STREAM INVENTORY REPORT

Marsh Gulch

INTRODUCTION

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

Marsh Gulch is tributary to the Navarro River, a tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Marsh Gulch's legal description at the confluence with Navarro River is T15N R17W S11. Its location is 39°10'41" north latitude and 123°42'28" west longitude. Marsh Gulch is a first order stream and has approximately 1.5 miles of blue line stream according to the USGS Elk 7.5 minute quadrangle. Marsh Gulch drains a watershed of approximately 1.4 square miles. Summer base flow is approximately 0.9 cubic feet per second (cfs) at the mouth. Elevations range from about 30 feet at the mouth of the creek to 1,000 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 Marsh Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 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.

Marsh Gulch

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 Marsh 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". Marsh 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 taken in feet to the nearest tenth.

Marsh Gulch

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 Marsh 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 Marsh 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 Marsh 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 Marsh 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.

Marsh Gulch

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Marsh 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 Marsh 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 July 1 and 2, 1996, was conducted by Chris Coyle (CCC) and Amber Siglar (WSP/AmeriCorps). The total length of the stream surveyed was 2,692 feet.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.9 cfs on July 1, 1996.

Marsh Gulch is an B2 channel type for the entire 2,692 feet of stream reach surveyed. B2 channels are moderately entrenched, moderate gradient, riffle dominated channels with

4

Marsh Gulch

infrequently spaced pools, very stable plan and profile, stable banks, and boulder channels.

Water temperatures taken during the survey period ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 56 to 70 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 40% riffle units, 23% flatwater units, and 37% pool units (Graph 1). Based on total **length** of Level II habitat types there were 40% riffle units, 33% flatwater units, and 27% pool units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffles, 20%; high gradient riffles, 17%; and mid-channel pools, 13% (Graph 3). Based on percent total **length**, low gradient riffles made up 22%, step runs 22%, and high gradient riffles 16%.

A total of 41 pools were identified (Table 3). Main and scour pools were most frequently encountered at 49% each and comprised, respectively, 49% and 48% 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. Seven of the 41 pools (17%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 41 pool tail-outs measured, 1 had a value of 1 (2.4%); 11 had a value of 2 (26.8%); 8 had a value of 3 (17.1%); 7 had a value of 4 (17.1%); and 14 had a value of 5 (34.1) (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 31, and flatwater habitats had a mean shelter rating of 9 and pool habitat types had a mean shelter rating of 61 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 75. Main channel pools had a mean shelter rating of 38 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Marsh Gulch. Graph 7 describes the pool cover in Marsh Gulch.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 3 of the 4 low gradient riffles measured (75%). Boulders were the next most frequently observed dominant substrate type and occurred in 25% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 90%. The mean percentages of deciduous and coniferous trees were 38% and 62%, respectively. Graph 9 describes the canopy in Marsh Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 82.3%. The mean percent left bank vegetated was 85.9%. The dominant elements composing the structure of the

Marsh Gulch

stream banks consisted of 0% bedrock, 31.8% boulder, 20.5% cobble/gravel, and 47.7% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 38.6% of the units surveyed. Additionally, 4.6% of the units surveyed had deciduous trees as the dominant vegetation type, and 22.7% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on July 16, 1996, in Marsh Gulch. The site was sampled by Andrew MacMillan (WSP\AmeriCorps) and David Jones (CCC).

The site sampled was habitat unit 11, a mid-channel pool approximately 259 feet from the confluence with Navarro River. The site yielded 13 steelhead, 1 coho, 32 sculpin, and Pacific Giant salamanders.

DISCUSSION

Marsh Gulch is a B2 channel type for the entire 2,692 feet of stream surveyed. The suitability of B2 channel types for fish habitat improvement structures is as follows: B2 channel types are excellent for low and medium stage plunge weirs, single and opposing wing deflectors, and bank cover.

The water temperatures recorded on the survey days July 1 and 2, 1996, ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 56 to 70 degrees Fahrenheit. This is a good water temperature range for salmonids. Marsh 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 23% of the total **length** of this survey, riffles 40%, and pools 37%. The pools are relatively shallow, with only 7 of the 41 (17%) 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.

Twenty-nine of the 41 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Only 1 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 Marsh 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 61. The shelter rating in the flatwater habitats was 9. A pool shelter rating of approximately 100 is desirable. The relatively large

Marsh Gulch

amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, small woody debris 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.

Three of the 4 low gradient riffles measured had gravel as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 90%. This is a relatively high percentage of canopy. In general, re-vegetation projects are considered when canopy density is less than 80%.

RECOMMENDATIONS

1)   Marsh Gulch should be managed as an anadromous, natural production stream.

2)   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.

3)   Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

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 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 measured from the beginning of the survey reach.

Position (ft):	Comments:
0'	Begin survey at confluence with Navarro River. Channel type is a B2.
206'	Log stringer bridge with flatcar superimposed, 30' wide x 20' long x 9' high.

Marsh Gulch

1,392'	Left bank tributary, <0.1 cfs. Not accessible to fish due to gradient.
2,349'	Left bank tributary, <0.1 cfs. Not accessible to fish due to gradient.
2,624'	Five foot jump blocked by debris.
2,692'	End of survey at a cascade with a 15% gradient for 75', followed by 100' of cascade with a 20% gradient.

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