STREAM INVENTORY REPORT

UNNAMED CASPAR CREEK TRIBUTARY (SOUTH FORK CASPAR CREEK)

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on an unnamed tributary of Caspar Creek, locally known and hereafter referred to as South Fork Caspar 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 South Fork Caspar Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. Spawner surveys have been conducted on South Fork Caspar Creek. Spawning survey results are available from the California Department of Fish and Game, Region 3 Office in Yountville, California. The United States Forest Service, Redwood Sciences Laboratory, in Arcata also has fisheries and large woody debris data available.

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. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

South Fork Caspar Creek is tributary to Caspar Creek, tributary to the Pacific Ocean, located in Mendocino County, California (Figure 1). South Fork Caspar Creek's legal description at the confluence with Caspar Creek is T17N R17W S09. Its location is 39E20'47" north latitude and 123E45'15" west longitude. South Fork Caspar Creek is an ephemeral stream according to the USGS Mendocino and Mathison Peak 7.5 minute quadrangles. South Fork Caspar Creek drains a watershed of approximately 1.6 square miles. Summer base runoff is approximately 0.08 cubic feet per second (cfs) at the mouth. Elevations range from about 80 feet at the mouth of the creek to 1000 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed. The watershed is located in Jackson Demonstration State Forest and is managed for timber production. This watershed is under study as part of a cooperative agreement between the California Department of Forestry and Fire Protection (CDF) and the United States Forest Service. Vehicle access exists via CDF Road 600.

METHODS

The habitat inventory conducted in South Fork Caspar 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 (WSP/AmeriCorps) members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). South Fork Caspar Creek personnel were trained in May, 1995, by Gary Flosi. This inventory was conducted by a two-person team.

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SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1994). 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. Habitat unit types encountered for the first time are further 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 South Fork Caspar 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.

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 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". South Fork Caspar 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 sampled for all features on the sampling form (*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 South Fork Caspar 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 South Fork Caspar 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 density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In South Fork Caspar 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.

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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 South Fork Caspar 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 and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In South Fork Caspar Creek fish presence was observed from the stream banks, and four sites were electrofished using one Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

LARGE WOODY DEBRIS (LWD) STREAM AND RIPARIAN INVENTORY

In South Fork Caspar Creek a large woody debris (LWD) stream and riparian inventory was conducted using the methodology as described in the *California Salmonid Stream Habitat Restoration Manual*. Data from the LWD Inventory Form are entered into a dBASE 4.2 data entry program developed by Inland Fisheries Division, California Department of Fish and Game. The South Fork Caspar Creek LWD Inventory Report is included as Appendix A in the Caspar Creek Stream Inventory Report.

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 Lotus 1,2,3. Graphics developed for South Fork Caspar 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 October 10 through 17, 1995, was conducted by Heidi Hickethier and Craig Mesman (CCC). The total length of the stream surveyed was 13,191 feet with an additional 140 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.08 cfs on October 12, 1995.

South Fork Caspar Creek is an F4 channel type for the first 8,572 feet of stream reach surveyed and an F3 channel type for the remaining 4,619 feet. F-type channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios. F4 channels have gravel-dominant substrates while F3 channels have cobble-dominant substrates.

Water temperatures ranged from 50 to 56 degrees Fahrenheit. Air temperatures ranged from 48 to 64 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 39% pool units, 29% flatwater units, and 29% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 46% flatwater units, 29% pool units, and 17% riffle units (Graph 2).

Eighteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent

occurrence were low-gradient riffles, 28%; mid-channel pools, 19%; and step runs, 19% (Graph 3). Based on percent total **length**, step runs made up 37%, low-gradient riffles 17%, and mid-channel pools 15%.

A total of 158 pools were identified (Table 3). Main channel pools were most frequently encountered at 51% and comprised 53% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Thirty-one of the 158 pools (20%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 112 pool tail-outs measured, 14 had a value of 1 (12.5%); 42 had a value of 2 (37.5%); 56 had a value of 3 (50.0%); and none had a value of 4 (0%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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 a mean shelter rating of 22, flatwater habitats had a mean shelter rating of 5 (Table 1). Backwater pools had a mean shelter rating at 28, and main channel pools rated 24 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders and small woody debris are the dominant cover types in South Fork Caspar Creek. Large woody debris is lacking in nearly all habitat types. Graph 7 describes the pool cover in South Fork Caspar Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 6 of the 13 low gradient riffles measured (46%). Gravel was the next most frequently observed dominant substrate type and occurred in 38% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 98%. The mean percentages of deciduous and coniferous trees were 19% and 81%, respectively. Graph 9 describes the canopy in South Fork Caspar Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 96%. The mean percent left bank vegetated was 98%. The dominant elements composing the structure of the stream banks consisted of 5.4% bedrock, 2.7% boulder, 84.6% cobble/gravel, and 7.3% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 69% of the units surveyed. Additionally, 1% of the units surveyed had deciduous trees as the dominant vegetation type, and 12% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished on October 17 and 18, 1995, in South Fork Caspar Creek. The units

were sampled by Craig Mesman and Heidi Hickethier (CCC). Sites one through three were located within the F4 channel type reach. Site four was within the F3 channel type reach.

The first site sampled was habitat unit 28, a mid-channel pool approximately 861 feet from the confluence with Caspar Creek. This site had a length of 32 feet. The unit yielded one 0+ coho and one 0+ steelhead.

The second site was habitat unit 72, a root wad-enhanced lateral scour pool located approximately 3,096 feet above the creek mouth. This site had a length of 30 feet. The site yielded one 0+ coho, two 0+ steelhead, and one 1+ steelhead.

The third site sampled included habitat units 182-193, a series of pools, runs, and riffles located approximately 6,256 feet above the creek mouth. The site had a length of 295 feet. The site yielded seventeen 0+ steelhead and seven 1+ steelhead.

The fourth site sampled included habitat units 382-397, a series of pools, runs, riffles, and dry units located approximately 12,595 feet above the creek mouth. The site had a length of 604 feet. The site yielded thirteen 0+ steelhead, one 1+ steelhead, and four Pacific giant salamanders.

LARGE WOODY DEBRIS (LWD) STREAM AND RIPARIAN INVENTORY RESULTS

The results of the LWD stream and riparian inventory are discussed in Appendix A of the Caspar Creek Stream Inventory Report.

DISCUSSION

South Fork Caspar Creek is an F4 channel type for the first 8,572 feet of stream surveyed and an F3 for the remaining 4,619 feet. The suitability of F3 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders and single and opposing wing deflectors; fair for low-stage weirs, boulder clusters, channel constrictors, and log cover; and poor for medium-stage weirs. F4 channels are considered good for bank-placed boulders; fair for low-stage weirs, single and opposing wing deflectors, channel constrictors, and log cover; and poor for medium-stage weirs and boulder clusters.

The water temperatures recorded on the survey days October 10 through 17, 1995, ranged from 50 to 56 degrees Fahrenheit. Air temperatures ranged from 48 to 64 degrees Fahrenheit. This is a very good water temperature range for salmonids. To make any further conclusions, temperatures would need to be monitored for several years throughout the warm summer months, and more extensive biological sampling would need to be conducted.

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Flatwater habitat types comprised 46% of the total **length** of this survey, riffles 17%, and pools 29%. The pools are relatively shallow, with only 31 of the 158 (19.6%) 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.

Fifty-six of the 112 pool tail-outs measured had embeddedness ratings of 3 or 4. Only 14 had a 1 rating. 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 South Fork Caspar 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 22. The shelter rating in the flatwater habitats was lower at 5. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders and small woody debris in all habitat types. 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.

Eleven of the 13 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 density for the stream was 98%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 96% and 98%, 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.

Coho were sampled 3,096 feet upstream from the confluence with Caspar Creek. No barriers to fish passage were identified until a log debris accumulation at habitat unit 317, approximately 10,871 feet above the confluence. Steelhead were observed throughout the entire 13,191 feet of stream surveyed.

RECOMMENDATIONS

1) South Fork Caspar Creek should be managed as an anadromous, natural production stream.

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders or small woody debris. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available. In particular, large wood should be

placed in a manner to increase backwater areas to produce winter holdover habitat.

3) 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.

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

5) 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.

6) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 579', should then be treated to reduce the amount of fine sediments entering the stream.

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 Caspar Creek. Channel type is F4.

330' Partial debris accumulation. Not a barrier.

579' Left bank erosion 40' high x 30' long contributing sand and gravel.

1361' Debris accumulation. Not a barrier.

1712' Series of rock weirs.

2045' South Fork Caspar Creek weir sediment catch basin. The basin is currently retaining an approximately 400-foot-long accumulation of sediment. At the downstream end of the basin is a step-and-pool fishway. This fishway must be maintained to provide fish passage.

2353' Left bank tributary. Flow estimated at <0.3 cfs.

3404' Bridge 30' wide x 8' clearance.

3800' Left bank tributary. Flow estimated at <0.3 cfs. Accessible to fish.

4806' Two debris accumulations retaining sediment 2' deep.

4892' Debris accumulation.

5152' LDA 3' high x 40' wide x 10' long. Not a barrier.

6567' Left bank tributary. Flow estimated at <0.2 cfs. Accessible to fish.

6615' Bridge 15' long x 20' wide x 10' clearance.

8095' Dry right bank tributary.

8418' Left bank tributary. Flow estimated at <0.1 cfs.

8572' Channel type changes to F3.

8834' Bridge 18' long x 25' wide x 10' clearance.

8878' Left bank tributary. Flow estimated at <0.1 cfs.

9155' Dry left bank tributary.

10139' Partial LDA.

10871' LDA 7' high x 17' wide retaining sediment 3' deep at base. Possible barrier to coho salmon. Steelhead were observed throughout the survey reach.

11287' LDA creates 6' change in elevation.

11377' Dry left bank tributary.

12553' LDA 8' high x 15' wide x 15' long retaining gravel 7' deep at base. Possible barrier.

12745' Boulder roughs with an approximate 10% gradient.

13094' Boulder roughs with an approximate 10% gradient.

13154' LDA 10' high x 30' wide x 20' long combined with large boulders. 5' jump.

13191' End of survey due to increased gradient, including a series of 5' jumps. 420' above the end of

survey is a pair of 3' diameter culverts 7' above the stream bed with no jump pool. Marsh conditions exist upstream of the culverts.

REFERENCES

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, 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