

Introduction

For most of Michigan's streams, the physical and ecological processes that determine channel conditions (or habitat for fish) have been degraded by human activities to the detriment of the fisheries. All of our streams and watersheds have been perturbed to some extent; many have been extensively damaged to the point where fisheries and aesthetic attributes have been severely diminished. Michigan Department of Natural Resources (MDNR), Fisheries Division seeks to:

Protect Michigan's streams from further degradation and restore, to the extent possible, their fish habitat, fish populations, and recreational potential.

This is best done by protecting and restoring flow dynamics, channel morphology, and sinuosity of streams. Restoration and protection programs should not be separated, because restoration programs must be coupled with perpetual protection of streams from new or ongoing degradation.

Michigan Chapter of the American Fisheries Society (MCAFS) developed a policy statement (Appendix A.) on stream protection and restoration in 1994. Their statement compliments this guide very well, and it is fully endorsed by MDNR, Fisheries Division. They defined *restoration* as movement of an ecosystem toward an approximation (not necessarily a re-creation) of its condition prior to disturbance. This definition acknowledges some of the realities of today's world. Clearly, it is impossible to restore all Michigan's river systems to their conditions prior to the arrival of European settlers. A number of fish and wildlife species have become extinct. Important genetic strains of surviving species have been lost and are probably unrecoverable. Many exotic species have been established and are thriving. Human population increases and related land-use activities have caused massive and relatively permanent changes to the landscape. However, it is still possible to improve the state of health and usefulness of all Michigan's river systems through well-planned restoration programs. Examples of restoration activities are: 1) providing fish passage in both directions at dams; 2) adding large woody debris, or a substitute cover material, if adequate amounts are not being produced and transported in the stream; or 3) modifying seasonal and daily stream flow patterns and total flow via water management in the streams' watershed. **The purpose of this report is to provide information to guide future stream protection and restoration efforts in Michigan, especially as they relate to the management of fisheries.**

To restore streams to healthy, functioning ecosystems, thus providing maximum fishery and aesthetic benefits, we need to emphasize management of the total watershed (Dewberry 1992; National Research Council 1992). We also need to adopt a broader watershed concept than is generally considered. For example, to most people watershed means "that land surface area which contributes surface water to lakes and streams". A broader concept would consider precipitation (rain and snow), vegetation, and human developments within the watershed. Our challenge is to manage the way human activities affect water in terms of overland flow, surface infiltration, subsurface groundwater flow, evaporation, evapotranspiration, and human water withdrawals.

Management activities that increase groundwater inputs and reduce surface runoff will benefit most streams in the midwestern United States, especially coldwater (trout) streams.

Streams whose flows have high ratios of groundwater to surface runoff tend to have the stable flow and temperature regimes which are beneficial to fish (Benson 1953, 1955; Hendrickson 1966; Hendrickson and Doonan 1972; Poff and Ward 1989, 1990; White et al. 1976). Maximizing groundwater input can be achieved by managing water so that the highest proportion possible of the annual precipitation infiltrates the ground to migrate slowly but steadily toward streams. Further, streams with relatively stable discharge patterns have lower rates of bank and bed erosion, everything else being equal. They are also less turbid than streams with high proportion of surface runoff, because surface runoff causes erosion and transports the displaced soil and debris particles to the stream.

The action plan for stream restoration and enhancement should be to correct problems and enhance conditions in the whole watershed. The first priority should be the uplands and the stream's headwaters. Conditions in the headwaters are the most important in determining the basic character and potential of the stream in terms of total discharge, discharge periodicity, and pollution load. Unsatisfactory conditions in the uplands can dominate and override satisfactory conditions in the stream corridor (lands adjacent to the stream channel) and channel. The next priorities in the action plan should be to improve the floodplains and corridors, and finally, the stream channels.

Watershed Plan

Completion and adoption of a comprehensive watershed management plan is the first step in stream restoration and enhancement. MDNR, Fisheries Division has developed an outline for preparing stream management plans focusing on fisheries. MDNR, Surface Water Quality Division (SWQD) has developed an outline for a watershed plan focusing on water quality (*Guidelines of Best Management Practices for Michigan Watersheds*). In general, comprehensive fisheries management oriented plans should contain the following components.

1. Assessments of the current and past conditions of the river and its watershed by tributary and stream segment, including the physical conditions (upland drainage patterns, channel conditions, water quality, and so on), as well as, the biological conditions (fish and other aquatic organisms).
2. Appraisals of a stream's fishery potential (based on the stream's physical and chemical characteristics).
3. Identifications of potential fishery management options. These may be different for tributaries or stream segments.
4. Recommendations of which fisheries management option(s) to pursue. For example, should management emphasize coldwater or coolwater species, free flowing stream habitat or impoundments, stream-resident fish or anadromous fish. Involvement of the agencies with jurisdiction in the watershed and all interested organizations and citizens is a critical component of this step.
5. Descriptions of what needs to be done to achieve the options (an action management plan).