STREAM INVENTORY REPORT

BOOTHS RUN

INTRODUCTION

A stream inventory was conducted during the summer of 1991 on Booths Run 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 Booths Run. 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.

There is no known record of adult spawning surveys being conducted on Booths Run. The objective of this report is to document the current habitat conditions, and recommend options for the enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Booths Run is tributary to Lawrence Creek, tributary to Yager Creek,tributary to the Van Duzen River, tributary to the Eel River, located in Humboldt County, California (Figure 1). Booths Run's legal description at the confluence with Lawrence Creek is T3N R2E S08. Its location is 40°39'45" N. latitude and 123°58'00" W. longitude. Booths Run is a second order stream. The total length of blue line stream, according to the USGS Iaqua Buttes 7.5 minute quadrangle, is 4.2 miles.

Booths Run drains a watershed of approximately 5.7 square miles. Redwood and Douglas fir forest dominates the watershed. The watershed is owned by the Pacific Lumber Company and is managed for timber production. Year round vehicle access exists from State Highway 36 near Carlotta, via Fisher Road, to Pacific Lumber Company's Yager Camp. The main Yager Lawrence Haul Road leads to Road Nine and Booths Run, approximately 13 miles from Yager Camp.

METHODS

The habitat inventory conducted in Booths Run follows the methodology as presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds). The inventory

was conducted by a two person team. The California Conservation Corps (CCC), Technical Advisors conducting the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Booths Run personnel were trained in May and June, 1991, by Gary Flosi and Scott Downie.

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 Booths Run 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 was 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 operations 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 used 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". Booths Run 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 measurements were accomplished using hip chains, range finders, tape measures, and stadia rods. Unit measurements included mean length, mean width, mean depth, and maximum depth. Depth of the pool tail crest at each pool habitat unit was measured at 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 Booths Run, 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 Booths Run, 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 Booths Run, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The percentages of the total canopy area was then further analyzed and recorded according to whether it was composed of either coniferous or deciduous trees.

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 Booths Run, 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.

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 Booths Run to document the salmonid species composition and distribution. Three sites were electrofished in Booths Run using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, measured, and returned to the stream.

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 0.85mm).

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. 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 Lotus 1,2,3. Graphics developed for Booths Run 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 August 16, 20, 21, and 22, 1991, was conducted by Steve Liebhardt and Jerry Suissa (CCC). The total length of the stream surveyed was 9,661 feet, with an additional 87 feet of side channel.

Flow was not measured on Booths Run.

Booths Run is a B2 channel type for the entire 9,661 of stream reach surveyed. B2 channels are moderate gradient (1.0-2.5%), moderately confined streams, with stable stream banks.

Water temperatures ranged from 55 to 63 degrees fahrenheit. Air temperatures ranged from 61 to 69 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 37.4%, flatwater types were 37.4%, and pools 25.2% (Graph 1). Flatwater habitat types made up 55.8% of the total **length**, riffles were 29.7%, and pools 14.5% (Graph 2).

Fourteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were low gradient riffles, 33.6%; step runs, 28.4%; and log enhanced lateral scour pools, 11.0% (Graph 3). By percent total **length**, step runs made up 49.8%, low gradient riffles made up 27.8%, and log enhanced lateral scour pools made up 6.7% (Table 2).

Thirty-nine pools were identified (Table 3). Scour pools were

most often encountered at 76.9%, and comprised 79.3% 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. Thirty-two of the 39 pools (82%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 39 pool tail-outs measured, 2 had a value of 1 (4.9%); 20 had a value of 2 (51.2%); 13 had a value of 3 (34.1%); and 4 had a value of 4 (9.8%). 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. Pool habitat types had the highest shelter rating at 60.6 (Table 1). For the pool types, the scour pools had the highest mean shelter rating at 68.0, and main-channel pools had a rating of 36.1 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the most common cover type in Booths Run. Large and small woody debris are the next most common cover types. Graph 7 describes the pool cover in Booths Run.

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 21 of the 52 low gradient riffles (40.4%). Gravel was the next most frequently observed dominant substrate type, and occurred in 36.5% of the low gradient riffles (Graph 8).

Sixty-one percent of the survey reach lacked shade canopy. Of the 37% of the stream covered with canopy, 92% was composed of deciduous trees, and 8% was composed of coniferous trees. Graph 9 describes the canopy in Booths Run.

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 85.8%. The mean percent left bank vegetated was 88.8%. The dominant elements composing the structure of the stream banks consisted of 17.0% bedrock, 2.2% cobble/gravel, 0.3% grass, 15.6% brush. Additionally, 62.4% of the banks were covered with deciduous trees, and 2.5% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three electrofishing sites were sampled on Booths Run. The objective was to identify fish species and distribution. The

units were sampled on September 9, 1991 by Erick Elliot and Brian Humphrey (CCC). Each unit was end-blocked with nets to contain the fish within the sample reach. Fork lengths (FL) were measured and recorded at each site, and the fish returned to the stream.

The first site sampled was habitat unit 007, a log enhanced lateral scour pool, approximately 41 feet from the confluence with Lawrence Creek. This site had an area of 792.0 sq ft, and a volume of 950.4 cu ft. The unit yielded 53 steelhead, ranging from 49 to 165 mm FL.

The second sample site was habitat unit 051, a log enhanced lateral scour pool, approximately 2,797 feet above the creek mouth. This site had an area of 663.0 sq ft, and a volume of 729.3 cu ft. Forty-four steelhead were sampled. They ranged from 69 to 151 mm FL.

The third site was a plunge pool, approximately 50 feet upstream from the bridge crossing. Two steelhead were sampled, 75 and 81mm FL.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Booths Run.

DISCUSSION

The B2 channel type is suitable for many types of instream enhancement structures. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and pool cover.

The water temperatures recorded on the survey days Aug. 16-22, 1991 ranged from 55° F to 63° F. Air temperatures ranged from 61° F to 69° F. This is a good water temperature regime for salmonids. However, 63° F, if sustained, is near the threshold stress level 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 55.8% of the total **length** of this survey, riffles 29.7%, and pools 14.5%. The pools are relatively deep with 32 of the 39 pools having a maximum depth of two feet or greater. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. Therefore,

installing structures that will increase or deepen pool habitat is recommended.

Seventeen of the 39 pool tail-outs measured had embeddedness ratings of 3 or 4. Only two had a 1 rating. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat. In Booths Run, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean shelter rating in the flatwater habitats was moderate with a rating of 30.7. The shelter rating for the pools was better at 60.6. However, a pool shelter rating of approximately

100 is desirable. The cover that now exists is being provided primarily by boulders and large and small woody debris in all habitat types. Log and root wad cover structures in the 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 of the 52 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 survey reach was 39%. This is a relatively low 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) Booths Run should be managed as an anadromous, natural production stream.

2) 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.

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) Increase the canopy on Booths Run 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 upstream erosion control projects.

5) Increase woody cover in the flatwater habitat units. Most of the existing cover is from boulders and large and small woody debris. Adding high quality complexity with additional woody cover is desirable.

6) There are several log debris accumulations present on Booths Run 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'	Survey begins at the confluence with Lawrence Creek. Channel type is B2 for the entire stream reach surveyed.
60'	Clearcut on the left bank 900' long.
759'	Stream is braided into 2-3 channels.
2136'	Log and debris accumulation (LDA), retaining gravel 70' long x 25' wide x 3' high.
2402'	LDA retaining gravel 10' long x 10' wide x 4' high, and causing the channel to braid.
3273'	LDA retaining gravel and sand.
4608'	Tributary enters from the left bank; no YOY observed.
4886'	Many YOY observed.
5809'	LDA 30' long x 50' wide x 7' high, retaining gravel; no apparent barrier. Trees sliding into the channel from both banks.

6029' LDA 5' long x 30' wide x 2.5' high, retaining gravel and causing the creek to change course.

6057' LDA 20' long x 50' wide x 6' high.

6544' LDA 50' long x 30' wide x 9' high, retaining gravel 40' long x 15' wide x 2.5' high.

6526' Right bank slide 100' high x 50' long, contributing boulders into the channel.

7737' Tributary enters from the left bank; no YOY observed.

8250' Large seep from bedrock on the left bank. Gravel slide 80' high x 15' long.

8737' LDA retaining gravel.

8781' Logged area on the right bank for 183'. Right bank slide 100' high x 30' long.

9116' LDA 3' long x 14' wide x 5' high, retaining gravel and silt.

9365' LDA 5' long x 20' wide x 6' high.

9402' LDA 10' long x 15' wide x 6' high, retaining gravel 40' long x 20' wide x 2' high.

9449' No fish observed for the remainder of the stream reach surveyed.

9563' Tributary enters from the left bank; no YOY observed.

9634' LDA retaining gravel and silt.

9661' End of survey.

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