STREAM INVENTORY REPORT

MIDDLE CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1992 on
Middle 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 Middle 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 Middle 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

Middle Creek is tributary to Hollow Tree Creek, tributary to the
South Fork Eel River, tributary to the Eel River, located in
Mendocino County, California (Figure 1). Middle Creek's legal
description at the confluence with Hollow Tree Creek is T23N R17W
S29. Its location is 40°21'00" N. latitude and 124°00'58" W.
longitude. Middle Creek is a first order stream and has
approximately 1.9 miles of blue line stream, according to the
USGS Hales Grove 7.5 minute quadrangle. Middle Creek drains a
watershed of approximately 1.7 square miles. Summer base runoff
is approximately 2- cfs at the mouth, but over 5,--- cfs is not
unusual during winter storms. Elevations range from about 1,000
feet at the mouth of the creek to 1,600 feet in the headwater
areas. Redwood forest dominates the watershed. The watershed is
owned by the Louisiana-Pacific Corporation and is managed for
timber production. Vehicle access exists from State Highway 1 at
Hales Grove, via Westside Road.

METHODS

The habitat inventory conducted in Middle Creek follows the
methodology presented in the California Salmonid Stream Habitat
Restoration Manual (Flosi and Reynolds, 1991). The California
Conservation Corps (CCC) and contract seasonal Technical Advisors
that conducted the inventory were trained in standardized habitat
inventory methods by the California Department of Fish and Game

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(DFG). Middle Creek personnel were trained in May and June, 1992, by Gary Flosi and Scott Downie. 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 Middle Creek to record measurements and observations. There are nine components to the inventory form. For specific information on the methods used, see the Hollow Tree Creek report.

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 Middle Creek to document the fish species composition and distribution. ---- sites were electrofished in Middle 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 Runtime, a dBASE 4.1 data entry program developed by the Department of Fish and Game. This program processes and summarizes the data.

The Runtime program produces the following summary 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.

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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 low gradient riffles
- Percent canopy
- Bank composition by composition type

HABITAT INVENTORY RESULTS

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

The habitat inventory of July 8, 1992, was conducted by Erick
Elliot and Jason Cleckler (CCC and contract seasonal). The total
length of the stream surveyed was 715 feet.

Flow was ESTIMATED to be 2-3 cfs during the survey period. OR:
Flow was MEASURED at the bottom of the survey reach with a Marsh-
McBirney Model 2000 flowmeter at 2-3 cfs on Aug. 20, 1990.

Middle Creek is a B1-1 channel type for the entire 715 feet of
stream reach surveyed. B1-1 channels are moderate gradient (1.5-
4.0%), moderately confined streams, with bedrock channels.

Water temperature was 56 degrees fahrenheit. Air temperatures
ranged from 64 to 67 degrees fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool
habitat types. By percent **occurrence**, riffles made up 43.5%,
flatwater types were also 43.5%, and pools 8.7% (Graph 1).
Flatwater habitat types made up 39.3% of the total survey **length**,
riffles 38.9%, and pools 7.7% (Graph 2).

Seven Level IV habitat types were identified. The data are
summarized in Table 2. The most frequent habitat types by
percent **occurrence** were runs, 34.8%; and low gradient riffles,
30.4% (Graph 3). By percent total **length**, runs made up 27.8%,
and low gradient riffles 26.2% (Table 2).

Two pools were identified, a mid-channel pool with a maximum
depth of 0.9 feet, and a plunge pool with a depth of 6.5 feet.
The depth of cobble embeddedness was estimated at the pool tail-

outs. Both of the pools in the survey reach had an embeddedness
value of three. Tables 3 & 4 summarize the pool data.

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. Flatwater habitat types had the highest
shelter rating at 38.5. Pool habitats followed with a rating of
37.5 (Table 1).

Table 5 summarizes mean percent cover by habitat type. Boulders
are the dominant cover type in Middle Creek and are extensive.
Large and small woody debris are the next most common cover
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 5 of the 7 low
gradient riffles (Graph 8).

Sixteen percent of the survey reach lacked shade canopy. Of the
84% of the stream covered with canopy, 93% was composed of
deciduous trees, and 7% was composed of coniferous trees.
  Graph 9 describes the canopy in Middle 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
65.7%. The mean percent left bank vegetated was 46.3%. The
dominant elements composing the structure of the stream banks
consisted of 34.8% bedrock, 19.6% bare soil, 15.2% grass, 6.5%
brush. Additionally, 15.2% of the banks were covered with
deciduous trees, and 8.7% with coniferous trees, including downed
trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

----- electrofishing sites were sampled on Middle Creek. The
objective was to identify fish species and distribution. The
units were sampled on SEPTEMBER --, 199- by E---k E----t, B---n
H------y, and S--a M----e (CCC). Each unit was end-blocked with
nets to contain the fish within the sample reach. T---e passes
were conducted at each site, fork lengths (FL) measured and
recorded, and the fish returned to the stream.

The first site sampled was habitat unit 0-0, a MID-CHANNEL POOL,
approximately --- feet from the confluence with the V-- D----
River. This site had an area of --- sq ft, and a volume of ---
cu ft. The unit yielded 2- steelhead, ranging from 3- to   11-
mm FL.

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The second site was habitat unit 0-0, a MID-CHANNEL POOL, located
below a CATTLE CROSSING approximately 2--- feet above the creek
mouth. This site had an area of 2-- sq ft, and a volume of 1--
cu ft. Ni----en steelhead were sampled. They ranged from 5-to
1-- mm FL.

The third site sampled was habitat unit 0-0, a CORNER POOL,
located approximately 5--- feet above the creek mouth. This site
is 2-- feet from the A--------- Road. The site had an area of 5-
sq ft, and a volume of 7- cu ft. ELEVEN steelhead were sampled,
ranging from 5- to 7- mm FL.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Middle Creek.

DISCUSSION

B1-1 channels are generally not suitable for fish habitat
improvement structures. However, bank placed boulders, shelter
structures, bank cover, log cover, and spawning weirs are often
appropriate in these reaches.

The water temperature recorded on the survey days July 8, 1992,
was 56° F. Air temperatures ranged from 64° F to 67° F. This is a
very good water temperature regime for salmonids. However, to
make any further conclusions, temperatures would need to be
monitored throughout the warm summer months, and more extensive
biological sampling conducted.

Flatwater habitat types comprised 39.3% of the total **length** of
this survey, riffles 38.9%, and pools 7.7%. There were only two
pools in the survey reach. However, in coastal coho and
steelhead streams, it is generally desirable to have primary
pools comprise approximately 50% of total habitat. Therefore,
installing structures that will increase or deepen pool habitat
is recommended.

The two pools in the survey reach had embeddedness ratings of 3.
 Embeddedness in excess of 26%, a rating of 2 or more, is
considered poor quality for fish habitat. In Middle Creek,
sediment sources should be mapped and rated according to their
potential sediment yields, and control measures taken.

The mean shelter rating for pools was moderate with a rating of

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37.5. The shelter rating in the flatwater habitats was slightly
better at 38.5. However, a pool shelter rating of approximately
100 is desirable. The cover that now exists is being provided
primarily by boulders in all habitat types. Additionally, large
and 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.

Five of the seven low gradient riffles had gravel as the dominant
substrate. This is generally considered good for spawning
salmonids.

The mean percent canopy for the stream was 84%. This is a high
percentage of canopy, since 80 percent is generally considered
optimum in these north coast streams.

RECOMMENDATIONS

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

2) 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.

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.

4)There are several log debris accumulations present on Middle
      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.

5)Inventory and map sources of stream bank erosion, and
      prioritize them according to present and potential sediment
      yield. Identified sites, like the site at 518', should then
      be treated to reduce the amount of fine sediments entering
      the stream.

6)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

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    tributaries.

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.

    0'Begin survey at confluence with Hollow Tree Creek. Channel
        type is a B1-1 for the entire survey reach.

  223'Left bank erosion 35' high x 25' long, contributing gravel
        and silt into the channel.

  271'Log and debris accumulation (LDA) 6' long x 25' wide x 5'
        high, retaining gravel 26' long x 8' wide x 2' high.
        No apparent barrier.

  367'Young-of-the-year steelhead (YOY) observed.

  470'Left bank erosion 25' high x 20' long, with log acting as
        armament.

  518'LDA 55' long x 30' wide x 16' high, retaining gravel 105'
        long x 15' wide x 4' high. Possible barrier.

  619'Left bank erosion 80' high x 50' long, contributing gravel
        and silt into the channel.

  715'Plunge 38' high from bedrock; no steps. End of survey.