Effects of temperature and biological invasions on food web structure and dynamics

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Résumé

Climate change and biological invasions are among the most important drivers of global change. Despite major advances in understanding their individual ecological impacts, their combined effects on ecological communities remain largely unexplored. Here we combined theoretical models and empirical data of freshwater food webs across France to investigate how these two drivers can affect the structure and dynamics of ecological communities. The model predicts that warmer communities have lower connectivity, shortened food chains and reduced temporal variability and, therefore, are more susceptible to invasions. In line with these theoretical predictions, we found that empirical food webs are simpler in warmer streams and lakes. In addition, warmer lakes host more exotic species, which, in turn, affects food web structure. Finally, we found that most lakes are warming fast promoting biological invasions. Surprisingly, the later contribute to increases species richness and to elongate food chain lengths. Nevertheless, we also show that, in alpine lakes, food chain elongation can destabilize communities and make them more vulnerable to perturbations. Overall, our theoretical models and empirical data indicate that climate warming and biological invasions are likely to have antagonist effects on food web structure and dynamics and that climate warming mostly impact food web structure indirectly by promoting exotic species.

Mots-Clés: food web, climate change, biological invasions, freshwater, community models

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