# STREAM INVENTORY REPORT

## Garrett Creek

## INTRODUCTION

A stream inventory was conducted during the summer of 2001 on Garrett Creek. The survey began at the confluence with Redwood Creek and extended upstream 0.9 miles.

The Garrett 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 Garrett 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

Garrett Creek is a tributary to Redwood Creek, a tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Garrett Creek's legal description at the confluence with Redwood Creek is T08N R03E S18. Its location is 41°04′52.5″ north latitude and 123°52′43.14″ west longitude. Garrett Creek is a second order stream and has approximately 3.6 miles of blue line stream according to the USGS Panther Creek 7.5 minute quadrangle. Garrett Creek drains a watershed of approximately 4.15 square miles. Elevations range from about 600 feet at the mouth of the creek to 3,000 feet in the headwater areas. Redwood/Douglas fir and mixed hardwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via Highway 299 to Redwood Valley Road.

## METHODS

The habitat inventory conducted in Garrett 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 Garrett 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 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". Garrett 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 Garrett 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 Garrett 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 Garrett Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the top 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 Garrett 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 Garrett Creek. In addition, thirteen 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 Garrett 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 July 8, 9, 10, and 23, 2001, was conducted by Michelle Wallar and Justin Martin (WSP/AmeriCorps). The total length of the stream surveyed was 4,779 feet with an additional 311 feet of side channel.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.26 cfs on July, 8 2001.

Garrett Creek is a B4 channel type for the entire 4,779 feet of the stream surveyed. B4 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks, and gravel dominated channel.

Water temperatures taken during the survey period ranged from 58 to 63 degrees Fahrenheit. Air temperatures ranged from 65 to 86 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 22% riffle units, 30% flatwater units, and 46% pool units (Graph 1). Based on total **length** of Level II habitat types there were 21% riffle units, 46% flatwater units, and 31% pool units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were mid-channel pools, 27%; step runs, 21%; and low gradient riffles, 11% (Graph 3). Based on percent total **length**, mid-channel pools made up 16%, step runs 38%, and low gradient riffles 10%.

A total of 64 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 75%, and comprised 79% 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. Twenty-six of the 64 pools (40%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. The first three pools were in the area of influence of Redwood Creek and therefore their embeddedness data was not estimated. Of the 61 pool tail-outs measured, 14 had a value of 1 (23%); 22 had a value of 2 (36%); 18 had a value of 3 (29.5%); 0 had a value of 4 and 7 had a value of 5 (11.5%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. The breakdown of dominant substrate composition for the 7 pool tail-outs that had a embeddedness value of 5 were as follows: 86% boulder and 14% gravel too small 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 21, flatwater habitat types had a mean shelter rating of 8, 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 33. Backwater pools had a mean shelter rating of 25 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Garrett Creek. Graph 7 describes the pool cover in Garrett Creek. Boulders are the dominant pool cover type followed by whitewater.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel and boulders were the dominant substrate, each observed in 31.1% of pool tail-outs while large cobble was the next most frequently observed substrate type, at 21.3%.

The mean percent canopy density for the surveyed length of Garrett Creek was 93%. The mean percentages of deciduous and coniferous trees were 70% and 23%, respectively. Graph 9 describes the mean percent canopy in Garrett Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 86.6%. The mean percent left bank vegetated was 88.1%. The dominant elements composing the structure of the stream banks consisted of 5.81% bedrock, 48.84% boulder, 40.70% cobble/gravel, and 4.65% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 72.1% of the units surveyed. Additionally, 22.1% of the units surveyed had coniferous trees as the dominant vegetation type, and 5.8% had brush as the dominant vegetation (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

Thirteen sites were electrofished for species composition and distribution in Garrett Creek on September 5, 2001. Water temperature during the electrofishing period was 59 degrees Fahrenheit. Air temperature was 64 degrees Fahrenheit. The sites were sampled by T. Tollefson (DFG), J. Martin and Devin Best (WSP/AmeriCorps).

The first site sampled was habitat unit 015, a lateral scour pool - boulder formed located approximately 557 feet from the confluence with Redwood Creek. The site yielded 7 young-of-the-year steelhead, and 1 age one-plus steelhead.

The second site was habitat units 034, a lateral scour pool - boulder formed located approximately 1,132 feet above the creek mouth. The site yielded 11 young-of-the-year steelhead and 2 age one-plus steelhead.

The third site sampled was habitat unit 048, a mid-channel pool located approximately 1,834 feet above the creek mouth. The site yielded 1 young-of-the-year steelhead, 2 age one-plus steelhead, and 1 age two-plus steelhead.

The fourth site sampled was habitat unit 062, a mid-channel pool located approximately 2,391

feet above the creek mouth. The site yielded 1 young-of-the-year steelhead and 5 age one-plus steelhead.

The fifth site sampled was habitat units 073, a mid-channel pool located approximately 2,801 feet above the creek mouth. The site yielded 6 age one-plus steelhead.

The sixth site sampled was habitat units 094, a mid-channel pool located approximately 3,654 feet above the creek mouth. The site yielded 2 young-of-the-year steelhead and 1 age one-plus steelhead.

The seventh site sampled was habitat units 106, a lateral scour pool - root wad enhanced located approximately 4,015 feet above the creek mouth. The site yielded 2 young-of-the-year steelhead, 3 age one-plus steelhead, and 1 age three-plus steelhead.

The eighth site sampled was habitat unit 108, a lateral scour pool - log enhanced located approximately 4,131 feet above the creek mouth. The site yielded 7 young-of-the-year steelhead.

The ninth site sampled was habitat unit 117, a lateral scour pool - log enhanced located approximately 4,393 feet above the creek mouth. The site yielded 6 young-of-the-year steelhead, 2 age one-plus steelhead and 2 age two-plus steelhead.

The tenth site sampled was habitat units 121, a mid-channel pool located approximately 4,544 feet above the creek mouth. The site yielded no fish.

The eleventh site sampled was habitat units 122, a mid-channel pool located approximately 4,544 feet above the creek mouth. The site yielded no fish.

The twelfth site sampled was habitat unit 125, a plunge pool located approximately 4,672 feet above the creek mouth. The site yielded no fish.

The thirteenth site sampled was habitat unit 128, a mid-channel pool located approximately 4,760 feet above the creek mouth. The site yielded no fish.

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+ |
|---|---|---|---|---|---|---|---|---|---|
| 09/05/01 | 1 | 557 | 0015 | 5.5 | 1 | B4 | 7 | 1 | 0 |
| 09/05/01 | 2 | 1,132 | 0034 | 5.5 | 1 | B4 | 11 | 2 | 0 |
| | | | | | | | | | |

| Date | Site # | Approx. Dist. from mouth (ft.) | Hab. Unit # | Hab. Type | Reach # | Channel type | Steelhead YOY | 1+ | 2+ |
|---|---|---|---|---|---|---|---|---|---|
| 09/05/01 | 3 | 1,834 | 0048 | 4.2 | 1 | B4 | 1 | 2 | 1 |
| 09/05/01 | 4 | 2,391 | 0062 | 4.2 | 1 | B4 | 1 | 5 | 0 |
| 09/05/01 | 5 | 2,801 | 0073 | 4.2 | 1 | B4 | 0 | 6 | 0 |
| 09/05/01 | 6 | 3,654 | 0094 | 4.2 | 1 | B4 | 2 | 1 | 0 |
| 09/05/01 | 7 | 4,015 | 0106 | 5.3 | 1 | B4 | 2 | 3 | 0 |
| 09/05/01 | 8 | 4,131 | 0108 | 5.2 | 1 | B4 | 7 | 0 | 0 |
| 09/05/01 | 9 | 4,393 | 0117 | 5.2 | 1 | B4 | 6 | 2 | 2 |
| 09/05/01 | 10 | 4,544 | 0121 | 4.2 | 1 | B4 | 0 | 0 | 0 |
| 09/05/01 | 11 | 4,583 | 0122 | 4.2 | 1 | B4 | 0 | 0 | 0 |
| 09/05/01 | 12 | 4,672 | 0125 | 5.6 | 1 | B4 | 0 | 0 | 0 |
| 09/05/01 | 13 | 4,760 | 0128 | 4.2 | 1 | B4 | 0 | 0 | 0 |

DISCUSSION

Garrett Creek is a B4 channel type for the entire 4,779 feet of the stream surveyed. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing deflectors, and log cover.

The water temperatures recorded on the survey days July 8, 9, 10 and 23, 2001, ranged from 58° to 63° Fahrenheit. Air temperatures ranged from 68° to 86° Fahrenheit. This is a suitable water temperature range 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 46% of the total **length** of this survey, riffles 21%, and pools 31%. The pools are relatively shallow, with only 26 of the 64 (40.6%) 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.

Thirty-six of the 61 pool tail-outs measured had embeddedness ratings of 1 or 2. Eighteen of the pool tail-outs had embeddedness ratings of 3 or 4. Seven of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Six of the 7 were unsuitable for spawning due to the dominant substrate being boulders and one of the seven had large cobble as the dominant substrate. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

Twenty-eight of the 61 pool tail-outs had gravel or small cobble as the dominant substrate. Suitable size spawning substrate is lacking in Garrett Creek.

The mean shelter rating for pools was 25. The shelter rating in the flatwater habitats was 8. 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 contributed 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 93%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 86.6% and 88.1%, 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) Garrett 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 boulders. 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 existing pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

5) 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.

6) Suitable size spawning substrate on Garrett Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

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 Redwood Creek. Channel type is B4. |
| 557' | Electrofishing site #1. |
| 839' | Log debris accumulation (LDA), 9' long x 40' wide x 9' high. It is comprised of approximately 12 pieces of large wood (1-2' diameter) and boulders. Water is flowing through and around. |
| 969' | Erosion on the left bank, 158' long x 15' high. |
| 1,007' | Erosion on right bank, 100' long x 15' high. |
| 1,132' | Electrofishing site #2. |
| 1,834' | Electrofishing site #3. |
| 1,963' | LDA, 18' long x 11' high x 27' wide, retaining sediment 24' long x 5' high x 27' wide. |
| 2,025' | Erosion on right bank, 102' long x 150' high. |
| 2,311' | LDA, 115' long x 15' wide x 6' high. |
| 2,328' | Erosion on the left bank, 109' long x 200' high. |
| 2,391' | Electrofishing site #4. |
| 2,429' | Unnamed tributary enters from left bank. |
| 2,801' | Electrofishing site #5. |
| 3,616' | Right bank erosion, 20' long x 30' high. |

| | |
|---|---|
| 3,654' | Electrofishing site #6. |
| 3,668' | Erosion on the left bank, 81' long x 60' high, vegetated with brush. |
| 4,015' | Electrofishing site #7. |
| 4,103' | LDA, 32' long x 12' high x 48' wide. |
| 4,131' | Electrofishing site #8. |
| 4,383' | Left bank erosion, 22' long x 50' high. |
| 4,393' | Electrofishing site #9. |
| 4,487' | Right bank erosion, 33' long x 75' high. |
| 4,544' | Electrofishing site #10. |
| 4,672' | Electrofishing site #11. |
| 4,760' | Electrofishing site #12. |
| 4,779' | End of survey due to potential fish barriers (bedrock sheets and cascades at least 10-15' high) and no fish were observed for approximately a quarter 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] | |