Interactions between species traits explain population dynamics in stream fishes under climate change

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Abstract

Species responses to climate change have been shown to vary strongly in both direction and extent among species. Understanding these idiosyncratic responses is crucial if we are to predict species extinction risk and set up efficient conservation strategies. Several species traits (e.g. physiological tolerance, ecological requirements or life-history strategies) and niche characteristics (e.g. niche breadth, niche position) have been related to variation in responses among species. Although previous studies have related these species attributes to population dynamics, few have considered whether their interaction can explain among-species differences in the influence of climate on populations. In this study we focus on among-species differences in the population growth rate, the strength of density-dependence and the influence of both mean temperature and its variability on stream fish populations for 35 species. Models including interactions between species attributes displayed greater support over simple additive models in explaining interspecific differences in the growth rate and the influence of both climatic variables on population abundances, while none of the traits considered here explained among-species differences in the strength of density-dependence. We show that although single traits could explain the observed differences, their predictive power was largely mediated by other attributes, especially niche breadth and thermal safety margins. Overall, our results highlight the importance of considering the interplay between species attributes in unraveling the mechanisms involved in population dynamics and understanding the vulnerability of species to global changes.

Keywords: hierarchical N, mixture models, bayesian inference, growth rate, density, dependence, climate, fish, phylogeny, trait, based models

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