

# **STREAM INVENTORY REPORT**

## **Unnamed Tributary to Bear River Tributary E**

### INTRODUCTION

A stream inventory was conducted during the summer of 1996 on an unnamed tributary to the Bear River referred to as Tributary E in this report. 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 Tributary E. 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

Tributary E is tributary to the Bear River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Tributary E's legal description at the confluence with Bear River is T01N R01W S29. Its location is 40°26'08" north latitude and 124°11'57" west longitude. Tributary E is a first order stream and has approximately 1.2 miles of blue line stream according to the USGS Taylor Peak 7.5 minute quadrangle. Tributary E drains a watershed of approximately 1.2 square miles. Elevations range from about 420 feet at the mouth of the creek to 900 feet in the headwater areas. Redwood/Douglas fir forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and grazing rangeland. Vehicle access exists via Monument Road.

### METHODS

The habitat inventory conducted in Tributary E 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, 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 Tributary E 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". Tributary E 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 Tributary E, 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 Tributary E, 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Tributary E, 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 Tributary E, 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 Tributary E 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 Tributary E 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

\* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT \*

The habitat inventory of September 19, and October 10, 1996, was conducted by Bill Malinowski (WSP\AmeriCorps) and David Jones (CCC). The total length of the stream surveyed was 3,103 feet.

Flow was not measured on Tributary E.

Tributary E is an F3 channel type for the entire 3,103 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 54 to 58 degrees Fahrenheit. Air temperatures ranged from 54 to 64 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 6% riffle units, 30% flatwater units, 35% pool units, and 30% dry units (Graph 1). Based on total **length** of Level II habitat types there were 2% riffle units, 43% flatwater units, 7% pool units and 48% was dry (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 35%; dry units, 30%; and step runs, 26% (Graph 3). Based on percent total **length**, dry units made up 48%, step runs 41%, and mid-channel pools 7%.

A total of 19 pools were identified (Table 3). Main channel pools were the only pools encountered and comprised 100% 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. One of the 19 pools (5%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 19 pool tail-outs measured, 10 had a value of 1 (53%); 4 had a value of 2 (21%); 0 had a value of 3; 0 had a value of 4 and 5 had a value of 5 (26%) (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 5, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 5 (Table 1). Main channel pools had a mean shelter rating of 5 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Large cobble was the dominant substrate observed in the two low gradient riffles measured (Graph 8).

The mean percent canopy density for the stream reach surveyed was 76%. The mean percentages of deciduous and coniferous trees were 77% and 23%, respectively. Graph 9 describes the canopy in Tributary E.

For the stream reach surveyed, the mean percent right bank vegetated was 36%. The mean percent left bank vegetated was 41%. The dominant elements composing the structure of the stream banks consisted of 17% boulder, and 83% cobble/gravel (Graph 10). Deciduous trees were the dominant vegetation type observed in 50% of the units surveyed (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

One site was electrofished on October 31, 1996, in Tributary E. The site was sampled by Bill Malinowski and Allan Renger (WSP\AmeriCorps).

The site sampled included habitat units 2 through 4, a step run approximately 12 feet from the confluence with Bear River. The site yielded a total of 21 steelhead.

## DISCUSSION

Tributary E is an F3 channel type for the entire 3,103 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; fair for low stage weirs, boulder clusters, channel constrictors and log cover; and poor for medium stage weirs.

The water temperatures recorded on the survey days September 9, and October 10, 1996, ranged from 54 to 58 degrees Fahrenheit. Air temperatures ranged from 54 to 64 degrees Fahrenheit. This is an good water temperature range 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 43% of the total **length** of this survey, riffles 2%, and pools 7%. The pools are relatively shallow, with only one of the 19 (5%) 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 structures that will increase or deepen pool habitat is recommended.

Five of the 19 pool tail-outs measured had embeddedness ratings of 5 or were unsuitable for spawning. Ten had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

The mean shelter rating for pools was low with a rating of 5. The shelter rating in the flatwater habitats was equivalent at 5. 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, small woody debris 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The two low gradient riffles measured had large cobble (5" to 10") as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean percent canopy density for the stream was 76%. This is a relatively high 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 low at 36% and 41%, 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) Tributary E 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) 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) Increase the canopy on Tributary E by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels.
- 7) Suitable size spawning substrate on Tributary E is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

### 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 confluence with Bear River. Channel type is an F3. |
| 287'   | Right bank erosion, 34 feet long.                                  |
| 998'   | Left bank dry tributary.   |
| 1,458' | Erosion, 120' long x 80' high.                                     |

1,809'	Seven young-of-the-year steelhead observed.
2,084'	Left bank erosion, 55' long x 85' high.
2,209'	Right bank tributary.
2,638'	Erosion, 40' long x 10' high.
3,103'	End of survey. Boulders dominate channel. Erosion, 60' long x 40' high.

#### 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**

HABITAT TYPE	LETTER	NUMBER
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#### **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

