DISCUSSION[1]

"Urbanization Influences on Aquatic Communities in Northeastern Illinois Streams," by Faith A. Fitzpatrick, Mitchell A. Harris, Terri L. Arnold, and Kevin D. Richards[2]

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Most water quality assessments based on biotic health address either macroinvertebrate or fish community conditions, but rarely are the two communities used conjunctively. Even fewer studies exist that compare indices based on the two different aquatic communities. The work by Fitzpatrick *et al.* (2004) addresses the influence of urbanization on aquatic communities using both macroinvertebrate and fish biotic indices, but they do not use their data to compare fish and macroinvertebrate biotic indices directly. They conclude that the Illinois fish alternative index of biotic integrity (AIBI) and macroinvertebrate index (MBI) scores respond similarly to land use changes, decreasing as agricultural land undergoes urbanization. The authors point out that macroinvertebrate assessments are useful in limited situations where fisheries data are unavailable or in streams with limited restricted aquatic resource. The protocol in Illinois is to use the MBI only when fish data are not available. This begs two questions: how well do fish and macroinvertebrate indices of biotic integrity (IBIs) correlate and do fish and macroinvertebrate IBIs respond similarly to stressors?

Using their data, we compared the relationship between the AIBI and MBI using a simple linear regression (Figure 1). The relationship is significant ($p < 0.0001$) but weak ($R^2 = 0.3579$). The large unexplained variability may be due to the fact that macroinvertebrates and fishes respond differently to stressors. For example, macroinvertebrate communities experience species loss following urbanization, while fish communities often see replacement of native species by nonnatives (Wang and Lyons 2003). This fact manifests itself in individual biotic indices; fish indices include a nonnative species metric, a metric absent in benthic indices. Also, as the authors pointed out, benthic organisms may react differently than more mobile fish species to substrate trapped contaminants, such as copper (Fitzpatrick *et al.*, 2004).

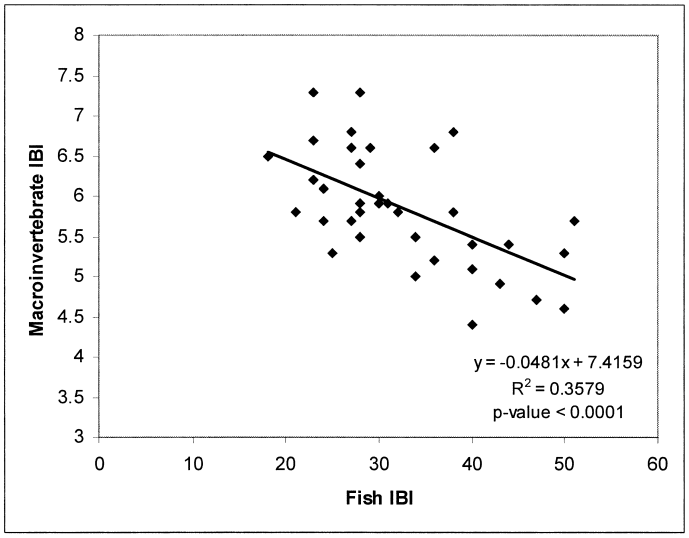

Figure 1. Regression Line Representing the Relationship Between MBI and AIBI Scores for Northeastern Illinois Streams.

Another interesting factor of the Fitzpatrick *et al.* (2004) dataset is the narrow range of scores produced by the biomonitoring surveys (Figure 2). Of the 43 streams, only three have excellent fish scores and

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only one has a very poor fish score. The remaining streams, 39 of 43, fall into only three of five categories for the fish AIBI (excellent, good, fair, poor, very poor). The breadth of MBIs is even smaller with scores ranging from 4.4 to 7.9. Illinois created only three categories for the MBI score (good, fair, poor). All of the streams fall into two MBI categories (good and fair). The category definitions suggest use of the Illinois MBI scores will tend to overestimate water quality if fish conditions are the reference.

To use the MBI and AIBI interchangeably, it is essential that the two indices are calibrated to show the same state of degradation. Previous studies by Seegert (2000), Houston *et al.* (2002), and Iliopoulou-Georgudaki *et al.* (2003) have shown the need for IBI calibration due to variation among IBI assessments. Seegert (2000) found that using the same dataset from the Pigeon River in North Carolina, three different fish IBIs produced scores differing by as much as 18 IBI units. These differences placed river condition in different categories (i.e., poor, fair, good) depending on which IBI was used. In Peloponnisos Greece, Iliopoulou-Georgudaki *et al.* (2003) used nine biotic indices and five different species to evaluate water quality. They found that macroinvertebrates were the most suitable bioindicator. However, stream health was dependent upon which biotic index was used (e.g., the Agios Dimitrios 3 site scored good, moderate, and poor using five different indices). Fitzpatrick *et al.'s* (2004) dataset also suggests that stream size, as quantified by basin area, also affects IBI scores (Figures 3 and 4 in Fitzpatrick *et al.,* 2004). Larger basins tend to have better biotic conditions as determined by the Illinois MBI and AIBI.

The work by Fitzpatrick *et al.* (2004) addresses the important but not well understood relationship of macroinvertebrate and fish biotic indices. Similar studies which further investigate these interconnections are essential to developing effective biomonitoring surveys.

LITERATURE CITED

Fitzpatrick, F.A., M.A. Harris, T.L. Arnold, and K.D. Richards, 2004. Urbanization Influences on Aquatic Communities in Northeastern Illinois Streams. Journal of the American Water Resources Association (JAWRA) 40(2):461-475.

Houston, L., M.T. Barbour, D. Lenat, and D. Penrose, 2002. A Multi-Agency Comparison of Aquatic Macroinvertebrate-Based Stream Bioassessment Methodologies. Ecological Indicators 1:279-292.

Iliopoulou-Georgudaki, V. Kantxaris, P. Katharios, P. Kaspiris, T. Georgiadis, and B Montesantou, 2003. An Application of Different Bioindicators for Assessing Water Quality: A Case Study in the Rivers Alfeios and Pineios (Peloponnisos, Greece). Ecological Indicators 2:345-360.

Seegert, G., 2000. The Development, Use, and Misuse of Biocriteria With an Emphasis on the Index of Biotic Integrity. Environmental Science and Policy 3:S51-S58.

Wang L. and J. Lyons, 2003. Fish and Benthic Macroinvertebrate Assemblages as Indicators of Stream Degradation in Urbanizing Watersheds. *In:* Biological Response Signatures: Indicator Patterns Using Aquatic Communities, Thomas Simon (Editor). CRC Press, LLC, Boca Raton, Florida, pp 227-250.

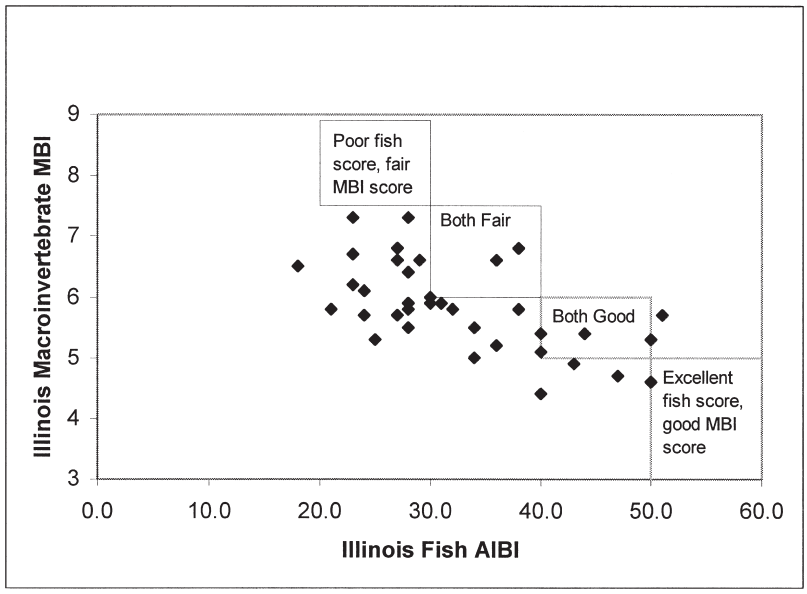

Figure 2. General Description of the Relationship of AIBI and MBI for Northeastern Illinois Streams.