STREAM INVENTORY REPORT

WEST FORK SPROUL CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1992 on West Fork Sproul Creek to assess habitat conditions for anadromous salmonids. 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 West Fork Sproul Creek. The objective of the biological inventory was to document the salmonid species present and their distribution. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

The reach of West Fork Sproul Creek below the confluence with La Doo Creek is a Department of Fish and Game (DFG) spawner index reach. The most recent carcass surveys were conducted in West Fork Sproul Creek in December of 1992 and January 1993. In December 1992, 8 live chinook salmon, 21 chinook carcasses and nine skeletons were found. A January 23, 1993 survey produced similar results. Thirty-one live chinook salmon were observed and three carcasses found. Data from earlier years is available from the Eureka DFG office. 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.

WATERSHED OVERVIEW

West Fork Sproul Creek is a tributary to the Sproul Creek, a tributary to South Fork Eel River, located in Humboldt County, California (Figure 1). West Fork Sproul Creek's legal description at the confluence with Sproul Creek is T5S R3E S8. Its location is 40°02'27" N. latitude and 123°51'54" W. longitude. West Fork Sproul Creek is a second order stream and has approximately 5.5 miles of blue line stream, according to the USGS Briceland and Garberville 7.5 minute quadrangle. West Fork Sproul Creek drains a watershed of approximately 8.4 square miles. Elevations range from about 520 feet at the mouth of the creek to 1800 in the headwater areas. Grass, oak, and Douglas fir forest dominate the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists by way of State Highway 101 at Garberville to Sprowel Creek Road (sic), which leads west for four miles to Sproul

Creek. A private, gated road controlled by Barnum Timber Company follows Sproul Creek upstream for approximately 4 miles to the mouth of West Fork Sproul Creek.

METHODS

The habitat inventory conducted in West Fork Sproul Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991). The California Conservation Corps (CCC) and contract seasonal Technical Advisors that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). West Fork Sproul Creek personnel were trained in May, 1992, by Gary Flosi and Scott Downie. This inventory was conducted by a two person team.

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 West Fork Sproul 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. Flows should also be measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed by David Rosgen (1985). 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 four measured parameters used to determine channel type: 1) water slope gradient, 2) channel confinement, 3) width/depth ratio, 4) substrate composition.

3. Temperatures:

Both water and air temperatures are taken and recorded at each tenth unit typed. The time of the measurement is also recorded. Both temperatures are taken in 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". West Fork Sproul 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. Unit measurements included mean length, mean width, mean depth, and maximum depth. Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken 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 West Fork Sproul 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), 76 - 100% (value 4).

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 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 West Fork Sproul 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 habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes.

8. Canopy:

Stream canopy is estimated using handheld spherical densiometers and is a measure of the water surface shaded during periods of high sun. In West Fork Sproul Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results recorded.

9. Bank Composition:

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 West Fork Sproul Creek, the dominant composition type in both the right and left banks was selected from a list of eight options on 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. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

Biological inventory was conducted in West Fork Sproul Creek to document the fish species composition and distribution. Three sites were electrofished in West Fork Sproul Creek using one Smith Root Model 12 electrofisher. Each site was end-blocked with nets to contain the fish within the sample reach. Fish from each site were counted by species, measured, and returned to the stream.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat Runtime, a dBASE 4.1 data entry program developed by the California Department of Fish and Game (DFG). This program also processes and summarizes the data.

The Habitat Runtime program produces the following 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 Lotus 1,2,3. Graphics developed for West Fork Sproul 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
- Percent canopy
- Bank composition by composition type

HABITAT INVENTORY RESULTS

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

The habitat inventory of October 8, 9, 13-16, 19, and 21-23 1992, was conducted by Chris Coyle and John Crittenden (CCC). The total length of the stream surveyed was 28,966 feet, with an additional 159 feet of side channel.

Flows were not measured on West Fork Sproul Creek.

West Fork Sproul Creek is an B3 channel type for the entire 28,966 feet of stream reach surveyed. B3 channels are well confined, with steep unstable rejuvenating slopes.

Water temperatures ranged from 47 to 58 degrees fahrenheit. Air temperatures ranged from 50 to 78 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 41.7%, flatwater types 32.8%, riffle 23.9%, and dry 1.7% (Graph 1). Flatwater habitat types made up 46.9% of the total survey **length**, pools 33.8%, riffles 18.3%, and dry 1.0% (Graph 2.)

Eighteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were mid-channel pools, 23.9%; low gradient riffles, 23.4%; and step runs, 19.3% (Graph 3). By percent total **length**, step-runs made up 36.2%, mid-channel pools 19.2%, and

low gradient riffles 19.2%.

One-hundred-ninety-two pools were identified (Table 3). Main-channel pools were most often encountered at 58.3%, and comprised 57.8% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. One-hundred-twenty-seven of the 192 pools (66%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 191 pool tail-outs measured, none had a value of 1 (0.0%); 39 had a value of 2 (20.4%); 129 had a value of 3 (67.5%); and 23 had a value of 4 (12.0%). On this scale, a value of one is the best for fisheries (Graph 6).

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 the highest shelter rating at 28.6. Pool habitats followed with a rating of 28.3 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 44.8, and main-channel pools rated 29.6 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in West Fork Sproul Creek and are extensive. Large woody debris and bedrock ledges are also contributing some cover in nearly all habitat types. Graph 7 describes the pool cover in West Fork Sproul Creek.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 56 of the 108 low gradient riffles (51.9%). Gravel was the next most frequently observed dominant substrate type, and occurred in 45.4% of the low gradient riffles (Graph 8).

Nineteen percent of the survey reach lacked shade canopy. Of the 81% of the stream covered with canopy, 66% was composed of deciduous trees, and 15% was composed of coniferous trees. Graph 9 describes the canopy in West Fork Sproul Creek.

Table 2 summarizes the mean percentage of the right and left stream banks covered with vegetation by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 85.1%. The mean percent left bank vegetated was 83.4%. The dominant elements composing the structure of the stream banks consisted of 7.6% bedrock, 0.9% boulder, 0.9% cobble/gravel, 3.3% bare soil, 4.9% grass, 25.0% brush. Additionally, 48.2% of the banks were covered with deciduous trees, and 9.3% with

coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on Oct. 7 and 28, 1992 in West Fork Sproul Creek. The units were sampled by Chris Coyle and John Crittenden (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled included habitat units 7 and 8, a mid-channel pool and a step run approximately 426 feet from the confluence with the Sproul Creek. This site had an area of 2,103 sq ft, and a volume of 2,125.5 cu ft. The unit yielded 18 steelhead, ranging from 54 to 158mm.

The second site was habitat unit 267, a mid-channel pool, located immediately upstream from an old road crossing, approximately 18,381 feet above the creek mouth. This site had an area of 418 sq ft, and a volume of 585 cu ft. Nineteen steelhead were sampled. They ranged from 50 to 127mm. One coho, measuring 76mm was also sampled.

Site number three, two habitat units above the end of the survey at 29,152 feet, was a shallow pool. It yielded one steelhead, 118mm. Area and volume of this sample site were not recorded.

DISCUSSION

The B3 channel type is generally not suitable for fish habitat improvement structures. B3 channels are found in moderate energy, moderate gradient stream reaches. They have channels dominated by cobble / gravel mix that contribute an unlimited supply of sediment into the stream. Usually within the B3 channel there are zones of bank stability where structures designed to scour can be constructed. This seems to be the case in West Fork Sproul Creek, but any structure sites must be selected with care because of the high stream energy which can create problems with stream bank erosion and structure stability.

The water temperatures recorded on the survey days October 8-9, 13-16, 19, 21-23, 1992 ranged from 47° F to 58° F. Air temperatures ranged from 50° F to 78° F. This is a very good water temperature regime for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling conducted.

Flatwater habitat types comprised 46.9% of the total **length** of this survey, riffles 18.3%, and pools 33.8%. The pools are relatively deep with 127 of the 192 pools having a maximum depth greater than 2 feet. However, in coastal coho and steelhead

streams, it is generally desirable to have primary pools comprise approximately 50% of total 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. Therefore, 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 numerous log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravels. Any necessary modifications to them should be done with the intent of metering the gravels 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.

One-hundred-fifty-two of the 191 pool tail-outs measured had embeddedness ratings of 3 or 4. None had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In West Fork Sproul Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean shelter rating for pools was low with a rating of 28.3. The shelter rating in the flatwater habitats was slightly lower at 18.1. However, 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, large woody debris and root masses contribute a small amount. 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.

One-hundred-five of the 108 low gradient riffles had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy for the stream was 81%. This is a high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) West Fork Sproul Creek should be managed as an anadromous, natural production stream.

2) 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.

3) 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.

4) 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 and in some areas the material is at hand.

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

PROBLEM SITES AND LANDMARKS

The following landmarks and possible problem sites were noted. All the distances are approximate and taken from the beginning of the survey reach.

0'	Begin survey at confluence with Sproul Creek. Vehicle bridge approximately 20' high spanning channel.
137'	Road crossing channel.
426'	Biological inventory site one.
2122'	Left bank stabilization project site.

2356' Right bank failure 8' high x 25' long, contributing fines.

2530' Right bank stabilization project site.

2715' High water scouring left bank and causing erosion 8' high x 40' long. Contributing fines.

3098' Cut left bank 12' high x 40' long contributing fines.

3260' Right bank cut 10' high x 30' long contributing fines.

3784' Left bank scour 12' high x 30' long contributing fines.

4266' Unconsolidated large woody debris accumulation, approximately 3' diameter by 40' long spanning channel.

4499' Left bank erosion 6' high x 100' long contributing fines.

4804' Right bank erosion 75' high x 50' long contributing fines. Left bank erosion 15' high by 25' long contributing fines.

5369' Right bank rock slide 15' high by 25' long.

5711' Dry tributary entering from right and left bank. Both channels very steep.

5986' Left bank erosion 25' high x 50' long. Contributing fines.

6794' Left bank erosion 20' high by 50' long. Contributing fines.

7457' Left bank erosion 15' high x 75' long contributing fines.

7660' Left bank erosion 7' high by 60' long contributing fines.

7682' Right bank erosion 50' high x 100 ' long contributing fines.

8682' Right bank erosion 20' high x 20' long contributing fines.

8778' Right bank erosion 30' high x 20' long contributing fines.

9086' Dry tributary entering from right bank.

9177' Gabions installed. Right bank gabion in major disrepair.

10025' Right bank rock slide 30' high x 40' long contributing boulders and cobble into channel.

10814' Cut right bank 7' high x 40' long contributing fines.

12251' Right bank erosion 40' high x 60' long contributing fines.

13216' Left bank erosion approximately 100' high x 30' long contributing fine. (Toe of erosional area vegetated.)

13321' LaDoo Creek enters from left bank.

13482' Left bank erosion 70' high by 100' long contributing fines.

13781' Left bank slide 70' high x 100' long contributing fines.

14803' Left bank erosion 25' high x 50' long contributing fines.

14940' Unnamed tributary entering from right bank. Possibly anadromous, but no fish observed within 150' of mouth.

16297' Large woody debris 5' high x 30' wide x 6' long at top of unit, retaining gravel at base. Low flow barrier.

16862' Begin large woody debris accumulation in channel from habitat unit 238 to unit 242. Approximate measurement 6' high x 25' wide x 50' long. Multiple pieces of LWD. Intermittent flow, but passible. Possible low flow barrier.

17693' Undercut left bank 7' high' x 100' long contributing fines.

17783' Left bank erosion 25' high x 40' long contributing fines.

18052' Cut left bank 7' high x 110' long contributing fines.

18343' Flatcar bridge spanning the creek. Approximate clearance of 25.

18381' Biological inventory site two.

18615' Dry tributary entering from left bank.

20271' Cut left bank 7' high x 50' long contributing fines.

20361 Creek forks 54 feet into the unit. The left fork is intermittent. Survey continues up right fork.

20763' Large woody debris accumulation 2' high x 15' wide x 3' long retaining gravel. Possible flow barrier. Also right and left bank cut approximately 6' high x 75' long contributing fines.

20829' LDA 3' high x 25' wide x 15' long. Not a barrier.

21120' LDA 8' high x 40' wide x 12' long retaining gravel. Possible low flow barrier.

21284' Tributary entering from right bank.

21390' Right bank cut 7' high x 30' long contributing fines. Flow percolates beneath logs in tail. Possible low flow barrier.

21538' Left bank erosion 15' high x 40' wide contributing fines.

21597' Right bank erosion 5' high x 30' long contributing fines.

21694' Right bank cut 6' high x 40' long contributing fines.

22037' Right bank erosion 10' high x 30' long contributing fines.

22330' Left bank erosion 30' high x 50' long contributing fines. LDA 7' high x 30' wide x 50' long. Partial gravel retention to 40' wide. Possible barrier.

22690' Left bank erosion 50' high x 100' long contributing fines.

23148' LDA 4' high x 50' wide x 15' long retaining gravel at base. Possible low flow barrier.

23250' Two left bank slides approximately 40' high x 30' long contributing fines.

23306' Tributary entering from right bank. Steep gradient

with much large woody debris. No fish observed.

23373' Left bank slide 40' high x 40' long contributing fines.

23535' LDA 6' high x 25' wide x 16' long retaining gravel 3' high x 20' wide at base. Possible low flow barrier.

23599' LDA 5' high x 20' wide x 25' long. Not a barrier.

23719' Left bank erosion 10' high x 50' long contributing fines.

23959' LDA 5' high x 25' wide x 20' long. Possible low flow barrier.

24147' LDA 3' high x 15' wide x 6' long.

24271' Right bank erosion 10' high x 40' long contributing fines.

24380' Tributary entering from left bank.

25085' LDA 3' high by 15' wide x 10' long. Not a barrier.

25099' LDA 3' high x 30' wide x 6' long contributing gravel. 2' x 20' at base. Possible low flow barrier.

25624' LDA 2' high x 10' wide x 5' long retaining gravel 2' x 15' at base. Possible low flow barrier.

25850' Left bank cut 4' high x 50' long contributing fines.

26325' Tributary enters from right bank, remaining flow in West Fork Sproul divided between this tributary and left fork.

26991' LDA 469' into habitat unit 418. LDA's approximate dimensions 4' high x 40' wide x 10' long retaining gravel. Possible low flow barrier.

27018' Right bank erosion 20' high x 40' long contributing fines.

27230' LDA 66' into habitat unit 422. Approximate dimensions 4' high x 20' wide x 6' long, retaining gravel. Possible barrier.

27623' LDA 6' high x 30' wide x 15' long retaining gravel 2' x 30' at base. Possible barrier.

27875' LDA 14' high x 15' wide x 20' long. Not a barrier.

28062' LDA 5' high x 25' wide x 15' long retaining gravel 2' x 12' at base. Not a barrier.

28102' Dry tributary entering from right bank. LDA 4' high x 15' wide x 10' long retaining gravel 4' x 10' at base. Possible barrier.

28347' Left bank erosion 8' high x 15' wide contributing fines.

28620' LDA 6' high x 20' wide x 50' long. No gravel retention but possible barrier.

28672' Left bank cut 4' high x 60' long contributing fines.

29152' West Fork splits. Left fork wetted. End of blue line stream on USGS 7.5 topo. End of survey.

29200' Biological inventory site three: One steelhead 118mm