

# STREAM INVENTORY REPORT

## Mustard Gulch

### INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Mustard Gulch. 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 Mustard Gulch. 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 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

Mustard Gulch is tributary to the Navarro River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Mustard Gulch's legal description at the confluence with Navarro River is T15N R16W S16. Its location is 39°09'58" north latitude and 123°38'28" west longitude. Mustard Gulch is a first order stream and has approximately 1.5 miles of blue line stream according to the USGS Elk and Navarro 7.5 minute quadrangles. Mustard Gulch drains a watershed of approximately 0.7 square miles. Elevations range from about 30 feet at the mouth of the creek to 600 feet in the headwater areas. Redwood/Douglas fir conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via State Route 128.

### METHODS

The habitat inventory conducted in Mustard Gulch 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). 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 (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, depth of pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further measured for all the parameters and characteristics on the field form. Additionally, from

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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 Mustard Gulch 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". Mustard Gulch 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 (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were in feet to the nearest tenth.

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### 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 Mustard Gulch, 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, 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 Mustard Gulch, 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*. Canopy density relates to the amount of stream shaded from the sun. In Mustard Gulch, 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 Mustard Gulch, 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 was estimated and recorded.

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### BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Mustard Gulch fish presence was observed from the stream banks, and one site was 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 Mustard Gulch 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

The habitat inventory of June 12, 1996, was conducted by Chris Coyle (CCC) and Amber Siglar (WSP\AmeriCorps). The total length of the stream surveyed was 871 feet.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.2 cfs on June 12, 1996.

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Mustard Gulch is an B6 channel type for the entire 871 feet of stream reach surveyed. B6 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks, and a silt/clay channel.

Water temperature taken during the survey period was 55 degrees Fahrenheit. Air temperature was 62 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 44% flatwater units and 50% pool units (Graph 1). Based on total **length** of Level II habitat types there were 56% flatwater units and 37% pool units (Graph 2).

Five Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 38%; step runs, 25%; and runs, 19% (Graph 3). Based on percent total **length**, step runs made up 46%, mid-channel pools 32%, and runs 9%.

A total of 8 pools were identified (Table 3). Main channel pools were the only type encountered, so comprised 100% 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. Three of the 8 pools (38%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 8 pool tail-outs measured, all had a value of 5, due to the dominant substrate consisting of fine sediments (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. Flatwater habitat types had a mean shelter rating of 38, and pool habitats had a mean shelter rating of 22 (Table 1). The main channel pools had the mean shelter rating of 22. (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris are the dominant cover type in Mustard Gulch. Large woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Mustard Gulch.

Table 6 summarizes the dominant substrate by habitat type. Silt/clay was the dominant substrate observed in the step run measured (Graph 8).

The mean percent canopy density for the stream reach surveyed was 98%. The mean percentages of deciduous and coniferous trees were 1% and 99%, respectively. Graph 9 describes the canopy in Mustard Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 83.3%. The mean percent left bank vegetated was 83.3%. The dominant elements composing the structure of the stream banks consisted of 100% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 50% of the units surveyed. Additionally, 8.3% of the units surveyed had deciduous trees as the dominant vegetation type, and 41.7% had coniferous trees as the dominant

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vegetation, including down trees, logs, and root wads (Graph 11).

### BIOLOGICAL INVENTORY RESULTS

One site was electrofished on July 9, 1996, in Mustard Gulch. The site was sampled by Andrew MacMillan and David Jones (WSP\AmeriCorps).

The site sampled included habitat units 7 through 10, a run, mid-channel pool, step run, mid-channel pool sequence approximately 271 feet from the confluence with Navarro River. The site yielded 6 sculpin and 3 crayfish.

### DISCUSSION

Mustard Gulch is a B6 channel type for the entire 871 feet of stream surveyed. The suitability of B6 channel types for fish habitat improvement structures is as follows: B6 channel types are excellent for bank placed boulders and log cover, and good for low-stage weirs, single and opposing wing deflectors, channel constrictors, and fair for medium stage weirs and boulder clusters.

The water temperature recorded on the survey day June 12, 1996, was 55 degrees Fahrenheit. Air temperature was 62 degrees Fahrenheit. This is a good water temperature range for salmonids. Mustard Gulch seems to have temperatures favorable to 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, and pools 37%. The pools are relatively shallow, with 3 of the 8 (38%) 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. All of the 8 pool tail-outs measured had embeddedness ratings of 5. 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 Mustard Gulch, 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 slightly better at 38. A pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by small woody debris in all units. 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.

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All of the step runs had silt as the dominant substrate. This is generally considered unsuitable 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%.

### RECOMMENDATIONS

- 1) Mustard Gulch 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 small woody debris. Adding high quality complexity with woody cover is desirable.
- 3) Suitable size spawning substrate on Mustard Gulch is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.
- 4) 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.

### 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.

Position (ft):	Comment:
100'	Begin survey within 100' of confluence with the Navarro River. Thick vegetation makes entrance to stream inaccessible at confluence. Channel type is a B6.
175'	State Route 128: concrete box culvert, 5' wide x 5' high x 65' long. No baffles.
759'	Begin marsh. Right bank tributary, <0.01 cfs.
871'	End of survey. Channel splits, both channels clogged with emergent vegetation (alders, brush, vines, willows and nettles). Channel bottom is 1 to 3' of silt throughout the surveyed reach. End of survey is within the floodplain influence of the Navarro River.

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### 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