

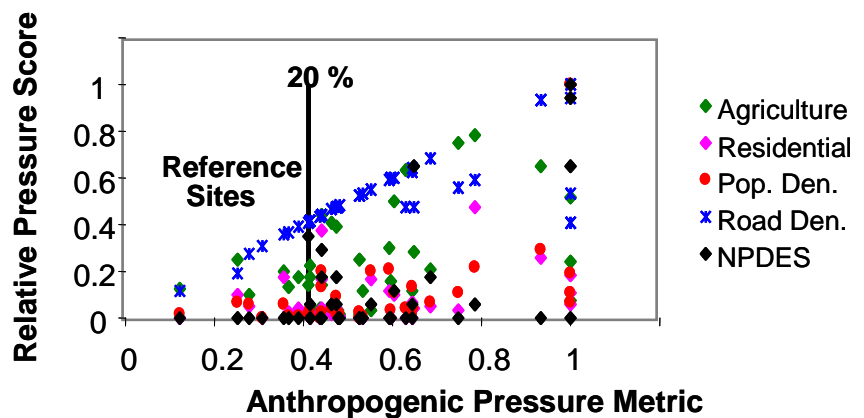


Fish Communities Respond to Habitat Conditions

The Great Lakes cover a wide geographic range in the heart of the North America. Human population, and consequently the impacts on aquatic habitats, are also highly variable across the region. Fish communities respond to both the natural habitat differences and the anthropogenic stresses in the basin. Fish community composition and characteristics have been shown to be excellent integrators of human disturbances, and are therefore used extensively as indicators of ecosystem health.

Reference Conditions

To determine overall ecosystem health, areas least impacted by human stress must first be defined; biological communities at test sites are then compared to reference sites to determine condition. The dominant anthropogenic stressors occurring in Great Lakes watersheds include: agriculture and residential landcover, population and road density, the number of discharge permits and designated areas of concern, and the extent of shoreline modification. Reference conditions are those areas comprising the lower 20% of all watersheds demonstrating the least amount of disturbance (Host et al. *In press*).



Wetland Indicators

Wetland fish were sampled at 86 individual wetlands during 2002 and 2003 using fyke nets. Fish catch per unit effort was calculated for each site. Species characteristics were summarized for each taxon. Community characteristics can be combined to form metrics that are useful tools when interpreting results. We found that widely used metrics, such as % exotic species or number of intolerant species, were correlated with the dominant stressors found throughout the Great Lakes basin (Figure 2).

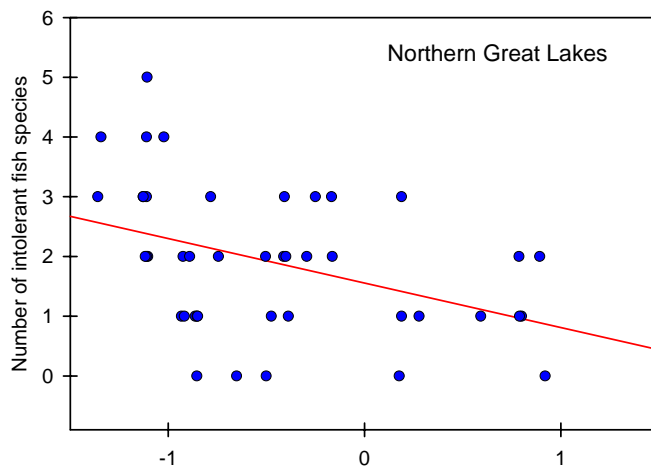


Figure 2. The number of sensitive fish species decreases with increasing amounts of agricultural activity in the northern Great Lakes wetlands.

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Spatial Scale of Responses to Stress

Indicators of wetland reference conditions vary across major climatic zones in the Great Lakes. Indicators in the northern regions, which are less disturbed than the southern region, include sand shiner, eastern slimy sculpin, longnose dace, and white sucker. Bluegill sunfish, pumpkinseed sunfish and white perch were consistently found in non-reference wetlands. Indicator species in the southern region included green sunfish and brown bullhead. Local factors have a profound impact on fish community composition and the scale of response is an important consideration during indicator development. Using a program called Focus (Holland et al. 2004), we examined the spatial scale at which an individual species responds to land use, summarized at increasingly large radii surrounding each wetland. More species respond to land use at large spatial scales than small.

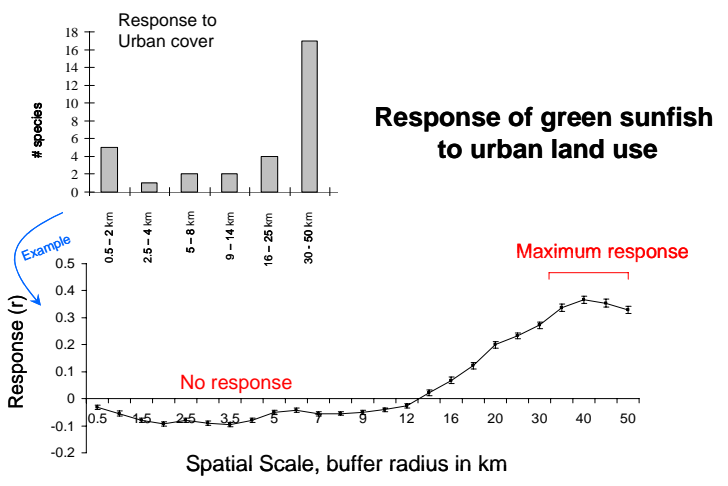


Figure 3. Analyses examining the scale of response (catch per unit effort) of green sunfish to land use at scales ranging from 0.5 km to 50 km surrounding the wetland. 24 other wetland fish species tested responded maximally to land use at the scale of 30-50 km around the sample wetland. Y axis represents the correlation coefficient.

References Cited

Holland, J.D., Bert, D.G. and Fahrig, L. 2004. Determining the spatial scale of species' response to habitat. *BioScience* 54, 227-233.

Host, G.E., J.A. Schuldt, J.J.H. Ciborowski, L.B. Johnson, T.P. Hollenhorst, and C. Richards. Use of GIS and remotely sensed data for *a priori* identification of reference areas for Great Lakes coastal ecosystems. *International Journal of Remote Sensing*, *In press*.

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- Carl Richards, MN Sea Grant

Acknowledgements

This research was supported by a grant from the US Environmental Protection Agency's Science to Achieve Results (STAR) Estuarine and Great Lakes (EaGLE) program through funding to the Great Lakes Environmental Indicators (GLEI) project, US EPA Agreement EPA/R-8286750.