STREAM INVENTORY REPORT

Snuffins Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Snuffins Creek. The survey began at the confluence with Daugherty Creek and extended upstream 1.3 miles.

The Snuffins Creek 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 Snuffins 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 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

Snuffins Creek is a tributary to Daugherty Creek, a tributary to the South Fork Big River, located in Mendocino County, California (Map 1). Snuffins Creek's legal description at the confluence with Daugherty is T15N R14W S10. Its location is 39°10′35.51″ north latitude and 123°23′42.43″ west longitude. Snuffins Creek is a first order stream and has approximately 2.5 miles of blue line stream according to the USGS Bailey 7.5 minute quadrangle. Snuffins Creek drains a watershed of approximately 2.0 square miles. Elevations range from about 997 feet at the mouth of the creek to 2,208 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via Masonite Road to Low Gap Road.

METHODS

The habitat inventory conducted in Snuffins 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 Snuffins 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 (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". Snuffins 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 were 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 Snuffins 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 Snuffins 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 Snuffins 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 Snuffins 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.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Snuffins Creek. In addition, a snorkel-survey was conducted in three sites.

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 Snuffins 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
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of July 30, 31 and August 5, 2002, was conducted by Ryan Wells and Hillary Kleeb (WSP). The total length of the stream surveyed was 7,056 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.05 cfs on August 1, 2002.

Snuffins Creek is a G4 channel type for the entire 7,056 feet of the stream surveyed. G4 channels are entrenched, with low width/depth ratio on moderate gradient, with a predominately

gravel substrate.

Water temperatures taken during the survey period ranged from 56 to 66 degrees Fahrenheit. Air temperatures ranged from 64 to 82 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 24% riffle units, 38% flatwater units, and 30% pool units (Graph 1). Based on total length of Level II habitat types there were 14% riffle units, 59% flatwater units, and 13% pool units (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were runs, 37%; mid-channel pools, 28%; and low gradient riffles, 21% (Graph 3). Based on percent total length, runs made up 58%, low gradient riffles 13%, and mid-channel pools 12%.

A total of 53 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 94%, and comprised 94% 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. Seven of the 53 pools (13%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 51 pool tail-outs measured, 9 had a value of 1 (17.7%); 18 had a value of 2 (35.3%); 16 had a value of 3 (31.4%); 4 had a value of 4 (7.8%); and 4 had a value of 5 (7.8%) (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 6, flatwater habitat types had a mean shelter rating of 8, and pool habitats had a mean shelter rating of 37 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 38. Scour pools had a mean shelter rating of 17 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Snuffins Creek. Graph 7 describes the pool cover in Snuffins Creek. Large woody debris is the dominant pool cover type followed by boulders.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 49% of pool tail-outs while small cobble was the next most frequently observed substrate type, at 33.3%.

The mean percent canopy density for the surveyed length of Snuffins Creek was 81%. The mean percentages of deciduous and coniferous trees were 45% and 55%, respectively. Graph 9 describes the mean percent canopy in Snuffins Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 76.4%. The mean percent left bank vegetated was 78.1%. The dominant elements composing the structure of the

stream banks consisted of 8.7% bedrock, 0.72% boulder, 45.65% cobble/gravel, and 44.93% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 46.38% of the units surveyed. Additionally, 26.81% of the units surveyed had deciduous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were snorkel surveyed for species composition and distribution in Snuffins Creek on October 1, 2002. Water temperature taken during the survey period was 50 degrees Fahrenheit. Air temperature was degrees 47 degrees Fahrenheit. The sites were snorkeled by Allan Renger and Trevor Tollefson (DFG).

The first site sampled included habitat unit 011, a run approximately 238 feet from the confluence with Daugherty. The site yielded no fish.

The second site included habitat unit 014, a mid-channel pool located approximately 323 feet above the creek mouth. The site yielded one young-of-the-year steelhead.

The third site sampled included habitat unit 016, a mid-channel pool located approximately 390 feet above the creek mouth. The site yielded 10 young-of-the-year steelhead and 15 young-of-the-year coho.

The following chart displays the information yielded from these sites:

Date	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead			Coho	
						YOY	1+	2+	YOY	1+
10/01/02	238	011	3.3	1	G4	0	0	0	0	0
10/01/02	323	014	4.2	1	G4	1	0	0	0	0
10/01/02	390	016	4.2	1	G4	10	0	0	15	0

DISCUSSION

Snuffins Creek is a G4 channel type for the entire 7,056 feet of stream surveyed. The suitability of G4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, opposing wing-deflectors, and log cover; poor for boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days of July 30, 31, and August 5, 2002 ranged from 56 to 66 degrees Fahrenheit. Air temperatures ranged from 64 to 82 degrees Fahrenheit. 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 59% of the total length of this survey, riffles 14%, and pools 13%. The pools are relatively shallow with only 7 of the 53 (13.2%) 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 the modification of the numerous log debris accumulations (LDA's) in the stream.

Twenty-seven of the 51 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty of the pool tail-outs had embeddedness ratings of 3 or 4. Four 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. Sediment sources in Snuffins Creek should be mapped and rated according to their potential sediment yields and control measures should be taken.

Forty-four of the 51 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 37. The shelter rating in the flatwater habitats was 8. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in most habitat types. Additionally, large woody debris contributes a small amount. Log and root wad cover structure 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 81%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 76.4 % and 78.1%, 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) Manage Snuffins Creek 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 a more complete and meaningful temperature regime information, perform 24-hour monitoring during July and

August 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) 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.

6) There are several log debris accumulations present on Snuffins Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches. Use the large wood from these LDA's to provide cover in the pool and flatwater habitat units.

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.

Position (ft):	Comments:
0'	Begin survey at confluence with Daugherty Creek. Channel type is G4. Flow measured at 0.05cfs.
153'	Out of influence of Daugherty Creek.
238'	Snorkel survey site #1.
323'	Snorkel survey site #2.
390'	Snorkel survey site #3.
405'	Log debris accumulation (LDA) of 3 pieces, 4' high x 15' wide x3' long, retaining sediment 4' high.
455'	LDA of 3 pieces: 4.5' high x 5' wide x 3' long, retaining sediment.
833'	Juvenile salmonids observed. LDA of 3 pieces, 6' high x 10' wide x 4' long, retaining sediment 5' high.

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961’	LDA of 4 pieces, 5’ high x 15’ wide x 4’ long, retaining sediment.
1,087’	LDA of 10 pieces, 5’ high x 15’ wide x 35’ long, retaining sediment.
1,442’	LDA of 3 pieces, 3’ high x 8’ wide x 5’ long, no stored sediment.
1,735’	LDA of 3 pieces, 5’ high x 10’ wide x 6’ long, retaining sediment.
1,922’	LDA of 4 pieces, 5’ high x 15’ wide x 7’ long, retaining sediment.
2,372’	LDA of 10 pieces, 8’ high x 12’ wide x 37’ long, retaining sediment.
3,331’	Five percent gradient for the next 70 feet of stream measured.
3,482’	LDA of 5 pieces, 5’ high x 9’ wide x 12’ long, retaining sediment.
3,500’	LDA of 7 pieces, 8’ high x 17’ wide x 10’ long, retaining sediment.
3,555’	Tributary enters on right bank. Dry at the time of survey.
3,572’	LDA of 6 pieces, 5’ high x 13’ wide x 20’ long, retaining sediment.
3,610’	LDA of 5 pieces, 5’ high x 9’ wide x 11’ long, retaining sediment.
4,060’	Juvenile salmonids observed.
4,105’	Marsh conditions for 45’ of stream. This section was not surveyed.
4,540’	LDA of approximately 20 pieces, 10’ high x 15’ wide x 15’ long, retaining sediment. This is a possible barrier to salmonids.
4,727’	LDA of 4 pieces, 7’ high x 13’ wide x 19’ long, retaining sediment.
4,938’	LDA of 12 pieces, 7’ high x 18’ wide x 19’ long, retaining sediment.
5,085’	LDA of 8 pieces, 3.5’ high x 14’ wide x 21’ long, retaining sediment.
5,633’	LDA of 10 pieces, 6.5’ high x 11’ wide x 16’ long, retaining sediment.
5,810’	LDA of 4 pieces, 3’ high x 6’ wide x10’ long, retaining sediment.
6,110’	Vehicle bridge, 9’ wide x 20’ long and 13’ above channel.
6,199’	LDA of 6 pieces, 5.5’ high x 8’ wide x 11’ long, retaining sediment.

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6,452’ LDA of 3 pieces, 3.5’ high x 5’ wide x 15’ long, no stored sediment.

6,486’ Orange algae in mass quantities, filling the wetted streambed.

6,496’ LDA of 5 pieces, 8’ high x 8’ wide x 12’ long, retaining sediment.

7,056’ LDA of 2 pieces, 8’ high x 12’ wide x 15’ long, retaining sediment. Tributary enters on right bank and was dry at the time of survey. Survey end due to dry streambed for 560 feet.

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.

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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]	