STREAM INVENTORY REPORT

Noyo River

WATERSHED OVERVIEW

The Noyo River is a tributary to the Pacific Ocean (Figure 1). Elevations range from 0 feet at the mouth of the creek to 2,400 feet in the headwater areas. The Noyo River's legal description at the confluence with the Pacific Ocean is T18N R17W S09. Its location is 39°27'36"N. latitude and 123°45'39"W. longitude according to the USGS Fort Bragg 7.5 minute quadrangle. The Noyo River drains a watershed of approximately 19,393 acres.

HABITAT INVENTORY RESULTS

The habitat inventory of August 2, 1996 through August 16, 1996, was conducted by Diana Hines, David Lundby, and Dave Wright. The portion of mainstem surveyed includes the area from the end of the tidal zone (first California Western crossing), to the Georgia-Pacific property line (near Alpine Gulch). The total length of surveyed stream in Noyo River was 90,729 feet (17.2 miles, 27.7 KM) (Table 1). Side channels comprised 232 feet of this total.

Flow measured at the Hayshed gauging station, by the USGS, from the period between August 1 to August 7, 1996, was approximately 22-23 cubic feet per second (cfs).

The Noyo River consists of four reaches: a B3 for the first 44,831 feet, a C3 for the next 21,580 feet, a B2 for the next 7,011 feet and a B1 for the remaining 17,307 feet.

Table 1 summarizes the Level II riffle, flatwater and pool habitat types. By percent occurrence riffles comprised 13%, flatwater 38% and pools 49% of the habitat types (Graph 1). By percent total length, riffles comprised 5%, flatwater 41% and pools 49% (Graph 2).

Sixteen Level IV habitat types were identified and are summarized in Table 2. The most frequently occurring habitat types were glides, 19%, lateral scour bedrock pools, 19% and runs, 14% (Graph 3). The most prevalent habitat types by percent total length were glides at 25%, lateral scour bedrock pools at 22% and mid-channel pools at 12% (Table 2).

Table 3 summarizes main, scour and backwater pools, which are Level III pool habitat types. Scour pools were most often encountered at 75% occurrence and comprised 75% of the total length of pools.

Table 4 is a summary of maximum pool depths by Level IV pool habitat types. In third and fourth order streams, pools with depths of three feet (0.91 m) or greater are considered optimal for fish habitat. In the Noyo River, 237 of the 274 pools (86%) had a depth of three feet or greater (Graph 4).

Noyo River

The depth of cobble embeddedness was estimated at pool tail-outs. Of the pool tail-outs measured, 0% had a value of 1, 6% had a value of 2, 33% had a value of 3 and 61% had a value of 4 (Graph 5).

Of the Level II habitat types, riffles had the highest mean shelter rating at 86. (Table 1). Of the Level III pool habitat types, main channel pools had the highest mean shelter rating at 69 (Table 3).

Of the 274 pools, 23% were formed by large woody debris: 15% by logs and 8% by root wads (calculated from Table 4).

Table 6 summarizes dominant substrate by Level IV habitat types. Of the low gradient riffles fully measured, 22% had gravel and 44% had small cobble as the dominant substrate (Graph 6).

Mean percent closed canopy was 49%: 27% coniferous trees and 22% deciduous trees. Mean percent open canopy was 51% (Graph 7, calculated from Table 7).

Table 7 summarizes the mean percent substrate/vegetation types found along the banks of the stream. Mean percent right bank vegetated was 71% while mean percent left bank vegetated was also 71%. Deciduous trees were the dominant bank vegetation type in 85% of the fully measured units. The dominant substrate composing the structure of the stream banks was sand/silt/clay, found in 40% of the fully measured units.

DISCUSSION

The information gathered in the process of habitat typing will provide Georgia-Pacific with baseline data on the current condition of this creek and the available habitat for salmonids. These data can be used to identify components of the habitat in need of enhancement so appropriate conditions for Noyo River can be obtained over time.

Level II habitat types by percent occurrence and length

Flatwater habitat types comprised a moderate percentage of the units by both percent occurrence and length at 38% and 41% respectively (Table 1 and Graph 1). These unit types usually do not provide optimal spawning or rearing habitat for salmonids. Riffle habitat units comprised a low percentage of the stream by both percent occurrence and length at 13% and 5% respectively. Pools comprised a high percentage by both percent occurrence and length at 49% and 54% respectively. Riffles usually provide good spawning habitat while pools provide important rearing habitat. In addition, Mundie (1969) reported that invertebrate food production is maximized in riffles while pools provide an optimum feeding environment for coho salmon. In fact, the most productive streams are those consisting of a pool to riffle ratio of approximately one to one (Ruggles 1966).

Noyo River

Pool Depth

According to Flosi and Reynolds (1994), a stream with at least 50% of its total habitat comprised of primary pools is generally desirable. Primary pools are at least two feet deep in first and second order streams and at least three feet deep in third order streams. The information from Graph 4 on maximum depth in pools was used to determine percent of primary pools. The Noyo River, a fifth order stream, is comprised mainly of deep pools with 86% of the pools having a maximum depth of three feet or greater.

Instream Shelter

Instream shelter ratings are derived from two measurements: instream shelter complexity and instream shelter percent cover. The first is a value rating which provides a relative measure of the quantity and composition of the shelter and the second is a measure of the area of a habitat unit covered by shelter. The various types of instream shelter include large woody debris, small woody debris, boulders, root wads, terrestrial vegetation, aquatic vegetation, bedrock ledges and undercut banks. Of the Level II habitat types, riffles had the highest shelter rating at 86. Of the Level III habitat types, main channel pools had the highest shelter rating at 69. These values are fair to good as shelter values of 80 or higher are considered optimal for good rearing habitat (Flosi and Reynolds 1994).

Large Woody Debris

The presence of large woody debris (LWD) in streams is a significant component of fish habitat. Woody debris creates areas of low flow, providing a refuge for fish during periods of high flow (Robison and Beschta, 1990). Woody debris also provides cover for fish, lowering the risk of predation, causes spawning gravel to collect behind it, and promotes general watershed stability. The percent of pools formed by LWD in the Noyo River was 23%. Whether these numbers are high or low, relative to the needs of salmonids is difficult to ascertain since the optimum amount of woody debris in streams has not been specified (Robison and Beschta 1990). However, based on data from Georgia-Pacific's 1995 Aquatic Vertebrate Study, the only coho found in the Ten Mile River Basin were in stream reaches where approximately 50% of pools were formed by large woody debris. Those reaches that did not support coho salmon had a significantly lower percentage of pools formed by large woody debris (Ambrose et al, 1996). This suggests that a low percentage of LWD formed pools could adversely affect juvenile coho salmon populations (C.S. Shirvel 1990).

The above LWD analysis pertains only to pools formed by logs or root wads as described in Flosi and Reynolds (1994)**:** lateral scour pool-log enhanced, lateral scour pool-rootwad enhanced, backwater pool-log formed and backwater pool-rootwad formed. Other pools containing LWD as a component were not included in the calculation. For example, plunge pools may be formed by boulders, bedrock or LWD, but are not described as such by habitat unit types. Therefore, the LWD formed pool calculation is limited to four pool types and does not quantify the total amount of LWD in the Noyo River.

Noyo River

Canopy

There are two important benefits of canopy cover in coastal streams. Canopy keeps stream temperatures cool as well as providing nutrients in the form of leaf litter and organic material (Bilby 1988). This leaf litter, organic material, and the associated nutrients are utilized as a food source by benthic macroinvertebrates (aquatic insects). The macroinvertebrates, in turn, are a major food source for most fish species in forested areas (Gregory et al., 1987). Mean percent canopy cover for the Noyo River was 49%. This is low since a canopy cover of 80% or higher is considered optimum (Flosi and Reynolds,1994).

Wood from coniferous trees deteriorates less rapidly than wood from alders and other deciduous species (Sedell, *et al*. 1988). Coniferous trees, at 27%, occupied a larger portion of the canopy than did deciduous trees at 22%. This indicates a greater recruitment potential for high quality logs as fish cover and LWD formed pools.

Embeddedness

High embeddedness values (silt levels), such as those found in the Noyo River, have been associated with many negative impacts to salmonids. These negative impacts can be observed in important environmental components of salmonid habitat, such as pool habitats, dissolved oxygen levels and water temperatures.

The impact high silt levels have on pool habitat is that they fill in and eventually eliminate pools. As already mentioned, pools provide important habitat for rearing salmonids.

High silt levels also impact oxygen levels in the water. They do so by reducing water circulation within the substrate, thus lowering the oxygen levels needed by salmonid eggs (Sandercock, 1991). This can hinder the survival of the eggs deposited in redds, as well as the survival of juvenile salmonids.

Water temperature is impacted by high silt levels in several ways. Hagans et al (1986) reported the following impacts to water temperatures: 1) the loss of a reflective bottom; 2) darker sediment (as opposed to clean gravels) storing heat from direct solar radiation which is then transferred to the water column; and 3) a reduction in the flow of water through the substrate interstitial spaces thereby exposing more of the water column to direct solar radiation.

Another means by which water temperatures are increased is through the widening of stream channels: over time, high silt levels increase the substrate surface level of the creek, resulting in a wider, shallower stream channel (Flosi and Reynolds 1994). In shallow streams, more surface area is exposed to the sun relative to the volume of water, leading to an increase in solar heating which in turn leads to higher water temperatures.

Substrates embedded with silt in varying degrees were given corresponding values as follows: 0-25%= value 1, 26 - 50% = value 2, 51 - 75% = value 3 and 76 - 100% = value 4. According to Flosi and Reynolds (1994), creeks with embeddedness values of two or higher are considered to have poor quality fish habitat. In the Noyo River, 100% of the pool tail-outs measured had embeddedness values of two or more.

It is important to consider, however, that the above embeddedness values were obtained in the summer during low flow conditions. In winter and spring, flows are usually higher due to the rainy season and the lowered evapotranspiration of the trees. This higher flow can carry away some of the previously deposited silt to sites further downstream. Therefore, embeddedness values may fluctuate throughout the year along different sections of the stream.

Substrate

In the Noyo River, 22% of the low gradient riffles had gravel and 44% had small cobble as the dominant substrate. Collectively, the relatively high concentration of both gravel and small cobble in riffles indicates that there is a sufficient amount of substrate available as potential spawning habitat in this river. However, there are two points that are important to consider: First, although there appears to be a suitable amount of substrate, its effectiveness for spawning is degraded as the level of embeddedness increases. Second, while the percentage of gravel and small cobble in riffles was acceptable, the overall percentage of riffles in the river was low at 13% (Table 1) indicating a lack of sufficient spawning habitat.

Overall, the surveyed portions of the Noyo River appear to have insufficient canopy, high embeddedness values, and a relatively low percentage of LWD formed pools. In addition, while there was sufficient substrate for spawning, habitat for spawning appeared to be limited. This river does appear to have a high percentage of primary pools.

Georgia-Pacific recognizes that there are areas of the mainstem Noyo River in need of enhancement, and where feasible will attempt to restore those areas over time as part of its long term management plan. The company will also attempt to facilitate a healthy environment for salmonids in this river through sound management practices.

<u>RECOMMENDATIONS</u>

1) The Noyo River should be managed as an anadromous, natural production watershed.

2) Sources of stream bank erosion should be mapped and prioritized according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediment entering the stream. In addition, sediment sources related to road systems need to be identified, mapped and treated according to their potential for sediment yield to the watershed.

3) Increase the canopy in the Noyo River by planting willow, alder, redwood and Douglas-fir along the watercourses where shade canopies are not at acceptable levels. Planting efforts need to be coordinated to follow bank stabilization or upslope erosion control projects. Since this is such a wide river, planting trees may not be sufficient because of the time it will take for them to grow to adequate heights for providing canopy. A

proportion of trees already present along the river should be allowed to grow and left to maintain a functional overstory canopy.

4) Large debris accumulations retaining large quantities of fine sediment should be modified carefully, over time, to avoid excessive sediment loading in downstream reaches.

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.

Position (ft):	Comment:
52’	Begin survey 370' upstream from railroad crossing. Channel type is a B3.
295’	One redd (these redds and most of the others noted in these comments were probably created by lamprey)
1,080’	Tributary entering left bank.
2,571’	Water tower structure on left bank at end of pool.
3,757’	Five redds.
4,284,	Young of Year (YOY) salmonids observed.
4,751’	Train crossing over pool.
5,634’	Tributary entering left bank. Possible southern seep salamander (SSS) site.
5,854’	Tributary entering left bank. Possible SSS site.
6,331’	Two redds, tributary entering left bank.
8,030’	Two YOY observed.
9,726’	Four salmonids approximately three inches long, two salmonids two inches long.
9,856’	Two redds.
10,531’	Channel type done here.
12,079’	Hayshed Gulch entering left bank.
12,202’	Gaging station at beginning of unit.

Noyo River

13,392’	Three redds.
16,547’	Confluence pool with South Fork Noyo River.
18,219’	Tributary enters right bank.
18,926’	Third railroad crossing.
20,122’	Six redds.
20,817’	Four redds.
23,592’	Three redds.
24,060’	Five redds.
24,192’	Fourteen redds.
24,732,	Fourth railroad crossing.
28,922,	Possible SSS site on left bank.
29,251,	Tributary enters left bank.
30,117’	Six redds.
30,263,	Bridge crossing.
30,631’	Green filamentous algae found throughout unit.
33,281’	Bridge crossing.
33,795’	Four redds observed.
34,115’	Ten YOYobserved.
34,646’	Bridge crossing. Scour created by cement block from bridge.
34,678’	Scour created by cement block from bridge.
34,866’	Eight redds.
35,554’	Large root wad along right bank providing good cover, two steelhead observed.
35,775’	Six redds.

36,005’	Two redds.
36,063,	Railroad tracks above.
36,423’	Left bank contains many boulders, appears to be artificial (perhaps erosion control) 25' high x 70' long. No vegetation, many of the boulders appear to be falling into creek. Railroad tracks above.
36,687’	Three redds observed.
36,991’	Approximately 80 percent exposed substrate.
38,120’	Three redds observed.
38,292’	Bridge crossing. Scour caused by cement block from bridge.
39,102’	Road crossing over beginning of unit. Bridge crossing 87’ upstream from road crossing.
39,752’	Railroad crossing. YOY observed.
40,360’	Belted kingfisher observed.
40,630,	Three redds.
41,775,	Tributary enters on left bank.
42,099,	Unit separated by gravel bar with willows and alders. Two redds.
42,337’	P & J ranch along left bank of this unit.
42,912’	One 3" STHD observed.
42,985’	Three redds observed.
43,347’	Two redds.
43,624’	Five redds.
43,748’	Four redds.
44,162’	Two YOY steelhead.
44,303’	Bank failure measures 15' long x 30' high. It is contributing sand and gravel to the channel.

Noyo River

44,517’	Four redds observed.
44,831’	Tributary enters on left bank. Possible SSS site.
45,447’	The channel is measured to be a C3.
45,641’	Three inch steelhead.
46,080,	Little Stinker Camp above right bank.
46,411’	Tributary enters on left bank. Possible SSS site.
46,539’	Bank failure along left bank measures 30' long x 30'high.
46,826’	Four redds observed. Train crossing. Scour created by cement block from bridge.
47,239’	Bank failure along right bank measures 30' long x 12' high.
47,780’	Seven redds.
48,886’	Tributary enters on right bank.
49,588’	Railroad crossing. Scour caused by cement block from bridge.
49,706’	Scour caused by cement block from bridge.
50,284’	Six redds. Three red-breasted mergansers observed. Tributary enters on the left bank.
50,804’	Three redds.
51,281’	Tributary enters on the right bank.
51,775’	Large root wad behind log providing good cover.
52,078’	Tributary enters on left bank.
53,202’	Four redds.
53,627’	Five redds. Tributary enters on the left bank.
54,207’	Right bank failure near end of pool measures18' high x 20' wide. Six YOY observed.

Noyo River

54,662’	Two redds. Tributary enters on left bank.
55,435’	Three 40 mm salmonids observed. Two redds.
55,823’	Tributary enters on left bank.
55,897’	Tributary enters on left bank. Possible SSS site.
56,719’	One redd.
57,068’	Eight salmonids observed, approximately two inches each.
57,177’	Six salmonids observed, approximately two inches each.
57,590’	Three redds.
58,055’	Two salmonids observed, approximately two inches each.
58,369’	Tributary enters on right bank.
58,526’	Five redds.
59,409’	Three redds.
60,375’	Five redds. Tributary enters on left bank.
61,571’	Two redds. Two salmonids observed, two inches each.
62,357’	Five inch salmonid observed.
63,150’	Tributary enters on the left bank. Possible SSS site.
63,423’	Eight redds.
63,550’	Tributary enters on left bank.
64,175’	Six redds.
65,130’	Three redds. Three two inch salmonids observed.
65,940’	Tributary enters on left bank. Possible SSS site.
66,411’	Three redds.
66,573’	The channel changes to a B2.

Noyo River

66,682’	Tributary entering right bank at end of unit.
67,416’	One redd. Three salmonids observed at three inches each.
67,613’	Tributary entering left bank at 107'. Possible SSS site.
67,641’	Railroad crossing at end of unit.
67,953’	Tributary enters on right bank.
68,503’	Large madrone fallen over creek, approximately 50' long.
68,634’	Four three inch salmonids observed.
68,805’	Three inch salmonids observed.
69,153’	Five salmonids observed, approximately three inches each.
69,456’	One redd.
69,719’	Three redds, eight salmonids observed, at three inches each.
70,095’	One two inch salmonid, two three inch salmonids observed.
70,403’	About 90% exposed substrate in middle of unit. Four thre inch salmonids observed.
70,805’	Three seven inch salmonids observed, four three inch salmonids observed.
71,720’	Three redds.
71,861’	Five YOY observed.
73,022’	Switchback Gulch entering left bank.
73,727’	Substrate has been predominantly bedrock for last three units.
74,918’	Five redds.
75,654’	From May to September temporary wood dam at boy scout camp. During that time, dam backs water up to about 3000 feet essentially creating one long pool. Tributary enters on left bank.
79,017’	Habitat unit number 457 through 477 affected by dam from May to September.
80,439’	American dipper observed.

Noyo River

80,922’ Tributary entering right bank at end of unit.

81,040’ Six YOY observed.

81,465’ One four inch salmonid observed. Large madrone over creek, approximately 50' long.

82,134’ Not as much bedrock substrate.

82,597’ Two redds.

84,093’ Four redds. Five YOY observed.

84,530’ Tributary entering right bank at end of unit.

85,901’ Seven redds. Duffy Gulch enters on right bank.

86,224’ Tributary enters on left bank.

86,671’ Three redds. Two juvenile raccoons along bank. Tributary enters on left bank.

87,316’ Four inch salmonid observed.

87,538’ Alpine Gulch enters on right bank.

88,965’ Railroad crossing.

89,153’ Tributary enters on right bank.

89,265’ Seven two inch salmonids observed.

90,729’ Three redds. End of survey at Georgia-Pacific property line.