STREAM INVENTORY REPORT

Westlund Creek, Mattole River

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on Westlund 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 Westlund 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

Westlund Creek is tributary to the Mattole River, located in Humboldt County, California (Map 1). Westlund Creek's legal description at the confluence with Mattole River is T3S R1E S00. Its location is 40°13′41″ North latitude and 124°02′26″ West longitude. Westlund Creek is a second order stream and has approximately 4.4 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Westlund Creek drains a watershed of approximately 4.7 square miles. Elevations range from about 400 feet at the mouth of the creek to 2,000 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production and rural residence. Vehicle access exists from Hwy 101 via the Bull Creek - Honeydew Road exit. Travel West approximately eight miles to Panther Gap Road. Further directions to the mouth of Westlund Creek are available from the local landowners.

METHODS

The habitat inventory conducted in Westlund 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.

Westlund Creek

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1995). 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 methodology and data sheet have been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This protocol was used in Westlund Creek to record measurements and observations. There are nine components to the inventory data sheet.

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". Westlund 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 Westlund 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 Westlund 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 Westlund 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 Westlund 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 Westlund Creek fish presence was observed from the stream banks, and four sites were electrofished using a 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 standard 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 Quattro Pro. Graphics developed for Westlund Creek include:

- Riffle, flatwater, pool habitats by percent occurrence

Westlund Creek

- 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
- 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 8 to 14, 1998, was conducted by John Wooster and Caroline Jezierski (AmeriCorps/WSP). The total length of the stream surveyed was 16,979 feet with an additional 348 feet of side channel.

A flow of 0.8 cfs was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter on September 15, 1998.

Westlund Creek is a B4 channel type for the first 12,331 feet of stream reach surveyed, and an A4 type for the remaining 4,648 feet of surveyed stream. B4 channels are moderately entrenched, meandering, riffle/pool channels on 2-4% gradients with moderate width/depth ratios and gravel-dominant substrates. A4 channels are steep, narrow, cascading, step-pool streams with high energy/debris transport associated with depositional soils. The dominant substrate is gravel.

Water temperatures taken during the survey period ranged from 61° to 66° F. Air temperatures ranged from 62° to 81° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% riffle units, 36% flatwater units, and 25% pool units (Graph 1). Based on total length of Level II habitat types there were 40% riffle units, 50% flatwater units, and 10% pool units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 35%; step runs, 26%; and mid-channel pools, 23% (Graph 3). Based on percent total length, step runs made up 44%, low gradient riffles 35%, and runs 6%.

Sixty-nine pools were identified (Table 3). Main channel pools were most frequently encountered at 94%, and comprised 98% 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. Forty of the 69 pools (58%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 69 pool tail-outs measured, none had a value of 1 (0%); 26 had a value of 2 (38%); 35 had a value of 3 (51%); three had a value of 4 (4%) and five had a value of 5 (7%) (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 22, flatwater habitat types had a mean shelter rating of 12, and pool habitats had a mean shelter rating of 18 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 19. Main channel pools had a mean shelter rating of 18 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 39 of the 69 pool tail outs measured (58%). Small cobble was the next most frequently observed dominant substrate type and occurred in 16% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 84%. The mean percentages of deciduous and coniferous trees were 95% and 5%, respectively. Graph 9 describes the canopy in Westlund Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 59%. The mean percent left bank vegetated was 62%. The dominant elements composing the structure of the stream banks consisted of 12.0% bedrock, 17.4% boulder, 70.7% cobble/gravel, and 0.0% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 5% of the units surveyed. Additionally, 92.4% of the units surveyed had deciduous trees as the dominant vegetation type, and 1.1% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished on September 24, 1998, in Westlund Creek. The sites were sampled by Barry Collins, Ruth Goodfield (DFG), John Wooster, and Caroline Jezierski (AmeriCorps/WSP). The ends of the sample sections were blocked with minnow seines.

The first site sampled included habitat units 0118-0119, a step run/pool sequence located approximately 6,013 feet above the confluence with Mattole River. The site had an area of 400 sq ft and a volume of 360 cu ft. The site yielded 98 young-of -the-year (YOY) steelhead, five age 1+ steelhead rainbow trout (SHRT) ranging in length from 81-133mm fork length (FL), and two

Westlund Creek

2+ SHRT with fork lengths of 148mm and 150mm.

The second site sampled included habitat units 0121-0122, a riffle/pool sequence located approximately 6,296 feet above the creek mouth. The site had an area of 460 sq ft and a volume of 368 cu ft. The site yielded 34 YOY steelhead, two age 1+ SHRT with 101 and 104mm FL, and two 2+ SHRT with 155 and 166mm FL.

The third site sampled included habitat unit 0125-0126, a riffle/pool sequence approximately 6,514 feet from the confluence with Mattole River. This site had an area of 360 sq ft and a volume of 324 cu ft. The site yielded nine YOY steelhead, ranging in size from 47 to 74mm FL and two age 1+ SHRT measuring 94mm and 123mm FL.

The fourth site included habitat units 0127-0128, a riffle/pool sequence located approximately 6,554 feet above the creek mouth. This site had an area of 400 sq ft and a volume of 360 cu ft. The site yielded eight YOY steelhead/rainbow trout ranging in size from 40 to 70mm FL and two age 1+ SHRT measuring 103mm and 122mm FL.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Westlund Creek.

DISCUSSION

Westlund Creek is a B4 channel type for the first 12,331 feet of stream surveyed and an A4 for the remaining 4,648 feet. 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 A4 channel types for fish habitat improvement structures is good for bank-placed boulders; fair for plunge weirs, opposing wing-deflectors, and log cover; and poor for boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days September 8 to 15, 1998, ranged from 61° to 66° F. Air temperatures ranged from 62° to 81° F. This is an acceptable water temperature range for salmonids.Although Westlund Creek seems to have temperatures favorable to salmonids, 66° F, if sustained, is near the threshold stress level 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 50% of the total length of this survey, riffles 40%, and pools 10%. The pools are relatively deep, with 40 of the 69 (58.0%) 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 for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with any needed modification of log debris accumulations (LDA's) in the stream. A LDA in the system may be retaining needed gravel. Any necessary modifications to it should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

None of the 69 pool tail-outs measured had an embeddedness rating of 1. Sixty-one of the pool tail-outs had embeddedness ratings of 3 or 4. Five of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. One of the five was unsuitable for spawning due to the dominant substrate being silt/sand/clay or gravel being too small to be suitable. 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 Westlund 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 low with a rating of 18. The shelter rating in the flatwater habitats was slightly lower at 12. 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, whitewater and 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.

Fifty of the 69 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 84%. 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 moderate at 59% and 62%, 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

Westlund Creek

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

2) 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.

3) 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.

4) Primary pools only comprise 6% 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 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.

7) The log debris accumulation present on Westlund Creek that could be retaining sediment. The modification of this debris accumulation may be desirable, but must be done carefully, over time, to meter gravel downstream to spawning sites.

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 Mattole River. Channel type is a B4 for the first 13,436' of stream surveyed.
91'	Hobo Temp located in this unit.
161'	Young-of-the-year (YOY) salmonids observed from streambanks by surveyors.
3013'	A failure on the left bank (LB) is trapping small woody debris and causing the stream channel to braid.
3546'	LB failure, 80'L x 30'H. Residence on the right bank (RB).

Westlund Creek

4189' LB failure, 200'L x 200'H.

5387' LDA at top of unit with 4' plunge.

5397' Dry tributary enters from RB.

5554' Slide 100' L on R.

5387' LDA spans channel and is retaining gravel. Gravel wedge is 4' high

5397' Dry tributary enters from RB.

5554' RB failure, 100'L x 50' H.

5778' LB failure, 100'L x 30'H.

6604' Skid trail fords stream. Good access to creek.

6819' LB failure, 80'L x 40'H.

8058' Dry tributary enters from RB.

8817' Steep, dry tributary enters from RB.

9614' Large debris accumulation (LDA) in stream channel; 10'L x 40'W x 6'H. Does not appear to be a barrier.

9884' LDA 10'L x 50'W x 6'H

10058' RB failure, 100'L x 150' H.

10476' Dry tributary enters from RB.

10597' Dry tributary enters from RB.

11538' The West Fork of Westlund Creek enters. Survey continues up the mainstem.

12166' Channel type changes to an A4 for the remaining 4648' of stream survey.

12727' LB failure, 175'L x 150' H.

13186' Tributary enters from LB; carrying approximately 1/3 of flow. The mouth of tributary is a steep bedrock sheet and a possible fish barrier. Surveyors walked about 300' upstream; no fish observed in tributary.

13421' YOY salmonids observed from streambanks by surveyors.

14085' Tributary enters from LB.

14192' LB failure, 50'L x 40'H.

14956' Tributary enters from LB.

15302' LB failure, 100'L x 60'H.

15792' LB failure, 150'L x 70'H.

Westlund Creek

16979' Dry tributary enters from LB. Slides on both banks are causing subsurface flow. Small intermittent pools above the slides. End of survey.

REFERENCES

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