STREAM INVENTORY REPORT

North Fork Big River

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on 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 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

North Fork Big River is tributary to Big River, tributary to the located in Mendocino County, California (Map 1). North Fork Big River's legal description at the confluence with Big River is T17N R15W S29. Its location is 39E18N03O north latitude and 123E33N02O west longitude. North Fork Big River is a third order stream and has approximate 64.5 miles of blue line stream according to the USGS Comptche 7.5 minute quadrangle. North Fork Big River drains a watershed of approximately 42.1 square miles. Elevations range from about 180 feet at the mouth of the creek to 2,700 feet in the headwater areas. The watershed is dominantly mixed conifer forest. The watershed is primarily within the Jackson Demonstration State Forest and is managed for timber production, however the lower reach is contained within private ownership. Vehicle access exists via Highway 20 to Union Lumber Company Truck Road.

METHODS

The habitat inventory conducted in North Fork Big 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, depth of the 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 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 instances the 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. 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 (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 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 which provide salmonids with 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 rates are 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 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 a stream shaded from the sun. In 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 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 North Fork Big 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 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 August 21, 1997 through September 3, 1997, was conducted by Craig Mesman and Tara Cooper (CCC). The total length of the stream surveyed was 63,250 feet with an additional 1,135 feet of side channel.

Three flows were measured using a Marsh-McBirney Model 2000 flowmeter. The first flow was measured 200 feet downstream from the confluence with the first unnamed right bank tributary at 3.84 cfs on August 27, 1997. The second flow was measured approximately 200 feet downstream from the confluence with Chamberlain Creek at 2.60 cfs on September 4, 1997. A third flow was measured approximately 200 feet downstream from the confluence with James Creek 1.37 cfs on September 4,

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1997.

North Fork Big River is an F4 channel type for the entire 63,250 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 60 to 71 degrees Fahrenheit. Air temperatures ranged from 53 to 81 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 28% riffle units, 29% flatwater units, and 43% pool units (Graph 1). Based on total length of Level II habitat types there were 21% riffle units, 38% flatwater units, and 40% pool units (Graph 2).

Sixteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 28%; lateral scour pools - bedrock formed, 18%; and mid-channel pools, 19% (Graph 3). Based on percent total length, low gradient riffles made up 21%, lateral scour pools - bedrock formed 18%, and mid-channel pools 19%.

A total of 324 pools were identified (Table 3). Scour pools were most frequently encountered at 49% and comprised 49% 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-fifty-three of the 324 pools (47%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 324 pool tail-outs measured, 50 had a value of 1 (15%); 160 had a value of 2 (49%); 97 had a value of 3 (30%); none had a value of 4 (0%); and 17 had a value of 5 (5%) (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 North Fork Big River, 8 of the 17 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-outs were unsuitable for spawning due to the tail-outs 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 27, flatwater habitat types had a mean shelter rating of 16, and pool habitats had a mean shelter rating of 19 (Table 1). Of the pool types, the main channel and scour pools had the highest mean shelter rating at 20. Backwater pools had a mean shelter rating of 14 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in

North Fork Big River. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in North Fork Big River.

Table 6 summarizes the dominant substrate by habitat type. In 11 of the 23 low gradient riffles fully measured, gravel was the dominant substrate. Small cobble was the dominant substrate in 7 of the 23 low gradient riffles measured. Gravel was the dominant substrate observed in 286 of the 324 pool tail-outs measured (88%). Small cobble was the next most frequently observed dominant substrate type and occurred in 9% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 67%. The mean percentages of deciduous and coniferous trees were 11% and 89%, respectively. Graph 9 describes the canopy in North Fork Big River.

For the stream reach surveyed, the mean percent right bank vegetated was 79%. The mean percent left bank vegetated was 80.4%. The dominant elements composing the structure of the stream banks consisted of 24.5% bedrock, 7.5% boulder, 59% cobble/gravel, and 9% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 55.5% of the units surveyed. Additionally, 19.5% of the units surveyed had deciduous trees as the dominant vegetation type, and 11.5% had brush as the dominant vegetation, (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished, one on August 27, 1997 and one on September 16, 1997 in North Fork Big River. The sites were sampled by Craig Mesman and Tara Cooper.

The first site sampled was habitat unit #117, a mid-channel pool approximately 14,138 feet from the confluence with Big River. The site yielded one two inch long (shell length) pond turtle.

The second site included habitat units 566-568, a lateral scour pool - bedrock formed, run and lateral scour pool - root wad enhanced located approximately 54,167 feet above the creek mouth. The site yielded 18 steelhead and two stickleback.

DISCUSSION

North Fork Big River is an F4 channel type for the entire 64,431 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders, fair for weirs, single and opposing wing deflectors, channel constrictors and log cover, and poor for boulder clusters.

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The water temperatures recorded on August 21 through September 3, 1997, ranged from 60 to 71 degrees Fahrenheit. Air temperatures ranged from 53 to 81 degrees Fahrenheit. This is an acceptable 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 38% of the total length of this survey, riffles 21%, and pools 40%. The pools are relatively deep, with 153 of the 324 (47%) pools having a maximum depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width.

Fifty of the 324 pool tail-outs measured had an embeddedness rating of 1. Ninety-seven of the pool tail-outs had embeddedness ratings of 3. Seventeen of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. Eight of the 17 were unsuitable for spawning due to the dominant substrate being silt/sand/clay or gravel 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.

The mean shelter rating for pools was low with a rating of 19. The shelter rating in the flatwater habitats was slightly lower at 16. 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, terrestrial vegetation contributes a small amount. Log and root wad cover structure 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-eighty-six of the 324 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 67%. This is a relatively low 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 moderate at 79% and 80%, 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

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1) North Fork Big River should be managed as an anadromous, natural production stream.

2) 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.

3) 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.

4) Increase the canopy on 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.

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 Big River. Channel type is a F4.
5,462'	Left bank tributary. The flow is less than 0.1 cfs with a steep narrow bedrock channel. Approximately 40' up from the North Fork Big River there is an 8' jump over the woody debris.
7,770'	Right bank erosion, 40' high x 70' long.
8,423'	Right bank tributary, very steep. Flow is less than 0.1 cfs.
9,405'	Right bank seep forms a ravine.
9,885'	Right bank seep forms a ravine.
11,277'	Left bank tributary. Approximately 200' upstream is a 4' diameter corrugated metal pipe under Road 800. The flow is less that 0.1 cfs. Channel is boulder and bedrock dominated, and steep and narrow. No fish observed. Water temperature was 61 degrees Fahrenheit at 14:30 on 8/27/97.
13,027'	Left bank seep with a steep ravine.
14,086'	Confluence with East Branch North Fork Big River. At 16:07 on 8/27/97 the water temperature was 68 degrees with a corresponding 70 degrees in North Fork Big River.
17,483'	Steep, narrow tributary. Culvert under Louisiana- Pacific Corporation road.
18,264'	Dry, steep tributary.
18,678'	Dry, narrow, steep left bank tributary.
20,243'	Dry, steep, narrow right bank tributary.

20,963' Left bank tributary. Flow is less that 0.05 cfs. The steep narrow channel is dominated by small cobble.

21,277' Dry left bank tributary, bedrock substrate.

21,515' Double railroad flatcar bridge. Approximately 80' wide x 20' long x 18' high above water.

21,814' Dirt road dead ends on the left bank. Possible draft site for water trucks.

22,279' Left bank tributary, not flowing but has water in it. The channel is approximately 6-8' wide.

22,436' Very steep dry, right bank tributary.

22,829' Jackson Demonstration State Forest Boundary.

23,178' Small dry right bank tributary.

24,097' Dry left bank tributary. The channel is 2-4' wide.

27,947' Steep, dry right bank tributary.

28,258' Steep, dry right bank tributary.

28,959' Footpath crossing.

29,840' Camp Dunlap on the right bank. Concrete tank in the center of the channel, 16' diameter x 8' long.

31,095' Redwood stairs on the right bank.

31,870' Highway 20 immediately above the stream on the right bank.

34,097' Steam donkey at Camp 20 up on right bank.

34,218' Six foot long foot bridge over the unit measuring approximately 60' wide and 20' above the water.

34,344' Chamberlain Creek enters North Fork Big River.

35,506' Downstream edge of concrete bridge to roads 800/810. The bridge measures approximately 40' wide x 17' long x 25' high above the water level.

37,015' Highway 20 and power line on the right bank.

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37,622' Left bank erosion measuring approximately 100' long x 50' high.

37,914' Steep, narrow, tricking tributary enters on left bank.

38,547' Dry, small tributary enters on the left bank.

40,118' Highway 20 on right bank.

40,362' Right bank tributary enters with a 9' vertical drop. Flow is a trickle.

40,898' Horse trail enters and goes up dry right bank stream bed.

41,505' Highway 20 immediately above stream on right bank.

41,779' Horse trail on left bank and Highway 20 on right bank.

45,901' Steep, dry, right bank tributary.

47,313' Left bank seep.

47,643' Soda Gulch enters from the right bank. The mouth is steep and narrow (2-3' wide) with an out-fall of a 6' diameter corrugated metal pipe culvert running under Highway 20 approximately 100' upstream from the confluence with North Fork Big River. Out-fall of the culvert protrudes about 4-6' from the roadbed and produces a 6-7' high jump into the culvert itself. The out-fall is onto a steep boulder strewn section providing no adult fish passage. Flow is less than 0.1 cfs.

49,253' Old car upside down in the channel.

49,629' Boulder rip rap on right bank, 373' long.

52,106' James Creek enter on right bank. It is contributing approximately half the flow of North Fork Big River below the confluence.

52,910' Corrugated metal pipe culvert with natural substrate measuring 29' wide x 9' high.

53,587' Left bank seep.

55,087' Left bank tributary, steep with only a trickle of the flow.

55,584' Left bank erosion approximately 100' high x 50' long.

55,963' Left bank tributary, steep (10% gradient) and has a flow of about 0.1 cfs. The water temperature

on September 2, 1997 was 59 degrees Fahrenheit.

56,210' Small, dry left bank tributary enters North Fork Big River.

57,239' Left bank seep.

57,660' Left bank tributary, steep and narrow with a flow of about 0.1 cfs. The water temperature at 16:40 on September 2, 1997 was 58 degrees Fahrenheit.

59,096' Tributary, steep and narrow with a flow of about 0.01 cfs. The water percolates under a 4' diameter log at the confluence.

59,745' Trail up to and onto road 911 goes up ravine.

60,219' Log debris accumulation (LDA), 15' long x 40' wide x 10' high, with a 12' root wad in the center of the accumulation. A channel is flowing through the LDA, not a barrier.

60,465' Left bank tributary, steep and narrow with a flow of about 0.1 cfs. The water temperature on September 3, 1997 at 12:50 was 59 degrees Fahrenheit.

60,913' LDA, 60' long x 40' wide x 9' high consisting of approximately 12 pieces of large woody debris and lot of small woody debris, not a barrier.

61,071' Dry right bank tributary.

62,735' Very steep right bank tributary.

63,250' End of survey at the left bank tributary due to lack of access. At 16:00 on September 3, 1997 the water temperature in the left bank tributary was 62 degrees Fahrenheit, while the corresponding water temperature in North Fork Big River above the confluence is 68 degrees. The habitat above the end of survey appears similar in quality and appearance to the area below this point. All age classes of steelhead and yellow-legged frogs were observed to 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

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