STREAM INVENTORY REPORT

LEWIS CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1994 on Lewis 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 Lewis 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 Lewis 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

Lewis Creek is tributary to Tenmile Creek, tributary to the South Fork Eel River, located in Mendocino County, California. Lewis Creek's legal description at the confluence with Tenmile Creek is T22N R15W S27. Its location is 39°44'21" N. latitude and 123°30'52" W. longitude. Lewis Creek is a first order stream and has approximately 1.8 miles of blue line stream according to the USGS Cahto Peak, Iron Peak, Laytonville, and Tan Oak Park 7.5 minute quadrangles. Lewis Creek drains a watershed of approximately 1.5 square miles. Elevations range from about 1,470 feet at the mouth of the creek to 2,400 feet in the headwater areas. Oak and grassland dominate the watershed. The watershed is privately owned and is managed for rangeland. Vehicle access exists via U.S. Highway 101 approximately 4 miles north of Laytonville.

METHODS

The habitat inventory conducted in Lewis 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). Lewis Creek personnel were trained in June, 1994, 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 Lewis 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 degrees 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". Lewis 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 Lewis 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 Lewis 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 Lewis 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 Lewis Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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.

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 0.85 mm).

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 Lewis 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

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of July 7, 11, and 12, 1994, was conducted by Ruth Goodfield and Will Abel (CCC). The total length of the stream surveyed was 6,908 feet with an additional 113 feet of side channel.

Flows were not measured on Lewis Creek.

Lewis Creek is a B3 channel type for the first 5,138 feet of stream reach surveyed and a B2 channel type for the remaining 1,770 feet. B-type channels are moderate gradient, moderately entrenched, riffle-dominated channels with infrequently spaced pools, very stable plan and profile, and stable banks.

Water temperatures ranged from 62 to 76 degrees Fahrenheit. Air temperatures ranged from 70 to 95 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles made up 40%, flatwater types 31%, and pools 27% (Graph 1). Flatwater habitat types made up 37% of the total survey **length**, riffles 34%, and pools 23% (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, 37%; runs, 20%; and mid-channel pools, 15% (Graph 3). By percent total **length**, low-gradient riffles made up 32%, step runs 22%, and runs 15%.

Sixty-one pools were identified (Table 3). Main channel pools were most often encountered at 59% 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. Thirty-one of the

61 pools (51%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 50 pool tail-outs measured, none had a value of 1 (0%); 8 had a value of 2 (16%); 38 had a value of 3 (76%); and 4 had a value of 4 (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 66. Flatwater habitats followed with a rating of 47 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 75, and scour pools rated 70 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Lewis Creek and are extensive. Large woody debris is lacking in nearly all habitat types. Graph 7 describes the pool cover in Lewis Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 37 of the 84 low gradient riffles (44%). Small cobble was the next most frequently observed dominant substrate type and occurred in 37% of the low gradient riffles (Graph 8).

Twelve percent of the survey reach lacked shade canopy. Of the 88% of the stream covered with canopy, 98% was composed of deciduous trees, and 2% was composed of coniferous trees. Graph 9 describes the canopy in Lewis 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 59%. The mean percent left bank vegetated was 61%. The dominant elements composing the structure of the stream banks consisted of 10% bedrock, 25% boulder, 39% cobble/gravel, and 25% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 48% of the units surveyed. Coniferous trees, including down trees, logs, and root wads, comprised the dominant vegetation type in less than 1% of the units surveyed (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on July 13, 1994, in Lewis Creek. The units were sampled by Ruth Goodfield and Will Abel (CCC).

All measurements are fork lengths unless noted otherwise.

The first site sampled was habitat unit 45, a mid-channel pool approximately 1,475 feet from the confluence with Tenmile Creek. This site had an area of 182 sq ft and a volume of 164 cu ft. The unit yielded 23 steelhead between 38 and 70mm.

The second site was habitat unit 141, a step run located approximately 4,576 feet above the creek mouth. This site had an area of 108 sq ft and a volume of 119 cu ft. The site yielded 3 steelhead between 64 and 66mm.

The third site sampled was habitat unit 212, a run located approximately 6,661 feet above the creek mouth. The site had an area of 72 sq ft and a volume of 36 cu ft. The site yielded 5 Pacific giant salamanders and one crayfish. No fish were sampled.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Lewis Creek.

DISCUSSION

Lewis Creek has two channel types: B2 and B3. The B2 channel type is considered excellent for low and medium-stage plunge weirs, single and double wing deflectors, channel constrictors, and bank cover. The B3 channel type is considered excellent for low-stage plunge weirs, random boulder placement, bank-placed boulders, single and double wing deflectors, channel constrictors, bank cover, and half and overhead log covers; and good for medium-stage plunge weirs.

The water temperatures recorded on the survey days July 7, 11, and 12, 1994, ranged from 62 to 76° Fahrenheit. Air temperatures ranged from 70 to 95° Fahrenheit. This is a poor water temperature range for salmonids. 76° F, if sustained, is 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 would need to be conducted.

Flatwater habitat types comprised 37% of the total **length** of this survey, riffles 34%, and pools 23%. The pools are relatively deep, with 31 of the 61 pools having a maximum depth greater than 2 feet. In coastal coho and steelhead streams where primary

pools comprise less than approximately 40% of total habitat, pool improvement projects are usually recommended. 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.

Forty-two of the 50 pool tail-outs measured had embeddedness ratings of 3 or 4. None 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 Lewis Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was moderate with a rating of 66. The shelter rating in the flatwater habitats was lower at 47. A pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by boulders in all habitat types. Additionally, small woody debris contributes 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.

Sixty-eight of the 84 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 88%. 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 moderate at 59% and 61%, respectively. Eighty percent is considered ideal. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2)Temperatures in this section of Lewis 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) 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.

4)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.

5)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.

6)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.

7)There are at least two sections where the stream is being impacted from cattle trampling the riparian zone and defecating in the water. Alternatives should be explored with the grazier and developed if possible.

8)Due to the high gradient of the upper stream reach, access for migrating salmonids is an ongoing potential problem. Fish passage should be monitored and improved where possible.

9)Further investigation should be conducted above the survey reach to determine why the water temperatures are so warm, and steps taken to address the problem.

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 Tenmile Creek. Channel type is a B3 for the first 5,138' of stream surveyed.

321'8' diameter corrugated pipe culvert under U.S. Highway 101.

4' high jump into culvert.

573'9' wide x 6' high concrete box culvert. Possible low flow barrier.

1955'Dry left bank (LB) tributary.

4923'Dry right bank (RB) tributary.

5138'Channel type changes to B2 for the remaining 1,770' of stream surveyed.

5268'Cattle have been impacting the stream.

5492'Boulder cascade. Possible fish barrier.

5964'Dry RB tributary.

6908'End of anadromous reach, due to steep gradient.
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