

Fishes in the net: The role of river network characteristics on fish diversity

Freshwater fishes are among the most restricted species worldwide because they are fully contained within fragmented networks of water bodies surrounded by land. Given that the natural fragmentation and isolation of these networks have been identified as a generator of the greatest diversity in this group, we need a deeper understanding of their role as drivers of fish diversity. Hints that the evolutionary history and distribution of fishes are closely linked to the geomorphological history of watersheds exist in the literature. For example, some studies have shown that certain watershed traits such as river size, surface area, and natural fragmentation of watersheds are correlated with measures of species diversity. Despite this progress, how the complex interplay between river network structure, watershed characteristics, and species' spatial ecologies drives diversification and biodiversity in freshwater fishes is not yet understood. Here, we combine a global fish occurrence database, a detailed, species-level phylogeny, and a novel dataset on river network structure and watershed traits to comprehensively reveal the determinants of freshwater fish biodiversity at the global scale. The dataset encompasses 11,300+ species distributed across 2,000+ watersheds worldwide, representing approximately 60% of the global diversity of freshwater fishes. To characterize watershed heterogeneity and connectivity we first calculated novel metrics of river network structure including centralization and density, and combined them with geomorphological and climatic characteristics. We then related these variables to fish diversity metrics considering the spatial autocorrelation in the regression analyses. Our preliminary findings indicate that fish diversity is jointly determined by environmental heterogeneity and river network connectivity, highlighting the necessity to account for network structure and characteristics when studying global biodiversity patterns of freshwater species.

References

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