# STREAM INVENTORY REPORT

## Murray Gulch

## INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Murray 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 Murray 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

Murray Gulch is tributary to the Navarro River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Murray Gulch's legal description at the confluence with Navarro River is T15N R17W S12. Its location is 39°10′43″ north latitude and 123°42’02″ west longitude. Murray Gulch is a first order stream and has approximately 2.0 miles of blue line stream according to the USGS Elk 7.5 minute quadrangle. Murray Gulch drains a watershed of approximately 0.85 square miles. Elevations range from about 30 feet at the mouth of the creek to 640 feet in the headwater areas. Redwood/Douglas 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 Murray 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 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 Murray 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". Murray 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.

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 Murray 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 Murray 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 Murray 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 Murray 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.

## BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Murray Gulch fish presence was observed from the stream banks, and two 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 Murray 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 21 and 27, 1996, was conducted by Chris Coyle (CCC) and Amber Siglar (WSP\AmeriCorps). The total length of the stream surveyed was 4,285 feet with an additional 155 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.44 cfs on June 28, 1996.

**Murray Gulch**

Murray Gulch is an F4 channel type for 1,800 feet of stream reach surveyed, and is an A3 channel type for 2,485 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and a gravel dominant substrate. A3 channels are steep, narrow, cascading step pool streams with high energy/debris transport associated with depositional soils and have a cobble dominant substrate.

Water temperatures taken during the survey period ranged from 53 to 56 degrees Fahrenheit. Air temperatures ranged from 58 to 68 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 40% riffle units, 27% flatwater units, and 34% pool units (Graph 1). Based on total **length** of Level II habitat types there were 37% riffle units, 40% flatwater units, and 23% pool units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffles, 35%; step runs, 15%; and mid-channel pools, 13% (Graph 3). Based on percent total **length**, low gradient riffles made up 34%, step runs 30%, and mid-channel pools 9%.

A total of 63 pools were identified (Table 3). Scour pools were most frequently encountered at 54% and comprised 50% 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. Thirteen of the 63 pools (21%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 63 pool tail-outs measured, 2 had a value of 1 (3%); 33 had a value of 2 (52%); 19 had a value of 3 (30%); 0 had a value of 4 (0%) and 9 had a value of 5 (14%) (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. Riffle habitat types had a mean shelter rating of 21, flatwater habitat types had a mean shelter rating of 12, and pool habitats had a mean shelter rating of 49 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 67. Scour pools had a mean shelter rating of 39 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris are the dominant cover type in Murray Gulch. Graph 7 describes the pool cover in Murray Gulch.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 5 of the 7 low gradient riffles measured (71%). Small cobble was the next most frequently observed dominant substrate type and occurred in 29% of the low gradient riffles (Graph 8).

**Murray Gulch**

The mean percent canopy density for the stream reach surveyed was 95%. The mean percentages of deciduous and coniferous trees were 56% and 44%, respectively. Graph 9 describes the canopy in Murray Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 85.3%. The mean percent left bank vegetated was 83.3%. The dominant elements composing the structure of the stream banks consisted of 0% bedrock, 7.1% boulder, 52.9% cobble/gravel, and 40% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 38.6% of the units surveyed. Additionally, 24.3% of the units surveyed had deciduous trees as the dominant vegetation type, and 21.4% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on July 10, 1996, in Murray Gulch. The sites were sampled by Andrew MacMillan and David Jones (WSP\AmeriCorps).

The first site sampled included habitat units 11 through 30, a low gradient riffle, run, mid-channel pool sequence approximately 341 feet from the confluence with Navarro River. The site yielded 8 steelhead, 5 sculpin, and 2 crayfish.

The second site included habitat units 79 through 83, a plunge pool, step run, low gradient riffle sequence located approximately 1,846 feet above the creek mouth. The site yielded 16 steelhead and 2 Pacific giant salamanders.

## DISCUSSION

Murray Gulch is a F4 channel type for the first 1,800 feet of stream surveyed and an A3 for the remaining 2,485 feet. The suitability of F4 and A3 channel types for fish habitat improvement structures are as follows: F4 channel types are 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. A3 channel types are good for bank placed boulders, fair for low-stage weirs, opposing wing deflectors and log cover, and poor for medium-stage weirs, boulder clusters, single wing deflectors and log cover.

The water temperatures recorded on the survey days June 21 and 27, 1996, ranged from 53 to 56 degrees Fahrenheit. Air temperatures ranged from 58 to 68 degrees Fahrenheit. This is a good water temperature range for salmonids. Murray 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 40% of the total **length** of this survey, riffles 37%, and pools 23%. The pools are relatively shallow, with only 13 of the 63 (21%) 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.

Twenty-eight of the 63 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Only 2 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 Murray 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 49. The shelter rating in the flatwater habitats was 12. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by small 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 7 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 95%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

## RECOMMENDATIONS

1) Murray 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) 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.

4) 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.

5) The limited water temperature data available suggest that maximum temperatures are

within the acceptable range for juvenile salmonids. To establish a more complete and meaningful temperature regime, Louisiana-Pacific Corp has conducted 24-hour monitoring during the July and August temperature extreme period. This should be continued for a continuous 3 to 5 year period.

## 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): | Comments: |
|---|---|
| 0' | Begin survey at confluence with Navarro River. Channel type is F6. |
| 321' | First electrofishing site. |
| 313' | Flatcar bridge, 15' long x 18' wide x 6' high. |
| 1,598' | Log debris accumulation (LDA), 4' high x 20' wide x 6' long. |
| 1,800' | LDA, 4' high x 20' wide x 5' long. Retaining sediment 20' high x 20' wide x 20' long, but passable. Channel type change to A3. |
| 1,846' | Second electrofishing site. |
| 1,996' | High gradient (>10%). Channel clogged with logs and debris. |
| 2,056' | LDA, 7' high x 25' wide x 30' long. Retaining sediment 7' high x 15' wide. Partial barrier. |
| 2,474' | Left bank tributary, <0.1 cfs. Not accessible to fish due to the high gradient. |
| 3,315' | Left bank erosion, 30' long x 40' high. Down trees spanning channel. |
| 3,918' | Left bank erosion, 60' long x 80' wide, consisting of down trees, boulders, and fine sediment. |
| 4,018' | Left bank tributary, <0.1 cfs. Not accessible to fish due to the high gradient. |
| 4,193' | LDA, 5' high x 30' wide x 7' long. Retaining sediment 5' high x 25' wide x 30' long. Possible barrier. |
| 4,285' | End of survey. Stream gradient increases in excess of 10%. |

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 |