Examining Anthropogenic Impacts on the Wabash River System

A research project funded by the Indiana Water Resources Research Center through the U.S. Geological Survey's 104B annual base grants (section 104 of the Water Resources Research Act of 1984, as amended).

The Wabash River is a large meandering stream that stretches 471 miles from Ohio through Indiana, where it ultimately joins the Ohio River (Figure 1). This study focused on a small stretch of the Wabash River near Terre Haute, Indiana.

The Wabash River Valley currently delivers some of the highest nutrient yields to the Mississippi River waterways. Of the more than 800 watersheds in the US that contribute nutrients to the Gulf of Mexico, multiple watersheds within the Wabash River Valley have been identified among the most substantial sources for nutrient pollution.

While aquatic eutrophication (overabundance of nutrients causing excessive algae growth in a waterbody) is commonly viewed as a nuisance because it leads to low water clarity, low water quality, unpleasant odors, and an unfavorable shift in the color of the water, eutrophication has many more serious implications. Because of a lengthy history of industrial, thermal, sewage, and agricultural pollution and, in its more recent history, severe cases of invasive species such as Asian carp, the Wabash River Valley is emblematic of anthropogenically-modified waterways in the Midwestern region of the US.

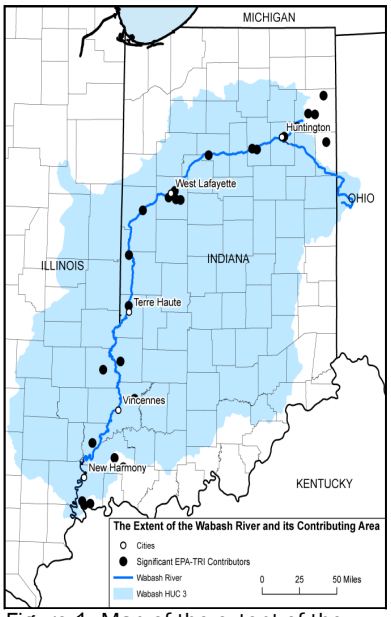

Figure 1. Map of the extent of the Wabash River and its floodplains (shaded area).

RESEARCH OBJECTIVES

1. Expand preliminary analyses of the anthropogenic impacts upon water conditions in the Wabash River Valley and determine its influence on the seasonal variation in the diatom (single-celled or colonial algae with silica skeletons) community and water chemistry.

   Seven sites were analyzed, including several upstream from Otter Creek, one near the confluence, one within the city of Terre Haute, and several downstream from Terre Haute to quantify seasonal variations in nutrient influx and its impacts on the aquatic environment.

   Stream chemistry and the diatom community was sampled for 1.5 years from each site to provide a natural baseline for changes that occurred.

2. Explore evidence of invasive diatom species associated with the introduction of Asian Carp and their potential to spread from the Wabash River to the surrounding lake systems.

   Sediment cores were collected and dated from several lakes near the Wabash River to determine the timing of the spread of the invasive diatom species (Discostella asterocostata) to the surrounding aquatic environments. Fish gut contents were also sampled from fish collected in the Wabash River over the past ~60 years to determine when D.

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RESEARCHER PROFILE

Principal Investigator, Dr. Jeffery Stone, coordinates the Paleolimnology Laboratory at Indiana State University, specializing in using fossil and modern diatoms to reconstruct past lake and river environments to observe changes over time.

Co-Principal Investigator, Dr. Jennifer Latimer, coordinates the Paleolimnology Laboratory at Indiana State University, specializing in using fossil and modern diatoms to reconstruct past lake and river environments to observe changes over time.

MAJOR CONCLUSIONS & SIGNIFICANCE

- This section of the Wabash River is a greater contributor of phosphorus (specifically dissolved phosphorus) than nitrogen.
- Seasonality and anthropogenic activities strongly influence the nutrient concentrations present in the river system.
- Population density and urban versus agricultural landscapes do not significantly alter diatom species assemblages along this section of the Wabash River.
- Preliminary data from lake sediments and fish gut contents suggest that the arrival of *Discostella asterocostata* appears to be coincident with the introduction of Asian Carp in the Wabash River (~1990).
- The diatom species, *Discostella asterocostata,* has subsequently spread to many lakes systems throughout the Wabash River Valley and, in at least a few lake systems, has become a dominant plankton observed in the sediment record.

WHAT DOES THIS MEAN FOR INDIANA?

Nutrients introduced into the Wabash River are carried down the river, typically spiraling through ecosystems in the form of additional body mass or available food resources. This additional nutrient loading has the potential to substantially impact all associated downstream watersheds. While this study focused mostly on a small stretch of the Wabash River near Terre Haute, it is clear that the largest impacts on the ecosystem are agricultural rather than industrial. Additionally, this research shows that 'invasive species' are not just limited to those that have a visible imprint on the landscape and that it is highly feasible that the introduction of new species to an environment, such as Asian Carp, has the potential to cascade additional microscopic species throughout aquatic ecosystems.

TRAINING THE NEXT GENERATION

One of the missions of the Indiana Water Resources Research Center, and all Water Centers, is to train the next generation of water scientists. This project successfully supported young faculty, Dr. Jeffery Stone, Assistant Professor, and funded research for a Master's student within Dr. Stone's lab. Additionally, five undergraduate students assisted or expanded upon this research project.

For more information about this project, visit iwwrc.org

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