STREAM INVENTORY REPORT

EAST BRANCH NORTH FORK BIG RIVER

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on East Branch North Fork Big 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 East Branch North Fork Big 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

East Branch North Fork Big River is tributary to the North Fork Big River, tributary to the Big River, tributary to the Pacific Ocean located in Mendocino County, California (Map 1). East Branch North Fork Big River's legal description at the confluence with North Fork Big River is T17N R15W S20. Its location is 39°19′13″ north latitude and 123°33′13″ west longitude. East Branch North Fork Big River is a 1st order stream and has approximately 7.0 miles of blue line stream according to the USGS Comptche 7.5 minute quadrangle. East Branch North Fork Big River drains a watershed of approximately 7.3 square miles. Elevations range from about 230 feet at the mouth of the creek to 1440 feet in the headwater areas. Redwood and mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via State Highway 20.

METHODS

The habitat inventory conducted in East Branch North Fork Big River follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). 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. 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, depth of pool tail crest, dominant substrate composing the pool tail crest, and embeddedness. 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 East Branch North Fork Big 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 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.

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". East Branch North Fork Big 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, 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. 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 East Branch North Fork Big 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) 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 East Branch North Fork Big 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. In addition the dominant substrate composing the pool tail outs is recorded for each pool.

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 East Branch North Fork Big 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 East Branch North Fork Big 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 East Branch North Fork Big River fish presence was observed from the stream banks, and **five** 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 East Branch North Fork Big 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 the pool tail-outs
- 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 25, 1998 through August 20, 1998, was conducted by Paul Retherford, Lisa Campbell and Tristan Behm (WSP\AmeriCorps) and Andrew MacMillan (CCC). The total length of the stream surveyed was 39,034 feet with an additional 447 feet of side channel.

Flow was measured to be 3.2 cfs on June 23, 1998 using a Marsh McBirney flow meter.

East Branch North Fork Big River is an B4 channel type for the first 34,792 feet of stream reach surveyed. B4 channels are moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools; very stable plan and profile; stable banks. It then changes to an A4 channel type for the next 4,242 feet of stream reach surveyed. A4 channels are steep, narrow, cascading, step-pool streams; high energy/debris transport associated with depositional soils.

Water temperatures taken during the survey period ranged from 56 to 65 degrees Fahrenheit. Air temperatures ranged from 58 to 81 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 32% riffle units, 38% flatwater units, and 30% pool units (Graph 1). Based on total **length** of Level II habitat types there were 27% riffle units, 53% flatwater units, and 19% 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, 31%; runs, 24%; and mid-channel pools, 16% (Graph 3). Based on percent total **length**, step runs made up 30%, low gradient riffles made up 26%, and runs made up 24%.

A total of 218 pools were identified (Table 3). Main channel pools were most frequently encountered at 56% 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. One hundred sixty-six of the 218 pools (76%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 218 pool tail-outs measured, 12 had a value of 1 (5.5%); 102 had a value of 2 (46.8%); 89 had a value of 3 (40.8%); 12 had a value of 4 (5.5%) and 3 had a value of 5 (1.4%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning. In East Branch North Fork Big River, 2 of the 3 pool tail-outs which were valued at 5 had silt/clay/sand or gravel too small to be suitable for spawning as the substrate.

The other tail-out was unsuitable for spawning due to the tail-out being comprised of large cobble, boulder, bedrock or wood.

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 16, flatwater habitat types had a mean shelter rating of 28, and pool habitats had a mean shelter rating of 87 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 120. Main channel pools had a mean shelter rating of 100 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks is the dominant cover type in East Branch North Fork Big River. Graph 7 describes the pool cover in East Branch North Fork Big River.

Table 6 summarizes the dominant substrate by habitat type. Of the twenty low gradient riffles fully measured, 18 had gravel as the dominant substrate. Gravel was the dominant substrate observed in 188 of the 218 pool tail-outs measured (86%). Small cobble was the next most frequently observed dominant substrate type and occurred in 12% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 74%. The mean percentages of deciduous and coniferous trees were 33% and 67%, respectively. Graph 9 describes the canopy in East Branch North Fork Big River.

For the stream reach surveyed, the mean percent right bank vegetated was 60%. The mean percent left bank vegetated was 63%. The dominant elements composing the structure of the stream banks consisted of 10% bedrock, 4% boulder, 38% cobble/gravel, and 48% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 43% of the units surveyed. Additionally, 24% of the units surveyed had coniferous trees as the dominant vegetation type, and 15% had no vegetation as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Five sites were electrofished on July 15, 1998 and August 20, 1998, in East Branch North Fork Big River. The sites were sampled by Paul Retherford, Tristan Behm and Andrew MacMillan.

The first site sampled included habitat units 56-58, a run, riffle, pool sequence approximately 3,913 feet from the confluence with North Fork Big River. This site had an area of 9,374 sq ft and a volume of 14,061 cu ft. The site yielded 12 steelhead and 3 yellow-legged frogs.

The second site included habitat units 115-117, a run, riffle, pool sequence located approximately 6,965 feet above the creek mouth. This site had an area of 175 sq ft and a volume of 315 cu ft. The site yielded 3 steelhead and 2 salamanders.

The third site sampled included habitat units 188-190, a lateral scour pool, riffle, lateral scour pool sequence located approximately 10,602 feet above the creek mouth. The site had an area of

3,219 sq ft and a volume of 3,862 cu ft. The site yielded 11 steelhead and 1 sculpin.

The fourth site sampled included habitat units 390-391, a step run and mid-channel pool located approximately 20,181 feet above the creek mouth. The site had an area of 4,563 sq ft and a volume of 6,845 cu ft. The site yielded 8 steelhead, 1 yellow-legged frog and 1 salamander.

The fifth site sampled included habitat units 498-499, a pool and step run sequence located approximately 28,072 feet above the creek mouth. The site had an area of 3,570 sq ft and a volume of 5,355 cu ft. The site yielded 20 steelhead, 4 salamanders, and 1 yellow-legged frog.

DISCUSSION

East Branch North Fork Big River is a B4 channel type for the first 34,792 feet of stream surveyed and a A4 for the remaining 4,242 feet. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover. A4 channel types are good for bank-placed boulders; fair for weirs, opposing wing-deflectors, and log cover; and poor for boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days June 23 to August 20, ranged from 56 to 65 degrees Fahrenheit. Air temperatures ranged from 58 to 81 degrees Fahrenheit. This is a fair 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 27%, and pools 19%. The pools are relatively deep, with 166 of the 218 (76%) 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 pool habitat is recommended.

Twelve of the 218 pool tail-outs measured had an embeddedness rating of 1. Two-hundred-three of the pool tail-outs had embeddedness ratings of 2, 3 or 4. Three of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. Two of the three were unsuitable for spawning due to the dominant substrate being silt/sand/clay or gravel being too small to be suitable. 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 East Branch North Fork Big 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 87. The shelter rating in the flatwater habitats was 28. A pool shelter rating of approximately 100 is desirable. The cover that now exists is being

provided primarily by undercut banks and large woody debris 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.

Two-hundred-fourteen of the 218 pool tail-outs 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 74%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 60% 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) East Branch North Fork Big River should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are nearing threshold stress levels 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, and depth 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. Adding high quality complexity with woody cover is desirable.

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) 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) Increase the canopy on East Branch North Fork Big River 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.

COMMENTS 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 North Fork Big River. Channel type is a B4.
226'	Log debris accumulation, 15' long x 25' wide x 6' high; retaining 3' of gravel.
366'	Right bank erosion, 20' long x 20' high. Flow taken.
508'	Right bank erosion, 25' long x 100' high, contributing fines and large woody debris.
612'	Left bank erosion, 100' long x 18' high.
1,541'	Left bank tributary; <0.01 cfs, 54 degrees F, no fish observed for 100'.
1,773'	Right bank erosion, 25' long x 30' high.
1,823'	Right bank erosion, 75' long x 30' high.
2,550'	Left bank erosion, 60' long x 100' high; large woody debris and boulder recruitment.
3,159'	Right bank erosion, 40' long x 30' high.
3,531'	Right bank erosion, 30' long x 10' high.
3,633'	Left bank erosion, 50' long x 100' high. Large woody debris recruitment from bank failure. Electrofishing site #1.
4,618'	Right bank tributary; <0.01 cfs, 56 degrees F, no fish observed for 100'.
5,189'	Right bank erosion, 30' long x 100' high.
5,527'	Left bank tributary; dry, not accessible to fish.
5,620'	Right bank erosion, 40' long x 30' high.
6,330'	Left bank road approximately 30' up bank running parallel.

6,460'	Left bank tributary; <0.01 cfs, 55 degrees F, no fish seen for 100'.
6,505'	Left bank and right bank roads approximately 30' up banks, running parallel.
6,632'	Right bank erosion, 20' long x 40' high.
6,775'	Wooden bridge, 26' long x 50' wide x 7' high.
6,815'	Left bank tributary; <0.01 cfs, 56 degrees F, no fish observed.
6,965'	Water truck access road; substantial amount of fines in this area. Electrofishing site #2.
8,564'	Right bank tributary; <0.01 cfs, 54 degrees F, no fish observed for 100'.
8,897'	Right bank erosion, 25' long x 20' high.
10,286'	Left bank erosion, 15' long x 20' high.
10,602'	Electrofishing site #3.
10,694'	Left bank erosion, 20' long x 30' high; recruiting fines.
10,951'	Right bank tributary; <0.01 cfs, 56 degrees F, fish seen for first 100' then a metal corrugated culvert causes a barrier; high gradient, no baffles.
11,166'	Right bank erosion, 30' long x 8' high.
12,368'	Log debris accumulation, 15' long x 20' wide x 8' high; retaining 4' gravel.
12,651'	Left bank erosion, 40' long x 25' high.
12,776'	Log debris accumulation, 8' long x 30' wide x 4' high; retaining 2' gravel.
12,789'	Right bank tributary; <0.01 cfs, 54 degrees F, no fish observed.
12,946'	Right bank seep; <0.01 cfs, 54 degrees F, no fish observed.
13,855'	Old log bridge, 16' long x 30' wide x 6' high; no longer in use.
16,174'	Left bank erosion, 30' long x 15' high.
16,843'	Left bank erosion, 25' long x 5' high.

18,186'	Left bank tributary; <0.01 cfs, 54 degrees F.
19,318'	Right bank tributary; <0.01 cfs, 54 degrees F, not accessible to fish.
20,191'	Flatcar bridge, 15' long x 50' wide x 8' high.
20,241'	Electrofishing site #4.
22,566'	Right bank tributary; 56 degrees F, <0.2 cfs, no fish seen for 100'.
22,801'	Left bank erosion, 15' long x 25' high.
24,152'	Left bank erosion, 10' long x 10' high; contributing large woody debris.
24,566'	Left bank failure, 25' long x 25' high.
26,306'	Right bank tributary; <0.05 cfs, 59 degrees F, no fish seen for 250'. Fifty feet up tributary there is a metal corrugated culvert with a 6' jump and 2' foot deep jump pool. Culvert has no baffles. Fish habitat above the culvert appears to be good.
26,868'	Log debris accumulation, 6' long x 25' wide x 6' high; retaining 4' gravel, passable.
28,072'	Electrofishing site #5.
28,714'	Left bank erosion, 50' long x 12' high.
30,465'	Left bank erosion, 10' long x 100' high.
30,696'	Log debris accumulation, 12' long x 25' wide x 15' high; retaining 3' gravel, passable.
32,307'	Log debris accumulation, 5' long x 35' wide x 6' high; retaining 6' gravel, passable.
33,524'	Left bank tributary; <0.01 cfs, 59 degrees F, no fish observed, not accessible to fish.
33,800'	Log debris accumulation, 5' long x 25' wide x 10' high; retaining 9' gravel.
34,430'	Log debris accumulation, 10' long x 30' wide x 6' high; retaining 5' gravel, passable.
34,498'	Right bank tributary; <0.01 cfs, 60 degrees F, not accessible to fish.

34,792' Channel type changes to an A4.

35,565' Right bank tributary; <0.01 cfs, 60 degrees F, no fish observed.

36,938' Log debris accumulation, 5' long x 15' wide x 6' high; retaining 5' gravel, passable.

37,626' Salmonids and amphibians observed.

37,838' Log debris accumulation, 30' long x 25' wide x 16' high; retaining 7' gravel, passable.

35,640' Right bank tributary; <0.01 cfs, 60 degrees F, no fish observed.

39,034' End of survey. The water flow stops and the channel dries up. The stream becomes extremely steep. The survey continued up 500' beyond the end of survey and no water was observed.

REFERENCES

Flosi, Gary and Scott Downie, James Hopelain, Michael Bird, Robert Coey and Barry Collins. 1998. California salmonid stream habitat restoration manual, 3rd edition. California Department of Fish and Game, 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