STREAM INVENTORY REPORT

DUNN CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Dunn Creek and an unnamed tributary. 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 Dunn Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. There is no known record of adult spawning surveys having been conducted on Dunn Creek.

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

Dunn Creek is tributary to Cottaneva Creek, tributary to the Pacific Ocean, located in Mendocino County, California (Figure 1). Dunn Creek's legal description at the confluence with Cottaneva Creek is T22N R18W S01. Its location is 39°47′34″ north latitude and 123°48′52″ west longitude. Dunn Creek is a second order stream and has approximately 1.2 miles of blue line stream according to the USGS Hales Grove 7.5 minute quadrangle. Dunn Creek drains a watershed of approximately 2.0 square miles. Summer base runoff is approximately 1.2 cubic feet per second (cfs) at the mouth. Elevations range from about 260 feet at the mouth of the creek to 1600 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via private road from State Route 1 approximately four miles west of Hales Grove.

METHODS

The habitat inventory conducted in Dunn 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). Dunn Creek personnel were trained in May, 1995, by Gary Flosi. 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 Dunn 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". Dunn 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 Dunn 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 Dunn 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 Dunn 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 Dunn 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.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Dunn Creek fish presence was observed from the stream banks, and three sites were electrofished using one 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 Lotus 1,2,3. Graphics developed for Dunn 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

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

The habitat inventory of June 12 and 13, 1995, was conducted by Craig Mesman (CCC) and Kyle Young (WSP/AmeriCorps). The total length of the stream surveyed was 6,646 feet with an additional 100 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.2 cfs on July 7, 1995.

Dunn Creek is an F4 channel type for the first 4,752 feet of stream reach surveyed, a G4 for the next 1,030 feet, and an E4 for the remaining 864 feet. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. G4 channels are entrenched, gully-like, step-pool channels with low width/depth ratios, moderate gradients, and gravel-dominant substrates. E4 channels are low gradient, meandering, very efficient and stable riffle/pool streams with low width/depth ratios, little deposition, high meander, and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 59 degrees Fahrenheit. Air temperatures ranged from 52 to 66 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 39% pool units, 31% riffle units, and 30% flatwater units (Graph 1). Based on total **length** of Level II habitat types there were 48% flatwater units, 27% riffle units, and 23% pool units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low-gradient riffles, 30%; mid-channel pools, 23%; and step runs, 19% (Graph 3). Based on percent total **length**, step runs made up 40%, low-gradient riffles 26%, and mid-channel pools 13%.

A total of 92 pools were identified (Table 3). Main channel pools were most frequently encountered at 65% and comprised 63% 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. Twenty-eight of the 92 pools (30%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 77 pool tail-outs measured, 28 had a value of 1 (36%); 33 had a value of 2 (43%); 14 had a value of 3 (18%); and 2 had a value of 4 (3%) (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 46, and flatwater habitats had a mean shelter rating of 42 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 82. Main channel pools had a mean

shelter rating of 39 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Dunn Creek. Graph 7 describes the pool cover in Dunn Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in all of the 8 low-gradient riffles measured (100%) (Graph 8).

The mean percent canopy density for the stream reach surveyed was 92%. The mean percentages of deciduous and coniferous trees were 19% and 81%, respectively. Graph 9 describes the canopy in Dunn Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 79%. The mean percent left bank vegetated was 85%. The dominant elements composing the structure of the stream banks consisted of 0% bedrock, 0% boulder, 69% cobble/gravel, and 31% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 69% of the units surveyed. Additionally, 30% of the units surveyed had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on August 3, 1995, in Dunn Creek. The sites were sampled by Craig Mesman (CCC) and Kyle Young (WSP/AmeriCorps).

The first site sampled included habitat units 8-12, three pools, a step run, and a riffle approximately 249 feet from the confluence with Cottaneva Creek and within the F4 channel type reach. This site had a length of 170 feet. The site yielded thirty-six 0+ steelhead, one 1+ steelhead, and four Pacific giant salamanders.

The second site included habitat units 159-166, a series of pools, runs, and riffles located approximately 4,484 feet above the creek mouth and within the G4 channel type reach. This site had a length of 368 feet. The site yielded fifteen 0+ steelhead, one 1+ steelhead, and one Pacific giant salamander.

The third site sampled included habitat units 198-201, a series of remnant pools located approximately 5,682 feet above the creek mouth and within the E4 channel type reach. The site had a length of 194 feet, of which only about 30 feet were actually wetted. The site yielded four 0+ steelhead.

DISCUSSION

Dunn Creek is an F4 channel type for the first 4,752 feet of stream surveyed, a G4 for the next 1,030 feet, and an E4 for the remaining 864 feet. The suitability of F4 channel types for fish

habitat improvement structures is as follows: good for bank-placed boulders; fair for low-stage weirs, single and opposing wing deflectors, channel constrictors, and log cover; and poor for medium-stage weirs and boulder clusters. G4 channels are considered: good for bank-placed boulders; fair for low-stage weirs, opposing wing deflectors, and log cover; and poor for medium-stage weirs, boulder clusters, and single wing deflectors. E4 channels are considered: good for bank-placed boulders; fair for opposing wing deflectors; and poor for medium-stage weirs, boulder clusters, and single wing deflectors.

The water temperatures recorded on the survey days June 12 and 13, 1995, ranged from 52 to 59 degrees Fahrenheit. Air temperatures ranged from 52 to 66 degrees Fahrenheit. This is a 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 48% of the total **length** of this survey, riffles 27%, and pools 23%. The pools are relatively shallow, with only 28 of the 92 (30%) 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.

Twenty-eight of the 77 pool tail-outs measured had an embeddedness rating of 1. Only 16 had ratings of 3 or 4. 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 Dunn 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 46. The shelter rating in the flatwater habitats was slightly lower at 42. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by large woody debris in all habitat types. Additionally, small woody debris 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.

All of the 8 low gradient riffles measured had gravel as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 92%. 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 high at 79% and 85%, 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) Dunn Creek should be managed as an anadromous, natural production stream.

2) The gabion weirs installed to back-flood the culvert at State Route 1 are in need of maintenance. Consideration should be given to replacing them with more durable structures.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools or deepen existing 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. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

5) 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.

6) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 3,462', should then be treated to reduce the amount of fine sediments entering the stream.

7) 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.

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 Cottaneva Creek. Channel type is F4.

2713' Series of two gabion weirs built to improve access into State Route 1 culvert.

2737' State Route 1 culvert 8' wide x 8' high x 85' long. Washington baffles installed.

3187' Left bank tributary. Not accessible to anadromous fish (NAF).

3274' Log and debris accumulation (LDA) 3' high x 10' wide x 12' long. No gravel retention.

3394' Five and one-half foot jump over embedded wood. Possible barrier. Retains gravel 5-6 feet deep at base.

3462' Right bank failure 60' high x 98' long contributing fines.

3909' Relic trestle.

3932' Right bank tributary enters through 3' diameter culvert. Estimated flow <1.0 cfs.

4001' Flatcar bridge 13' wide x 20' long x 4' clearance.

4316' Unnamed Dunn Creek Tributary enters left bank (see subsection).

4752' Channel type changes to G4.

5158' Habitat unit covered by woody debris and soil.

5682' Channel type changes to E4.

5842' Last noted observation of fish presence.

6646' End of survey due to increasing gradient and diminished habitat.

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.