STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES
July 1997

Muskegon River Watershed Assessment

Richard P. O'Neal

FISHERIES DIVISION
SPECIAL REPORT
Number 19 [Excerpt]

Dams and Barriers

There are numerous dams and impoundments in the Muskegon River watershed (Figure 11). Many dams are not registered with the State of Michigan and are established on tributary streams. Impoundments of these small dams are usually for swimming, fishing, wildlife, and aesthetics. Many small impoundments are often created by improper placement of culverts for road crossings over streams. Some of the registered dams are lake level control structures on the outlets of lakes.

There are 32 dams registered with the State (Table 15). Four dams are currently located on the mainstem and include Reedsburg Dam (constructed in 1940), Rogers Dam (constructed in 1906), Hardy Dam (constructed in 1931), and Croton Dam (constructed in 1907). Reedsburg Dam is a wildlife flooding located at the headwaters of the river, just below Houghton Lake. The other three are large hydroelectric dams with large impoundments, located in the middle portion of the river (Figure 2). Two other dams were located on the mainstem but have been dismantled. Newaygo Dam was constructed in 1900 and dismantled in 1969 and Big Rapids Dam was constructed in 1866 and dismantled in 1966 (hydropower starting in 1906). Remnants of the Big Rapids Dam (the sill) are still present.

Dams and impoundments affect river ecosystems in many ways. Some effects are obvious and can be measured directly using relatively short studies. Other effects are more subtle, occurring over long periods of time, and requiring long, expensive studies to evaluate. Most dams on the Muskegon River were built before any information on river habitat and biological communities was collected, and this makes assessments more difficult. A number of studies have recently been conducted on the major hydroelectric dams as a requirement of the Federal Energy Regulatory Commission relicensing process.

Dams directly and indirectly affect aquatic communities in various ways. Direct effects include entrainment and fish mortalities in hydroelectric turbines, and blockage of movement of aquatic organisms. Fish mortalities occur in all types of hydroelectric

turbines and spillways across dams, and they often occur in significant quantities. Fish entrainment and mortality has been found to be a problem at the three hydroelectric dams on the Muskegon River. Total annual entrainment at the three dams is currently estimated at 301,583 fish and 79% of these are game fish. Total annual mortality is 44,042 fish, with 31,055 (70%) game fish and 12,987 (30%) nongame fish killed (Table 16). The estimated economic value of fish mortalities ranges from $52,256 to $328,570, annually. Overall, Croton Dam has the largest entrainment rates and fish mortalities, followed by Rogers Dam, then Hardy Dam (Table 16). Economic values of fish losses provided in Table 16 are calculated using two methods. The two methods provide a range of monetary values that indicate the extent of economic loss from direct fish mortalities. Mitigation for these losses is provided for in the 1994 Settlement Agreement (Appendix 3). Monetary losses in the Settlement Agreement for these three dams were negotiated at $62,000 annually (1992 dollars). Monetary retribution will decrease as fish protection devices are installed and fish mortalities decrease.

Blockage of movement produces fragmentation of the river system and occurs for both fish and aquatic invertebrates. Aquatic insects drift downstream as larvae until suitable habitats are found. After maturation, adults fly upstream to reproduce. Downstream movements of these insects can be inhibited when encountering reservoirs and upstream movement of adults can be inhibited by the dam structure and reservoir size. Many potamodromous (walleye, salmon, steelhead, lake trout) fish migrate long distances within rivers as part of their life histories. Generally these movements are for reproduction. Additionally, many river fish (brown trout, rainbow trout, northern pike, channel catfish, smallmouth bass, brook trout, Arctic grayling) also migrate within the river system as part of their life histories (Schlosser 1991). These movements are associated with reproduction, foraging, different summer and winter habitat requirements for cover, water temperature, velocities, and depth. Genetic viability of resident and non-resident river species can be decreased by barriers in a river (Kapuscinski and Jacobson 1987).

Mussels are affected by dams and impoundments in various ways (Fuller 1974). Low oxygen, water pressure, parasitism and siltation limit adult mussels in impoundments. Mussel reproduction is affected by changes in glochidial hosts (primarily fish), delays in maturation from cold water, siltation, and changes in drift patterns of young.

The affect of dams on habitat include: changes in water quality for temperature and dissolved oxygen; changes in river flows for "peaking" operations with resulting losses in downstream fish habitat due to high water velocities or uncovering and drying of the stream bottom during low flows; changing channel cross sections; increasing sediment erosion and lowering habitat diversity, increasing water evaporation in the reservoir with resulting loss of water flow in downstream sections; disrupting normal downstream movement of woody materials that is important habitat for aquatic life; covering and blocking the highest gradient and most productive habitats; and creating lake environments within the river system resulting in lower fish productivity and shifts in fish communities favoring lake species, that in turn affect upriver and down river fisheries. The 1994 Settlement Agreement provides mitigation of some problems at the hydroelectric

dams. Marion Dam on the Middle Branch River, and Miller Dam on the Hersey River are causing substantial water temperature increases (refer to Water Quality).

Sometimes, dams offset current problems in a river system. When development increases water temperatures or sediment erosion, reservoirs can act as sediment and cold water traps, which can reduce downstream effects on the aquatic system. Pest species, such as sea lamprey, can be blocked from upstream river sections used for spawning, by dams. Some dams on the Muskegon River are currently producing some of these benefits for sediment removal and lamprey blockage. It must be pointed out that these dams were not built for these purposes and better alternatives are available to remedy the sediment and lamprey problems. Lamprey can be blocked by low head or electric barriers that do not have other negative effects of hydroelectric dams. Excessive sediment erosion needs to be dealt with using proper agricultural practices and non-point source control methods. Use of dams for sediment removal is only a temporary solution, because a reservoir will eventually fill with sediment or the dam will be retired from use. When this happens, the volume of stored sediment can be so large there may be no solution to remove it.

Numerous bridges and culverts are creating barriers to fish passage due to excessive water velocity or elevation of the culvert over the streambed. Poor design of bridges and culverts create excessive water velocities. Culvert elevation results from improper installation in conjunction with continuing natural streambed erosion. Some of the known problem sites include Little Henna Creek (Muskegon County), Rosy Run Creek (Mecosta County), Sand Creek (Newaygo County), and many Mecosta County culverts. A road crossing inventory needs to be completed for the watershed.

The old Big Rapids Dam sill is still in place in the mainstem and is a barrier to fish passage. Efforts are currently underway to remove this structure.

Offer of Settlement Hydroelectric Dam Issues

Three hydroelectric dams on the main segment of the Muskegon River were relicensed for operation, by the Federal Energy Regulatory Commission (FERC), for a 40 year period beginning in 1994. FERC provided for review and consideration of natural resources issues as part of the relicensing procedure. Resource agencies (Michigan Department of Natural Resources, United States Department of Agriculture Forest Service, United States Department of Interior Fish and Wildlife Service, United States Department of Interior National Park Service, and Michigan State Historic Preservation Officer) and Consumers Power Company worked for several years to study and evaluate environmental effects of these dams on the Muskegon River system. Negotiations between Consumers Power Company and resource agencies resulted in a proposed Settlement Agreement designed to provide mitigation for many hydroelectric dam effects on the river system. The Offer of Settlement was submitted to the FERC along with the new license applications and licenses were issued in July 1994. Most components of the proposed Settlement Agreement were incorporated as provisions of the new licenses.

The final Settlement Agreement for Rogers, Hardy, and Croton projects on the Muskegon River is included in Appendix 3. The Settlement concerns the resolution of issues on: land

management including recreational facilities and leases; protection for movement of fish from the impoundments into turbines or downstream areas; water quality (water temperatures, dissolved oxygen, contaminants, sediment); historical and archeological resources; stream gauging and water quality monitoring; fish passage structures; project boundaries; dam retirement studies and trust fund; project coordination; resource agencies review and consultation; disputes; liquidated damages; soil erosion control; and stream flows through Rogers, Hardy, and Croton dams.