STREAM INVENTORY REPORT

Dolly Varden Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2001 on Dolly Varden Creek. The survey began at the confluence with Redwood Creek and extended upstream 1.1 miles.

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

Dolly Varden Creek is a tributary to Redwood Creek, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Dolly Varden Creek's legal description at the confluence with Redwood Creek is T08N R02E S36. Its location is 41.0348 degrees north latitude and 123.8873 degrees west longitude. Dolly Varden Creek is a second order stream and has approximately 1.8 miles of blue line stream according to the USGS Panther Creek 7.5 minute quadrangle. Dolly Varden Creek drains a watershed of approximately 3.3 square miles. Elevations range from about 540 feet at the mouth of the creek to 1,840 feet in the headwater areas. Mixed hardwood forest and mixed conifer forest dominate the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 299 to Redwood Valley Road.

METHODS

The habitat inventory conducted in Dolly Varden Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The 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. 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 (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are 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 Dolly Varden 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 a Marsh-McBirney Model 2000 flow meter.

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. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

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". Dolly Varden 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. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Dolly Varden 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, bedrock, 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 Dolly Varden 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 Dolly Varden 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 Dolly Varden 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 (including downed trees, logs, and rootwads) was estimated and recorded.

Dolly Varden Creek

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 Dolly Varden 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
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of July 25 through August 27, 2001 was conducted by J. Martin, M. Wallar, and D. Best (WSP/AmeriCorps). The total length of the stream surveyed was 5,968 feet with an additional 375 feet of side channel.

Stream flow was not measured on Dolly Varden Creek.

Dolly Varden Creek is a B3 channel type for 4,639 feet (Reach 1) and an F3 channel type for 1,204 feet (Reach 2). B3 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools; very stable plans and profiles; stable banks; with cobble channels. F3 channels are entrenched meandering riffle/pool channels, on low gradients, with high width/depth ratio, and cobble dominated.

Water temperatures taken during the survey period ranged from 56 to 64 degrees Fahrenheit. Air temperatures ranged from 58 to 76 degrees Fahrenheit.

Dolly Varden Creek

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 43% pool units, 27% flatwater units, and 26% riffle units (Graph 1). Based on total length of Level II habitat types there were 46% flatwater units, 27% pool units, and 24% riffle units (Graph 2).

Seventeen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 23%; step runs, 17%; and mid-channel pools, 14% (Graph 3). Based on percent total length, step runs made up 35%, low gradient riffles 21%, and mid-channel pools 9%.

A total of 81 pools were identified (Table 3). Scour pools were the most frequently encountered, at 54%, and comprised 46% 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. Fifteen of the eighty-one pools (19%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 81 pool tail-outs measured, 19 had a value of 1 (24%); 27 had a value of 2 (33%); 21 had a value of 3 (26%); eight had a value of 4 (10%); and six had a value of 5 (7%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. The breakdown of dominant substrate composition for the six pool tail-outs that had a embeddedness value of 5 were as follows: 50% large cobble, 33% boulders, 17% silt/clay/sand or small gravel.

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 50, flatwater habitat types had a mean shelter rating of 36, and pool habitats had a mean shelter rating of 50 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 52. Scour pools had a mean shelter rating of 50 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders and large woody debris are the dominant cover type in Dolly Varden Creek. Graph 7 describes the pool cover in Dolly Varden Creek. Large woody debris is the dominant pool cover type, followed by boulders.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 42% of pool tail-outs while small cobble was the next most frequently observed substrate type, at 37%.

The mean percent canopy density for the surveyed length of Dolly Varden Creek was 90%. The mean percentages of deciduous and coniferous trees were 34% and 66%, respectively. Graph 9 describes the mean percent canopy in Dolly Varden Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 95%. The mean percent left bank vegetated was 91%. The dominant elements composing the structure of the stream banks consisted of 60% cobble/gravel, 27% sand/silt/clay, 11% boulders, and 1% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 49% of the units surveyed. Additionally, 36% of the units surveyed had deciduous trees as the dominant

vegetation type, and 8% had brush as the dominant vegetation (Graph 11).

DISCUSSION

Dolly Varden Creek is a B3 channel type for the first 4,639 feet of stream surveyed and an F3 channel type for the remaining 1,204 feet. The suitability of B3 channel types for fish habitat improvement structures is as follows: excellent for plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. 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; and fair for plunge weirs, boulder clusters, channel constrictors, and log cover.

The water temperatures recorded on the survey days July 25 to August 27, 2001 ranged from 56 to 64 degrees Fahrenheit. Air temperatures ranged from 58 to 76 degrees Fahrenheit. This is a suitable water temperature range for salmonids. 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 47% of the total length of this survey, riffles 24%, and pools 28%. The pools are relatively shallow, with only 15 of the 81 (19%) 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.

Forty-six of the 81 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-nine of the pool tail-outs had embeddedness ratings of 3 or 4. Six of the pool tail-outs had a rating of 5, which is considered not suitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

Sixty-four of the 81 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 50. The shelter rating in the flatwater habitats was 36. A pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by large woody debris and boulders in all habitat types. Log and root wad cover structures in the pool and flatwater habitats would enhance 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.

The mean percent canopy density for the stream was 90%. Reach 1 had a canopy density of 89% while Reach 2 had canopy density of 93%. In general, revegetation projects are considered when canopy density is less than 80%.

Dolly Varden Creek

The percentage of right and left bank covered with vegetation was high at 95% and 91%, respectively.

RECOMMENDATIONS

1) Dolly Varden 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) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from large woody debris. Adding high quality complexity with woody cover is desirable.

4) Where feasible, design and engineer pool enhancement structures to increase the number of pools or deepen the existing pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

5) There are several log debris accumulations (LDA's) present on Dolly Varden Creek that are retaining fine sediment. Monitor fish passage for three to five years to determine if these LDA's are preventing 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 the confluence with Redwood Creek. The channel type is a B3.
418'	Log debris accumulation (LDA) measures 267' long x 70' wide x 10' high.
962'	LDA measures 132' long x 40' wide.
1,674'	LDA measures 90' long x 65' wide x 15' high.
2,091'	LDA measures 58' long x 45' wide x 10' high.
2,177'	Tributary enters right bank.
2,918'	Tributary enters left bank.

4,128' LDA measures 90' long x 30' wide x 10' high.

4,263' LDA measures 123' long x 30' wide x 8' high.

4,729' Tributary enters on left bank.

5,138' LDA measures 30' long x 8' high x 25' wide.

5,236' LDA measures 90' long x 40' wide x 15' high.

5,453' Bridge crosses creek; it measures 78' long x 5' wide x 10' high.

5,532' Tributary enters left bank.

5,645' Tributary enters right bank.

5,968' End of survey. No fish have been seen for approximately 1/4 mile.

REFERENCES

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

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8}
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9}
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4}
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5}
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6}
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7}
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	