6) 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.

7) 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.

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 the confluence of Tomki Creek. Channel type is a B3.

870' Middleton Road fords the stream.

1,097' A bridge crossing, 50' long x 9' wide x 2' high. Riprap supports both banks, 15' long x 8' wide x 3' high.

2,857' Tomki Road fords the stream. Unnamed tributary enters on the left bank.

4,065' Tomki Road fords the stream.

4,248' Left bank erosion, 60' long and 25' high.

4,326' Channel type taken. Channel type remains a B3.

4,818' Slide on left bank contributing boulders, gravel, small woody debris, and trees into the creek.

6,157' Tomki Road fords the stream.

6,555' Unnamed tributary enters the creek on the left bank.

6,678' Tomki Road fords the stream. Electrofishing site number two.

6,972' Log debris accumulation (LDA) five or more feet in diameter, 60 feet long, 15 feet wide, and 8 feet high supporting the right bank, as well as nine logs one to two feet in diameter.

7,860' Six foot diameter culvert runs under the unused Old Tomki Road on the left bank.

8,095' Tomki Road fords the stream.

8,579' Unnamed tributary enters the left bank.

10,335' Tomki Road fords the stream. Electrofishing site number 3.

10,405' Left bank slide, 50' long and 50' high.

10,770' Channel type taken. Channel type changes from B3 to F3.

12,819' Electrofishing site number 4.

12,927' Tributary enters on right bank, dry at the time of survey.

13,122' Tributary enters creek, dry at the time of survey.

13,357' Navarra’s Road fords the stream.

13,446' Little Cave Creek enters on left bank, dry at the time of survey. Site of electrofishing number 5.

13,465' Tributary enters on right bank, dry at the time of survey.

13,778' Riprap on right bank 69' long x 8' high, above riprap is a road.

13,847' Right bank erosion approximately 25' long x 8' high.

13,977' Left bank erosion approximately 53' long x 10' high.

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14,613' Road fords the stream.

14,908' Tributary enters on left bank, dry at the time of the survey.

15,318' Tomki Road fords the stream.

16,043' Channel type taken. Channel type changes from F3 to B4.

16,162' End of survey. No fish observed for last 3,400 feet. Tomki Road fords Cave Creek eight times; salmon have been observed spawning in fords (good gravel) in the winter but the road is open year round and has some traffic that uses the fords as well.

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 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