

STREAM INVENTORY REPORT

Grindstone Creek, Mattole River

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on Grindstone Creek, a stream in the Mattole River drainage. 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 Grindstone 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

Grindstone Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Grindstone Creek's legal description at the confluence with Mattole River is T03S R01E S25. Its location is 40°10'30" north latitude and 124°00'41" west longitude. Grindstone Creek is a first order stream and has approximately 3.4 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Grindstone Creek drains a watershed of approximately 3.8 square miles. Elevations range from about 520 feet at the mouth of the creek to 2400 feet in the headwater areas. Douglas fir forest and mixed hardwood dominate the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. Vehicle access exists via Mattole Road to Honeydew. From Honeydew take the Wilder Ridge Road. After passing the turnoff for Horse Mountain Road, continue along the Wilder Ridge Road eastward and then turn left on the second unimproved dirt road. Follow it until it crosses the Mattole River. Grindstone Creek will be the first creek on right bank (facing downstream) that enters the Mattole River upstream from the crossing.

METHODS

The habitat inventory conducted in Grindstone 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.

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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 has 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 Grindstone 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.

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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". Grindstone 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 Grindstone 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 Grindstone 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.

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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 Grindstone 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 Grindstone 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 Grindstone Creek, fish presence was observed from the stream banks and 1 site was 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:

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- 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 Grindstone 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 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 August 27, 31, and September 1, 1998, was conducted by John Wooster and Stu McMorrow, AmeriCorps/WSP. The total length of the stream surveyed was 13,772 feet with an additional 124 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.7 cfs on August 27, 1998.

Grindstone Creek is a B4 channel type for the entire 14,155 feet of stream reach surveyed. B4 channel types are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; gravel channel.

Water temperatures taken during the survey period ranged from 64° to 72° F. Air temperatures ranged from 70° to 89° F.

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Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% riffle units, 32% flatwater units, and 28% pool units (Graph 1). Based on total length of Level II habitat types there were 49% riffle units, 40% flatwater units, and 11% pool units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle, 39%; step run, 25%; and mid-channel pool, 25% (Graph 3). Based on percent total length, low gradient riffle made up 48%, step run 36%, and mid-channel pool 10%.

A total of sixty-four pools were identified (Table 3). Main pools were most frequently encountered at 89% and comprised 90% 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-four of the 64 pools (69%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the sixty-three pool tail-outs measured, zero had a value of 1 (0%); thirteen had a value of 2 (20.6%); forty had a value of 3 (63.5%); seven had a value of 4 (11.1%) and three had a value of 5 (4.8%) (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 6, flatwater habitat types had a mean shelter rating of 8, and pool habitats had a mean shelter rating of 17 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 30. Scour 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 Grindstone Creek and are extensive. Small woody debris is not abundant while large woody debris is absent in nearly all habitat types. Graph 7 describes the pool cover in Grindstone Creek.

Table 6 summarizes the dominant substrate in pool habitat types. Gravel was the dominant substrate observed in 33 of the 63 pool tail outs measured (52.4%). Small cobble was the next most frequently observed dominant substrate type and occurred in 25.4% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 51%. The mean percentages of conifer and deciduous trees were 10.7% and 40.3%, respectively. Graph 9 describes the canopy in Grindstone Creek.

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For the stream reach surveyed, the mean percent right bank vegetated was 51.9%. The mean percent left bank vegetated was 55.1%. The dominant elements composing the structure of the stream banks consisted of 17.65% bedrock, 8.82% boulder, 73.53% cobble/gravel, and 00% sand/silt/clay (Graph 10). Deciduous trees were the dominant bank vegetation type observed in 66.18% of the units surveyed. Additionally, 66.18% of the units surveyed had deciduous trees as the dominant bank vegetation, and 19.12% had coniferous trees as the dominant bank vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on September 3, 1998 on Grindstone Creek. The site was sampled by Scott Downie, Heidi Hickethier, and Carolyn Jezierski, (DFG and AmeriCorps/WSP).

The first site sampled included 3 habitat units, a mid-channel pool, a riffle, and a run and was located approximately 300 feet from the confluence with the Mattole River. This site had an area of 420 sq ft and a volume of 514 cu ft. The site yielded 30 juvenile steelhead and 1 threespine stickleback. The breakdown of steelhead age classes was: 21 steelhead rainbow trout (SHRT) Young-of-the-year (YOY) , 5 SHRT 1+, and 4 SHRT 2+.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Grindstone Creek.

DISCUSSION

Grindstone Creek is a B4 channel type for the entire 13,772 feet of stream surveyed. The suitability of B4 channels 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 water temperatures recorded on the survey days August 27, 31 and September 1, 1998, ranged from 64° to 72° F. Air temperatures ranged from 70° to 89° F. This is a poor water temperature range for coho salmon and a fair-poor range for steelhead. Grindstone Creek appears to have temperatures unfavorable to salmonids, particularly, coho salmon. However, 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 49%, and pools 11%. The pools are relatively deep, with 44 of the 64 (69%) pools having a maximum depth

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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. The LDAs in the system may be retaining needed gravel. Any necessary modifications to them 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. At least one of the LDAs is retaining silt.

None of the 63 (0%) pool tail-outs measured had an embeddedness rating of 1, 20.6% had a rating of 2, 74.6% had ratings of 3 or 4, and 4.8% had a rating of 5 and were 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. In Grindstone 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 17. The shelter rating in the flatwater habitats was lower at 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 nearly all habitat types. Additionally, small woody debris contributes some cover. Log and root wad cover structures in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Instream cover created by small and large woody debris provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Forty-nine of the 63 (78%) 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 51%. This is a relatively low to moderate 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 52% and 55%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting native species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

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RECOMMENDATIONS

- 1) Grindstone 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 Grindstone Creek by planting willow, alder, redwood, and Douglas fir 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) 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.
- 5) 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.
- 6) 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.
- 7) 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.
- 8) There are several log debris accumulations present on Grindstone Creek. At least one is retaining silt. The modification of these debris accumulations may be desirable, but if conducted 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.

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- 0' Survey begins at the confluence of Grindstone Creek and the Mattole River. Channel type is a B4.
- 2540' A nearly dry tributary enters from the left bank at the top of the unit.
- 3325' A left bank slide 100' long.
- 3722' A right bank slide 100' L x 50' W x 120' H.
- 4002' A left bank slide 90' L x 20' W x 60' H.
- 4083' A left bank slide 90' L x 20' W x 45' H.
- 4694' A log debris accumulation (LDA) located at the top of the unit is 10' L x 25' W x 5' H.
- 4722' A right bank slide 80' L x 50' W x 100' H. A dry tributary enters from the right bank.
- 6087' A tributary that is barely flowing enters from the left bank.
- 6304' LDA retaining silt is 60' L x 30' W x 10' H.
- 6438' A rotational slump landslide 250' L x 90' W x 125' H.
- 6697' LDA 100' L x 40' W x 20' H.
- 6925' A dry tributary enters from the right bank.
- 7844 A tributary enters from the right bank 60' into the unit.
- 8812' LDA 40' L x 25' W x 10' H.
- 9485' A dry tributary enters from the right bank 38' into the unit.
- 9653' Young of the year (YOY), 1+, 2+ steelhead/rainbow trout were observed.
- 11448' LDA 40' L x 25' W x 12' H is causing a 6' plunge.
- 11786' A tributary enters from the right bank.
- 12413' A tributary enters from the left bank in this unit.

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13772' End of survey. Stream gradient has increased to a slope of 10% and no fish have been observed for 1500'.

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