

SALMON AND STEELHEAD RESTORATION AND ENHANCEMENT PROGRAM

NORTH COAST

BASIN PLANNING PROJECT

STREAM INVENTORY REPORT

SULPHUR CREEK, MATTOLE RIVER, 1999

CALIFORNIA DEPARTMENT OF FISH AND GAME

SPORT FISH RESTORATION ACT

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NORTH COAST WATERSHED PLANNING and COORDINATION PROJECT

The North Coast Watershed Planning and Coordination Project (NCWPCP), formerly the Basin Planning Project (BPP), was begun in 1991 to develop salmon and steelhead restoration and enhancement programs in North Coast watersheds for the Department of Fish and Game (DFG). The objectives of the project conform with the goals of California's Salmon and Steelhead Restoration and Enhancement Program of 1988. The Restoration Program strives to enhance the status of anadromous salmonid populations and improve the fishing experience for Californians. The program intends to achieve a doubling of the population of salmon and steelhead by the year 2000. The project is supported by the Sport Fish Restoration Act, which uses sport fishermen's funds to improve sport fisheries.

The NCWPCP conducts stream and habitat inventories according to the standard methodologies discussed in the *California Salmonid stream Habitat Restoration Manual*, (Flossi et.al., 1998). Biological sampling is conducted using electrofishing and direct observation to determine species presence and distribution; selected streams are electrofished for population estimates. Some streams are also sampled for sediment composition. Collected information is used for base-line data, public cooperation development, restoration program planning, specific project design and implementation, and for project evaluation.

The Eel River system was identified as the initial basin for project planning activities. Most anadromous tributaries to the Van Duzen, South Fork Eel, Mainstem Eel, Middle Fork Eel, and the North Fork Eel rivers have been inventoried since 1991. Initial field inventory of the Eel River system should be essentially complete in 1996. NCWPCP personnel have also worked in cooperation with the DFG Salmon Restoration Project's staff to inventory streams on the Mattole River, Mendocino Coast, and Humboldt Bay.

STREAM INVENTORY REPORT

Sulphur Creek, Mattole River, 1999

INTRODUCTION

A stream inventory was conducted during the summer of 1999 on Sulphur 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 Sulphur 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

Sulphur Creek is tributary to the East Branch of the Lower North Fork of the Mattole River, tributary to the North Fork of the Mattole River, tributary to the Mattole River, located in Humboldt County, California (Map 1). Sulphur Creek's legal description at the confluence with East Branch N. F. Mattole River is T01S R01W S27. Its location is 40°20'49.2" North latitude and 124°10'16.8" West longitude. Sulphur Creek is a third order stream and has approximately 6.8 miles of blue line stream according to the USGS Buckeye Mt. 7.5 minute quadrangle. Sulphur Creek drains a watershed of approximately 3.8 square miles. Elevations range from about 1080 feet at the mouth of the creek to 2800 feet in the headwater areas. Douglas fir and mixed conifer forest dominate the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists from Monument Ridge on private road controlled by Pacific Lumber Company, across Bear River Bridge near Bear Bottle Creek. Continue for eight miles to trailhead. From the trailhead you will have to hike about a half a mile to the confluence of Sulphur Creek and the East Branch of the Lower North Fork of the Mattole River

METHODS

The habitat inventory conducted in Sulphur Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flossi et. al., 1998). The Watershed Stewards Project (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 (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 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 Sulphur 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 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.

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". Sulphur 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 Sulphur 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 Sulphur 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 Sulphur 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 Sulphur 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 Sulphur Creek fish presence was observed from the stream banks, and sites were 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:

- 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 Sulphur

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 June 29, and 30, 1999, was conducted by Donn Rehbarg and Michelle Anderson (WSP/AmeriCorps). The total length of the stream surveyed was 7,137 feet with an additional 701 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 2.1 cfs on June 7, 1999.

Sulphur Creek is a B4 channel type for the entire 7,136 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 56°- 67° F. Air temperatures ranged from 64°- 85° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 41% riffle units, 29% flatwater units, and 30% pool units (Graph 1). Based on total length of Level II habitat types there were 50% riffle units, 39% flatwater units, and 11% pool units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle, 38%; mid-channel pool, 25%; and run, 17% (Graph 3). Based on percent total length, low gradient riffle made up 46%, step run 25%, and run 14%.

A total of forty-six pools were identified (Table 3). Main-channel pools were most frequently

encountered at 87% and comprised 86% 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-seven of the 46 pools (59%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the forty-seven pool tail-outs measured, fourteen had a value of 1 (29.7%); twenty-one had a value of 2 (44.7%); six had a value of 3 (12.8%); zero had a value of 4 (0%) and six had a value of 5 (12.8%) (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 08, flatwater habitat types had a mean shelter rating of 7, and pool habitats had a mean shelter rating of 60 (Table 1). Of the pool types, the main-channel pools had the highest mean shelter rating at 75. Scour pools had a mean shelter rating of 22 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Sulphur Creek and are extensive. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Sulphur Creek.

Table 6 summarizes the dominant substrate in pool habitat types. Gravel was the dominant substrate observed in 20 of the 45 pool tail outs measured (44%). Boulder was the next most frequently observed dominant substrate type and occurred in 24% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 72%. The mean percentages of conifer and deciduous trees were 39% and 33%, respectively. Graph 9 describes the canopy in Sulphur Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 68.8%. The mean percent left bank vegetated was 58.3%. The dominant elements composing the structure of the stream banks consisted of 10.72% bedrock, 48.21% cobble/gravel, and 41.07% sand/silt/clay (Graph 10). Deciduous trees were the dominant bank vegetation type observed in 46.43% of the units surveyed. Additionally, 46.43% of the units surveyed had deciduous trees as the dominant bank vegetation, and 17.86% had coniferous trees as the dominant bank vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

No electrofishing was conducted on Sulphur Creek. However, the surveyors observed numerous young of the year and juvenile salmonids.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Sulphur Creek.

DISCUSSION

Sulphur Creek is a B4 channel type for the entire 7,136 feet of stream surveyed. The suitability of B4 channel types for fish habitat improvement structures are excellent for low-stage plunge weirs; boulder clusters; bank placed boulders; single and opposing wing-deflectors; log cover.

The water temperatures recorded on the survey days June 29 and 30, 1999, ranged from 56°- 67° F. Air temperatures ranged from 64°- 85° F. This is a fair water temperature range for salmonids. However, 67° F, if sustained, is at the threshold stress level for salmonids. This seem to be the case here, and Sulphur Creek seems to have temperatures favorable to 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 29% of the total length of this survey, riffles 41%, and pools 30%. The pools are relatively deep, with twenty-seven of the forty-six (59%) 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. 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 the modification of the log debris accumulations (LDA's) in the stream. Some of the LDA's 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.

Fourteen of the forty-seven(30%) pool tail-outs measured had an embeddedness rating of 1. Twenty-one (44%) of the pool tail-outs measured had an embeddedness rating of 2. Six (13%) of the pool tail-outs had embeddedness ratings of 3 or 4. Six of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning because the dominant substrate was boulders or cobble too large to be suitable. 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 Sulphur 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 60. The shelter rating in the flatwater habitats was much lower at 7. A pool shelter rating of approximately 100 is desirable. The relatively large amount of cover that now exists is being provided primarily by boulders in all habitat types. 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.

Twenty-eight of the forty-five 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 72%. This is an acceptable 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 to low at 68.8% and 58.3%, 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.

RECOMMENDATIONS

- 1) Sulphur Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are at 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) 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.
- 4) 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.
- 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) Increase the canopy on Sulphur 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.

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 with the confluence with the East Branch of the Lower North Fork of the Mattole River. Channel type is a B4. Young of the year (YOY) observed.
- 438' Left bank failure approximately 30' H x 30' L
- 1116' Right bank slide 40' high. YOY and 1+ salmonids observed
- 1333' Left bank slide. 1+ salmonid observed.
- 1822' Left bank tributary. 57° F water temperature.
- 2083' LDA at top of pool. Both banks are bedrock
- 2245' Right bank slide starts and continues into the next unit
- 2365' Right bank failure depositing trees and other woody debris in stream
- 3248' Left bank tributary, dry
- 3443' YOY, 1+ salmonids observed.
- 3608' Right bank tributary dry
- 3754' Right bank slide. Side channel on left bank
- 4486' Left bank tributary dry
- 4816' Right bank tributary, dry
- 5141' Right bank tributary, dry
- 5393' Right bank slide 60' up slope..
- 5650' LDA spans the width of the channel and is retaining gravel with a wedge 3' high
- 5784' Side channel flow fed mainly by right bank tributary

6155' Right bank tributary trickle from side channel to main channel
6639' Right bank debris slide
6921' LWD around and over the unit, but not in the water. Left bank erosion, slide enters channel
7025' LDA 20' high
7039' LDA, 63' in length and spans the stream channel, currently not a fish barrier
7102' Two LDA's are separated by pools
7136' 25' high LDA at top of pool. Juvenile salmonids observed. Walked .5 miles above the LDA and observed no fish. Gradient became very steep and channel is dominated by boulder substrate. End of survey

REFERENCES

- Flosi, G., and F. Reynolds. 1998. *California Salmonid Stream Habitat Restoration Manual*, 2nd 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