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Land Use Impacts On The Fisheries Of The Swan Drainage

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A unique combination of economic and political events beginning about ten years ago allowed the Montana Department of Fish, Wildlife and Parks and the U.S. Forest Service to conduct a unique basinwide fisheries study in the Swan River drainage in northwestern Montana. The study was funded by the Bonneville Power Administration as part of the Columbia River Basin Fish and Wildlife Program and it's objective was to determine the cumulative biological and economic impacts of 20 proposed small hydroelectric projects on the fisheries of the Swan River drainage. These projects on small tributaries to the Swan River would have consisted of a small diversion dam and corresponding underground pipelines to transport water 1/2 to three miles downhill to the powerhouse where the water would be returned to the stream. A major concern to fishery biologists was that a substantial amount of silt would enter the stream due to excavation of pipeline routes in steep unstable terrain within stream corridors. Excessive sediment in streams can clog the streambed, suffocating incubating trout eggs and filling the spaces between and underneath cobbles where young trout often reside. The presence of migratory fish like bull trout compounded the problem since negative impacts on spawning and rearing success in small headwater nursery streams would eventually effect the fishery of Swan Lake.

The first and most time consuming step of the study was to survey and inventory fish populations and habitat quality in 260 miles of the 46 tributary streams considered in the study. The streams were divided into 102 physically distinct segments (or "reaches") and ground surveys were conducted on 74 of these during the summers of 1982 and 1983. These two-day surveys were conducted by crews of two fisheries technicians and included numerous measurements of stream habitat (stream bed and bank characteristics) and an estimate of the number and species of trout present was made using electrofishing equipment. Also, surveys were done in 1983 to determine the number of anglers, their catch, and the economic value of their fishing on Swan Lake (2700 acres), 53 miles of the Swan River, and the 260 mile tributary system.

The tributary and river surveys showed that the Swan system differs markedly from the way it was prior to the arrival of white settlers in the west. Westslope cutthroat trout, once the dominant native trout species, are now found almost exclusively in the remote headwaters of the steepest ~~small mountain~~ streams which probably are too inaccessible and environmentally harsh for introduced brook trout and rainbow trout to colonize. The lower reaches of most tributary streams have essentially ~~mostly~~ been taken over by brook trout while the river itself is now populated primarily by rainbow and brook trout. The near-absence of cutthroats in the lower ends of the tributaries, the river, and Swan Lake indicates that the migratory cutthroat common in the Flathead Lake/River system has disappeared in the Swan. This observation is not atypical of many Montana watersheds where competing exotic fish species have been introduced. Compounding the problems for migratory cutthroat in the Swan are introductions of kokanee salmon and predatory northern pike in Swan Lake.

Fortunately, the population of native bull trout has managed to survive the changes in the drainage that have occurred in this century. The study findings showed about 5,000 bull trout longer than 16 inches reside in Swan Lake. This is a much denser population than in Flathead Lake or Pend Oreille Lake in Idaho. Growth of these fish is very good in Swan Lake where fish average about 20 inches long after six years. Each year about 1000 adults leave Swan Lake to spawn during the fall in four main tributary streams where 90% of all bull trout spawning in the entire Swan drainage occurs. The young bull trout spend one to three years in their natal streams before emigrating to Swan Lake where growth accelerates and maturity is attained. Habitat and fish population surveys in tributary steams showed that unlike brook trout, young bull trout were very sensitive to fine sediment in streambeds. The highest numbers of juvenile bull trout were found in large streams having relatively coarse substrate with very little fine material. Other studies have shown that young bull trout prefer to live on, or even <u>in,</u> the streambed. The more coarse and unsedimented the streambed, the more "nooks and crannies" for young bull trout, hence higher population densities.

The critical link between sediment in streambeds and concurrent land use practices (logging, road construction, and proposed hydro project construction) was identified by Mike Enk, a fisheries biologist with the Flathead National Forest. He meticulously inventoried all roads, skid trails, and logging units by age, size and the type of land they covered in the drainages of 46 of the stream reaches that had been ground surveyed by fisheries crews. Using erosion coefficients developed in other USFS studies for specific land types and development activities, it was possible to roughly estimate the amount of sediment delivered to the streams under "natural" and "developed" conditions. The results of the sediment analysis showed that the amount of sand and silt in the streambeds of Swan tributaries was determined primarily by the steepness of the stream channel and the amount of road construction in the drainage. ~~area.~~ Roads built in association with logging operations (rather than the logging itself) have been identified as the main sediment-contributors in some other studies in the West as well. The reason for this is that during runoff and rainstorms, roads serve as "conduits" that rapidly transport sediment laden runoff water to streams.

One of the end products of the study was a computer model that would predict the amount of sediment (and subsequent juvenile bull trout losses) that would [redacted] result from various amounts of road construction in the Swan drainage. The model estimated that at present, juvenile bull trout density is about

6-7% below what it should be due to road-generated sediment in the beds of nursery streams. An additional 1-2% loss was predicted from sedimentation if the hydro projects were built, however, none ever were. The additional losses due to sedimentation of spawning grounds were not determined. The greatest negative effect probably would have resulted from stream dewatering if the hydro projects had been built since several projects were proposed on key bull trout nursery streams.

While the results of this study were a significant contribution to the state-of-the-art for determining the influences of land use activities on fisheries in a river drainage, they are certainly not the last words on the subject. The science of quantifying and predicting drainage-wide impacts is still in its infancy and our study though extensive, was relatively crude and the predictive models have not been verified by field testing. ~~tests.~~ In spite of a large amount of accomplishment to date, much needs to be done. Unfortunately, quantifying and tracking sediment created by land disturbances in a drainage is much like attempting to make accurate long-range weather forecasts. Just as each weather system differs, do does each watershed.

Many fisheries biologists believe that improved long-term watershed monitoring by land management agencies such as the USFS and BLM will do much to foster better understanding of relationships between land use, aquatic habitat quality, and fish production in western watersheds. This will result in better decision making and better habitat management. One way for concerned citizens to take an active role in protecting and improving fish populations and habitat in our river drainages is to actively participate in the ongoing National Forest planning process and stress the need for increased long-term watershed and fisheries monitoring.