Species traits and phylogenetic conservatism of climate-induced range shifts in stream fishes

© Gaël Grenouillet

The intrinsic characteristics of freshwater fish and their evolutionary history determine their vulnerability to recent climate change (here barbel Barbus barbus).

Understanding climate-induced range shifts is crucial for biodiversity conservation. However, no general consensus has so far emerged about the mechanisms involved and the role of phylogeny in shaping species responses has been poorly explored. Here, we investigate whether species traits and their underlying phylogenetic constraints explain altitudinal shifts at the trailing and leading edges of stream fish species ranges. We demonstrate that these shifts are related to dissimilar mechanisms: whereas range retractions show some support for phylogenetic clustering due to a high level of conservatism in thermal safety margins, range expansions are underpinned by both evolutionarily conserved and labile traits, notably trophic position and life-history strategy, hence decreasing the strength of phylogenetic signal. Therefore, while climate change brings many difficulties in establishing a general understanding of species vulnerability, these findings emphasize how combining trait-based approaches in light of the species evolutionary history may offer new opportunities in facing conservation challenges.

In the near future, biodiversity patterns could be greatly modified owing to the spatially selective reshuffling of communities with species displaying specific combinations of traits and evolutionary history. Whether the biological impacts of climate change will ultimately depend on the complex interplay of species responses thus deserves urgent attention. Only with improved understanding of the potential impacts of species range shifts on biological interactions and their consequences on ecosystem functioning will researchers be able to quantify the ecological threat posed by future climate change.

Nature Communications, 2014, 5: 5023

Lise Comte, Jérôme Murienne & Gaël Grenouillet

Conception : M. Aizpuru (FR AIB) - Photo : © G. Grenouillet (EDB)