

Invited Abstract

**FISH HABITAT, RIVERINE INFLOWS AND WESTERN LAKE ERIE:
IMPLICATIONS FOR FISHERIES MANAGMENT**

JEFF TYSON ODNR - Division of Wildlife, Dave Davies ODNR – Division of Wildlife,
Scudder Mackey ODNR – Division of Geological Survey

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Fisheries related habitat issues in the Great Lakes, specifically Lake Erie, are very complex. Due to this complexity, few broad-scale initiatives have been undertaken to affect habitat restoration in the Lake Erie basin. Most habitat "restoration" projects in the Lake Erie basin have been site specific in nature, including the addition of offshore reefs, enhanced wetlands, and other areas for species-specificity based upon HSI curves. Therefore, although these projects have had largely local positive impacts, there is some question as to how these fit in to the larger picture, and what cumulative impacts they have on the basin as a whole.

Part of the problem appears to be the lack of a broad systematic framework into which the numerous site specific habitat projects, undertaken by a broad spectrum of government authorities, as well as individual citizens, would fit. This is one reason why fisheries managers have been slow to promote long-term, broad-scale habitat initiatives. The two primary factors that Lake Erie managers feel that they can directly control from a fisheries standpoint is exploitation and stocking. Habitat initiatives, although viewed as important, perceptually have no immediate returns for the economically important offshore fisheries.

The relatively shallow western basin of Lake Erie, being influenced largely by riverine, as well as large-lake processes is unique to the Great Lakes. While approximately 90% of the volume of Lake Erie inflow is derived through the Detroit River, systematic productivity is derived primarily from the large watersheds along the south shore due to their young, productive, Pleistocene glacial soils, and the high percentage of land-use in agriculture. Due to this physical setting, the western basin has long been purported to be the most productive water in the Great Lakes, supporting a high biomass of forage fishes, three extant spawning stocks of walleye, and remnant populations of lake sturgeon, as well as other native species of interest.

Perceiving habitat in the western basin at a broader scale, by identifying broad, spatially, repeatable patterns in physical characteristics of the basin, should allow us to simplify the habitat complexity. We also attempted to determine if fish and zooplankton were responding to these repeatable patterns in the physical setting with repeatable patterns of aggregation. From these results we will propose an overarching framework for additional habitat restoration work and target techniques such that we can potentially have a long-term impact upon the sustainability of the fish community in western Lake Erie.

We used interagency bottom trawling data, collected since 1988, to examine whether there were repeatable spatial patterns in the physical characteristics of the western basin

of Lake Erie. We also used this data to examine the spatial distribution of fishes within the basin to determine if there were repeatable patterns in distribution. The spatial integrity of these samples was maintained and the data were combined across agency and year to spatially quantify if there were repeatable aggregations inter-annually. In 1996 we also collected zooplankton samples at each station in Ohio waters, and abundance of crustacean zooplankton was also examined relative to patterns in physical data and fish distribution data.

Using a hierarchical agglomerative clustering procedure, with temperature and secchi transparency information collected during the annual basin-wide bottom trawling surveys, we found that the major inflows into the western basin do remain relatively discrete and could be characterized as habitat polygons. Several of the species of fish examined also exhibited repeatable spatial patterns in distribution and abundance across the 12 year time series and tended to aggregate within certain habitat polygons. The zooplankton data showed similar spatial trends in density as well. Relatively high zooplankton densities were associated with the large south shore inflows, and lower abundance was associated with the Detroit River. The higher primary and secondary production associated with the inflows of these south shore tributaries is most likely a function of the high systematic productivity of these watersheds and indicates the importance of these rivers as structuring forces in the western end of Lake Erie.

From our preliminary results it appears that the physical characteristics of inflows remain discrete through time and the influences of large tributaries (Detroit, Maumee, Sandusky) are significant structuring forces in the western basin. The natural ecological boundary of these tributaries and watersheds extends well beyond the confluence of the rivers and Lake Erie. Western basin waters are strongly influenced by these tributary water mass temperatures, dissolved and suspended substances, and hydraulics. By examining both spatially and temporally explicit repeated patterns in distribution and abundance of fishes we can begin to effectively define physical habitats for these species without the significant subjectivity of Habitat Suitability Curves.

By breaking down the complexity of the basin and providing physical linkages between watersheds and the physical habitats supporting Lake Erie fish communities, we should be able to effectively develop and implement a habitat enhancement/restoration scheme that will affect tributary, nearshore and offshore fish community abundance and sustainability. Additionally it provides an opportunity to create an overarching systematic framework for habitat restoration at watershed/lake basin scales. This information would also give Lake Erie fisheries managers impetus to move up into the watersheds to affect water quantity (i.e. flow regime) and water quality characteristics for the benefit of Lake Erie fisheries. Rehabilitation/protection of important structuring forces on habitats that are predictable in space and time is truly meaningful to the long-term sustainability of fish communities. The specter of repeated aggregation of species in the western basin will not only provide for further habitat research, but will also influence assessment protocols, as well as exploitation strategies and adds to knowledge of the biology of the resources we steward.