
Morphological diversity of the world freshwater fishes is driven by both taxonomy and biogeography

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Abstract

More than 13000 freshwater fish species are distributed throughout the World Rivers, with strong differences in species composition between realms, but how such taxonomic turnover translates into morphological differences remains unanswered. Here we use a global database of freshwater fishes to test the variability of the morphological traits among biogeographic realms. We measured ten morphological traits on 9150 species, i.e. 75% of the described freshwater fish species to test if these traits are homogeneously distributed among the fish faunas of the six terrestrial biogeographic realms. We then analysed the contribution of order membership and within order morphological variability to the morphological differences between realms, and determined to which extent the realm distributions of morphological traits were supported by extreme morphologies (i.e. species belonging to the 2.5% tails of the trait distributions). We report a strong morphological variability among freshwater fishes of the world, with significant morphological differences among realm fish faunas, caused by an interplay between taxonomic composition of the realm faunas and morphological differences within orders among the realms. Morphologically extreme species accounted for a large percentage of the trait range and distribute throughout the world. Moreover, the Neotropical realm hosts a disproportionate proportion of extreme morphologies. Our results indicate that fish morphology, which differs among realms, is largely supported by a few species with extreme morphologies, encouraging therefore forthcoming studies to focus on the functional role played by those extreme species. To this aim, our results will serve as a benchmark for future regional and local assessments of morphological diversity.

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