STREAM INVENTORY REPORT

West Fork Bridge Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on West Fork Bridge 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 West Fork Bridge Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. There is no known record of adult spawning surveys having been conducted on West Fork Bridge Creek.

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

West Fork Bridge Creek is tributary to Bridge Creek, tributary to the Mattole River, located in Humboldt County, California. West Fork Bridge Creek's legal description at the confluence with Bridge Creek is T05S RO2E S00. Its location is 40°02'41" North latitude and 123°59'32" West longitude. West Fork Bridge Creek is a second order stream and has approximately 3.0 miles of blue line stream according to the USGS Briceland and Shelter Cove 7.5 minute quadrangles. West Fork Bridge Creek drains a watershed of approximately 2.6 square miles. Summer base flow is approximately 0.4 cubic feet per second (cfs) at the mouth, but over 15 cfs is not unusual during winter storms. Elevations range from about 1,040 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily Bureau of Land Management property and is managed for recreation. Vehicle access exists via the Briceland/Shelter Cove Road from Redway west to Whitethorn Junction. Continue 1.7 miles west on the Shelter Cove Road and turn left on the unimproved road to the south. This road parallels the creek and ends near the mouth of the stream.

METHODS

The habitat inventory conducted in West Fork Bridge 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). West Fork Bridge Creek personnel were trained in May, 1996, by Scott Downie and Ruth Goodfield. A two person team conducted this inventory.

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 West Fork Bridge 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 (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". West Fork Bridge 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 West Fork Bridge 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 5 or "not suitable" (NS) 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 West Fork Bridge 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 West Fork Bridge 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 West Fork Bridge 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.

West Fork Bridge Creek

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In West Fork Bridge Creek fish presence was observed from the stream banks. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes: 25.4, 12.5, 4.7, 2.37, and 0.85 mm (Valentine, 1995).

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 West Fork Bridge 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

West Fork Bridge Creek

- 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 June 24, 25, and 26, 1996, was conducted by Dave Smith and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 7,386 feet with no additional feet of side channel.

Flow was estimated to be 0.9 cfs during the survey period.

West Fork Bridge Creek is a B4 channel type for the first 4,667 feet of stream surveyed and a C4 type for the remaining 2,719 of the survey. B4 channels are moderately entrenched, meandering, riffle dominated channels on moderate gradients with stable banks and gravel-dominant substrates. C4 channel types are low gradient,meandering, alluvial channels with well defined floodplains and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 51 to 56 degrees Fahrenheit. Air temperatures ranged from 49 to 65 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 37% pool units, 32% flatwater units, 30% riffle units and 1% dry units (Graph 1). Based on total **length** of Level II habitat types there were 53% flatwater units, 25% riffle units, 20% pool units and 1% dry units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffles, 30%; step runs, 25%; and mid-channel pools, 25% (Graph 3). Based on percent total **length**, step runs made up 46%, low gradient riffles 25%, and mid-channel pools 13%.

A total of fifty-six pools were identified (Table 3). Mid-channel pools were most frequently encountered at 66% and comprised 63.4% 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. Twenty-four of the 56 pools (43%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 56 pool tail-outs measured, none had a value of 1; none had a value of 2; 39 had a value of 3 (70%); none had a value of 4; and 17 had a value of 5 and were not suitable for sampling (30%). (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 42, and flatwater habitats had a mean shelter rating of 40 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 64. Main channel pools had a mean shelter rating of 30 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in West Fork Bridge Creek and are extensive. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in West Fork Bridge Creek.
Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 2 of the 3 low gradient riffles measured (67%). Small cobble was the next most frequently observed dominant substrate type and occurred in 33% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 77%. The mean percentages of deciduous and coniferous trees were 58% and 42%, respectively (Graph 9).

For the stream reach surveyed, the mean percent right bank vegetated was 79%. The mean percent left bank vegetated was 78%. The dominant elements composing the structure of the stream banks consisted of 100% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 16% of the units surveyed. Additionally, 29% of the units surveyed had deciduous trees as the dominant vegetation type, and 45% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

West Fork Bridge Creek

Young-of-the-year (YOY) salmonids were observed from the streambank in West Fork Bridge Creek by the 1996 survey crew.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on West Fork Bridge Creek.

DISCUSSION

West Fork Bridge Creek is a B4 channel type for the first 4,667 feet of stream surveyed and a C4 for the remaining 2,719 feet. The suitability of B4 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, boulder clusters, and log cover structures. The suitability of C4 channel types for fish habitat improvement structures is good for bank-placed boulders and log cover structures, and fair for low-stage weirs and channel constrictors.

The water temperatures recorded on the survey days June 24 -26, 1996, ranged from 51 to 56 degrees Fahrenheit. Air temperatures ranged from 49 to 65 degrees Fahrenheit. This is a good water temperature range 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 53% of the total **length** of this survey, riffles 25%, and pools 20%. The pools are of relatively moderate depth, with 24 of the 56 (42.9%) 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 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.

All of the 56 pool tail-outs measured had embeddedness ratings of 3. None 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 salmonids. In West Fork Bridge 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 low with a rating of 42. The shelter rating in the flatwater habitats was slightly lower at 40. 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, bubble curtain contributes 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

All of the three 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 77%. 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 79% and 78%, 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) West Fork Bridge Creek should be managed as an anadromous, natural production stream.

2) 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.

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 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, like the site at 1,171', should then be treated to reduce the amount of fine sediments entering the stream.

6) 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.

7) There are several log debris accumulations present on West Fork Bridge Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

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.

0' Begin survey at confluence with Bridge Creek. Channel type is B4 for the first 4667' of stream surveyed.

795' Spring on left bank (LB). Temperature is 52°F.

West Fork Bridge Creek

1096'	Fairly extensive large debris accumulation (LDA) amongst boulders in stream channel. LDA is retaining fines.
1171'	South Branch of the West Fork enters from the right bank (RB). Dirt road fords stream. Erosion on the left bank is impacting the road along the stream.
2011'	Rip-rap on LB - is working effectively.
2829'	Spring on RB - 51°F. Spring on LB - 51°F.
3719'	Several pieces of large woody debris on this site - potential project wood.
4080'	Spring on LB - 54°F.
4323'	Spring on RB.
4667'	Channel type changes to a C4 channel for the remainder of the survey.
4784'	Spring on RB - 52°F.
4968'	LDA - retaining gravel and fines.
5092'	LDA - retaining gravel and fines. Four-foot gain in elevation of channel substrate behind the LDA.
5512'	Spring on LB.
6023'	LB erosion, approximately 30'. LDA in stream, retaining gravel and fines.
6629'	Spring on RB.
7386'	Stream channel narrows; gradient steepens; diminished flow. End of 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.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, 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