CAN FISH MORPHOLOGY PREDICT MOVEMENT

OVER LOW-HEAD BARRIERS?

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EXTENDED ABSTRACT ONLY- DO NOT CITE

The parasitic sea lamprey, *Petromyzon, marinus*, is an exotic invader in the Laurentian Great Lakes. It has been a serious economic concern for the past 50 years. This situation has the status of a textbook example in many areas of ecology and management. The parasitic sea lamprey causes significant economic losses in the Laurentian Great Lakes 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 currently being installed and assessed as an alternative to existing chemical control of sea lamprey in tributary streams around the lakes (Great Lakes Fishery Commission 1992). Low-head barriers are installed to block the seasonal spawning migration of parasitic sea lamprey, *Petromyzon, marinus*, in tributary streams around the Laurentian Great Lakes (Hunn & Youngs 1980). With increasingly numbers of these barriers being installed, there is concern as to the potential impact on nontarget fish species (e.g., Fausch & Young 1995).

We carried out a combined extensive survey and intensive experimental study of streams with and without barriers to address this concern. We followed this with an analysis of morphological characters of selected fish species to test for any predictive relationship with negative or positive impacts of barriers on fish movements. It would be a major advantage to develop a predictive relationship between morphology and impact of low - head barriers. Although this would be an indirect method, it could lead to considerable savings in time, effort and resources required for direct field studies of the responses of fishes to barriers.

We chose a number of representative streams with barriers for our studies. For each barrier stream we selected an adjacent stream without a barrier as a paired control. Our extensive surveys of barrier streams and comparable reference streams (with no barriers) show that on average there is a reduction in the number of fish species found in barrier streams. Intensive studies of selected barrier and reference streams show that upstream movement of some species is reduced by the presence of the barriers (Porto et al. 1999).

We analyzed external morphological characters ("size and shape") of the fish species affected by barriers to determine if there is a suite of characters that can predict whether a particular species will be able to pass over these barriers. We digitized lateral images of individual fishes, with a number of landmarks of features generally thought to be significant for swimming and jumping (e.g., body length, body depth, size and placement of caudal fin) (Motta et al. 1995). We applied Principal Component Analysis to these data. We categorized fish presence or absence above and below barriers, and also calculated odds ratios for each species to estimate the impact of low - head barriers on their occurrence upstream and downstream of barriers.

We could not find any evidence of a simple, predictive relationship between external morphology and whether that species could successfully move over low-head barriers. Thus we reluctantly conclude that it may not be possible to develop such an indirect method for assessing the impact of low - head barriers on non-target fishes. It appears that we will need direct observations of behavioral responses of fish to various configurations of barriers to develop a predictive relationship for fish passage.

References

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