Summary

Chippewa River Watershed

Biological Stressor Identification

Online: www.pca.state.mn.us/water/watersheds/chippewa-river

Collecting mussel samples in the Chippewa River

Stressor identification is a formal and rigorous process that identifies major factors causing harm to fish and other river and stream life. It draws upon a broad variety of disciplines, such as aquatic ecology, geology, geomorphology, chemistry, land-use analysis, and toxicology. The Chippewa River watershed is impaired for biology at 16 different stream reaches. Multiple stressors were found at all streams studied.

Watershed description

The Chippewa River Watershed covers 2,083 square miles in west central Minnesota. As it flows south through eight counties, joining the Minnesota River in Montevideo, the river moves from hardwood forests to prairie. Many of the river's tributaries emerge from wetlands and lakes in the northern third of the watershed. The river's riparian zones have remained intact on many stretches but channelization has occurred on a large scale, including the Chippewa River itself.

The area is primarily agricultural with 79 percent of the land used for pasture and cropland, the majority planted with corn and soybeans. The draining of wetlands and the straightening of the river and its tributaries has allowed nearly all remaining arable land to be in agricultural production. Today land cover in the watershed is distributed: 68.3 percent cropland, 11.1 percent rangeland, 4.5 percent forest/shrub, 5 percent developed, 5.9 percent open water, 5.2 percent wetland and 0.1 percent barren/mining.

Highlights

The Chippewa River watershed was assessed in 2012 for aquatic recreation, aquatic consumption and aquatic life beneficial uses. Based on this investigation, it was determined that 16 stream reaches were impaired for fish and/or invertebrates, as part of the aquatic life use designation. The watershed had many more instances where the fish and invertebrate Index of Biotic Integrity scores were below their respective threshold.

A comprehensive review of biological, chemical, and physical data was performed to select probable causes for the impairments. The causes for the biologically impaired streams in the Chippewa River are the following: Low dissolved oxygen, high phosphorus, high nitrates, altered hydrology, high turbidity/total suspended solids, lack of habitat, and lack of connectivity.

Key issues

Dissolved oxygen has been extensively measured throughout the watershed. Thirty-five percent of the sites documented DO to be below 5mg/L over 10% of the time.

In general nitrite-nitrate (NO2-NO3) levels increase from north to south and upstream to downstream in the Chippewa watershed. Areas where row cropping is dominant tend to have the highest nitrite-nitrate levels. Exposure to elevated nitrite or nitrate

concentrations can lead to the development of methemoglobinemia in infants.

Phosphorus is an essential nutrient for all aquatic life, but elevated phosphorus concentrations can result in an imbalance which can impact stream organisms. The effect of excess phosphorus occurs as it alters other factors in the water environment. Measured phosphorus concentrations exceeding the standard have been identified throughout the watershed.


Bank sloughing a source of sediment

Much of the Chippewa River is impaired for turbidity. In 2009 and 2010 most of the Chippewa's load monitoring sites exceeded the standard. In 2009 and 2010 overall, 32% of the samples taken exceeded the standard for turbidity. In the Chippewa, in areas where row cropping is more prevalent, there is a trend toward higher turbidity during the spring months when there is little canopy cover. The consistently high turbidity levels seen throughout the watershed suggest that aquatic habitat and recreational enjoyment on the Chippewa is seriously degraded.

Recommendations

- Dissolved oxygen is a widespread stressor. More monitoring is needed watershed wide (particularly 24-hour measurements) to better understand the stress this parameter has on the biological communities.
- High phosphorus readings were fairly common throughout the watershed. A watershed scale plan to reduce phosphorus amounts is needed.
- Elevated levels of nitrates are stressing the invertebrate communities in many parts of the southern watershed. Reducing the amounts of nitrates in the system can be achieved by lowering fertilizer application rates, better application times, using cover crops, wetland restorations and increasing the stream buffer width.
- Poor turbidity is a prevalent condition in many Chippewa River reach sections. It needs to be addressed with practices such as decreasing algae bloom on in-stream lakes, decreasing nutrient delivery to waterways, increasing stream buffer widths, improving hydrology, as well as improving riparian conditions.
- Altered hydrology is a major stressor to the fish and invertebrate communities in many parts of the Chippewa River. Drain tiles and channelized streams designed to remove water quickly from the landscape have had a significant impact on the Chippewa River's hydrology. Practices that reduce the volume, rates and timing of runoff as well as increase the base flows will be needed to prevent continued and further impairments to biological assemblages not only in the studied stream reaches, but throughout the Chippewa River watershed.

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