STREAM INVENTORY REPORT

North Fork Elk River

INTRODUCTION

A stream inventory was conducted during the summer of 1993 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 1993. The table below describes the results of those surveys:

North Fork Elk River Carcass Surveys 1990 - 1993

		Chinook Salmon			All Spp.	Other	
Year	# of Surveys	Live Fish	# of Carcass	AdiposeClip CWT	Redds seen	Coho seen	SH/RT seen
1990-91	6	32	12	0	377	84	14
1991-92	5	0	2	0	317	70	22
1992-93	4	17	26	0	169	56	7

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 a tributary to Elk River, a tributary to Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California. North Fork Elk River's legal description at the confluence with 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 22.5 square miles. Elevations range from about 40 feet at the mouth of the creek to 600 feet in the headwater areas. Second-growth redwood forest dominates the watershed. The watershed is privately owned and is managed for timber harvest. Vehicle access exists via Wrigley Road off of Elk River Road or via Road 10 through Pacific Lumber Company's Yager Camp.

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). 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 (DFG). North Fork Elk River personnel were trained in June, 1993, 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 by David Rosgen (1985). 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 four measured parameters used to determine channel type: 1) water slope gradient, 2) channel confinement, 3) width/depth ratio, and 4) substrate composition.

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 Fahrenheit degrees 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 *et al* (1988). Habitat units are numbered sequentially and assigned a type identification number selected from among the 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 by 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.

8. Canopy:

Stream canopy is estimated using handheld spherical densiometers 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 its percentage of coniferous or deciduous trees.

9. Bank Composition:

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 on both the right and left banks was selected from a list of eight options on the habitat inventory form. Additionally, the percentage of each bank covered by vegetation was estimated and recorded.

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BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. 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. One site was electrofished in North Fork Elk River using one Smith-Root Model 12 electrofisher. The site was end-blocked with nets to contain the fish within the sample reach. Fish from the site were counted by species, measured, and returned to the stream.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat Runtime, a dBASE 4.1 data entry program developed by the 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
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type

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HABITAT INVENTORY RESULTS

The habitat inventory of November 2 through November 18, 1993 was conducted by Erick Elliott, Jason MacDonnell, and Chris Coyle (CCC). The reach surveyed was from the confluence of Bridge Creek to the confluence of the South Branch North Fork Elk River. The total length of the stream surveyed was 18,178 feet with an additional 201 feet of side channel.

Flow was not measured on North Fork Elk River.

North Fork Elk River is a C2 channel type for the first 12,155 feet of stream surveyed, an A2 channel for the next 2,449 feet, and a B2 channel for the last 3,574 feet surveyed. C2 channels are stable, low gradient (0.3-1.0%), overfit cobble bed channels. A2 channels are steep (4-10% gradient), very well confined channels with stable stream banks. B2 channels are moderate gradient (1.0-2.5%), stable, large cobble/coarse gravel channels.

Water temperatures ranged from 39 to 51 degrees Fahrenheit. Air temperatures ranged from 38 to 55 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, pool units made up 39%, riffle units 31%, and flatwater units 30% (Graph 1). Flatwater habitat types made up 40% of the total survey length, pools 36%, and riffles 25% (Graph 2).

Eighteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent occurrence were low gradient riffles, 27%; runs, 13%; and step runs and mid-channel pools, 12% each (Graph 3). By percent total length, low gradient riffles made up 22%, step runs 21%, and runs 12%.

Ninety-six pools were identified (Table 3). Scour pools were most often encountered at 65%, and comprised 65% 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. Eighty-nine of the ninety-six pools (93%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 92 pool tail-outs measured, 17 had a value of 1 (19%); 41 had a value of 2 (45%); 27 had a value of 3 (29%); and seven had a value of 4 (8%). 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 56. Flatwater habitats followed with a rating of 28 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 59. Main channel pools had a mean shelter rating of 49 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in North Fork Elk River and are extensive. With the exception of scour pools, large and small

woody debris is lacking in nearly all habitat types. Graph 7 describes the pool cover in North Fork Elk River.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 23 of the 67 low gradient riffles (34%). Large cobble was the next most frequently observed dominant substrate type, occurring in 33% of the low gradient riffles (Graph 8).

Twenty-six percent of the survey reach lacked shade canopy. Of the 74% of the stream covered with canopy, 62% was composed of deciduous trees and 38% was composed of coniferous trees. Graph 9 describes the canopy in North Fork Elk River.

Table 2 summarizes by habitat type the mean percentage of the right and left stream banks covered with vegetation. For the stream reach surveyed, the mean percent right bank vegetated was 68%. The mean percent left bank vegetated was 71%. The dominant elements composing the structure of the stream banks consisted of 14% bedrock, 5% boulder, 2% grass, and 5% brush. Additionally, 57% of the banks were covered with deciduous trees and 17% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on Nov. 24, 1993 in North Fork Elk River. The unit was sampled by Erick Elliott and Chris Coyle (CCC). All measurements are fork lengths unless noted otherwise.

The site sampled was Habitat Unit #247, a channel confluence pool approximately 17,977 feet from the confluence of Bridge Creek and North Fork Elk River. This site had an area of 1644 square feet and a volume of 1644 cubic feet. The unit yielded nine steelhead ranging from 63 millimeters to 180 millimeters, and six coho salmon ranging from 61 millimeters to 70 millimeters.

DISCUSSION

A2 channel types are generally not suitable for fish habitat improvement structures. A2 channels are found in high energy, steep gradient stream reaches. They have channels dominated by boulders, do not retain gravels very well, but do have stable stream banks.

Stable, low gradient C2 type channels are considered excellent candidates for low stage plunge weirs, bank placed boulders, floating log covers, submerged shelters in meander and straight reaches, and straight spawning weirs. They are also considered good for medium stage plunge weirs, in-channel boulder placement, single wing deflectors, log cover structures, and "V" spawning weirs.

Stable, moderate gradient B2 type channels are considered excellent candidates for low stage plunge weirs, in-channel and bank boulder placement, single and double wing deflectors, channel

constrictors, log cover structures, and, in straight reaches, submerged structures. They are also considered good for medium stage plunge weirs, submerged shelters in meander reaches, "V" and straight spawning weirs, and gravel placement.

The water temperatures recorded on the survey days November 2 through November 18, 1993 ranged from 39 to 51 degrees Fahrenheit. Air temperatures ranged from 38 to 55 degree Fahrenheit. This is a very good water temperature profile 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.

Flatwater habitat types comprised 40% of the total length of this survey, pools 36%, and riffles 25%. The pools are of adequate depth with 89 of the 96 pools having a maximum depth greater than two feet. In coastal coho and steelhead streams, it is generally desirable to have primary pools (defined in first and second order streams as those having a maximum depth of at least two feet, occupying at least half the width of the low flow channel, and being as long as the low flow channel width) comprise approximately 50% of total habitat; therefore, installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy.

Thirty-four of the ninety-two pool tail-outs measured had embeddedness ratings of 3 or 4. Only 17 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 should be taken.

The mean shelter rating for pools was moderate at 56. However, a pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists in all habitat types is being provided primarily by boulders. 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 structure provides rearing fry with protection from predation and rest from water velocity, as well as divides territorial units to reduce density related competition.

Thirty-four of the sixty-seven 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 74%. This is a relatively high percentage of canopy, since 80% is generally considered optimum in north coast streams. In areas of stream bank erosion, planting native species of coniferous and deciduous trees in conjunction with bank stabilization is recommended.

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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) 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.

4) 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.

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 (ft):	Comments:
0'	Start of survey at confluence with Bridge Creek.
1233'	Right bank erosion site measures 15' high x 60' long.
4404'	Log stringer bridge measures 40' long x 25' wide x 20' high.
5998'	McWhinney Creek enters from the right bank.
6298'	Braided channel.
8321'	Right bank erosion site measures 5' high x 30' long. It is contributing fine sediment to the channel.
10540'	Right bank erosion site measures 10' high x 20' long. It is contributing fine sediment to the channel.
11390'	Right bank erosion site measures 6' high x 25' long. It is contributing fine sediment to the channel at higher flows.
14515'	Unstable right bank measures 200' high x 80' long. It is contributing gravel off of bedrock face.

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17381' Left bank erosion site measures 150' high x 20' long. Partially revegetated.

18187' End of survey at confluence with South Branch North Fork Elk River.

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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