STREAM INVENTORY REPORT

South Fork Bear River

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on South Fork Bear River and an unnamed tributary to South Fork Bear River. 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 South Fork Bear River. 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

South Fork Bear River is a tributary to Bear River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). South Fork Bear River's legal description at the confluence with Bear River is T01N R02W S21. Its location is 40.4614 degrees north latitude and 124.2914 degrees west longitude. South Fork Bear River is a second order stream and has approximately 7.0 miles of blue line stream according to the USGS Cape Town 7.5 minute quadrangle. South Fork Bear River drains a watershed of approximately 12.9 square miles. Elevations range from about 180 feet at the mouth of the creek to 1,400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and grazing rangeland.

METHODS

The habitat inventory conducted in South Fork Bear River 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 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 South Fork Bear River 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 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. Temperature

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 South Fork Bear River from June 20 to October 18, 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". South Fork Bear River 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 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 South Fork Bear River, 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 value of 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 South Fork Bear River, 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 South Fork Bear River, 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 South Fork Bear River, 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 South Fork Bear River 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 South Fork Bear River 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 July 9 through August 9, 1996 was conducted by Bill Malinowski and Andrew McMillan (WSP/AmeriCorps), and Craig Mesman (CCC). The total length of the stream surveyed was 42,647 feet with an additional 7,088 feet of side channel.

South Fork Bear River

Flow was measured approximately 400 feet from the confluence with Bear River, with a Marsh-McBirney Model 2000 flowmeter, at 2.70 cfs on August 13, 1996.

South Fork Bear River is an F3 channel type for the entire 42,647 feet of stream reach surveyed. F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios, and have cobble dominant substrates.

Water temperatures taken during the survey period ranged from 55 to 74 degrees Fahrenheit. Air temperatures ranged from 56 to 79 degrees Fahrenheit. Water temperatures taken with a recording thermograph deployed from June 20 to October 18, 1996 ranged from 50 to 74 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 42% pool units, 40% flatwater units, and 16% riffle units (Graph 1). Based on total length of Level II habitat types there were 65% flatwater units, 20% pool units, and 13% riffle units (Graph 2).

Twenty Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step runs, 35%; mid-channel pools, 31%; and low gradient riffles, 8% (Graph 3). Based on percent total length, step runs made up 61%, mid-channel pools 14%, and low gradient riffles 10%.

A total of two-hundred-eighty-five pools were identified (Table 3). Main channel pools were most frequently encountered at 80% and comprised 78% 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. Forty-eight of the 285 pools (17%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the two hundred and eighty-five pool tail-outs measured, 15 had a value of 1 (5%); 153 had a value of 2 (53%); 57 had a value of 3 (20%); 22 had a value of 4 (8%); and 40 had a value of 5 (14%), which is considered to be not suitable 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 28, and pool habitats had a mean shelter rating of 47 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 55. Scour pools had a mean shelter rating of 47 (Table 3).

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

South Fork Bear River

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in three of the six low gradient riffles measured (50%). Gravel was the next most frequently observed dominant substrate type and occurred in two of the six low gradient riffles measured (33%); (Graph 8).

The mean percent canopy density for the stream reach surveyed was 66%. The mean percentages of deciduous and coniferous trees were 72% and 28%, respectively. Graph 9 describes the canopy in South Fork Bear River.

For the stream reach surveyed, the mean percent right bank vegetated was 65%. The mean percent left bank vegetated was 66%. The dominant elements composing the structure of the stream banks consisted of 56% cobble/gravel, 32% boulders, 6% bedrock, and 3% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 59% of the units surveyed (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on August 20, 1996 in South Fork Bear River. The sites were sampled by Craig Mesman and Bill Malinowski.

The first site sampled included Habitat Units #019 and #020, a low gradient riffle and rootwad enhanced lateral scour pool, approximately 1,097 feet from the confluence with Bear River. The site yielded 41 steelhead/rainbow trout, two sculpin, one stickelback, three suckers and one yellow-legged frog.

The second site sampled included Habitat Units #562 through #570, a plunge pool, step run, mid-channel pool, step run, mid-channel pool, step run, mid-channel pool, step run, plunge pool sequence located approximately 41,991 feet from the confluence with Bear River. The site yielded one steelhead/rainbow trout and one Pacific giant salamander.

DISCUSSION

South Fork Bear River is an F3 channel type for the entire 42,647 feet of stream surveyed. The suitability of F3 channel types for fish habitat improvement structures is as follows: good for placed boulders, and single and opposing wing deflectors, and fair for low-stage weirs, boulder clusters, channel constrictors and log cover and poor for medium stage weirs.

Water temperatures taken during the survey period ranged from 55 to 74 degrees Fahrenheit. Air temperatures ranged from 56 to 79 degrees Fahrenheit. Samples from a recording thermograph deployed during the summer of 1996 measured water temperatures ranging from 50 to 74 degrees Fahrenheit. This is a poor water temperature range for salmonids. Sixty-nine degrees Fahrenheit, if sustained, is near the threshold stress level for salmonids. To obtain a more complete temperature profile, temperature monitoring should be performed for several additional years.

Flatwater habitat types comprised 65% of the total length of this survey, riffles 13%, and pools 20%. The pools are relatively shallow, with only 48 of the 285 (17%) pools having a maximum depth greater than three feet. In general, pool enhancement projects are considered when pools comprise less than 40% of the length of total stream habitat. Installing structures that will increase or deepen pool habitat is recommended.

One-hundred-nineteen of the 285 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Only 15 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. In South Fork Bear River, 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 47. The shelter rating in the flatwater habitats was lower at 22. 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. 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.

Five of the six low gradient riffles measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 66%. This is a relatively moderate 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 65% and 66%, 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) South Fork Bear River should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are above the tolerance range for salmonids, especially in the lower section of the stream. 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 woody cover is desirable and in some areas the material is locally available.

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) Increase the canopy on South Fork Bear River by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels.

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

PROBLEM SITES AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position (ft):	Comments:
0'	Start of survey at confluence with Bear River. Channel type is F3.
1,300'	Bridge.
13,013'	Right bank erosion site measures 20' high.
14,683'	Right bank erosion site measures 60' long x 50' high and is contributing “blue goo” to the channel.
15,000'	Left bank erosion site measures 40' wide x 70' high.
15,170'	Right bank erosion site measures 80' long x 40' high.
15,900'	Right bank erosion site measures 70' long x 40' high.
16,000'	Right bank erosion site measures 100' long x 40 high.
16,700'	Cattle tracks in stream.
18,173'	Steep, unstable right bank erosion site measures 200' long x 70' high and is contributing “blue goo” to the channel.

19,158' Right bank erosion site measures 135' long x 130' high.

19,597' Right bank erosion site measures 90' long x 50' high and is contributing “blue goo” to the channel.

19,942' Treasure Rock Road crosses.

22,000' Right bank gully erosion through "blue goo".

22,384' Major cow trail on right bank.

23,000' Log debris accumulation (LDA) measures 25' long x 35' wide. It is not retaining gravel.

23,456' Right bank erosion site measures 80' long x 20' high and is contributing “blue goo” to the channel.

23,590' Left bank tributary, not accessible to fish.

24,163' Small, steep, dry right bank tributary.

24,365' Steep, dry right bank tributary.

25,417' Left bank tributary. Water temperature was 57 degrees Fahrenheit.

26,000' No canopy cover.

26,525' Small log debris accumulation. It is not retaining gravel.

27.391' Dense foliage and canopy on both banks, completely shaded stream channel.

27,850' LDA measures 20' long x 30' wide. Right bank erosion site measures 200' long x 40' high. Channel is constricted to 12' wide, could be a barrier during low flows.

27,900' Left bank erosion site measures 50' long x 30' high. Sediment stored for 2,400 feet upstream of the erosion site.

30,463' Numerous large saw logs in channel, suitable for structure material.

30,933' Dry right bank tributary.

31,412' Right bank tributary. Water temperature was 57 degrees Fahrenheit.

32,040' LDA. It is not retaining gravel.

South Fork Bear River

34,235' Bridge.

34,270' Right bank tributary contributes 45% of the flow to South Fork Bear River. The water temperature was 57 degrees Fahrenheit (see subsection report).

34,490' Right bank tributary.

34,535' LDA measures 10' high x 25' wide. Steelhead observed above the LDA.

35,444' Right bank tributary.

35,670' Steep, dry right bank wash.

36,068' Tree across stream with 4.5' diameter is creating a 7' high plunge. It is not retaining gravel.

36,128' Six foot diameter redwood tree across the channel creating 6' high plunge. It is not retaining gravel.

36,148' LDA.

36,785' Log across channel creating 4' high plunge.

37,120' LDA measures 20' long x 15' wide.

37,590' LDA with 3' high plunge.

37,750' Left bank tributary. The water temperature was 57 degrees Fahrenheit.

37,914' LDA measures 25'long x 20' wide.

38,431' Right bank tributary.

38,744' Left bank tributary.

39,320' 8" long steelhead observed.

39,400' 12" long steelhead observed.

39,450' 5" long steelhead observed.

40,153' Old road on right bank.

40,683' Dry right bank tributary.

41,859' Dry right bank tributary.

41,127' Area of dense underbrush.

41,377' Log debris accumulation measures 10' wide x 15' long.

41,458' Old road on right bank.

42,784' End of survey. Marginal habitat, very little gravel in channel, extremely steep gradient, substrate consists of large cobble and boulders with no pools. Road crossing with a culvert, 1,470 feet above the end of the survey.

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

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