STREAM INVENTORY REPORT

MINOR CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Minor Creek. 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 Minor Creek. 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

Minor Creek is a tributary to Redwood Creek, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Minor Creek's legal description at the confluence with Redwood Creek is T07N R03E S28. Its location is 40.9606 degrees north latitude and 123.8342 degrees west longitude. Minor Creek is a second order stream and has approximately 6.5 miles of blue line stream according to the USGS Lord-Ellis Summit 7.5 minute quadrangle. Minor Creek drains a watershed of approximately 11.6 square miles. Elevations range from about 730 feet at the mouth of the creek to 2,800 feet in the headwater areas. Redwood forest, Douglas fir forest, and mixed conifer forest dominate the watershed. The watershed is primarily privately owned with some Six Rivers national forest and is managed for timber production. Vehicle access exists via State Route 299.

METHODS

The habitat inventory conducted in Minor Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The Northwest Emergency Assistance Program (NEAP) Members and 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). 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 Minor Creek to record measurements and observations. There are nine components to

the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Minor Creek 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. 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 Minor Creek, 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 not suitable 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 Minor Creek, 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 density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Minor Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every unit. 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 Minor Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each 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 Minor Creek fish presence was observed from the stream banks, and four 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 Minor Creek 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

The habitat inventory of July 19 through August 3, 1995 was conducted by Nancy Pearson, Phil Reig and Dave Allen (NEAP). The total length of the stream surveyed was 14,046 feet with an additional 666 feet of side channel.

Flows were not measured on Minor Creek.

Minor Creek is an F4 channel type for the first 2,245 feet of stream reach surveyed (Reach 1). F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

The next 2,018 feet is a B3 channel type (Reach 2). B3 channel types are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks and are cobble dominant.

The next 522 feet is an A2 channel type (Reach 3). A2 channel types are steep, narrow, cascading step-pool streams with high energy/debris transport associated with depositional soils and are boulder dominant.

The next 1,041 feet returns to an F4 channel type (Reach 4). The next 268 feet returns to a B3 channel type (Reach 5).

The next 6,921 feet is an F3 channel type (Reach 6). F3 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratio and are cobble dominant.

The next 840 feet returns to a B3 channel type (Reach 7). The last 191 feet returns to an A2 channel type (Reach 8).

Water temperatures taken during the survey period ranged from 57 to 66 degrees Fahrenheit. Air temperatures ranged from 65 to 86 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 45% flatwater units, 31% riffle units, and 25% pool units (Graph 1). Based on total length of Level II habitat types there were 53% flatwater units, 26% riffle units, and 21% pool units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were high gradient riffles, 18%; step runs, 15%; and pocket water, 14% (Graph 3). Based on percent total length, step runs made up 21%, runs 14%, and high gradient riffles 13%.

A total of 63 pools were identified (Table 3). Scour pools were most frequently encountered at 75% and comprised 71% 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. Forty-nine of the 63 pools (78%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 63 pool tail-outs measured, 24 had a value of 1 (38%); 35 had a value of 2 (56%); four had a value of 3 (6%); (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. Riffle habitat types had a mean shelter rating of 17, flatwater habitat types had a mean shelter rating of 14, and pool habitats had a mean shelter rating of 20 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 28. Scour pools had a mean shelter rating of 18 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Minor Creek. Large woody debris is lacking in nearly all habitat types. Graph 7 describes the pool cover in Minor Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 13 of the 25 low gradient riffles measured (52%). Large cobble was the next most frequently observed dominant substrate type and occurred in 40% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 89%. The mean percentages of deciduous and coniferous trees were 97% and 3%, respectively. Graph 9 describes the canopy in Minor Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 71%. The mean percent left bank vegetated was 72%. The dominant elements composing the structure of the stream banks consisted of 54% sand/silt/clay, 27% boulders, 17% cobble/gravel, and 2% bedrock (Graph 10). Deciduous trees were the dominant vegetation type observed in 67% of the units surveyed. Additionally, 4% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished on October 3, 1995 in Minor Creek. The sites were sampled by Chris Coyle (CCC) and Mike Delvin (PCFWWRA).

The first site included Habitat Unit #017, a boulder formed lateral scour pool located approximately 965 feet above the creek mouth. This site had an area of 1,098 square feet and a volume of 1,318 cubic feet. The site yielded three coho salmon, eleven steelhead/rainbow trout, a Pacific giant salamander and an unidentified frog.

The second site sampled included Habitat Units #048 through #050, a corner pool and pocket water, approximately 2,670 feet from the confluence with Redwood Creek. This site had an area of 2,474 square feet and a volume of 3260 cubic feet. The site yielded one coho salmon, and nineteen steelhead/rainbow trout.

The third site sampled included Habitat Unit #077, a corner pool located approximately 4,181 feet above the creek mouth. The site had an area of 1,482 square feet and a volume of 2,668 cubic feet. The site yielded twenty-one steelhead/rainbow trout.

The fourth site sampled included Habitat Units #130 and #131, two lateral scour pools, one root wad enhanced and one boulder formed, located approximately 7,239 feet above the creek mouth. The site had an area of 545 square feet and a volume of 491 cubic feet. The site yielded three steelhead/rainbow trout.

DISCUSSION

Minor Creek is an F4 channel type for the first 2,245 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders; fair for low-stage weirs, single and opposing wing deflectors, channel constrictors, and log cover; and poor for medium-stage weirs and boulder clusters.

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Minor Creek is a B3 channel type for the next 2,018 feet of the stream surveyed. The suitability of B3 channel types for fish habitat improvement structures is as follows: B3 channel types are excellent for low-stage plunge weirs, boulder clusters and bank placed boulders, single and opposing wing deflectors and log cover; and good for medium-stage plunge weirs.

Minor Creek is an A2 channel type for the next 522 feet of the stream surveyed. A2 channel types are generally not suitable for fish habitat improvement structures.

Minor Creek returns to a F4 channel type for the next 1,041 feet of the stream surveyed. Minor Creek returns to a B3 channel type for the next 268 feet of the stream surveyed.

Minor Creek is an F3 channel type for the next 6,921 feet of the stream surveyed. F3 channel types are good for bank-placed boulders, single and opposing wing deflectors; fair for low-stage weirs, boulder clusters, channel constrictors and log cover; and poor for medium-stage weirs.

Minor Creek returns to a B3 channel type for the next 840 feet of the stream surveyed. Minor Creek returns to an A2 channel type for the last 191 feet of the stream surveyed.

The water temperatures recorded on the survey days July 19 through August 3, 1995 ranged from 57 to 66 degrees Fahrenheit. Air temperatures ranged from 65 to 86 degrees Fahrenheit. Minor Creek seems to have temperatures favorable to salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 53% of the total length of this survey, riffles 26%, and pools 21%. The pools are relatively deep, with 49 of the 63 (78%) pools having a maximum depth greater than two feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy.

Four of the 63 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Twenty-four 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 20. The shelter rating in the flatwater habitats was slightly lower at 14. 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, white water contributes 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.

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Fifteen of the 25 low gradient riffles 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 89%. This is a relatively high 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 71% and 72%, 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) Minor Creek should be managed as an anadromous, natural production stream.

2) 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.

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) 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.

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) Due to the high gradient of the A3 channel comprising the third stream reach, approximately 4,263 feet from the confluence, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.

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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.

Position (ft):	Comments:
0'	Start of survey at the confluence with Redwood Creek. The channel type is an F4.
116'	Concrete bridge.
965'	Log truck bridge. First electrofishing site.
2,245'	Beginning of stream Reach 2, channel type is a B3.
2,334'	Small log jam.
2,670'	Second electrofishing site.
3,484'	Log jam on the right bank.
3,721'	Four foot high plunge.
3,860'	Dry right bank tributary.
3,930'	Left bank greywacke slide.
4,181'	Third electrofishing site.
4,263'	Beginning of stream Reach 3, channel type is an A2.
4,308'	500 gallon fuel tank 15' up on left bank.
4,425'	Water passes under two large boulders for 15'. Four foot high plunge over boulders.
4,785'	Beginning of stream Reach 4, channel type is an F4.
4,833'	Culvert in water creating plunge, dammed with gravel.
4,937'	Clay slide on left bank.
4,993'	Old landing on left bank. Left bank slide 100' high.
5,826'	Beginning of stream Reach 5, channel type is a B3.

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6,094' Beginning of stream Reach 6, channel type is an F3.

6,559' Left bank tributary.

6,708' Left bank tributary. Log road on left bank.

7,103' Left bank spring creating a side channel measuring 180' long x 3' wide.

7,239' Fourth electrofishing site.

12,991' Gradient increases to 6%.

13,015' Beginning of stream Reach 7, channel type is a B3.

13,278' Right bank spring.

13,611' Right bank rock slide.

13,855' Beginning of stream Reach 8, channel type is an A2.

13,928' Right bank tributary, barely flowing.

14,046' End of survey. Sixty foot rise over 100' with massive a boulder cascade.

REFERENCES

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

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