STREAM INVENTORY REPORT
JORDAN CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1991 on Jordan 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 Jordan 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.

Adult spawning surveys conducted in December 1987 documented chinook salmon in Jordan Creek. The objective of this report is to document the current habitat conditions, and recommend options for the enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Jordan Creek is a tributary to the Eel River, located in Humboldt County, California (Figure 1). Jordan Creek's legal description at the confluence with the Eel River is T1N R1E S26. Its location is 40°26'43" latitude and 124°02'06" longitude. Jordan Creek is a second order stream. The total length of blue line stream, according to the USGS Scotia quadrangle is 5.6 miles.

Jordan Creek drains a watershed of approximately 4.7 square miles. Redwood and Douglas fir forest dominates the watershed. The watershed is owned by the State of California and the Pacific Lumber Company and is managed as a state park and for timber production. Vehicle access exists from U.S. Highway 101, via the Pepperwood exit. Highway 101 crosses the channel approximately 1/4 mile from the mouth of Jordan Creek.

METHODS

The habitat inventory conducted in Jordan Creek follows the methodology as presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds). The inventory was conducted by two person teams. The California Conservation

Corps (CCC), Technical Advisors conducting the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Jordan Creek personnel were trained in May and June, 1991, by Gary Flosi and Scott Downie.

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 Jordan Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured at the beginning of the stream survey reach using standard flow measuring equipment. The flow is recorded in cubic feet per second of discharge.

2. Channel Type:

Channel typing was 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 operations 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 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 used 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". Jordan 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 measurements were accomplished using hip chains, range finders, tape measures, and stadia rods. Unit measurements included mean length, mean width, mean depth, and maximum depth. Depth of the pool tail crest at each pool habitat unit was measured at 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 Jordan 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 Jordan 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 Jordan Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The percentages of the total canopy area was then further analyzed and recorded according to whether it was composed of either coniferous or deciduous trees.

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 Jordan 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 Jordan Creek to document the salmonid species composition and distribution. Four sites were electrofished in Jordan Creek using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, measured, and returned to the stream.

DATA ANALYSIS

Data from the habitat inventory form is entered into Runtime, a dBASE 4.1 data entry program developed by the Department and Fish and Game. This program processes and summarizes the data.

The Runtime program produces the following summary 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 Jordan 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 June 19, 26, 27, and 28, 1991, was conducted by Chris Coyle, Craig Mesman, and Jerry Suissa (CCC). The total length of the stream surveyed was 9,616 feet, with an additional 863 feet of side channel.

Jordan Creek is a B2 channel type for the first 3,787 feet from the confluence with the Eel River, then it changes to a C2 channel for the next 2,688 feet, then it changes to an A3 channel for the remaining 3,141 feet of stream reach surveyed. B2 channels have a gradient of 2-4%, are moderately entrenched, riffle dominated channel, with infrequently spaced pools and very stable stream banks. C2 channels are low gradient (0.3-1.0%), moderately confined, cobble streams. A3 channels are steep (4-10% gradient), well confined channels, with unstable streambanks.

Water temperatures ranged from 50 to 53 degrees fahrenheit. Air temperatures ranged from 52 to 72 degrees fahrenheit.

Table 1 summarizes the riffle, flatwater, and pool habitat types. By percent **occurrence**, riffles make up 50.5%, flatwater types make up 25.8%, and pools make up 22.6% (Graph 1). Riffles make up 69.9% of the total **length**, flatwater habitats make up 17.0%, and pools make up 12.6% (Graph 2).

Twelve habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were low gradient riffles, 24.2%, runs, 19.4%, and high gradient riffles, 18.3% (Graph 3). By percent total **length**, low gradient riffles made up 45.1%, high gradient riffles made up 19.3%, and runs made up 10.7%.

Table 3 summarizes the pool habitat types. Of these pools, 73.8% were main channel pools. These main channel pool types comprised 83.4% of the total length for all pools (Graph 4).

Table 4 (Graph 5) is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. The maximum depth for 24 of the 42 pools (57.1%) was two feet or deeper. This level indicates a fair quality of pool habitat in

Jordan Creek.

The depth of cobble embeddedness was estimated at the pool tail-outs. Of the 42 pool tail-outs, 9 (21.4%) had a value of 1; 31 (73.8%) had a value of 2; and 2 (4.8%) had a value of 3; and zero had a value of 4. Graph 6 describes embeddedness.

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 types had the highest shelter rating at 63.6 (Table 1). For the pool types, the backwater pools had the highest mean shelter rating at 73.3, scour pools had a mean shelter rating of 67.5, and main channel pools had a rating of 53.7 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Jordan Creek and are extensive. Graph 7 describes the pool cover in Jordan Creek.

Table 6 (Graph 8) describes the dominant substrate by habitat type. Large cobble was the dominant substrate observed in 51.1% of the low gradient riffles. Small cobble was the next most frequently observed dominant substrate type, and occurred in 28.9% of the 45 low gradient riffles.

Nearly 31% of Jordan Creek lacked shade canopy. Of the 69% of the stream that was covered with canopy, 91% was composed of deciduous trees, and 9% was composed of coniferous trees. Graph 9 describes the canopy in Jordan Creek.

Table 2 summarizes the mean percent by habitat unit type of the right and left stream banks covered with vegetation. For the stream reach surveyed, the mean percent right bank vegetated was 72.7%. The mean percent left bank vegetated was 71.8%. The dominant stream bank composition consisted of 9.1% boulder, 7.0% cobble/gravel, 1.6% bare soil, 5.4% grass, 0.5% brush, 70.4% deciduous trees, and 5.9% coniferous trees (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Four electrofishing sites were sampled on Jordan Creek. The units were sampled on September 23, 1991 by Erick Elliot and Brian Humphrey (CCC). The results are as follows:

The first unit sampled was habitat unit 18, a log formed backwater pool, approximately 1,288 feet from the confluence with the Eel River. This site had an area of 224 sq ft and a volume of 224 cu ft. The combined total of fish was 57 steelhead, ranging from 39 to 117 mm fork length, 4 coho, 76, 77, 79, and 86 mm fork length, and 5 sculpin, ranging from 91 to 114 mm fork length.

The second unit was habitat unit 54, a mid-channel pool, approximately 4,011 feet from the confluence and just above the PALCO stream crossing. This site had an area of 900 sq ft and a volume of 630 cu ft. The total fish sampled were 24 steelhead, ranging from 43 to 148 mm fork length, and 2 sculpin, 96 and 112 mm fork length.

The third unit was habitat unit 144, a step pool, approximately 8,552 feet from the confluence. The site had an area of 623.2 sq ft and a volume of 498.6 cu ft. Twenty-two steelhead were sampled, ranging from 42 to 113 mm fork length. Five salamanders were also found.

The fourth unit was habitat unit 168, a step pool, approximately 9,446 feet from the confluence with the Eel River. This site had an area of 382.9 sq ft and a volume of 344.6 cu ft. Nine steelhead were sampled, ranging from 53 to 147 mm fork length.

DISCUSSION

Jordan Creek has three channel types: A3, C1, and C2. The high energy and unstable stream banks of the A3 channel type are generally not suitable for instream enhancement structures. The C1 and C2 channel types are suitable for many types of low and medium stage instream enhancement structures. Site specific projects can be designed within these channel types, to increase pool frequency, volume and pool cover.

The water temperatures recorded on the survey days ranged from 50° F to 53° F. Air temperatures ranged from 52° F to 72° F. This is a very good water temperature regime for salmonids. However, 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 17.0% of the total **length** of this survey, riffles 69.9%, and pools 12.6%. The pools are relatively deep with 24 of the 42 pools having a maximum depth of two feet or greater. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. 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 will not interfere with unstable streambanks.

Nine of the 42 pool tail-outs measured had an embeddedness rating of 1. Only two had ratings of 3 or 4. Embeddedness in excess of 26%, a rating of 2 or more, is considered poor quality for fish habitat.

The mean shelter rating for flatwater habitats was low with a rating of 29.7. The shelter rating for the pools was better at 57.7. However, a pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by 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.

Only 17 of the 45 low gradient riffles had gravel or small cobble as the dominant substrate. Twenty-three had large cobble as the dominant substrate. This is generally considered poor for spawning salmonids.

The mean percent canopy for the stream was 69%. This is a relatively high percentage of canopy, since 80 percent is generally considered desirable. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) 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.

3) 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.

4) Suitable sized spawning gravel on Jordan Creek is limited. Projects should be designed at the appropriate sites to trap and sort spawning gravel.

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) There are several log debris accumulations present on Jordan Creek that are retaining fine sediment. The modification of these debris accumulations is desirable.

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 the confluence with the Eel River. First 620' is in the Eel River floodplain. Reach #1 is a B2 channel type.
740'	Left bank erosion 6' high x 100' long.
1012'	Madsen Bridge crosses the channel.
1228'	Right bank slump 8' high x 20' long, contributing gravel into the channel.
1483'	Northbound Highway 101 bridge crosses the channel.
1882'	Southbound Highway 101 bridge crosses the channel.
2934'	Left bank erosion 6' high x 20' long, contributing gravel into the channel.
2953'	Right bank erosion 15' high x 40' long, contributing gravel and fines into the channel.
3591'	Left bank erosion 8' high x 10' long, contributing gravel into the channel.
3613'	Left bank erosion 6' high x 20' long, contributing boulders and fines into the channel.
3638'	Left bank erosion 5' high x 20' long, contributing gravel and fines into the channel.
3722'	Right bank erosion 10' high x 30' long, contributing gravel and fines into the channel.
3787'	Channel changes from a B2 to a C2 channel type (reach #2).

4111' Road crosses the channel.

4298' Right bank erosion 10' high x 25' wide, contributing fines into the channel. Log debris accumulation (LDA) 10' wide x 25' long; no barrier.

5380' Tributary enters from the right bank.

5420' Right bank slide 8' high x 30' long, partially revegetated, contributing gravel into the channel.

5590' Left bank erosion 15' high x 30' wide, contributing fines into the channel.

5617' Tributary enters from the left bank.

5644' Two left bank slides, 7' high x 50' long and 20' high x 30' long, contributing fines and gravel into the channel.

5699' Right bank erosion 60' high x 50' long.

5794' Right bank erosion 25' high x 40' long.

6241' Unstable channel walls contributing gravel, fines, and root wads into the channel.

6475' Channel changes from a C2 to an A3 channel type.

6755' Left bank erosion 8' high x 20' long, contributing gravel into the channel.

6818' Right bank erosion 15' high x 25' long.

7402' Tributary enters from the left bank.

7516' Two embedded logs 4' diameter x 40' long form a chute in the channel.

7558' Right bank undercut 8' high x 30' long. Standing redwoods are being undercut.

8107' Right bank erosion 20' high x 25' long.

8196' LDA and boulders across the channel, causing gravel accumulation 8' high x 15' wide x 20' long. Possible barrier.

8518' LDA 8' high forms a mid-channel bar 20' wide x 50' long; no barrier.

8639' LDA 6' high x 25' wide x 20' long, causing gravel accumulation 3' high x 30' long. Possible barrier.

8891' Tributary enters from the right bank.

9106' Tributary enters from the right bank.

9139' Right bank erosion 5' high x 15' long. 5' plunge over embedded logs.

9181' LDA 14' high x 40' wide x 30' long, retaining gravel 10' high; probable barrier. Left bank erosion 40' high x 50' long, contributing fines into the channel.

9211' Left bank erosion 20' high x 20' long.

9637' Large, mid-channel bar.

9682' End of survey.