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ASSESSING THE POTENTIAL OF SELECTIVE FISH PASSAGE USING TRAP-AND SORT FISHWAYS

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ABSTRACT:

Management decisions to enhance or restrict the movements of fishes in river systems can be complicated. Removing in-stream obstructions to fish movement can allow desirable native and non-native species of fish to access new habitat and increase the production and diversity of these fish, but can also facilitate the spread and reproduction of invasive fishes and the harm they have on desirable fish. Conversely, restricting the movement of invasive fishes using instream barriers can reduce their spread and reproduction, and the harm they have on desirable fishes, but will also restrict the movement of desirable species. Selective passage of desirable fishes past in-stream barriers, while blocking invasive fishes, could resolve this connectivity conundrum, but requires the development of efficient, cost effective methods for sorting desirable and invasive fishes. This project examined the potential for improving the sorting of fishes at fishways operated by the sea lamprey control program to selectively pass desirable fishes by in-stream barriers that deny invasive sea lamprey (Petromyzon marinus) access to spawning habitat upstream. Our study focused on three trap-and-sort fishways that allow fish to self-sort between two sequential chambers based on body size before being manually netted, sorted, and released upstream (desirable fishes) or removed (sea lamprey). The fishways considered were Big Creek (Lake Erie), Big Carp River (Lake Superior), and Cobourg Brook (Lake Ontario). Analysis of historical catch records (>15 years per site) revealed that the level of size-selective sorting achieved in the fishways is consistently low within and among years, largely due to small desirable fishes moving into the upstream chamber with sea lamprey, but also due to infrequent occurrences of sea lamprey in the downstream chamber with large, migrant desirable fishes. Field experiments in 2019 and 2021 demonstrated that manipulating the lighting and water velocity in the fishways, and altering the design of the sorting funnel connecting the downstream and upstream chambers of the fishway, did not improve the level of size-selective sorting of desirable fishes and sea lamprey appreciably. Analyses of body lengths and maximum depths of desirable fishes occurring in the downstream and upstream fishway chambers confirmed that movement from the downstream chamber into the upstream chamber is determined by a fish’s maximum body depth and gains in size-selective sorting could be made by adding a third chamber upstream that small desirable fish could enter, but sea lamprey could not. Information from these studies was used to simulate the potential of automating the two-chamber fishways to reduce the need for costly manual netting and sorting of fishes from the fishway chambers. For the two chamber design, automated daily releases of fish from the downstream fishway chamber is not practical for selective fish passage, because the sorting efficiency for desirable fishes is low, the time cost of manually sorting fish from the upstream chamber remains high, and the risk of sea lamprey escapement via automated releases from the downstream chamber is concerning even though most sea lamprey (>96%) are collected from the upstream chamber. For a three-chamber fishway design, automated daily releases of fish from the downstream and upstream chambers could be more feasible, because the size-selective sorting of desirable fishes and reductions in the need for manual sorting are expected to improve dramatically. However, uncertainty about the risks of sea lamprey escapement during releases from the downstream and upstream chambers needs to be addressed. Our findings indicate that achieving the level of sorting necessary for selective fish passage without the manual sorting of fishes will be challenging, but is possible.