STREAM INVENTORY REPORT

SPROUL CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1992 on 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 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.

Spawning surveys were conducted in December 1988, January 1989, February 1991, December 1992, and January 1992. These surveys documented the presence of chinook salmon and steelhead in Sproul Creek. 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

Sproul Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Humboldt County, California (Figure 1). The legal description at the confluence with the South Fork Eel River is T4S R3E S34. Its location is 40°04'10" N. latitude and 123°49'35" W. longitude. Sproul Creek is a third order stream and has approximately 9 miles of blue line stream, according to the USGS Briceland and Garberville 7.5 minute quadrangles. Sproul Creek and its tributaries drain a basin of approximately 24 square miles, and the system has a total of 26.5 miles of blue line stream. Elevations range from about 320 feet at the mouth of the creek to 1,400 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed, but there are zones of grassland and oak-woodland in the upper watershed. The majority of the watershed is owned by the Barnum Timber Company and is primarily managed for timber production. Year round vehicle access exists from U.S. Highway 101 near Garberville to Sproul Creek Road.

METHODS

The habitat inventory conducted in 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). 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 Sproul Creek to record measurements and observations. There are nine components to the inventory form.

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. 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". 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 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 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 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 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 Sproul Creek to document the fish species composition and distribution. One site was electrofished in Sproul Creek using one Smith Root Model 12 electrofisher. The site was end-blocked with nets to contain the fish within the sample reach. The fish 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 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 5-8, 13-15, 19-21, and 26 1992, was conducted by Michelle Rose and John Cleckler (contract seasonals). The survey began at the confluence with the South Fork Eel River. The total length of the stream surveyed was 34,238 feet, with an additional 2,012 feet of side channel.

Flows were not measured on Sproul Creek.

This section of Sproul Creek has three channel types: C1, B1, and A2. C1 streams have a gradient of 1.0 to 1.5%, with meandering, cobble/gravel channels. B1 channels are moderate gradient (2.5-4.0%), moderately confined small boulder/large cobble channels. A2 types are high gradient (4-10%), are well confined, with a deeply incised bedrock channel, and very stable stream banks.

Water temperatures ranged from 51 to 59 degrees fahrenheit. Air temperatures ranged from 53 to 86 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence** pools made up 37.5%, flatwater types 36.6%, riffles 22.9%, and dry 3.0% (Graph 1). Flatwater habitat types made up 50.0% of the total survey **length**, pools 33.1%, riffles 14.7%, and 2.2% was dry. (Graph 2).

Fifteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were step runs, 21.5%; low gradient riffles, 16.0%; runs, 14.9%; and mid-channel pools, 14.1% (Graph 3). By percent total **length**, step runs made up 33.8%, runs 15.7%, mid-channel pools 14.4%, and low-gradient riffles 11.1%.

One-hundred-thirty-six pools were identified (Table 3). Scour pools were most often encountered at 55.8%, and comprised 51.1%

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. Sixty-eight of the 136 pools (50%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at the pool tail-outs. Of the 121 pool tail-outs measured, seventeen had a value of 1 (14%); 79 had a value of 2 (65.3%); 25 had a value of 3 (20.7%); and none had a value of 4. On this scale, a value of one is 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. Pools types had the highest shelter rating at 46.9. Flatwater had the lowest rating with 35.9 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 67.5, scour pools rated 52.4, and main channel pools 39.1 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Sproul Creek and are extensive. Large wood and bedrock ledges are the next most common cover type. Graph 7 describes the pool cover in Sproul Creek.

Table 6 summarizes the dominant substrate by habitat type. Large cobble was the dominant substrate observed in 21 of the 58 low gradient riffles (36.2%). Boulders were the next most frequently observed dominant substrate type, and occurred in 34.5% of the low gradient riffles (Graph 8).

Thirty-nine percent of Sproul Creek lacked shade canopy. Of the 61% of the stream that was covered with canopy, 53.8% was composed of deciduous trees, and 7.3% was composed of coniferous trees. Graph 9 describes the canopy in 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 51%. The mean percent left bank vegetated was 49.4%. The dominant elements composing the structure of the stream banks consisted of 12.4% bedrock, 23.8% boulder, 50.8% cobble/gravel, 7.9% bare soil, 0.8% grass, 0.0% brush. Additionally, 2.8% of the banks were covered with deciduous trees, and 1.5% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on October 7, 1992 in Sproul Creek. The unit was sampled by Chris Coyle and John Crittenden (CCC). All measurements are fork lengths unless noted otherwise.

The site sampled was habitat unit 6, a mid-channel pool, approximately 1,059 feet from the confluence with the South Fork Eel River, and 121 yards upstream from the Sproul Creek Road bridge. The site had an area of 2,018 sq ft, and a volume of 1,816 cu ft. The sample included 2 steelhead, 71 and 107mm; 67 roach, ranging from 35 to 83mm; 2 squaw fish 77 and 89mm: 4 stickleback, ranging from 30 to 36mm; 1 sucker, 95mm; and 1 Pacific lamprey ammocete 90mm total length.

DISCUSSION

Sproul Creek has three channel types: A2, B1, and C1. The high energy and steep gradient of the A2 channel type is generally not suitable for instream enhancement structures. The total length of the A2 channel type in Sproul Creek is a relatively low percentage.

The B1 channel type is excellent for many types of low and medium stage instream enhancement structures. There are approximately 2,300 feet of this type of channel in the upper middle section of Sproul Creek. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and pool cover.

The lower, middle, and a small portion of the upper reach of Sproul Creek is a C1 channel type. C1 channels have suitable gradients and the stable stream banks that are necessary for the installation of instream structures designed to increase pool habitat, trap spawning gravel, and provide protective cover for fish. Well placed and engineered structures that constrict the channel to form pool habitat, or cover structures, are usually appropriate and have a good chance of success in these channel types.

The water temperatures recorded on the survey days October 5-8, 13-15, 19-21, 26, 1992 ranged from 51° F to 59° F. Air temperatures ranged from 53° F to 86° F. This is a very good temperature regime for salmonids. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and more extensive biological sampling must be conducted.

Flatwater habitat types comprised 50.1% of the total **length** of this survey, pools 33.1%, and riffles 14.7%. The pools are relatively deep with 68 of the 136 pools having a maximum depth greater than 3 feet. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. In third and fourth order streams a primary pool is defined to have a maximum depth of at least three 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 pool habitat is recommended for locations where their installation will not jeopardize any unstable stream banks or subject the structures to high stream energy.

Twenty-five of the 121 pool tail-outs measured had embeddedness ratings of 3 or 4. Seventeen 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 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 relatively low with a rating of 46.9. The shelter rating in the flatwater habitats was slightly lower at 35.9. Riffles also rated relatively low at 43.9. However, a pool shelter rating of approximately 100 is desirable. The small amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, large woody debris and bedrock ledges 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. Forty-one of the 58 low gradient riffles had either large cobble or boulders as the dominant substrate. This is generally considered poor habitat for spawning salmonids.

The mean percent canopy for the survey reach was 61%. In this climatic zone, 80 percent is generally considered desirable. Summer water temperatures could be reduced by increasing stream canopy. To do this, large trees are needed in the wide channels found in portions of Sproul Creek. These trees would furnish a long term source of shade and large woody debris. This condition would cool the stream, develop instream habitat structure, and provide shelter from predators for salmon and steelhead.

RECOMMENDATIONS

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

2) Temperatures in this section of Sproul Creek, as well as upstream, should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

3) Increase the canopy on Sproul Creek by planting willows, 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) Where feasible, increase woody cover in the pool and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations. In some areas the material is at hand.

5) 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.

6) Spawning gravel on Sproul Creek are limited to relatively few reaches. Crowding and/or superimposition of redds have been observed during winter surveys. Projects should be designed at suitable sites to trap and sort spawning gravel in order to expand redd site distribution in the stream.

7) 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. This treatment will help develop spawning gravel sites as well.

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 South Fork Eel River. Channel type is C1.
686'	County road bridge 40' long by 35' high spanning creek.
2635'	Private vehicle bridge under construction 16' high x 12' wide x 75' long.
2640'	Little Sproul Creek enters from the left bank.
7923'	Small slide on left bank contributing fines. Subsurface flow between units 57-59.
8248'	Intermittent tributary entering from right bank, heavily wooded with extensive debris in the channel.
9438'	Several slides are on the left bank contributing fines, and causing the channel to narrow.
10000'	Road access to creek at old logging camp and rock quarry. Lower end of DFG spawner survey index reach.
10949'	Old logging road runs parallel to creek. Road has forded the channel in the past.
11826'	Warden Creek enters from the left bank.
12846'	Log jam 12' high x 15' wide x 50' long across the channel. Not a fish barrier.
12966'	Large and small woody debris at top of habitat unit 106. Not a fish barrier but causing gravel to accumulate and channel to braid. At low flow three distinct channels were cut, each with a small amount of water.
23111'	West Fork Sproul Creek enters. There is a deep confluence pool under a flat-car logging road bridge.
24394'	Large woody debris accumulation 5' high x 17' wide x 10' deep causing subsurface water flow.

30000 Unnamed trib enters from the left bank. Old road fords the channel. Road access to stream.

31935' Cox Creek enters at top of habitat unit 287 on right bank. Upper end of DFG spawner survey index reach.

33040' Downed redwood in creek causing large woody debris to accumulate at bend in channel.

36223' Large woody debris accumulation on both left and right bank, 15' wide x 6' high x 12' long. Not a fish barrier.

36983' Large woody debris accumulation in main channel as well as in the side channel retaining large amounts of sand and gravel, causing subsurface flows and a second smaller log jam. Dimensions of first LDA: 45' wide x 7' high x 14' long. Dimensions of second LDA: 30' wide x 5' high x 8' long. Also debris has begun to accumulate between jams.

37845' Intermittent tributary entering from the left bank.

38035' Property boundary crosses stream. Landowners above this point denied access to fishery program inventory personnel. Sproul Creek inventory terminated. End of survey.