STREAM INVENTORY REPORT

McMullen Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2000 on McMullen Creek. The survey began at the confluence with the Noyo River and extended upstream for 1.9 miles.

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 McMullen 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 Chinook salmon, coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

McMullen Creek is a tributary to the Noyo River, a tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). McMullen Creek's legal description at the confluence with Noyo River is T18N R14W S07. Its location is 39°25′52″ north latitude and 123°27′34″ west longitude. McMullen Creek is a first order stream and has approximately 1.23 miles of blue line stream according to the USGS Burbeck 7.5 minute quadrangle. McMullen Creek drains a watershed of approximately 2.8 square miles. Elevations range from about 600 feet at the mouth of the creek to 1500 feet in the headwater areas. Redwood forest and oak woodland vegetation dominates the watershed. The watershed is entirely privately owned, and is managed for timber production and rangeland. Vehicle access exists via Highway 20 to Irmulco Road, past the Skunk Train tracks and right at the first gate.

METHODS

The habitat inventory conducted in McMullen 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 McMullen 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 flowmeter.

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 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". McMullen 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 reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In McMullen 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, 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 McMullen 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 McMullen 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 McMullen 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 root wads) was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In McMullen Creek fish presence was observed from the stream banks, and 2 sites were electrofished by Mendocino Redwoods Company 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 McMullen 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

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HABITAT INVENTORY RESULTS

The habitat inventory of June 26-29, 2000 was conducted by Randy Turner (WSP) and Jennifer Jenkins (CCC). The total length of the stream surveyed was 9,858 feet with an additional 157 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.22 cfs on June 28, 2000.

McMullen Creek is an F3 channel type for the entire 9,858 feet of stream reach surveyed. F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 57 to 67 degrees Fahrenheit. Air temperatures ranged from 56 to 88 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 43% riffle units, 30% flatwater units, and 27% pool units (Graph 1). Based on total length of Level II habitat types there were 55% riffle units, 29% flatwater units, and 16% pool units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 41%; runs, 26%; and mid-channel pools, 23% (Graph 3). Based on percent total length, low-gradient riffles made up 53%, runs 21%, and mid-channel pools 13%.

A total of 62 pools were identified (Table 3). Main channel pools were most frequently encountered at 89% and comprised 86% 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 62 pools (38%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 62 pool tail-outs measured, 6 had a value of 1 (10%); 27 had a value of 2 (43%); 21 had a value of 3 (34%); 3 had a value of 4 (5%) and 5 had a value of 5 (8%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning. The dominant substrate composition for the 5 pool tail-outs that had a embeddedness values of 5 was 60% bedrock and 40% boulder.

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 12, flatwater habitat types had a mean shelter rating of 13, and pool habitats had a mean shelter rating of 22 (Table 1). Of the pool types, the main pools had the highest mean shelter rating at 23. Scour pools had a mean shelter rating of 21 (Table 3).

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Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in McMullen Creek, while large woody debris is the sub-dominant cover type. Graph 7 describes the pool cover in McMullen Creek. In the pools, root mass is the dominant cover type followed by large woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 61% of pool tail outs while small cobble was the next most frequently observed substrate type, at 26%.

The mean percent canopy density for the stream reach surveyed was 93%. The mean percentages of deciduous and coniferous trees were 43% and 54%, respectively. Graph 9 describes the mean percent canopy in McMullen Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 87%. The mean percent left bank vegetated was 84.8%. The dominant elements composing the structure of the stream banks consisted of 9.5% cobble/gravel, and 90.5% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 51% of the units surveyed; 25% of the units surveyed had deciduous trees as the dominant vegetation type; 20.2% had brush as the dominant vegetation type; and 3.6% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished for species composition and distribution in McMullen Creek on July 19, 2000. The sites were sampled by Mendocino Redwood Company.

The first site sampled included habitat units 4-5, located above the area of influence at the creek mouth. The site yielded 1 one-plus age class steelhead, 1 Pacific giant salamander, 1 three-spined stickleback, and 1 rough skinned newt.

The second site sampled included habitat units 185-187, located approximately 1.5 miles above the creek mouth. The site yielded 1 young-of-the-year steelhead, 4 one-plus age class steelhead, and 9 Pacific giant salamanders.

The following chart displays the information yielded from these sites. The site numbers are according to the Mendocino Redwood Company data and correspond to the habitat unit numbers listed in the table.

Date	Site #	Approx. dist from mouth (Ft)	Hab. Unit #	Hab. Type	Channel Type	Steelhead		
						YOY	1+	2+
7/19/2000	1 (70-45*)	@ mouth	004-005	4.2, 3.3	F3	0	1	0
7/19/2000	2 (70-47*)	7920'	0185-0187	3.3, 1.1, 4.2	F3	1	4	0

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DISCUSSION

McMullen Creek is an F3 channel type for the entire 9,858 feet of stream surveyed. The suitability of F3 channel types for fish habitat improvement structures is as follows: good for bank placed boulders and single and opposing wing deflectors. F3 channels are fair for plunge weirs, boulder clusters, channel constrictors and log cover.

The water temperatures recorded on the survey days June 26-29, 2000, ranged from 57 to 67 degrees Fahrenheit. Air temperatures ranged from 56 to 88 degrees Fahrenheit. This is an acceptable water temperature range for salmonids. However, 68 degrees Fahrenheit, if sustained, is near the threshold stress level for 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 29% of the total length of this survey, riffles 55%, and pools 16%. The pools are relatively shallow, with only 24 of the 62 (38%) pools having a maximum depth greater than 2 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 structure that will increase or deepen pool habitat is recommended.

Six of the 62 pool tail-outs measured had an embeddedness rating of 1. Twenty-four of the pool tail-outs had embeddedness ratings of 3 or 4. Five of the pool tail-outs had a rating of 5 which is considered unsuitable for spawning. Three of the five were unsuitable for spawning due to the dominant substrate being bedrock. The remainder of pool tails valued at 5 were dominated by boulders. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In McMullen Creek, sediment sources should be mapped and rated according to their potential sediment yields and control measures should be taken.

Fifty-four of the 62 pool tail outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 22. The shelter rating in the flatwater habitats was 13. 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, undercut banks, root mass, and large and small woody debris contribute a small amount. 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 93%. In general, revegetation projects are considered when canopy density is less than 80%.

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The percentage of right and left bank covered with vegetation was high at 87% and 84.8%, 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) McMullen 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) Evaluate fish passage through the concrete box culvert located 397' from the mouth of McMullan Creek.

4) Where feasible, design and engineer pool enhancement structures to increase the number of pools or increase the depth of existing pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

5) 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.

6) 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.

7) 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.

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'	Begin survey at confluence with Noyo River. Channel type is F3.
397'	Skunk Train Railroad crosses creek. Concrete box culvert 8' high x 8' wide x 72' long. Concrete bottom is exposed at upstream end. Two feet of substrate lies on the bottom of the culvert on the downstream end.

593' Left bank erosion, 15' high x 35' long.

1,831' Right bank log debris accumulation (LDA) mostly out of wetted channel. Contains one log, 3-4' diameter, < 20' long; and six logs, 1-2' diameter, < 20' long. Right bank erosion, 30' long x 12' high.

2,414' Humboldt crossing, 21' wide.

2,995' Several small wood accumulations containing two logs, 1-2' diameter x 20' long.

3,222' LDA, containing one log, 1-2' diameter, < 20' long, retaining small woody debris.

3,438' Left bank steep and exposed, 8' high x 40' long.

4,118' Road following along right bank, through meadow.

4,284' Log spanning channel,1-2' diameter, > 20 long. LDA, 25' wide x 10' long x 4' high.

4,430' LDA containing 5 trees,1' diameter, > 20' long, fallen over with only roots in the creek.

4,440' One tree 2-3' diameter, < 20' long in creek. Creating scour; not retaining gravel.

4,805' Left bank erosion,15' high x 50' long.

5,104' Right bank road.

5,927' LDA, with 3' plunge creating pool. Contains four logs,1-2' diameter, < 20' long; one log, 1-2' diameter, > 20' long; and one log, 3-4' diameter, > 20' long.

6,036' Culvert on right bank;1.5' diameter, 0.3' to rust line, with a 2.5' jump into the culvert, water trickling out <0.1 cfs. Left bank erosion, 18' high x 50' long.

6,266' LDA, 10' long x 3' high x 18' wide. Contains two logs, 1-2' diameter, > 20' long and three logs, 1-2' diameter, <20' long.

6,362' Left bank tributary (see sub-section report).
6,471' Bridge, 12' wide x11' high x 50' long.

6,737' Old Humboldt crossing. Upstream ends of logs buried in stream bed. The right bank downstream end of logs are 1' above water level.

7,516' Left bank erosion, 52' long x 10' high. The nearly vertical banks are vegetated with some grasses.

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7,827' LDA, 15' long x 12' wide x 4' high, retaining 2' of sediment. Contains six logs 1-2' diameter, <20' long; and one log 2-3' diameter, <20' long.

8,008' LDA, 3' long x 12' wide x 3' high, retaining 3' of sediment.

8,111' LDA, 30' long x 8' high x 15' wide. Contains one log 2-3' diameter, >20' long; ten logs 1-2' diameter, <20' long; and one log 1-2' diameter, >20' long.

8,268' LDA, 33' long x 20' wide x 6' high. Numerous 6" to 1' drops, with an overall drop of 6'. Retaining 6' of sediment.

8,301' Creek goes subsurface.

8,317' LDA, 19' long x 15' wide x 3' high.

8,948' Right bank tributary. Temperature is 60 degrees Fahrenheit. Surveyed the first 100'; steep gradient, no fish observed.

8,823' LDA, 20' long x10' wide x 2' high. Retaining 1' of sediment.

9,148' Bridge crossing, 50' long x 16' wide x 9' high.

9,474' LDA, 15' long x 15' wide x 7' high. Four foot jump from 0.8' deep pool.

9,850' LDA, 20' long x 25' wide x 12' high. Nine foot jump, no jump pool, bedrock. Retaining 9' of sediment.

9,858' End of survey. Walked approximately 200' above 9' jump. Creek dry except for occasional pockets of water. No fish observed.

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.