Uncovering aquatic toxicity as a specific driver among multiple stressors affecting the functional structure of French stream macroinvertebrate communities.

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Résumé

Since recent years, freshwaters ecosystems such as rivers are subjected to increasing pressures from human-induced drivers of changes, including chemical contamination and warming. These different pressures are expected to impact freshwater communities, notably through changes of the biological traits of their component species. Although a growing literature exist on the subject, uncertainties remain on how independent and combined effects of those pressures affect communities and ecosystem functioning.
Here, we used multivariate analyses to estimate the relative influences of potential environmental drivers of stress (e.g. toxic contamination, temperature) on the functional structure of macroinvertebrate communities (community weighted means) in French streams. The dataset gathers community records and environmental descriptors for 76 stations of the national monitoring network. Toxic contamination was estimated using indicators based on repeated in situ *Gammarus fossarum* feeding inhibition bioassays. With variation partitioning, we estimated the independent and combined effects of the different environmental variables on biological traits. We then compared our results with *a priori* models of expected trait responses to stressors as well as null models (random species-trait associations).

Our results showed that all environmental descriptors significantly influence the functional structure of invertebrates, with the most important driver being temperature. Confirming previous results gained on taxonomic compositions, the variation partitioning procedure revealed that toxic contamination influenced species traits independently from temperature. Comparisons with the *a priori* and null models showed that, for toxic contamination, temperature and nitrites, the observed trait responses were compatible with models of stress and were significantly different from null models. When including the shared fractions of explained variance in the analyses, those drivers were associated with several types of a *priori* models of stress, but, when focusing on the independent fractions, each driver was associated with specific models.

*Intervenant

Our study thus showed the importance of independent and combined effects of multiple stressors on the functional structure of freshwater communities, and notably revealed toxic contamination as a significant driver of stress.

Mots-Clés: community ecology, functional traits, ecotoxicology, disturbances, global changes