How to improve hydromorphological assessments of rivers and streams?

According to the Water Framework Directive (WFD), adequate assessment of stream and river hydromorphology requires the consideration of any modifications to flow regime, sediment transport, river morphology, lateral channel mobility, and river continuity. A large variety of hydromorphological assessment methods are available, with notable differences in terms of aims, spatial scales, and approaches and consequently with specific strengths and shortcomings. This review on eco-hydromorphological methods (REFORM deliverable 1.1) compares existing methods, identifies gaps in the applicability of methods, and recommends how to improve hydromorphological assessments.

Hydromorphological assessment includes the application of methods and procedures developed to characterise the hydromorphological conditions of streams and rivers and thereby classify its status. For the scope of this review, five broad methodological categories were distinguished:

(1) Physical habitat assessment

(2) Riparian habitat assessment

(3) Morphological assessment

(4) Hydrological regime alteration assessment

(5) Longitudinal fish continuity assessment.

The general characteristics of a total of 139 methods (European and non-European) have been reviewed. Next, the analysis focussed on a selection of European methods (in total 22), i.e., those methods that have been formally approved or that are commonly used by European countries for the implementation of the WFD. Characteristics, recorded features, indicators, processes, and strengths of each method were revised, allowing for a comparative analysis of the different categories and of the various methods.

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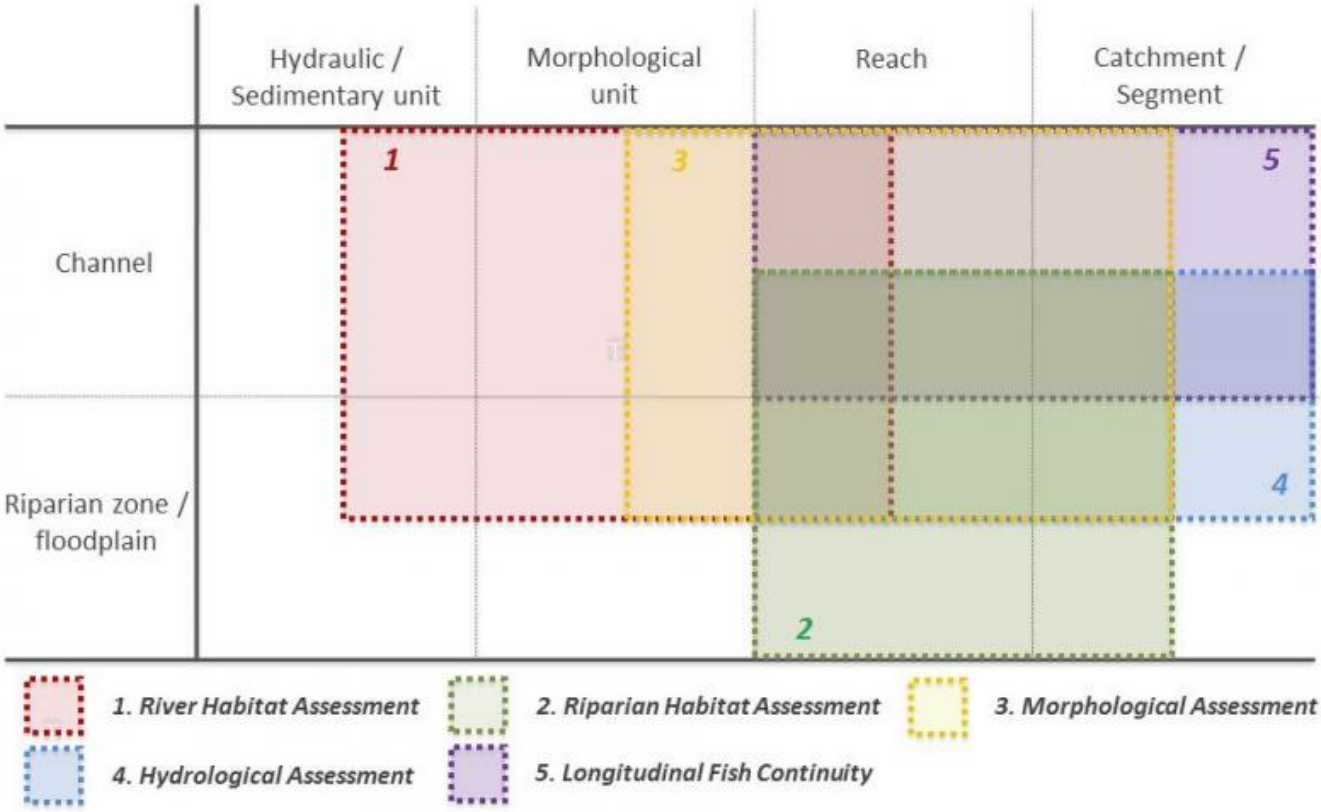

Spatial context, spatial scales and overlap between assessment method categories. Graph: Barbara Belletti, Università di Firenze.

Physical habitat methods, which are useful for characterising the range and diversity of habitats, have long been identified with hydromorphological assessment. However, it is now recognised that a characterisation of physical habitats alone, without a consideration of physical processes and morphological alterations, does not allow a sufficient understanding of the causal impact – response relations that are extremely important for the implementation of rehabilitation measures. Moreover, physical habitat assessment methods generally require very detailed site-specific data collection, and their application to large numbers of water bodies may thus be impracticable.

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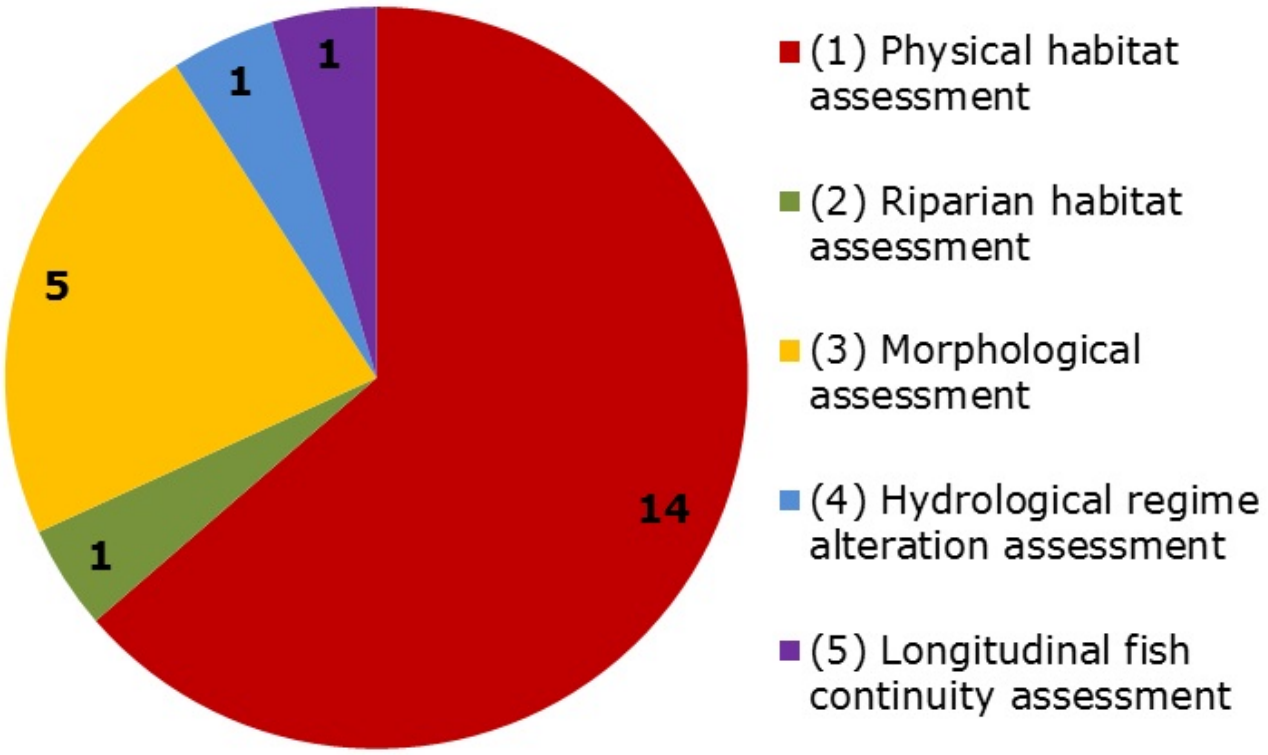

Total number of methods used by EU countries for the WFD divided into methodological categories. Graph: Barbara Belletti, Università di Firenze.

Consideration of physical processes presents one main gap in WFD implementation because most EU countries have selected physical habitat methods for their assessment of hydromorphology. At the same time the use of morphological assessment methods has significantly increased in the last few years. The suitability of methods should be considered in more detail for future hydromorphological assessment and monitoring. Herewith the integration of several components is recommended to ensure a comprehensive assessment.

REFORM recommends developing a framework for integrated hydromorphological analysis, where the morphological and hydrological components are key parts of the evaluation and classification of hydromorphological state and quality. Physical habitat and longitudinal fish continuity should represent an additional characterisation of the overall stream conditions at representative sites. Assessment of morphological processes and alterations should be included in an appropriate spatial hierarchical framework and scaling methodology, emphasizing relevant spatial units and temporal time scales, and identifying key controlling factors at each spatial scale as well as appropriate morphological indicators.

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Practicing a morphological assessment method during a training course. Photo: Martina Bussettini, ISPRA.

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