

## Bubble curtain and novel 'dancing rods' behavioural guidance solutions for out-migrating European eels and Atlantic salmon smolts

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**ABSTRACT:** Hydropower plants and their adjacent infrastructure obstruct migratory pathways, and the lack of free-flowing rivers worldwide is a significant factor contributing to the rapid decline in migratory fish populations. To ensure river connectivity, restoration of downstream migration is necessary in addition to upstream. During downstream migration, fish rely on bulk water flow and require a guidance system to steer them away from dam intake channels and towards safe fish passage. While some physical guidance structures have been effective, they are expensive to maintain and difficult to scale up for large hydropower plants. Alternatively, guidance systems based on fish behaviour may provide an alternative, but finding a viable solution has been challenging. We conducted experiments using a bubble curtain for the endangered European eel and a novel "dancing rods" behavioural barrier for Atlantic salmon smolts in a large experimental flume and compared them to no-barrier control. Our findings showed that the bubble curtain was ineffective for guiding eels, as the guidance efficiency was similar to the control treatment. In contrast, the "dancing rods" had significantly higher guidance efficiency compared to the control treatment. Based on our results, we conclude that the bubble curtain is not practical for eel guidance, while the "dancing rods" principle could be applied to the design of future behavioural guidance solutions. Discovering effective behavioural guidance solutions that companies can implement is crucial for ensuring downstream fish passage and restoration of river connectivity.