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Review

Review of national methodologies for rivers' hydromorphological assessment: A comparative approach in France, Romania, and Croatia

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ABSTRACT

Conducting hydromorphological assessments for evaluating the ecological status of rivers is a key requirement of the Directive 2000/60/EC (Water Framework Directive – WFD) within European Union (EU) Member States. This paper aims at understanding how this requirement was implemented, through an original comparative review of methodologies for rivers' hydromorphological assessment in three EU Member States, which joined the EU at different times, and with many differences in terms of hydrographic features, socio-economic and water management systems: France, Romania, and Croatia. More precisely, the paper aims at identifying and understanding the main principles guiding the hydromorphological assessment methodologies, elements and data used, giving an overview of the results of hydromorphological river status assessment, and concluding on the stage of hydromorphological assessment implementation. France developed numerous methodologies for physical habitat survey since the 1990s and it is currently conducting a rigorous hydromorphological field survey, but it does not yet have any national methodology for rivers' hydromorphological status assessment, nevertheless foreseen for the next cycle of the WFD. Besides, Romania and Croatia have already started the assessment of the hydromorphological status of rivers within the two cycles of the River Basin Management Plans and are making efforts to improve the hydromorphological monitoring activity. The methods generally differ in indicators, data used, and spatial scale of analysis, which makes it difficult to compare the results of the assessments. Despite a common water policy, the methodological dissimilarities seem to be rather usual between EU Member States. Therefore, the standardization of methodologies appears to be necessary, but the current results could be useful for setting priorities for river restoration and for achieving a better status at a national scale.

Contents

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1. Introduction

Hydromorphological pressures and altered habitats are some of the most common issues impacting European surface waters (EEA ETC/ICM, 2012). These pressures affect almost half of the river water bodies in the European Union (EU), and more than 40% of the classified transitional water bodies (EEA, 2012). The assessment of rivers' hydromorphological status is essential to mitigate their alteration and, furthermore, to design measures for river restoration in order to achieve the environmental objectives (Rinaldi et al., 2017). Studies on identifying and classifying the hydromorphological alterations might support the prioritization for river restoration works (Moldoveanu et al., 2015; Ioana-Toroimac et al., 2017; Ioana-Toroimac, 2018).

Within EU Member States, following the Directive 2000/60/EC (Water Framework Directive WFD), hydromorphological assessment gained a core role in water management plans and has spread rapidly within the scientific community. This kind of assessment is carried out at different spatial scales (national, regional, local), both by governmental or public agencies and academic/research institutions, as well as by other agencies/offices (public or private) concerned by this issue. Belletti et al. (2015) performed a worldwide review of hydromorphological assessment methods, based on the analysis of 121 methods (dating from 1983 to 2013), almost 50% of which being from Europe. The authors found that the developed methods are notably different in their aims, scales, and approaches. They underlined that there is still insufficient knowledge on the strengths and limitations of different methods used for the hydromorphological assessment and how they should be integrated to ensure a comprehensive assessment (Belletti et al., 2015). Other studies compared and applied hydromorphological assessment methodologies at regional scale, their results showing significant differences especially in terms of percentage of morphological quality classes for the analyzed case studies (e.g. Raven et al., 2002; Weiß et al., 2008; Šípek et al., 2010; Hajdukiewicz et al., 2017).

In terms of management issues, previous studies showed the timing of adoption and completeness of first River Basin Management Plans (RBMPs) in EU (Kanakoudis and Tsitsifli, 2014) or across-country water governance in the WFD context (e.g. in Denmark, Finland, France, Latvia, Lithuania, Netherlands, Poland, Sweden, United Kingdom, according to Bourblanc et al., 2013; Nielsen et al., 2013). So far, none of these comparative studies focused on implementing the WFD in EU's newest members, especially concerning the national hydromorphological assessments. Comparative works could only be beneficial for developing scientific knowledge, further aligning it with water policies, and boosting the implementation process of the WFD.

This paper conducts an original comparative review of current national methodologies for hydromorphological assessment in France, Romania, and Croatia, three countries which joined the EU at different time, having different hydrogeographical features, as well as socio-economic and water management systems (Table 1). For instance, France is an important European economic power, with a generally decentralized system and a long experience within EU, while Croatia and Romania are former communist countries, newer EU members, where the state and the centralized policies still play a major role in economy and water management. These differences have left their mark on national water management strategies and the WFD requirements implementation. In the current work, we only focused on France, Romania and Croatia, because the study is performed within an international research project including members of the three countries and the paper is largely based on the experience of the authors in rivers' hydromorphological assessment, as well as on the opinion of other experts from the analyzed countries, who have been consulted in order to have the most accurate and current information. So far, no

Table 1
Main geographical and hydrographical features of the EU Member States analyzed in this study.

EU Member State	Area (km^2)	Number of inhabitants (millions)	River network length (km)*	Number of RBDs	Mean area of RBD (km^2)*
France					
Metropolitan	551,000	~61	221,570	9	60,819
Overseas	24,000	~6	20,019	5	23,849
Romania	238,391	~20	77,513	1 (including 11 sub-basins)	238,391
Croatia	56,594	~4.3	67,593	2	28,281

RBD – River Basin District; *According to data in Figs. 1c, 2c and 3c.