

Ohio's streams and rivers have substantially improved in quality over the past 10-15 years. The majority of this improvement has been the result of improvements in the quality of municipal wastewater treatment discharges across Ohio.

Ohio EPA uses multiple chemical, physical, and biological measures to assess the health and integrity of surface water resources. The biological measures are emphasized because the fish and invertebrates that comprise this measure serve as living indicators of the health and well-being of Ohio's waterways. They also serve as a direct measure of the biological integrity goal of the Clean Water Act. These organisms are sensitive indicators of water pollution because they inhabit the water all of the time and all aspects of their life cycles are dependent on water. A healthy fish or invertebrate community is also associated with high quality recreational opportunities (e.g., fishing, swimming, canoeing, etc.).

Causes of impairment are the "agents" that actually damage or impair the aquatic life in a stream, such as the toxic effects of heavy metals or acidic water. **Sources** of impairment are the origin of the agent. For example, an industry may discharge a heavy metal, a farm may erode topsoil, or a coal mine may be the source of acid water leaching into a stream.

In addition to biological data, Ohio EPA also collects information on the chemical quality of the water, sediment and effluents; data on the contaminants in fish flesh; and data on the physical nature of streams (i.e., aquatic habitat, siltation). This data is essential to identify the factors that are limiting or impair aquatic life and which constitute threats to human health.



Describing the causes and sources associated with the impairments revealed by the biological data and linking this with pollution sources involves an interpretation of multiple lines of evidence including water and sediment chemistry data, habitat data, effluent data, biomonitoring results, land use data, and response signatures within the biological data itself. The assignment of *principal* causes and sources of

impairment represents the association of impairments (defined by the biological response) with stressor and exposure indicators (e.g., chemical and physical data).

Leading Causes

The leading causes of impairment in Ohio streams and rivers are listed in Figure 1. Although the leading cause had been organic enrichment

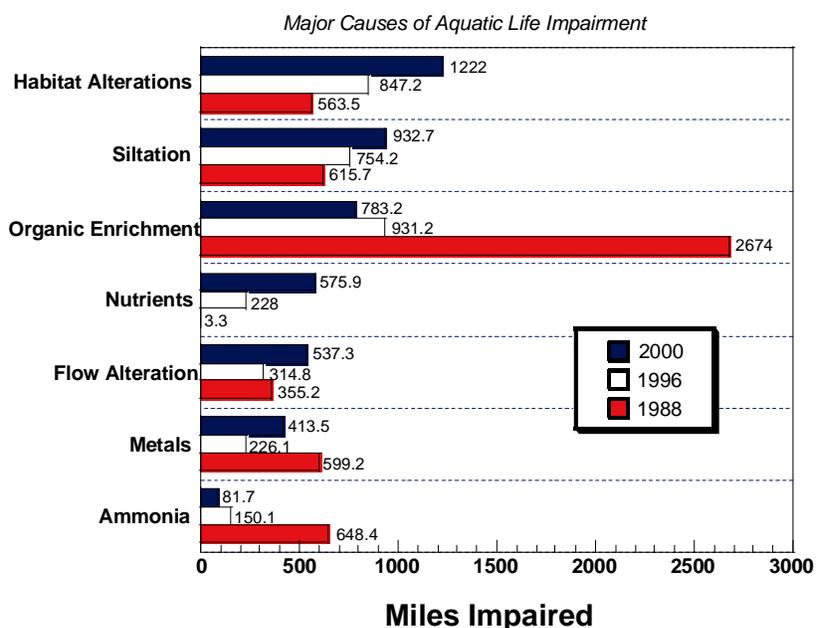


Figure 1. Changes in major causes of aquatic life use impairment in Ohio streams and rivers over the past three 305(b) assessment cycles: 1988, 1996, and 2000. These represent the water years 1980-87, 1993-94, and 1997-98.

and low dissolved oxygen up until 1996, habitat degradation and sedimentation are now the leading causes of impairment. Habitat refers to the physical character of a stream or river which is necessary to supporting aquatic life. Many human activities can directly or indirectly degrade habitat, thus making it less suitable for aquatic life. Aquatic life is especially dependent on intact instream habitat and the adjacent vegetated riparian habitat as are many other forms of wildlife. Ohio is not unique in this regard. The National Academy of Sciences (National Research Council 1992) recognized the devastation of riparian and instream habitats and recommended that 400,000 miles of river-riparian ecosystems be restored over the next 20 years. The mosaic of intact instream and riparian habitats is also critical to a stream or watershed maintaining the capacity to intercept and assimilate nonpoint source runoff, particularly nutrients and sediment. This ensures that high quality water and biological resources are “exported” to downstream reaches and larger receiving water bodies.

Point Sources

Impairments from organic enrichment and low dissolved oxygen largely originated from the inadequate treatment of municipal waste-

water (a “point source”). These have been the most rapidly declining causes of impairment since 1988. In 2000 point sources, as a principal source of impairment, declined to 8.7% of impaired stream miles from 41.7% in 1988 (Fact Sheet FS-3-EAS-2000).

Point source-related *causes* of impairment have also declined since 1988. Ammonia, a toxic component of municipal wastewater and the second leading cause of impairment in 1988 (responsible for 648 miles of impairment), dropped to tenth in 2000 (82 miles; Figure 1). This dramatic improvement resulted from the construction of new and upgraded sewage treatment facilities in the 1980s at a cost of approximately \$6 billion across Ohio. Heavy metals as a principal cause of impairment showed a less

dramatic decline since 1988 (Figure 1).

Nonpoint Sources: Leading Sources of Impairment in Ohio

The major sources of aquatic life impairment are illustrated in Figure 2. Hydromodification is now the leading source of impairment and is the origin of habitat degradation and sedimentation problems that are now the top two leading *causes* of impairment. These are termed “non-point sources” because they do not emanate from pipes or other discrete conveyances, but instead are the result of land disturbance activities or direct modifications of stream ecosystems. In 2000 we initiated a more detailed analysis of hydromodification by more precisely delineating the origin (e.g., associated with development or agricultural activities, etc.). Urban and suburban development associated hydromodification was responsible for 23.8% of the impairment attributed to hydromodification (Figure 2). Combined with the construction category, development is the fifth ranked source of impairment behind mining. Development-related activities are also the highest

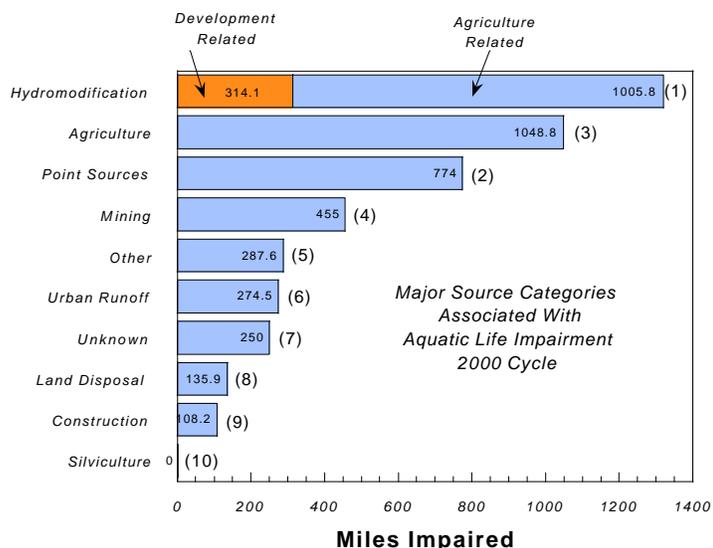


Figure 2. Major sources associated with aquatic life use impairment in Ohio streams and rivers and considered current for the 2000 assessment cycle (data collected as of 1998). Numbers in parentheses are ranks from the 1998 assessment cycle.

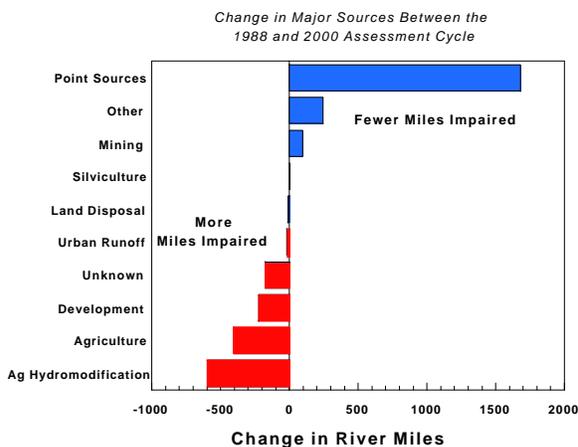


Figure 3. Change in major source categories associated with aquatic life use impairment in Ohio streams and rivers between the 1988 and the 2000 assessment cycles.

ranked threat to fully attaining streams and rivers.

Point sources of impairment have declined the most since 1988 when we began tracking it in this manner. At that time point sources were a major source in 2,453 miles of rivers and streams versus 777 miles in 2000. Figure 3 summarizes these changes for the leading source categories. Increases in agriculture and related hydromodification does not mean that these sources have worsened, rather they were previously overshadowed by now corrected point source impacts. It is these remaining nonpoint source impacts that will provide the primary restoration challenge for the TMDL process.

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National Research Council. 1992. Restoration of aquatic ecosystems: science, technology, and public policy. Committee on Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy. National Academy Press, Washington, D.C.

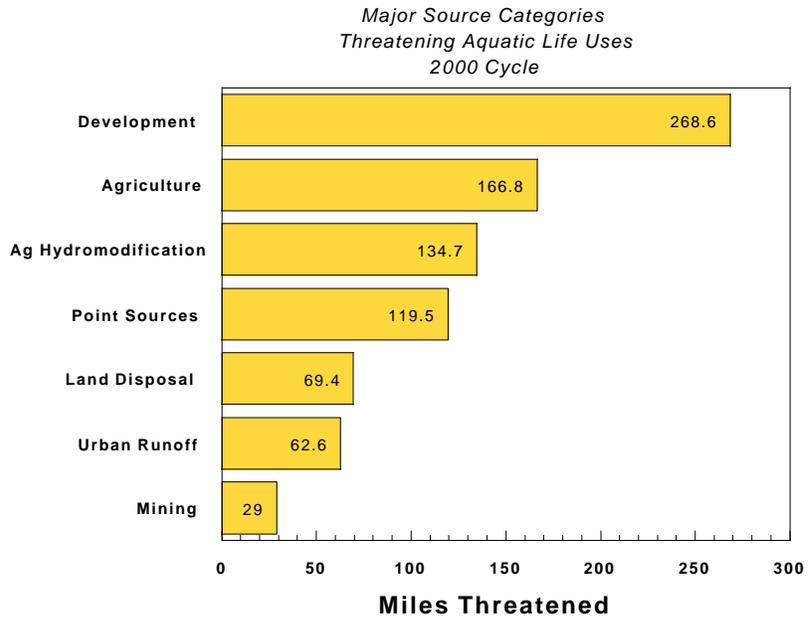
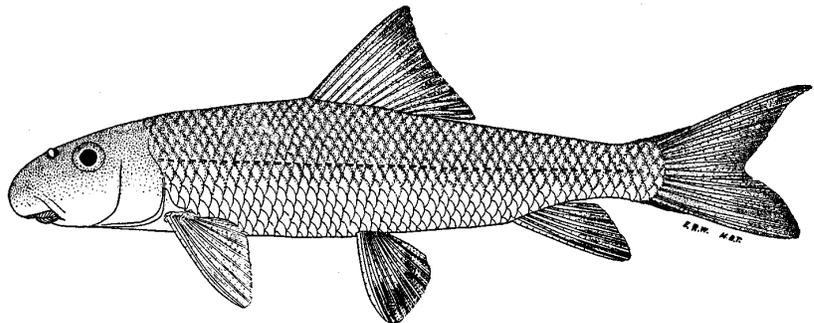


Figure 4. Major sources threatening aquatic life use attainment in Ohio streams and rivers and considered current for the 2000 assessment cycle (data collected as of 1998).



Black Redhorse - Moxostoma duquesnei (Lesueur)
An intolerant species found in medium to large streams and rivers that feeds on insects and invertebrates and is sensitive to the causes of impairment that predominate in Ohio waters (e.g., sedimentation, habitat destruction, nutrient enrichment)