STREAM INVENTORY REPORT

Pilchuck Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2001 on Pilchuck Creek. The survey began at the confluence with Redwood Creek and extended upstream 0.3 miles.

The Pilchuck Creek 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 Pilchuck 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 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

Pilchuck Creek is a tributary to the Redwood Creek, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Pilchuck Creek's legal description at the confluence with Redwood Creek is T07N R03E S08. Its location is 41.0038 degrees north latitude and 123.8600 degrees west longitude. Pilchuck Creek is a first order stream and has approximately 0.2 miles of blue line stream according to the USGS Lord-Ellis Summit 7.5 minute quadrangle. Pilchuck Creek drains a watershed of approximately 1.6 square miles. Elevations range from about 640 feet at the mouth of the creek to 1,080 feet in the headwater areas. Redwood forest, Douglas fir forest and mixed hardwood 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 Pilchuck 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 Pilchuck 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". Pilchuck 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 Pilchuck 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 Pilchuck 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 Pilchuck 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 Pilchuck 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.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Pilchuck Creek. In addition, nine sites were 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 Pilchuck 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 2, 2001 was conducted by Laura Ward and Anne Jeffrey (WSP/AmeriCorps). The total length of the stream surveyed was 1,617 feet with an additiona1 114 feet of side channel.

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Stream flow was not measured on Pilchuck Creek, but was estimated to be less than 0.1 cfs.

Pilchuck Creek is a B3 channel type for the entire 1,617 feet of the stream surveyed. B3 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks and cobble channel.

Water temperatures taken during the survey period ranged from 54 to 57 degrees Fahrenheit. Air temperatures ranged from 62 to 66 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 49% riffle units, 29% pool units, and 22% flatwater units (Graph 1). Based on total length of Level II habitat types there were 52% riffle units, 30% flatwater units, and 18% pool units (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 40%; mid-channel pools, 20%; and runs, 16% (Graph 3). Based on percent total length, low gradient riffles made up 46%, step runs 20%, and runs 10%.

A total of 13 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 77%, and comprised 84% 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. Two of the 13 pools (15%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 13 pool tail-outs measured, three had a value of 1 (17.0%); four had a value of 2 (33.0%); and six had a value of 5 (50.0%); (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 an embeddedness value of 5 were as follows: 100% boulders.

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 10, flatwater habitat types had a mean shelter rating of 23, and pool habitats had a mean shelter rating of 8 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 10. Main channel pools had a mean shelter rating of 7 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Pilchuck Creek. Graph 7 describes the pool cover in Pilchuck Creek. Boulders are the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Boulders were the dominant substrate observed in 46% of pool tail-outs while large cobble was the next most frequently observed substrate type, at 38%.

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The mean percent canopy density for the surveyed length of Pilchuck Creek was 97%. The mean percentages of deciduous and coniferous trees were 100% and 0%, respectively. Graph 9 describes the mean percent canopy in Pilchuck Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 53%. The mean percent left bank vegetated was 58%. The dominant elements composing the structure of the stream banks consisted of 65% cobble/gravel and 35% boulders (Graph 10). Deciduous trees were the dominant vegetation type observed in 81% of the units surveyed. Additionally, 8% of the units surveyed had brush as the dominant vegetation type, and 12% had no vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Nine sites were electrofished for species composition and distribution in Pilchuck Creek on August 02, 2001. The water temperatures taken during the electrofishing period ranged from 57 to 61 degrees Fahrenheit. The air temperature was 77 degrees Fahrenheit. The sites were sampled by Glenn Yoshioka (DFG), Elizabeth Gill, Michelle Waller and Laura Ward (WSP/AmeriCorps).

The first site sampled was Habitat Unit #006, a mid-channel pool located approximately 148 feet from the confluence with Redwood Creek. The site yielded one young-of-the-year (YOY) steelhead and one age 1+ steelhead.

The second site was Habitat Unit #013, a mid-channel pool located approximately 683 feet above the creek mouth. The site yielded two YOY steelhead.

The third site sampled was Habitat Unit #017, a step pool located approximately 887 feet above the creek mouth. The site yielded 13 YOY steelhead and one age 1+ steelhead.

The fourth site sampled was Habitat Unit #018, a mid-channel pool located approximately 910 feet above the creek mouth. The site yielded one YOY steelhead.

The fifth site sampled was Habitat Unit #021, a mid-channel pool located approximately 1,039 feet above the creek mouth. The site yielded one YOY steelhead and one age 1+ steelhead.

The sixth site sampled was Habitat Unit #022, a high gradient riffle located approximately 1,061 feet above the creek mouth. The site yielded one age 1+ steelhead.

The seventh site sampled was Habitat Unit #023, a step run located approximately 1,169 feet above the creek mouth. The site yielded two YOY steelhead.

The eighth site sampled was Habitat Unit #024, a mid-channel pool located approximately 1,178 feet above the creek mouth. The site yielded no fish.

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The ninth site sampled was Habitat Unit #030, a plunge pool located approximately 1,369 feet above the creek mouth. The site yielded two YOY steelhead.

The following chart displays the information yielded from these sites:

Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead YOY	1+	2+
8/02/01	1	148	6	4.2	1	B3	1	1	0
8/02/01	2	683	13	4.2	1	B3	2	0	0
8/02/01	3	887	17	3.4	1	B3	13	1	0
8/02/01	4	910	18	4.2	1	B3	1	0	0
8/02/01	5	1,039	21	4.2	1	B3	1	1	0
8/02/01	6	1,061	22	1.2	1	B3	0	1	0
8/02/01	7	1,169	23	3.4	1	B3	2	0	0
8/02/01	8	1,178	24	4.2	1	B3	0	0	0
8/02/01	9	1,369	30	5.6	1	B3	2	0	0

DISCUSSION

Pilchuck Creek is a B3 channel type for the entire 1,617 feet of stream surveyed. The suitability of B3 channel types for fish habitat improvement structures is as follows: excellent for plunge weirs, boulder clusters and bank placed boulders, single and opposing wing-deflectors and log cover.

The water temperatures recorded on the survey day July 02, 2001 ranged from 54 to 57 degrees Fahrenheit. Air temperatures ranged from 62 to 66 degrees Fahrenheit. This is a good 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 30% of the total length of this survey, riffles 52%, and pools 18%. The pools are relatively shallow, with only two of the 13 (15.0%) 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.

Seven of the 13 pool tail-outs measured had embeddedness ratings of 1 or 2. None 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. The six pool tail-outs were not suitable due to the dominant substrate being boulders. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

Eleven of the 13 pool tail-outs had large cobble or boulders as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 8. The shelter rating in the flatwater habitats was 23. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in all habitat types. Additionally, boulders contribute a small amount. 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 97%. In general, revegetation projects are considered when canopy density is less than 80% or the canopy composition is dominated by deciduous trees. The percentage of right and left bank covered with vegetation was moderate at 53% and 58%, respectively.

RECOMMENDATIONS

1) Pilchuck 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 small woody debris. Adding high quality complexity with woody cover is desirable.

4) Increase the canopy on Pilchuck Creek by planting redwood, Douglas fir or other native conifers within the riparian zone. Tributaries to Pilchuck Creek and the reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream.

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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 B3.
148'	Electrofishing site #1.
683'	Electrofishing site #2.
887'	Electrofishing site #3.
910'	Electrofishing site #4.
1,039'	Electrofishing site #5.
1,061'	Electrofishing site #6.
1,169'	Electrofishing site #7.
1,178'	Electrofishing site #8.
1,369'	Electrofishing site #9.
1,731'	End of Survey due to long section of moderate to high gradient with subsurface flow under large boulders. No fish seen for approximately 400 feet before flow goes subsurface.

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]	