STREAM INVENTORY REPORT

Doe Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1994 on Doe 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 Doe 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 spawning surveys having been conducted on Doe Creek. The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for coho salmon and steelhead trout.

WATERSHED OVERVIEW

Doe Creek is tributary to North Branch North Fork Elk River, a tributary to the North Fork Elk River, a tributary to Elk River, a tributary to Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California. Doe Creek's legal description at the confluence with North Branch North Fork Elk River is T04N R01E S36. Its location is 40.6881 degrees north latitude and 124.0225 degrees west longitude. Doe Creek is a first order stream and has approximately 1.0 mile of blue line stream according to the USGS McWhinney 7.5 minute quadrangle. Doe Creek drains a watershed of approximately 0.8 square miles. Elevations range from about 480 feet at the mouth of the creek to 1,500 feet in the headwater areas. Redwood forest and fir forest dominate the watershed. The watershed is privately owned and is managed for timber production. Access is via a locked gate on the Wrigley Road.

METHODS

The habitat inventory conducted in Doe Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). 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). Doe Creek personnel were trained in June, 1994, by Gary Flosi and Scott Downie. This inventory was conducted by a two- person team.

Doe Creek

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 Doe 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 and revised by David Rosgen (1985 rev. 1994). 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 five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity.

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". Doe 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 Doe 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 Doe 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 and recorded as a one and two respectively.

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 Doe 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 and Vegetation:

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 Doe Creek, the dominant composition type and the dominant vegetation type of both the right and left banks were selected from 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 Doe Creek to document the fish species composition and distribution. One site was electrofished in Doe Creek using a Smith-Root Model 12

electrofisher. The site was end-blocked with nets to contain the fish within the sample reach. Fish from the site were counted by species, measured, and returned to the stream.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, 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 Doe 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
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of June 21 and June 22, 1994 was conducted by Jason MacDonnell and Charles Bartolotta (CCC). The total length of the stream surveyed was 3,132 feet with an additional 5 feet of side channel.

Flow was estimated to be 0.18 cfs during the survey period.

Doe Creek is an F4 channel type for the first 2,817 feet of stream reach surveyed (Reach 1) and an F3 channel type for the remaining 315 feet (Reach 2). F-type channels are entrenched, meandering riffle-pool channels on low gradients with high width/depth ratios. F4 channels have gravel-dominant substrates, and F3 channels have cobble-dominant substrates.

Doe Creek

Water temperatures ranged from 53 to 54 degrees Fahrenheit. Air temperatures ranged from 59 to 64 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, flatwater made up 36%, riffles 32%, and pools 30% (Graph 1). Flatwater habitat types made up 52% of the total survey length, riffles 28%, and pools 18% (Graph 2).

Thirteen 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, 32%; runs, 20%; and mid-channel pools, 18% (Graph 3). By percent total length, step runs made up 31%, low gradient riffles 28%, and runs 20%.

Forty pools were identified (Table 3). Main channel pools were most often encountered at 63% and comprised 67% 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. Fifteen of the forty pools (38%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 35 pool tail-outs measured, eight had a value of 2 (23%); 21 had a value of 3 (60%); and six had a value of 4 (17%). 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 30. Flatwater habitats followed with a rating of 19 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 38, and backwater pools rated 20 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Doe Creek. Graph 7 describes the pool cover in Doe Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 36 of the 43 low gradient riffles (84%). Silt/clay was the next most frequently observed dominant substrate type and occurred in 12% of the low gradient riffles (Graph 8).

Seven percent of the survey reach lacked shade canopy. Of the 93% of the stream covered with canopy, 46% was composed of deciduous trees, and 54% was composed of coniferous trees. Graph 9 describes the canopy in Doe 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 93%. The mean percent left bank vegetated was 96%. The dominant elements composing the structure of the stream banks consisted of 85% sand/silt/clay, 12% cobble/gravel, 2% bedrock, and 1% boulders (Graph 10). Deciduous trees were the dominant vegetation type observed in 43% of the units surveyed. Additionally, 26% of the units had coniferous trees as the dominant vegetation type, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on June 24, 1994 in Doe Creek. The unit was sampled by Chris Coyle and Craig Mesman (CCC). All measurements are fork lengths unless noted otherwise.

The site sampled consisted of Habitat Units #014, #016, and #018, two mid-channel pools and a plunge pool approximately 169 feet from the confluence with North Branch North Fork Elk River. This site had an area of 387 square feet and a volume of 523 cubic feet. Numerous Pacific giant salamanders were observed, but no fish were collected. Two young-of-the-year salmonids were observed during the habitat survey approximately 1,700 feet above the mouth.

DISCUSSION

Doe Creek has two channel types: F3 and F4. The F3 channel types are considered good for bank-placed boulders and single and opposing wing deflectors; fair for low-stage weirs, random boulder placement, channel constrictors, bank cover, and log cover structures; and poor for medium-stage weirs. F4 channel types are considered good for bank-placed boulders; fair for low-stage weirs, single and opposing wing deflectors, channel constrictors, bank cover, and log cover structures; and poor for medium-stage weirs and random boulder placement.

The water temperatures recorded on the survey days June 21 and June 22, 1994 ranged from 53 to 54 degrees Fahrenheit. Air temperatures ranged from 59 to 64 degrees Fahrenheit. This is an excellent water temperature range for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 52% of the total length of this survey, riffles 28%, and pools 18%. The pools are relatively shallow, with only 15 of the 40 pools having a maximum depth greater than two feet. In coastal coho salmon 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. 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 log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravel. Any necessary modifications to them should be done with the intent of metering the gravel 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.

Twenty-seven of the 35 pool tail-outs measured had embeddedness ratings of 3 or 4. None had an embeddedness rating of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In Doe 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 30. The shelter rating in the flatwater habitats was lower at 19. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by small woody debris in all habitat types. Additionally, large woody debris and undercut banks 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 structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

Thirty-eight of the 43 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 93%. This is a relatively high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams.

The percentage of right and left bank covered with vegetation was high at 93% and 96%, respectively. In areas of stream bank erosion or where bank vegetation is at unacceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) 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.

3) There are several log debris accumulations present on Doe 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. The log debris accumulations on the North Branch North Fork Elk River also need to be modified to provide fish access to Doe Creek.

4) Increase woody cover in the pools and flatwater habitat units. 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.

Doe Creek

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.

Position (ft):	Comments:
0'	Start of survey at the confluence with North Branch North Fork Elk River. Channel type is F4.
140'	Trail crossing.
1389'	Unconsolidated logs and debris in channel. Overgrown with alders and retaining an unspecified amount of gravel. There is a 4' high plunge.
1528'	Right bank tributary. It is barely flowing and not accessible to anadromous fish.
1610'	Right bank erosion site contributing sand and gravel to the channel.
1661'	Young-of-the-year (YOY) salmonid observed.
1737'	YOY salmonid observed.
2181'	Log debris accumulation (LDA) measures 4.7' high x 8' wide x 10' long.
2590'	LDA measures 5' high x 8' wide x 15' long.
2728'	Unconsolidated logs in channel.
2776'	Left bank tributary. It is not accessible to anadromous fish.
2817'	Channel type changes to F3.
2913'	LDA measures 5' high x 20' wide x 15' long. It is overgrown with alders. The LDA is retaining gravel measuring 15' long.
2971'	LDA measures 5' high 15' wide x 20' long.
3100'	Right bank erosion site measures 4' high x 20' long. It is contributing gravel and sand to the channel.
3132'	End of survey. End of anadromous fish habitat due to combination of increased number of LDA's, lack of spawning gravel, and inadequate flow.

LEVEL III and LEVEL IV HABITAT TYPE KEY

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