STREAM INVENTORY REPORT

# Bridge Creek

## INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Bridge 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 Bridge Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. An adult spawning survey was conducted on Bridge Creek by the Department of Fish & Game (DFG) on January 10, 1991. No spawning fish or carcasses were observed on this survey.

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

Bridge Creek is tributary to the Mattole River, located in Humboldt County, California. Bridge Creek's legal description at the confluence with the Mattole River is T04S R02E S33. Its location is 40°03'45" North latitude and 123°57'49" West longitude. Bridge Creek is a third order stream and has approximately 6.5 miles of blue line stream according to the USGS Briceland and Shelter Cove 7.5 minute quadrangles. Bridge Creek drains a watershed of approximately 4.2 square miles. Summer base flow is approximately 1.3 cubic feet per second (cfs) at the mouth, but over thirty cfs is not unusual during winter storms. Elevations range from about 900 feet at the mouth of the creek to 1800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned, and parts are subdivided for rural residence. The remainder of the watershed is the Kings Range National Conservation Area, and is managed for recreation by the Bureau of Land Management. Vehicle access exists from Redway via the Briceland/Shelter Cove Road to Whitethorn junction. Continue on Shelter Cove Road across the Mattole River. The mouth of Bridge Creek is about 50' directly upstream from the bridge.

## METHODS

The habitat inventory conducted in Bridge Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1994). The Pacific Coast Fisheries, Wildlife, and Wetlands Restoration Association members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Bridge Creek personnel were trained in May, 1996, by Scott Downie and Ruth Goodfield. 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 Bridge 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". Bridge 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 taken 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 Bridge 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), 76 - 100% (value 4). Additionally, a rating of "not suitable" (NS) 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 Bridge 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*, 1994. Canopy density relates to the amount of stream shaded from the sun. In Bridge 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 Bridge Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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.

**Bridge Creek**

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Bridge Creek fish presence was observed from the stream banks, and one site was electrofished using one Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes: 25.4, 12.5, 4.7, 2.37, and 0.85 mm (Valentine, 1995).

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 Lotus 1,2,3. Graphics developed for Bridge 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

**Bridge Creek**

- 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 June 17 through July 2, 1996, was conducted by Dylan Brown, Dave Smith, and Raymond Bevitori (PCFWWRA). The total length of the stream surveyed was 16,467 feet with an additional 113 feet of side channel. However,

included in this distance are approximately 2,500 feet of habitat that was not surveyed due to denied access by a landowner.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.3 cfs on June 26, 1996.

Bridge Creek is an F4 channel type for 13,967 feet of the entire 16,467 feet of stream reach surveyed. The 2,500 feet of stream not surveyed was also not channel typed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients (<2%), with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 53 to 57 degrees Fahrenheit. Air temperatures ranged from 53 to 70 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 41% pool units, 32% flatwater units, and 27% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 45% flatwater units, 23% pool units, 16% riffle units, and 15% of the total length was denied access (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 32%; low gradient riffles, 26%, and step runs, 23% (Graph 3). Based on percent total **length**, step runs made up 41%, mid-channel pools 20%, and low gradient riffles 15%.

**Bridge Creek**

A total of eighty-nine pools were identified (Table 3). Main channel pools were most frequently encountered at 83% and comprised 54% 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. Fifty-one of the 89 pools (57%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 80 pool tail-outs measured, none had a value of 1; 15 had a value of 2 (19%); 65 had a value of 3 (81%); and none had a value of 4 (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. Pool habitat types had a mean shelter rating of 57, and flatwater habitats had a mean shelter rating of 29 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 66. Backwater pools had a mean shelter rating of 60 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 3 of the 5 low gradient riffles measured (60%). Small cobble was the next most frequently observed dominant substrate type and occurred in 20% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 88%. The mean percentages of deciduous and coniferous trees were 82% and 18%, respectively. Graph 9 describes the canopy in Bridge Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 85%. The mean percent left bank vegetated was 87%. The dominant elements composing the structure of the stream banks consisted of 32.9% bedrock, 1.2% boulder, 23.2% cobble/gravel, and 42.7% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 9.7% of the units

surveyed. Additionally, 63.4% of the units surveyed had deciduous trees as the dominant vegetation type, and 21.9% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

One site was electrofished on June 26, 1996, in Bridge Creek. The site was sampled by Ruth Goodfield (DFG), Kelley Garrett, and Todd Kraemer(AmeriCorps).

The site sampled included habitat units 0010-0011, a riffle/run sequence approximately 610 feet from the confluence with the Mattole River. This site had an area of 450 sq ft and a volume of 315 cu ft. The site yielded two steelhead young-of-the-year (YOY) and one coho salmon YOY.

## GRAVEL SAMPLING RESULTS

No gravel samples were taken on Bridge Creek.

## DISCUSSION

Bridge Creek is an F4 channel type for all of the surveyed 13,967' of the total 16,467' stream distance. F4 channel types for fish habitat improvement structures is good for bank-placed boulders; fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors, and cover logs; and poor for medium-stage weirs and mid-channel boulder clusters.

The water temperatures recorded on the survey days June 17 - July 2, 1996, ranged from 53 to 57 degrees Fahrenheit. Air temperatures ranged from 53 to 70 degrees Fahrenheit. This is an excellent 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 45% of the total **length** of this survey, riffles 16%, and pools 23%. The pools are relatively shallow, with only 26 of the 89 pools (23.1%) having a maximum depth greater than 3 feet. In general, pool enhancement projects

are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum depth of at least three 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.

Sixty-five of the 80 pool tail-outs measured had embeddedness ratings of 3 or 4. None 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. In Bridge 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 moderate with a rating of 57. The shelter rating in the flatwater habitats was slightly lower at 29. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders and bedrock ledges in all habitat types. Additionally, bubble curtain 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition. Four of the five low gradient riffles 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 88%. This is a relatively high percentage of canopy. In general, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 85% and 87%, 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

**Bridge Creek**

1) Bridge 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. 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 bedrock ledges and boulders. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

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.

PROBLEM SITES 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 the Mattole River. Channel type is an F4 for the entire length of survey. |
| 248' | High voltage power lines observed above the stream. |
| 553' | Culvert on left bank (LB). |
| 610' | Bioinventory site. Bureau of Land Management (BLM) |

administrative buildings on LB.

873' BLM pumphouse on LB.

1505' Bridge crosses stream. Pumphouse on right bank (RB).

1745' Tributary enters stream from the RB - temperature of tributary is 55°F. Two pumps on the LB; one pump on the RB.

2363' Pump on RB.

2730' Pump on LB.

3891' Tributary enters from RB - temperature is 52°F.

3951' Access denied by landowner for the next 2500 feet. This distance is included in the total stream length.

8609' Spring on RB - temperature is 52°F.

9460' Road fords stream.

10444' Old log bridge crosses creek. It is in poor condition.

574' Spring on LB - 52°F.

10741' Large supply of large woody debris near the stream in this area.

10945' Road on LB.

12140' Spring on RB - 53°F.

12508' Spring on LB.

13869' Spring on RB - 52°.

14251' Culvert on LB under inner gorge road. Gullying has occurred around culvert. Spring runs down gully - not the culvert. Problem spot.

14594' Bridge Creek forks. See related reports.

16467' Bridge Creek stream gradient increases significantly.

**Bridge Creek**

No fish observed. End of survey.

## 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

| 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 |