

STREAM INVENTORY REPORT

Caspar Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Caspar Creek, starting at the Highway 1 bridge and ending at the confluence with the unnamed tributary designated locally 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 Caspar Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. Adult spawning surveys, juvenile index reach surveys, and juvenile downstream migrant trapping surveys, have been conducted on Caspar Creek. The data from those surveys is available from the California Department of Fish and Game Region 3 Office in Yountville, California.

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

Caspar Creek is tributary to the Pacific Ocean, located in Mendocino County, California (Figure 1). Caspar Creek's legal description at its mouth is T17N R18W S01. Its location is 39°21'43" north latitude and 123°31'25" west longitude. Caspar Creek is a first order stream and has approximately 8.0 miles of blue line stream according to the USGS Mendocino, Mathison Peak, and Noyo Hill 7.5 minute quadrangles. Caspar Creek drains a watershed of approximately 8.2 square miles. Summer base runoff is approximately 1.1 cubic feet per second (cfs) at the mouth. Elevations range from sea level at the mouth of the creek to 1000 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed, but there are areas of pasture land and urbanization near the mouth. The watershed is primarily located within Jackson Demonstration State Forest, and is managed for timber production, the balance being private holdings. A cooperative paired watershed study between the California Department of Forestry and Fire Protection (CDF) and the United States Forest Service is ongoing upstream of the main stem. Vehicle access exists via CDF Road 600.

METHODS

The habitat inventory conducted in 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). Caspar Creek personnel were trained in May, 1995, by Gary Flosi. This inventory was

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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 (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 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". 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

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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 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 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 a modified handheld spherical densiometer as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In 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 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 Caspar Creek fish presence was observed from the stream banks, and two 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 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 Caspar Creek LWD Inventory Report is included in this report as Appendix A.

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 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

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- 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

The habitat inventory of October 16-18, 1995, was conducted by Bettina Chimarios and Shelly Dunn (WSP/AmeriCorps). The total length of the stream surveyed was 20,352 feet with an additional 892 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.06 cfs on October 18, 1995.

Caspar Creek is an F5 channel type for the first 2,889 feet of stream reach surveyed and an F4 for the remaining 17,463 feet. F-type channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios. F5 channels have sand-dominant substrates while F4 channels have gravel-dominant substrates.

Water temperatures ranged from 54 to 57 degrees Fahrenheit. Air temperatures ranged from 50 to 66 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 52% pool units, 40% flatwater units, and 7% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 61% pool units, 37% flatwater units, and 3% riffle units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 42%; runs, 15%; and glides, 14% (Graph 3). Based on percent total **length**, mid-channel pools made up 53%, glides 18%, and step runs 12%.

A total of 195 pools were identified (Table 3). Main channel pools were most frequently encountered at 81% and comprised 88% 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. One hundred and fifty-three of the 195 pools (78%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 168 pool tail-outs measured, none had a value of 1 (0%); 1 had a value of 2 (0.6%); 57 had a value of 3 (33.9%); and 110 had a value of 4 (65.5%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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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 at 103, and flatwater habitats had a mean shelter rating of 73 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 158. Main channel pools had a mean shelter rating of 99 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in all of the four low gradient riffles measured (100%) (Graph 8).

The mean percent canopy density for the stream reach surveyed was 96%. The mean percentages of deciduous and coniferous trees were 88% and 12%, respectively. Graph 9 describes the canopy in Caspar Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 86%. The mean percent left bank vegetated was 94%. The dominant elements composing the structure of the stream banks consisted of 0% bedrock, 0% boulder, 27% cobble/gravel, and 73% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 57% of the units surveyed. Additionally, 5% of the units surveyed had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on October 18 and 19, 1995, in Caspar Creek. The units were sampled by Craig Mesman and Heidi Hickethier (CCC).

The first site sampled included habitat units 2-5, a series of mid-channel pools approximately 72 feet from the Highway 1 bridge and within the F5 channel type reach. This site had a length of 168 feet. The unit yielded one 0+ coho, eighteen 0+ steelhead, six 1+ steelhead, eight sculpin, and two three-spine stickleback.

The second site included habitat units 319-323, a series of mid-channel pools, a log-enhanced lateral scour pool, and a riffle located approximately 18,849 feet above the Highway 1 bridge and within the F4 channel type reach. This site had a length of 283 feet. The site yielded six 0+ coho, seven 0+ steelhead, seven 1+ steelhead, three sculpin, and three stickleback.

Additional biological sampling information is available from Weldon Jones and Scott Harris at the California Department of Fish and Game, Region 3.

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LARGE WOODY DEBRIS (LWD) STREAM AND RIPARIAN INVENTORY RESULTS

The results of the LWD stream and riparian inventory are discussed in Appendix A of this report.

DISCUSSION

Caspar Creek, starting at the Highway 1 bridge and ending at the confluence of South Fork Caspar Creek, is an F5 channel type for the first 2,889 feet of stream surveyed and an F4 for the remaining 17,463 feet. The suitability of F4 and F5 channel types for fish habitat improvement structures is as follows: 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 16-18, 1995, ranged from 54 to 57 degrees Fahrenheit. Air temperatures ranged from 50 to 66 degrees Fahrenheit. This is a 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.

Flatwater habitat types comprised 37% of the total **length** of this survey, riffles 3%, and pools 61%. The pools are relatively deep, with 153 of the 195 (78.5%) pools having a maximum depth greater than two 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.

One hundred sixty-seven of the 168 pool tail-outs measured had embeddedness ratings of 3 or 4. None 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 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 high with a rating of 103. The shelter rating in the flatwater habitats was slightly lower at 73. A pool shelter rating of approximately 100 is desirable. However, the relatively large amount of cover that now exists is being provided primarily by terrestrial and aquatic vegetation in all habitat types. Additionally, small woody debris contributes 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.

All of the four 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 96%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than

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80%.

The percentage of right and left bank covered with vegetation was high at 86% and 94%, 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.

Juvenile coho and steelhead were observed throughout the surveyed reach, which ended at the confluence with South Fork Caspar Creek, after which the stream is known as North Fork Caspar Creek. See the report for North Fork Caspar Creek for observations regarding upstream access limits for anadromous fish.

RECOMMENDATIONS

- 1) Caspar Creek should be managed as an anadromous, natural production stream.
- 2) 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.
- 3) Increase woody cover in the pool and flatwater habitat units. Most of the cover was from terrestrial and aquatic vegetation. 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 hold over habitat.
- 4) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 17,330', should then be treated to reduce the amount of fine sediments entering the stream.
- 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.

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.

Position

(ft): Comments:

0' Begin survey at Highway 1 bridge. Channel type is F5.

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- 1331' Log and debris accumulation (LDA) 4' high x 25' wide x 12' long.
- 1545' LDA 2' high x 35' wide x 40' long.
- 2889' Channel type changes to F4.
- 5792' Right bank seep.
- 7347' Right bank tributary.
- 9008' Left bank tributary.
- 9059' Left bank tributary.
- 10934' Left bank tributary.
- 15603' Foot bridge with 3' clearance.
- 17330' Right bank erosion 15' high x 45' long contributing fines.
- 17721' Left bank seep.
- 17986' Left bank tributary.
- 18931' Right bank tributary.
- 20235' Road 600 culvert 25' wide x 45' long. This is an arch culvert that maintains a natural bottom stream crossing.
- 20352' End of survey at confluence of North Fork and South Fork Caspar Creek.

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.

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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

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