# STREAM INVENTORY REPORT

# BONANZA GULCH

## INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Bonanza 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 Bonanza 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 chinook salmon, 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

Bonanza Gulch is tributary to the Bear River, tributary to the Pacific Ocean, located in Humboldt County, California (Figure 1). Bonanza Gulch's legal description at the confluence with Bear River is T01N R02W S16. Its location is 40°27′43″ north latitude and 124°17′59″ west longitude. Bonanza Gulch is a first order stream and has approximately 1.5 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. Bonanza Gulch drains a watershed of approximately 1.8 square miles. Elevations range from about 190 feet at the mouth of the creek to 960 feet in the headwater areas. Grass dominates the watershed. The watershed is entirely privately owned and is managed for rangeland.

## METHODS

The habitat inventory conducted in Bonanza 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 the AmeriCorps Watershed Stewards Project (WSP\AmeriCorps) Members who 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 Bonanza 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". Bonanza 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 Bonanza 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 Bonanza 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 Bonanza Gulch, an estimate of the percentage of the habitat unit covered by canopy was made from the end of approximately every third unit in addition to every fully-described unit, giving approximately a 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 Bonanza 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 Bonanza 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 Bonanza 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

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

The habitat inventory of August 14 through August 16, 1996, was conducted by Bill Malinowski (WSP\AmeriCorps) and Craig Mesman (CCC). The total length of the stream surveyed was 5,808 feet with an additional side channel length of 176 feet.

Flows were not measured on Bonanza Gulch due to the flow being too low to measure.

Bonanza Gulch is a B2 channel type for the entire 5,808 feet of stream reach surveyed. B2 channels are moderately entrenched, moderate gradient, riffle dominated channels, with infrequently placed pools, very stable plan and profile, stable banks, and a boulder channel.

Water temperatures taken during the survey period ranged from 56 to 69 degrees Fahrenheit. Air temperatures ranged from 55 to 71 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 5% riffle units, 45% flatwater units, 41% pool units, and 10% were dry (Graph 1). Based on total **length** of Level II habitat types there were 1% riffle units, 69% flatwater units, 12% pool units, and 19% were dry (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were step runs, 45%; mid-channel pools, 36% and low gradient riffles, 5% (Graph 3). Based on percent total **length**, step runs made up 69%, mid-channel pools 10%, and low gradient riffles 1%.

A total of forty-five pools were identified (Table 3). Main channel pools were most frequently encountered at 91% and comprised 88% 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. Six of the 45 pools (13.3%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 45 pool tail-outs measured, 7 had a value of 1 (15.6%); 9 had a value of 2 (20%); 6 had a value of 3 (13.3%); 13 had a value of 4 (28.9%), and 10 had a value of 5 (22.2%) (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. Riffle habitat types had a mean shelter rating of 3, flatwater habitats had a mean shelter rating of 26, and pool habitats had a mean shelter rating of 31 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 90. Main channel pools had a mean shelter rating of 32 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in the two low gradient riffles measured (Graph 8).

The mean percent canopy density for the stream reach surveyed was 84%. The mean percentages of deciduous and coniferous trees were 73% and 27%, respectively. Graph 9 describes the canopy in Bonanza Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 45.6%. The mean percent left bank vegetated was 48.2%. The dominant elements composing the structure of the stream banks consisted of 5.88% bedrock, 8.82% boulder, 79.41% cobble/gravel, and 5.88% sand/silt/clay (Graph 10). Deciduous trees was the dominant vegetation type observed in 44.12%

of the units surveyed and 5.88% had coniferous trees as the dominant vegetation, including downed trees, logs, and root wads (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

One site was electrofished on August 20, 1996, in Bonanza Gulch. The site was sampled by Bill Malinowski and Craig Mesman.

The site sampled included habitat unit 3, a mid-channel pool approximately 583 feet from the confluence with Bear River. This site had an area of 95 sq ft and a volume of 47.5 cu ft. The site yielded 16 steelhead and one Pacific giant salamander.

## DISCUSSION

Bonanza Gulch is a B2 channel type for the entire 5,808 feet of stream surveyed. The suitability of B2 channel types for fish habitat improvement structures is as follows: excellent for low-and medium-stage plunge weirs, single and opposing wing deflectors and bank cover.

The water temperatures recorded on the survey days August 14 through 16, 1996, ranged from 56 to 69 degrees Fahrenheit. Air temperatures ranged from 55 to 71 degrees Fahrenheit. This is a marginal water temperature range for salmonids. Sixty-nine degrees Fahrenheit, if sustained, is near the threshold stress level for 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 69.0% of the total **length** of this survey, riffles 1.0%, and pools 12.0%. The pools are relatively shallow with only 6 of the 45 (13.3%) 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 45 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Only 7 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 Bonanza 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 31. The shelter rating in the flatwater habitats was slightly lower at 26. A pool shelter rating of approximately 100 is desirable. The relatively small 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 structure in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest

from water velocity, and divides territorial units to reduce density related competition.

The two 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 84%. This is a relatively high percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 45.6% and 48.2%, 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) Bonanza Gulch should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are nearing the threshold of 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 number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) 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.

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) There are sections where the stream is being impacted from cattle trampling the riparian zone. Alternatives should be explored with the grazier and developed if possible.

## 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 Bear River. Channel type is a B2.

264' Bridge, 30' wide x 4.4' high x 25' long.

800' Earthen dam, 6' high x 12' wide at the base. Three large steelhead observed in the pool.

1,288' Steelhead observed.

1,340' Left bank erosion, "blue goo", 260' long x 20' high.

1,630' Left bank erosion, "blue goo", 60' long x 12' high.

2,517' Cows in channel.

2,634' Electric fence across channel.

3,170' Erosion on both sides of the channel.

4,300' Five foot plunge over log retaining 5' of sediment.

4,768' Dry tributary, left bank.

4,820' Left bank erosion, 30' long x 40' high.

5,808' End of survey due to a log debris accumulation (LDA), 8' long x 40' wide x 6' high. The unit upstream of the LDA is dry. No fish have been observed since 4,300'.

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 |