STREAM INVENTORY REPORT

CONNICK CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1993 on Connick 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 Connick 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 Connick 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

Connick Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Humboldt County, California. Connick Creek's legal description at the confluence with the South Fork Eel River is T4S R3E S24. Its location is 40°05'44" N. latitude and 123°48'13" W. longitude. Connick Creek is a first order stream and has approximately 2.2 miles of blue line stream, according to the USGS Garberville 7.5 minute quadrangle. Connick Creek drains a watershed of approximately 2.6 square miles. Summer base runoff is approximately 0.75 cfs at the mouth. Elevations range from about 310 feet at the mouth of the creek to 1,300 feet in the headwater areas. Grass, oak, and Douglas fir forest dominate the watershed. The watershed is privately owned and is managed for timber production and rangeland. Approximately half of the watershed has been subdivided for rural development. Vehicle access exists from U.S. Highway 101 at Garberville, west on Sproul Creek Road to Pancoast Lane, a private road, which is the first road on the right after crossing the South Fork Eel River bridge.

METHODS

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

seasonal that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Connick Creek personnel were trained in May, 1993, 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 Connick 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". Connick 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 Connick 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 Connick 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 Connick 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 Connick 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 Connick Creek to document the fish species composition and distribution. Two sites were electrofished in Connick 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.

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

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- Mean percent shelter by habitat types

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Connick 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 6 and 7, 1993, was conducted by Warren Mitchell and Ruth Goodfield (contract seasonal and CCC). The total length of the stream surveyed was 11,866 feet, with an additional 258 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.75 cfs on July 14, 1993.

Connick Creek is a C1 channel type for the entire 11,866 feet of stream reach surveyed. C1 channels are low gradient (1.0-1.5%), slightly confined streams, with stable stream banks.

Water temperatures ranged from 58 to 71 degrees Fahrenheit. Air temperatures ranged from 61 to 85 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 33.2%, flatwater types 33.2%, and pools 33.7% (Graph 1). Flatwater habitat types made up 55.6% of the total survey **length**, riffles 28.2%, and pools 16.2% (Graph 2).

Sixteen 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, 30.6%; step runs, 18.1%; mid-channel pools, 17.1%; and runs, 15.1% (Graph 3). By percent total **length**, step runs made up 42.9%, low gradient riffles 26.4%, runs 12.7%, and mid-channel pools 6.6%.

Sixty-seven pools were identified (Table 3). Main channel pools were most often encountered at 71.6%, and comprised 72.2% 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-nine of the 67 pools (58%) had a depth of less than two feet (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 55 pool tail-outs measured, zero had a value of 1 (0.0%); 9 had a value of 2 (16.4%); 31 had a value of 3 (56.3%); and 15 had a value of 4 (27.3%). 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 40.4. Flatwater habitats followed with a rating of 16.8 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 45.4, and scour pools rated 28.9 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 52 of the 61 low gradient riffles (85.2%). Small cobble was the next most frequently observed dominant substrate type, and occurred in 11.5% of the low gradient riffles (Graph 8).

Twenty-three percent of the survey reach lacked shade canopy. Of the 77% of the stream covered with canopy, 74% was composed of deciduous trees, and 26% was composed of coniferous trees. Graph 9 describes the canopy in Connick 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 61.3%. The mean percent left bank vegetated was 57.0%. The dominant elements composing the structure of the stream banks consisted of 5.3% bedrock, 1.5% cobble/gravel, 4.3% bare soil, 9.1% grass, 12.9% brush. Additionally, 55.0% of the banks were covered with deciduous trees, and 11.9% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

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BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on July 12, 1993 in Connick Creek. The units were sampled by Ruth Goodfield and Warren Mitchell (CCC and contract seasonal). All measurements are fork lengths (FL) unless noted otherwise.

The first site sampled was habitat unit 051, a mid-channel pool, approximately 1,886 feet from the confluence with the South Fork Eel River. This site had an area of 242 sq ft, and a volume of 339 cu ft. The unit yielded 4 steelhead, ranging from 82 to 145mm FL. Three passes were performed, for an effort of 602 seconds.

The second site was a step pool. This site yielded 4 steelhead, ranging from 70 to 85mm FL; one coho salmon, 85mm FL; and 10 California roach, ranging from 75 to 114mm FL. Three passes were performed, for an effort of 411 seconds.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Connick Creek.

DISCUSSION

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 gravels, 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 this channel type.

The water temperatures recorded on the survey days July 6 and 7, 1993 ranged from 58° F to 71° F. Air temperatures ranged from 61° F to 85° F. This is a poor water temperature regime for salmonids. The higher temperatures recorded in Connick Creek, if sustained, are above 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 55.6% of the total **length** of this survey, riffles 28.2%, and pools 16.2%. The pools are relatively shallow with only 28 of the 67 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 several 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.

Forty-six of the 55 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 Connick 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 40.4. The shelter rating in the flatwater habitats was lower at 16.8. However, a pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by boulders, bedrock ledges, 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.

Fifty-nine of the 67 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 77%. This is a relatively 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) Connick Creek should be managed as an anadromous, natural production stream.

2) Temperatures in this section of Connick 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) 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) 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.

5) Increase woody cover in the 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.

6) There are several log debris accumulations present on Connick 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.

7) Increase the canopy on Connick 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 here is effected by upstream conditions. In many cases, planting will need to follow bank stabilization or upslope erosion control projects.

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 South Fork Eel River. Channel type is a C1 for the entire survey reach.

566' Good pool habitat, but no fish observed.

1398' Small man-made dam. No fish observed yet.

1809' The rootballs of two recently fallen trees along the bank are depositing silt and cobble into the stream.

2242' Roach observed; first fish seen during the survey.

2869' Left bank (LB) slide 12' high x 55' long, depositing clay and boulders into the channel.

3309' Small log and debris accumulation (LDA) 30' long x 15' wide x 7' high; could be a selective barrier. There is a gulch above the LDA.

3806' Salmonid observed, approximately 100mm long, probably a resident. Dead juvenile steelhead approximately 80mm.

3953' Small tributary enters from the right bank (RB).

5955' LB slide 100' long x 60' high, creating an LDA at the base.

6567' Tributary enters from LB. Bridge crossing, composed of logs and steel with two culverts.

7610' Concrete and earthen dam, probably for domestic water supply.

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7701'Small tributary enters from RB.

8000'Old RB slide 60' high x 75' wide, doesn't appear to be contributing sediment into the channel.

8200'LDA 20' wide x 25' long x 8' high. RB slide 100' high x 50' long, contributing silt and cobble into the channel.

8689'LDA 30' wide x 18' long x 8' high, not a barrier.

8999'Small tributary enters from RB.

9405'RB failure 100' high x 100' long, contributing trees, fines, gravel, and cobble into the channel. Fish observed above slide.

9420'Plunge 5' high.

9718'Small tributary enters from LB.

10110'LB slide 100' high x 20' long, constricting the channel. Lots of small woody debris accumulated, but not a barrier.

10313'LDA 20' wide x 13' long x 9' high.

10335'LDA 30' wide x 15' long x 7' high.

10955'Small tributary enters from LB. No salmonids observed since last series of LDAs.

11314'Railroad bridge crosses creek. Private road access to stream. Small tributary enters from LB.

11866'LDA 30' wide x 30' long x 15' high, retaining fines, gravels, and root wads for 200' upstream. Continued walking upstream: no fish observed, and flow decreasing. 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

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Dammed Pool	[DPL]	6.5