



Effective hydromorphological parameters for the diversity and structure of benthic invertebrate communities in rivers

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The increase of species richness with increasing habitat diversity is a general paradigm in river ecology. Therefore, it is crucial to improve river morphology in an ecological oriented management of rivers and streams. This necessity is becoming increasingly important due to the fact that morphological degradation is the main reason for failing the “good ecological status” of rivers and streams according to the Water Framework Directive by 2015 (approximately 60% of water bodies in Germany).

Based on 250 quantitative samples of benthic invertebrates across a gradient of morphologically degraded river sections in the low mountain range of Hesse, Germany, the relationships between biological attributes of the benthic community and morphological attributes were analysed. In particular species diversity, taxonomic composition and functional attributes of the benthic community were related to twenty different parameters of the standardised German stream habitat survey in order to identify morphological parameters with a significant influence on benthic invertebrates.

We identified six significant morphological parameters with complex relations to benthic communities. The relations between biological attributes and single morphological parameters along degradation gradients were diverse. Our results indicate both linear relationships between biological attributes (especially taxonomic composition) and respective morphological parameters and non-linear relations with no general trend of increasing species richness even across wide gradients of habitat features.

Particular with regard to the functional composition of the benthic community there is evidence for a maximum of functional diversity at intermediate disturbance.

Nevertheless, the dependencies between the biological attributes and the morphological parameters were diverse with a high total variance of relationships (maximum correlation coefficients were 0.35 to 0.40). We suppose, that a high proportion of that variability is caused by the fragmentation of valuable habitats. As can be learned from inconclusive restoration measures, a fragmented network of habitats and refugia may be a major reason for the missing recovery of benthic communities.

We conclude that (a) stream habitat surveys have to carefully select the ecological effective hydromorphological parameters and may consider the diverse relationships between abiotic factors and biological responses for evaluation schemes. (b) The assessment of the ecological status has to consider interactions between different hydromorphological factors and (c) the necessity of more comprehensive consideration of dispersion and colonisation patterns of aquatic communities in rivers and streams.