Designing sortable guilds for multispecies selective fish passage

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ABSTRACT:

Despite the recognized importance of connectivity for freshwater organisms, in-stream barriers, which have been associated with decreased population sizes and increased risk of extinction, are globally ubiquitous. Despite these negative consequences, barriers can also serve to protect aquatic communities by limiting the spread of invasive species, leading to a conflict in management goals. Selective fish passage has been proposed as a solution for these conflicting ideas. The development of selective fish passage solutions will depend on the number of species present, as well as the level of variation in their traits and attributes. Subsequently, approaches that can target groups of species that share similar attributes (i.e., guilds) are likely to be more efficient and feasible than those that target each species individually, particularly in diverse systems. In this study, we explored the guild structure of 220 Great Lakes freshwater fishes based on morphological, phenological, physiological, and behavioural attributes associated with passage and movement. We identified five distinct guilds as well as the attributes most important for defining these groupings: maximum total length, trophic level, relative eye size, spawning temperature, spawning season, presence/absence of ampullary electroreceptors, and the presence/absence of hearing specializations. Through a secondary analysis and case study, we highlight how site-specific data can be used to further inform the design of selective fish passage systems in a local context. The approaches outlined in this work can be used worldwide to inform selective fish sorting and address issues of connectivity in aquatic ecosystems.