

# STREAM INVENTORY REPORT

## North Fork Elk River

### INTRODUCTION

A stream inventory was conducted during the summer of 1994 on North Fork Elk River to assess habitat conditions for anadromous salmonids. 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 Elk River. The objective of the biological inventory was to document the salmonid species present and their distribution. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

Adult carcass surveys were conducted on North Fork Elk River by the California Department of Fish and Game (DFG) from 1990 through 1994. The table below describes the results of those surveys:

North Fork Elk River Carcass Surveys 1990-1994

		Chinook Salmon				Other	
Year	# of Surveys	Live Fish	# of Carcass	AdiposeClipCWT	Redds seen	Coho seen	SH/RT seen
1990-91	6	32	12	0	377	84	7
1991-92	4	0	2	0	317	70	28
1992-93	3	17	13	0	169	56	7
1993-94	5	10	1	0	753	576	10

The objective of this report is to document the current habitat conditions in North Fork Elk River, and recommend options for the enhancement of habitat for coho salmon and steelhead trout.

### WATERSHED OVERVIEW

North Fork Elk River is tributary to Elk River, a tributary to Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California (Figure 1). North Fork Elk River's legal description at the confluence with the Elk River is T04N R01W S26. Its location is 40.7025 degrees north latitude and 124.1511 degrees west longitude. North Fork Elk River is a second order stream and has approximately 12.1 miles of blue line stream according to the USGS Fields Landing 7.5 minute quadrangle. North Fork Elk River drains a watershed of approximately 22.9 square miles. Elevations range from about 40 feet at the mouth of the creek to 600 feet in the headwater areas. Redwood forest and fir forest dominate the watershed. The

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watershed is privately owned and is managed for timber production. Vehicle access exists via U.S. Highway 101 at the Elk River Road exit, then east approximately 3.5 miles on Elk River Road to North Fork Elk River.

### METHODS

The habitat inventory conducted in North Fork Elk 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 that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game. North Fork Elk River personnel were trained in June, 1994, by Gary Flosi and Scott Downie. This inventory was conducted by a two-person team.

### 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 Elk 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. Flows should also be measured or estimated at major tributary confluences.

#### 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 each tenth unit typed. 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.

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### 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 Elk 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. Unit measurements included mean length, mean width, mean depth, and maximum depth. 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 Elk 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).

### 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 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 Elk 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 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 is estimated using handheld spherical densimeters and is a measure of the water surface shaded during periods of high sun. In North Fork Elk River, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The area of canopy was further analyzed to estimate

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### 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 Elk River, the dominant composition type and the dominant vegetation type of both the right and left banks 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. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

Biological inventory was conducted in North Fork Elk River to document the fish species composition and distribution. Four sites were electrofished in North Fork Elk River using one Smith-Root Model 12 electrofisher. Each site was end-blocked with nets to contain the fish within the sample reach. Fish from each site were counted by species, measured, and returned to the stream.

## 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 Elk 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

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- 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

The habitat inventory of July 6 through August 30, 1994 was conducted by Jason MacDonnell, Charles Bartolotta, and Kevan Schukraft (CCC). The total length of the stream surveyed was 64,536 feet with an additional 4,231 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.4 cfs on June 16, 1994.

North Fork Elk River is a C5 channel type for the first 13,253 feet of stream surveyed, an F4 channel for the next 17,400 feet, an F2 channel for the next 10,819 feet, an F4 for the next 6,856 feet, and a B2 channel for the final 16,208 feet. B2 channels are moderately entrenched, moderate gradient, riffle-dominant channels with infrequently spaced pools, very stable plan and profile, stable banks, and boulder-dominant substrates. C5 channels are low-gradient, meandering, riffle/pool, alluvial channels with broad, well-defined flood plains, point bars, and sand-dominant substrates. F-type channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios. F2 channels have boulder-dominant substrates, and F4 channels have gravel-dominant substrates.

Water temperatures ranged from 54 to 64 degrees Fahrenheit. Air temperatures ranged from 58 to 82 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, pools made up 43%, flatwater 29%, and riffles 26% (Graph 1). Pool habitat types made up 44% of the total survey length, flatwater 35%, and riffles 19% (Graph 2).

Twenty-three Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent occurrence were mid-channel pools, 27%; low gradient riffles, 23%; and runs, 16% (Graph 3). By percent total length, mid-channel pools made up 30%, step runs 18%, and low gradient riffles 17%.

Six-hundred-twenty-two pools were identified (Table 3). Main channel pools were most often encountered at 64% and comprised 70% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Four hundred thirty-nine of the 622 pools (71%) had a depth of two feet or greater (Graph 5).

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The depth of cobble embeddedness was estimated at pool tail-outs. Of the 588 pool tail-outs measured, 63 had a value of 1 (11%); 357 had a value of 2 (61%); 115 had a value of 3 (19%); and 53 had a value of 4 (9%). On this scale, a value of one is the best for fisheries (Graph 6).

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 the highest shelter rating at 68. Riffle habitats followed with a rating of 48 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 91. Main channel pools had a shelter rating of 68 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in North Fork Elk River. Graph 7 describes the pool cover in North Fork Elk River.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 177 of the 335 low gradient riffles (53%). Small cobble was the next most frequently observed dominant substrate type and occurred in 37% of the low gradient riffles (Graph 8).

Twelve percent of the survey reach lacked shade canopy. Of the 88% of the stream covered with canopy, 83% was composed of deciduous trees, and 17% was composed of coniferous trees. Graph 9 describes the canopy in North Fork Elk River.

Table 2 summarizes the mean percentage of the right and left stream banks covered with vegetation by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 94%. The mean percent left bank vegetated was 96%. The dominant elements composing the structure of the stream banks consisted of 55% cobble/gravel, 34% sand/silt/clay, 7% boulders, and 3% bedrock (Graph 10). Deciduous trees were the dominant vegetation type observed in 70% of the units surveyed. Additionally, 9% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished on July 21, August 12, and August 16, 1994 in North Fork Elk River. The units were sampled by Chris Coyle, Craig Mesman, Jason MacDonnell, and Charles Bartolotta (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled was Habitat Units #0240-#0243, a run/riffle/pool combination approximately 12,367 feet from the survey start. This site had an area of 1,500 square feet and a volume of 1,200 cubic feet. The site yielded 47 steelhead between 30 and 159 mm, 21 coho between 42 and 69 mm, one 152 mm coastal cutthroat trout, six three-spine stickleback between 44 and 59 mm, three Pacific lamprey, and three Pacific giant salamanders.

The second site sampled was Habitat Units #0869-#0871, a low gradient riffle/mid-channel pool/high gradient riffle combination located approximately 49,874 feet above the survey start. This site had an area of 913 square feet and a volume of 639 cubic feet. The site yielded 45

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steelhead between 35 and 134 mm, 13 coho between 48 and 70 mm, eight Pacific giant salamanders, and one red-legged frog.

The third site sampled was Habitat Units #1026-#1028, a low gradient riffle/mid-channel pool/low gradient riffle combination located approximately 55,739 feet above the survey start. The site had an area of 364 square feet and a volume of 218 cubic feet. The site yielded 20 steelhead between 90 and 156 mm and two Pacific giant salamanders.

The fourth site sampled was Habitat Units #1230-#1231, a step run/mid-channel pool combination located approximately 62,876 feet above the survey start. The site had an area of 966 square feet and a volume of 966 cubic feet. The site yielded 12 steelhead between 59 and 210 mm and one Pacific giant salamander.

## DISCUSSION

North Fork Elk River has four channel types: B2, C5, F2, and F4. B2 channel types are considered excellent for low and medium stage weirs, single and opposing wing deflectors, channel constrictors, and bank cover. C5 channel types are considered good for bank-placed boulders and log cover structures; fair for low-stage weirs and bank cover; and poor for medium-stage weirs, random boulder placement, single and opposing wing deflectors, channel constrictors, and log cover structures. F2 channel types are considered fair for low-stage weirs, single and opposing wing deflectors, channel constrictors, bank cover, and log cover structures; and poor for medium-stage weirs. F4 channel types are considered good for bank-placed boulders; fair for low-stage weirs, single and opposing wing deflectors, channel constrictors, bank cover, and log cover structures; and poor for medium-stage weirs and random boulder placement.

The water temperatures recorded on the survey days July 6 through August 30, 1994 ranged from 54 to 64 degrees Fahrenheit. Air temperatures ranged from 58 to 82 degrees Fahrenheit. This is a good water temperature range for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Pool habitat types comprised 44% of the total length of this survey, flatwater 35%, and riffles 19%. The pools are relatively deep, with 439 of the 622 pools having a maximum depth greater than two feet. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total 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

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modification.

One-hundred-sixty-eight of the 588 pool tail-outs measured had embeddedness ratings of 3 or 4. Only 63 had an embeddedness rating of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In North Fork Elk River, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean shelter rating for pools was moderate with a rating of 68. The shelter rating in the flatwater habitats was lower at 43. A pool shelter rating of approximately 100 is desirable. The relatively moderate amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, large and small woody debris 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 structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

Three-hundred-two of the 335 low gradient riffles had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy for the stream was 88%. This is a relatively high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams.

The percentage of right and left bank covered with vegetation was high at 94% and 96%, respectively. In areas of stream bank erosion or where bank vegetation is at unacceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

## RECOMMENDATIONS

- 1) North Fork Elk 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 and in some areas the material is at hand.
- 3) 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.
- 4) 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.

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

### PROBLEM SITES AND LANDMARKS

The following landmarks and possible problem sites were noted. All the distances are approximate and taken from the beginning of the survey reach.

Position    Comments:  
(ft):

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0'	Start of survey at Pacific Lumber Company property line. Channel type is C5.
547'	Floating log debris accumulation (LDA).
760'	Floating LDA.
2389'	LDA measures 3' high x 15' wide x 20' long and is congesting the channel.
2423'	Right bank erosion site measures 5' high x 20' long and is contributing fine sediment to the channel.
3975'	Floating LDA measures 3' high x 20' wide x 15' long and is congesting the channel.
4306'	Redwood Bible Camp trail access.
6279'	Right bank slump measures 10' high x 20' long and is contributing fine sediment to the channel. Unit is covered with floating debris overgrown with alders.
6725'	LDA measures 5' high x 30' wide x 25' long.
7011'	Right bank slump measures 20' high x 30' long and is contributing sand and gravel to the channel.
7485'	Right bank erosion site measures 8' high x 30' long and is contributing sand and silt to the channel.
8226'	LDA measures 5' high x 35' wide x 20' long.

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- 8311' Left bank erosion site measures 12' high x 10' long and is contributing sand and gravel to the channel.
- 9201' Dunlap Gulch enters right bank.
- 9940' Floating LDA.
- 11964' Brown's Gulch enters right bank.
- 13253' Channel type changes to F4.
- 13871' Floating LDA measures 4' high x 35' wide x 15' long.
- 22978' Lake Creek enters left bank.
- 23187' Clay wall measures 40' high x 100' long and is eroding into channel.
- 24366' LDA measures 5' high x 20' wide x 8' long and forms barrier on side channel.
- 27737' Bridge Creek enters right bank.
- 28875' Right bank erosion site measures 10' high x 20' long and is contributing fine sediment and gravel to the channel.
- 29110' Left bank erosion site measures 25' high x 75' long and is contributing fine sediment to the channel.
- 30653' Channel type changes to F2.
- 31969' Flatcar bridge at Wrigley Road measures 35' long x 40' wide x 20' high.
- 33670' McWhinney Creek enters right bank.
- 34994' Erosion site measures 7' high x 30' long.
- 40601' Erosion site measures 7' high x 120' long and is undercutting standing redwoods.
- 41472' Channel type changes to F4.
- 43484' Right bank undercut 10'.
- 45621' Runoff from left bank culvert.
- 45910' South Branch North Fork Elk River enters left bank.
- 48328' Channel type changes to B2.

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- 48827' North Branch North Fork Elk River enters right bank.
- 50489' Left bank tributary with residual surface flow.
- 54678' LDA measures 6' high x 30' wide x 15' long. It is retaining gravel.
- 54770' LDA measures 20' wide x 15' long.
- 55315' LDA measures 10' high x 15' wide.
- 55374' LDA measures 10' high x 35' wide x 30' long.
- 56004' LDA measures 12' high x 28' wide x 18' long.
- 56426' LDA measures 10' high x 30' wide x 8' long.
- 57283' LDA measures 8' high x 20' wide x 17' long.
- 57581' LDA measures 15' high x 33' wide x 35' long.
- 57972' Left bank tributary. Not accessible to anadromous fish.
- 58709' LDA measures 5' high x 17' wide x 15' long.
- 59324' Left bank tributary. Not accessible to anadromous fish.
- 59359' Left bank seepage contributing fine sediment to the channel.
- 60086' Tributary. Not accessible to anadromous fish.
- 60113' LDA measures 3' high x 8' wide x 60' long.
- 60389' Tributary. Flow estimated at 0.1 cfs. Possibly fish-bearing.
- 60631' Right bank trail.
- 61101' Floating LDA.
- 61928' LDA, unspecified dimensions.
- 62823' LDA measures 4' high x 12' wide x 5' long.
- 63015' Left bank tributary. Not accessible to anadromous fish.
- 63234' Culvert measures 5' diameter x 24' long.

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63730' Left bank tributary. Accessible to fish for approximately 300'.

63779' Dry right bank tributary.

63912' LDA measures 5' high x 35' wide x 50' long.

64536' End of survey.

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### LEVEL III and LEVEL IV HABITAT TYPE KEY

#### **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