



Project Summary

The Ohio Stream Regionalization Project: A Compendium of Results

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Regional patterns in terrestrial characteristics can be used as a framework to monitor, assess and report the health of aquatic ecosystems. In Ohio, five ecological regions were delineated using spatial patterns in land-surface form, land use, soil and potential natural vegetation. We evaluated this framework by studying the water quality, physical habitat, and fish and macroinvertebrate assemblages of 109 minimally impacted representative streams. Water quality and fish assemblages showed clear regional differences. The highest quality water and fish assemblages were consistently found in the southeast ecoregion and the lowest quality in the northwest ecoregion. We found no clear regional patterns in macroinvertebrate assemblages and limited regional patterns in physical habitat.

This Project Summary was developed by EPA's Environmental Research Laboratory, Corvallis, OR, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

To implement the mandates of the Clean Water Act of 1977 (CWA), many state environmental protection agencies have relied on statewide chemical criteria that presumably protect fish, shellfish, and wildlife. These agencies increasingly

face a need to address the goals of the CWA more directly, through regional chemical and biological objectives for water quality management.

The Ohio Environmental Protection Agency (OEPA) saw a need to determine what was reasonably attainable in Ohio streams. OEPA also recognized differences in streams in various parts of the state. These concerns led to cooperative research between OEPA and the USEPA to evaluate a land classification for identifying regional patterns in aquatic ecosystems and attainable physical, chemical and biological conditions within them.

Ecoregion Concept

An important premise in our work is that streams reflect the characteristics of the land they drain. Streams in areas of relatively homogeneous land should be relatively similar to each other. Thus, regional patterns in terrestrial characteristics can be used as a framework for studying aquatic ecosystems. In Ohio, five ecological regions were delineated using spatial patterns in land-surface form, land use, soil, and potential natural vegetation.

Sampling sites were chosen at 109 locations throughout Ohio that met three criteria: 1) The watersheds and streams were minimally impacted by human activity, 2) The streams, watersheds and sites were representative of their regions, and 3) The watersheds above the sampling site were wholly contained within one ecoregion (some cross-regional boundary sites were also

studied). This sampling scheme helps assure that data from these sites represent attainable conditions for each region. The OEPA sampled these sites in 1983-84 for fish, macroinvertebrates, water quality, and physical habitat.

Regional Patterns

The clearest regional patterns were found in the fish assemblages and the water quality attributes. The Index of Biotic Integrity (IBI) which expresses ecological health by assessing fish assemblages, was highest in southeast Ohio (particularly in the Western Allegheny Plateau). The lowest values were in northwest Ohio (mostly in the Huron/Erie Lake Plain), Figure 1. These two regions also have the most distinctly different landscapes; the northwest is flat and predominantly used for row crop agriculture, the southeast is a dissected plateau consisting of woodland mixed with some cropland and pasture. The other (transitional) regions had generally intermediate IBI values. This pattern was found for several other measures generally considered indicative of the quality of fish assemblages, e.g. species richness, diversity, and number of species and proportion of fish intolerant of siltation and low dissolved oxygen.

Similar patterns in water quality occurred. The highest quality was in southeast Ohio and the lowest in the northwest. The streams in the Huron/Erie Lake Plain were nutrient and mineral rich. Figure 2 summarizes the relationship between water quality of the sites and their regions.

There were only slight regional patterns in the physical habitat attributes. Streams in the southeast portion of Ohio tended to have more instream cover for fish (logs, boulders, undercut banks) and coarser substrate materials (cobbles, rocks and boulders), than the other regions. Macroinvertebrate assemblages showed almost no regional pattern.

Conclusions

There are clear regional patterns in Ohio's stream ecosystems. While the ecoregion classification does not fit perfectly for any single component of aquatic ecosystems, it does provide a useful geographic framework to monitor, assess, and report on the status of aquatic resources. The regions, combined with the sampling strategy outlined here, can be used to determine a range of reasonable regional expectations for attainable water quality and biological communities.

Ohio's current, highly-detailed stream standards based on several categories of biological uses and biological criteria are being revised by the OEPA based on reasonably attainable conditions. The OEPA is combining the data and methods of this study with their extensive knowledge of Ohio stream conditions to determine regional background water quality. For example, based on these results, attainable phosphorus levels for the Western Allegheny Plateau could be <0.05 mg/l; in the Huron/Erie Lake Plain a more realistic goal might be <0.15 mg/l. These levels are based on this study only and will be subject to revision.

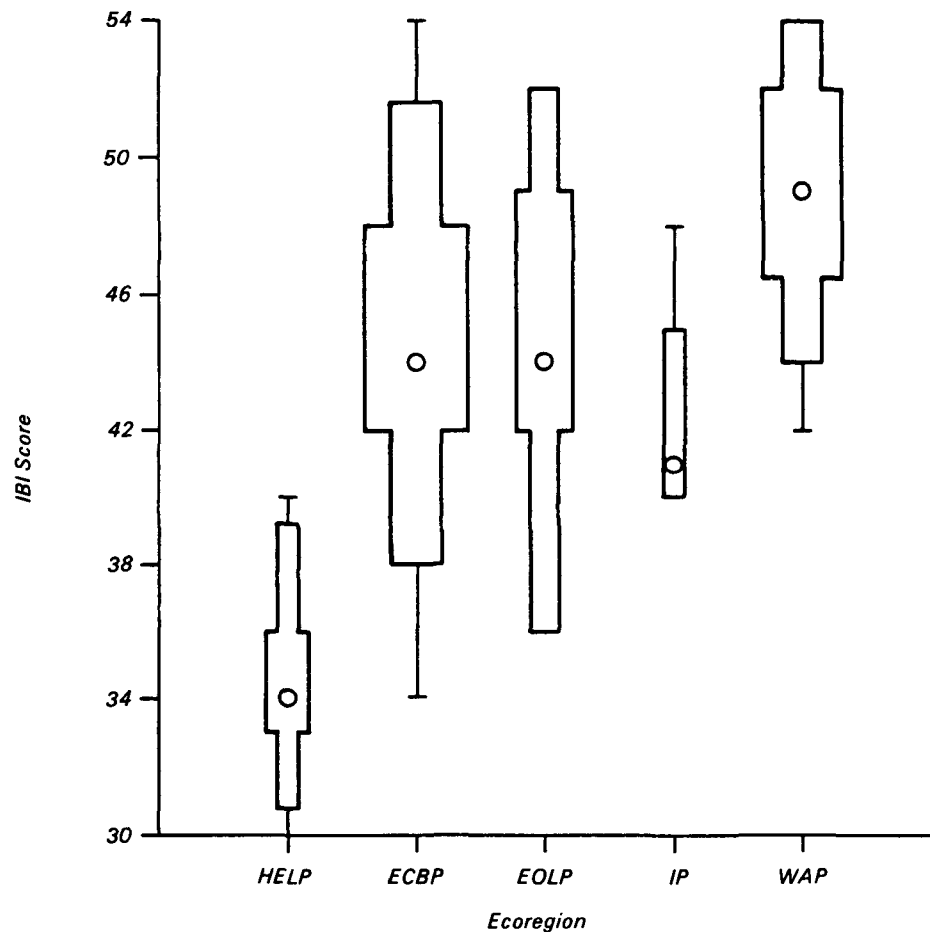


Figure 1. Relationship between the Index of Biotic Integrity and ecoregions in Ohio. Each boxplot includes: median (the circle), interquartile range (height of the wide box), 10 and 90 percentiles (height of the narrow box), relative sample size (width of the box), and range.

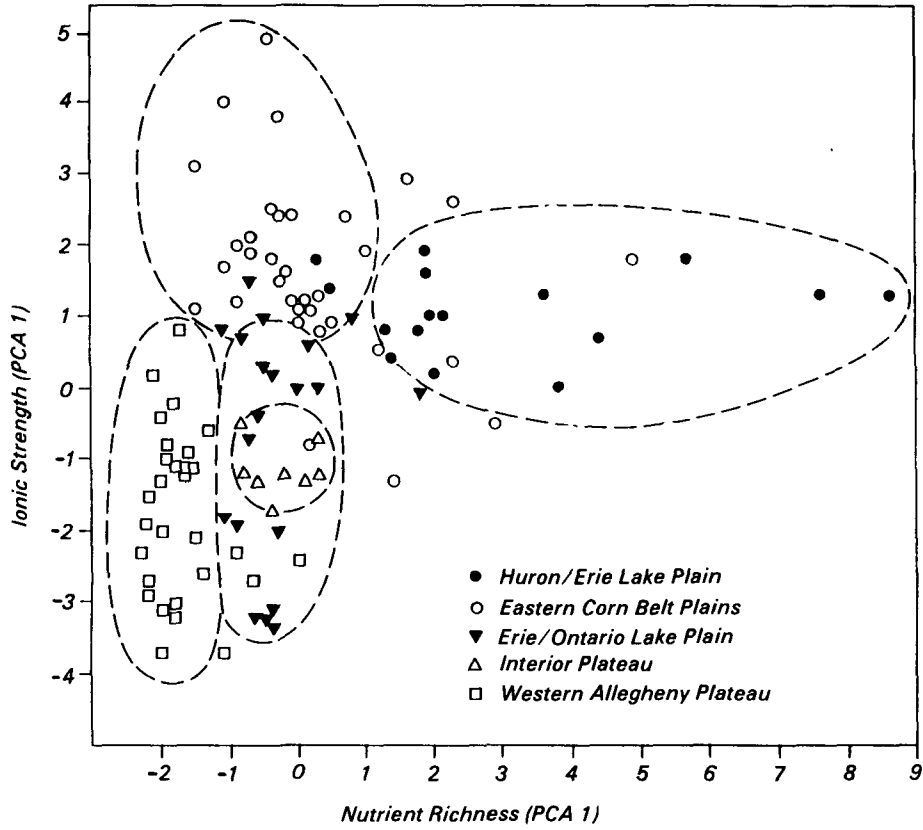


Figure 2. Regional patterns in nutrient richness and ionic strength variables indicated by principal component axis I scores for each. Areas enclosed indicate hypothesized attainable water quality for each region.

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The complete report, entitled "The Ohio Stream Regionalization Project: A Compendium of Results," (Order No. PB 88-204 227/AS; Cost: \$14.95, subject to change) will be available only from:

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