STREAM INVENTORY REPORT

SHAW CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1993 on Shaw 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 Shaw 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.

Adult carcass surveys were conducted on Shaw Creek by the California Department of Fish and Game (DFG) from 1988 through 1993. The table below describes the results of those surveys:

Shaw Creek Carcass Surveys 1987 - 93

	Chinook Salmon				Other		
Year	# of Surveys	Live Fish	# of Carcass	Adipose ClipCWT	Redds seen	Coho seen	SH/RT seen
1988-89	1	3	4	1	3	3	0
1989-90	2	11	10	0	11	0	0
1990-91	1	0	0	0	0	0	0
1991-92	2	3	0	0	15	1	3
1992-93	5	83	25	0	112	2	3

The drought related low flows during prime migration periods from 1989 through 1992 made Shaw Creek, typical of many Van Duzen tributaries, inaccessible to most chinook salmon. The objective of this report is to document the current habitat conditions in Shaw Creek, and recommend options for the enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Shaw Creek is tributary to Lawrence Creek, tributary to Yager

Creek, tributary to the Van Duzen River, located in Humboldt County, California. Shaw Creek's legal description at the confluence with Lawrence Creek is T3N R2E S30. Its location is 40°37'12" N. latitude and 123°59'26" W. longitude. Shaw Creek is a second order stream and has approximately 6.0 miles of blue line stream, according to the USGS Owl Creek and Iaqua Buttes 7.5 minute quadrangles. Shaw Creek drains a watershed of approximately 5.4 square miles. Summer base runoff is approximately 1 cfs at the mouth, but over 15 cfs is not unusual during winter storms. Elevations range from about 580 feet at the mouth of the creek to 2,400 feet in the headwater areas. Redwood, grass, and Douglas fir forest dominate the watershed. Privately owned by The Pacific Lumber Company (PALCO) this watershed 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 Shaw Creek, 9 miles from Yager Camp.

METHODS

The habitat inventory conducted in Shaw Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991). Survey personnel that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). The two person Shaw Creek survey team was trained in May, 1993, 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 Shaw 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 measured 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". Shaw 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 Shaw 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 Shaw 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 Shaw 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 Shaw 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.

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 Shaw 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 July 26, 27, 29 and August 9, 10, 11, 12, & 16 1993, was conducted by Chris Coyle, Michelle Rose, Erick Elliot, Craig Mesman and Jason MacDonnell (CCC and DFG). The total length of the stream surveyed was 16,239 feet, with an additional 363 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.0 cfs on Aug. 3, 1993.

The surveyed section of Shaw Creek has three channel types and four channel reaches; from the stream mouth to 832 feet a B5; the next 1,518 feet a B3; the next 4,616 feet a B2; and the

upper 9,273 feet a B3. B5 channels are moderate gradient (2.0-4.0%), moderately entrenched streams, with silt and clay as the dominant substrate. B type channels have a very stable plan and profile with stable banks. B3 channels are similar to B5 channels except the dominant substrate is cobble/gravel. B2 channels are boulder dominated channels with moderately confined, stable stream banks.

Water temperatures ranged from 55 to 60 degrees Fahrenheit. Air temperatures ranged from 53 to 79 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 39%, pools 36%, and flatwater types 25% (Graph 1). Riffle habitat types made up 45% of the total survey **length**, pools 28%, and flatwater 28% (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 low gradient riffles, 37%; mid-channel pools, 18%; and runs, 16% (Graph 3). By percent total **length**, low gradient riffles 41%, mid-channel pools 15%, and step runs 15%.

One hundred sixty-five pools were identified (Table 3). Main-channel pools were most often encountered at 55%, and comprised 58% 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 five of the 165 pools (64%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 158 pool tail-outs measured, six had a value of 1 (3.8%); 59 had a value of 2 (37.3%); 50 had a value of 3 (31.6%); and 43 had a value of 4 (27.2%). 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 57. Riffle habitats followed with a rating of 41 (Table 1). Of the pool types, the backwater had the highest mean shelter rating at 73, and scour pools rated 57 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Shaw Creek. Large and small woody debris are also found in nearly all habitat types. Graph 7

describes the pool cover in Shaw Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 113 of the 172 low gradient riffles (65.7%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 19.8% of the low gradient riffles (Graph 8).

Sixteen percent of the survey reach lacked shade canopy. Of the 84% of the stream covered with canopy, 64.7% was composed of deciduous trees, and 19.3% was composed of coniferous trees. Graph 9 describes the canopy in Shaw 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 82.7%. The mean percent left bank vegetated was 81.8%. The dominant elements composing the structure of the stream banks consisted of 1.4% bedrock, 4.8% boulder, 1.6% bare soil, 3.2% brush. Additionally, 62.8% of the banks were covered with deciduous trees, and 26.2% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Shaw Creek.

DISCUSSION

Shaw Creek has three channel types: B5, B3, and B2. The B-type channel is excellent for many types of low and medium stage instream enhancement structures. There are 16,239 feet of this type of channel in Shaw Creek, along with a plentitude of large woody debris either in or nearby the stream. Many site specific projects can be designed within this channel type, especially to increase pool frequency and volume.

The water temperatures recorded on the survey days July 26, 27, 29, and August 9-12, and 16 1993 ranged from 55° F to 60° F. Air temperatures ranged from 53° F to 79° F. This is a very good water temperature regime for salmonids. To make any further conclusions, temperatures should be monitored throughout the warm summer months, and more extensive biological sampling conducted.

Flatwater habitat types comprised 27.5% of the total **length** of this survey, riffles 44.8%, and pools 27.7%. The pools are

moderately deep with 105 of the 165 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.

Ninety-three of the 158 pool tail-outs measured had embeddedness ratings of 3 or 4. Only six 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 Shaw 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 56.8. The shelter rating in the flatwater habitats was considerably less at 35.2. 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 and small woody debris 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 forty-seven of the 172 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 84%. 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) Shaw 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, like the site at 613' 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) Spawning gravels on Shaw 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 gravels in order to expand redd site distribution in the stream.

5) There are several log debris accumulations present on Shaw 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.

6) 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.

7) Temperatures in this section of Shaw 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.

8) 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.

9) Increase the canopy on Shaw 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.

10) Due to the high gradient in some reaches of the stream, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored, and improved where possible.

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 Lawrence Creek. Stream is a B2 channel type for the first 832 feet of stream surveyed.
68'	Right bank (RB) pool enhancement project. Site not flagged. Structure is catching debris on the up stream side.
613'	Left bank (LB) erosion 6' high x 40' long contributing fines.
656'	Humboldt crossing 7' high x 40' long x 30' wide.
832'	Channel type changes to a B3 for the next 1,518' of stream surveyed.
1102'	Cut right bank 6' high x 25' long contributing fines and cobble.
1900'	RB erosion 6' high x 40' long.
2055'	CCC work site. Armored right bank.
2350'	Channel type changes to a B2 for the next 4,616' of stream surveyed.
2865'	CCC work site. Armored left bank.
3325'	Cut LB, 10' high x 40' long. CCC work site. LB armored.
3755'	LB erosion 20' high x 40' long. Bank slumping into

channel.

3984' Large woody debris accumulation (LDA) 7' high x 40' wide x 20' long. Possible low flow fish barrier.

4379' LB slide 90' high x 60' long contributing fines.

4833' LB slide 50' high x 10' long contributing fines.

5231' Department of Fish and Game/ CCC Evaluation site #2.

5400' LDA 4' high x 40' wide x 5' long retaining gravel 2' high x 30' wide x 40' long on upstream end.

5465' LB erosion 18' high x 20' long contributing fines.

5561' CCC work site; LDA modification and bank stabilization.

5596' LDA 4' high x 15' wide x 10' long. Not a fish barrier.

5678' CCC work site; left bank stabilization project.

6015' Department of Fish and Game/ CCC Evaluation site #3.

6734' Active right bank undercutting 6' high x 25' long causing trees and other bank material to fall directly into main channel.

6966' Channel type changes to a B3 for the remaining 9,273' of stream surveyed.

7529' LDA 14' high x 50' wide x 25' long retaining gravel 8' high x 50' wide x 25' long. Possible fish barrier.

7553' LB erosion 20' high by 60' long contributing fines.

7579' LDA 6' high x 30' wide x 10' long retaining gravel 2' high x 20' wide x 25' long. Not a fish barrier.

7634' LB erosion 20' high x 30' long contributing fines.

7690' LDA 6' high x 30' wide x 10' long. RB erosion 30' high x 30' long contributing fines. Young-of-the-Year (YOY) observed above barrier.

7728' LDA 4' high x 30' wide x 5' long retaining gravel 3' high x 25' wide x 40' long. Not a fish barrier.

8420' LDA 4' high x 30' wide x 10' long. Not a fish barrier.

9079' Tributary entering from RB. Flow estimated at 0.1 cfs.

9180' CCC work site P-3 07/21/93; log/boulder weir.

9212' CCC work site P-2 07/21/93; inverted V boulder.

10065' RB erosion 50' high x 100' long contributing fines.

10299' Forks of Shaw Creek.

10626' RB erosion 80' high x 80' long contributing fines.

10682' Small LDA at top of unit causing gravel retention and possible low flow barrier.

11093' RB erosion 30' high x 40'long yielding fines.

11201' LDA 50' long x 10' high x 30' wide retaining gravel 5' high x 25' wide x 50' long. YOY observed barrier.

11293' RB erosion 70'high x 50'long yielding fines.

11454' LDA 6' high x 25' wide x 10' long. Not a fish barrier.

11597' Tributary entering from LB. Flow estimated at 0.1 cfs.

12096' LDA 10' high x 70' wide x 20' long retaining gravel 9' high x 50' wide x 100' long.

12096' LB erosion 20' high x 50'long yielding fines.

12211' Multiple 2+ (possibly resident) salmonids observed.

13236' LB erosion 20' high x 30' long contributing fines.

13431' LDA/ boulder constriction 7' high x 18' wide x 10' long retaining gravel 5' high x 15' wide x 50' long. Low flow barrier.

13533' LDA 6' high x 40' wide x 6' long retaining gravel 4' high x 20' wide x 40' long. Not a fish barrier.

14265' LDA 7' high x 40' wide x 15' long. Not a fish barrier.

14621' LDA 5' high x 20' wide x 6' long retaining gravel 4' high x 18' wide x 50' long. Possible barrier.

15102' Tributary entering LB. Flow estimated at 0.1 cfs.

15266' LDA 5' high x 25' wide x 6' long retaining gravel 3' high x 20' wide x 40' long. Low flow barrier.

15452' LDA 6' high x 30' wide x 6' long. Not a fish barrier.

15991' Tributary entering from RB. Flow estimated at 0.1 cfs.

16239' 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
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5