

STREAM INVENTORY REPORT

Wheelbarrow Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Wheelbarrow 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 Wheelbarrow 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 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

Wheelbarrow Creek is tributary to Tomki Creek, tributary to the mainstem Eel River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Wheelbarrow Creek's legal description at the confluence with Tomki Creek is T19N R13W S9. Its location is 39°31'09" north latitude and 123°18'44" west longitude. Wheelbarrow Creek is an ephemeral stream according to the USGS Willis Ridge 7.5 minute quadrangle. Wheelbarrow Creek drains a watershed of approximately 4.88 square miles. Elevations range from about 1,900 feet at the mouth of the creek to 2,800 feet in the headwater areas. Douglas fir and mixed hardwood forest dominates the watershed. The watershed is primarily privately owned and is managed as rangeland and for timber production. Vehicle access exists from U.S. Highway 101 3 miles north of Willits, turn south on Reynolds Highway. From Reynolds Highway take the first left, this will be a private unimproved road that will lead over the ridge to the Wheelbarrow Creek drainage. Stay on this main road and follow it through the valley and along Wheelbarrow Creek to the confluence with Tomki Creek.

METHODS

The habitat inventory conducted in Wheelbarrow Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). 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). 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 Wheelbarrow 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.

Wheelbarrow Creek

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". Wheelbarrow 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 Wheelbarrow 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 Wheelbarrow 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.

Wheelbarrow Creek

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 Wheelbarrow 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 Wheelbarrow 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 Wheelbarrow Creek, one site was 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

Wheelbarrow Creek

Graphics are produced from the tables using Quattro Pro. Graphics developed for Wheelbarrow 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

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

The habitat inventory of June 5, 19, 23 and 24, 1997, was conducted by Jessie Robertson, Jeannie Richey, David Jones, and Bethany Reisberger (WSP). The total length of the stream surveyed was 11,445 feet.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.06 cfs on July 15, 1997.

Wheelbarrow Creek is a B4 channel type for the first 9,114 feet, and a F3 channel type for the remaining 1,900 feet surveyed. B4 channels are moderately entrenched, moderate gradient, riffle dominated gravel channels with infrequently spaced pools; very stable plan and profile; and stable banks. F3 channels are entrenched, meandering, low gradient, riffle/pool cobble channels on low gradients with high width/depth ratio.

Water temperatures taken during the survey period ranged from 57° to 79° F. Air temperatures ranged from 59° to 88° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 29% riffle units, 33% flatwater units, and 38% pool units (Graph 1). Based on total **length** of Level II habitat types there were 23% riffle units, 42% flatwater units, and 35% pool units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by

Wheelbarrow Creek

percent **occurrence** were mid-channel pools, 32%; low gradient riffles, 27%; and runs, 24% (Graph 3). Based on percent total **length**, mid-channel pools made up 31%, runs 29%, and low gradient riffles 22%.

A total of sixty-seven pools were identified (Table 3). Main channel pools were most frequently encountered at 87% and comprised 89% 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-one of the sixty-seven pools (61%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the sixty-five pool tail-outs measured, thirty-one had a value of 1 (48%); thirteen had a value of 2 (20%); four had a value of 3 (6%); four had a value of 4 (6%) and thirteen had a value of 5 (20%) (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 41, flatwater habitat types had a mean shelter rating of 13, and pool habitats had a mean shelter rating of 16 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 19. Backwater pools had a mean shelter rating of 15 and main channel pools had a shelter rating of 14 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders and aquatic vegetation are the dominant cover type in Wheelbarrow Creek. Graph 7 describes the pool cover in Wheelbarrow Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in twenty-eight of the sixty-two pool tail-outs measured (45%). Small cobble was the next most frequently observed dominant substrate type and occurred in 27% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 57%. The mean percentages of deciduous and coniferous trees were 60% and 42%, respectively. Graph 9 describes the canopy composition in Wheelbarrow Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 60.6%. The mean percent left bank vegetated was 59.1%. The dominant elements composing the structure of the stream banks consisted of 4.7% bedrock, 12.5% boulder, 40.6% cobble/gravel, and 42.2% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 39.1% of the units surveyed. Additionally, 18.8% of the units surveyed had deciduous trees as the dominant

Wheelbarrow Creek

vegetation type, and 18.8% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on July 15, 1997, in Wheelbarrow Creek. The sites were sampled by Jessie Robertson (WSP) and Allan Renger (CCC).

The site sampled included habitat units 45 - 47, approximately 2,884 feet from the confluence with Tomki Creek. This site had an area of 770 sq ft and a volume of 539 cu ft. The site yielded 24 rough skinned newts, 5 California roach, and 4 young-of-the-year steelhead rainbow trout.

DISCUSSION

Wheelbarrow Creek is a B4 channel type for the first 9,114 feet of stream surveyed and a F3 for the remaining 1,900 feet. The suitability of B4 channel types for fish habitat improvement structures is as follows: B4 are excellent for low-stage plunge weirs; boulder clusters; bank placed boulders; single and opposing wing-deflectors; and log cover. F3 channels are good for bank-placed boulders; and single and opposing wing-deflectors; fair for plunge weirs; boulder clusters; channel constrictors; and log cover.

The water temperatures recorded on the survey days June 5, 19, 23 and 24, 1997, ranged from 57° to 79° F. Air temperatures ranged from 59° to 88° F. The upper end of the water temperature range is very poor for salmonids and 79° F is well above 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 42% of the total **length** of this survey, riffles 23%, and pools 35%. The pools are relatively deep, with forty-one of the sixty-seven (61%) pools having a maximum depth greater than 2 feet. 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. Primary pools only comprised 21% of the total length of stream habitat surveyed. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. Installing structures that will increase or deepen pool habitat is recommended.

Thirty-one (48%) of the sixty-five pool tail-outs measured had an embeddedness rating of 1, 20% had a rating of 2, 12% had a ratings of 3 or 4, and 20% had a rating of 5 and were considered unsuitable for spawning. Eight of the pool tail-outs were unsuitable for spawning due to the dominant substrate being bedrock, boulders, or cobble too large. Cobble

Wheelbarrow Creek

embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In Wheelbarrow 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 16. The shelter rating in the flatwater habitats was 13. A pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by boulders and aquatic vegetation in all habitat types. 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.

Forty-five of the sixty-two (67%) 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 57%. This is a relatively low 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 60.6% and 59.1%, 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) Wheelbarrow Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are above 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 the canopy on Wheelbarrow Creek by planting willow, alder and other native riparian tree species along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.
- 4) 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

Wheelbarrow Creek

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 and aquatic vegetation. Adding high quality complexity with woody cover is desirable.

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 Tomki Creek. Channel type is B4.

- | | |
|---------|---|
| 1,383' | Right bank erosion, 150' long x 20' high. |
| 2,567' | Road fords stream. |
| 2,614' | Riprap on left bank extending for 290'. |
| 4,533' | Riprap extends on left bank for 200'. |
| 5,120' | Road 25' up left bank. |
| 5,990' | Dry tributary. |
| 6,357' | Road 50' up left bank. |
| 8,088' | Shelving Rock Creek enters from the right bank. |
| 8,572' | Road fords stream. |
| 8,649' | Tributary enters left bank, dry at mouth. |
| 8,967' | Road crosses stream. |
| 9,227' | Channel type changes to a F3. |
| 9,738' | Bank failure on both sides of the channel. |
| 9,985' | Concrete spillway enters creek. |
| 10,119' | Riprap on right bank. |

Wheelbarrow Creek

10,228' Exclusionary fencing in place on both banks.

10,491' Concrete spillway enters creek

10,838' Dry tributary enters on left bank.

11,384' Riprap on both banks.

11,391' Human-made afterbay, concrete pool tail-out.

11,420' End of survey. Eight foot high dam holding pool behind. No salmonids observed in reservoir or stream beyond.

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 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