STREAM INVENTORY REPORT

West Fork of the North Fork Eel River

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on West Fork of the North Fork Eel 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 West Fork of the North Fork Eel River. 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 of the North Fork Eel River.

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 of the North Fork Eel River is tributary to the Eel River, located in Trinity County, California. West Fork of the North Fork Eel River's legal description at the confluence with the Eel River is T03S R07E S09. Its location is 40°13'40" North latitude and 123°23'12" West longitude. West Fork of the North Fork Eel River is a third order stream and has approximately 18.7 miles of blue line stream according to the USGS Zenia and Pickett Peak 7.5 minute quadrangles. West Fork of the North Fork Eel River drains a watershed of approximately 5.2 square miles. Summer base runoff is approximately 1.0 cubic feet per second (cfs) at the mouth, but over 15 cfs is not unusual during winter storms. Elevations range from about 2,100 feet at the mouth of the creek to 3,200 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is part of Six Rivers National Forest and is managed for timber production and diverse recreation. Contact Six Rivers National Forest for information on how to best access the mouth of West Fork of the North Fork Eel River.

METHODS

The habitat inventory conducted in West Fork of the North Fork Eel River follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds,

1991 rev. 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 of the North Fork Eel River 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 West Fork of the North Fork Eel 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. Additionally, a recording thermograph was deployed in West Fork of the North Fork Eel River from 7/24/96 to 9/18/96 to record temperatures on a 24 hour basis during warm summer months.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". West Fork of the North Fork Eel 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 West Fork of the North Fork Eel River, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4). Additionally, a 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 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 of the North Fork Eel River, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two respectively.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In West Fork of the North Fork Eel 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 West Fork of the North Fork Eel River, 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.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In West Fork

of the North Fork Eel River 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 standard McNeil gravel sampler. 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 of the North Fork Eel River include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

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The habitat inventory of July 30 to August 7, 1996, was conducted by Greg Mullins and Frank Humphrey (PCFWWRA). The total length of the stream surveyed was 25,121 feet with an additional 1,571 feet of side channel.

Flow was estimated to be 1.0 cfs during the survey period.

West Fork of the North Fork Eel River is an F3 channel type for the first 16,957 feet of stream reach surveyed, and a B2 channel type for the remaining 8,164 of stream surveyed. F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates. B2 channels are moderately entrenched, moderate gradient, riffle dominated channels, with a very stable plan and profile and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 56 to 73 degrees Fahrenheit. Air temperatures ranged from 65 to 88 degrees Fahrenheit. Water temperatures taken 500' above the stream's mouth with a recording thermograph deployed from July 24 to September 18, 1996, ranged from a low of 53° to a high of 73° Fahrenheit (see next page).

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 40% riffle units, 31% pool units, and 29% flatwater units (Graph 1). Based on total **length** of Level II habitat types there were 38% riffle units, 35% flatwater units, and 27% 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, 29%; mid-channel pools, 21%; and runs, 12% (Graph 3). Based on percent total **length**, low gradient riffles made up 30%, mid-channel pools 17%, and step runs 15%.

A total of 151 pools were identified (Table 3). Main channel pools were most frequently encountered at 78% and comprised 78% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. One hundred thirty of the 151 pools (86%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 151 pool tail-outs measured, 105 had a value of 1 (70%); 40 had a value of 2 (26%); six had a value of 3 (4%); 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 36, and riffle habitats had a mean shelter rating of 32 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 53. Scour pools had a mean shelter rating of 46 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Boulder was the dominant substrate observed in 21 of the 142 low gradient riffles measured (86%). Gravel was the next most frequently observed dominant substrate type and occurred in 10% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 69%. The mean percentages of deciduous and coniferous trees were 84% and 16%, respectively. Graph 9 describes the canopy in West Fork of the North Fork Eel River.

For the stream reach surveyed, the mean percent right bank vegetated was 39%. The mean percent left bank vegetated was 34%. The dominant elements composing the structure of the stream banks consisted of 15.2% bedrock, 76.6% boulder, 7.6% cobble/gravel, and 0.6% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 20% of the units surveyed. Additionally, 72.2% of the units surveyed had deciduous trees as the dominant vegetation type, and 3.8% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Due to difficult access into the stream, no sites were electrofished during the survey of July 30 to August 7, 1996, in West Fork of the North Fork Eel River. Young-of-the-year and juvenile salmonids were observed from the stream banks throughout the survey reach, and seemed abundant.

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GRAVEL SAMPLING RESULTS

No gravel samples were taken on West Fork North Fork Eel River.

DISCUSSION

West Fork of the North Fork Eel River is an F3 channel type for the first 16,957 feet of stream surveyed and a B2 for the remaining 8,164 feet. The suitability of F3 channel types for fish habitat improvement structures is good for bank-placed boulders; fair for low-stage weirs, boulder clusters, and channel constrictors; and poor for medium-stage weirs. The suitability of B2 channel types is excellent for low- and medium-stage plunge weirs, single and opposing wing deflectors, and bank cover.

The water temperatures recorded on the survey days July 30 to August 8, 1996, ranged from 56 to 73 degrees Fahrenheit. Air temperatures ranged from 65 to 88 degrees Fahrenheit. Further samples from a recording thermograph deployed during the summer of **1996** measured water temperatures ranged from 52 to 73° Fahrenheit. This is a fair water temperature range for salmonids. Temperatures over 73° F, if sustained, are stressful for salmonids. However, West Fork of the North Fork Eel River seems to have conditions that are supporting salmonids.

Flatwater habitat types comprised 35% of the total **length** of this survey, riffles 38%, and pools 27%. The pools are relatively deep, with 61 of the 151 (40%) 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. 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.

Only six of the 151 pool tail-outs measured had embeddedness

ratings of 3 or 4. One hundred and five 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.

The mean shelter rating for pools was low with a rating of 36. The shelter rating in the flatwater habitats was slightly lower at 23. 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, bedrock ledges contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats would 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.

Nineteen of the 21 low gradient riffles sampled had large cobble or boulders as the dominant substrate. This is generally considered poor spawning salmonids.

The mean percent canopy density for the stream was 69%. This is a relatively moderate percentage of canopy. 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 low at 39% and 34%, 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 of the North Fork Eel River should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are somewhat high, but seem to be within the 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 West Fork of the North Fork Eel River by planting willow, alder, 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.

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 the North Fork Eel River. Channel type is an F3 for the first 16,957' of stream surveyed.

677' Large school of California roach observed by surveyors.

793' Small tributary enters stream from right bank (RB). Temperature is 60°F.

2598' Tributary enters from RB - 60°F.

2783' Bradburn Creek enters from the RB - 65°F.

4866' Young-of-the-year (YOY) salmonids observed.

7746' Large debris accumulation (LDA) in stream channel. Does not appear to be a barrier to migrating salmonids.

10265' Slope failure on RB - approximately 200' long x 150' wide. Contributing sediment directly into the creek.

10459' Spring on RB.

12377' Slope failure on RB - approximately 200' L x 200' W. Contributing material to the stream.

12712' Large numbers of juvenile salmonids (probably steelhead rainbow trout) observed by surveyors.

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13007'Salt Creek enters from RB - 63°F.

16787'Tributary enters from RB - 66°F.

16957'Channel type changes from F3 to a B2 for the remaining 8,164' of stream surveyed.

18299'Slope failures on both banks for approximately 200'. Both failures are contributing material to the stream.

19422'Spring enters from RB - 58°F.

19691'LDA in stream channel - possibly a seasonal barrier for fish. The stream channel is very wide and braided in this area. Potential enhancement project site.

19939'Dry tributary enters from RB.

19969' Spring enters from RB.

20609'Dry tributary enters from left bank (LB).

20895'Dry tributary enters from RB.

20935'Access trail to the county road on the RB - one hour walk from stream to the road.

22780'Spring enters from RB.

23170'Slope failure on LB - 100' x 200'.

23956'Access trail to county road on RB.

24497'Twelve-inch steelhead rainbow trout observed in pool.

25121'Confluence of Panther and Bar Creeks. End of the West Fork of the North Fork Eel River. 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.

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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