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Abstract

The Impact of River Fragmentation on Freshwater Fish Population Connectivity in Spanish River Basins †

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Abstract

Introduction: Artificial infrastructure interrupts river longitudinal connectivity, preventing the free flow of water, matter, energy, and organisms through the system, altering the habitat and impacting freshwater biodiversity. Freshwater fishes are especially sensitive to this threat, since they are constrained to the limits of the river network. Transversal obstacles, such as dams and weirs, hinder their movements upstream and downstream and fragment populations. Longitudinal connectivity can be simply measured as the proportion of connected river length in a basin. However, other indices have been suggested more recently, measuring connectivity as the proportion of connected elements of interest (e.g., populations of a species) in a river basin. **Objective:** The aim of this work was to study (1) the degree of connectivity of native freshwater fish species populations in eleven Spanish river basins and (2) the impact of artificial river fragmentation in these basins on population connectivity. **Methodology:** Fish populations' location and size were estimated through sampling presence data, and completed using the predicted occurrence of each species in a river basin, calculated through Species Distribution Models (SDMs). To estimate the degree of connectivity between populations of each species, the Population Connectivity Index (PCI) was calculated under two scenarios: the "current" scenario, considering all the artificial obstacles fragmenting the river network and their specific passabilities, and the "natural" scenario, considering that all the artificial obstacles in the river network were completely passable. **Results**: Native freshwater fish populations are severely fragmented in Spanish rivers, with a mean current PCI of 9.8% across species and river basins. The impact of artificial fragmentation is high, causing a mean decrease in PCI of 52 percentage points across species and river basins. Moreover, although the impact of artificial river fragmentation is high in all river basins, it is important to point out that there are significant differences between river basins attributed to their size and the specific traits of the ichthyofauna inhabiting them. **Conclusions:** The degree of connectivity in a river basin varies depending on the elements of interest considered. Therefore, incorporating ichthyofauna into the decision-making process is essential to improve the effectiveness of river restoration actions.

Keywords: river connectivity; freshwater fish populations; fragmentation

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