Report for 2002MI2B: Water quality trends of Michigan inland lakes and their relationship to ecoregions:1974-2001

- Other Publications:
  - Bruhn, L.C. (2002) A State-wide Assessment of water clarity trends in Michigan lakes: 1974-2001. M.S. thesis, Michigan State University, December 2002.
- unclassified:
  - Bruhn, L.C., and P.A. Soranno. (In review) Water clarity trends in Michigan lakes and their relationship to ecoregion and land use/cover: 1974-2001. Currently in review as of 7/10/03 at: Lake and Reservoir Management.

Report Follows:

State: Michigan
Project Number: 2002MI2B
Title: Water quality trends of Michigan inland lakes and their relationship to ecoregions: 1974-2001
Project Type: Research Project
Focus Category: Water Quality (WQL)
Keywords: Michigan, Lake, Water-quality trends, Secchi depth, Volunteer-monitoring
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The nearly 11,000 inland lakes in Michigan are valued ecosystems susceptible to degradation due to anthropogenic stresses. Few, if any, long-term programs have been implemented by state agencies monitoring the inland lakes of Michigan. However, Michigan does have a lake-volunteer sampling program; the Cooperative Lakes Monitoring Program (CLMP).

The first objective was to assess statewide water quality trends from the early 1970s to present using data from the volunteer CLMP program. For this analysis we used 71 inland lakes that were distributed across the state which had volunteer-collected Secchi depth (SD). Water clarity in most of these lakes has either increased or stayed the same since the 1970s. Thirty-one percent of the lakes significantly increased in water clarity, 63% had no significant trend, and 6% significantly decreased in water clarity.

The second objective was to examine the relationship between lake water clarity and ecoregion, and land use/cover. CLMP program data collected from 1974-1983 from 54 lakes for which we had land use data, was analyzed using t-tests, regressions, and analysis of covariance. The mean SD was significantly lower for the southern ecoregion than the northern ecoregion, but a few significant regressions between land use/cover and water clarity across lakes was detected. In general, significant differences in SD existed between the ecoregions, however effects of land use on SD is more difficult to identify.

These analyses have expanded our knowledge of water quality trends in Michigan inland lakes. Volunteer monitoring programs such as Michigan's CLMP provide an invaluable contribution to water quality information and can assist in setting priorities for statewide lake monitoring and management. The Institute of Water Research is continuing to investigate the technical feasibility of integrating these data into an interactive, web-based Geographic Information Systems (GIS) tool.

Training Potential
This research project served as graduate student Laura Bruhn's thesis research for partial fulfillment of her Master of Science degree. Additionally, one undergraduate student was employed to help organize and compile the water quality data.

Manuscripts in preparation:
Soranno, P.A., M.T. Bremigan. The organization of lakes on the landscape: clustering of landscape features. To be submitted to Ecosystems.

Cheruvelil, K.S. and P.A. Soranno. Predicting macrophyte cover and Eurasian watermilfoil (EWM) presence from multi-scaled landscape and lake features. To be submitted to Ecosystems.

Cheruvelil, K.S., P.A. Soranno, T. Wagner, M.T. Bremigan, N.A. Nate, and J.E. Breck. In prep. Predicting lake water quality from multi-scaled landscape features. To be submitted to Canadian Journal of Fisheries and Aquatic Sciences.

Wagner, T., Bremigan, M.T , K.S. Cheruvelil, P.A. Soranno, N.A. Nate, and J.E. Breck. In prep. Predicting fish growth rates using landscape features and water quality. To be submitted to Canadian Journal of Fisheries and Aquatic Sciences.

Bremigan, M.T., P.A. Soranno. The classification of lakes using landscape features. To be submitted to Fisheries.

Invited research presentation:
Soranno, P.A. The role of landscape context on lake chemistry and biology. Invited presentation to the Grand Valley State University Annis Water Resources Institute. March 20, 2003.

Research Presentation:
Webster, K.E., P.A. Soranno, K.L. Ness and R.J Bouchard. Lake littoral zones and shoreline development: scientific and social challenges to maintaining the ecological integrity of lakes. North American Lake Management Society Meeting, Mashantucket, CT. November 4 - 8, 2003.