Applying life-history strategies for freshwater macroinvertebrates to lentic waters

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Abstract

1. Effective environmental management requires a sound understanding of the causal mechanisms underlying the relationship of species with their environment. Mechanistic explanations linking species and environment are ultimately based on species traits. Many tools for ecological assessment and biomonitoring lack such explanations. Elsewhere, we have defined life-history strategies, based on the interrelations between species traits and their functional implications.

2. This study tests the hypothesis that life-history strategies represent different solutions to particular ecological problems, thus connecting species and their environment through species traits. Data on aquatic macroinvertebrates in a variety of water bodies were analysed in terms of life-history strategies. These water bodies differed in environmental conditions and macroinvertebrate assemblages. Solutions to the ecological problems present in each type of water body were expected to be reflected in the abundance of (species exhibiting) different life-history strategies.

3. Results show clear differences in strategy composition between the different water types, which could be related to the prevailing environmental conditions through mechanistic explanations. For example, species with a long period of juvenile development and a synchronised emergence of short-lived adults were most dominant in large mesotrophic water bodies with stable and predictable environmental conditions. In contrast, species that have a rapid development and spread successive reproduction attempts over a longer time period were most abundant in water bodies with fluctuating and less predictable environmental conditions.

4. Differences in strategy composition provide insight into the prevailing environmental conditions related to temporal predictability, and habitat favourability, from the perspective of the species themselves. By reducing diverse species assemblages to a small number of strategies, representing easily interpretable relationships, this approach may be useful in environmental quality assessment programmes, including those required by the European Water Framework Directive. Based on mechanistic explanations, life-history strategies may generate testable predictions and guide future research. Further research may focus on expanding life-history strategies to include other species groups and ecosystems.

Keywords: Biomonitoring; Causal mechanisms; Indicator species; Species traits; Water Framework Directive

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