January 9, 1979

Mr. Cliff Fago
Department of Forestry
Room 1516 - 30
1416 Ninth Street Sacramento, California 95814

Dear Cliff:

Enclosed, as promised, is a description of the fishery resources at the Hare Greek drainage. Also enclosed is a description of potential adverse impacts of timber harvest on fishery resources if carried out in an improper manner.

If I can be of further help please call.

Weldon E. Jones
Assistant Fishery Biologist
Region 3

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Baker
Acting F.W.S.

The fishery resource of Hare Creek drainage is characterized by the silver salmon-steelhead trout-sculpin association. The most significant fishery values are the anadromous, silver salmon and steelhead trout, resource. Both of these species have nearly identical life cycle patterns, entering the stream from the ocean as adults, migrating upstream for spawning, and the juvenile remain in the stream for a period of a year or more before migrating to the ocean.

The silver salmon and steelhead trout spawning migrations occur during the late fall and early spring. Silver salmon usually migrate first, November through February. The steelhead migration occurs from late November through April. Most upstream migration occurs during and immediately following periods of heavy storm runoff. Such runoff provides for the physical transport and upstream attraction of adult fish.

The average size of a spawning silver salmon or steelhead is smaller on the short coastal streams as compared with runs on larger streams such as the Eel, Klamath and Russian Rivers. Although fish 12 to 32 inches in length spawn in Hare Creek drainage, most fish are within the 12 to 22 inch size class.

Provided that suitable gravel deposits and sufficient streamflows are present, spawning in accessible reaches of most primary and secondary tributaries. Adult steelhead begin their return migration to the ocean soon after completion of spawning. Silver salmon die after spawning.

Following egg incubation and hatching, juvenile silver salmon and steelhead emerge from the gravel and enter the free-floating stream environment. Most emergence occurs during the period from February through June, silver salmon emerging generally before steelhead. Emerging fry seek and move into suitable nursery habitat consisting of pools, glides and the lower velocity areas of riffles.

Juvenile steelhead spend a varying amount of time in the stream environment before migrating downstream to the ocean. The length of freshwater residency may vary from several

months to three years or more. Silver salmon residency in freshwater may extend up to one year. The length of time juveniles spend in freshwater depends upon living conditions in the stream. These conditions include magnitude of streamflow, water temperature, dissolved oxygen content, water quality, shelter, competition from other species, predation and availability of food.

The peak downstream migration of juveniles occurs during the period from February through June, and is influenced by the pattern of runoff. For Mendocino County coastal streams, this out-migration is composed primarily of juvenile silver salmon and steelhead one and two years of age.

Adult silver salmon and steelhead runs in the Hare Creek drainage have not been enumerated. Estimates by local Department personnel place the annual spawning run, depending on the water year, at 200 to 300 adults.

High winter flows during periods of storm runoff provide upstream attraction and produce water depths necessary for adult steelhead to ascend Hare Creek and the tributaries. Bunker Gulch and the South Fork of Hare Creek, Fish have physical access to approximately 3 miles of Hare Greek, 1 mile of the South Fork, and 2 miles of Bunker Gulch Creek.

Gravels in the South Fork of Hare Greek and Bunker Creek are within the size range acceptable to steelhead trout. Steelhead are opportunistic spawners and will select the best gravel of what is available. This characteristic helps maintain viable steelhead populations in a variety of stream types.

In the absence of significant water diversion and pollution. Hare Creek offers important summer-fall nursery habitat for both juvenile silver salmon and steelhead. Springs produce a perennial streamflow that sustains nursery habitat throughout the reach utilized by these fish. Summer water temperatures range between 55° F and 65° F, well within acceptable limits for steelhead trout. Pool,, shelter and escape cover are present.

Angling for adult silver salmon and steelhead during the fall-winter sport fishing season is legally not permitted in the Hare Creek drainage. Most angling use occurs during the general trout season. Trout caught on the mainstream and tributaries during the "summer trout season" are, in fact, juvenile silver salmon and steelhead. Most summer angling is by local residents. Magnitude of use is unknown.

In addition to silver salmon and steelhead trout, the Hare Creek drainage supports populations of prickly and coast-range sculpin, threespine stickleback and lamprey. Crayfish are present throughout the drainage.

## EFFECT OF PROPOSED PROJECT 5 APPROPRIATION ON FISHERY RESOURCES

The Department of Fish and Game is concerned that the proposed timber harvest, if carried out in an improper manner, could be extremely damaging to both anadromous and resident fishery resources.

It is possible to physically destroy thousands of fish through crushing them with heavy equipment if operated in the stream. However, most losses of aquatic resources relative to timber harvest activities result from heavy increases in turbidity and settleable solids (siltation). Siltation is one of the most severe problems occurring in stream habitats, especially in streams utilized by salmon and steelhead. Siltation may adversely affect fish in several ways, some of which are not readily apparent to the untrained eye.

Increased turbidity allows more of the sun's rays to be absorbed into the water, thereby increasing water temperatures. This can raise the stream temperature to a level which is unsuitable for cold water fishes such as salmon and steelhead. Also, an increase in water temperature lowers the amount of oxygen which can be dissolved into the water.

Increased siltation is most damaging during dropping or low water flows. The amount of material which a stream can transport is directly related to water velocity. Thus, if a streambed is disturbed at low flows, the silt drops out of the water rapidly. This material then settles into downstream spawning gravels, causing several problems. Developing fish eggs, for example, are soon smothered as the deposition of silt stops the flow of water through the gravels depriving the eggs of oxygen and eliminating the flushing of toxic metabolic wastes. Also, as the fine silts and sand settle into the gravels, they "cement" the gravels together. Once the gravels become cemented, adult fish are no longer able to dig nests to lay their eggs. It may take as long as five to ten years for gravels to recover their original spanning potential

once this has occurred. Filling in the spaces between the gravels with sand and silt also smothers out most of the aquatic insects which form the bulk of the food for stream fishes. Elimination of this portion of the food chain eventually results in the loss of all animals dependent on this food source. Siltation also results in the filling in of pools, important for resting and nursery areas. Fish, for the most part, cannot swim all the time. If they do not have pools or relatively quiet waters in which to rest, they will eventually die of exhaustion. Excessive turbidity will also severely reduce the amount of light reaching the stream bottom. Without sunlight, green plants such as algae cannot undergo photosynthesis, resulting in a loss of the green plants in the stream system. Since these plants form the basis for the entire food chain, their loss is extremely damaging to the stream ecosystem.

Excessive sand in a stream during high flows can adversely affect adult salmonids by abrading the slime from the fishes body, allowing for bacterial infections.

Adult fish are extremely difficult to kill by direct clogging at the gills with silt. However, the smaller the fish, the more susceptible they are to this problem. Thus, with extremely heavy siltation the younger, smaller fish will probably die first.

Siltation problems in coastal lagoons and estuaries are similar to those in the stream; reduced photosynthesis, deposition of materials in the bottom which shrink the available habitat, and warming of the water.

Timber harvest adjacent to streams are often accompanied by destruction of riparian habitat. Loss of this habitat will reduce the amount of shade available, causing warming of the water. Streamside vegetation also attracts many terrestrial insects which fail into the water and provide food for the fish in the stream.

A logging activity does not have to occur in an area utilized by fish to be damaging. Many of these activities take place on minor tributaries which may not support any fish life. However, winter storms may wash siltation downstream to areas where fishery values can be heavily damaged. It should also be recognized that many small tributaries support fish spawning in the winter and spring and go dry during summer and early fall. Fish hatched in these areas will often move downstream into areas of permanent water and summer nursery areas.

As shown, the problems caused by timber harvest are often extremely deleterious to fish life. Unfortunately, they do not result in dramatic fish kills which are relatively easy to handle in court. Fish suffering from exhaus-tion and starvation usually die gradually and in small -numbers up and down the stream where they are picked off by predators such as birds and raccoons. Usually there are no dead fish to present as evidence in court. Also, fish that are never hatched due to damaged spawning gravels never enter the stream ecosystem at all.

Another point is that many birds and mammals are dependent upon a healthy stream ecosystem for food. Reduction of aquatic insects and/or fish may have a severe affect upon these birds and mammals. Thus, a stream supporting any aquatic organism is extremely Important to riparian wildlife species.