

The European Water Framework Directive and the DPSIR, a methodological approach to assess the risk of failing to achieve good ecological status

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Abstract

The European Water Framework Directive (WFD) establishes a framework for the protection of groundwater, inland surface waters, estuarine waters, and coastal waters. The WFD constitutes a new view of water resources management in Europe, based mainly upon ecological elements; its final objective is achieving at least ‘good ecological quality status’ for all water bodies by 2015. The approach to identify these water bodies includes, amongst others, the sub-division of a water body into smaller water bodies, according to pressures and resulting impacts. The analyses of pressures and impacts must consider how pressures would be likely to develop, prior to 2015, in ways that would place water bodies at risk of failing to achieve ecological good status, if appropriate programmes of measures were not designed and implemented. This contribution focuses on the use of the DPSIR (Driver, Pressure, State, Impact, Response) approach, in assessing the pressures and risk of failing the abovementioned objective, using the Basque (northern Spain) estuarine and coastal waters as a case study, using the following steps: (i) determination of the water bodies to be analysed; (ii) identification and description of the driving forces producing pressures over the region; (iii) identification of all existing pressures within the water bodies; (iv) identification, from them, of the most relevant pressures; (v) determination, from the relevant pressures, of those which are significant; (vi) assessing the impacts on water bodies (in terms of ecological and chemical impacts); and (vii) assessing the risk of failing the WFD objectives.

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1. Introduction

The European Water Framework Directive (WFD; 2000/60/EC) establishes a framework for the protection of groundwater, inland surface waters, estuarine (= transitional) waters, and coastal waters. This legislation has several well-defined objectives: (i) to prevent further deterioration, to protect and to enhance the status of water resources; (ii) to promote sustainable water

use; (iii) to enhance protection and improvement of the aquatic environment, through specific measures for the progressive reduction of discharges; (iv) to ensure the progressive reduction of pollution of groundwater and prevent its further pollution; and (v) to contribute to mitigating the effects of floods and droughts. Overall, its final objective is achieving at least ‘good ecological quality status’ for all water bodies by 2015. The status will be based upon the biological (phytoplankton, macroalgae, benthos and fishes), hydromorphological and physico-chemical quality elements, with the biological elements being especially important.

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In order to assist the WFD implementation, a ‘Common Implementation Strategy’ (CIS) was agreed in May 2001. The CIS incorporated four key activities, which include: (i) the development of guidance on technical issues; and (ii) the application, testing and validation of the guidance provided. Several working groups were created to deal with these issues. The COAST working group dealt specifically with transitional and coastal waters, with their guidance document being published in <http://forum.europa.eu.int/Public/irc/env/wfd/home> (see Vincent et al., 2002; Murray et al., 2002).

The WFD requires surface waters within the River Basin District to be divided into water bodies, representing the classification and management unit of the Directive. The WFD defines a ‘water body’ as “a discrete and significant element of surface water such as a lake, a river, a transitional water or a stretch of coastal water”.

The suggested hierarchical approach to the identification of surface water bodies includes: (i) the definition of the River Basin District; (ii) the division of surface waters into one of six surface water categories (i.e. rivers, lakes, transitional waters, coastal waters, artificial waters and heavily modified water bodies); (iii) the sub-division of surface water categories into types, then assigning the surface waters to one of those types; and (iv) the sub-division of a water body of one type into smaller water bodies, according to pressures and resulting impacts (for details, see Vincent et al., 2002; Borja et al., 2004a; Heiskanen et al., 2004).

Recently, some methodological approaches to implementing parts of such a complex Directive have been developed in Europe (Henocque and Andral, 2003; Borja et al., 2004a,b,c; Casazza et al., 2004). However, taking into account the very considerable amount of work to be carried out, some complementary research should be undertaken in order to accomplish the abovementioned WFD objectives, as highlighted by Borja (2005).

Within the context of this strategy, a working group was set up, focused upon the identification of pressures and assessment of impacts, within the characterisation of water bodies, according to Article 5 of the Directive. The main objective of this working group, launched in October 2001 and named IMPRESS, was the development of a non-legally binding and practical Guidance Document on this topic within the WFD. Their conclusions were published as WFD CIS Guidance Document No. 3 (IMPRESS, 2002).

The analysis of pressures and impacts must consider how pressures would be likely to develop, prior to 2015, in ways that would place water bodies at risk of failing to achieve ecological good status if appropriate programmes of measures were not designed and implemented (IMPRESS, 2002). This will require consideration of the effects of existing legislation and forecasts of how the key economic factors that influence water uses will evolve over time; likewise, how these changes

may affect the pressures on the water environment. Therefore, it is not clear how to assess, in practice, the risks of failing to achieve this objective. Clarification may be provided in a daughter Directive, to be established under Article 17. This Directive is expected also to establish criteria for the identification of significant and sustained upward trends [Article 4.1(b)(iii)]. Until these criteria have been established, Member States will need to decide what constitutes a significant and sustained upward trend, according to their own criteria. The review of the pressures and impacts is required, in the design of monitoring programmes which must be operational by 2006 (Article 8), and also to help develop programmes of measures, which must be established by 2009, to be made operational by 2012 (Article 11).

In this way, IMPRESS (2002) established the DPSIR (Driver, Pressure, State, Impact, Response) approach (OECD, 1993; Elliott, 2002; European Commission, 2002) as a possible analytical framework for determining pressures and impacts under the WFD. The DPSIR Framework provides an overall mechanism for analysing environmental problems, with regards to sustainable development. Hence, ‘Driving Forces’ are considered normally to be the economic and social policies of governments, and economic and social goals of those involved in industry. ‘Pressures’ are the ways that these drivers are actually expressed, and the specific ways that ecosystems and their components are perturbed, i.e. for the ecosystem effects of fishing, the central pressure would be fishing effort. These pressures degrade the ‘State’ of the environment, which then ‘Impacts’ upon human health and ecosystems, causing society to ‘Respond’ with various policy measures, such as regulations, information and taxes; these can be directed at any other part of the system.

Likewise, ideally, a pressures and impacts assessment will be a four-step process:

- describing the ‘driving forces’, especially land use, urban development, industry, agriculture and other activities which lead to pressures, without regard to their actual impacts;
- identifying pressures with possible impacts on the water body and on water uses, by considering the magnitude of the pressures and the susceptibility of the water body;
- assessing the impacts resulting from the pressures; and
- evaluating the risk of failing the WFD objectives.

Although this methodological approach offers only general guidelines, in assessing such impacts and risks (IMPRESS, 2002), some applications of the DPSIR approach to marine waters have been undertaken recently (Elliott, 2002; Ledoux and Turner, 2002; Casazza et al., 2002; Bowen and Riley, 2003; Bricker et al., 2003; Cave

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