SALMON AND STEELHEAD RESTORATION AND ENGANCEMENT PROGRAM

NORTH COAST

BASIN PLANNING PROJECT

STREAM INVENTORY REPORT

Middle Creek, Mattole River, 1998

CALIFORNIA DEPARTMENT OF FISH AND GAME

SPORT FISH RESTORATION ACT

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STREAM INVENTORY REPORT

MIDDLE CREEK, MATTOLE RIVER

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on Middle Creek. 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 Middle 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 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

Middle Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Middle Creek's legal description at the confluence with Mattole River is T3S R1E S0. Its location is 40°13′44″ North latitude and 124°02′46″ West longitude. Middle Creek is a first order stream and has approximately 3.6 miles of blue line stream according to the USGS honeydew 7.5 minute quadrangle. Middle Creek drains a watershed of approximately 2.7 square miles. Elevations range from about 430 feet at the mouth of the creek to 2100 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for rangeland. Vehicle access exists via Panther Gap Road to a private road.

METHODS

The habitat inventory conducted in Middle 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 AmeriCorps Watershed Stewards Project (WSP) 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 (Hopelain, 1994). 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, dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further 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 Middle 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". Middle 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. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). 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 Middle 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 Middle 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 Middle 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 Middle 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 was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Middle Creek fish presence was observed from the stream banks, and two sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes (25.4, 12.5, 4.7, 2.37, and 0.85 mm)(Valentine, 1995).

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 Middle 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 the pool tail outs
- 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 16, 1998, was conducted by Stu McMorrow and John Wooster (WSP). The total length of the stream surveyed was 7,475 feet with an additional 422 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.2 cfs on September 16, 1998.

Middle Creek is an B4 channel type for the entire 7,475 feet of stream reach surveyed. B4 channels are moderate in entrenchment and gradient, dominated by riffles with infrequently spaced pools, stable in plan and profile, with stable banks and gravel channels.
Water temperatures taken during the survey period ranged from 57 to 64° F. Air temperatures ranged from 59 to 75° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 30% riffle units, 31% flatwater units, and 33% pool units (Graph 1). Based on total length of Level II habitat types there were 35% riffle units, 47% flatwater units, and 10% pool units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle, 28%; main channel pool, 26%; and step run, 23% (Graph 3). Based on percent total length, step runs made up 36%, low gradient riffles 33%, and main channel pools 8%.

A total of thirty-six pools were identified (Table 3). However, tail-outs and tail-out substrate

were only measured for thirty-five of these thirty-six. Main channel pools were most frequently encountered at 81% and comprised 82% 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. Nine of the thirty-six pools (25%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the thirty-five pool tail-outs measured, none had a value of 1; none had a value of 2; nineteen had a value of 3 (54.3%); thirteen had a value of 4 (37.1%) and three had a value of 5 (8.6%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning. In Middle Creek, three pool tail-outs which were valued at 5 had silt/clay or gravel too small to be suitable for spawning as the 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 5, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 11 (Table 1). Of the pool types, the scour and backwater pools had the highest mean shelter rating at 13. Main channel pools had a mean shelter rating of 9 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in twenty of the thirty-five pool tail outs measured (57%). Large cobble was the next most frequently observed dominant substrate type and occurred in 17% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 52%. The mean percentages of deciduous and coniferous trees were 99% and 1%, respectively. Graph 9 describes the canopy in Middle Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 53%. The mean percent left bank vegetated was 52%. The dominant elements composing the structure of the stream banks consisted of 10.5% bedrock, 13.2% boulder, 71.1% cobble/gravel, and 5.3% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 76.3% of the units surveyed. Additionally, 5.3% of the units surveyed had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on September 21, 1998, in Middle Creek. The sites were sampled by Barry Collins (DFG), Ruth Goodfield (DFG), Caroline Jezierski, and John Wooster (WSP). The first site sampled included habitat units 5-8, approximately 731 feet from the confluence with Mattole. This site had an area of 4,785 sq ft and a volume of 36,366 cu ft. The site yielded fourty-six steelhead rainbow trout (SHRT) young-of-the-year (YOY), six 1+ SHRT with fork lengths ranging from 100 to 121 mm, and three 2+ SHRT with fork lengths of 152 and 160 mm

The second site included habitat unit 12, located approximately 1,393 feet above the creek mouth. This site had an area of 576 sq ft and a volume of 288 cu ft. The site yielded seventy-six SHRT YOY and four 1+ SHRT with fork lengths ranging from 82 to 106 mm.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Middle Creek.

DISCUSSION

Middle Creek is a B4 channel type for the entire 7,475 feet of stream surveyed. The suitability of B4 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; log cover.

The water temperatures recorded on September 6, 1998, ranged from 57° to 64° F. Air temperatures ranged from 59° to 75° F. This is a fair water temperature range for salmonids. However, 64° F, if sustained, is near the threshold stress level for salmonids. This does not seem to be the case here, and Middle Creek seems to have temperatures favorable to 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 47% of the total length of this survey, riffles 35%, and pools 10%. The pools are relatively shallow, with only nine of the thirty-six (25%) 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 log debris accumulations (LDA's) in the stream. A LDA in the system is retaining gravel. Any necessary modifications 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.

None of the thirty-five pool tail-outs measured had an embeddedness rating of 1. Thirty-two of the pool tail-outs had embeddedness ratings of 3 or 4. Three of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. One of the three was unsuitable for spawning due to the dominant substrate being silt, which is unsuitable. 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 Middle 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 11. The shelter rating in the flatwater habitats was slightly lower at 5. 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, terrestrial vegetation contributes 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.

Twenty-four of the thirty-five pool tail outs 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 52%. This is a relatively low percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was low at 53% and 52%, 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) Middle Creek should be managed as an anadromous, natural production stream.

2) 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.

3) 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.

4) Increase the canopy on Middle Creek by planting willow, alder, redwood, 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.

5) 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.

6) 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.

7) 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 three to five 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'	This survey begins at the confluence of Middle Creek and the Mattole River. A road crosses Middle Creek 250' into this habitat unit. Channel type is B4.
305'	Young-of-the-year salmonids were observed in this unit.
530'	Middle Creek is out of the hydraulic influence of the Mattole River.
796'	A log debris accumulation (LDA) 30' long, 40' wide, and 6' high is retaining gravel in this unit.
1929'	A right bank (RB) slide 300' long and 200' high is contributing fines and small woody debris.
2025'	A LDA of dead alders is 10' long, 30' wide, and 5' high.
2145'	YOY salmonids were observed in this unit.
2167'	Left bank (LB) slide is 300' long and 100' high.
2496'	RB slide is 100' long, 100' wide, and 80' high.
2773'	RB slide is 60' long and 80' high.

3726'	Active RB 80' long, 110' wide, and 100' high.
4314'	RB slide is 100' long, 100' wide, and 80' high.
4635'	RB tributary shown on the USGS quad enters in this unit and has fish.
4635'	YOY salmonids are trapped in an isolated pool.
6417'	LB slide is 400' long, 50' wide, and 130' high.
7475'	End of survey. Many YOY salmonids are trapped in this unit by the dry unit below. The channel is dry above this unit.

REFERENCES

Flosi, G., and F. Reynolds, 1998. *California Salmonid Stream Habitat Restoration Manual, 2nd edition*. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, 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