Summary

Yellow Medicine River Watershed

Biological Stressor Identification

To view the full report, visit: http://www.pca.state.mn.us/yhizdd8

Description

Located in west-central Minnesota, the Yellow Medicine River watershed encompasses approximately 754,100 acres. It includes many streams that flow into Yellow Medicine River, but also many are direct tributaries to the Minnesota River. The biological monitoring and assessment approach looks at fish and aquatic invertebrates (mostly insects), and related habitat conditions, at sites throughout a major watershed. The resulting information is used to produce an Index of Biotic Integrity. IBI scores can then be compared to standards. Segments of streams and rivers with low IBI scores are deemed "impaired." This report describes the connection between the biological community and the stressor(s) causing the impairments. Stressors are those factors that negatively impact the biological community. Stressors can interact with each other and can be additive to the stress on the biota.

Key issues

After examining many candidate causes for the biological impairments, the following stressors were identified for the impaired streams: High phosphorus and nitrates, altered hydrology, low dissolved oxygen, lack of habitat, high turbidity/total suspended solids, and pesticides.

Highlights

Dissolved oxygen (DO) refers to the concentration of oxygen gas within the water column. Low or highly fluctuating concentrations of DO can have detrimental effects on many fish and invertebrate species. DO concentrations change seasonally and daily in response to shifts in ambient air and water temperature, along with various chemical, physical, and biological processes within the water column.

Dissolved oxygen has been measured frequently in the Yellow Medicine River watershed; however the watershed did not have enough measurements before 9a.m. to assess for DO in many streams. Currently, no AUIDs with a biological impairment are also impaired for DO. Spring Creek (07020004-538) is the only stream reach in this watershed listed as impaired for this parameter.

Agricultural and urban land-uses, impoundments (dams), and point-source discharges are just some of the anthropogenic factors that can cause unnaturally high, low, or volatile DO concentrations.

Phosphorus is an essential nutrient for all aquatic life, but elevated phosphorus concentrations can result in an imbalance, which can impact stream organisms. It is delivered to streams by wastewater treatment facilities, urban stormwater, agriculture, and direct discharges of sewage. Excess phosphorus does not result in direct harm to fish and invertebrates. Rather, its detrimental effect occurs as it alters other factors in the water environment. Dissolved oxygen, pH, water clarity, and changes in food resources and habitat are all stressors that can result when there is excess phosphorus.

From 2000-2012, there has been 1,163 phosphorus samples collected in streams in the watershed. Of those samples, over 52% of them have been at or above the current draft standard of 0.15 mg/L or higher. The highest reading was above 2 mg/L, with many readings above 1 mg/L. While phosphorus concentrations are not nearly as high as the neighboring Hawk Creek watershed (71% exceedances);

phosphorus is still a watershed-wide issue that will need to be addressed in the Yellow Medicine River watershed. Phosphorus is delivered to streams by wastewater treatment facilities, urban stormwater, agriculture, and direct discharges of sewage.

Exposure to elevated **nitrite or nitrate** concentrations can lead to the development of methemoglobinemia, which ultimately limits the amount of oxygen that can be absorbed by fish and invertebrates. Minnesota currently does not have a nitrate standard for other classes of waters of the state.

From 2000-2012, there were 393 nitrate samples collected throughout the Yellow Medicine River watershed. Values ranged from 0.008 mg/L up to 39.8 mg/L. Generally, spring months had higher nitrate values. Nitrate levels were elevated watershed wide, but seem to be in much lower than the neighboring Hawk Creek watershed. The elevated nitrate levels during the spring months coincide with fertilizer applications and periods of snowmelt/runoff. The abundance of row crop agriculture in the watershed makes this a large scale issue.

Increases in suspended **sediment and turbidity**, which is a measure of water clarity affected by sediment, algae, and organic matter, within aquatic systems are now considered one of the greatest causes of water quality and biological impairment in the United States. The most recent assessments for the Yellow Medicine River watershed determined that the existing turbidity impairments are still present and will remain listed.

Altered hydrology: Increased flows may directly impair the biological community or may contribute to additional stressors. Increased channel shear stresses, associated with increased flows, often cause increased scouring and bank destabilization. With these stresses added to the stream, the fish and invertebrate community may be influenced by the negative changes in habitat and sediment.

The Yellow Medicine River watershed has a fair amount of channelization taking place in its streams. Approximately 27% of the entire watershed has been identified as being altered. The channelized reaches and subsurface tiling serve to route water quickly off the landscape which alters the natural hydrologic regime of the system.

Recommendations

The primary stressor to the majority of the streams in this watershed is altered hydrology. Restoring the hydrology to provide a consistent base flow is imperative for the survival of the biological communities in this watershed. Changes to the landscape 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.

More monitoring is needed on those streams to better understand the stress that low dissolved oxygen has on the biological communities. Management plans focusing on the timing and intensity of the fertilizers and manure application would help reduce the amount of phosphorus in the system. These reductions would also aid in the DO problems present in the watershed. Further monitoring is recommended watershed-wide to better understand the magnitude of stress phosphorus is causing. Increasing stream buffer width, improving hydrology, as well as improving riparian conditions are activities that need to be considered to reduce turbidity values. Increases in riparian buffer width and stabilizing stream banks would greatly help the in-stream habitat.

Contact

Katherine Pekarek-Scott
Minnesota Pollution Control Agency
katherine.pekarek-scott@state.mn.us
320-441-6973