STREAM INVENTORY REPORT

SPANISH CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Spanish Creek. The survey began at the confluence with Black Butte River and extended upstream 3.5 miles.

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

Spanish Creek is a tributary to Black Butte River, a tributary to the Middle Fork Eel River located in Mendocino County, California (Map 1). Spanish Creek's legal description at the confluence with Black Butte River is T20N R9W S10. Its location is 39E36N23.1O North latitude and 122E51N53O West longitude. Spanish Creek is a second order stream with approximately 7.2 miles of solid blue line stream according to the USGS Kneecap Ridge and Plaskett Meadows 7.5 minute quadrangles. Spanish Creek drains a watershed of approximately 13.1 square miles. Elevations range from about 3,398 feet at the mouth of the creek to 5,397 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed ownership is private landowners, National Forest and the Bureau of Land Management. It is managed for timber production, rangeland and recreation. Vehicle access exists via Highway 160 through Covelo on Mendocino Pass Road to Mendocino Pass and then on Forest Service roads.

METHODS

The habitat inventory conducted in Spanish Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Pacific States Marine Fisheries Commission (PSMFC) field technicians and the California Department of Fish & Game (DFG) Scientific Aides that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game. 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. All pools except step-pools are fully sampled.

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 Spanish 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". Spanish 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 Spanish 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 Spanish 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 Spanish 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 Spanish 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.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100'.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

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 Spanish Creek. This sampling technique is discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE 8.4 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 Microsoft Excel. Graphics developed for Spanish 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

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of September 9-23, 2002, was conducted by Frank Humphrey (DFG) and Allen Palacios (DFG). The total length of the stream surveyed was 18,664 feet with an additional 897 feet of side channel.

Stream flow was measured 1,690 feet from the confluence with Black Butte River with a Marsh-McBirney Model 2000 flowmeter at 0.2 cfs on September 9, 2002.

Spanish Creek is a C3 channel type for the first 7,331 feet of stream surveyed, a B4 channel type for the next 2,474 feet, and a B3 channel type for the remaining 8,859 feet. C3 channels are low gradient, meandering, riffle/pool alluvial channels with broad well defined flood plains and cobble-dominant substrates. B4 and B3 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools; very stable plan and profile, stable banks, and have cobble and gravel dominated substrates.

Water temperatures taken during the survey period ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 56 to 84 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 15% riffle units, 39% flatwater units, and 40% pool units (Graph 1). Based on total length of Level II habitat types there were 5% riffle units, 65% flatwater units,

and 25% pool units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step-runs, 34%; mid-channel pools, 28%; and low gradient riffles, 11% (Graph 3). Based on percent total length, step-runs made up 64%, mid-channel pools 14%, and step-pools 9%.

A total of 123 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 91%, and comprised 92% 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. Sixty five of the 123 pools (53%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 123 pool tail-outs measured, 34 had a value of 1 (27%); 42 had a value of 2 (34%); 39 had a value of 3 (32%); 8 had a value of 5 (7%) (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 15, flatwater habitat types had a mean shelter rating of 20, and pool habitats had a mean shelter rating of 28 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 30. Main channel pools had a mean shelter rating of 28 (Table 3).

In reach one, Spanish Creek had an average of 1.1 pieces of LWD per 100'; in reach two, 1.0 pieces; and in reach three 0.7 pieces / 100'.

Table 5 summarizes mean percent cover by habitat type. Boulders and bedrock ledges are the dominant cover types in Spanish Creek. Graph 7 describes the pool cover in Spanish Creek. Boulders is the dominant pool cover type followed by bedrock ledges.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Boulders was the dominant substrate observed in 33% of pool tail-outs while small cobble was the next most frequently observed substrate type, at 21%.

The mean percent canopy density for the surveyed length of Spanish Creek was 74%. The mean percentages of deciduous and coniferous trees were 18% and 59%, respectively. Twenty six percent of the canopy was open. Graph 9 describes the mean percent canopy in Spanish Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 22%. The mean percent left bank vegetated was 22.4%. The dominant elements composing the structure of the stream banks consisted of 49% bedrock, 16% boulder, and 35% cobble/gravel (Graph 10). Deciduous trees was the dominant vegetation type observed in 28.3% of the units surveyed.

Additionally, 25.7% of the units surveyed had brush as the dominant vegetation type, and 23.7% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Although salmonids were observed from streambanks, survey crews were unable to electrofish for species composition and distribution in Spanish Creek during September, 2002. These salmonids ranged from 2 inches to 8 inches in size. Water temperatures during this period ranged from 55 to 62 degrees Farenheit.

DISCUSSION

Spanish Creek is a C3 channel type with an average bankfull width of 21.6 feet for the first 7,331 feet of stream surveyed, a B4 channel type with an average bankfull width of 19.0 feet for the next 2,474 feet, and a B3 channel type with an average bankfull width of 20.5 feet for the remaining 8,859 feet. The suitability of C3 channel types for fish habitat improvement structures is as follows: excellent for bank placed boulders; good for plunge weirs, boulder clusters, single and opposing wing deflectors, and log cover. The suitability of B4 and B3 channel types for fish habitat improvement structures is as follows: 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 days September 9-23, 2002, ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 56 to 84 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 65% of the total length of this survey, riffles 5%, and pools 25%. The pools are relatively deep, with 66 of the 123 (53.6%) 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, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Seventy-six of the 123 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty-nine of the pool tail-outs had embeddedness ratings of 3. Eight 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 Spanish Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Seventy two of the 123 pool tail-outs had silt or sand/large cobble or boulders as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 28. 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, bedrock ledges contribute a large 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 74%. Reach 1 had a canopy density of 65% while Reaches 2 and 3 had canopy densities of 77% and 78%, respectively. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 23% and 22.4%, 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) Spanish Creek should be managed as an anadromous, natural production stream.

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders and bedrock ledges. Adding high quality complexity with woody cover is desirable.

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) 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.

6) Suitable size spawning substrate on Spanish Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

7) Increase the canopy on Spanish Creek by planting willow, 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.

8) 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.

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 Black Butte River. Channel type is C3.
1,221'	Juvenile salmonids observed.
2,744'	Left bank landslide contributing sediment, 50' x 100'. Flow measured at 0.2 cfs.
2,893'	Log Debris Accumulation (LDA) of 12 pieces: 10' high x 42' wide x 15' long. Stored Sediment 45' wide x 200' long x 10' deep.
4,521'	Tributary enters on left bank, water temperature was 54° Fahrenheit. Mouth located at 39E36N40.2O north latitude and 122E51N21.5O west longitude.
5,178'	Salmonids observed, two plus.
5,949'	Juvenile salmonids observed, one plus.
6,818'	Right bank tributary enters on right bank, dry at time of survey.
7,331'	Channel type changes from C3 to B4.
8,512'	Tributary enters on right bank, dry at time of survey. Mouth located at 39E37'07.4O north latitude and 122E51N11.8O west longitude.
9,242'	Salmonids observed, one plus.

9,805’ Channel type changes from B4 to B3.

11,207’ Tributary enters on left bank, dry at time of survey. Mouth located at 39E37N15.5” north latitude and 122E50N43.3O west longitude.

12,586’ LDA of approximately 35 pieces: 10’ high x 42’ wide x 15’ long. Not withholding sediment.

12,722’ Salmonids observed, one plus.

12,843’ LDA of approximately 50 pieces: 15’ high x 35’ wide x 20’ long. Not withholding sediment.

13,284’ Tributary enters on right bank, water temperature was 58° Fahrenheit at time of survey. Mouth located at 39E37N30.1O north latitude and 122E50N30.5 O west longitude.

14,013’ Salmonids observed, one plus.

14,600’ Tributary enters on left bank, dry at time of survey. Mouth located at 39E37N34.6O north latitude and 122E50N19.0O west longitude.

15,184’ Plunge pool with 5’ high plunge, may be a possible barrier during low flows to juvenile salmonids.

15,318’ Juvenile salmonids observed.

16,359’ Salmonid observed, two plus.

16,834’ Tributary enters on right bank, water temperature was 58° Fahrenheit at time of survey. Mouth located at 39E37N42.7O north latitude and 122E 49’56.8O west longitude.

17,603’ Salmonid observed.

17,792’ Six foot high cascade.

17,905’ Right bank landslide contributing sediment, 50’ x 100’.

17,945’ 4.5 foot high cascade.

18,551’ Boulders at top of unit combined with extensive LDA, appears to be a possible barrier to salmonids. The LDA has 20 pieces of large wood and is 15’ high x 35’ wide x 20’ long. Stored sediment is 40’ wide x 750’ long x 10’ deep.

18,664’ End of survey.

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]