STREAM INVENTORY REPORT

Ten Mile River

WATERSHED OVERVIEW

Ten Mile River is a tributary to the Pacific Ocean (Figure 1). Elevations range from sea level feet at the mouth of the creek to 3,600 feet in the headwater areas. Ten Mile River's legal description at the confluence with the Pacific Ocean is T20N R17W Sec26. Its location is 39°34'14"N. latitude and 123°43'10"W. longitude according to the USGS Dutchmans Knoll 7.5 minute quadrangle.

HABITAT INVENTORY RESULTS

The habitat inventory of September 28, 1996, was conducted by David Lundby and Dave Wright. The total length of surveyed stream in Ten Mile River was 4,055 feet (0.8 miles, 1.2 km) (Table 1). There were no side channels in this creek.

Ten Mile River consists of one reach: a B4 for the entire length of surveyed stream.

Table 1 summarizes the Level II riffle, flatwater and pool habitat types. By percent occurrence riffles comprised 13%, flatwater 44% and pools 41% of the habitat types (Graph 1). By percent total length, riffles comprised 5%, flatwater 55% and pools 40% (Graph 2).

Seven Level IV habitat types were identified and are summarized in Table 2. The most frequently occurring habitat types were glides, 25%, mid-channel pools, 22%, and runs, 19% (Graph 3). The most prevalent habitat types by percent total length were glides at 31%, runs at 24% and mid-channel pools at 22% (Table 2).

Table 3 summarizes main, scour and backwater pools which are Level III pool habitat types. Main channel pools were most often encountered at 50% occurrence and comprised 55% of the total length of pools.

Table 4 is a summary of maximum pool depths by Level IV Pool Habitat Types. In fifth order streams, pools with depths of three feet (0.91 m) or greater are considered optimal for fish habitat. In Ten Mile River, eight of the 14 pools (61%) had a depth of three feet or greater (Graph 4).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the pool tail-outs measured, 0% had a value of 1, 0% had a value of 2, 0% had a value of 3 and 100% had a value of 4 (Graph 5).

Of the Level II habitat types, pools had the highest mean shelter rating at 19 (Table 1). Of the Level III pool habitat types, main channel pools had the highest mean shelter rating at 30 (Table 3).

Of the 14 pools, none were formed by large woody debris (LWD).

Table 6 summarizes dominant substrate by Level IV habitat types. Of the low gradient riffles fully measured, 50% had gravel as the dominant substrate (Graph 6).

Mean percent closed canopy was 20%: 5% coniferous trees and 15% deciduous trees. Mean percent open canopy was 80% (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 63.5% while mean percent left bank vegetated was 57%. Deciduous trees were the dominant bank vegetation type in 85% of the units fully measured. The dominant substrate composing the structure of the stream banks was silt/clay, found in 90% of the units fully measured.

DISCUSSION

When reviewing Ten Mile River data it is important to consider the short distance surveyed. The survey was limited to approximately 4,055 feet with only 31 units; therefore, many of the determinations for the indicated parameters were based on only one or two completely measured units. Determinations based on such a limited sample size may lack statistical validity and therefore are of questionable analytical value.

Level II habitat types by percent occurrence and length

Flatwater habitat types comprised a high percentage of the units by both percent occurrence and length at 44% and 55% 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 percent occurrence and a moderately high percentage by length at 41% and 40% 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).

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 and higher order streams. The

information from Graph 4 on maximum depth in pools was used to determine percent of primary pools. Ten Mile River, a fifth order stream, is comprised mainly of deep pools with 61% 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 quality 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 LWD, small woody debris, boulders, rootwads, terrestrial vegetation, aquatic vegetation, bedrock ledges and undercut banks. Of the Level II habitat types, pools had the highest shelter rating at 19. Of the Level III habitat types, main channel pools had the highest shelter rating at 31. These values are low 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 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. The percent of pools formed by LWD in Ten Mile River was 0%

The above LWD analysis pertains only to pools formed by logs or rootwads 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 Ten Mile 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 their associated nutrients are utilized as a food source by benthic macroinvertebrates (aquatic insects). The macroinvertebrates, in turn, are major food sources for most fish species in forested areas (Gregory et al., 1987). Mean percent canopy cover for the Ten Mile River was 20%. This is relatively low since a canopy cover of 80% or higher is considered optimum, Flosi and Reynolds (1994).

Deciduous trees occupied a larger portion of the canopy than did coniferous trees. Coniferous trees comprised only 5% of the canopy. The significance of this is that wood from alders and most other deciduous species deteriorates more rapidly than wood from coniferous species (Sedell, *et al*. 1988). Therefore, less LWD would be available in the future for fish cover and LWD formed pools in this creek and others dominated by deciduous species.

Embeddedness

High embeddedness values (silt levels), such as those found in Ten Mile 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 Ten Mile 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 Ten Mile River, 100% of the low gradient riffles had gravel/small cobble as the dominant substrate. The high concentration of gravel/small cobble in riffles indicates that there is a sufficient amount of substrate available as potential spawning habitat in this creek. While this creek had sufficient substrate for spawning in the riffles surveyed, the overall percentage of

riffles in the surveyed portions of the creek was very low at only 13 (Table 1). Subsequently, there may be a lack of sufficient spawning habitat.

Overall, Ten Mile River appears to have a relatively high percentage of primary pools and spawning substrate. However, this stream also appears to have insufficient canopy, low shelter values and high embeddedness values. In addition, while there was sufficient substrate for spawning, habitat for spawning appeared to be limited.

RECOMMENDATIONS

Due to marginal habitat and small size of this creek, the net results of any expense or effort directed towards creek restoration, other than maintaining good canopy cover, would not be cost effective.