STREAM INVENTORY REPORT

Marble Gulch

INTRODUCTION

A stream inventory was conducted during the summer of 1999 on Marble Gulch. The survey began at the confluence with the North Fork Noyo River and extended upstream 4,083 feet.

The Marble Gulch 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 Marble 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

Marble Gulch is a tributary to the North Fork Noyo River, a tributary to the Noyo River, located in Mendocino County, California (Map 1). Marble Gulch's legal description at the confluence with the North Fork Noyo River is T18N R15W S09. Its location is 39°25′47″ north latitude and 123°32′15″ west longitude. Marble Gulch is a first order stream and has approximately 3.0 miles of blue line stream according to the USGS Northspur 7.5 minute quadrangle. Marble Gulch drains a watershed of approximately 1.9 square miles. Elevations range from about 320 feet at the mouth of the creek to 1,520 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via the main road running parallel to the North Fork Noyo River. At mile marker 8.75 take left fork. Stay left at next fork and at Newlon Water sign, go right. Park at 3-way fork after crossing bridge and walk along right fork towards creek.

METHODS

The habitat inventory conducted in Marble Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The 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. 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 (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are 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 Marble 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 a Marsh-McBirney Model 2000 flow meter.

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*. 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. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and stadia rod.

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". Marble 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. Habitat characteristics were measured using a clinometer, hip chain, and stadia

rod. All measurements are in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Marble 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, 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 Marble 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 boulder 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. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

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 Marble 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 Marble 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 (including downed trees, logs, and rootwads) was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Marble Gulch. In addition, six 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 Marble 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
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of August 19 and 24, 1999, was conducted by Toni Beaumont and Christine Ramsey (WSP/AmeriCorps). The total length of the stream surveyed was 4,083 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.03 cfs on August 23, 1999.

Marble Gulch is a G4 channel type for the 4,083 feet of the stream surveyed. G4 channels are entrenched "gully" step-pool channels with low width/depth ratios and moderate gradients.

Water temperatures taken during the survey period ranged from 56 to 58 degrees Fahrenheit. Air temperatures ranged from 64 to 68 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 3% riffle units, 35% flatwater units, 59% pool units, and 4% dry units (Graph 1). Based on total length of Level II habitat types there were 2% riffle units, 48% flatwater units, 44% pool units, and 6% dry units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were runs, 26%; lateral scour pools - log enhanced, 23%; and lateral scour pools - bedrock formed, 11% (Graph 3). Based on percent total length, runs made up 37%, lateral scour pools - log enhanced, 15%, and lateral scour pools - bedrock formed, 12%.

A total of 67 pools were identified (Table 3). Scour pools were the most frequently encountered, at 81%, and comprised 79% 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. Twelve of the 67 pools (18%) had a depth between two and three feet. (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 64 pool tail-outs measured, 1 had a value of 1 (1.6%); 14 had a value of 2 (21.9%); 15 had a value of 3 (23.4%); and 34 had a value of 5 (53.1%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. The breakdown of dominant substrate composition for the 34 pool tail-outs that had an embeddedness value of 5 was 12% sand, 76% small gravel, 3% boulder, and 9% bedrock.

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 5, flatwater habitat types had a mean shelter rating of 17, and pool habitats had a mean shelter rating of 28 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 37, main channel pools had a mean shelter rating of 14, and backwater pools had a rating of 5. (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders, bedrock ledges, and undercut banks are the dominant flatwater and riffle cover types in Marble Gulch. Graph 7 describes the pool cover in Marble Gulch. Undercut banks are the dominant pool cover type followed by large woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 83% of pool tail-outs while sand was the next most frequently observed substrate type, at 6%.

The mean percent canopy density for the surveyed length of Marble Gulch was 94%. The mean percentages of deciduous and coniferous trees were 24% and 76%, respectively. Graph 9 describes the mean percent canopy in Marble Gulch.
For the stream reach surveyed, the mean percent right bank vegetated was 74%. The mean percent left bank vegetated was 81%. The dominant elements composing the structure of the stream banks consisted of 19.6% bedrock, 2.2% boulder, 21.7% cobble/gravel, and 56.5% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 78.3% of the units surveyed. Thirteen percent of the units surveyed had deciduous trees as the dominant vegetation type, and 8.7% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Six sites were electrofished for species composition and distribution in Marble Gulch on October 19, 1999. Water temperatures taken during the electrofishing period ranged from 46 to 48 degrees Fahrenheit. Air temperatures ranged from 58 to 61 degrees Fahrenheit. The sites were sampled by Michelle Gilroy (DFG) and Toni Beaumont (WSP/AmeriCorps).

The first site sampled included habitat unit 26, a lateral scour pool - bedrock formed, with log cover, approximately 817 feet upstream of the confluence with the North Fork Noyo River. The site yielded 1 one-plus age class steelhead.

The second site sampled included habitat unit 28, a lateral scour pool - bedrock formed, with log cover, located approximately 870 feet upstream of the creek mouth. The site yielded 1 one-plus age class steelhead.

The third site sampled included habitat unit 30, a lateral scour pool - bedrock formed, with log cover, located approximately 1,017 feet upstream of the creek mouth. The site yielded 1 one-plus age class steelhead.

The fourth site sampled included habitat unit 33, a lateral scour pool - bedrock formed, located approximately 1,043 feet upstream of the creek mouth. The site yielded 1 two-plus age class steelhead.

The fifth site sampled included habitat unit 35, a lateral scour pool - bedrock formed, with log cover, located approximately 1,155 feet upstream of the creek mouth. The site yielded 2 one-

plus age class steelhead.

The sixth site sampled included habitat unit 37, a lateral scour pool - bedrock formed, located approximately 1,252 feet above the creek mouth. The site yielded no fish.

The following chart displays the information yielded from these sites:

Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead YOY	1+	2+
10/19/99	1	817	26	LSBk	1	G4	0	1	0
10/19/99	2	870	28	LSBk	1	G4	0	1	0
10/19/99	3	1,017	30	LSBk	1	G4	0	1	0
10/19/99	4	1,043	33	LSBk	1	G4	0	0	1
10/19/99	5	1,155	35	LSBk	1	G4	0	2	0
10/19/99	6	1,252	37	LSBk	1	G4	0	0	0

DISCUSSION

Marble Gulch is a G4 channel type for the 4,083 feet of stream surveyed. The suitability of G4 channel types for fish habitat improvement structures is as follows: good for bank placed boulders; fair for plunge weirs, opposing wing-deflectors, and log cover; and poor for boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days of August 19 and 24, 1999, ranged from 56 to 58 degrees Fahrenheit. This is a good water temperature range for salmonids. Air temperatures ranged from 64 to 68 degrees Fahrenheit. 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 48% of the total length of this survey, riffles 2%, and pools 44%. The pools are shallow, with 12 of the 67 (17.9%) pools having a maximum depth between two and three 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.

One of the 64 pool tail-outs measured had an embeddedness rating of 1, fourteen had an embeddedness rating of 2, fifteen had an embeddedness rating of 3, and 34 had a rating of 5, which is considered unsuitable for spawning. Four of the 34 were unsuitable for spawning due to the dominant substrate being sand, and twenty-six of the 34 were unsuitable for spawning due to the dominant substrate being gravel too small to be suitable for spawning. The four remaining pool tail-outs valued at 5 were dominated by either boulders or bedrock. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Marble Gulch should be mapped and rated according to their potential sediment yields and control measures should be taken.

Fifty-three of the 64 pool tail-outs measured had gravel as the dominant substrate; however, 49% of that gravel was considered too small to be suitable for spawning.

The mean shelter rating in the flatwater habitats was 17. The mean shelter rating for pools was 28. A pool shelter rating of approximately 100 is desirable. The small amount of cover that now exists is being provided primarily by boulders, bedrock ledges, large woody debris, and undercut banks. Log and root wad complex cover structure in the pool and flatwater habitats would enhance 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.

The mean percent canopy density for the stream was 94%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 74% and 81%, 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.

RECOMMENDATIONS

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

2) 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.

3) Where feasible, design and engineer pool enhancement structures to increase the depths of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase large wood component in the pools and flatwater habitat units. Adding high quality complexity with woody cover is desirable.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

6) 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.

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.

0'	Begin survey at confluence with the North Fork Noyo River. Channel type is a G4. The banks are 10' high and steep.
102'	Log debris accumulation, 5' long x 5' high, containing 10 pieces of large wood, and retaining gravel and fine sediment.
143'	Large root wad on left bank.
261'	Large overhanging root wad on right bank.
359'	Left bank failure, 10' long x 10' high.
400'	Log debris accumulation, 25' wide x 15' long x 5.5' high, with associated right bank failure, retaining fine sediment and gravel. Dry unit beyond log debris accumulation formed by aggraded sediment.
407'	Bank failure, 15' long x 8' high. Log debris accumulation, 10' long x 10' high, containing 10 pieces of large woody debris.
652'	Ephemeral tributary enters.
737'	Small debris accumulation.
817'	Bridge crosses creek. Log debris accumulation, 10' long x 15' high, containing 10 pieces of large wood. Electrofishing site #1.
861'	Right bank failure, 10' high x 10' long.
870'	Electrofishing site #2.

1,017'	Electrofishing site #3. Left bank stabilization project.
1,043'	Electrofishing site #4.
1,155'	Electrofishing site #5. Left bank failure, 15' long x 7' high.
1,192'	Log debris accumulation (LDA), 5' long x 5' high. The majority of LDA is on left bank.
1,252'	Electrofishing site #6.
1,308'	Log debris accumulation, 10' long x 10' high, containing 6 logs. The majority of LDA is on left bank.
1,417'	Log debris accumulation, 20' long x 15' wide, containing approximately 25 pieces of large wood; associated left bank failure, 15' long x 20' high.
1,491'	“FISH 1996" flag.
1,579'	Log debris accumulation, 10' long x 10' wide x 4' high, accumulating fine sediment and gravel.
1,624'	Channel full of logs and small woody debris. Left bank failure/debris torrent, 50' long x 50' high.
1,647'	Four large root wads in channel retaining small woody debris, fine sediment, and gravel.
1,697'	Right bank failure, 15' long x 25' high.
1,732'	Log debris accumulation, containing 20 pieces of large wood and accumulating 5' of gravel and fine sediment.
1,728'	Left and right bank failures.
1,796'	Log debris accumulation, 10' long x 15' wide.
1,825'	Log debris accumulation, 10' long x 15' wide, containing 15 pieces of wood and retaining 4' of fine sediment and gravel.
1,872'	Left bank failure, 20' long.
2,046'	Log debris accumulation containing 10 large logs and retaining gravel and fine

	sediment.
2,079'	Scouring occurring due to three large logs in stream channel. Flags for "Timber Harvest Boundary" on left bank for the next 400'.
2,145'	Ephemeral tributary enters on left bank. Log debris accumulation containing 10 large pieces of wood.
2,271'	Log debris accumulation, containing 25 pieces of small wood.
2,315'	Left bank failure, 16' long x 20' high.
2,342'	Log debris accumulation containing 25 pieces of wood, constricting the channel. Right bank failure, 10' long x 10' high; left bank failure, 25' long x 10' high.
2,419'	Log debris accumulation, 20' long x 10' wide, containing 20 pieces of large wood.
2,523'	Log debris accumulation, 10' long x 10' wide, containing 20 pieces of large wood.
2,543'	Ephemeral tributary enters from left bank.
2,879'	Two foot plunge.
2,824'	Two foot plunge.
2,856'	Log debris accumulation, 5' long x 5' wide.
2,972'	Channel completely covered by overhanging vegetation.
3,113'	"L&W Protection 1995", pink flagging.
3,275'	Log debris accumulation, 10' long x 10' wide. Minimal stream flow.
3,447'	Right bank failure.
3,611'	Log debris accumulation, 10' long x 10' wide, accumulating fine sediment and gravel.
3,739'	One and a half foot plunge.
3,784'	Log debris accumulation, 10' long x 10' wide.
3,872'	Tributary enters from right bank, 58 degrees Fahrenheit water temperature, very low flow.

3,895' Ephemeral tributary enters from right bank.

4,083' End of survey due to dry channel.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8}
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9}
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4}
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5}
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6}
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7}
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	