Potential Impacts of Climate Change on Riverine Ecosystems in the Great Lakes Region

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INTRODUCTION

The rivers and streams of the Great Lakes Region sustain diverse ecosystems ranging from intermittent and ephemeral streams which support amphibian and local invertebrate populations to the larger cold and cool water streams and rivers which are important for sustaining various temperature dependent fish populations. These ecosystems are sensitive to both the direct and indirect consequences of climate change. Over the coming decades average temperatures in the region are predicted to rise and precipitation patterns be altered by anthropogenic climate change. These changes will have direct physical impacts on the streams and local hydrology as well as indirect effects on the chemistry and ecology of the streams. Climate change may also induce changes in the human activities which affect these ecosystems and/or amplify the existing pressures of anthropogenic disturbances such as land use and non-point source pollution. These potential changes resulting from climate change will be important to understand from a speculative point of view, but also from a management perspective. If we choose to manage our water resources with concern for the existing ecosystems, we will also have to take into account the changes induced by climate change.

MANAGEMENT IMPLICATIONS

In order to manage our streams and rivers in the Great Lakes Basin sustainably and with long term ecosystem health in mind we must take into account the potential impacts of climate change. Withdrawals may have amplified effects on the hydrologic system due to already decreased and altered flows (Sousinous et al., 2000). Land use changes, perhaps influenced in part by climate change, may cause increased sedimentation or nutrient loading. Flood control may become more of an issue especially for highly altered and urban streams due to their lesser ability to absorb and respond to such events (Palmer, 2008).

FISH

Fish populations are of particular interest in the Great Lakes Basin, because of their importance for the fisheries and sport fishing industries. Fish populations, especially certain cool and coldwater species, are expected to be strongly influence by climate change.

Fish tend to be very sensitive to temperature and have specific temperature preferences based upon species (Figure 6). As streams warm it is predicted that species will move northward (up to 500km / 4°C [Kling, 2003]). Alterations in flow regime and productivity at lower trophic levels will also impact fish populations.

EPHEMERAL AND INTERMITTENT STREAM ECOSYSTEMS

Headwater streams comprise approximately 75% of the river miles in the Great Lakes Basin (Kling et al., 2003). Near their origin these streams are often ephemeral or intermittent. These ecosystems are particularly susceptible to climate change due to their small volume and sensitivity to hydrologic changes. Potential changes may include altered flow regimes and connectivity. These changes could have severe impacts on species such as Coho Salmon, Brook Trout, and stream breeding salamanders who are strongly dependent on specific flow regimes for breeding and other critical life stages (Brooks, 2009).