STREAM INVENTORY REPORT

Box Canyon Creek, Mattole River

INTRODUCTION

A stream inventory was conducted during the summer of 2000 on Box Canyon 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 Box Canyon 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

Box Canyon Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Box Canyon Creek's legal description at the confluence with the Mattole River is T 04S R 02E S18. Its location is 40°07′24″ north latitude and 123°59′45″ west longitude. Box Canyon Creek is a first order stream and has approximately 0.6 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Box Canyon Creek drains a watershed of approximately 0.8 square miles. Elevations range from about 620 feet at the mouth of the creek to 1,200 feet in the headwater areas. Redwood, Douglas fir, and mixed hardwood forest dominate the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists from U.S. Highway 101 at Redway. Take the Briceland Road through Briceland and continue on to Ettersburg Road. Turn right onto Etterburg Road and follow to the French Ranch Road. Follow the private ranch road for about 2.5 miles to the mouth of Box Canyon Creek. This private road is only accessible with prior permission from the landowner.

METHODS

The habitat inventory conducted in Box Canyon Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi, et al. 1998). The 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 Box Canyon 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". Box Canyon 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 Box Canyon 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 Box Canyon 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 Box Canyon 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 Box Canyon 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 Box Canyon Creek fish presence was observed from the stream banks, and two 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 Box Canyon 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
- 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 11 and 12, 2000 was conducted by Dan Kintz and Johanna Schussler (WSP). The total length of the stream surveyed was 2,776 feet with an additional 12 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.2 cfs on July 11, 2000.

Box Canyon Creek is a F4 channel type for the first 777 feet, a B4 channel type for the next 1,208 feet, and a B2 channel type for the final 791 feet of the survey. F4 channel types are entrenched meandering riffle/pool gravel channels on low gradients with high width/depth ratio. B4 channels are moderately entrenched, moderate gradient, riffle dominated gravel channels with infrequently spaced pools; very stable plan and profile; and stable banks. B2 channels are moderately entrenched, moderate gradient, riffle dominated boulder channels with infrequently spaced pools; very stable plan and profile; and stable banks.

Water temperatures taken during the survey period ranged from 60° to 69° F. Air temperatures ranged from 63° to 85°.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 36% riffle units, 34% pool units, and 30% flatwater units (Graph 1). Based on total **length** of Level II habitat types there were 56% riffle units, 30% flatwater units, and 14% pool units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffle 36%, mid-channel pools 26%, and runs 19% (Graph 3). Based on percent total **length**, low gradient riffles made up 56%, runs 15%, and step runs 14%.

A total of twenty-five pools were identified (Table 3). Main channel pools were most frequently encountered at 76% occurrence and comprised 71% 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. Four of the twenty-five pools (16%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the twenty-four pool tail-outs measured, seven had a value of 1 (29.2%); four had a value of 2 (16.7%); five had a value of 3 (20.8 %); two had a value of 4 (8.3%) and six had a value of 5 (25%) (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.

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 15, flatwater habitat types had a mean shelter rating of 10, and pool habitats had a mean shelter rating of 31 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 210. Main channel and scour pools had a mean shelter rating of 11 and 10 respectively (Table 3).

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

Table 6 summarizes the dominant substrate by habitat types. Small cobble was the dominant substrate observed in ten of the twenty-four (41.7%) pool tail-outs measured. Gravel was the next most frequently observed dominant substrate type and occurred in 20.8% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 60%. The mean percentages of conifer and deciduous trees were 6% and 94%, respectively. Graph 9 describes the canopy in Box Canyon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 85.4%. The mean percent left bank vegetated was 82.9%. The dominant elements composing the structure of the stream banks consisted of 55.6% cobble/gravel, 19.4% bedrock, 19.4% boulders, and 5.6% sand/silt/clay (Graph 10). Deciduous trees was the dominant bank vegetation type observed in

83.3 % of the units surveyed. Additionally, 16.7% of the units surveyed had coniferous trees as the dominant bank vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on Box Canyon Creek in 2000. Both sites were sampled on October 27, 2000 by Glenn Yoshioka (DFG), Gordon Johnson (CCC), Ben Beaver, and Kirsten Williams (WSP).

The first site sampled included habitat units 006, 007, 010, and 014. These units included a run, a low gradient riffle, mid-channel pool, and a plunge pool, respectively. The site yielded 22 juvenile steelhead rainbow trout and 1 juvenile coho salmon. Based upon visually estimated lengths, the probable distribution of steelhead age classes was 20 age 0+ and 2 age 1+ juveniles.

The second site sampled began 957 feet upstream from the mouth and included habitat units 027, 028, 031, 033, and 034. These units included a low gradient riffle, a run, a plunge pool, a dammed pool, and another dammed pool, respectively. The site yielded 13 juvenile steelhead rainbow trout. Based upon visually estimated lengths, all of these juvenile steelhead trout appeared to be young-of-the year (age 0+).

DISCUSSION

Box Canyon Creek is a F4 channel type for the first 777 feet of stream surveyed, a B4 channel type for the next 1,208 feet, and a B2 for the remaining 791 feet. 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, and log cover; and poor for boulder clusters. The suitability of B4 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. The suitability of B2 channel types for fish habitat improvement structures is excellent for plunge weirs, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 11 and 12, 2000, ranged from 60° to 69° F. Air temperatures ranged from 63° to 85° F. This is an acceptable water temperature range for steelhead rainbow trout. 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 30% of the total length of this survey, riffles 56%, and pools 14%. The pools are relatively shallow, with only four of the twenty-five (16%) pools having a

maximum depth 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. Primary pools comprised 2% of the total length of the habitat surveyed. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. Installing structures that will increase or deepen pool habitat is recommended.

Seven of the twenty-four (29.2%) pool tail-outs measured had an embeddedness rating of 1, 16.7% had a rating of 2; 29.1% had a rating of 3 or 4; and 25% had a rating of 5 and were considered unsuitable for spawning. Five of the six (83%) with a rating of 5 were unsuitable for spawning due to the dominant substrate being boulders and 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. In Box Canyon 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 31. The shelter rating in the flatwater habitats was 10. 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. Log and root wad cover structures in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Instream cover created by small and large woody debris provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Fifteen of the twenty-four (62%) 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 60%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 85.4% and 82.9%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting native species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Box Canyon Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are suitable 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) Increase the canopy on Box Canyon 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.

4) Primary pools comprise only 2% of the total stream length. 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 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) The culvert at 64' should be evaluated to determine it impedes downstream and upstream fish passage.

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.

0' Begin survey at the confluence with the Mattole River. Channel type is an F4.

64' Plunge pool is created by a drop from a perched corrugated metal pipe (CMP) culvert. Culvert may be a barrier to juvenile salmonids migrating up stream. Juvenile steelhead trout observed in the pool.

302' Log debris accumulation (LDA), 20' long x 15' wide x 6' high.

532' Four foot plunge to pool below.

550' Channel type taken. Channel type is a F4.

884' Channel type taken. Channel type is a B4.

1,295' LDA, 10' long x 20' wide.

1,474' LDA, 20' long x 20' wide x 8' high.

1,727' Channel type taken. Channel type is a B2.

2,117' LDA, 20' long x 17' wide x 7' high.

2,330' 4' plunge off of bedrock wall.

2,370' Right bank tributary enters. Gradient may be too steep and impede passage for upstream migrating fish.

2,388' Boulder substrate more common.

2,618' LDA, 8' long x 8' wide x 6' high.

2,788' Sixty foot water fall over bedrock cliff. End of survey.

REFERENCES

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3nd 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