STREAM INVENTORY REPORT

Bar Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Bar Creek. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Bar Creek. There is no known record of adult spawning surveys having been conducted on Bar Creek.

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

Bar Creek is a tributary to the West Fork of the North Fork Eel River, a tributary to the North Fork Eel River, a tributary to the Eel River, which drains to the Pacific Ocean. It is located in Trinity County, California. Bar Creek's legal description at the confluence with the North Fork Eel River is T02S R07E S31. Its location is 40.2450 degrees north latitude and 123.4325 degrees west longitude. Bar Creek is a second order stream and has approximately 3.2 miles of blue line stream according to the USGS Zenia 7.5 minute quadrangle. Bar Creek drains a watershed of approximately 4.9 square miles. Summer base flow is approximately 0.5 cubic feet per second (cfs) at the mouth, but over ten cfs is not unusual during winter storms. Elevations range from about 2,650 feet at the mouth of the creek to 3,250 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely National Forest and is managed for timber production, rangeland, and dispersed recreation. Vehicle access exists via Alderpoint Road to the community of Zenia. Follow the Ruth/Zenia Road until it crosses Bar Creek near the headwaters. Continue downstream on foot until you reach the mouth of Bar Creek.

METHODS

The habitat inventory conducted in Bar Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1994). The Pacific Coast Fisheries, Wildlife, and Wetlands Restoration Association (PCFWWRA) members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Bar Creek personnel were trained in May, 1996, by Scott Downie and Ruth Goodfield. 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 Bar 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 taken 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". Bar 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.

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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 Bar 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), 76-100% (value 4). Additionally, a rating of "not suitable" (value 5) was assigned to tail-outs deemed not suitable 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 Bar 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*, 1994. Canopy density relates to the amount of stream shaded from the sun. In Bar 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 Bar Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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.

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 Lotus 1,2,3. Graphics developed for Bar 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

The habitat inventory of August 8 to August 14, 1996 was conducted by Greg Mullins and Frank Humphrey (PCFWWRA). The total length of the stream surveyed was 13,916 feet with an additional 735 feet of side channel.

Flow was estimated to be 0.3 cfs during the survey period.

Bar Creek is an F3 channel type for the first 4,941 feet of stream reach surveyed (Reach 1), a B2 channel type for the next 6,308 feet (Reach 2), and an A2 for the final 2,667 feet of stream surveyed (Reach 3). F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates. B2 channel types are moderately entrenched, moderate gradient streams, with stable banks and boulder-dominant substrates. A2 channel types are steep, cascading streams, with high energy/debris transport associated with depositional soils. The dominant substrate is boulders.

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Water temperatures taken during the survey period ranged from 57 to 66 degrees Fahrenheit. Air temperatures ranged from 58 to 86 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 36% riffle units, 35% flatwater units, and 29% pool units (Graph 1). Based on total length of Level II habitat types there were 44% flatwater units, 35% riffle units, and 20% pool units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 24%; pocket water, 17%; and runs, 10% (Graph 3). Based on percent total length, low gradient riffles made up 26%, pocket water 20%, and step runs 16%.

A total of one hundred and fourteen pools were identified (Table 3). Scour pools were most frequently encountered at 60% and comprised 56% 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. Sixty of the 114 pools (53%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 114 pool tail-outs measured, 52 had a value of 1 (46%); 44 had a value of 2 (38%); and 18 had a value of 3 (16%); (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 82, and riffle habitats had a mean shelter rating of 76 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 105. Scour pools had a mean shelter rating of 89 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Boulders were the dominant substrate observed in twelve of the 18 low gradient riffles measured (67%). Large cobble was the next most frequently observed dominant substrate type and occurred in 17% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 82%. The mean percentages of deciduous and coniferous trees were 70% and 30%, respectively. Graph 9 describes the canopy in Bar Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 23%. The mean percent left bank vegetated was 21%. The dominant elements composing the structure of the stream banks consisted of 63% boulders, 28% bedrock, and 8% cobble/gravel (Graph 10). Grass was the dominant vegetation type observed in 36% of the units surveyed. Additionally, 47% of the units surveyed had deciduous trees as the dominant vegetation type, and 2% had coniferous

trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

DISCUSSION

Bar Creek is an F3 channel type for the first 4,941 feet of stream surveyed, a B2 type for the next 6,308 feet, and an A2 for the remaining 2,667 feet. The suitability of F3 channel types for fish habitat improvement structures is described as good for low-stage weirs, single and opposing wing-deflectors, and log cover; and poor for medium-stage weirs. The suitability of B2 channel types for instream structures is excellent for low and medium-stage plunge weirs, single and opposing wing-deflectors, and bank cover. Because they are high energy streams with poor gravel retention capabilities, A2 channel types are generally not considered as suitable for fish habitat improvement structures.

The water temperatures recorded on the survey days August 8 to August 14, 1996 ranged from 57 to 66 degrees Fahrenheit. Air temperatures ranged from 58 to 86 degrees Fahrenheit. This is an acceptable water temperature range for salmonids. Bar Creek seems to have temperatures favorable to salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 46% of the total length of this survey, riffles 36%, and pools 29%. The pools are relatively deep, with 60 of the 114 (53%) pools having a maximum depth greater than two 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 for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

The LDA's in the system are retaining needed gravel. Any necessary modifications to them should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

Eighteen of the 114 pool tail-outs measured had embeddedness ratings of 3 or 4. Fifty-two had embeddedness ratings of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

The mean shelter rating for pools was high with a rating of 82. The shelter rating in the flatwater habitats was slightly lower at 70. 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, bedrock ledges 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 structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

Eighty -four of the 95 low gradient riffles had large cobble or boulders as the dominant substrate. This is generally considered not suitable for spawning salmonids.

The mean percent canopy density for the stream was 82%. 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 low at 23% and 21%, respectively. In areas of stream bank erosion or where bank vegetation is at unacceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Bar 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 boulders. 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.

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.

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.

Position (ft):	Comments:
0'	Start of survey at confluence with Panther Creek and Bar Creek on West Fork North Fork Eel River. Channel type is an F3 for the first 4941' of stream surveyed (Reach 1).
518'	Dry tributary enters from the left bank.

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2429'	Small failure on the right bank.
3687'	Access to the stream on the right bank, from the county road. This is steep, dangerous access.
4666'	Dry tributary on right bank.
4942'	Channel type changes from an F3 to a B2 for the next 6308' of stream surveyed (Reach 2).
6601'	Small tributary enters from right bank; the water temperature was 61 degrees Fahrenheit.
7026'	Dry tributary on left bank.
7701'	Dry tributary on left bank.
7815'	Small tributary enters from right bank; the water temperature was 54 degrees Fahrenheit.
9302'	Dry tributary on left bank.
9340'	Large tributary enters from left bank; it is dry at the mouth, but has flowing water upstream.
11250'	Channel type changes from a B2 to an A2 for the remaining 2667' of stream surveyed (Reach 3).
11622'	Cascade in stream channel with a vertical drop in water elevation of 8'.
12947'	Gulch on left bank is contributing sediment directly to the stream from the county road.
13916'	Channel is too steep for anadromous fish. Native trout were observed from the streambanks above this point by the stream surveyors. End survey below county road.

REFERENCES

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

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