Water Resour Manage (2017) 31:3043–3060
DOI 10.1007/s11269-017-1723-5

The WFD Implementation in the European Member States

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Received: 18 January 2017 / Accepted: 17 May 2017 /
Published online: 8 June 2017

Abstract The Water Framework Directive (WFD), one of the most influential pieces of European water legislation, presents a general framework for integrated river basin management in Europe to meet the environmental objectives. More than 16 years after the WFD adoption and after the end of the first management cycle (in 2015), it is time for a screening assessment of the implementation of the WFD in the different Member States (MSs). This article provides a global overview about the evolution of WFD implementation in MSs, highlighting the progression of the European water bodies status, as well as, some of the main challenges of WFD implementation: ecological flows, pricing policies/economic analysis, climate change, exemptions, public participation and transboundary issues. The paper examines these different topic, drawing up their situation in different MSs. For that purpose, not only the foreseen second cycle of the River Basin Management Plans (RBMPs) is analysed as also, at a larger scale, the expectations and challenges for the future set by the WFD are examined.

Keywords Water Framework Directive · River basin management plans

1 Introduction

The Water Framework Directive (WFD) (EC 2000) presents a framework for integrated river basin management in Europe, in order to achieve good water status (Boeuf et al. 2016). The WFD, together with its daughter directives, is undoubtedly one of the most relevant and challenging policy tools for the European Union (EU) MSs. The main defined goal was that all water bodies of surface and groundwater would achieve good status by 2015 unless there is ground for exemptions (i.e. specific and justified situations). Within this situation, achievement of good status may be extended to 2021 or 2027 at the latest.

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This piece of legislation, which deeply promotes integrated water management has been a challenge for the different MSs, not only in achieving the defined goals of the WFD but also to adapt the specificities of the country to the requirements of the legislation.

In this context, more than 16 years after the implementation of such an ambitious initiative of the European Union, the WFD is still the main challenge ahead for the EU MSs in what concerns water resources management. The WFD is recognized as still needing some strong efforts from the MSs to address all the issues it embraces and to comply with its requirements (Tsakiris 2015).

The main goals of this paper are: (i) to provide a global overview about the evolution of the WFD implementation in MSs, highlighting the progression of the European water bodies status, and (ii) to recognize some challenges (key issues) for WFD implementation and perceive the relevance and progress on those throughout the corresponding river basin management cycles (in accordance with updated information). A special emphasis is made on: (i) ecological flows, that still have, in many cases, to be thoroughly defined and/or implemented; (ii) the economic analysis, where a common and integrated approach among the MSs seems to be lacking; (iii) the incorporation of climate change into River Basin Management Plans (RBMPs), due to its relevance and urgency in the global and European agenda; (iv) exemptions, due to their role in the assessment of water bodies; (v) public participation, highlighting its relevance, and finally; (vi) transboundary issues, where the development and integration of the WFD policy in the countries involved is most often very different, and the International River Basin Commissions role on WFD's implementation.

2 Research Methods and Data

To achieve the main goals of this paper, namely the assessment of the main topics that have been on the agenda of the MSs in what concerns the implementation of the WFD, a (non-exhaustive) analysis of documents published by the European Commission, of scientific papers and of contributions received upon request from entities of the different EU MSs involved in the implementation of the WFD was carried out.

Firstly, in order to frame the analysis and to provide a global overview on WFD's implementation progress, the following section (3.) focuses on: (i) the timetable (deadlines and milestones) for implementation; (ii) the Commission WFD's assessments (WFD implementation reports); (iii) the status of adoption of RBMPs (2nd cycle), as well as; (iv) the progress achieved on European water bodies status.

Through this global assessment, it was possible to recognize some key issues that represent a challenge for WFD implementation in the different MSs. The ensuing section (4.) is dedicated to the challenges/key issues that were recognized as the most important or most subject to controversy or divergence in terms of interpretation or implementation: (i) ecological flows; (ii) economic analysis; (iii) incorporation of climate change; (iv) exemptions; (v) public participation; and, (vi) transboundary issues.

These topics were evaluated by following a five-step approach: (i) review of the WFD specific requirements for each topic (what are the WFD requirements for the topic?); (ii) evaluation of the water status following the adoption of the 1st River Basin Management Plans (RBMPs) (for each topic, have WFD requirements been accomplished in the 1st RBMPs?); (iii) review of the European Commission recommendations along the 1st RBMPs cycle; (iv) evolution on the setting frame for the adoption of the 2nd RBMPs' cycle (have the

Commission's recommendations been considered in the 2nd RBMPs?); and (v) foreseen progress up to the end of the second cycle (2021). When necessary or find relevant, specific cases of different MSs are presented.

3 WFD Implementation

3.1 WFD Key Milestones and Implementation Reports

The Water Framework Directive (WFD) introduces a system of coordinated objectives to be accomplished, within a specific timeframe (Wilby et al. 2006). The RBMPs and the accompanying Programme of Measures (PoM) are the main instruments for the implementation of the WFD. The WFD implementation was planned to follow and/or include (COM 2012a): (i) transposition and administrative arrangements; (ii) characterisation of river basin districts; (iii) monitoring and assessment of water status; (iv) setting of objectives; and (v) programme of measures and their implementation. The monitoring and evaluation of the effectiveness of the planned programme of measures is crucial to link one planning cycle with the next. The RBMPs (except for the first set) are a major outcome of the previous implementation cycle. Three river basin management cycles are foreseen to implement WFD, framed on the associated RBMPs: a first one, already ended in 2015; the (current) second one, ending in 2021; the third, ending in 2027, which is the final deadline to meet the WFD objectives (EC 2016). Within each cycle, the WFD sets out clear deadlines and key milestones that should be respected by MSs. Within the 1st cycle, the key milestones were: (i) 2006, when the public participation should be starting (at the latest); (ii) 2009, when the 1st RBMPs, including the programme of measures, should be finished; (iii) 2010, deadline for the introduction of pricing policies; (iv) 2012, when the programmes of measures should be operational; (v) 2015, deadline to achieve environmental objectives, corresponding to the end of the first management cycle and when the 2nd RBMPs should be adopted. In 2015, MSs should also have developed and adopted (the first cycle of) Flood Risk Management Plans (FRMPs), to assess, map and manage flood risks and hazards. The FRMPs are a requirement of the Floods Directive (FD), adopted in 2007, to complement the WFD, in order to help MSs to be prepared for extreme weather events (that are becoming more frequent and the cause of significant damages, due to climate change) (COM 2015).

The European Commission has the role to assess the progress of the implementation of the WFD, at certain intervals, in the context of the reporting requirements defined in article 18. Four implementation reports (IRs) have been published, following some of the most important WFD milestones: (i) the 1st IR, published in March 2007, dedicated to the first stage of implementation; (ii) the 2nd IR (April 2009) on the analysis of the monitoring networks; (iii) the 3rd IR, dedicated to the assessment of the 1st RBMPs, published in November 2012; and finally, (iv) the 4th IR focused on the Programmes of Measures (March 2015).

Taking into account the main goals of this paper, special emphasis was given to the 3rd and 4th IRs. The 3rd IR includes a review of progress in the implementation of WFD based on information reported by MSs, including a survey of the 1st RBMPs, as well as recommendations for the 2nd RBMPs (for all EU MSs and Norway) (COM 2012a, SWD 2012a, SWD 2012b). Furthermore, it should be emphasized that to prepare the 3rd IR the Commission worked closely with the European Environment Agency (EEA), which, in 2012, published a report on the State of Water Resources (EEA 2012). The 4th IR includes a review of the

progress in the implementation of the (1st cycle) Programmes of Measures, suggestions for improvement of the future Programmes of Measures (within the 2nd RBMPs) and an assessment of the Floods Directive (FD) implementation (COM 2015; SWD 2015a, b). The 4th IR draws on the conclusions from several reports and assessments: the 3rd IR, MSs interim reports on the progress in implementation of the programmes of measures, information from bilateral meetings between the Commission and MSs. The IR information provided the Commission with an overview of the strengths and weaknesses, in the different MSs, on the implementation of the WFD. Thus, based on this knowledge, the Commission presented in the 4th IR several recommendations for each MS (SWD 2015a). The main goal of these recommendations was to assist each MS in identifying the areas which should be improved in the 2nd WFD cycle (though, the set of recommendations, for each country, cannot be considered exhaustive). The Commission expectation was that the existing gaps detected in the 1st management cycle could be assessed in time of being taken into account in the final version of the 2nd cycle RBMPs (scheduled to be approved in December 2015).

It should be stressed that an important step for a wide and common policy for the WFD enforcement has been the development of a common strategy to support EU MSs during its implementation. The common implementation strategy (CIS) is a cooperative and open process established in 2001, led by the Water Directors of the MSs and the Commission with the participation of relevant stakeholders. In order to report best practices and boost mutual learning, CIS participants are organized in different working groups dedicated to key aspects/challenges of WFD implementation. The CIS has delivered more than 30 legally nonbinding implementation guidelines and a significant number of policy papers, showing best-practice cases and advising for specific water management issues. The information exchange platform, the CIRCABC – Communication and Information Resource Centre for Administrators, Businesses and Citizens (EC 2016), is used to create collaborative workspaces where communities of users can work together and share information and resources, under the WFD Common Implementation Strategy.

In accordance with the key issues analysed in this study, a special relevance is due to some of those guidance documents, namely: (i) on integration of the economic component into the decision making process associated to RBMPs' development (EC 2003a); (ii) to assist competent authorities on the public participation process required for WFD's implementation (EC 2003b); (iii) on the use of exemptions (EC 2009a); (iv) on how MSs should incorporate considerations of climate variability and change into the implementation of EU water policy (EC 2009b); and (v) to support a shared understanding of ecological flows and ways to integrate them in the RBMPs (EC 2015a).

Having, as a basis, the recommendations presented in the 4th IR, a screening assessment report on the progress made from the 1st to the 2nd cycle of RBMPs was prepared (WRc 2015). That was done by the occasion of the fourth European Water Conference, at the time of the public consultations on the 2nd RBMPs. The WRc (2015) report shows to which extent the 4th IR recommendations have been considered in the draft versions of the 2nd RBMPs. Even though the assessment is based on drafts of the 2nd RBMPs, the study provides an overview of the progress achieved (in 38 River Basin Districts). Although relevant information and conclusions could be extracted from the WRc (2015) report, it shall be noted that the restricted number of RBDs analysed makes that information not directly comparable to the information presented in the IRs, which focus on most of all RBDs with territory in the EU.

According to information obtained directly from the European Commission (DG Environment), the screening process would be finished by the autumn 2016/spring 2017. Moreover, the WFD foresees a Commission implementation report by 2018.

3.2 State of Adoption of River Basin Management Plans and Flood Risk Management Plans

According to the WFD (article 11 and 13), the MSs were expected to finalise their first RBMPs, including the programmes of measures, by the end of 2009 (by then, 27 EU MSs). To the EU MSs adds Norway that (transposed the WFD in 2007 and) is implementing the WFD as part of the European Economic Area Agreement, with specific timetable agreed therein. As referred before, some delays were verified as, in 2012, four MSs (Belgium, Greece, Spain and Portugal) still had not adopted all or some of their RBMPs (COM 2012a). According to the same source (COM 2012a), the referred delays verified in the adoption of the RBMPs could have consequences in the second implementation cycle, not only for those MSs, but also for their neighbour and sharing catchments' countries, if any. The EU Court of Justice ruled against those four MSs. At that time, the Commission had received 124 RBMPs, out of the expected 174 RBMPs (of which 75% correspond to transboundary river basins).

As for the second cycle of river basin management plans, due to be approved until the end of 2015, by the end of October 2016, according to the European Commission website (as accessed in May 2017, http://ec.europa.eu/environment/water/participation/map_mc/map.htm), by the end of October 2016, only four countries (Austria, Greece, Ireland and Lithuania) had not yet adopted their RBMPs and one country, Spain, had only adopted part of its RBMPs.

According to the corresponding European Commission website (http://ec.europa.eu/environment/water/flood_risk/implem.htm, last accessed in May 2017), only four countries (Slovenia, Greece, Ireland and Lithuania) had not yet reported their Flood Risk Management Plans (FRMPs) by the end of October 2016.

3.3 Status of European Water Bodies

The WFD requires that all surface and groundwater water bodies achieve good status by 2015 unless there is ground for exemptions. Within this situation, achievement of good status may be extended to 2021 or 2027 at the latest. The water status assessment is based on an evaluation of ecological, chemical and quantitative criteria. Heavily modified and artificial water bodies present more limited criteria for assessing their status. Groundwater bodies are evaluated without considering the ecological criteria. All the water bodies are assigned to one of the WFD's status of classification: high, good, moderate, poor or bad. Surface water (estuaries, lakes, ponds, rivers, reservoirs and coastal waters) is assessed by both ecological and chemical status. The ecological status is obtained taking into consideration the biological, hydromorphological and physico-chemical quality (WFD, Annex V). The chemical status of surface waters is assessed according to chemical quality, measured by reference to environmental quality standards for chemical substances at European level (HL 2012, Priesley 2015). A water body will fail to achieve or loose good status, if part of the water body fails on any of the criteria monitored ("one out all out" approach).

According to EEA (2012), by then, only 43% of classified water bodies presented a good/high ecological status/potential. Within the overall surface water bodies (rivers, lakes,

transitional and coastal waters), the worst status corresponded to transitional water bodies (with two thirds of those holding less than good ecological status/potential), while lakes did show the best status (with 44% of lakes in less than good ecological status/potential). Concerning coastal waters and rivers, 50% and 56% of the water bodies were reported to be in less than good ecological status/potential, respectively. For the individual MSs, the tendencies were quite diverse. For example, more than half of the river water bodies of MSs like Portugal, Spain, Finland and Sweden achieved at least good ecological status/potential, while in other MSs (such as Czech Republic, Germany and Luxembourg) less than 20% of river water bodies were in good ecological status (EEA 2012).

The above referred situation shall be mostly ascribed to several obstacles found by MSs to achieve these goals (SWD 2012a), namely, in the case of surface water bodies, by most of those having been mainly affected by pollution from diffuse sources (particularly from agriculture) and from hydromorphological pressures (hydropower, navigation, flood protection, urban development), as reported by SWD (2012a). The assessment of the 1st RBMPs (3rd IR) concluded that although progress on the achievement of good ecological status/potential could be expected, good status would not be reached in 2015 by a significant number of water bodies. The corresponding predictions were that, in 2015, the number of water bodies in good/high ecological status or potential number would reach 53% of the overall water bodies (COM 2012a, EEA 2012). Even though this projection demonstrates an improvement due to the 1st cycle of RBMPs, the modesty of the achievement did show that the main objective of the WFD was still quite distant. In accordance, the Commission suggested that the MSs should increase their efforts to improve water bodies' status during the remaining 1st cycle period to meet the environmental objectives in 2021 and 2027 (COM 2012a, b; EEA 2015). To take this into account, in the 2nd RBMPs, MSs should: (1) develop a sound assessment of pressures and impacts on aquatic ecosystems, as well as a reliable assessment of water status; (2) improve monitoring, for example, for surface water regarding the evaluation of priority substances; (3) address shortcomings associated with the methods used to assess water status; (4) due to their importance, develop methodologies sensitive to hydrological and physical alterations of water bodies.

According to WRc (2015), the evaluation of the progress on the ecological status represents a difficult task since many MSs changed: i) the delineation and numbers of surface water bodies, and ii) some biological assessment and corresponding classification systems. Hence, a direct comparison between the number of water bodies with good ecological status/potential is not possible. Thus, to overcome this reality, the 2nd RBMPs should provide two classifications, defined in accordance to the classification and water body delineation criteria corresponding respectively to the 1st and 2nd RBMPs' cycles. (WRc 2015).

4 Challenges (Key Issues) of WFD Implementation

4.1 Ecological Flows

As stated in COM (2012a) "the achievement of the WFD objectives is only possible if sufficient quantity of clean water is available for the aquatic ecosystems. To this end, the ecological flow is necessary to support the ecological status and ensure water availability for different uses". Thus, by 2012, the Commission recommended MSs to define and apply ecological flow regimes to achieve the objective of good ecological status.

According to SWD (2012b), about 38% of the 1st RBMPs evaluated, have set the minimum ecological flow requirements as one of the hydromorphological measures. In 45% of the assessed River Basin Districts (RBDs) – 124 RBDs, within the 3rd IR – the RBMPs make reference to (national/regional) existing guidelines or regulations to define an ecologically based flow regime (as in Austria, Bulgaria, Denmark, Spain, France, Germany, Hungary, Italy, Lithuania, Latvia, Slovenia, Sweden and UK). Table 1 summarizes the criteria followed in different European countries for the definition of an ecological flow regime, as presented in SWD (2012b).

Through the evaluation of Table 1, it is possible to notice that different methods have been used to define minimum ecological flows. Within the 3rd implementation report (COM 2012a), the Commission recommended and/or stated that: (i) links between the status, the pressures and the hydromorphological measures should be evident in the 2nd and 3rd RBMPs; (ii) ecological flows methodologies should be clearly indicated in the RBMPs; (iii) there is a need for standardised methods for setting ecological flows; (iv) monitoring programmes should especially be applied in those river stretches where ecological flows were implemented, enabling to enhance knowledge on the specific effects of ecological flow application on biological quality elements; (v) the establishment of ecological flows for all water bodies in Europe is very important for dealing efficiently with water scarcity and drought situations.

In this context, COM (2012b) proposed the development of a guidance document, aimed "to support a shared understanding of ecological flows and ways to use them in the RBMPs", so that ecological flows may be applied in the 2nd RBMPs. The guidance document (EC 2015a) defined ecological flows as "a hydrological regime consistent with the achievement of the environmental objectives of the WFD in natural surface water bodies as mentioned in Article 4(1)", referring to as a "working definition" that does not apply to water bodies designed as heavily modified and/or qualifying for an exemption. It also provides some recommendations for ecological flow consideration and implementation in the WFD as well as some examples of implementation of ecological flows in the MSs. The document EC (2015a) still emphasizes that the work presented in its contents "does not offer a full protocol for the implementation" nor "lead to uniform implementation" of ecological flows.

In the scope of the 4th IR, the Commission stated that ecological flows should be applied according to information presented in EC (2015a). Also, it was made clear that reducing the impact of abstractions and flow regulations should be a priority to MSs within the implementation of the 2nd cycle PoMs, and that could be achieved through the provision of ecological flows. Nevertheless, the 4th IR also mentions that in some (8) MSs still about 50% of the

Table 1 Ecological flow regime definition criteria in different European countries (SWD 2012b)

Static definition for minimum ecological flow (e.g. 5% to 10% of annual mean flow)	Bulgaria, Czech Republic, Lithuania, Romania, Sweden, Slovakia
Dynamic definition of minimum ecological flow (different fixed minimum flow values distributed over the year)	Finland, The Netherlands, Portugal, Slovenia, Iceland
Static definitions of minimum ecological flow are combined with a dynamic definition and modelling determination	Austria, France, Germany, Italy, UK and Switzerland
Static definition is combined with a dynamic definition of minimum ecological flow	Latvia and Luxembourg
Static definition with modelling determination	Belgium (Wallonia)
For relevant locations, double studies are carried out, using hydrological and ecological (IFIM) data.	Spain
No specific information was provided	Hungary

measures planned by the 1st RBMPs (related to water abstraction and establishment of ecological flows) had not even started. Once again, in the 4th IR, the Commission highlighted the urgent need to monitor, in a systematic way, the effects of ecological flows on biological elements, enabling the evaluation of ecological effectiveness. This is important since most of the ecological flows defined by then do not guarantee a relationship with good status. Having that in attention, some specific recommendations on this topic were provided by SWD (2015a) to some countries, namely: Austria, Bulgaria, Czech Republic, Germany, Estonia, Finland, France, Latvia, Romania, Croatia and Spain.

The assessment of the 2nd RBMPs (WRc 2015) enables to conclude that there was some progress concerning the consideration of ecological flows for existing and planned abstractions. Following the (restricted number) of RBDs analysed, several countries have included the establishment of ecological flows as a specific measure, addressed by specific regulations, in the 2nd RBMPs. Furthermore, several ongoing initiatives to establish new standards for ecological flows definition to achieve WFD objectives were also reported. Overall, over the 38 RBDs assessed in WRc (2015), it was possible to perceive (from a total of 17 RBDs), in terms of the progression of the incorporation of ecological flows within the context of the WFD that: (i) good progress on the actions associated with the recommendations is being (or has been) made (8 RBDs); (ii) fair progress on the actions proposed was achieved (5 RBDs); and (iii) the same inadequate approaches/methodologies used in the first RBMP have been reported in the 2nd RBMPs and/or the ecological flow implementation has worsened (4 RBDs). WRc (2015) did not present any classification for the remaining (21) RBDs, since SWD (2015a) did not provide any specific recommendation for those on this subject.

4.2 Economic Analysis

Pricing policies and other economic instruments are in the core of the application and success of the WFD. This Directive has set December 2004 (article 5) as the deadline to present an economic analysis for water use and 2010 (article 9) as the deadline for the achievement of its requirements, namely on the introduction of adequate pricing policies. For that purpose, the "recovery of costs for water services" is required, including environmental and resources costs, framed by two other important concepts: the polluter-pays principle and the incentive pricing. Additionally, Annex III states that a cost-effectiveness analysis has to be performed for the selection of the combination of measures to be included in the PoMs.

According to Kanakoudis and Tsitsifli (2010), most of the MSs were not able to fulfil the requirements of Article 5, namely concerning the economic analysis of water use, due by the end of 2004. More specifically, a legal action was taken by the Commission against Spain, Portugal, Greece and Italy, for "non-communication". Moreover, data on cost recovery and environmental and resource costs was insufficient or even not supplied to the Commission (by the end of 2004) by half of the MSs.

In 2010, a CIS workshop held in Liège with more than 100 participants (CIS 2010) highlighted, among other issues, the difficulties encountered by MSs in complying with Article 9 requirements, from data provision to the estimation and internalisation of environmental and resource costs. In fact, despite the strong economic concepts introduced, article 9 requirements can be considered as not always clearly defined and flexible, leading to a range of approaches to implementation (EU 2010).

De Paoli et al. (2012) collected and reviewed cost and benefit information in selected EU RBDs from the first cycle of implementation of the WFD and concluded that the information

provided by the different countries was very diverse. They concluded that, despite the efforts of the MSs and the specific CIS guidance on water economics (EC 2003a), the economic knowledge in the field of water is very heterogeneous among the MSs. De Paoli et al. (2012) suggested the elaboration of common guidelines to overcome these challenges, promoting more coherence in the assessment and reporting of WFD costs.

Also, the 3rd IR (COM 2012a) highlighted the lack of transparency in the development of water pricing policies and the fact that very few MSs were able to implement a transparent recovery of environmental and resource costs. COM (2012a) strongly advises for "the definition of a shared methodology for the calculation of costs (including environmental and resource costs) and benefits (including ecosystem services)" noting that this would enable effective pricing policies to be implemented and disproportionate and inadequate measures to be avoided.

Ortega (2012) stresses that, despite significant progress on the economic aspects of the WFD, a number of issues like the cost-effectiveness analysis (CEA) associated uncertainty had still to be solved. SWD (2015a) emphasized that in most of the first RBMPs, a CEA was carried out during the development of the programmes of measures but, unfortunately, not always in the optimal way: only in 8 of the 23 MSs assessed, the CEA was used in the development of the programmes of measures for all significant pressures (Germany, France, Lithuania, Luxembourg, Latvia, Portugal, Romania and United Kingdom). In 8 other MSs, the CEA was performed for some of the significant pressures and in the remaining 6, the CEA was not performed (4 MSs) or the information was inexistent or unclear (2 MSs).

Three years later, the assessment of the draft RBMPs of the second cycle, performed by WRc (2015), showed that only a few river basin districts (among the 38 screened) improved their economic analysis of water uses when compared with the first cycle of RBMPs. Despite some encouraging progresses concerning cost-benefit and cost effectiveness analyses, it seems that additional efforts are needed, in the 2nd cycle, to fulfil the requirements of article 9 of the WFD, namely on cost-recovery, which should embrace a broader range of water services and include environmental and resources costs. According to WRc (2015), MSs should not only demonstrate that a cost-effectiveness analysis has been performed but also elucidate on how it has been performed and which were the hypotheses considered for the selection of measures. The cost-effectiveness analysis takes a central role when it comes to the definition of the PoMs to be implemented.

MSs are strongly encouraged to provide more specific and sound information on the selection of measures used in the cost-effectiveness analysis (WRc 2015). There is a clearly assumed need to homogenise concepts and clarify methods and approaches used in the economic analysis of water uses in the context of the WFD.

4.3 Incorporation of Climate Change

Climate is changing and this is leading to several effects on water resources, namely within the European regions. Even though the modifications are different in several regions of Europe, it is possible to identify some main challenges related to the effects of climate change (CC) on water resources: increase in flood risks (along coastal zones and in riverine areas), decrease in water availability and deterioration of water quality (Dworak and Lepprand 2007; Brouwer et al. 2013).

In the future, considerable changes in annual water availability are expected. In northern European regions, water availability is projected to increase (although summer river flows

could decrease). For the southern and south eastern region, reductions in water resources due to increased frequency and intensity of droughts may occur. Moreover, over some parts of Europe, the increasing intensities of heavy rain events are projected to increase river flows peaks. Regarding temperature, even though some regional variations are possible, an increasing trend is generally projected. Still some cooling is expected to occur in some years and decades, related to natural climate variability (EC 2009b).

CC will pose an additional challenge to achieve WFD objectives, since there are several elements that may be affected by it: water demand, water availability, intensity and frequency of extreme events, water quality and biodiversity of aquatic ecosystems.

The WFD does not explicitly consider the risks posed by CC to the achievement of its environmental objectives (Döll et al. 2015; Kilsby et al. 2006; Wilby et al. 2006). In fact, at the time of the adoption of the WFD, a year before the publication of the Third Assessment Report of the Intergovernmental Panel on Climate Change (2001), the relation between climate change and water was not yet a prominent concern in the European Union. Nevertheless, several WFD articles provide good arguments for including climate change impacts into the planning process. With the launch of the second European Climate Change Programme in 2005, the EU water experts started to look with special attention to the effects of climate change (Massey et al. 2010; Brouwer et al. 2013).

A synthesis of the information on the inclusion of climate change issues within the 1st RBMP is presented in Table 2, based on SWD (2012b). In addition to comments and remarks to the approach followed by the MSs to the different CC issues at that stage, the report enables to conclude that in the majority of the RBMPs, it remains unclear how those influenced other steps of the process in practice.

In fact, in the 1st RBMPs cycle, the consideration of climate change in the management process was introduced in a very diverse and largely qualitative way (namely by the content of the RBMPs adopted), as referred in EC (2009b). Hence, this CIS guidance document's purpose was to illustrate ways to include climate change within the 2nd and 3rd RBMP cycles, considering provision for floods and droughts. This will require MSs to clearly demonstrate,

Table 2 Inclusion of climate change within the 1st RBMP (based on SWD 2012b)

RBMPs		Number of River Basin Districts, RBDs (percent, on a ratio to 112)
Do not mention CC		16 (14.2%)
Dedicate a separate chapter to the topic of adaptation to CC		45 (40.0%)
Include future CC scenarios (based on temperature and/ or precipitation)		78 (69.6%)
Influence of some of the most cited CC risks and pressures	Flooding	75 (66.9%)
	Changes in water demand and availability	71 (63.4%)
	Drought	65 (63.4%)
	Impacts on water quality and biodiversity	65 (58%)
	Scarcity	29 (25.9%)
Present a climate check of PoMs		46 (41.1%)
Present details of the methodology applied for climate checking		31 (27.7%)
Influence of climate check of PoMs on other steps in the process of developing RBMPs		20 (17.9%)
Address specific adaptation measures to CC		52 (46.4%)
Clearly outline how CC issues will be addressed in the 2nd and 3rd planning cycles		26 (23.2%)
It is unclear how CC issues will be addressed in the 2nd and 3rd planning cycles		40 (35.7%)
No information has been provided about how CC issues will be addressed in the 2nd and 3rd planning cycles		46 (41.1%)

in the 2nd and 3rd cycle RBMPs, at minimum: (i) how climate change projections have been considered in the assessment of pressures and impacts; (ii) if and how monitoring programmes are configured to detect climate change impacts; and (iii) how selected measures are robust enough and adequate to projected climate conditions (EC 2009b). In order to fully integrate climate change issues into the RBMPs, from the 2nd planning cycle onwards, some recommendations shall be taken into account, as suggested by EC (2009b) and SWD (2012b), namely: (i) to use the CIS guidance document (EC 2009b) as a reference for the 2nd and 3rd cycles; (ii) to plan considering a time period longer than the RBMPs six-year cycle; (iii) to assess direct and indirect (primary and secondary) climate pressures; (iv) to monitor climate impacts in reference sites; (v) to integrate potential additional pressures, impacts and constraints caused by climate change in the economic analysis of the WFD; (vi) to undertake a "climate check" of the PoMs introducing the results in the RBMPs and describing, in a clear and transparent way, the methodology applied for this process; (vii) to enhance harmonisation and integration with national adaptation initiatives; (viii) to better identify and describe specific adaptation measures; and (ix) to exchange information between MSs and stakeholders.

Climate change issues were also highlighted in the general recommendations made in the 4th IR on the WFD implementation (SWD 2015a) for four countries: Greece, France, Portugal and Slovakia. For Portugal and Slovakia, this report refers the importance to effectively include climate change in the assessment of pressures and status of water bodies, as well as that the objectives of the National Strategy for Adaptation to Climate Change are properly considered in the design of the PoMs. For France, the recommendations are the inclusion of climate change in a more extensive way including the analysis of the pressures, the monitoring and a climate check of the measures. Finally, for Greece, the recommendation was on the need to the CC issues being dealt with urgency, since there was no consideration of climate change. Within WRc (2015), aiming to monitor progress made from the 1st to the 2nd cycle RBMPs with respect to the EC' recommendations to MSs (as defined in the 4th IR), it was possible to perceive that: for France, a single statement referring that "climate change adaptation was taken into account" was made; for Slovakia, according with the evaluation, the RBMPs are referred as presenting some evidence of progress; while progress on RBDs from Greece and Portugal were not assessed.

4.4 Exemptions

Article 4 of the WFD presents the environmental objective to be achieved in all surface and groundwater bodies by 2015: good status or potential (for heavily modified water bodies). However, as the achievement of good status may take more time in some water bodies, the WFD allows MSs to rely on exemptions, that have to be thoroughly justified in the RBMPs, allowing the extension of deadlines until 2027 or beyond (article 4.4c) (COM 2012a). Exemptions can correspond to and/or be due to (EC 2009a): (i) an extension of the deadline for the achievement of good status (Article 4.4); (ii) the achievement of less stringent objectives (Article 4.5); (iii) the temporary deterioration of the status in case of natural causes or "force majeure" (Article 4.6); and, (iv) new modifications affecting water bodies (Article 4.7).

However, the general framework for exemptions provided by the WFD was not sufficient to allow MSs to rightfully use exemptions, causing differences in understanding and implementation (SWD 2012b). In this context, a guidance document on exemptions was developed (EC 2009a), providing some needed clarifications and summarizing the conditions in which they

can be applied. In fact, exemptions to the environmental objectives have been extensively used by MSs during the first cycle of RBMPs (EC 2015b) to postpone the achievement of the goals set by the WFD with, in some cases, some poor or debatable justifications.

EC (2015a, b) highlights that there was an increase in the use of exemptions (between the 1st and 2nd RBMPs cycles) under Articles 4.4, 4.5 and 4.7, but the justifications for these exemptions are not always satisfactory. Boeuf et al. (2016) point out three major justifications that have been used to justify deadline extensions: adverse natural conditions, technical unfeasibility or disproportionality in costs.

In fact, exemptions have been in the centre of many discussions at the EU level as the limits and conditions for considering an exemption are permeable and allow different interpretations. Moreover, climate change effects have been added to that discussion. According to EC (2009a, b: "There is a danger that anthropogenic climate change could be used as an excuse to set lower objectives for water bodies, even though formal attribution of a detected trend to anthropogenic climate change is unlikely at the scale of RBDs for several decades to come".

Another important aspect to be highlighted is the concept of "disproportionality" that arises from the discussion on exemptions. As described by Boeuf et al. (2016), exemptions can also be justified if restoration measures imply disproportionate costs or expenses. However, the ambiguity of this concept led the MSs to different interpretations and applications to justify exemptions. For example, in Sweden, despite, globally, better justifications for exemptions were provided in the 2nd RBMPs, no methodology for the calculation of disproportionate costs has yet been provided. In Spain, in the majority of RBMPs analysed in WRc (2015), a lack of clear justifications for exemptions is verified with frequent ambiguity in what concerns disproportionality of costs of unaffordability.

The assessment of the progress performed between the 1st and the 2nd RBMPs (WRc 2015) shows that some strong efforts from the MSs are still needed to better justify the exemptions as there is still a long path to achieve a reliable methodology and adequate criteria. It seems that exemptions should be considered and analysed at a broader level, taking not only into account environmental aspects but also social and political ones.

In that context, the recommendations to MSs presented by COM (2012a) are still valid almost 5 years later: (i) "assess the obstacles that have hindered the implementation in the first cycle and take action to overcome them in the second cycle"; and, (ii) "step up ambition in taking measures to achieve good status. In case of uncertainties about effectiveness, take no-regret measures".

4.5 Public Participation

Public participation and stakeholder involvement is, undoubtedly, one of the most discussed and reported topics of the WFD as it embodies the belief that the transition to sustainability will only be achieved with governments, citizens and stakeholders acting together.

The WFD refers in its Article 14 that "MSs shall encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the River Basin Management Plans". MSs are compelled to ensure that, for each RBD, they publish and make available a set of documents, specified in article 14, to the public. EC (2003b) states that each river basin/country has to find its own way to carry out an active public involvement as there is no blueprint solution as public participation is a tool to achieve the goals set in the WFD.

Although Jager et al. (2016) refer that the purpose of the WFD on public participation is clear, they also note that its wording is ambiguous in some aspects, leading to different interpretations on who should be involved, at what stage, and how. That seems to fit well the description below.

SWD (2012a) assessment enabled to conclude that MSs undertook important efforts to carry out public participation and stakeholder involvement using various methods, but, by the time of the adoption of the 1st RBMPs, the impact of that work was not always clear. According to the same assessment, MSs which chose to involve the interested parties in the drafting of the RBMPs seem to have been more successful.

By the end of the first RBMPs cycle, water authorities considered that, in several cases, the involvement of stakeholders was not fruitful in providing innovative measures (Nones 2016). In many cases, the contribution from the public was (and still is) almost inexistent. This can be partly explained by the fact that stakeholders are often invited to take part in the discussion after the process was fully scrutinized through political and technical levels, leading to pre-defined options. According to Nones (2016), a better, earlier and clearer involvement of stakeholders during the second cycle would be fruitful, emphasizing that the quality and quantity of stakeholders need to be evaluated and the methods to involve them have to be wisely defined. An earlier involvement seems to be the right path to achieve the ambitious goals set by the WFD. EEA (2014), based on the analysis of several case studies, highlighted some important issues to be dealt in the future development of public participation: (i) it should be developed on a multiple scale basis, involving a wider public (as performed in Northern Portugal, for example); (ii) the involvement of stakeholders should be permanent (as in France, with stakeholders participating in the decision-making bodies, the "Comités de Bassin"); and (iii) the financial constraints should be wisely pondered as they can be an important impediment in the short term (as in the Ebro RBD, Spain, where the water authorities anticipated not being able to run large-scale activities for the second management cycle).

4.6 Transboundary Issues

The WFD application introduced a tremendous progress on integrated water resources management and policy at the EU scale, by stating the river basin as the management unit, also embracing international river basins. For this case, the WFD states that "within a river basin where use of water may have transboundary effects, the requirements for the achievement of the environmental objectives established (…), and in particular all programmes of measures, should be coordinated for the whole of the river basin district. For river basins extending beyond the boundaries of the Community, Member States should endeavour to ensure the appropriate coordination with the relevant non-MSs. (…)". More specifically, article 13 of the WFD makes mandatory to MSs sharing an international river basin district ("falling entirely within the Community") to "ensure coordination with the aim of producing a single international RBMP". Alternatively, MSs should, at least, cover the "parts of the international river basin district falling within their territory to achieve the objectives of this Directive".

The WFD does not impose any specificities concerning the definition of the Competent Authority/ies for the International River Basin Districts (IRBDs), only referring to necessary "administrative arrangements". In fact, as many European countries sharing IRBDs had already previous agreements for the management of shared water resources, those countries could use existing international commissions to fulfil the WFD requirements, benefiting from their experience in shared river basins countries' cooperation. These international commissions

encourage and facilitate: (i) the sharing of data between the riparian states; (ii) decisions through consensus; and (iii) dialogue between partners (INBO 2008).

As an example in Europe, in the south-western Iberian Peninsula, Portugal and Spain's first agreement related to shared watercourses was celebrated in the eighteenth century. Since then, the two countries have dedicated many efforts to strengthen and optimize the cooperation on their five shared river basins. This led, in 1998, to the approval of the "Convention on Cooperation for Portuguese- Spanish River Basins Protection and Sustainable Use", known as the Albufeira Convention, which defined the framework of bilateral cooperation for the sustainable management of all the five shared river basins: Minho, Lima, Douro, Tejo and Guadiana (Maia 2008). This Convention also defines an operational board, the CADC (the Commission for Convention Development and Appliance) which, by means of different Working Groups has been supporting not only the implementation of the Albufeira Convention but also of the WFD.

The European Commission considers (EU 2012) three main categories/levels of transboundary co-operation: (i) IRBDs framed under a cooperation agreement, with a cooperation body and with an international RBMP in place; (ii) IRBDs with a similar cooperation frame and body, but with no international RBMP in place; and (iii) IRBDs where only a cooperation agreement exists.

Many large IRBDs can be cited as examples: for (i) (as defined above), with established international river basin commissions, like the Danube, Rhine, Elbe, Meuse, Scheldt, and that, unlike some EU countries, have already adopted their revised RBMP's (in 2015); for (ii) (as defined above), the Iberian Peninsula case can be cited as corresponding to no joint but coordinated RBMPs for each of the four IRBDs (as two of the five shared rivers were joined on a same IRBD) elaborated by both Portugal and Spain for the 1st and 2nd cycles. The declared will to achieve joint RBMPs in a next future will surely require stronger cooperation efforts than those already undertaken by the two countries (Pulwarty and Maia 2015). Finally, the third category ((iii), as defined above) is the less representative, mostly corresponding to IRBDs involving MSs and non-MSs like the Vistula, flowing through two MSs, Poland and Slovakia (Poland adopted the 2nd RBMPs by the end of 2016, Slovakia in the beginning of 2016) and two non-MSs, Belarus and Ukraine.

COM (2012a) acknowledged that "international cooperation has been reinforced and improved significantly" with the adoption of the WFD, in some cases, from "exchange of information" to "a joint problem diagnosis and joint decisions on transboundary measures". However, additional efforts are needed, namely regarding the coordination of measures.

In the assessment of the PoMs performed in 2015 (SWD 2015a), some specific recommendations were addressed to some countries like Greece, Portugal and Spain, concerning transboundary cooperation, calling attention to the need of improvement of cooperation with neighbouring countries (Greece) and to a necessary improvement of cooperation to achieve the required RBMPs goals, namely by means of "the identification of pressures and impacts, design of monitoring networks, methodologies used to assess status and development of PoMs" (Portugal and Spain).

Apart from the river basin districts falling in the first category ((i), as defined above), where it seems that the WFD implementation was rather an additional opportunity to strengthen the already existing cooperation, in the two other referred categories, (ii) and (iii), it seems that the achievement of joint RBMPs will probably still require additional commitment from the riparian countries, calling for a major effort on hydro-diplomacy in the cases where the RBDs are involving a major percentage of non-MSs.

5 Conclusions

This paper aimed at contributing to the perception of the status of the WFD implementation in the MSs and to foster this process in the near future by means of highlighting specific and more relevant discussed topics. From the analysis performed, it stands out that the MSs have been, in a large scale, undertaking huge efforts to comply with the WFD requirements. However, also because of the disparity in MSs cultural, political and social realities, some different interpretations of the goals to be achieved and of the paths to be taken for such became evident.

In terms of the ecological status of the water bodies, it could be concluded that, although some general improvement occurred along the 1st cycle of RBMPs, the main objective of the WFD is still quite distant. That requires some triggering efforts by the MSs and a definition of a clear set of actions, namely regarding the key issues discussed in this paper, taking into account some broad conclusions drawn on those:

- Although MSs have been conducting several efforts to foster ecological flows considerations into RBMPs, the relationship between the effect of ecological flow regimes definition on water bodies status is still not clear. Hence, efforts to understand and evaluate this effect by means of existing cause-effect relationships are required. Moreover, a standardised methodology for the ecological flows definition will be important.
- The progress made by MSs to comply with the economic aspects of the WFD are still insufficient, urging for a more transparent provision of the cost/benefits analysis performed in the RBMPs, considering environmental and resources costs, which are, in many cases, still not properly accounted for.
- Even though the incorporation of climate change in RBMPs has been progressing, more efforts are required. Namely, on the provision of a clear understanding of the observed and projected CC effects at the local scale (namely, on water availability and changes in water consumptions), as well as on adaptation for the future (by enhancing local climate adaptation measures and conducting specific monitoring programmes for detection of climate change trends and effects).
- MSs were not always able to rightfully justify the exemptions used in the 2nd RBMPs. The elaboration of a common methodology and criteria would be a key factor for this.
- Public participation in the context of the WFD has been strongly discussed, with very different opinions, and also leading to very different perspectives on its role and relevance. Nevertheless, the effort put into public participation actions by the MSs is unquestionable. If the methods used for the involvement of the stakeholders and public, as also the scale of implementation of public participation, can be questioned, the efforts carried out by the MSs should be acknowledged.
- There are very different realities and levels of achievement concerning transboundary river basins. Nevertheless, those depend mostly on previous (to WFD) existing IRBDs country cooperation agreements and bodies, as also the RBD's scale, geographic position and number and involvement of non-MSs. In fact, up from those already existing, there are no clear specific mechanisms in place to foster river basin management beyond national borders (Boeuf and Fritsch 2016). And that is key for the WFD implementation as half of the EU RBDs are shared by more than one country.

It should be highlighted that all the specific topics have been addressed separately but are deeply linked in the everyday management of the river basins. For instance, the effects of climate change will obviously influence the management to be performed in shared river basins.

Less than five years from the end of the second management cycle, it is clear that MSs still have many challenges to overcome to be able to achieve the very ambitious goals set by the WFD.

Acknowledgements The valuable and dedicated contribution of Cristina Silva, MSc and Senior Researcher, and Vanessa Ramos, MSc and PhD Researcher at the Hydraulics, Water Resources and Environment Division of the Civil Engineering Department of the Faculty of Engineering of Porto University on compilation of information and contact with MSs water institutions is gratefully acknowledged.

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