STREAM INVENTORY REPORT

BRANDON GULCH

INTRODUCTION

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

Brandon Gulch is tributary to the North Fork of the South Fork Noyo River, tributary to the South Fork Noyo River, located in Mendocino County, California (Map 1). Brandon Gulch's legal description at the confluence with the North Fork of the South Fork Noyo River is T18N R16W S19. Its location is 39°24'16" north latitude and 123°40'52" west longitude. Brandon Gulch is a first order stream and has approximately 1.7 miles of blue line stream according to the USGS Noyo Hill 7.5 minute quadrangle. Brandon Gulch drains a watershed of approximately 1.7 square miles. Elevations range from about 160 feet at the mouth of the creek to 1200 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is in the Jackson Demonstration State Forest and is managed by the California Department of Forestry and Fire Protection for timber production.

METHODS

The habitat inventory conducted in Brandon 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. 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 Brandon 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". Brandon 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, 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.

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 Brandon 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 Brandon 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 Brandon 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 Brandon 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 Brandon Gulch fish presence was observed from the stream banks, and two sites were electrofished using one 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 Brandon 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

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- Bank composition by composition type
- Bank vegetation by vegetation type

<u>HABITAT INVENTORY RESULTS</u>

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

The habitat inventory of September 17 and 18, 1996, was conducted by Craig Mesman (CCC) and Mark Dombrowski (WSP/AmeriCorps). The total length of the stream surveyed was 2547 feet.

Flows were not measured on Brandon Gulch.

Brandon Gulch is a B3 channel type for the first 2,083 feet of stream surveyed and a G6 channel for the remaining 464 feet. B3 channels are moderately entrenched, moderate gradient, riffle dominated, with infrequently spaced pools, very stable plane and profile, stable banks, and cobble dominated substrate. G6 channels are entrenched, gully, step-pool streams with a low width to depth ratio and moderate gradient.

Water temperatures taken during the survey period ranged from 48 to 57 degrees Fahrenheit. Air temperatures ranged from 44 to 64 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 15% riffle units, 35% flatwater units, and 39% pool units (Graph 1). Based on total **length** of Level II habitat types there were 7% riffle units, 58% flatwater units, and 28% pool units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were step runs, 28%; mid-channel pools, 25%; and dry, 10% (Graph 3). Based on percent total **length**, step runs made up 53%, mid-channel pools 18%, and dry 6%.

A total of 31 pools were identified (Table 3). Main channel pools were most frequently encountered at 77% and comprised 82% 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. Fifteen of the 31 pools (48%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 31 pool tail-outs measured, 0 had a value of 1 (0.0%); 5 had a value of 2 (16.1%); 8 had a value of 3 (25.8%); 4 had a value of 4 (12.9%); and 14 had a value 5 (45.2%) (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. Pool habitat types had a mean shelter rating of 17, and riffle habitats had a mean shelter rating of 5 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 27. Main channel pools had a mean shelter rating of 10 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Root masses are the dominant cover type in Brandon Gulch. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Brandon Gulch.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in the one low gradient riffle measured (Graph 8). Three step runs were measured, one of those had small cobble as the dominant substrate.

The mean percent canopy density for the stream reach surveyed was 92%. The mean percentages of deciduous and coniferous trees were 28% and 72%, respectively. Graph 9 describes the canopy in Brandon Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 82.5%. The mean percent left bank vegetated was 79.3%. The dominant elements composing the structure of the stream banks consisted of 28.6% bedrock, 3.6% boulder, 43.4% cobble/gravel, and 21.4% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 53.6% of the units surveyed. Additionally, 7.1% of the units surveyed had deciduous trees as the dominant vegetation type, and 10.7% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on september 25, 1996 in Brandon Gulch. The sites were sampled by Mark Dombrowski (WSP/AmeriCorps) and Craig Mesman (CCC).

The first site sampled included habitat units 0020, 0021, and 0022 a mid-channel pool, run, and mid-channel pool approximately 371 feet from the confluence with the North Fork of the South Fork Noyo River. The site yielded 3 steelhead and one Pacific giant salamander.

The second site included habitat units 0070, and 0071 a mid-channel pool and trench pool located approximately 2,237 feet above the creek mouth. The site yielded 3 steelhead.

DISCUSSION

Brandon Gulch is a B3 channel type for the first 2,083 feet of stream surveyed and a G6 for the remaining 464 feet. The suitability of B3 channel types for fish habitat improvement structures is as follows: B3 channels are excellent for low-stage plunge weirs, boulder clusters, bank placed boulder, single and opposing wing deflectors and log cover, and good for medium-stage plunge weirs. G6 channels 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 September 17 and 18, 1996, ranged from 48 to 57 degrees Fahrenheit. Air temperatures ranged from 44 to 64 degrees Fahrenheit. This is a good water temperature range for salmonids. Brandon 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 58% of the total **length** of this survey, riffles 7%, and pools 28%. The pools are relatively shallow with 15 of the 31 (48%) 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.

Twenty of the 31 pool tail-outs measured had embeddedness ratings of 3, 4, or 5 . Zero 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 Brandon 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 17. The shelter rating in the flatwater habitats was lower at 3. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by root masses in all habitat types. Additionally, undercut banks contribute a small amount. Log and root wad cover structure 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 divide territorial units to reduce density related competition.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in the one low gradient riffle measured (Graph 8). Three step runs were measured, one of those had small cobble as the dominant substrate.

The one low gradient riffle and one of three step runs measured had gravel or small cobble as the dominant substrate. The other two step runs had silt/clay and bedrock as the dominant substrate. Quality spawning substrate is lacking in Brandon Gulch.

The mean percent canopy density for the stream was 92%. This is a relatively high percentage of canopy. In general, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 82.5% and 79.3%, 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) Brandon 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 root masses. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

3) 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.

4) 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.

5) Spawning gravel on Brandon Gulch are limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

6) 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 measured from the beginning of the survey reach.

0'	Begin survey at confluence with the North Fork of the South Fork Noyo River. Channel type is B3.
91'	Road on the left bank is approximately 8' above water.
123'	Creek flows through a 3' diameter x 35' long corrugated metal culvert. The upstream end of the culvert is 90% clogged with gravel. Concrete slab bridge crosses creek above culvert.

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371'	First electrofishing site.
753'	Young-of-the-year salmonid observed.
776'	Right bank seeping tributary flowing at less than 0.01 cubic feet per second.
1,603'	Right bank seeping tributary flowing at less than 1 gallon per minute.
2,083'	Channel type changes to G6 channel.
2,237'	Second electrofishing site.
2,547'	End of survey. The stream channel separates into a long side channel. Both channels are intermittent and run through very dense brush. The stream was overgrown in many places with poison oak and stinging nettles. Very few fish have been observed. A 3" fish was observed in an isolated pool approximately 0.33 miles upstream.

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