

STREAM INVENTORY REPORT

CROCKER CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Crocker Creek. The survey began at the confluence with Elk Creek and extended upstream 0.4 miles. The objective of this habitat inventory was to document the habitat available to anadromous salmonids in Crocker 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 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

Crocker Creek is a tributary to Elk Creek, a tributary to the Eel River, located in Mendocino County, California (Map 1). Crocker Creek's legal description at the confluence with Elk Creek is T20N R10W S00. Its location is 39°33'35.59" North latitude and 123°02'4.07" West longitude. Crocker Creek is a second order stream and has approximately 5.2 miles of blue line stream according to the USGS Sanhedrin Mountain 7.5 minute quadrangle. Crocker Creek drains a watershed of approximately 4.8 square miles. Elevations range from about 1,798 feet at the mouth of the creek to 5,231 feet in the headwater areas. Mixed hardwood forest, mixed conifer forest, and grassland dominates the watershed. The watershed is partially in private ownership, with the remainder being managed by Mendocino National Forest and the Bureau of Land Management. The watershed is managed for timber production, rangeland, and recreation.

METHODS

The habitat inventory conducted in Crocker Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) 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. 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 (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are 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 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 Crocker 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 a Marsh-McBirney Model 2000 flow meter.

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. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

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

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(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". Crocker 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. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Crocker 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, bedrock, 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 Crocker 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 Crocker Creek, an

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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 Crocker 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 (including downed trees, logs, and rootwads) was estimated and recorded.

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 Crocker 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
- Mean percent canopy
- Bank composition by composition type

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- 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 24, 2002, was conducted by Frank Humphrey (DFG). The total length of the stream surveyed was 2,133 feet with an additional 338 feet of side channel.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.128 cfs on July 24, 2002.

Crocker Creek is B4 channel type for the entire 2,133 feet of the stream surveyed. B4 channels are moderately entrenched, moderate-gradient, riffle-dominated channels with infrequently spaced pools; very stable plan and profile; stable banks; gravel channel.

Water temperatures taken during the survey period ranged from 63 to 68 degrees Fahrenheit. Air temperatures ranged from 69 to 83 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 6% riffle units, 45% flatwater units, 36% pool units, and 12% dry units (Graph 1). Based on total length of Level II habitat types there were 4% riffle units, 69% flatwater units, 12% pool units, and 15% dry units (Graph 2).

Five Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step-run, 45%; mid-channel pool, 33%; and dry, 12% (Graph 3). Based on percent total length, step-run made up 69%, dry 15%, and mid-channel pool 10%.

A total of 12 pools were identified (Table 3). Main channel pools comprised 100% 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. Six of the 12 pools (50%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 12 pool tail-outs measured, one had a value of 1 (8.3%); seven had a value of 2 (58.3%); four had a

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value of 3 (33.4%); 0 had a value of 4; and 0 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 30, flatwater habitat types had a mean shelter rating of 20, and pool habitats had a mean shelter rating of 24 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 24 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Crocker Creek. Graph 7 describes the pool cover in Crocker Creek. Boulders are the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel and boulders were the dominant substrate, both observed in 41.7 % of pool tail-outs while small cobble was the next most frequently observed substrate type, at 16.6%.

The mean percent canopy density for the surveyed length of Crocker Creek was 69%. The mean percentages of deciduous and coniferous trees were 99% and 1%, respectively. Graph 9 describes the mean percent canopy in Crocker Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 42.5%. The mean percent left bank vegetated was 45.6%. The dominant elements composing the structure of the stream banks consisted of 78.13% boulder, 18.75% cobble/gravel, and 3.13% bedrock (Graph 10). Deciduous trees was the dominant vegetation type observed in 96.88% of the units surveyed. Additionally, 3.13% of the units surveyed had brush as the dominant vegetation type (Graph 11).

DISCUSSION

Crocker Creek is a B4 channel type for the entire 2,133 feet of stream surveyed. The suitability of B4 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, boulder clusters, bank-placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey day July 24, 2002, ranged from 63 to 68 degrees Fahrenheit. Air temperatures ranged from 69 to 83 degrees Fahrenheit. Sixty-eight degrees Fahrenheit, if sustained, is near 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.

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Flatwater habitat types comprised 69% of the total length of this survey, riffles 4%, and pools 12%. The pools are relatively deep, with only six of the 12 (50%) 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. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy.

Eight of the 12 pool tail-outs measured had embeddedness ratings of 1 or 2. Four of the pool tail-outs had embeddedness ratings of 3 or 4. None of the pool tail-outs had a rating of 5, which is 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.

Seven of the 12 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered fair for spawning salmonids.

The mean shelter rating for pools was 24. The shelter rating in the flatwater habitats was 20. A pool shelter rating of approximately 100 is desirable. The amount of 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 would enhance 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.

The mean percent canopy density for the stream was 69%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 42.5% and 45.6%, 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) Crocker Creek should be managed as an anadromous, natural production stream.

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- 2) The limited water temperature data available suggest that maximum temperatures are nearing the threshold stress 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) 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.
- 5) Increase the canopy on Crocker Creek by planting willow, white alder, 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 flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.
- 6) Suitable size spawning substrate on Crocker Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

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 Elk Creek. Flow taken. Channel type is B4.

115' Unidentified juvenile salmonids present.

811' Unidentified juvenile salmonids present.

1,583' Six-inch steelhead present.

2,133' End survey due to steep channel with large boulder substrate. Dry streambed for 200' upstream of last unit. Probable end of anadromy.

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REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)[1.2]		{ 2}

CASCADE

Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8}
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9}

BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4}
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5}
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6}
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7}
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	