

STREAM INVENTORY REPORT

Molasses Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Molasses Creek. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Molasses 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, 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

Molasses Creek is tributary to the Redwood Creek, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Molasses Creek's legal description at the confluence with Redwood Creek is T07N R03E S17. Its location is 40°59'50" north latitude and 123°51'25" west longitude. Molasses Creek is a second order stream and has approximately 3.3 miles of blue line stream according to the USGS Lord-Ellis Summit 7.5 minute quadrangle. Molasses Creek drains a watershed of approximately 1.7 square miles. Elevations range from about 600 feet at the mouth of the creek to 2800 feet in the headwater areas. Redwood/Douglas conifer forest dominates the watershed. The watershed is privately owned, and is managed for timber production and livestock grazing in the lower reaches and prairies. Vehicle access exists via Highway 299 to Redwood Valley Road.

METHODS

The habitat inventory conducted in Molasses Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The NEAP fisherpersons 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 Molasses 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". Molasses 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, tape measures, and stadia rods. 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 Molasses 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). Additionally, a rating of "not suitable" (NS) 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 Molasses 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.

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 Molasses Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of every third . 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 Molasses 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.

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 Molasses 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 July 17, 18, and 19, 1995, was conducted by Phil Reig and Nancy Pearson. The total length of the stream surveyed was 2,806 feet.

No flows were measured on Molasses Creek.

Molasses Creek is a B3 channel type for 1,681 feet and an A2 channel type for the remaining 1,125 feet of the stream reach surveyed. B3 channels are moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools, very stable plan and profile, stable banks and a cobble dominant substrate. A2 channels are steep, narrow, cascading, step-pool streams, with high energy/debris transport associated with depositional soils, and boulder dominant channels.

Water temperatures taken during the survey period ranged from 62 to 68 degrees Fahrenheit. Air temperatures ranged from 67 to 92 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 46% flatwater units, 36% riffle units, and 18% pool units (Graph 1). Based on total **length** of Level II habitat types there were 54% flatwater units, 36% riffle units, and 10% pool units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were step runs, 24%; high gradient riffles, 16%; and runs, 13% (Graph 3). Based on percent total **length**, step runs made up 37%, cascades 18%, and high gradient riffles 14%.

A total of 12 pools were identified (Table 3). Scour pools were most frequently encountered at 100% and 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. None of the twelve pools had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the pool tail-outs measured, 10 had a value of 2 (83%); and 2 had a value of 3 (17%). 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 and pool habitat types both had a mean shelter rating of 18, and flatwater habitats had a mean shelter rating of 12 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 18 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 4 of the 5 low gradient riffles measured (80%). Large cobble was the next most frequently observed dominant substrate type and occurred in 20% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 91%. The mean percentages of deciduous and coniferous trees were 92% and 8%, respectively. Graph 9 describes the canopy in Molasses Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 73.1%. The mean percent left bank vegetated was 76.6%. The dominant elements composing the structure of the stream banks consisted of 1% bedrock, 56% boulder, 37% cobble/gravel, and 6% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 46.5% of the units surveyed. Additionally, 29.3% of the units surveyed had grass as the dominant vegetation type, and 23.2% had brush as the dominant vegetation (Graph 11).

DISCUSSION

Molasses Creek is a B3 channel type for the first 1,681 feet of stream surveyed and a A2 for the remaining 1,125 feet. The suitability of B3 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters and bank placed boulders, single and opposing wing-deflectors and log cover, and are good for medium-stage plunge weirs. A2 channel types are generally not suitable for fish habitat improvement structures, because A2 channels are high energy streams with stable stream banks, and poor gravel retention capabilities.

The water temperatures recorded on the survey days July 17, 18 and 19, 1995, ranged from 62 to 68 degrees Fahrenheit. Air temperatures ranged from 67 to 92 degrees Fahrenheit. This is a fair

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 54% of the total **length** of this survey, riffles 36%, and pools 10%. The pools are relatively shallow, with no 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 within the B3 channel type is recommended for locations where their installation will not be threatened by high stream energy.

Two of the twelve pool tail-outs measured had embeddedness ratings of 3. No pools 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. In Molasses 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 with a rating of 18. The shelter rating in the flatwater habitats was slightly lower at 12. 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, small woody debris contribute 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.

Four of the five 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 91%. This is a relatively high percentage of canopy, although more conifers are needed within the riparian zone. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 73.1% and 76.6%, 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) Molasses Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are

above 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) 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.
- 4) Within the B3 channel type, design and engineer pool enhancement structures to increase the number of pools or deepen existing pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
- 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) Plant conifers to improve the canopy in the riparian zone.

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 Redwood Creek. Channel type is a B3.
- 295' Concrete bridge.
- 419' Channel type B3.
- 477' Large amount of small woody debris on both banks.
- 830' Bedrock on left bank.
- 1120' Black plastic water line across creek.
- 1681' Channel type A2.
- 1841' Three foot high waterfall at top of pool.
- 2092' Small waterfall at top.
- 2226' Forty foot high rock on left bank.
- 2568' Water intake for black pipe.

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