STREAM INVENTORY REPORT

"Byron Creek"

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on an unnamed tributary to Bridge Creek locally known as, and herein after referred to as, Byron Creek. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Byron Creek.

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

Byron Creek is a tributary to Bridge Creek, a tributary to the Eel River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Byron Creek's legal description at the confluence with Bridge Creek is T01N R02E S34. Its location is 40.4294 degrees north latitude and 123.9289 degrees west longitude. Byron Creek is a first order stream and has approximately 1.7 miles of blue line stream according to the USGS Redcrest 7.5 minute quadrangle. Byron Creek drains a watershed of approximately 1.0 square miles. Elevations range from about 240 feet at the mouth of the creek to 1,080 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access from Scotia via US Highway 101 South to Shively Road. Turn left on to Shively Road and follow for approximately 12.5 miles to the Larabee Haul Road controlled by Palco. Follow this road for approximately 2 miles to the mouth of Byron Creek.

METHODS

The habitat inventory conducted in Byron 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 AmeriCorps Watershed Stewards Project (WSP) 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, 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 Byron 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". Byron 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. 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 Byron 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 Byron 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 Byron 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 Byron 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.

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 Byron 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 July 1, 1998 was conducted by Kelly Turner and John Wooster (WSP). The total length of the stream surveyed was 1,828 feet.

Flow was not measured on Byron Creek.

Byron Creek is an F4 channel type for the entire 1,828 feet of stream reach surveyed. F4 channels are entrenched meandering riffle/pool channel on low gradients with high width/depth ratio; gravel channel.

Water temperatures taken during the survey period ranged from 59 to 60 degrees Fahrenheit. Air temperatures ranged from 56 to 59 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 48% pool units, 39% flatwater units, and 11% riffle units (Graph 1).

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Based on total length of Level II habitat types there were 66% flatwater units, 26% pool units, and 6% riffle units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pools, 35%; step-runs, 22%; and runs, 17% (Graph 3). Based on percent total length, step runs made up 49%, mid-channel pools 18%, and runs 16%.

A total of 22 pools were identified (Table 3). Main channel pools were most frequently encountered at 73% and comprised 70% 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. Nineteen of the 22 pools (86%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the twenty-two pool tail-outs measured, three had a value of 4 (14%) and nineteen had a value of 5 (86%); (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 Byron Creek, all of the nineteen pool tail-outs with embeddedness values of 5 had silt/clay/sand or gravel too small to be suitable for spawning as the 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 5, flatwater habitat types had a mean shelter rating of 92, and pool habitats had a mean shelter rating of 8 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 22. Main channel pools had a mean shelter rating of 3 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Silt/clay was the dominant substrate observed in eight of the 22 (36%) pool tail-outs measured. Sand also occurred in 36% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 89%. The mean percentages of deciduous and coniferous trees were 43% and 57%, respectively. Graph 9 describes the canopy in Byron Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 26%. The mean percent left bank vegetated was 29%. The dominant elements composing the structure of the stream banks consisted of 85% sand/silt/clay and 15% bedrock (Graph 10). Brush was the dominant vegetation type observed in 50% of the units surveyed. Additionally, 10% of the units surveyed had deciduous trees as the dominant vegetation type, and 10% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

DISCUSSION

Byron Creek is an F4 channel type for the entire 1,828 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, log cover; and poor for boulder clusters.

The water temperatures recorded on July 1, 1998 ranged from 59 to 60 degrees Fahrenheit. Air temperatures ranged from 56 to 59 degrees Fahrenheit. This is a good water temperature range for salmonids. However, 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 66% of the total length of this survey, riffles 6%, and pools 26%. The pools are relatively deep, with nineteen of the 22 (86%) 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. Primary pools comprised 22% of the total length of the habitat surveyed. Installing structures that will increase or deepen pool habitat is recommended.

None of the twenty-two pool tail-outs measured had an embeddedness rating of 1 or 2, 14% had ratings of 3 or 4, and 86% of the pool tail-outs had embeddedness ratings of 5, which is considered not suitable for spawning. The tail-outs were not suitable for spawning due to the dominant substrate being silt/clay, sand, or 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 salmonids. In Byron 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 8. The shelter rating in the flatwater habitats was 92. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by small woody debris in all habitat types. Additionally, root masses contribute 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.

Sixteen of the 22 (72%) pool tail outs had silt or sand as the dominant substrate. This is generally considered not suitable for spawning salmonids.

The mean percent canopy density for the stream was 89%. 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 26% and 29%, 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) Byron 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. However, 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) 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.

4) Suitable size spawning substrate on Byron Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

5) Primary pools comprise 22% of the total length of habitat surveyed. 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.

6) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from small woody debris. Increasing habitat complexity and quality by trapping additional small woody debris is desirable.

7) Assess culvert at 55' for fish passage.

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 Bridge Creek. Channel type is F4.
55'	4.5’ plunge from culvert outlet. Culvert is 4' diameter, with 30% rust line on downstream end and 45% on upstream end.
198'	Tributary enters right bank.

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654' Railroad tracks in creek.

721' 3’ high plunge.

952' 6’ high plunge.

1,018' 6’ high plunge.

1,150' Log debris accumulation (LDA) measures 8' long x 11' wide x 6' high.

1,427' LDA measures 5' long x 15' wide x 5' high.

1,590' Right bank bedrock slide measures 30' high x 25' wide and contains large boulders (>2') and fine sediment.

1,604' LDA measures 30' long x 15' wide x 7' high.

1,737' 4’ high plunge.

1,828' End of survey. LDA measures 65' long x 20' wide x 9' high. There is an 8' high plunge over the LDA into 4" of water which is filled with debris. Another large LDA with large silt accumulation found 150' upstream. Stream is generally filled with silt and debris jammed.

REFERENCES

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

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
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