

# STREAM INVENTORY REPORT

## “Middle Fork Caspar Creek”

### INTRODUCTION

A stream inventory was conducted during the summer of 1995 on an unnamed tributary to Caspar Creek locally known as, and hereafter referred to as, Middle 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 Middle Fork Caspar Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. There is no known record of adult spawning surveys having been conducted on Middle Fork Caspar Creek.

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

Middle Fork Caspar Creek is tributary to Caspar Creek, tributary to the Pacific Ocean, located in Mendocino County, California (Figure 1). Middle Fork Caspar Creek's legal description at the confluence with Caspar Creek is T17N R17W S10. Its location is 39°21'13" north latitude and 123°44'02" west longitude. Middle Fork Caspar Creek is an ephemeral stream according to the USGS Mathison Peak 7.5 minute quadrangle. Middle Fork Caspar Creek drains a watershed of approximately 0.6 square miles. Summer base runoff is approximately 0.01 cubic feet per second (cfs) at the mouth. Elevations range from about 220 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 within Jackson Demonstration State Forest and is managed for timber production. Vehicle access exists via California Department of Forestry and Fire Protection (CDF) Road 630.

### METHODS

The habitat inventory conducted in Middle 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). Middle 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 Middle 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". Middle 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

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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 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 Middle 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 Middle 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In Middle 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.

### **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

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withstand winter flows. In Middle 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 Middle Fork Caspar Creek fish presence was observed from the stream banks, and three 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 Middle 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 Middle Fork Caspar Creek LWD Inventory Report is included in the Caspar Creek Stream Inventory 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 Middle 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

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- 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 19-24, 1995, was conducted by Heidi Hicketier and Craig Mesman (CCC). The total length of the stream surveyed was 2,647 feet with an additional 68 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.01 cfs on October 19, 1995.

Middle Fork Caspar Creek is a B4 channel type for the entire 2,647 feet of stream reach surveyed. B4 channels are moderately entrenched, moderate gradient, riffle-dominated channels with infrequently-spaced pools, stable banks, and gravel substrates.

Water temperatures ranged from 48 to 52 degrees Fahrenheit. Air temperatures ranged from 44 to 62 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 50% pool units, 29% riffle units, and 19% flatwater units 19% (Graph 1). Based on total **length** of Level II habitat types there were 41% pool units, 35% flatwater units, and 23% riffle units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 29%; low-gradient riffles, 29%; and step runs, 13% (Graph 3). Based on percent total **length**, step runs made up 29%, mid-channel pools 25%, and low-gradient riffles 23%.

A total of 64 pools were identified (Table 3). Main channel pools were most frequently encountered at 58% and comprised 62% 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. Four of the 64 pools (6%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 52 pool tail-outs measured, 1 had a value of 1 (1.9%); 13 had a value of 2 (25.0%); 38 had a value of 3 (73.1%); and none had a value of 4 (0%) (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 of 16, and flatwater habitats had a mean shelter rating of 7 (Table 1). Scour pools had a mean shelter rating of 20, and main channel pools had a mean shelter rating of 15 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 2 of the 3 low gradient riffles measured (67%). Gravel was the next most frequently observed dominant substrate type and occurred in 33% 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 2% and 98%, respectively. Graph 9 describes the canopy in Middle Fork Caspar Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 96%. The mean percent left bank vegetated was 94%. The dominant elements composing the structure of the stream banks consisted of 8.3% bedrock, 0% boulder, 91.7% cobble/gravel, and 0% sand/silt/clay (Graph 10). Coniferous trees, including down trees, logs, and root wads, were the dominant vegetation type observed in 56% of the units surveyed. Additionally, 4% of the units surveyed had deciduous trees as the dominant vegetation type (Graph 11).

## **BIOLOGICAL INVENTORY RESULTS**

Three sites were electrofished on October 19 and 23, 1995, in Middle Fork Caspar Creek. The units were sampled by Craig Mesman and Heidi Hicketier (CCC) and Bettina Chimarios and Shelly Dunn (WSP/AmeriCorps).

The first site sampled included habitat units 19-21, a corner pool/low-gradient riffle/step run combination approximately 329 feet from the confluence with Caspar Creek. This site had an area of 312 sq ft. The unit yielded four 0+ steelhead and five Pacific giant salamanders.

The second site included habitat units 61-64, three scour pools and a run located approximately 1,188 feet above the creek mouth. This site had a length of 67 ft. The site yielded two 1+ steelhead.

The third site sampled included habitat units 116-122, a pools, riffles, and runs located approximately 2,389 feet above the creek mouth. The site had a length of 180 ft. The site yielded one 0+ and one 1+ steelhead.

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### DISCUSSION

Middle Fork Caspar Creek is a B4 channel type for the entire 2,715 feet of stream surveyed. 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; and good for medium-stage plunge weirs.

The water temperatures recorded on the survey days October 19 and 24, 1995, ranged from 48 to 52 degrees Fahrenheit. Air temperatures ranged from 44 to 62 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.

Flatwater habitat types comprised 35% of the total **length** of this survey, riffles 23%, and pools 41%. The pools are relatively shallow, with only 4 of the 64 (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 deepen pool habitat is recommended.

Thirty-eight of the 52 pool tail-outs measured had embeddedness ratings of 3 or 4. Only one 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 Middle 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 16. The shelter rating in the flatwater habitats was lower at 7. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by large woody debris in all habitat types. Additionally, boulders 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.

All of the three 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, re-vegetation projects are considered when canopy density is less than 80%.

No coho were sampled or observed in Middle Fork Caspar Creek. Steelhead were observed only through unit 122, although no barriers to fish migration exist between that unit and the end of the surveyed reach where a 13' bedrock plunge impedes further passage, 2,647 feet from Caspar Creek.

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### RECOMMENDATIONS

- 1) Middle Fork 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 pools and flatwater habitat units. 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.
- 4) Where feasible, design and engineer pool enhancement structures to 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.

### 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<br>(ft): | Comments:   |
|-------------------|---|
| 0'                | Begin survey at confluence with Caspar Creek. Channel type is B4.                                   |
| 110'              | Log and debris accumulation (LDA) 3' high x 15' wide x 10' long retaining sediment 1' deep at base. |
| 478'              | Debris accumulation.  |
| 1180'             | LDA 2' high x 10' wide x 10' long retaining gravel 1' deep at base. Not a barrier.                  |
| 1823'             | Debris accumulation retaining gravel 1' deep.   |
| 2161'             | Left bank tributary. Flow estimated at <0.1 cfs. This tributary was electrofished                   |



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for 50' starting at the confluence; no fish were sampled.

2301' Debris accumulation.

2647' End of survey at 13' bedrock plunge.

## **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 |
|--|--------|--------|
| <b>RIFFLE</b>                          |        |        |
| Low Gradient Riffle                    | [LGR]  | 1.1    |
| High Gradient Riffle                   | [HGR]  | 1.2    |
| <b>CASCADE</b>                         |        |        |
| Cascade                                | [CAS]  | 2.1    |
| Bedrock Sheet                          | [BRS]  | 2.2    |
| <b>FLATWATER</b>                       |        |        |
| Pocket Water                           | [POW]  | 3.1    |
| Glide                                  | [GLD]  | 3.2    |
| Run                                    | [RUN]  | 3.3    |
| Step Run                               | [SRN]  | 3.4    |
| Edgewater                              | [EDW]  | 3.5    |
| <b>MAIN CHANNEL POOLS</b>              |        |        |
| Trench Pool                            | [TRP]  | 4.1    |
| Mid-Channel Pool                       | [MCP]  | 4.2    |
| Channel Confluence Pool                | [CCP]  | 4.3    |
| Step Pool                              | [STP]  | 4.4    |
| <b>SCOUR POOLS</b>                     |        |        |
| 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    |
| <b>BACKWATER POOLS</b>                 |        |        |
| 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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