STREAM INVENTORY REPORT

SQUAW CREEK

INTRODUCTION

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

There is no known record of adult spawning surveys having been conducted on Squaw 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

Squaw Creek is tributary to the Mattole River, located in Humboldt County, California (Figure 1). The legal description at the confluence with the Mattole River is T2S R1W S30. Its location is 40°16'08" N. latitude and 124°13'32" W. longitude. Squaw Creek is a third order stream and has approximately 22.0 miles of blue line stream, according to the USGS Buckeye Mountain, Shubrick Peak, Petrolia, and Cooskie Creek 7.5 minute quadrangles. Squaw Creek and its tributaries drain a basin of approximately 16.7 square miles. Elevations range from about 160 feet at the mouth of the creek to 2,000 feet in the headwater areas. Douglas fir forest and oak grassland dominates the watershed. The watershed is privately owned and is managed for timber production and grazing. Year round vehicle access exists from U.S. Highway 101 at Dyerville, via the Bull Creek / Mattole Road.

METHODS

The habitat inventory conducted in Squaw Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991). The California Conservation Corps (CCC) Technical Advisors that conducted the

inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Squaw 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 Squaw 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. 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". Squaw 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 Squaw 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 Squaw 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 Squaw 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 Squaw 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 Squaw Creek to document the fish species composition and distribution. Three sites were electrofished in Squaw 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 Squaw 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 September 10, 15, 17, 22, and 24, 1992, was conducted by Erick Elliot and Brian Humphrey (CCC). The total length of the stream surveyed was 21,506 feet, with an additional 811 feet of side channel.

Flows were not measured on Squaw Creek.

Squaw Creek is an F3 channel type for the entire 21,443 feet of stream reach surveyed. F3 channels are low gradient, very well confined streams, with cobble/gravel beds.

Water temperatures ranged from 57 to 66 degrees fahrenheit. Air temperatures ranged from 50 to 73 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 37.9%, riffles 37.5%, and flatwater 24.6% (Graph 1). Riffle habitat types made up 37.7% of the total survey **length**, pools 35.4%, and flatwater 26.9% (Graph 2).

Nine 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, 37.5%; runs, 21.4%; and bedrock formed lateral scour pools, 20.4% (Graph 3). By percent total **length**, low gradient riffles made up 37.7%, runs 22.6%, and bedrock formed lateral scour pools 21.3%.

One hundred-six pools were identified (Table 3). Scour pools were most often encountered at 79.3%, and comprised 84.3% 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. Seventy-seven of the 106 pools (73%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 103 pool tail-outs measured, zero had a value of 1 (0.0%); 20 had a value of 2 (19.4%); 39 had a value of 3

(37.9%); and 44 had a value of 4 (42.7%). 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. Pool types had the highest shelter rating at 41.7. Riffles had the lowest rating with 14.4 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 42.8, and main channel pools rated 37.7 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 55 of the 105 low gradient riffles (52.4%). Large cobble was the next most frequently observed dominant substrate type, and occurred in 26.7% of the low gradient riffles (Graph 8).

Approximately 57% of Squaw Creek lacked shade canopy. Of the 43% of the stream that was covered with canopy, 80% was composed of deciduous trees, and 20% was composed of coniferous trees. Graph 9 describes the canopy in Squaw 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 51.1%. The mean percent left bank vegetated was 48.9%. The dominant elements composing the structure of the stream banks consisted of 29.1% bedrock, 0.9% boulder, 15.7% cobble/gravel, 5.0% bare soil, 7.5% grass, 1.6% brush. Additionally, 39.6% of the banks were covered with deciduous trees, and 0.5% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on September 29, 1992 in Squaw Creek. The units were sampled by Erick Elliot and Brian Humphrey (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled was habitat unit 017, a bedrock formed lateral scour pool, approximately 966 feet from the confluence with the Mattole River, and 250 feet downstream from the private steel bridge. The site had an area of 1,040 sq ft, and a volume of 2,496 cu ft. The sample included 11 steelhead, ranging from

70 to 164mm; 7 sculpin, ranging from 61 to 95mm; and 1 stickleback, 30mm.

The second sample site was habitat unit 126, a run, approximately 9,192 above the confluence with the Mattole River, and 100 feet upstream from a road crossing. This site had an area of 2,323 sq ft, and a volume of 2,091 cu ft. The sample included 36 steelhead, ranging from 63 to 155mm; 8 stickleback, ranging from 33 to 40mm; and 1 roach, 113mm.

The third site was habitat unit 179, a run, approximately 14,041 feet from the confluence with the Mattole River and just above the private foot bridge above the brown cabin. This site had an area of 1,168 sq ft, and a volume of 935 cu ft. The sample included 37 steelhead, ranging from 57 to 149mm; 5 sculpin, ranging from 63 to 79mm; 3 stickleback, ranging from 33 to 41mm; and 3 Pacific lamprey ammocetes, which were not measured.

DISCUSSION

The F3 channel type is generally not suitable for fish habitat improvement structures. F3 channels are found in low gradient, highly meandering stream reaches. They have channels dominated by cobble/gravel, do not retain gravel very well, and have unstable stream banks.

The water temperatures recorded on the survey days September 10-24, 1992 ranged from 57° F to 66° F. Air temperatures ranged from 50° F to 73° F. Sixty-six degrees, if sustained, is above the threshold stress level 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 conducted.

Riffle habitat types comprised 37.7% of the total **length** of this survey, pools 35.4%, and flatwater 26.9%. The pools are relatively deep with 77 of the 106 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.

Eighty-three of the 103 pool tail-outs measured had embeddedness ratings of 3 or 4. Zero 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 Squaw 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 moderate with a rating of 41.8. The shelter rating in the flatwater habitats was lower at 18.9. Riffles rated lowest at 14.4. However, a pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by bedrock ledges and boulders in all habitat types. 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. Sixty-eight of the 105 low gradient riffles had either 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 only 43%. This is a low percentage of canopy, since 80 percent is generally considered desirable. Elevated water temperatures could be reduced by increasing stream canopy. Cooler water temperatures are desirable in Squaw Creek. The trees required to contribute shade to the channel would also eventually provide a long term source of large woody debris needed for instream structures.

RECOMMENDATIONS

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

2) Temperatures in this section of Squaw 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 Squaw Creek by planting willow, alder, conifers 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) 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.

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) Where feasible, increase woody cover in the pool and flatwater habitat units. Most of the existing cover is from bedrock ledges and 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.

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 the Mattole River. Channel type is F3.
423'	Left bank slide 40' high x 50' long, contributing silt, gravel, and cobble into the channel.
557'	Cattle trail accesses the creek; some erosion, but not presently a problem.
642'	Right bank slide 35' high x 85' long, contributing fines into the channel at high flows.
782'	Right bank slide 30' high x 20' long, contributing fines into the channel.
1333'	Steel bridge crossing 15' wide x 80' long x 25' high.
1536'	Left bank slide 35' high x 30' long.
1795'	Left bank cut 7' high x 20' long.
2936'	Left bank slide 35' high x 25' long, contributing silt and gravel into the channel.
3056'	Left bank slide 35' high x 23' long, contributing fines into the channel.
3436'	Numerous young-of-the-year (YOY) and 1+ steelhead observed.
3468'	Left bank slide 25' high x 30' long, contributing boulders and fines into the channel.

3510' Left bank slide contributing a large amount of fines into the channel.

4063' Left bank slide 50' high x 30' long, depositing fines into the channel.

5018' Right bank slide 45' high x 40' long, contributing fines into the channel.

5437' Right bank cut 3' high x 30' long.

5593' Right bank slide 35' high x 25' long, contributing fines into the channel at high flows.

5960' Left bank slide 85' high x 200' long, contributing a large amount of fines into the channel.

6762' Left bank slide 35' high x 90' long, contributing fines into the channel.

7312' Right bank slide 35' high x 20' long, contributing fines into the channel.

9081' Road crosses the channel.

9429' Left bank cut 5' high x 20' long.

9607' Small tributary enters from the left bank.

10094' Right bank slide 40' high x 45' long, contributing fines into the channel.

10663' Log foot bridge crosses the creek.

10693' Road crosses the creek--no bridge.

11129' Right bank slide 50' high x 100' long, partially revegetated by alder, contributing fines into the channel.

11315' Right bank slide 45' high x 20' long, contributing fines into the channel.

11467' Left bank slide 35' high x 45' long, contributing fines into the channel.

12921' Numerous YOY and 1+ steelhead observed.

13420' Right bank slide 30' high x 55' long, contributing fines into the channel.

13676' Right bank slide 60' high x 100' long, contributing fines into the channel.

14041' Left bank slide 85' high x 20' long, contributing fines into the channel.

14887' Unstable right cut bank 7' high x 60' long.

15163' Left bank cut 13' high x 75' long, contributing fines into the channel.

15724' Left bank slide 40' high x 80' long, contributing fines into the channel.

15917' Left bank slide 45' high x 57' long, contributing fines into the channel.

16015' Left bank slide 55' high x 60' long, contributing large amounts of fines into the channel.

16133' Left bank slide 100' high x 50' long, contributing fines into the channel.

16537' Massive right bank slide 150' high x 70' long, contributing fines into the channel.

17912' Left bank slide 50' high x 35' long.

18227' Right bank slide 45' high x 80' long, contributing fines into the channel.

18488' Right bank slide 55' high x 25' long, contributing fines into the channel.

19782' Left bank slide 45' high x 60' long, partially revegetated by alders, and contributing fines into the channel.

20325' Left bank slide 30' high x 20' long, contributing fines into the channel.

20391' Right bank slide 60' high x 70' long, contributing fines into the channel.

20721' Left bank slide 55' high x 45' long, contributing large amounts of fines into the channel.

20831' Tributary enters from the left bank.

21275' Left bank slide 65' high x 20' long.

21506' End of survey due to lack of access by landowners.

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