STREAM INVENTORY REPORT

Oil Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1999 on Oil Creek, a tributary to the mainstem Eel River. 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 Oil 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 anadromous salmonids, including steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Oil Creek is tributary to the Eel River, located in Humboldt County, California (Map 1). Oil Creek's legal description at the confluence with Eel River is T2N R1W S27. Its location is 40°31′40″ North latitude and 124°09′42″ West longitude. Oil Creek is a first order stream and has approximately 2.0 miles of blue line stream according to the USGS Fortuna and Taylor Peak 7.5 minute quadrangles. Oil Creek drains a watershed of approximately 1.46 square miles. Elevations range from about 40 feet at the mouth of the creek to 360 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. Vehicle access exists via U.S. Highway 101 at Rio Dell. Take Blue Slide Road approximately 4 miles to where it crosses Oil Creek.

METHODS

The habitat inventory conducted in Oil Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al., 1998). The AmeriCorps Watershed Stewards Project (AmeriCorps/WSP) Members 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.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1995). All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest, dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory methodology and data sheet have been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This protocol was used on Oil Creek to record measurements and observations. There are nine components to the inventory data sheet.

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". Oil 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. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were 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 Oil 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 Oil 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 fully-described 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. In addition the dominant substrate composing the pool tail outs is recorded for each pool.

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 Oil Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. 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 Oil Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described 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 Oil Creek fish presence was observed from the stream banks and one site was electrofished using a Smith-Root Model 12 electrofisher. 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; Valentine, 1995).

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 Oil 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 the pool tail outs
- 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 November 8 and 9, 1999, was conducted by Don Rehberg and Pual Ferns (AmeriCorps/WSP). The total length of the stream surveyed was 2,742 feet with an additional 0 feet of side channel.

Flows were not measured on Oil Creek.

Oil Creek is a F4 channel type for the entire 2,742 feet of stream reach surveyed. F4 channels are entrenched, meandering, gravel riffle/pool channels on low gradients with high width/depth ratio.

Water temperatures taken during the survey period ranged from 52° to 53° F. Air temperatures ranged from 53° to 57° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 35% riffle units, 24% flatwater units, and 40% pool units (Graph 1). Based on total length of Level II habitat types there were 32% riffle units, 24% flatwater units, and 40% pool units (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle, 33%; mid-channel pools, 31%; and runs, 24% (Graph 3). Based on percent total length, low gradient riffles and mid channel pools each made up 31% and runs, 24%.

A total of 34 pools were identified (Table 3). Main channel pools were most frequently encountered at 76% (Graph 4) and comprised 77% of the total length of all pools (Table 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. 22 of the 34 pools (65%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 31 pool tail-outs measured, 0 had a value of 1 (0%); 7 had a value of 2 (22.6%); 9 had a value of 3 (25.8%); 1 had a value of 4 (3.2%) and 14 had a value of 5 (48.4%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning.

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 6, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 90 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 119. Backwater pools had a mean shelter rating of 60 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Oil Creek. Large and small woody debris is not abundant and is lacking in some habitat types. Graph 7 describes the pool cover in Oil Creek.

Table 6 summarizes the dominant substrate in pool habitat types. Gravel and small cobble were the dominant substrates observed, each in 9 of the 30 (60%) pool tail outs measured. Silt/clay was the next most frequently observed dominant substrate type and occurred in 26.7% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 83%. The mean percentages of conifer and deciduous trees were 41% and 59%, respectively. Graph 9 describes the canopy in Oil Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 88.3%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 46.7% bedrock, 0% boulder, 0% cobble/gravel, and 53.3% sand/silt/clay (Graph 10). Deciduous trees are the dominant bank vegetation type observed in 36.70% of the units surveyed. Additionally, 36.7% of the units surveyed had deciduous trees as the dominant bank vegetation, and 26.7% had coniferous trees as the dominant bank vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on October 15, 1999 on Oil Creek. The site was sampled by Glenn Yoshioka and Jason Hadley (CDFG and CCC).

The sample site extended upstream from the mouth of the creek. Ten mid-channel pools, one run, and one low gradient riffle were sampled in this F4 reach. The site yielded 63 juvenile steelhead rainbow trout and one sculpin (*Cottus* sp.). Based upon visually estimated lengths, the probable breakdown of steelhead age classes was 46 age 0+, 10 age 1+, 6 age 2+, and 1 age 3+ juveniles. No fish of any kind were caught in the riffle.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Oil Creek.

DISCUSSION

Oil Creek is a F4 channel type for the entire 2742 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover; and poor for boulder clusters.

The water temperatures recorded on the survey days of November 8-9, 1999, ranged from 52° to 53° F. Air temperatures ranged from 53° to 57° F. This is an excellent water temperature range for salmonids. However, we lack data to determine if summer water temperatures reach stressful levels 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 24% of the total length of this survey, riffles 32%, and pools 40%. The pools are relatively deep, with 22 of the 34 (65%) pools having a maximum depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream 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. Primary pools comprised 26% of the total stream length. 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 any needed modification of the numerous log debris accumulations (LDA's) in the stream. The LDA's in the system may be 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.

None of the 31 (0%) pool tail-outs measured had an embeddedness rating of 1, 23% had a rating of 2, 29% had ratings of 3 or 4, and 48% had a rating of 5 or were considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In Oil 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 low-moderate with a rating of 90. The shelter ratings for riffles and the flatwater habitats were much lower at 6 and 5, respectively. 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 most habitat types. Additionally, small and large woody debris contributes to cover, particularly in pools. Log and root wad cover structures in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Instream cover created by small and large woody debris provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Eighteen of the 30 (60%) pool tail outs 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, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 88% and 100%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting native species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Oil 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) 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) 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.

5) There are numerous log debris accumulations present on Oil Creek, at least some of

which are retaining sediment. The modification of these debris accumulations could be desirable, but must be done carefully, over time, to meter gravel downstream to spawning sites. Furthermore, these LDA's should be evaluated to determine if they are barriers to fish passage. In the short section surveyed, Oil Creek supports multiple age classes of juvenile steelhead trout. Oil Creek should be resurveyed to determine if access for migrating salmonids is an ongoing potential problem in the upper reaches. If so, then fish passage should be monitored and improved where possible.

6) Primary pools comprise 26% of the total stream length. 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.

COMMENTS AND LANDMARKS

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

0' Begin survey at confluence with the mainstem Eel River. Channel type is F4. The mouth of this stream empties into a backwater section of the mainstem Eel River. The mouth of Price Creek also empties into this same section. The beginning part of this creek has steep walled clay banks. The landowner reported that when he was a kid, he used to catch cutthroat trout in this creek, he also said that the water was dark, probably acidic from riverbed geology, redwood decay or mineral deposits. He said old redwood log bridges used to cross the creek in many places. Now they have been washed out or dismantled and are now in the creek.

82' Debris accumulation, 23 feet wide, 4' tall, 4' long; natural structure retaining gravel.

128' Still in the zone of hydrologic influence of the mainstem Eel River.

309' Aquatic vegetation value is actually leaf litter. Start 100% occurrence.

374' Banks are steep sloped, made of clay and lack tree growth, but are covered with herbaceous vegetation. Tree growth is at the tops of these slopes, where the ground levels off. Slopes vary 30 to 60 feet tall, and are almost vertical. LDA 20' wide, 13' long, and 5.5' tall.

383' Aquatic vegetation readings are due to leaf litter. This water does not support any algae.

493' A 2' plunge, into a pool, exiting a concrete culvert that travels under the road that is at the top of the unit. The plunge is out of the culvert and into the pool.

523' The concrete culvert is 6'2"high x 6'2"wide; it has a series of alternating baffles. Left bank baffles are at 90 degrees to the flow, right bank baffles are angled at about 45 degrees. Angled baffles are retaining sediment. Walking upstream, the culvert turns to the right about 40 degrees. See drawing on back of habitat form #2 for Oil Creek.

1190' LDA 25' wide, 10' long, 4' high. Three logs, two rootwads, 14' wide, 5' tall, 10' long. These are two separate debris accumulations over the pool.

1247' LDA at top of riffle. 2 rootwads, 4 small logs that are retaining gravel. 2' rise in channel because of sediment retention.

1269' Plunge substrate is bedrock. LDA on left bank of pool in channel. 40' long, 30' wide, and 6' tall. Right bank, retaining wall for road visible 80' upslope. 60 degree slope to base of wall.

1291' Dark water and silty substrate complicates cover ratings in deep pools. In most cases, these pools with deep dark water would supply excellent cover.

1388' Debris accumulation at beginning of unit. 3 logs one with rootwad.

1704' LWD in pool. 2 old trees across the channel. 3.5' jump. At high flows this would be a plunge pool. Possible barrier.

1795' Black, dark water. 2.5' plunge. LDA 40' wide, 12' long, 6' tall. Stream pools underneath the LDA. Under this dark water condition, we have not seen any fish.

1837' LDA at top of unit.

2074' Large pool with at least 8 pieces of large wood. Possibly old bridge material.

2128' LDA at top of pool. 32' wide, 8' long, and 7' tall.

2164' LDA at top of run. 30' wide, 30' long, and 8' tall.

2209' Large LDA at top of the pool, 13' high, 45' wide, 10' long, and is retaining sediment.

2446' Plunge pool at high flows.

2618' LDA is 6' tall, 25' wide, 20' long. No fish seen.

2673' 4 large logs in pool. Plunge flows over the log. 2' plunge.

2742' LDA, 35' wide, 8' high, and 18' long. End of survey. Large debris accumulations very common now. Looking upstream, the only features observed are large pieces of wood, criss-crossed and tangled together. This LDA in front of us poses too much of a threat for injury to cross under current weather conditions.

REFERENCES

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California salmonid stream habitat restoration manual, 3rd edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, 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