

STREAM INVENTORY REPORT

North Fork Bear Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on North Fork Bear 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 North Fork Bear 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 North Fork Bear 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

North Fork Bear Creek is tributary to Bear Creek, tributary to the Mattole River, located in Humboldt County, California. North Fork Bear Creek's legal description at the confluence with Bear Creek is T04S R01E S09. Its location is 40°07'35" North latitude and 124°03'41" West longitude. North Fork Bear Creek is a second order stream and has approximately 4.4 miles of blue line stream according to the USGS Ettersburg 7.5 minute quadrangle. North Fork Bear Creek drains a watershed of approximately 5.3 square miles. Summer base flow is approximately 4.5 cubic feet per second (cfs) at the mouth, but over 30 cfs is not unusual during winter storms. Elevations range from about 940 feet at the mouth of the creek to 2,300 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily owned by the Bureau of Land Management and is managed for recreation. Vehicle access exists via Wilder Ridge Road from Ettersburg. Go west to Horse Mountain Road. Drive south on Horse Mountain Road. The road crosses the stream, then three tributaries. Park at the third tributary. Walk downstream for approximately 500 feet to the mouth of North Fork Bear Creek.

METHODS

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The habitat inventory conducted in North Fork Bear 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). North Fork Bear 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 North Fork Bear 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

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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". North Fork Bear 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 North Fork Bear 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" (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

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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 North Fork Bear 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In North Fork Bear 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 North Fork Bear 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.

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BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In North Fork Bear Creek fish presence was observed from the stream banks, and one site was electrofished using one Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard 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 North Fork Bear 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

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- 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 July 8, 9, 10, and 11, 1996, was conducted by Dale Melton (WSP\AmeriCorps) and Frank Humphrey (PCFWWRA). The total length of the stream surveyed was 17,774 feet with an additional 553 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 5.9 cfs on July 8, 1996.

North Fork Bear Creek is a B4 channel type for the first 13,152 feet and an A3 channel type for the remaining 4,622 feet of stream reach surveyed. B4 channels are entrenched, meandering, riffle/pool channels on moderate gradients with high width/depth ratios and gravel-dominant substrates. A3 channels are steep, narrow streams with high energy/debris transport and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 58 to 69 degrees Fahrenheit. Air temperatures ranged from 60 to 83 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 40% riffle units, 38% flatwater units, and 22% pool units (Graph 1). Based on total **length** of Level II habitat types there were 46% flatwater units, 39% riffle units, and 15% pool units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were high gradient riffles, 25%; step runs, 22%; and mid-channel pools, 13% (Graph 3). Based on percent total **length**, step runs made up 32%, high gradient riffles 21%, and low gradient riffles 14%.

A total of seventy-one pools were identified (Table 3). Main channel pools were most frequently encountered at 70% and

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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. Sixty-six of the 71 pools (93%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 71 pool tail-outs measured, 20 had a value of 1 (28%); 22 had a value of 2 (31%); 18 had a value of 3 (25%); and none had a value of 4 (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 49, and riffle habitats had a mean shelter rating of 20 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 59. Scour pools had a mean shelter rating of 50 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in four of the nine low gradient riffles measured (44%). Large cobble was the next most frequently observed dominant substrate type and occurred in 22% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 59%. The mean percentages of deciduous and coniferous trees were 91% and 9%, respectively. Graph 9 describes the canopy in North Fork Bear Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 74%. The mean percent left bank vegetated was 63%. The dominant elements composing the structure of the stream banks consisted of 12.5% bedrock, 40.8% boulder, 44.2% cobble/gravel, and 2.5% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 6% of the units surveyed. Additionally, 74.2% of the units surveyed had deciduous trees as the dominant vegetation type, and 3.3% had coniferous trees as

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

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on July 8, 1996, in North Fork Bear Creek. The sites were sampled by Ruth Goodfield (DFG) and Kelley Garrett (WSP/AmeriCorps).

The site sampled included habitat units 0165-0166, a riffle/run sequence approximately 10,820 feet from the confluence with Bear Creek. This site had an area of 750 sq ft and a volume of 750 cu ft. The site yielded five young-of-the-year (YOY) steelhead rainbow trout.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on North Fork Bear Creek.

DISCUSSION

North Fork Bear Creek is a B4 channel type for the first 13,152 feet of stream surveyed and an A3 for the remaining 4,622 feet. The suitability of B4 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, boulder clusters, and bank-placed boulders, single and opposing wing-deflectors, and log cover; and good for medium-stage plunge weirs. The suitability of A3 channel types for fish habitat improvement structures is good for bank-placed boulders; fair for low-stage weirs and opposing wing-deflectors; and poor for medium-stage weirs, boulder clusters, and bank cover.

The water temperatures recorded on the survey days July 8 - 11, 1996, ranged from 58 to 69 degrees Fahrenheit. Air temperatures ranged from 60 to 83 degrees Fahrenheit. This is a fair water temperature range for salmonids. However, 69° F, 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 46% of the total **length** of this survey, riffles 39%, and pools 15%. The pools are relatively

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deep, with 66 of the 71 (93%) 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.

Eighteen of the 71 pool tail-outs measured had embeddedness ratings of 3 or 4. Only 20 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 North Fork Bear 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 49. The shelter rating in the flatwater habitats was slightly lower at 19. 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, undercut banks 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Six of the nine 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 59%. This is a relatively moderate percentage of canopy. In general, re-vegetation projects are considered when canopy density is less

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than 80%.

The percentage of right and left bank covered with vegetation was moderate at 74% and 63%, 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) North Fork Bear Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within the tolerable 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) Increase the canopy on North Fork Bear Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.
- 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) There are several log debris accumulations present on North Fork Bear 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.
- 6) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 10170', should then be treated to reduce the amount of fine sediments

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entering the stream.

- 7) 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.

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.

- 0' Begin survey at confluence with Bear Creek. Channel type is a B4 for the first 13152' of stream surveyed.
- 437' Young-of-the-year (YOY) and 1+ salmonids observed from the stream banks by the surveyors.
- 1012' Steep tributary enters stream from the right bank (RB). Temperature is 60°F.
- 3750' Steep tributary on RB - 59°F.
- 6412' Slope failure on left bank (LB), approximately 185' long x 30' high. Contributing sediment directly to the stream channel.
- 6412' Large debris accumulation (LDA) in stream channel; probably a factor in the LB failure. Not a barrier to migrating fish.
- 6412' Tributary enters from RB - 58°F.
- 7744' LDA in stream channel, approximately 20' long x 40' wide x 10' high. Retaining sediment for a distance of about 150' upstream. Not a barrier to salmonids.
- 7981' Slope failure on LB, 120' high x 60' wide. Contributing sediment to the stream channel.
- 8122' Tributary enters from LB - 55°F.

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- 8352' LDA in stream channel, approximately 30' long x 15' wide x 10' high. Not a barrier to salmonids.
- 9356' Spring on RB.
- 10170' Failure on RB; 150' long x 150' high. Contributing sediment to channel.
- 10648' Tributary enters from LB - 61°F.
- 10713' Horse Mountain Road bridge crosses stream.
- 10820' LDA in stream channel; approximately 10' long x 15' wide x 10' high. Not a barrier to salmonids.
- 10820' Dry tributary enters from LB.
- 10820' Bioinventory site. Five YOY steelhead rainbow trout were identified.
- 11140' Failure on LB; approximately 50' long x 100' high. Contributing material to stream.
- 12380' Tributary enters from RB - 57°F.
- 13152' LDA in stream channel; approximately 30' long x 15' wide x 10' high. Not a barrier to salmonids.
- 13152' Channel type changes from a B4 to an A3 for the remaining 4622' of stream surveyed.
- 13502' Spring on RB.
- 14582' Dry tributary on LB.
- 14911' Possible salmonid barrier - 5' vertical drop in water elevation; no jumping pool downstream.
- 15285' YOY salmonids observed from streambanks.
- 15767' LDA in stream channel; 15' long x 40' wide x 10' high. Not a barrier to salmon.
- 15907' Dry tributary on RB.
- 16087' Spring on LB. Failure on RB; 40' long x 60' high.

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- 17552' Tributary on RB - 58°F.
- 17774' Surveyors are observing fewer fish; flow has decreased by half of original 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]	6.52