STREAM INVENTORY REPORT

Hollister Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Hollister Creek and an unnamed tributary to Hollister 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 Hollister Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

A spawner survey conducted on Hollister Creek during December of 1996 found no live fish, carcasses or redds. 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

Hollister Creek is tributary to South Fork Bear River, a tributary to Bear River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Hollister Creek's legal description at the confluence with South Fork Bear River is T01N R02W S34. Its location is 40.4275 degrees north latitude and 124.2861 degrees west longitude. Hollister Creek is a second order stream and has approximately 2.5 miles of blue line stream according to the USGS Capetown 7.5 minute quadrangle. Hollister Creek drains a watershed of approximately 3.5 square miles. Elevations range from about 520 feet at the mouth of the creek to 2,200 feet in the headwater areas. Mixed hardwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and grazing.

METHODS

The habitat inventory conducted in Hollister 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.

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 Hollister 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.

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". Hollister 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 Hollister 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 Hollister 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.

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 Hollister 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 Hollister 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 Hollister Creek fish presence was observed from the stream banks, and one site was 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 Hollister 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 August 15 through August 22, 1996 was conducted by Craig Mesman and David Jones (CCC), and Bill Malinowski and Andrew McMillan (WSP\AmeriCorps). The total length of the stream surveyed was 6,659 feet with an additional 923 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.5 cfs on September 11, 1996.

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Hollister Creek is an F2 channel type for the entire 6,659 feet of stream reach surveyed. F2 channels are entrenched, meandering, riffle/pool channels on low gradients with a high width/depth ratio and a boulder channel.

Water temperatures taken during the survey period ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 59 to 78 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 43% pool units, 34% flatwater units, and 23% riffle units (Graph 1). Based on total length of Level II habitat types there were 54% flatwater units, 26% pool units, and 20% riffle units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step runs, 28%; mid-channel pools, 22%; and plunge pools, 15% (Graph 3). Based on percent total length, step runs made up 50%, mid-channel pools 14%, and plunge pools 8%.

A total of ninety-one pools were identified (Table 3). Main channel pools were most frequently encountered at 54% and comprised 59% 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 91 pools (43%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 91 pool tail-outs measured, 27 had a value of 1 (30%); 35 had a value of 2 (39%); nine had a value of 3 (10%); one had a value of 4 (1%); and 19 had a value of 5 (21%) or were not suitable for spawning (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 14, flatwater habitats had a mean shelter rating of 33 and pools a mean shelter rating of 43 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 61. Backwater pools had a mean shelter rating of 37 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Hollister Creek. Graph 7 describes the pool cover in Hollister Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in two of the three low gradient riffles measured (67%). Gravel was the next most frequently observed dominant substrate type and occurred in 33% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 69%. The mean percentages of deciduous and coniferous trees were 75% and 25%, respectively. Graph 9 describes the

canopy in Hollister Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 74%. The mean percent left bank vegetated was 76%. The dominant elements composing the structure of the stream banks consisted of 54% cobble/gravel, 29% boulders, 14% bedrock, and 3% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 42% of the units surveyed. Additionally, 35% of the units surveyed had deciduous trees as the dominant vegetation type, and 7% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on August 27, 1996 in Hollister Creek. The site was sampled by Bill Malinowski and Dave Jones.

The site sampled included Habitat Units #006-#008, a boulder formed lateral scour pool, glide, and mid-channel pool, located approximately 545 feet from the confluence with South Fork Bear River. This site had an area of 780 square feet and a volume of 1,170 cubic feet. The site yielded 83 steelhead/rainbow trout.

DISCUSSION

Hollister Creek is an F2 channel type for the entire 6,659 feet of stream surveyed. The suitability of F2 channel types for fish habitat improvement structures is as follows: fair for low stage weirs, single and opposing wing-deflectors and log cover, and poor for medium stage weirs.

The water temperatures recorded on the survey days August 15 through August 22, 1996 ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 59 to 78 degrees Fahrenheit. This is a good water temperature range for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 54% of the total length of this survey, riffles 20%, and pools 26%. The pools are relatively shallow with only 39 of the 91 (43%) 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.

Twenty-nine of the 91 pool tail-outs measured had embeddedness ratings of 3, 4 or 5. Twenty-seven had an embeddedness rating of 1. 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 Hollister 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 43. The shelter rating in the flatwater habitats was slightly lower at 33. 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 structure 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.

The low gradient riffles measured had gravel or small cobble as the dominant substrate. This is considered good for spawning salmonids.

The mean percent canopy density for the stream was 69%. This is a relatively moderate 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 74% and 76%, 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) Hollister Creek should be managed as an anadromous, natural production stream.

2) 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.

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

4) 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.

5) Increase the canopy on Hollister Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable 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.

6) 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.

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 South Fork Bear River. Channel type is F2.
362'	Log debris accumulation (LDA) measures 10' long x 30' wide x 7' high. It is not retaining sediment.
816'	Six foot cascade.
1,720'	Right bank erosion site measures 60' long x 30' high and is contributing fine sediment to the channel.
2,623'	Right bank tributary contributes 25% to the flow of Hollister Creek. The water temperature was 59 degrees Fahrenheit.
2,884'	Right bank erosion site measures 250' high x 30' long.
3,923'	LDA measures 15' long x 12' wide x 8' high. It is retaining gravel measuring 6' high.
3,938'	Salmonids observed.
4,141'	Left bank tributary.
5,014'	Left bank erosion site measures 50' long x 35' high.
5,310'	Left bank tributary contributes 30% to the flow of Hollister Creek. It is accessible to fish.
5,783'	Left bank erosion site measures 70' long x 30' high.
6,109'	Salmonid observed.
6,553'	Five foot high plunge.

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6,632' Twenty-one foot rise in a distance of 81 feet.

6.694' Six foot high plunge.

6,704' End of survey. Seven foot high plunge. No fish observed for several hundred feet. The stream banks are bedrock. Above this area the stream flattens out, but no fish were observed for over 400 additional feet of stream walked.

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.

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