
Effect of multiple stressors on migratory fishes: does watershed functioning help better explain population declines?

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Abstract

Aquatic vertebrates, especially fish, have experienced a drastic decline over the last decades. This is especially true for migratory fish species that depend on freshwater habitats to complete their lifecycle (e.g., anadromous and catadromous). While this finding has already been related to anthropogenic activities, to date, no study has investigated simultaneously the contribution of the causes of this decline across watersheds and along migratory pathways relying on causal inference. Based on historical archives, experts’ knowledge, and recent national electrofishing surveys from the "Office français de la biodiversité" (OFB) and his partners, we have investigated the direct and indirect relationships between the decline of migratory fishes and anthropogenic pressures, including landscape use, hydromorphological responses and resulting alterations, stream continuity disruptions (e.g., dams, weirs), physico-chemical parameters, and chemical contamination. More especially, we used Structural Equation Modelling (SEM) to explore the cascading effects of human activities on freshwater ecosystems across spatial scales (i.e., from the watershed to the study site) and their effect on migratory fish species. Our results suggest that using a quantitative approach that quantifies the relative contribution of multiple stressors to migratory fish’s decline, as well as considering their indirect effects, is particularly relevant to improve conservation strategies on freshwater streams.

Keywords: Multiple Stressors, Migratory Fishes, Anthropogenic Pressures, Structural Equation Modelling

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