STREAM INVENTORY REPORT

Lacks Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Lacks Creek. 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 Lacks Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

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. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Lacks Creek is tributary to Redwood Creek, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Lacks Creek's legal description at the confluence with Redwood Creek is T08N R03E S19. Its location is 41°03'42" north latitude and 123°62'20" west longitude. Lacks Creek is a third order stream and has approximately 18.6 miles of blue line stream according to the USGS Hupa Mountain 7.5 minute quadrangle. Lacks Creek drains a watershed of approximately 17.4 square miles. Summer base flow is approximately 0.2 cubic feet per second (cfs) at the mouth. Elevations range from about 440 feet at the mouth of the creek to 3,200 feet in the headwater areas. Redwood/Douglas fir forest and grassland dominates the watershed. The watershed is primarily privately owned, but some of the watershed is managed by the Bureau of Land Management. Lacks Creek watershed is managed for timber production and rangeland. Vehicle access exists via Highway 299 to Redwood Valley Road.

METHODS

The habitat inventory conducted in Lacks Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1994). The Northwest Emergency Assistance Program (NEAP) Members and 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). 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 Lacks 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.

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 every tenth habitat unit. 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". Lacks 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. 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 Lacks 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) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size,

having a bedrock tail-out, or other considerations.

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 fully-described 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 Lacks 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 density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Lacks Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of every unit. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

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 Lacks Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each unit 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. In Lacks Creek fish presence was observed from the stream banks, and three sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

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 Quattro Pro. Graphics developed for Lacks 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 August 14 through 17, 21, 23, 25, 28, and September 13 through 15, 20, and 22, 1995, was conducted by Nancy Pearson (NEAP) and Mike Develin (PCFWWRA). The total length of the stream surveyed was 15,147 feet with an additional 2,297 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.2 cfs on September 21, 1995.

Lacks Creek is an F4 channel type for the first 1,061 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios

and gravel-dominant substrates.

Lacks Creek is a B3 channel type for the next 6,088 feet of stream reach surveyed. B3 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks, and cobble-dominant substrates.

Lacks Creek is an A2 channel type for the next 1,560 feet of stream reach surveyed. A2 channels are steep, narrow, cascading, step-pool streams with high energy/debris transport associated with depositional soils and boulder-dominant substrates.

Lacks Creek returns to a B3 channel type for the next 2,615 feet of stream reach surveyed.

Lacks Creek returns to an A2 channel type for the next 693 feet of stream reach surveyed.

Lacks Creek returns to a B3 channel type for the last 3,130 feet of stream reach surveyed.

Water temperatures taken during the survey period ranged from 54 to 64 degrees Fahrenheit. Air temperatures ranged from 57 to 77 degrees Fahrenheit.
Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 15% riffle units, 41% flatwater units, and 43% pool units (Graph 1). Based on total **length** of Level II habitat types there were 9% riffle units, 49% flatwater units, and 41% pool units (Graph 2).

Nineteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were step runs, 16%; lateral scour pool - boulder formed, 16%; and pocket water, 14% (Graph 3). Based on percent total **length**, step runs made up 26%, lateral scour pool - boulder formed 15%, and step pools 14%.

A total of 167 pools were identified (Table 3). Scour pools were most frequently encountered at 50% and comprised 45% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Forty of the 167 pools (24%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 135 pool tail-outs measured, 57 had a value of 1 (42%); 58 had a value of 2 (43%); 16 had a value of 3 (12%); 4 had a value of 4 (3%); and none had a value of 5 (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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. Riffle habitat types had a mean shelter rating of 14, and flatwater habitats had a mean shelter rating of 15 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 22. Main channel pools had a mean shelter rating of 21 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 11 of the 15 low gradient riffles measured (73%). Gravel and large cobble were the next most frequently observed dominant substrate types and both occurred in 13% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 83%. The mean percentages of deciduous and coniferous trees were 88% and 11%, respectively. Graph 9 describes the canopy in Lacks Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 50.7%. The mean percent left bank vegetated was 52.2%. The dominant elements composing the structure of the stream banks consisted of 4.3% bedrock, 52.5% boulder, 28.0% cobble/gravel, and 15.2% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 71.8% of the units surveyed. Additionally, 19.4% of the units surveyed had deciduous trees as the dominant vegetation type, and 0.13% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on October 3 and 5, 1995, in Lacks Creek. The sites were sampled by Chris Coyle (CCC) and Mike Devlin (PCFWWRA).

The first site sampled included habitat units 13 and 14, a backwater pool - boulder formed, pocket water sequence approximately 642 feet from the confluence with Redwood Creek. This site had an area of 1,092 sq ft and a volume of 1,320 cu ft. The site yielded 3 steelhead.

The second site included habitat unit 46, a lateral scour pool - boulder formed, located approximately 2,194 feet above the creek mouth. This site had an area of 1,092 sq ft and a volume of 1,310 cu ft. The site yielded 19 steelhead.

The third site sampled included habitat units 301 through 303, a mid-channel pool, pocket water, mid-channel pool sequence located approximately 12,958 feet above the creek mouth. The site had an area of 4,040 sq ft and a volume of 2,504 cu ft. The site yielded 19 steelhead and 3 Pacific giant salamanders.

DISCUSSION

Lacks Creek is a F4 channel type for the first 1,061 feet of stream surveyed, a B3 for the next 6,088 feet, an A2 for the next 1,560 feet, returns back to a B3 the next 2,615 feet, returns back to

an A2 for the next 693 feet, and returns back to a B3 for the remaining 3,130 feet. The suitability of F4 channel types for fish habitat improvement structures is as follows: F4 channels are good for bank placed boulders; fair for low stage weirs, single and opposing wing deflectors, channel constrictors, and log cover; and poor for medium stage weirs and boulder clusters.

The suitability of B3 channel types for fish habitat improvement structures is as follows: B3 channels are excellent for low stage plunge weirs, boulder clusters and bank placed boulders, single and opposing wing deflectors, and log cover; and good for medium stage plunge weirs.

A2 channels are generally not suitable for fish habitat improvement structures because it is a high energy stream with stable stream banks, and poor gravel retention capabilities.

The water temperatures recorded on the survey days August 14 through 17, 21, 23, 25, 28, and September 13 through 15, 20, and 22, 1995, ranged from 54 to 64 degrees Fahrenheit. Air temperatures ranged from 57 to 77 degrees Fahrenheit. This is a suitable water temperature range 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 49% of the total **length** of this survey, riffles 9%, and pools 41%. The pools are relatively shallow, with 40 of the 167 (24%) pools having a maximum depth greater than three feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum depth of at least three 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 deepen pool habitat is recommended for the F4 and B3 stream reaches. Twenty of the 135 pool tail-outs measured had embeddedness ratings of 3, 4, or 5. Fifty-seven had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

The mean shelter rating for pools was low with a rating of 21. The shelter rating in the flatwater habitats was slightly lower at 15. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, white water 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.

Thirteen of the 15 low gradient riffles measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 83%. This is a relatively high percentage of canopy. In general, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 50.7% and 52.2%,

respectively. 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) Lacks Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) In the F4 and B3 channel type reaches, design and engineer pool enhancement structures to deepen the existing 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 locally available.

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) Due to the high gradient of the A3 channel comprising the third stream reach, approximately 7,149 feet from the confluence and the A3 channel comprising the fifth stream reach, approximately 11,324 feet from the confluence, 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.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and measured from the beginning of the survey reach.

0'	Begin survey at confluence with Redwood Creek. Channel type is F4.
642'	First electrofishing site.
1,061'	Begin of stream reach 2, channel type is an B3.
1,454'	Failed culvert and log jam on left bank.

1,794'	Slide on left bank constricting a run, making a plunge pool.
2,130'	USGS gauging station float valve and measure.
2,170'	Logging bridge crosses stream.
2,194'	Second electrofishing site.
2,489'	Dirt road crosses stream.
3,954'	Large slide.
4,054'	Slide filled in the channel.
4,088'	Channel above this pool is filled by a slide. The fish are landlocked.
4,757'	Slide on both banks.
4,859'	Left bank slide.
5,407'	Most of pool covered by a log jam.
6,651'	Small plunge.
6,784'	Left bank slide. Large boulder, log, and root mass across the creek.
7,149'	Begin of stream reach 3, channel type is an A2.
8,709'	Begin of stream reach 4, channel type is an B3.
8,984'	Small left bank slide, delivering blue goo to creek.
10,403'	Right bank tributary.
10,416'	Left bank tributary.
10,846'	Left bank spring.
11,324'	Begin of stream reach 5, channel type is an A2.
11,476'	Small blue goo slide.
12,017'	Begin of stream reach 6, channel type is an B3.

12,958' Third electrofishing site.

13,856' Tributary.

14,332' Right bank tributary.

15,147' End of survey.

References

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

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