STREAM INVENTORY REPORT

North Fork Hayworth Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1999 in North Fork Hayworth Creek. The survey began at the confluence with Hayworth Creek and extended upstream 3 miles. A subsection to this report was also completed for an unnamed tributary to North Fork Hayworth Creek .

The North Fork Hayworth Creek 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 Hayworth 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

North Fork Hayworth Creek is a tributary to Hayworth Creek, a tributary to the North Fork Noyo River, a tributary to the Noyo River located in Mendocino County, California (Map 1). North Fork Hayworth Creek's legal description at the confluence with Hayworth Creek is T19N R15W S26. Its location is 38°28′13″ north latitude and 123°30′03″ west longitude. North Fork Hayworth Creek is a second order stream and has approximately 1.1 miles of blue line stream according to the USGS Northspur 7.5 minute quadrangle. North Fork Hayworth Creek drains a watershed of approximately 3.7 square miles. Elevations range from about 600 feet at the mouth of the creek to 2,100 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 20 to Irmulco Road (approximately 6 miles west of Willits), a private road which connects to Mendocino Redwood Company land.

METHODS

The habitat inventory conducted in North Fork Hayworth Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG).

This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in North Fork Hayworth 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 a Marsh-McBirney Model 2000 flow meter.

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. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

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

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988).

Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". North Fork Hayworth 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. All measurements are in feet to the nearest tenth. Habitat characteristics were measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In North Fork Hayworth 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 unsuited for spawning due to inappropriate substrate particle size, 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 North Fork Hayworth 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 fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In North Fork Hayworth Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In North Fork Hayworth Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in North Fork Hayworth Creek. In addition, 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 North Fork Hayworth 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
- Mean percent canopy
- Bank composition by composition type

- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

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

The habitat inventory of July 14, 15, and 26, 1999, was conducted by Ethan Jankowski and Toni Beaumont (WSP/AmeriCorps). The total length of the stream surveyed was 15,999 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.58 cfs on August 23, 1999.

North Fork Hayworth Creek is an F1 channel type for the first 7,531 feet of the stream surveyed and a B2 channel type for the remaining 8,468 feet surveyed. F1 channels are entrenched, meandering, riffle/pool channels with low gradients and high width/depth ratios. These are very stable channels if bedrock controlled. B2 channel types have moderate entrenchment and gradients, very stable plan and profile, and stable banks. These channel types are riffle dominated, pools are infrequent, and boulders are the dominant substrate.

Water temperatures taken during the survey period ranged from 58 to 71 degrees Fahrenheit. Air temperatures ranged from 62 to 84 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% riffle units, 14% flatwater units, 43% pool units, and 4% dry units (Graph 1). Based on total length of Level II habitat types there were 70% riffle units, 18% flatwater units, 11% pool units, and 1% dry units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 18%; plunge pools, 17%; and high gradient riffles, 15% (Graph 3). Based on percent total length, low gradient riffles made up 28%, high gradient riffles 23%, and cascades 19%.

A total of 60 pools were identified (Table 3). Scour pools were the most frequently encountered, at 75% , and comprised 73% 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. Twenty-four of the 60 pools (40%) had a depth between two and three feet, four had a depth between three and four feet (7%), and five had a depth over four feet (8%) (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 60 pool tail-outs measured, 1 had a value of 1 (1.6%); 15 had a value of 2 (25 %); 31 had a value of 3 (51.6%); 5 had a value of 4 (8.3%); and 8 had a value of 5 (13.3%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. The eight pool tail-outs that had an

embeddedness value of 5 were composed of bedrock 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 19, flatwater habitat types had a mean shelter rating of 9, and pool habitats had a mean shelter rating of 24 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating, at 28. Main channel pools had a mean shelter rating of 13 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in North Fork Hayworth Creek. Graph 7 describes the pool cover in North Fork Hayworth Creek. Boulders are the dominant pool cover type followed by root mass.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Boulders were the dominant substrate observed in 42% of pool tail-outs while gravel and bedrock were the next most frequently observed substrate types, at 17% each.

The mean percent canopy density for the surveyed length of North Fork Hayworth Creek was 89%. The mean percentages of deciduous and coniferous trees were 52% and 48%, respectively. Graph 9 describes the mean percent canopy in North Fork Hayworth Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 72%. The mean percent left bank vegetated was 70%. The dominant elements composing the structure of the stream banks consisted of 27.3% bedrock, 10.6% boulder, 54.6% cobble/gravel, and 7.5% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 34.9% of the units surveyed. Additionally, 30.3% of the units surveyed had deciduous trees as the dominant vegetation type, and 16.7% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished for species composition and distribution in North Fork Hayworth Creek on October 20, 1999. Water temperatures taken during the electrofishing period of 1:15 to 2:15pm ranged from 52 to 58 degrees Fahrenheit. Air temperatures ranged from 60 to 70 degrees Fahrenheit. The sites were sampled by Michelle Gilroy (DFG) and Toni Beaumont (WSP/AmeriCorps).

The first site sampled included habitat unit 32, a lateral scour pool - bedrock formed, located approximately 2,922 feet upstream of the start of survey. The site yielded 2 one-plus age class steelhead and 2 sculpin.

The second site sampled included habitat unit 34, a lateral scour pool - bedrock formed, located approximately 3,209 feet upstream of the start of survey. The site yielded 2 young-of-the-year age class steelhead.

The third site sampled included habitat unit 39, a lateral scour pool - bedrock formed, located approximately 3,554 feet upstream of the start of the survey. The site yielded 2 young-of-the-year and 2 one-plus age class steelhead.

The fourth site sampled included habitat unit 43, a plunge pool, located approximately 4,383 feet upstream of the creek mouth. The site yielded 3 young-of-the-year age class steelhead.

The following chart displays the information yielded from these sites:

Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead YOY	1+	2+
10/20/99	1	2,922	32	LSBk	1	F1	0	2	0
10/20/99	2	3,209	34	LSBk	1	F1	2	0	0
10/20/99	3	3,554	39	LSBk	1	F1	2	2	0
10/20/99	4	4,383	43	PLP	1	F1	3	0	0

DISCUSSION

North Fork Hayworth Creek is an F1 channel type for the first 7,531 feet of stream surveyed and a B2 channel type for the remaining 8,468 feet. The suitability of F1 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for single wing-deflectors and log cover; poor for plunge weirs, boulder clusters, and opposing wing deflectors. The suitability of B2 channel types for fish habitat improvement structures is as follows: excellent for plunge weirs, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 14, 15, and 26, 1999, ranged from 58 to 71 degrees Fahrenheit. Air temperatures ranged from 62 to 84 degrees Fahrenheit. To make 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 18% of the total length of this survey, riffles 70%, and pools 11%. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. Thirty-three of the 60 (55%) pools had maximum depths greater than 2 feet. 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.

One of the 60 pool tail-outs measured had an embeddedness rating of 1, fifteen had a rating of 2, thirty-one had a rating of 3, and five had a rating of 4. Eight of the pool tail-outs had an embeddedness rating of 5, which is considered unsuitable for spawning. The pool tails valued at 5 were dominated by bedrock. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in North Fork Hayworth Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Seventeen percent of the pool tail-outs had gravel as the dominant substrate and 10% had small cobble as the dominant substrate. The remaining 73% of the pool tail-outs were dominated by large cobble, boulders, and bedrock substrate.

The mean shelter rating in the flatwater habitats was 9. The mean shelter rating for pools was 24. A pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by boulders in most habitat types. Log and root wad cover structure in the pool and flatwater habitats would enhance 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.

The mean percent canopy density for the stream was 89%. Reaches 1 and 2 had canopy densities of 90% and 88%, respectively. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 72% and 70%, 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) North Fork Hayworth Creek should be managed as an anadromous, natural production stream.

2) 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 the large wood component in the pool and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

5) 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.

6) Projects should be designed at suitable sites to trap and sort spawning gravel.

COMMENTS AND LANDMARKS

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

0' Begin survey at the confluence with Hayworth Creek. Channel type is an F1.

606' ' Two foot plunge.

711' One and one-half foot plunge.

1,438' Bridge, 12 feet long x 30 feet wide x 10 feet high.

2,922' Electrofishing site #1.

3,209' Electrofishing site #2.

3,241' Unnamed, high gradient tributary enters from right bank; 60° Fahrenheit water temperature.

3,257' Thirteen foot plunge over bedrock.

3,305' Five foot plunge.

3,554' Electrofishing site #3.

4,190' Unnamed tributary enters from right bank; 59° Fahrenheit water temperature.

4,383' Electrofishing site #4.

4,663' Small log debris accumulation on left bank, 10 feet long x 10 feet wide x 5 feet high.

5,905' Log debris accumulation, 15 feet long x 15 feet wide x 5' high, not retaining gravel.

7,277' Log debris accumulation, 15 feet long x 25 feet wide x 8 feet high, retaining gravel and cobble. Unnamed high gradient tributary enters from right bank; 60° Fahrenheit

water temperature.

7,321' Unnamed high gradient tributary enters from left bank; 62° Fahrenheit water temperature.

7,531' Channel type changes to B2.

8,563' Spring on right bank; 55° Fahrenheit water temperature.

8,990' Unnamed tributary enters from right bank; 59° Fahrenheit water temperature.

9,791' Unnamed ephemeral tributary enters from left bank.

10,031' Unnamed tributary enters from right bank (See subsection report). Log debris accumulation, 10 feet long x 10 feet wide x 4 feet high.

10,064' Rock slide on right bank, 25 feet high x 15 feet long x 12 feet wide, contributing boulders to channel.

12,143' Nine foot plunge.

12,552' Unnamed high gradient tributary enters from left bank; 59° Fahrenheit water temperature.

13,078' Seven foot plunge over bedrock.

15,609' Unnamed high gradient tributary enters from right bank; 56° Fahrenheit water temperature.

15,999' End of survey due to high gradient and dry channel.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8}
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9}
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4}
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5}
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6}
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7}
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	