STREAM INVENTORY REPORT

John Smith Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1994 on John Smith Creek to assess habitat conditions for anadromous salmonids. 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 John Smith Creek. The objective of the biological inventory was to document the salmonid species present and their distribution. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

There is no known record of adult spawning surveys having been conducted on John Smith 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.

WATERSHED OVERVIEW

John Smith Creek is tributary to the North Branch North Fork Navarro River, tributary to the North Fork Navarro River, located in Mendocino County, California. John Smith Creek's legal description at the confluence with North Branch North Fork Navarro River is T16N R15W S33. Its location is 39°12'26" North latitude and 123°32'07" West longitude. John Smith Creek is a second order stream and has approximately 7.8 miles of blue line stream, with 3.3 miles in the mainstem, according to the USGS Bailey Ridge and Navarro 7.5 minute quadrangles. John Smith Creek drains a watershed of approximately 5.8 square miles. Summer base runoff is approximately 0.05 cubic feet per second (cfs) at the mouth. Elevations range from about 280 feet at the mouth of the creek to 1000 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via Masonite Road.

METHODS

The habitat inventory conducted in John Smith Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991 rev. 1994). The California Conservation Corps (CCC) Technical Advisors that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). John Smith Creek personnel were trained in June, 1994, by Gary Flosi and Scott Downie. This inventory was conducted by a two-person team.

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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 John Smith 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. Flows should also be measured or estimated at major tributary confluences.

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 each tenth unit typed. 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". John Smith 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. Unit measurements included mean length, mean width, mean depth, and maximum depth. Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken 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 John Smith 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).

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 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 John Smith 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 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 is estimated using handheld spherical densiometers and is a measure of the water surface shaded during periods of high sun. In John Smith Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results recorded.

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 John Smith Creek, the dominant composition type and the dominant vegetation type of both the right and left banks 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. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

Biological inventory was conducted in John Smith Creek to document the fish species composition and distribution. Three sites were electrofished in John Smith Creek using one

Smith-Root Model 12 electrofisher. Each site was end-blocked with nets to contain the fish within the sample reach. Fish from each site were counted by species, measured, and returned to the stream.

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 Lotus 1,2,3. Graphics developed for John Smith 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

The habitat inventory of June 8, 9, 14, 15, 16, 17, and 21, 1994, was conducted by Chris Bysshe and Jeff Strayer (CCC). The total length of the stream surveyed was 14,998 feet with an additional 173 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.05 cfs on July 8, 1994.

John Smith Creek is a F4 channel type for the first 7,714 feet of stream reach surveyed, a B4 for the next 5,687 feet, and a F3 for the remaining 1597 feet. B4 channels are moderately entrenched, moderate gradient, riffle-dominated channels with infrequently spaced pools, very

stable plan and profile, and stable banks; with a gravel channel. F-type channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios. F4 channels have gravel-dominant substrates, and F3 channels have cobble-dominant substrates.
Water temperatures ranged from 50 to 61 degrees Fahrenheit. Air temperatures ranged from 55 to 78 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 36%, flatwater types 34%, and riffles 30% (Graph 1). Pool habitat types made up 41% of the total survey **length**, flatwater 38%, and riffles 20% (Graph 2).

Eight Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were mid-channel pools, 35%; low gradient riffles, 30%; and runs, 20% (Graph 3). By percent total **length**, mid-channel pools made up 41%, low gradient riffles 20%, and step runs 17%.

One-hundred-forty-one pools were identified (Table 3). Main channel pools were most often encountered at 99% and comprised 99% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Eighty-two of the 141 pools (58%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 139 pool tail-outs measured, 30 had a value of 1 (21%); 65 had a value of 2 (47%); 44 had a value of 3 (32%); and none had a value of 4 (0%). On this scale, a value of one is the best for fisheries (Graph 6).

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 the highest shelter rating at 148. Flatwater habitats followed with a rating of 47 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 60, and main channel pools rated 29 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Aquatic vegetation is the dominant cover type in John Smith Creek and is extensive. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in John Smith Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 66 of the 118 low gradient riffles (56%). Small cobble was the next most frequently observed dominant substrate type and occurred in 19% of the low gradient riffles (Graph 8).

Twenty-six percent of the survey reach lacked shade canopy. Of the 74% of the stream covered with canopy, 42% was composed of deciduous trees, and 58% was composed of coniferous trees. Graph 9 describes the canopy in John Smith Creek.

Table 2 summarizes the mean percentage of the right and left stream banks covered with vegetation by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 77%. The mean percent left bank vegetated was 77%. The dominant elements composing

the structure of the stream banks consisted of 2.8% bedrock, 0% boulder, 19.9% cobble/gravel, and 77.3% sand/silt/clay (Graph 10). Coniferous trees, including down trees, logs, and root wads, were the dominant vegetation type observed in 43% of the units surveyed. Additionally, 40% of the units surveyed had deciduous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on July 8, 1994, in John Smith Creek. The units were sampled by Gary Flosi and Wendell Jones (DFG) and Chris Bysshe and Jeff Strayer (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled was a plunge pool immediately below the culvert at the confluence of John Smith Creek and the North Branch North Fork Navarro River and the adjacent side channel pool on the North Branch North Fork Navarro River. This site had an area of 638 sq ft and a volume of 2,552 cu ft. The unit yielded 43 steelhead between 30 and 63 mm, seven coho between 47 and 67 mm, ten three-spine stickleback between 29 and 55 mm, two California roach, both 40 mm, one 60 mm sculpin, two Pacific giant salamanders, one yellow-legged frog, and two crayfish.

The second site was habitat units 002-004, a mid-channel pool / low gradient riffle / mid-channel pool combination located directly upstream from the culvert at Masonite Road. This site had an area of 1,073 sq ft and a volume of 676 cu ft. The site yielded 39 steelhead between 36 and 139 mm, eight three-spine stickleback between 43 and 56 mm, one unidentified frog, and two crayfish.

The third site sampled was habitat unit 77, a mid-channel pool located approximately 3,208 feet above the creek mouth. The site had an area of 2,268 sq ft and a volume of 3,631 cu ft. The site yielded eleven steelhead between 31 and 178 mm, one 95 mm coho, 13 three-spine stickleback between 22 and 52 mm, four Pacific giant salamanders, one unidentified frog, and one unidentified newt.

DISCUSSION

John Smith Creek has three channel types: B4, F3, and F4. The B4 channel type is considered excellent for low-stage weirs, random boulder placement, bank-placed boulders, single and opposing wing deflectors, channel constrictors, bank cover, and log cover structures; and good for medium-stage weirs. The F3 channel type is considered good for bank-placed boulders and single and opposing wing deflectors; fair for low-stage weirs, random boulder placement, channel constrictors, bank cover, and log cover structures; and poor for medium-stage weirs. The F4 channel type is considered good for bank-placed boulders; fair for low-stage weirs, single and opposing wing deflectors, channel constrictors, bank cover, and log cover structures; and poor for medium-stage weirs and random boulder placement.

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The water temperatures recorded on the survey days June 8, through 21, 1994, ranged from 50 to 61° Fahrenheit. Air temperatures ranged from 55 to 78° Fahrenheit. This is a good 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 38% of the total **length** of this survey, riffles 20%, and pools 41%. The pools are relatively deep, with 82 of the 141 pools having a maximum depth greater than 2 feet. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total 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. The LDA's in the system are 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.

Forty-four of the 139 pool tail-outs measured had embeddedness ratings of 3 or 4. Thirty had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In John Smith 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 29. The shelter rating in the flatwater habitats was better at 47. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by aquatic vegetation in all habitat types. Additionally, undercut banks 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.

Eighty-eight of the 118 low gradient riffles had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy for the stream was 74%. This is a relatively high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams.

The percentage of right and left bank covered with vegetation was high at 77% and 77%, 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.

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RECOMMENDATIONS

1) John Smith Creek should be managed as an anadromous, natural production stream.

2) The culvert at the confluence of John Smith Creek with the North Branch North Fork Navarro River appears to be a barrier to coho salmon at some flows. This was evidenced by the presence of young-of-year (YOY) coho below the culvert and no YOY coho above the culvert. The culvert has baffles, but the jump into the culvert may be too high to allow access except under very high flows. Options for improving fish passage into the culvert should be explored and action taken to remedy this problem.

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from aquatic vegetation. Adding high quality complexity with woody cover is desirable and in some areas the material is at hand.

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 or deepen the existing pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

PROBLEM SITES AND LANDMARKS

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

Position (ft):	Comments:
0'	Begin survey at upstream end of culvert at Masonite Road Channel type is F4.
2756'	Right bank culvert contributing fines from road.
3016'	Left bank culvert contributing fines from road.
3208'	Bridge.
3551'	Log and debris accumulation (LDA). Not a barrier.
3663'	LDA. Not a barrier.
4265'	Bridge.

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5149' LDA. Not a barrier.

5870' Culvert contributing fines from road.

6834' Left bank tributary.

7213' Bridge.

7714' Channel type changes to B4.

9640' Right bank tributary.

11418' LDA. Possible barrier.

12028' LDA.

12292' LDA. Not a barrier.

12808' LDA. Not a barrier.

13219' Matilla Gulch enters left bank.

13401' Channel type changes to F3.

13455' LDA. Not a barrier.

13765' Bridge.

13994' LDA. Possible barrier.

14532' LDA. Possible barrier.

14738' Left bank tributary.

14934' LDA. End of survey due to increase in gradient.

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