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How to comprehensively evaluate river corridor conditions? A comparison of different biotic and morphological indices in northern Italy

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The assessment of river conditions is crucial for planning appropriate management actions. The European Water Framework Directive 2000/60/EC (WFD) requires the assessment of biological, physical-chemical and hydromorphological elements to define the ecological status of rivers. The WFD suggests the use of different bioindicators (i.e. benthic macroinvertebrates, diatoms, aquatic macrophytes and fish), the so called "biological quality elements" (BQEs). However, recent studies showed that BQEs-based indices have two main limitations: (i) their standard application is limited to flowing channels and (ii) they are not sensitive to hydromorphological alteration. Hydromorphological conditions are usually evaluated applying methods for physical habitat assessment (i.e. the River Habitat Survey or derived methods) that consist in site-scale inventories of river forms and anthropic structures. The lack of consideration of wider spatial (i.e. reach or catchment scale) and temporal scales (e.g. channel evolution over the last 50-100 years) make such methods inadequate for a sound diagnosis of morphological alterations.
The Morphological Quality Index (MQI) and the dragonfly-based Odonate River Index (ORI) were developed in the recent years to overcome the above-mentioned limitations and to assess the condition of the whole river corridor (i.e. the channel and its adjacent floodplain) at reach scale. In this study we correlated the assessments of MQI, ORI and two BQEs-based biotic indices (i.e. STAR_ICMi for benthic macroinvertebrates and ICMi for diatoms) in 15 lowland river reaches in northern Italy. The selected reaches are characterized by a wide range of morphological degradation.
MQI and ORI were highly correlated, probably because both methods work at reach scale and consider the integrity of the whole river corridor, either in terms of morphology or considering ecological aspects. In contrast, no significant relationships were found between MQI and ORI and the BQEs-based indices (i.e. ICMi and STAR_ICMi). This can be probably attributed to the differences in spatial scale (i.e. site scale) at which the BQEs-based indices apply and to the human pressure that they were originally designed to detect (i.e. water quality).
These results show that MQI and ORI are useful tools to evaluate the integrity of the river corridor, at reach scale. The ORI provides information on the ecological condition of the river not covered by the other biotic indices, thanks to the sampling strategy that considers also secondary channels and ponds. We underline the importance of integrating the assessment of the lateral dimension of the river corridor in the evaluation and the need to choose appropriate indicators. The choice of the indicators must also consider the spatial and temporal scale of their application, in order to detect pressures operating at various scales (e.g. water quality and hydromorphological alteration). Only the integration of reach-scale indicators, such as MQI and ORI, would allow for a comprehensive evaluation of river corridor conditions and to define sound and appropriate management actions.