STREAM INVENTORY REPORT

Harmonica Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Harmonica Creek beginning at the confluence with Bear River. 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 Harmonica 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

Harmonica Creek is a tributary to Bear River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Harmonica Creek's legal description at the confluence with Bear River is T01S R01E S16. Its location is 40.3842 degrees north latitude and 124.0744 degrees west longitude. Harmonica Creek is a third order stream and has approximately 4.5 miles of blue line stream according to the USGS Scotia 7.5 minute quadrangle. Harmonica Creek drains a watershed of approximately 4.1 square miles. Elevations range from about 1,320 feet at the mouth of the creek to 3,160 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 Mattole Road to Pole Line Road.

METHODS

The habitat inventory conducted in Harmonica Creek 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 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 (Hopelain, 1994). 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, dominant substrate composing the pool tail crest, and embeddedness.

Habitat unit types encountered for the first time are further 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 Harmonica 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". Harmonica 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. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). 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 Harmonica 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 Harmonica 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 Harmonica 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 Harmonica 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 was

estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Harmonica Creek fish presence was observed from the stream banks, and three 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 Harmonica 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 the pool tail outs
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of June 9 through July 2, 1997 was conducted by David Jones (WSP/AmeriCorps) and Bill Malinowski(WSP/AmeriCorps). The total length of the stream surveyed was 19,741 feet with an additional 1,719 feet of side channel.

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Flow was estimated to be 3.2 cfs during the survey period.

Harmonica Creek is a C4 channel type for the first 5,888 feet of stream reach surveyed (Reach 1). C4 channels are low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well defined floodplain; gravel channel.

Harmonica Creek is an A2 channel for the next 4,291 feet of stream reach surveyed (Reach 2). A2 channels are steep, narrow cascading, step-pool streams; high energy/debris transport associated with depositional soils; boulder channel.

Harmonica Creek is a C4 channel for the last 9,539 feet of stream reach surveyed (Reach 3).

Water temperatures taken during the survey period ranged from 53 to 61 degrees Fahrenheit. Air temperatures ranged from 55 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 36% pool units, 32% riffle units, and 30% flatwater units (Graph 1). Based on total length of Level II habitat types there were 41% riffle units, 30% flatwater units, and 14% pool units (Graph 2).

Seventeen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 26%; step runs, 26%; and mid channel pools, 20% (Graph 3). Based on percent total length, step runs made up 43%, and low gradient riffles made up 38%.

A total of 103 pools were identified (Table 3). Main pools were most frequently encountered at 63% and comprised 64% 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. Thirty-nine of the 103 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 104 pool tail-outs measured, 24 had a value of 1 (23%); 28 had a value of 2 (27%); 32 had a value of 3 (31%); five had a value of 4 (5%) and 15 had a value of 5 (14%); (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. In Harmonica Creek, one of the 15 pool tail-outs which were valued at 5 had silt/clay/sand or gravel too small to be suitable for spawning as the substrate. The other tail-outs were not suitable for spawning due to the tail-outs being comprised of large cobble, boulders, bedrock or wood.

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 42, flatwater habitat types had a mean shelter rating of 30, and pool habitats had a mean shelter rating of 77 (Table 1). The main pools had the highest mean shelter rating at 95. Scour

pools had a mean shelter rating of 71 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 53 of the 102 pool tail outs measured (52%). Small cobble was the next most frequently observed dominant substrate type and occurred in 24% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 46%. The mean percentages of deciduous and coniferous trees were 71% and 29%, respectively. Graph 9 describes the canopy in Harmonica Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 53%. The mean percent left bank vegetated was 54%. The dominant elements composing the structure of the stream banks consisted of 61% cobble/gravel, 19% boulders, and 18% sand/silt/clay, and 3% bedrock (Graph 10). Deciduous tree was the dominant vegetation type observed in 56% of the units surveyed. Additionally, 23% of the units surveyed had coniferous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on June 30, 1997 in Harmonica Creek. The sites were sampled by David Jones (WSP/AmeriCorps) and Bill Malinowski (WSP/AmeriCorps).

The first site sampled included Habitat Unit #002, a low gradient riffle approximately 120 feet from the confluence with Bear River. This site had an area of 290.5 square feet. The site yielded 19 young-of-the-year (YOY) steelhead/rainbow trout and one age 1+ steelhead/rainbow trout.

The second site sampled included Habitat Units #092-#094, a mid-channel pool located approximately 7,797 feet above the creek mouth. This site had an area of 570 square feet. The site yielded nine YOY steelhead/rainbow trout, two age 1+ steelhead/rainbow trout, and three age 2+ steelhead/rainbow trout.

The third site sampled included Habitat Units #173-#175, a run, step pool, and pool located approximately 13,973 feet above the creek mouth. The site had an area of 950 square feet. The site yielded no fish.

DISCUSSION

Harmonica Creek is a C4 channel type for the first 5,888 feet of stream surveyed, an A2 channel for the next 4,291 feet of stream reach surveyed, and a C4 for the remaining 9,539 feet. The suitability of C4 and A2 channel types for fish habitat improvement structures is as follows:

good for bank-placed boulders; log cover, and fair for low-stage weir; single and opposing wing-deflectors; channel constrictors; log cover. A2 channel types are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days June 9 through July 2, 1997 ranged from 53 to 61 degrees Fahrenheit. Air temperatures ranged from 55 to 72 degrees Fahrenheit. 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 30% of the total length of this survey, riffles 32%, and pools 36%. The pools are relatively shallow, with only 39 of the 103 (38%) 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, 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 modification.

Twenty-four of the 104 pool tail-outs measured had an embeddedness rating of 1. Thirty-seven of the pool tail-outs had embeddedness ratings of 3 or 4. Fifteen of the pool tail-outs had a rating of 5 or were considered not suitable for spawning. One of the 15 tail-outs was not suitable for spawning due to the dominant substrate being silt/sand/clay or the gravel being too small to be suitable. 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 Harmonica Creek, 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 low with a rating of 77. The shelter rating in the flatwater habitats was lower at 30. 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, large woody debris 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.

Thirty-seven of the 104 pool tail outs 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 46%. This is a low percentage of canopy. 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 low at 53% and 54%, 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) Harmonica Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within/above 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) 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.

7) Increase the canopy on Harmonica Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is at unacceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

8) There are several log debris accumulations present on Harmonica Creek 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.

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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 confluence with Bear River. Channel type is C4.
1500'	Road crossing.
2453'	Left bank slide measures 81’ long x 40' high.
3936'	Dry left bank tributary.
4093'	Log debris accumulation (LDA) measures 30' long x 55' high x 21' wide.
4154'	LDA measures 21' long x 8.5' high.
4663'	LDA spanning channel measures 5'high, and is retaining one foot of gravel.
4768'	LDA covering unit.
4984'	Right bank tributary with extremely high gradient. The water temperature is 55 degrees Fahrenheit. It is not accessible to salmonids and is contributing fine sediment to the channel.
5181'	Left bank tributary with high gradient is not accessible to salmonis. The water temperature was 59 degrees Fahrenheit.
5442'	Right bank tributary with water temperature of 55 degrees Fahrenheit. It is not accessible to salmonids.
6260'	Dry right bank tributary.
8705'	Right bank tributary with high gradient is not accessible to fish.
9102'	Dry left bank tributary.
11954'	LDA (fresh trees down) spans channel and is retaining 20 feet of gravel.
12311'	4.5' jump from base of pool; retaining approximately 12' of gravel.
12508'	Massive landslide at left bank tributary source of LDA and bedload downstream. It is dumping trees and sediment into the channel. No fish seen were observed above it.

12674' Dry left bank tributary. Non-fish bearing and extremely high gradient.

14454' LDA begins with accompanying right bank and left bank slides measuring 139' long x 35' high.

14872' Right bank slide measures 153' long x 20' high.

15338' Dry right bank tributary.

15471' LDA measures 30' long x 50' wide x 8.3' high and is retaining 8' of gravel.

15853' Right bank tributary is not accessible to fish. The water temperature was 53 degrees Fahrenheit.

15996' LDA measures 161' long x 66' wide x 6' high.

17470' Right bank tributary with very little flow.

18008' Left bank slide measures 81' long x 50' high.

18228' Left bank tributary is accessible to salmonids. The water temperature was 58 degrees Fahrenheit.

18619' Right bank slide measures 107' long x 100' high.

18863' Right bank slide measures 149' long x 50' high.

18951' Left bank slide measures 86' long x 40' high.

19071' LDA measures 10' long x 30' wide x 2' high.

19229' Right bank slide measures 362' long x 30' high.

19416' Dry right bank tributary contributing fine sediment to the channel.

19741' End of survey. There is a 150 foot long LDA followed by a 100 foot long dry unit. No fish seen since Habitat Unit #219. There are also right bank and left bank slides that are contributing sediment to the channel

REFERENCES

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

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, 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