STREAM INVENTORY REPORT

NORTH FORK STRONGS CREEK

INTRODUCTION

A stream inventory was conducted during the summer of 1993 on
North Fork Strongs 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 North Fork Strongs 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 North Fork Strongs 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

North Fork Strongs Creek is tributary to Strongs Creek tributary
to the Eel River, located in Humboldt County, California. North
Fork Strongs Creek's legal description at the confluence with
the Strongs Creek is T3N R1W S36. Its location is 40°35'55" N.
latitude and 124°07'16" W. longitude. North Fork Strongs Creek
is a first order stream and has approximately 2.5 miles of blue
line stream, according to the USGS Hydesville 7.5 minute
quadrangle. North Fork Strongs Creek drains a watershed of
approximately 2.3 square miles. Summer base runoff is
approximately 0.31 cfs the mouth. Elevations range from about
100 feet at the mouth of the creek to 1,200 feet in the
headwater areas. Redwood forests dominate the watershed. The
watershed is privately owned and is managed for rangeland and
timber production. Vehicle access exists via the Kenmar exit
from Highway 101 to Fortuna Blvd. to the eastern end of Newberg
Road, and through a private road gate controlled by Pacific
Lumber Co.

METHODS

The habitat inventory conducted in North Fork Strongs Creek

follows the methodology presented in the <u>California Salmonid Stream Habitat Restoration Manual</u> (Flosi and Reynolds, 1991). 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). North Fork Strongs Creek personnel were trained in June, 1993, by Gary Flosi and Scott Downie. This inventory was conducted by two person teams.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the <u>California Salmonid Stream Habitat Restoration Manual</u>. This form was used in North Fork Strongs 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 by David Rosgen (1985). This methodology is described in the <u>California Salmonid Stream Habitat Restoration Manual</u>. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are four measured parameters used to determine channel type: 1) water slope gradient, 2) channel confinement, 3) width/depth ratio, 4) substrate composition.

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 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". North Fork Strongs 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 North Fork Strongs
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 North Fork Strongs
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.

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 North Fork Strongs 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:

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 North Fork Strongs Creek, the
dominant composition type in both the right and left banks was
selected from a list of eight options on 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 North Fork Strongs Creek
to document the fish species composition and distribution. Five
sites were electrofished in North Fork Strongs Creek using one
Smith Root Model 12 electrofisher. Each site was end-blocked to
contain the fish within the sample reach. Fish from each site
were counted by species, measured, and returned to the stream.

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 0.85mm).

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat
Runtime, a DBASE 4.1 data entry program developed by the
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 North Fork Strongs 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 REPORT *

The habitat inventory of July 1, 7, and 8, 1993, was conducted by Chris Coyle, Erick Elliot, and Craig Mesman (CCC). The total length of the stream surveyed was 6,091 feet, with an additional 154 feet of side channel length.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.31 cfs on July 8, 1993.

North Fork Strongs Creek is a B5 channel type for the entire 6,091 feet of stream reach surveyed. B5 channels are moderate gradient, (1.5-4.0%), well confined channels with silt/ clay substrate, and moderately steep, unstable slopes.

Water temperatures ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 56 to 68 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 54.1%, flatwater types 24.1%, and riffles 21.2% (Graph 1). Pool habitat types made up 55.9% of the total survey **length**, flatwater 25.3%, and riffles 17.9% (Graph 2).

Eighteen 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, 22.9%; low gradient riffles, 19.4%; and runs, 12.9% (Graph 3). By percent total **length**, mid-channel pools made up 24.7%, low gradient riffles, 16.1%, and step runs, 13.5%.

Ninety-two pools were identified (Table 3). Main-channel pools were most often encountered at 57.6 % and comprised 63.2% 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. Sixty-two of the 92 pools (78%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 90 pool tail-outs measured, none had a value of 1 (0.0%); 5 had a value of 2 (5.6%); 16 had a value of 3 (17.8%); and 69 had a value of 4 (76.7%). 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. Pool habitat types had the highest shelter rating at 54.8. Riffle habitats followed with a rating of 30.1 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 70.0, and main-channel pools rated 59.2 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large and small woody debris are the dominant cover type in North Fork Strongs Creek. Boulders also contribute some. Graph 7 describes the pool cover in North Fork Strongs Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 25 of the 33 low gradient riffles (75.8%). Small cobble and silt were the next most frequently observed substrate. Each substrate material occurred in 9.0% of the low gradient riffles (Graph 8).

Seven percent of the survey reach lacked shade canopy. Of the 93% of the stream covered with canopy, 65.9% was composed of coniferous trees, and 33.5% was composed of deciduous trees. Graph 9 describes the canopy in North Fork Strongs 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 86.2%. The mean percent left bank vegetated was 82.4%. The dominant elements composing the structure of the stream banks consisted of 7.4% bedrock, 0.6% boulder, 2.7% bare soil, 1.8% grass, 29.4% brush. Additionally, 7.1% of the banks were

covered with deciduous trees, and 51.2% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Five sites were electrofished on July 7 and 15, 1993 in North Fork Strongs Creek. The units were sampled by Shea Monroe, Michelle Rose, Chris Coyle and Craig Mesman (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled included habitat units 84, 85, and 86, a mid-channel pool, run, and low gradient riffle, approximately 3,228 feet from the beginning of the survey. This site had an area of 914 sq ft, and a volume of 577 cu ft. These units yielded 3 steelhead, ranging from 31 to 104mm FL. Total effort was 127 seconds.

The second site included habitat units 89 and 90, a run and glide, located immediately below a 5' diameter culvert and approximately 3,401 feet from the beginning of the survey. This site had an area of 246 sq ft, and a volume of 85 cu ft. No fish were sampled. Total effort was 74 seconds.

The third site included habitat units 95, 96, and 97, a mid-channel pool, step run, and low gradient riffle, located approximately 3,649 above the confluence with North Fork Strong and upstream from the 5' diameter culvert. No fish were sampled, however, the area had very recently been logged. The total effort for this site was 69 seconds.

The fourth site sampled on July 15, included habitat units 135, 136 and 137, a low gradient riffle, mid-channel pool, and run, located approximately 5,142 feet above the confluence. This site had an area of 1,019 sq ft and a volume of 692 cu ft. Eight coastal cutthroat trout were sampled. They ranged from 35mm to 150mm FL. Total effort was 294 seconds.

The fifth site sampled was habitat unit 83, a lateral scour pool root wad enhanced, located approximately 3,228 feet above the confluence with Strongs Creek and adjacent to biological inventory site 1. Site five had an area of 343 sq ft and a volume of 274 cu ft. Three steelhead were observed. They ranged from 55mm to 82mm FL.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on North Fork Strongs Creek.

DISCUSSION

The B5 channel type is generally not suitable for fish habitat
improvement structures. B5 channels, although moderate
gradient, are composed of unconsolidated silt/ clay substrate
and bank material that is prone to erosion and lateral
migration.

The water temperatures recorded on the survey days July 1, 7 and
8, 1993 ranged from 53° F to 58° F. Air temperatures ranged from
56° F to 68° F. This is a very good water temperature regime for
salmonids. To make any further conclusions, however,
temperatures would need to be monitored throughout the warm
summer months, and more extensive biological sampling conducted.

Flatwater habitat types comprised 25.5% of the total **length** of
this survey, riffles 17.9%, and pools 55.9%. The pools are
relatively deep with 62 of the 92 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.
Therefore, installing structures that will increase or deepen
pool habitat is recommended for locations where their
installation will not threaten unstable stream banks, 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 gravels. Any
necessary modifications to them should be done with the intent
of metering the gravels 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.

Eighty-five of the 90 pool tail-outs measured had embeddedness
ratings of 3 or 4. None 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 North Fork Strongs
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 relatively low with a
rating of 54.8. The shelter rating in the flatwater habitats
was lower at 25.5. A pool shelter rating of approximately 100
is desirable. The cover that now exists is being provided
primarily by large and small woody debris in all habitat types.
Additionally, boulders and root wads 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.

Twenty-eight of the 33 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 92%. This is a high percentage of canopy, since 80 percent is generally considered optimum in these north coast streams. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1)   North Fork Strongs Creek should be managed as an anadromous, natural production stream.

2)   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.

3)   Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield, then be treated to reduce the amount of fine sediments entering the stream.

4)   There are several log debris accumulations present on North Fork Strongs 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)   Spawning gravels on North Fork Strongs Creek are limited to relatively few reaches. Crowding and/or superimposition of redds have been observed during winter surveys. Projects should be designed at suitable sites to trap and sort spawning gravels in order to expand redd site distribution in the stream.

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)   Increase the canopy on North Fork Strongs 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.

8)   There are at least two sections where the stream is being
     impacted from cattle trampling the riparian zone, and
     defecating in the water. Alternatives should be explored
     with the grazier, and developed if possible.

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 Strongs Creek.
         Channel type is a B5.

 158'   Cattle crossing through stream. Cattle excrement in
         and around channel.

 277'   Left bank slide 8' high x 40' long, contributing fines
         and large woody debris.

 315'   Cattle crossing through stream. Cattle excrement in
         and around channel.

 388'   Small tributary entering from right bank.

 460'   Old wooden structure in creek 11' high x 45' wide x
         50' long, retaining logs and silt. Possible low flow
         barrier.

 526'   Collapsed bridge in stream trapping debris.

 573'   Old wooden weir at top of unit retaining 2' of silt.
         Not a barrier.

1606'   Channel becomes constricted between downed and
         standing redwood, eroding both banks. Left bank
         erosion 3' high x 75' long. Right bank erosion 3'
         high x 40' long.

1765'   Left bank slide 200' high x 100' long, contributing
         fines and large and small woody debris in channel.
         Not a barrier.

1945'   Small tributary enters from right bank. Flow is
         approximately 1 gallon per/ minute.

2116'   Log debris accumulation (LDA) 6' high x 15' wide x 10'
         long. Possible low flow barrier.

2139'   LDA 7' high x 25' wide x 30' long retaining gravel and
         fines.

2188'   LDA 8' high x 30' wide x 90' long, retaining silt 30'
         wide x 6' deep.

2479'   LDA associated with standing railroad trestles, 8'
         high x 30' wide x 150' long.

3279'   Debris accumulation over top of habitat unit, 35' long
         x 25' wide x 7' high.

3443'   Five foot diameter steel culvert under logging road
         42' long.

3844'   Five foot diameter x 50' long newly cut log in
         channel, trapping woody debris. LDA 60' long x 20'
         wide x 8' high.

3897'   Timber harvest at waters edge with associated debris
         in creek.

4253'   Large woody debris accumulation over entire unit.

4584'   Unit covered by LDA 8' high x 35' wide, retaining
         sediment 3' deep.

4759'   Unit covered by LDA 30' wide x 35' long x 9' high.

5142'   Two inch long salmonid observed.

5153'   Small intermittent tributary entering from left bank.

5338'   LDA 20' wide x 26' long x 6' high.

5374'   Young-of-the-year (YOY) observed.

5483'   LDA 15' wide x 20' long x 6' high.

5545'   Several 1+ fish observed.

5917'   LDA 25' wide x 103' long x 10' high covers entire unit.

6091'   Active logging operation, END OF SURVEY.