

Utility of GIS to Characterize Watersheds and Lakes for a Methylmercury Study in National Parks of the Great Lakes Inventory and Monitoring Network

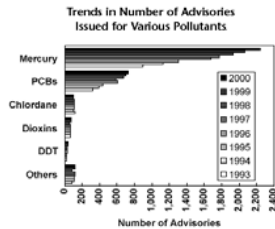
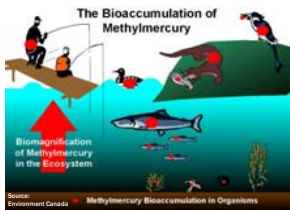
Sean Bailey – Rivers Studies Center and Department of Biology, University of Wisconsin-La Crosse

INTRODUCTION: GIS is an effective tool in the analysis of watershed characteristics as related to an investigation of methylmercury in aquatic ecosystems

This poster illustrates the utility of a GIS to quantify landscape attributes in the context of an ongoing study of methylmercury in the National Parks of Great Lakes Region. An overview of the methylmercury research study is presented along with examples showing how GIS is utilized to provide data for this research study.

BACKGROUND: Methylmercury is a harmful neurotoxin which poses risks to humans and wildlife.

- Early life stages of fish, wildlife, and humans are most sensitive to MeHg
- MeHg is globally dispersed, with ~70% attributable to anthropogenic sources of inorganic mercury (primarily combustion of fossil fuels)
- Sulfate-reducing bacteria in wetland habitats and littoral areas methylate inorganic mercury (total Hg)
- MeHg enters food webs at low trophic levels
- As it is not readily eliminated, MeHg bioaccumulates in organisms and biomagnifies in food chains
- Mercury is the leading cause of fish consumption advisories for the U.S. and Canada; ~95% of total Hg in fish present as MeHg



RESEARCH INVESTIGATION: UW-L's River Studies Center is collaborating with the Great Lakes Inventory and Monitoring Program to quantify total Hg in fish and MeHg in fish and dragonfly larvae in 6 national parks in the western Great Lakes region. Many waters in this region contain fish with high concentrations of MeHg.

- The long-term objectives of this investigation in the parks are:
- (1) To assess spatial patterns in Hg contamination of aquatic food webs,
 - (2) To identify parks and surface waters where MeHg exposure may adversely effect aquatic biota,
 - (3) To evaluate trends in contamination of aquatic food webs,
 - (4) To identify factors that control or influence bioaccumulation of MeHg in aquatic food webs, and
 - (5) To assess the utility of dragonfly larvae as biosentinels of methylmercury in aquatic ecosystems.

STUDY SITES: In 2008, prey and predatory fish and larval dragonflies were sampled in three park units. Fish were analyzed from 10 lakes and 3 wetland sites.

Parks sampled in 2008:

- Indiana Dunes National Lakeshore
- Sleeping Bear Dunes National Lakeshore
- Pictured Rocks National Lakeshore

Parks sampled in 2009:

- Voyageurs National Park
- Isle Royale National Park
- Grand Portage National Monument

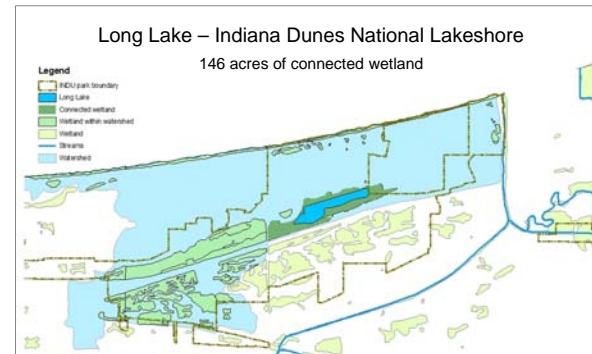


GIS ANALYSIS OBJECTIVES: Lake and watershed characteristics are to be defined and quantified for each site sampled, as these spatial attributes influence methylmercury formation

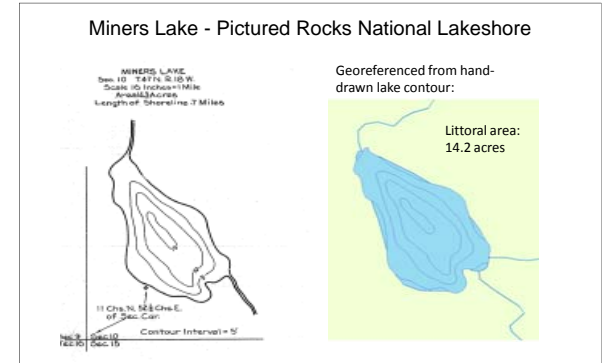
- The objectives of the GIS analysis for the sampling sites are:
- (1) To identify watershed boundaries,
 - (2) To quantify area of connected wetland to the site, and
 - (3) To quantify area of littoral zone for each site.

CONNECTED WETLANDS: Area of connected wetlands quantified, providing a measure of potential methylation sites

Connected wetlands are defined as wetlands adjacent to the site's shoreline or connected by a surface inflow.

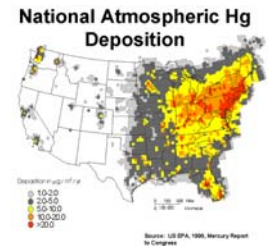


BATHYMETRY: Depth contour data allows for the quantification of littoral zones (≤ 15 ft in depth), important habitat areas as well as potential methylation sites



CONTINUING EFFORTS AND FURTHER APPLICATIONS:

- Georeference lakes not yet completed
- Complete characterization for each site sampled in six parks
- Map with layer containing mercury deposition data
- Map with layer containing sulfate deposition data



GIS DATA SOURCES UTILIZED:

- Natural Resources Conservation Service Geospatial Data Gateway: watershed boundaries
- National Park Service Data and Information Clearinghouse: hydrography, park boundaries
- Indiana Geological Survey IndianaMap: hydrography, wetlands
- Michigan Geographic Data Library: hydrography, wetlands
- Personal communication - Ulf Gafvert, NPS, Ashland, WI: georeferenced lake contours

ACKNOWLEDGMENTS:

National Park Service, Great Lakes Inventory and Monitoring Network
University of Wisconsin-La Crosse Graduate Studies Program
University of Wisconsin System Distinguished Professors Program
Dr. Cynthia Berlin and Mr. J.C. Nelson, Dept of Geography, UW-La Crosse

