

STREAM INVENTORY REPORT

Horsethief Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Horsethief Creek. The survey began at the confluence with Daugherty Creek and extended upstream 0.14 miles.

The Horsethief 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 Horsethief 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

Horsethief Creek is a tributary to Daugherty Creek, a tributary to the South Fork Big River, located in Mendocino County, California (Map 1). Horsethief Creek's legal description at the confluence with Daugherty Creek is T15S R14W S5. Its location is 39E11N19.01O north latitude and 123E25N7.84O west longitude. Horsethief Creek is a first order stream and has approximately 0.8 miles of solid blue line stream according to the USGS Bailey Ridge 7.5 minute quadrangle. Horsethief Creek drains a watershed of approximately 0.42 square miles. Elevations range from about 740 feet at the mouth of the creek to 1360 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Masonite Road.

METHODS

The habitat inventory conducted in Horsethief 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

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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 Horsethief 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". Horsethief 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.

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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 Horsethief 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, 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 Horsethief 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Horsethief 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 Horsethief 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.

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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 Horsethief Creek. In addition, five 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 Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Quattro Pro. Graphics developed for Horsethief Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

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HABITAT INVENTORY RESULTS

The habitat inventory of June 4 and 5, 2002 was conducted by Toni Russell and Janelle Breton (WSP/AmeriCorps). The total length of the stream surveyed was 686 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.02 cfs on June 4, 2002.

Horsethief Creek is an F4 channel type for the entire 686 feet of the stream surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 52° to 58° Fahrenheit. Air temperatures ranged from 59° to 72° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 46% riffle units, 38% flatwater units, and 17% pool units (Graph 1). Based on total length of Level II habitat types there were 53% riffle units, 40% flatwater units, and 7% pool units (Graph 2).

Four Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle, 46%; run, 38%; and mid-channel pool, 13% (Graph 3). Based on percent total stream length, low gradient riffle made up 53%, run 40%, and mid-channel pool 5%.

A total of four pools were identified (Table 3). Main channel pools were the most frequently encountered, at 75%, and comprised 66% 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. None of the 4 pools had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 4 pool tail-outs measured, 0 had a value of 1 (0%); 3 had a value of 2 (75%); 0 had a value of 3 (0%); 0 had a value of 4 (0%); and 1 had a value of 5 (25%) (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. Riffle habitat types had a mean shelter rating of 0, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 25 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 30. Main channel pools had a mean shelter rating of 20 (Table 3).

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

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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 100% of pool tail-outs.

The mean percent canopy density for the surveyed length of Horsethief Creek was 95%. The mean percentages of deciduous and coniferous trees were 74.1% and 20.9%, respectively. Graph 9 describes the mean percent canopy in Horsethief Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 91%. The mean percent left bank vegetated was 92%. The dominant elements composing the structure of the stream banks consisted of 90% sand/silt/clay and 10% bedrock (Graph 10). Deciduous trees were the dominant vegetation type observed in 70% of the units surveyed. Additionally, 30% of the units surveyed had coniferous trees as the dominant vegetation type.

BIOLOGICAL INVENTORY RESULTS

Five sites were electrofished for species composition and distribution in Horsethief Creek on July 25, 2002. Water temperature taken during the electrofishing period was 58° Fahrenheit. The sites were sampled by Trevor Tollefson (DFG) and Toni Russell (WSP).

The sites sampled included habitat units 0002, 0003, 0016, 0022, and 0024, three mid-channel pools, one run, and one plunge pool, beginning approximately 105 feet from the confluence with Daugherty Creek. No salmonids were sampled.

The following chart displays the information yielded from these sites:

Date	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead		
						YOY	1+	2+
07/25/02	105	0002	4.2	1	F4	0	0	0
07/25/02	117	0003	5.6	1	F4	0	0	0
07/25/02	450	0016	4.2	1	F4	0	0	0
07/25/02	649	0022	3.3	1	F4	0	0	0
07/25/02	676	0024	4.2	1	F4	0	0	0

DISCUSSION

Horsethief Creek is an F4 channel type for the entire 686 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is good for bank placed boulders; fair

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for plunge weirs, single and opposing wing-deflectors, channel constrictors, log cover; poor for boulder clusters.

The water temperatures recorded on the survey days, June 4 and 5, 2002, ranged from 52° to 58° Fahrenheit. Air temperatures ranged from 59° to 72° Fahrenheit. 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 40% of the total length of this survey, riffles 53%, and pools 7%. The pools are relatively shallow, with none of the 4 (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.

Three of the 4 pool tail-outs measured had embeddedness ratings of 1 or 2. Zero of the pool tail-outs had embeddedness ratings of 3 or 4. One of the pool tail-outs had a rating of 5, which is considered unsuitable 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. Sediment sources in Horsethief Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Three of the 4 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 25. The shelter rating in the flatwater habitats was 5. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in nearly all habitat types. Additionally, undercut banks contributed a small amount.

The mean percent canopy density for the stream was 95%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 91% and 92%, 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) Horsethief 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

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August temperature extreme period should be performed for 3 to 5 years.

- 3) There are several log debris accumulations present on Horsethief Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

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'	Begin survey at confluence with Daugherty Creek. Channel type is an F4.
105'	Electrofishing site #1.
117'	Electrofishing site #2.
140'	Log Debris Accumulation (LDA) of 4 pieces: 40' long x 6' wide x 4' high. Stored sediment is 5' long x 5' wide x 4' deep, possible barrier.
450'	LDA of 5 pieces: 7' long x 8' wide x 4' high. Stored sediment is 8' long x 6' wide x 3' deep, possible barrier. Electrofishing site #3.
562'	LDA of 14 pieces: 50' long x 12' wide x 8' high. Stored sediment is 40' long x 8' wide x 7' deep, possible barrier.
649'	Electrofishing site #4.
679'	Electrofishing site #5.
686'	LDA of 9 pieces: 45' long x 12' wide x 12' high. Stored sediment is 40' long x 11' wide x 12' deep, possible barrier. End of survey due to dry streambed above LDA.

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.

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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]	