In 1994 a small-scale instream monitoring project was initiated to evaluate the status of the aquatic environments located on Coastal Forestlands Ltd. (CFL). The purpose of the project was to begin developing baseline instream information, following the most widely accepted and locally utilized protocols. These protocols are being reviewed and implemented by members of the Fish, Farms and Forestry Committee (FFFC) and are designed to quantify specific instream habitats unique to the North Coast. Particularly, critical instream habitat factors potentially limiting salmonid abundance, occurrence and species distribution within watersheds. These critical factors are temperature, sediment, large woody debris, nutrient input and water flow.

Following is a brief discussion of the 1995 instream temperature, particle-size distribution and fish population documented for Inman Creek under this instream effort. A more thorough discussion of methods is discussed in the 1995 Instream Monitoring Proposal.

Stream Temperatures for Inman Creek Watershed

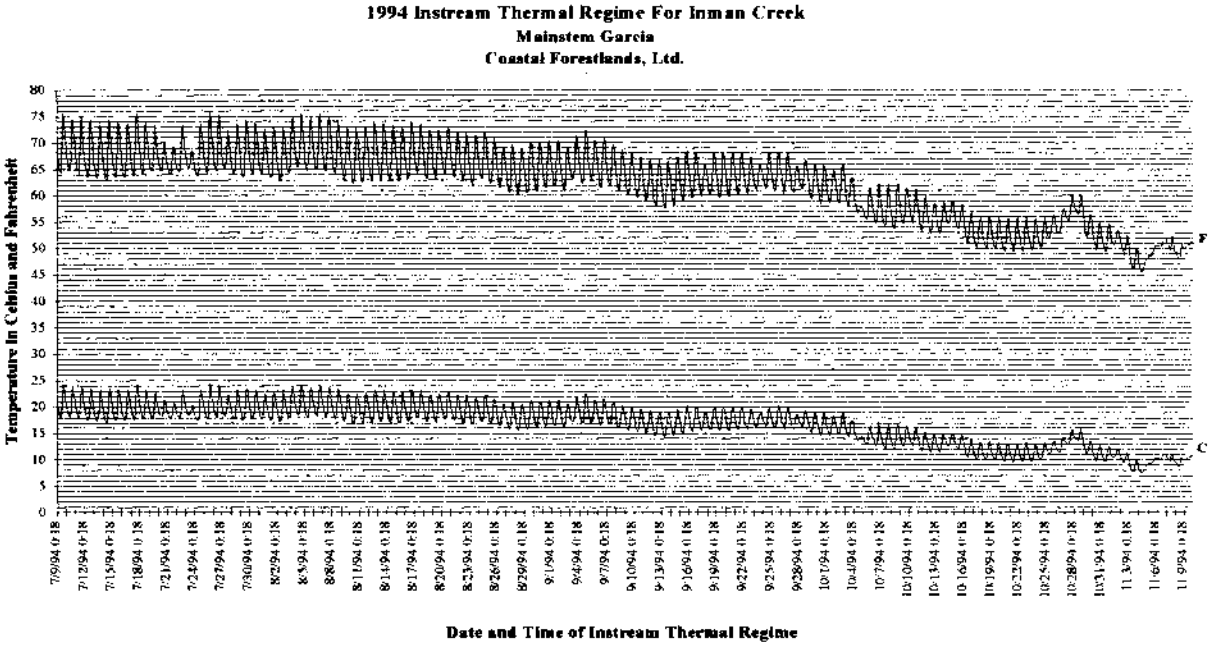
Streams reach highest temperatures from mid- to late summer, the time of greatest solar incidence and ambient air temperature in Mendocino County. In order to address concerns relative to the instream environment on CFL, instream probes, Hobo-Temps®, were placed across the ownership. The Hobo-Temp probes were designed to record instream temperatures between June and October at 2.4 hour intervals. Specific information was collected during Hobo installation for Inman Creek (CFL Hobo-Temp Data Form). Specific thermograph locations are mapped and attached to Hobo-Temp Data forms.

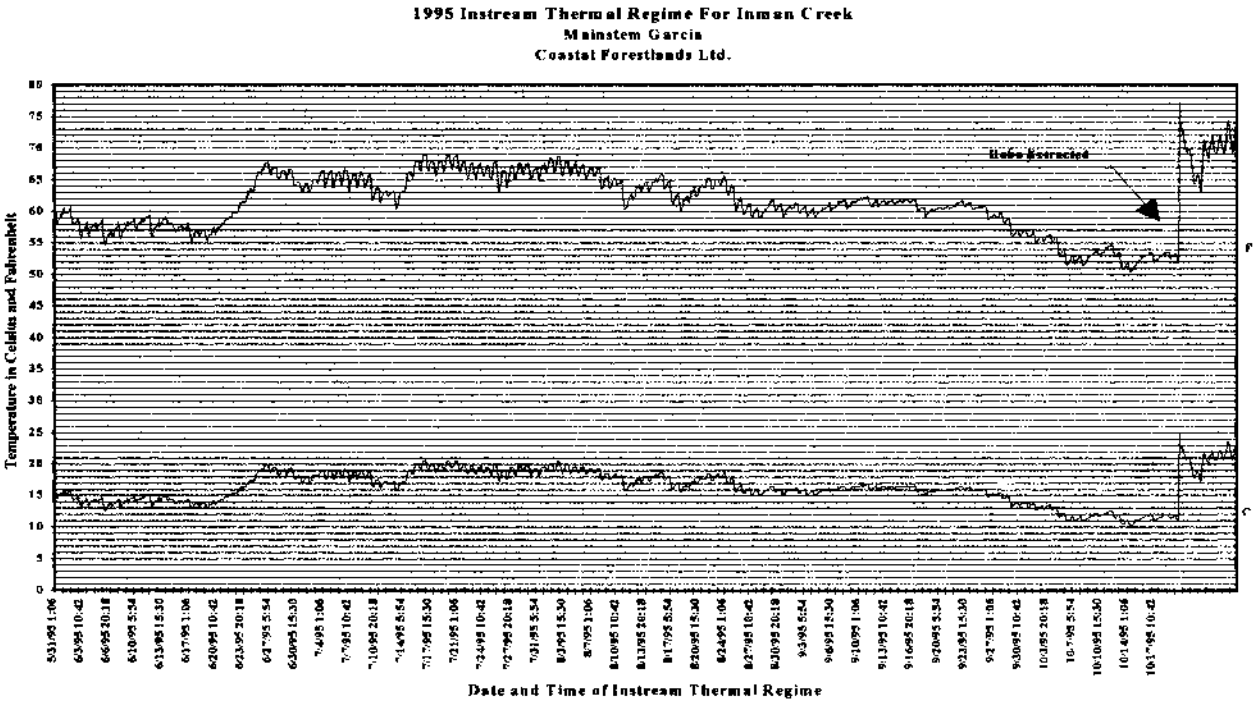
A variety of interactive factors strongly dictate local thermal regimes and should always be considered when evaluating stream temperatures. In general, these factors are: topographic location, channel morphology, ambient climate, channel slope, rate of flow, type and density of riparian vegetation and water surface area exposed to solar radiation. Unfortunately, discussion of these factors is far beyond the scope of this memorandum.

The management threshold temperature to evaluate instream thermal quality has been defined by Bradley Valentine, wildlife biologist for the California Department of Forestry (Valentine 1994). Temperatures are considered limiting to salmonids if "maximum summer temperature exceeds 20° C (or 68° F) for 2 weeks or more during the summer low flow" (Reeves 1989 in Valentine 1994). This threshold is consistent with standards set by local agencies and other instream committees across the North Coast and is typically used by persons conducting instream monitoring in the Redwood Region (Fish, Farms, and Forestry Technical Committee, 1995).

One temperature monitoring probe was placed in lower Inman Creek in 1994 and 1995 near the CFL and Louisiana Pacific property boundary.

Graph 1 & 2





Stream temperatures were dramatically different between years: 1995 temperatures were much lower and less variable than temperatures in 1994 (Graphs 1 & 2). Temperatures in 1994 varied between 15°C and 25° C during the critical summer months. Temperatures in 1995 varied between 15° C and 21° C during the critical summer months with a distinct increase in stream temperatures between 20 June and 27 June*[*]. It is my opinion that this data set sufficiently bracketed the critical summer months in 1995 as indicated by the increase in stream temperatures in June and the subsequent decrease in late September. The instream thermal regime in 1994 and 1995 exceeded management thresholds.

The dramatic difference in temperatures between years could be due to: (1) increase in cool-water inputs, (2) seasonal variation (i.e. cooler summer), (3) unknown phenomenon, (4) malfunctioned Hobo-Temp. To address the possibility of Hobo-Temp malfunction, temperature peaks subsequent to Hobo-Temp extraction from the stream was provided in the 1995 graph. Normal reactions by the Hobo-Temp to removal was observed. A Hobo-Temp malfunction is still possible, but unlikely. Hence, data from 1996 will be heavily scrutinized and is expected to provide insight to temperature conditions along Inman Creek.

Although only preliminary information, the instream thermal regime for Inman Creek exceeds the management threshold of 20° C; hence, temperatures would be considered limiting to the survival of Coho Salmon and Steelhead juveniles over the critical summer months. The tepidity of this instream environment could be attributed to many factors, including, but not limited to: topographic positioning, riparian canopy cover, sources of cool-water influence, air temperature and stream flow.

Temperature Effects on Fish

So what do these temperatures *really* mean to fish? Although optimal temperatures for most salmonid species range between 12-14° C, the impacts of threshold temperatures to natural fish populations is not well documented. Sub-lethal and lethal effects vary according to factors such as acclimation temperature, duration of temperature increase, daily fluctuations and ecological adaptations (Bjornn and Reiser, 1991). Studies have shown that many populations of native salmonids respond to natural temperature patterns in streams by moving upstream or downstream when water temperatures become unsuitable (Bjornn and Reiser, 1991). In small streams where daily maximum temperatures approach lethal values, salmonids can thrive if the temperature is high for only a short time and then declines into the optimum range (Bjornn and Reiser, 1991).

[*] * This distinct increase in temperature between 20 June and 27 June of 1995 occurs on many other instream data sets collected from CFL

Fish Sampling for Inman Creek

Fish sampling was conducted for Inman Creek in 1994 by Theodore Wooster, CDF&G Environmental Specialist IV, and myself. Although only opportunist data was collected, Steelhead were abundant (CFL Fish Sampling Data 1994).

Instream Sediments for Inman Creek

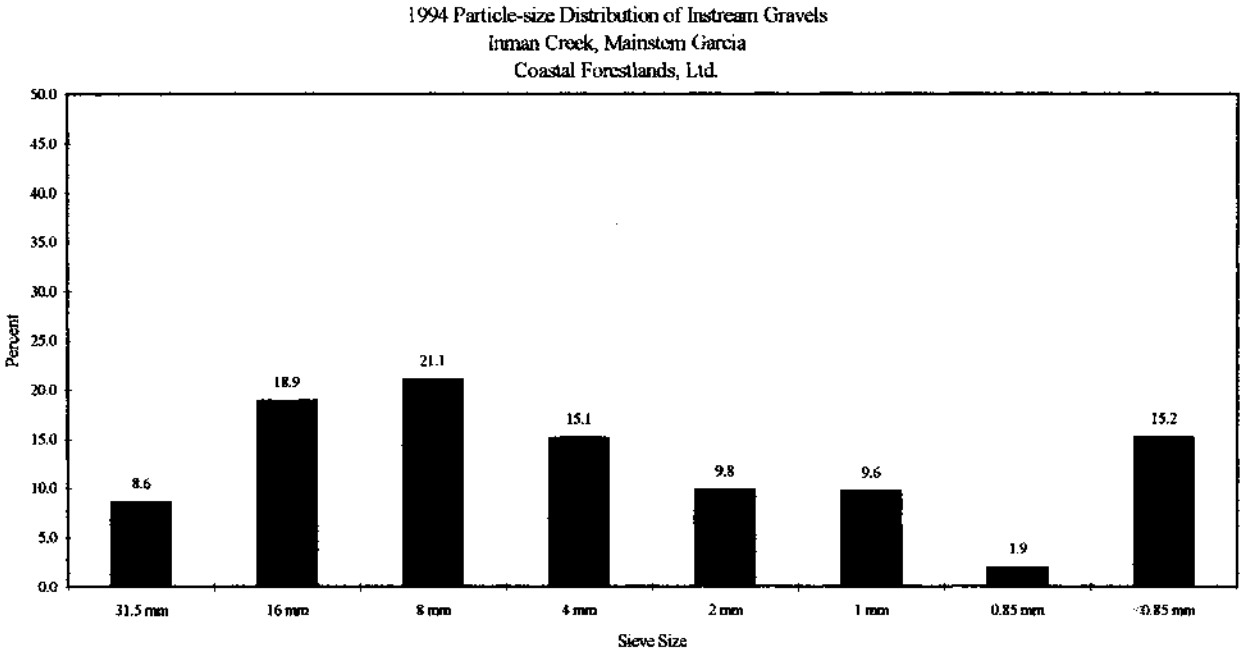
Anadromous fish exhume pits, called "redds", at the pool/riffle juncture of spawning streams, deposit their eggs and cover them with upstream substrate. Egg incubation period for salmonids ranges between 2-6 months and following hatch, the young fry maneuver through the gravels to reach the water column. High levels of fine instream sediment (less than 0.85 mm) can reduce intergravel flow through the redd and, thus, restrict the availability of oxygenated water from reaching the eggs, resulting in low survivorship. Additionally, high sedimentation can create an impermeable layer within redds, preventing emerging fry from reaching the surface. Subsequently, stream gravels are often evaluated to estimate egg-to-fry survival to emergence and have been identified as limiting for salmonids. To address these concerns, stream substrate was collected with a McNeil sediment sampler (McNeil and Ahnell 1964). McNeil samples, of all the current instream metrics (V*, Q*, RASI, etc...) provide the best biological link between instream gravel composition, salmonid spawning and fry survivorship (Dr. Bill Trush, Humboldt State University; FFFC 1996).

Since no single statistic can serve as an effective indicator of gravel quality (Kondolf and Wolman 1993; Young et al. 1991; Chapman 1988; Beschta 1982), results are typically expressed in three forms: 1) Percent finer; 2) Geometric mean diameter and 3) Fredle index. Percent finer represents the percent of substrate collected within a particular sieve size, quantified by volume. Geometric mean diameter and the Fredle index describe potential suitability and composition of spawning gravels. The most widely accepted management threshold to evaluate quality of spawning gravels is 20% fines, less than 0.85 mm (Lisle and Eads 1991; Valentine 1993; FFFC Draft 1996).

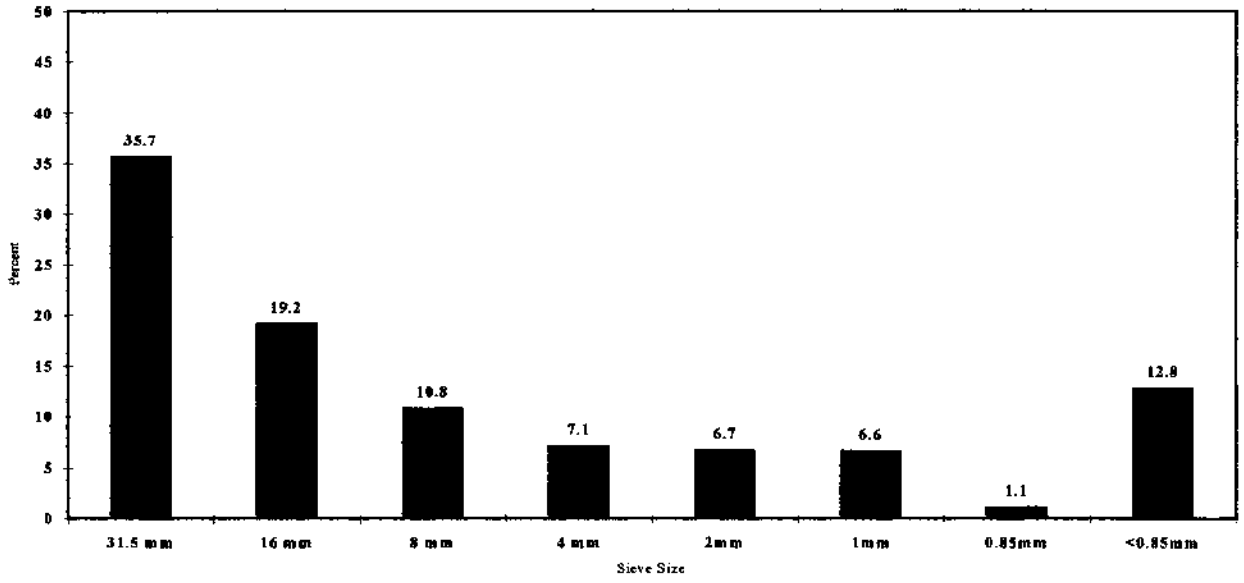
Particle-size distribution of the instream substrate was evaluated for Inman Creek and is presented in graphical form*. Percent fine levels (>0.85mm) were 15.2% in 1994 and 12.8% in 1996 (Graphs 3 & 4). These numbers do not reach the standard management threshold of 20%. More distinct changes occurred within the cobble and gravel size classes. Bear in mind that sediment sampling is only a "picture-in-time" and conclusions cannot be formed from only two years' data.

* Geometric Mean Diameter and Fredle Index are not presented for this report.

Graph 3



Graph 4



Instream Monitoring Conclusions

Temperatures for Inman Creek exceeded management thresholds for 1995. Sediment levels are below management thresholds; nonetheless, initial results can only provide site-specific information and may not reflect representative condition of the watershed. These data, when compared over-time to future efforts, can eventually provide valuable information on trends. Until then, broad-based conclusions cannot be made.

With the likely listing of the Coho Salmon, under the Federal Endangered Species Act, areas within the historic range of this species will undoubtedly be scrutinized by regulatory agencies. Five watershed processes (or habitat factors) have been identified as significant to the survival and reproduction of Coho Salmon. These are: temperature, large woody debris, canopy cover, stream flow and nutrient input. Restrictive measures will focus on key Coho Salmon areas, relative to the five watershed processes. Efforts to address these concern should focus on 1) protecting the existing habitat from further degradation and 2) provide mitigations to ensure the recovery rate of this species is not impeded.

In order to address these concerns for Inman Creek, recommended mitigations *could* include:

- Increasing shade canopy retention levels for all perennial watercourses
- Riparian planting
- Recruit professional opinions on sediment reduction from Jack Monschke, CFL Watershed Specialist
- Remedial projects (e.g., stabilize old or failed instream landings, re-establish diverted watercourses)
- Mulching (e.g. on spoils, side-casts and near the mouth of culverts)
- Rolling-dips at stream-crossings
- Properly sizing culverts
- Closing/abandoning un-used roads
- Gating roads to public access
- Rocking roads

Thank you for your time and consideration. If you have any questions please feel free to contact me at (707) 964-1959 or at the CFL office in Willits (707) 459-3093.

With Regards,

Charlotte Morrison
Consulting Wildlife Biologist