

**EFFECTS OF LOW-HEAD BARRIERS  
ON FISH SPECIES RICHNESS IN STREAMS  
WITHIN THE LAURENTIAN GREAT LAKES BASIN**

Marlene D. Ross,  
Robert L. McLaughlin and David L. G. Noakes  
Department of Zoology and Axelrod Institute of Ichthyology,  
University of Guelph, Guelph, Ontario N1G 2W1 Canada

**EXTENDED ABSTRACT ONLY- DO NOT CITE**

The parasitic sea lamprey, *Petromyzon, marinus*, is an exotic invader and a serious economic concern in the Laurentian Great Lakes. It causes significant economic losses by attacks on a variety of fishes, including those of commercial and recreational value. A variety of potential control procedures have been suggested or attempted to deal with this species in the Great Lakes.

Low-head barriers are being installed as an alternative to chemical control of sea lamprey in tributary streams around the lakes (Great Lakes Fishery Commission 1992). We assessed historical data from federal, provincial and state agencies to investigate whether the placement of low-head sea lamprey barriers has had an effect on stream fish communities within the Laurentian Great Lakes basin (McLaughlin et al. 2001). Previous field surveys and experimental studies on selected Great Lakes streams had suggested that sea lamprey barriers could impede instream movements of non-target fishes (Porto et al. 1999). This lead us to predict that the construction of low - head barriers would block upstream movement of nontarget fishes, and hence cause a reduction in species diversity upstream of barriers. The results of Pringle (1997) further supported our prediction of a decline in fish species diversity following the installation of low - head barriers.

Lester et al. (1996) have assessed the protocols necessary for detecting changes in nearshore fish communities, but those methods cannot be directly transferred to historical data on stream fish communities. We collated and compared

historical data from a variety of sources on collections of fishes from Great Lakes tributary streams. We had data from stream before and after construction of low - head barriers (“barrier streams”), as well as from streams where no low - head barriers had been constructed (“reference streams”). We compared fish species diversity in collections before and after the placement of barriers. We also compared fish species diversity in comparable barrier and reference stream pairs to control for baseline (secular) changes in fish species diversity over time.

The lack of adequate geo-referencing of most sample locations, and inconsistencies in fish identification and collecting techniques limited our analyses of these historical data. We found no statistical differences in fish species diversity between streams with and without barriers. However, our analysis is complicated by inherent inconsistencies in the database. The major limitation is that we had to restrict our analyses to the level of overall fish species diversity within given streams (barrier versus reference).

The value of using historical databases is limited, given the inconsistent nature of data collection over the past 100 years of sampling. The pitfalls of using historical data include variability of collection methodologies, gaps in the data time series, difficulties in pairing streams, and lack of vital georeferencing data (Underwood 1996). Given the limitations with existing data, we recommend a standardized data collection methodology in conjunction with sampling before and after construction of future barriers to assess impacts of sea lamprey barriers on fish communities. Furthermore, it is essential that identification of all species be verified by the use of voucher specimens deposited in reference collections.

## References

- Great Lakes Fishery Commission. 1992. Strategic vision of the Great Lakes Fishery Commission for the decade of the 1990's. Ann Arbor, Michigan.
- Lester, N. P., W. I. Dunlop & C. C. Wilcox. 1996. Detecting changes in the nearshore fish community. *Canadian Journal of Fisheries and Aquatic Sciences* 53 Supplement 1): 391 - 402.
- McLaughlin, R. L., L. M. Carl, T. Middell, M. Ross, D. L. G. Noakes, D. B. Hayes & J. R. Baylis. 2001. Potentials and pitfalls of database design:

lessons from a historical database for Great Lakes fishes. *Fisheries* 26:  
14 - 23.

Porto, L. M., R. L. McLaughlin & D. L. G. Noakes. 1999. Low - head barrier  
dams restrict the movements of fishes in two Lake Ontario streams.  
*North American Journal of Fisheries Management* 19: 1028 - 1037.

Pringle, C. M. 1997. Exploring how disturbance is transmitted upstream: going  
against the flow. *Journal of the North American Benthological Society*  
16: 425 - 438.

Underwood, A. J. 1996. On beyond BACI: sampling designs that might reliably  
detect environmental disturbances. In: R. J. Schmidt & C. W. Osenberg  
(editors) *Detecting Ecological Impacts: Concepts and Applications in  
Coastal Habitats*. Academic Press, San Diego.

