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‘Good ecological status of surface water’ – technical provision or legal norm?

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Abstract: This article addresses the Water Framework Directive and the legal norm ‘good ecological status’ with respect to the ecological quality of bodies of surface water, and examines the connections between ecology and law in this regard. The legal norm ‘good ecological status’ refers to the structure and function of ecosystems. In terms of ecology, the concepts of good structure and functioning of an ecosystem reflect a resilient ecosystem of high quality, with a high level of adaptive capacity. However, further legal provisions of the Directive, concerning assessment of the status of surface waters, compromise this concept. The Directive’s approach assumes that taking a given body of water, and quantifying certain fixed biological elements in this body on the basis of the Directive’s guidelines and the national classification systems developed from those guidelines, it is possible to accurately assess the structure and function of the body of water. This approach is legally manageable, but highly contestable from an ecological perspective, which suggests the necessity of reconsidering the Directive’s approach.

Keywords: Water Framework Directive, environmental objectives, biological classification systems, ecological quality ratios, biological quality elements, environmental law.

1 Introduction

The Water Framework Directive is unique in the complex technical and ecological aspects of its legal provisions. This article takes up the challenge of examining the connections between ecology and law, associated with the legal norm ‘good ecological status’. This legal norm concerning the ecological state of bodies of water may be one of the most important in the Directive.

Bodies of water and the legal regime established for their management may be described in terms of a social-ecological system.[1] This article does not address this social-ecological system as such, but examines the interconnection between the two subsystems within the system: the environment with its bodies of water, and the legal regime with its environmental management objectives.

[1] C. Folke, 'Resilience: The emergence of a perspective for social-ecological systems analyses', 16:3 *Global Environmental Change* (2006), pp. 253-267.

For this examination, I will first discuss the legal regime established by the Directive, regarding the objective 'good ecological status' for bodies of water.[2] Secondly, I will examine the legal regime in the light of present understanding of ecosystems.

2 'Good status' as established by the Directive

The norm 'good ecological status' in Article 2 no. 22 is linked to the definition of 'ecological status' in Article 2 no. 21. Ecological status is here understood as a matter of the *quality of the structure and functioning of aquatic ecosystems*. Good ecological status in Article 2 no. 22 further refers to the classification according to Annex V.

Section 1.1 of Annex V lists the 'quality elements' that are assessed in the classification of ecological status, and section 1.2 provides guidelines for assessing the quality elements for status being 'high', 'good', and 'moderate'.

The assessment of the Directive's legal standard 'good status' is in this way guided by the more instructive technical provisions in Annex V. The thinking reflected in Annex V is that, for a given body of water, an assessment of the elements listed in Annex V section 1.1, based on the guidelines in Annex V section 1.2, should make it possible to determine the quality of the structure and functioning of the ecosystem of said body of water.

Each Member State must further develop its own specific classification or assessment system in accordance with Annex V, and the Member States have developed such systems, either from scratch or by adjusting or reconstructing their existing systems. These systems 'translate' the qualitative descriptions in Annex V for different types of waters into quantitative descriptions of 'high', 'good', and 'moderate'. Annex V section 1.2 addresses what are to be considered 'high', 'good', and 'moderate', when designing such systems. The heading is: 'Normative definitions of ecological status classifications'. The definitions are normative in the sense that they establish a norm for further classification by the Member States, when designing and using their own classification systems.[3]

To make these national systems comparable, the Directive institutes an intercalibration process led by the Commission.[4] [5] By this process, the national systems are correlated to a general 'ecological quality ratio scale' ranging from 0 to 1, as described in Annex V section 1.4.1(ii). The ratio represents the relationship between the values of the biological parameters observed for a given body of surface water, and values for these parameters in the reference conditions applicable to that body. 'High' ecological status is represented by values close to one, and 'bad'

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[2] Other descriptions are found in D. J. E. Grimeaud, 'Reforming EU Water Law: Towards Sustainability? (part 1)', 10:2 *European Environmental Law Review* (2001), pp. 44-45; P. A. Chave, 'The EU Water Framework Directive: An Introduction', (2001), pp. 75-97. A more practical manual is given by the CIS Working Group 2A, 'Guidance Document No. 13. Overall approach to the classification of ecological status and ecological potential', (2003).

[3] It seems, however, that this sentence has been misinterpreted, to some extent, as being normative when it comes to the ecological quality demanded by the directive.

[4] The process was finalized by the Commission's decision on intercalibration, and the ecological quality ratios for the member states' different classification systems were published in 2008/915/EF, according to the provisions in Annex V section 1.4.1(ix).

[5] Against this background, the overall achievement of the environmental objectives is described by Grimeaud as based on competence-sharing between the EC and the member states, cf. D. J. E. Grimeaud, 'Reforming EU Water Law: Towards Sustainability? (part 1)', p. 47.

ecological status by values close to zero. The definition of 'good' status – the general environmental objective in the Directive – is hence a status that it is 'slightly different' from 'high' status, as expressed in Annex V section 1.2.

Part of this intercalibration process has been determining or establishing 'reference conditions' for each type of body of surface water, in accordance with Annex V section 1.4.1 (v). Legally, establishing reference conditions means deciding, on the basis of the guidelines in Annex V section 1.2, what presence of the elements listed in Annex V section 1.1, that are to be required for reaching 'high status'. From the standpoint of the natural sciences, 'setting the reference conditions' has been the process of analysing, estimating, or modelling sites with 'no, or only minor anthropogenic impact', with reference to the elements listed in Annex V section 1.1.

This is the legal regime that establishes and qualifies the general environmental objective of 'good ecological status' of surface water. However, the process established by this regime does not manifest itself that clearly, when the Directive is read through from start to finish.

2.1 The new legal constructs

The Water Framework Directive establishes a framework for improving water quality and the efficiency of water management within the European Union, as described above. A number of new legal constructs, expressed in certain legal terms, are embedded in this framework:

- 'Reference conditions'
- 'Typology' of bodies of water
- Biological 'quality elements'
- 'One out – all out' principle
- 'Ecological quality ratios'

The legal regime established by these legal constructs reflects a certain conception of ecology. There is a question, however, as to whether this conception corresponds to what we actually know of ecology and nature management from the natural sciences. This will be addressed in the subsequent sections.

3 'Reference conditions' and pristine ecosystems as management objectives

The environmental objectives of the Directive take their point of departure from the pristine and historical states of aquatic ecosystems. This state establishes the 'reference conditions' for assessing the environmental quality of bodies of water. In the Directive's Annex V, this is generally formulated as a state in which there are 'no, or only very minor, anthropogenic alterations' to the bodies of water and the values of the biological quality elements for the surface water body reflect 'undisturbed conditions' with no, or only very minor alterations.[6]

Setting the reference conditions as 'no, or only minor anthropogenic impact', as stated in Annex V, section 1.2, has been discussed thoroughly, and criticized by both ecologists and legal scholars as

[6] The type-specific reference conditions may be derived for each established ecotype using (i) a spatially based network of high status sites, (ii) modelling approaches using historical, palaeoecological and other data, (iii) a combination of the spatial network and modelling approaches, or (iv) expert judgement, where the other methods cannot establish the reference conditions.

over-ambitious and practically impossible.[7] It has also been suggested that large-scale, global climate changes undermine the possibility of returning to the state of previously existing ecosystems – at least, at a given location.[8]

However, there are further fundamental flaws in the Directive's approach. An ecosystem is in a state of ongoing development, where every evolutionary step is unique, and no previous step can be recaptured.[9] One may therefore question whether a return to 'pristine' conditions is an ecologically adequate – or feasible – objective, in terms of specific species and secondary ecological features. The fundamental uniqueness of ecosystems over time and space is poorly accounted for in the Directive's management objectives, set out as environmental objectives in Article 4.

4 'Typology' and type-specific biological references

Another of the Directive's constructs is the typology of bodies of water, and type-specific biological references. According to Article 5, analysis of river basin districts has to be made, and Annexes II and III of the Directive specify the requirements of these analysis. Part of this process has been the grouping of bodies of surface water within a river basin district into specified types: rivers, lakes, transitional waters, coastal waters, or artificial or heavily modified bodies of surface water, and to characterize them by natural characteristics such as altitude, latitude, longitude, depth, geology, size, and so forth (cf. section 1 of Annex II).

For surface waters, Member States are allowed to decide on which classification to use. They may choose between system A, with fixed descriptors of the natural factors, or the more flexible system B, which can be individually designed by the Member States (cf. section 1.1 (ii) of Annex II).[10] Bodies of groundwater are to be characterized by location and boundaries, in accordance with section 2 of Annex II, and the Directive has not established further provisions for this characterization.

A classification system built on characterizing types of bodies of water according to natural factors such as depth, geology, size, and so forth, is probably – from the perspective of an ecologist – conceptually flawed, because it assumes a concordance among similarly typed bodies of water.[11] It

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[7] Cf. e.g. B. Moss, 'The Water Framework Directive: Total environment or political compromise?', 400:1-3 *Science of The Total Environment* (2008), p. 28; W. Howarth, 'The Progression Towards Ecological Quality Standards', 18:1 *J Environmental Law* (2006), pp. 3-35; D. J. E. Grimeaud, 'Reforming EU Water Law: Towards Sustainability? (part 1)', p. 46.

[8] P. Nõrges *et al.,* 'Assessment of the ecological status of European surface waters: a work in progress', 633:1 *Hydrobiologia* (2009), p. 199. For a thorough examination of the risks to the environmental objectives posed by climate changes and the possibilities of mitigating such risks in river basin management planning, see also R. L. Wilby *et al.* 'Risks posed by climate change to the delivery of Water Framework Directive objectives in the UK', 32:8 *Environment International* (2006), pp. 1043-1055.

[9] S. E. Jørgensen *et al.,* 'A new ecology: systems perspective', (2007), p. 57.

[10] These systems have had influenced the further management planning and aimed environmental quality, as they have essentially determined the biological elements that are monitored, and that guide the assessment of ecological status (cf. Annex V) in river basin management planning.

[11] Cf. also K. Irvine, 'Harmonizing assessment of conservation with that of ecological quality: fitting a square peg into a round hole?', 19:4 *Aquatic Conservation: Marine and Freshwater Ecosystems* (2009), p. 366; D. Hering *et al.,* 'The European Water Framework Directive at the age of 10: A critical review of the achievements with recommendations for the future', 408:19 *Science of The Total Environment* (2010), p. 4012.

may have some advantages as a simple tool for water managers, and for helping the general public to understand some of the differences among aquatic ecosystems, and hereby differences in management objectives or restoration targets.[12] However, management objectives established by the use of this tool might not be achievable, or even desirable, from an ecological standpoint. There is no guarantee that they will reflect the potential ecological quality of the actual site; instead, they will reflect the average potential quality of the typology to which the site is assigned.

5 Biological 'quality elements'

Another of the new legal constructs is that of 'quality elements', which are used to determine the environmental objective of 'good status', defined as good structure and functioning of the ecosystem. The Directive's idea is that, by taking a given body of water and assessing the quality elements listed in Annex V section 1.1 on the basis of the guidelines in Annex V section 1.2, it should be possible to assess the structure and function of the ecosystem of that body of water.

Biologists have presented a substantial and convincing critique of this decomposition of the overall norm of 'good status' into secondary features that address specific quality elements, such as particular concentrations of substances, or lists of species. They have pointed out the fundamental difference between functionally 'good' status of aquatic habitats, and the presence of single indicator species and other biological quality elements.

The quality of ecosystems is not a function of lists of taxa, but of fundamental properties, some suggested examples being: Parsimony of nutrient supply, a characteristic structure, including both physical structure and food web structure, and spatial connectedness.[13] 'Connectedness' in this context embraces sufficient size to guarantee possibilities of natural immigration of new species, to allow resilience to natural environmental fluctuations, and also to encompass sufficiently large gene pools.[14] The concepts of 'good structure' and 'good functioning' of an ecosystem reflect a resilient ecosystem with a high adaptive capacity. The term 'ecological integrity' seems to comprise those characteristics, and has been suggested as an adequate management objective for rivers.[15]

The point is that legal and practical focuses must be directed at the structure and function of aquatic ecosystems, enabling resilience of high quality ecosystems and connectivity among them, rather than the narrow scope of specific quality elements described in section 1.1 of Annex V.[16]

Biologists' distinctions between primary and secondary features of an ecosystem are to some extent reflected in legal science, and in the general distinction between 'environmental quality

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[12] D. Hering *et al.*, 'The European Water Framework Directive at the age of 10: A critical review of the achievements with recommendations for the future', p. 4012.

[13] B. Moss, 'The Water Framework Directive: Total environment or political compromise?', pp. 32-41; B. Moss, 'Shallow lakes, the Water Framework Directive and life. What should it all be about?', 584:1 *Hydrobiologia* (2007), pp. 381-394.

[14] B. Moss, 'Shallow lakes, the Water Framework Directive and life. What should it all be about?', p. 388.

[15] Ecological integrity is protected when the compositional and structural diversity and natural functioning of affected ecosystems is maintained, cf. B. D. Richter *et al.* 'Ecologically sustainable water management: Managing river flowa for ecological integrity', 13:1 *Ecological Applications* (2003), p. 207.

[16] Cf. A. G. Solimini *et al.*, 'Towards holistic assessment of the functioning of ecosystems under the Water Framework Directive', 28:2 *TrAC* (2009), pp. 143-149.

objectives' and 'environmental quality standards'.[17] Environmental quality objectives reflect the focus on primary features in the science of ecology, whereas environmental quality standards focus on secondary features.

The focus among natural scientists across Europe, and in the classifications systems of the member states, has apparently been on the quality elements, such as aquatic flora, benthic invertebrate fauna, and fish, as described in Annex V, and not directed at assessment of the structure and function of aquatic habitats. [18] Legal scholars seems to follow that line of thinking, focusing more on the details in Annex V, in the interpretation of the 'good status' provision, than on the fundamental legal and ecological definition of Article 2.[19]

Furthermore, most national classification systems actually rely on a very limited number of indicator species to assess the ecological quality elements of the Directive.[20] Indicator species provide an even less precise description of the quality and function of an ecosystem being monitored.[21] Thus, relying on indicators for the ecological quality elements, when assessing the status of a body of water, further potentially jeopardizes the achievement of the Directive's objectives.

The importance of the selection of indicators for the overall achievement of the Directive's objectives is realized within the scientific community,[22] but seems to go rather unnoticed by lawyers and legal scholars.

6 The 'one out – all out' principle.

The 'one out – all out' principle is applied when using the national classification systems for the biological quality elements, and determining the status of a body of water. In general, the biological parameters of the classification systems, such as different organism groups, are sampled and assessed independently for each body of water. The lowest scores of these assessments determine the overall ecological quality class (cf. Annex V section 1.4.2(i)); this is what is generally referred to as the 'one out – all out' principle.

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[17] Cf. W. Howarth, 'The Progression Towards Ecological Quality Standards', pp. 6-11. Emmerlin and Lerman also use 'environmental quality standards' to cover 'environmental objectives' and 'environmental quality norms', cf. L. Emmelin and P. Lerman, 'Environmental Quality Standards as a Tool in Environmental Governance - the Case of Sweden', (2008), p. 465. In Sweden, however, the term 'environmental quality norms' seems to cover what is referred to in the Water Framework Directive as 'environmental objectives'.

[18] B. Moss, 'The Water Framework Directive: Total environment or political compromise?', pp. 35-36.

[19] See e.g. D. J. E. Grimeaud, 'Reforming EU Water Law: Towards Sustainability?(part 1)', p. 45; D. Grimeaud, 'The EC Water Framework Directive - An Instrument for Integrating Water Policy', 13:1 *RECIEL* (2004), pp. 27-39.

[20] The national classification system In Denmark, as is probably the case in other Member States, does not even address all the ecological quality elements in their choice of indicators. However, this has been accepted by the Commission; cf. also statements 9 and 10 in the preface of Commission's decision 2008/915/EC on intercalibration, and the ecological quality ratios for the member states' classification systems.

[21] Howarth refers to indicator species as 'pseudo ecological quality standards', cf. W. Howarth, 'The Progression Towards Ecological Quality Standards', p. 11.

[22] This debate among ecologists and natural scientists on indicators, reference sites, intercalibration, misclassification, and uncertainty in classification is summarized and evaluated in a study supported by the European Commission Seventh Framework Programme, see P. Nõrges *et al.* 'Assessment of the ecological status of European surface waters: a work in progress', pp. 197-211.

This procedure, established according to the 'one out – all out' principle, is intended to reduce the likelihood of a body of water being classified as having 'good status', when in reality it falls below 'good status'. Thus, the 'one-out, all-out' principle is consistent with the precautionary principle,[23] and effectively protects those biological quality elements that are most vulnerable to the most dominant pressures.

However, the 'one out – all out' principle has been criticized by several authors in the natural sciences for not complying with the ecosystem approach the Directive ought to pursue, as the quality of an ecosystem is not adequately determined by the relative absence of a single biological parameter.[24]

7 The use of 'Ecological Quality Ratios'

The national assessment systems are correlated to a general 'ecological quality ratio scale' ranging from 0 to 1, as described in Annex V section 1.4.1(ii). As stated previously, the ratio represents the relationship between the numeric values of the biological parameters observed for a given body of surface water, and numeric values for these parameters in the reference conditions applicable to that body. High ecological status is represented by values close to one, and bad ecological status by values close to zero, 'good' status being somewhere in between.

However, ecosystems are characterized by non-linear processes: ecologists have known this for many years, and recently it has also been recognized as a fundamental ecological condition in science of environmental law.[25]

Given a body of water, one of the signs of this non-linearity is that, as a driver or pressure diminishes, the recovery of the ecosystem may not follow a similar and linear return path to the previously-existing state.[26] 'Good status' is slightly different from 'high status' or reference conditions. Another result of non-linearity is that the deviation of a status from 'high' or 'good' cannot be adequately described by a specific numeric value on a linear scale. The construct of linear ecological quality ratios according to Annex V does not account for the non-linearity and resilience of degraded bodies of water.

8 Conclusion

The biological content of the standard 'good status' are established legally by a number of legal constructs: 'reference conditions', 'typology' of bodies of water, 'biological quality elements', the 'one out – all out' principle, and 'ecological quality ratios'. Inherent in these concepts are outdated perceptions of environmental quality and of the way ecosystems function.

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[23] See also CIS Working Group 2A, 'Guidance Document No. 13.Overall approach to the classification of ecological status and ecological potential'.

[24] D. Hering *et al.,* 'The European Water Framework Directive at the age of 10: A critical review of the achievements with recommendations for the future', p. 4013.

[25] L. Gipperth, 'Miljökvalitetsnormer. En Rättsvetenskaplig studie i regelteknik för operationalisering av miljömål', (1999) Also see S. Westerlund, 'Rätt och riktig rättsvetenskap', 2010:1 *Nordisk Miljörättslig Tidskrift / Nordic Environmental Law Journal* (2010), p. 12.

[26] P. Nõrges *et al.* 'Assessment of the ecological status of European surface waters: a work in progress', p. 199.

The problem lies not in the legal norm itself, but in the legal and technical specification of the legal norm in the Directive's Annexes. In other words, the legal regime established to qualify the general environmental objective of 'good ecological status' of surface water, transform the adequate ecological and legal norm to an inadequate technical provision.

It seems necessary to re-interpret the norm so it equates modern environmental concepts by focusing the assessment of structure and functioning on fundamental ecosystem properties, such as connectedness, resilience, and integrity.

Article 20 allows for technical adaptations of Annex II at the initiative of the Commission. It opens for changes of the prescribed typology systems (cf. Annex II, section 1.1 and 1.2), and to some extent, for an adjustment of the established reference conditions (cf. Annex II, section 1.3). However, the problems cannot be not solved without changes being made to Annex V, which establishes the use of biological quality elements, the ecological quality ratios, and the 'one out – all out principle'. Unfortunately, the Directive does not allow for technical changes in this respect.

The Commission will review the Directive in 2019, and suggest any necessary changes (cf. Article 19(2)). This gives the opportunity for a more general adoption of the concept of ecology established by environmental science.