# STREAM INVENTORY REPORT

## Antone Creek

## INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Antone Creek. 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 Antone Creek. 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

Antone Creek is tributary to the Bear River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Antone Creek's legal description at the confluence with Bear River is T01N R01W S29. Its location is 40°26'10" north latitude and 120°12'18" west longitude. Antone Creek is a second order stream and has approximately 4.1 miles of blue line stream according to the USGS Taylor Peak 7.5 minute quadrangle. Antone Creek drains a watershed of approximately 1.8 square miles. Elevations range from about 400 feet at the mouth of the creek to 1600 feet in the headwater areas. Mixed hardwood/mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is primarily managed for timber harvest and livestock grazing.

## METHODS

The habitat inventory conducted in Antone Creek 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 Antone Creek 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. Additionally, a recording thermograph was deployed in Antone Creek from June 20 to October 21, 1996 to record temperatures on a 24 hour basis during warm summer months.

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". Antone Creek 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.

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 Antone Creek, 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 Antone Creek, 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 Antone Creek, 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 Antone Creek, 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 Antone Creek 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 Antone Creek 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 28, 1996, was conducted by Craig Mesman (CCC) and Bill Malinowski (WSP/AmeriCorps). The total length of the stream surveyed was 2,838 feet with an additional 637 feet of side channel.

Flow was measured to be 0.84 cfs on August 29, 1996 approximately 800 feet upstream of confluence with Bear River.

Antone Creek is an B3 channel type for the entire 2,838 feet of stream reach surveyed. B3 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and a cobble channel.

Water temperatures taken on the day of the survey ranged from 58 to 61 degrees Fahrenheit. Air temperatures ranged from 58 to 79 degrees Fahrenheit. Water temperatures taken with a recording thermograph deployed from June 20 to October 21, 1996, ranged from 50 to 63 degrees Fahrenheit (Graph 12).

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 47% pool units, 8% riffle units, and 45% flatwater units (Graph 1). Based on total **length** of Level II habitat types there were 20% pool units, 9% riffle units, and 72% flatwater units (Graph 2).

Eight level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were step runs, 41.0%; mid-channel pools, 32.0%; and plunge pools, 13.0% (Graph 3). Based on percent total **length**, step runs made up 69.0%, mid-channel pools 13.0%, and plunge pools 4.0%.

A total of 52 pools were identified (Table 3). Main channel pools were most frequently encountered at 73.0% and comprised 78.0% 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. Eight of the 52 pools (15%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 52 pool tail-outs measured, 6 had a value of 1 (11.5%); 23 had a value of 2 (44.2%); 9 had a value of 3 (17.3%); 3 had a value of 4 (5.7%); and 11 had a value of 5 (21.3%) or were unsuitable for spawning (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 8, flatwater habitats had a mean shelter rating of 32.0, and pool habitat types a mean shelter rating of 54 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 102.0. Main channel pools had a mean shelter rating of 19.0 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulder and white water are the dominant cover types in Antone Creek. Large woody debris is lacking in all habitat types. Graph 7 describes the pool cover in Antone Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in the one low gradient riffle measured. Of the seven step runs measured one had small cobble, four had large cobble and two had boulders as the dominant substrate (Graph 8).

The mean percent canopy density for the stream reach surveyed was 86.0%. The mean percentages of deciduous and coniferous trees were 96.0% and 4.0%, respectively. Graph 9 describes the canopy in Antone Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 56.6%. The mean percent left bank vegetated was 46.1%. The dominant elements composing the structure of the stream banks consisted of 0% bedrock, 31.58% boulder, 68.42% cobble/gravel, and 0% sand/silt/clay (Graph 10). Deciduous trees was the dominant vegetation type observed in 68.42% of the units surveyed including down trees, logs, and root wads (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on July 29, 1996, in Antone Creek. The sites were sampled by Craig Mesman and Bill Malinowski.

The first site sampled included habitat units 10 through 13, a high gradient riffle, mid-channel pool, step run and plunge pool, approximately 184 feet from the confluence with Bear River. The site yielded thirty-six steelhead and one yellow-legged frog.

The second site sampled included habitat units 16 through 18, a mid-channel pool, low gradient riffle, mid-channel pool, approximately 328 feet from the confluence with Bear River. The site yielded two steelhead and one yellow-legged frog.

## DISCUSSION

Antone Creek is a B3 channel type for the entire 2,838 feet of stream surveyed. The suitability of B3 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, bolder clusters, bank placed boulders, single and opposing wing deflectors and log cover, and good for medium-stage plunge weirs.

The water temperatures recorded on the survey day August 28, 1996, ranged from 58 to 61 degrees Fahrenheit. Air temperatures ranged from 58 to 79 degrees Fahrenheit. Further samples from a recording thermograph deployed during the summer of 1996 measured water temperatures ranged from 50° to 63° Fahrenheit. This is a good water temperature range for salmonids.

Flatwater habitat types comprised 72.0% of the total **length** of this survey, riffles 9.0%, and pools 20.0%. The pools are relatively shallow, with only 8 of the 52 (15%) 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-three of the 52 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Only six 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 Antone Creek, 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 moderate with a rating of 54.0. The shelter rating in the flatwater habitats was slightly lower at 32.0. A pool shelter rating of approximately 100 is desirable. The relatively large amount of cover that now exists is being provided primarily by boulders in all habitat types. 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.

The one low gradient riffle, and one of seven step runs measured had small cobble (2.5" to 5") as the dominant substrate. The other six step runs had large cobble (5" to 10") or boulders (> 10") as the dominant substrate. Large cobble and boulder substrates are too large for spawning steelhead and coho salmon. Installing structures that will trap and sort gravel and small cobble is recommended.

The mean percent canopy density for the stream was 86%. This is a 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 low at 56.6% and 46.1%, 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) Antone Creek 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 conifers. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

4) 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.

5) 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.

6) Spawning gravel on Antone Creek are limited to relatively few reaches. Projects should

be designed at suitable sites to trap and sort spawning gravel in order to expand redd site distribution in the stream.

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.

0' Begin survey at confluence with Bear River. Channel type is B3.

1,191' Right bank erosion, 200' long x 80' high.

1,429' Right bank erosion, 200' long x 50' high.

2,096' Log debris accumulation (LDA), 100' wide x 300'long, possible barrier for anadromous salmonids. End of survey for main channel, 6.5 ft. high cascade with no pool below. Continue survey on side channel.

2,661' Log debris accumulation 10' high jump.

2,838' End of survey 400 feet below the forks. No fish observed on side channel survey, high gradient and two LDA's prevent access.

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 |