Upstream Fish Passage solutions: is the answer one-size-fit-all or made-to-measure?

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Nearly 60,000 large dams (higher than 15 m) occur worldwide in addition to an estimated 16 million smaller impoundments with surface area larger than 100 m2. The resulting habitat fragmentation threatens global riverine biodiversity and sustainable fish populations.  Two opposing approaches for selecting fish passage designs to mitigate river fragmentation are possible: develop a limited number of standardized (reference), more general, design solutions from which a design for a candidate dam is selected vs. conduct scientific fish passage studies specific to each dam and targeted fish species.  The two approaches vary in probability of success, cost of supporting biological studies, and project schedule impacts.  To address this conundrum, we analyzed approximately 600 USA dams to identify two groups that differed markedly in fish passage planning.  Snake River dams are similar in design, flow, geological setting, and target fish species.  In contrast, Mississippi River dams are relatively dissimilar in design, flow, geological setting, but generally similar in target fish species.  We conclude that the more similar a candidate dam for fish passage is to a reference set of similar dams (i.e., the Snake River Dams), then the more likely fish passage technology can be successfully extrapolated from the reference dams, thereby reducing reliance on supporting scientific studies.  In contrast, the more dissimilar reference dams are as a group, then the less likely fish passage technology can be extrapolated from the reference dams and the greater is the need for supporting scientific studies. We recommend that dams in a region be clustered by their similarity using key hydrologic, structural, operational, and biological variables to develop sets of fish passage templates that can be used to optimally extrapolate fish passage solutions to new dams or retrofit of fish passage facilities to existing dams.