Proceedings of H04, IAHS-IAPSO-IASPEI Assembly, Gothenburg, Sweden, July 2013 (IAHS Publ. 361, 2013).

Pan-European information needs on quality of freshwater

ANITA KÜNITZER
CENIA, česká informační agentura životního prostředí, Vršovická 1442/65, 100 10 Praha 10, Czech Republic
anita.kuenitzer@cenia.cz

Abstract In Europe, the Water Framework Directive (WFD) requires EU Member States to achieve good ecological and chemical status of their water bodies by the year 2015. In 2009, Member States reported the status of their water bodies, including pressures, impacts and measures taken, to the European Commission. This huge amount of data has been analysed since then and the results were published by the end of 2012 in a series of reports by the European Environment Agency and its European Topic Centre on inland, coastal and marine waters. The political analysis was published by the end of 2012 as "a Blueprint to safeguard Europe's water resources" by the European Commission, including accompanying documents. This article reviews the main findings and identifies the main areas for further research need.

Key words water; quality; Europe; rivers; groundwater

INTRODUCTION

The most important directive of the European Union that regulates the quality of surface water and groundwater is the Water Framework Directive (EC, 2000). It aims at protecting all water ecosystems and to reach good status (ecological, chemical, and quantitative) of all water bodies by 2015. The spatial units are River Basin Districts (RBD), the management unit of the river catchments and the water bodies. In 2009, all 27 EU Member States had to report their River Basin Management Plans (RBMP), including the underlying data.

This major reporting exercise resulted in a database that has been analysed by the European Topic Centre on inland, coastal and marine water (ETC/ICM) for the European Environment Agency (EEA) and for the DG Environment. The analysis was published during 2012 in three summarising EEA Reports (EEA 2012a,b,c) and three more detailed ETC Technical Reports (Feher *et al*., 2012; Kossida *et al*., 2012; Solheim *et al*., 2012). This article reviews the main findings and identifies major future research needs.

For surface waters, there are two separate classifications, ecological and chemical status. Groundwater bodies are classified according to their chemical status and quantitative status. For a water body to be in overall good status, both the chemical status and ecological or quantitative status must be at least good.

MATERIAL AND METHODS

EU Member States have reported on 13 300 groundwater bodies and more than 127 000 surface water bodies; 82% of these are rivers, 15% are lakes and 3% are coastal and transitional waters. All Member States have reported on groundwater bodies, and all EU Member States, except Malta, have reported on river water bodies. In addition, 24 Member States reported on lake water bodies, and 16 and 22 Member States have reported on transitional and coastal water bodies, respectively (EEA, 2012a).

These tabular and spatial data were reported via the EEA Reportnet system and compiled and quality assured by a consultant. The resulting complex database was analysed in its May 2012 version by the ETC/ICM for data on status, pressures and impacts. The database is not publically available, but tabular aggregation reports can be downloaded from the EEA website and the data can be viewed in zoom-in-maps (EEA, 2012d,e). Only data from water bodies of which the status had been classified were taken into the analysis. The data were aggregated by five water categories (rivers, lakes, transitional water, coastal water, and groundwater) and by the 27 Member States, and presented in bar charts. If the data were aggregated by the 111 River Basin Districts, the result was presented as map. For further details of the analysis see Solheim *et al*., 2012.

RESULTS ON PRESSURES AND IMPACTS TO SURFACE AND GROUNDWATER

The WFD requires that Member States collect and maintain information on the type and magnitude of significant pressures and impacts affecting water bodies. Pressures to water bodies were reported by Member States under the WFD Art. 13 reporting, regarding: point source, diffuse sources, water abstraction, hydromorphology, other pressures, and no pressure.

The analysis of the reported data showed that the most commonly occurring pressures to surface waters are diffuse sources and hydromorphological alterations (Fig. 1, EEA, 2012a). These cause impacts of nutrient enrichment and altered habitats.

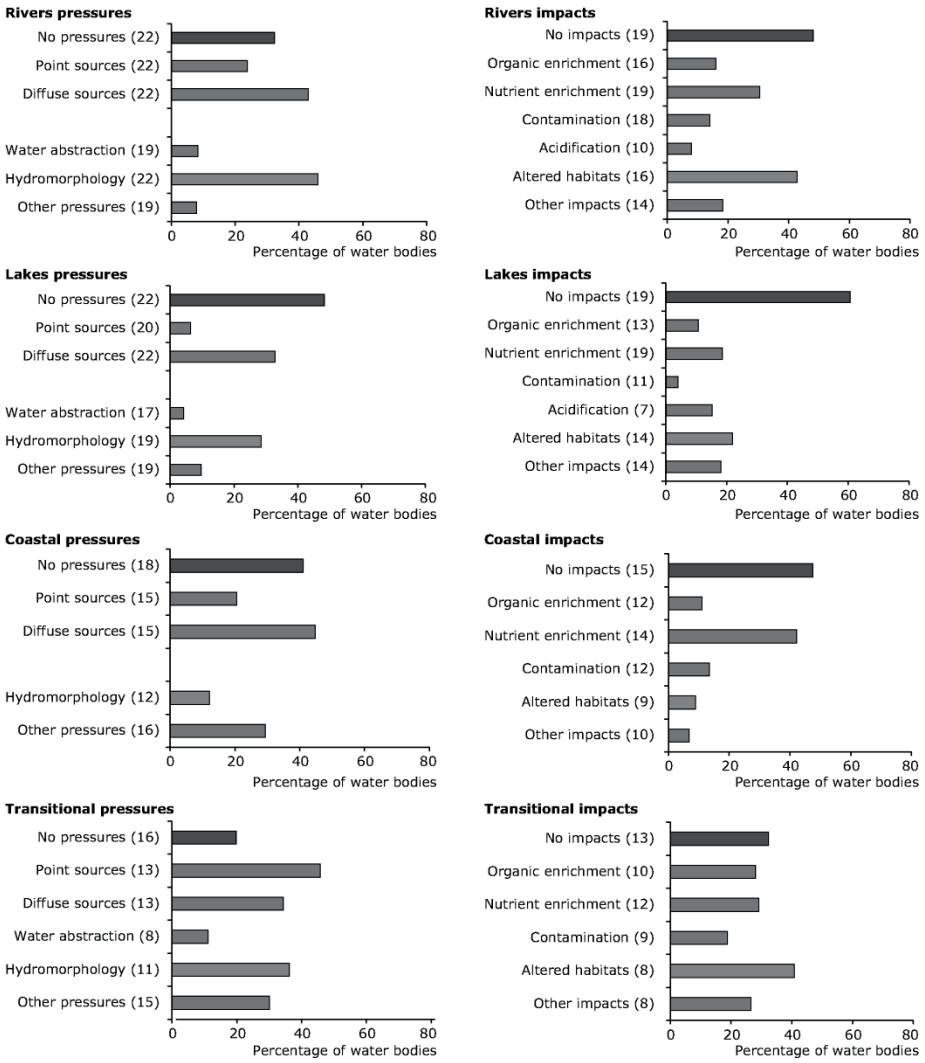

Fig. 1 Proportion of total number of classified water bodies with identified significant pressures (left column) and impacts (right column) for rivers, lakes, coastal waters and transitional waters (number of Member States in brackets) (EEA, 2012a, Figure 4.3). Source: WISE-WFD database, May 2012.

Pressures from point and diffuse sources

Diffuse pollution from agriculture is a significant pressure in more than 40% of Europe's water bodies in rivers and coastal waters, and in one third of the water bodies in lakes and transitional waters. The RBDs and Member States with a high proportion of water bodies affected by diffuse pollution are found in northwestern Europe in particular, and correspond to the regions with high fertilizer input and high river nitrate concentration. Discharges from wastewater treatment plants and industries, and the overflow of wastewater from sewage systems still cause pollution: 22% of water bodies still have point sources as a significant pressure (EEA, 2012a).

Pressures from hydromorphological alterations

The hydromorphological pressures are mainly attributable to hydropower, navigation, agriculture, flood protection and urban development. Hydromorphological pressures are the most commonly occurring pressures in rivers, lakes and transitional waters, affecting more than 40% of all river and transitional water bodies, and 30% of lake water bodies (EEA, 2012a; Feher *et al.*, 2012).

In RBMPs, hydromorphological pressures on surface water bodies were categorized by the Member States into the main pressure groups: (a) Water abstraction: modifying significantly the flow regime of the water body, (b) Water flow regulations and morphological alterations, (c) River management, (d) Transitional and coastal water management, (e) Other morphological alterations, and (f) Other pressures (including land drainage – in transitional and coastal water bodies other pressures were not included in the hydromorphological analysis).

In each of the pressure groups Member States had the possibility to report different hydromorphological pressures such as barriers in rivers or the dredging of sediment. However, many Member States did not report details on pressures or did not report in the same pressure groups. Water flow regulations and morphological alterations were the most commonly reported pressure for rivers and lakes.

Heavily modified water bodies (HMWB) and artificial water bodies (AWB)

The Water Framework Directive (WFD) allows Member States (MS) to designate their surface waters as heavily modified water bodies (HMWB) or artificial water bodies (AWB) whereby they will not need to meet the same quality criteria required for natural type surface waters. A heavily modified water body refers to a body of surface water that as a result of physical alteration by human activity is substantially changed in character. A surface water body is considered as artificial when created by human activity.

Overall, 16.4% of European water bodies were designated as HMWBs or AWBs during the first RBMPs (EEA, 2012a). Heavily modified and artificial water bodies are clearly associated with densely populated, urbanized areas with industrial areas and ports, as well as low-lying or mountainous regions (Feher *et al*., 2012).

RESULTS ON ECOLOGICAL STATUS OF SURFACE WATERS

The main objective of the WFD is that all surface waters should hold good or high ecological status by 2015. The current status classification constitutes the baseline from which future improvements towards the objective of the WFD are measured.

Quality elements

The WFD defines “good ecological status” in terms of a healthy ecosystem based upon classification of the biological quality elements (phytoplankton, phytobenthos, benthic fauna, macrophytes and fish) and supporting hydromorphological, physico-chemical quality elements and non-priority pollutants. Water bodies are classified by assessment systems developed for the different water categories (river, lake, transitional and coastal waters) and the different natural type characteristics within each water category.

Although the proportions are low, the absolute number of European rivers being monitored for biological quality elements is still substantial, ranging from 23 000 for benthic invertebrates, 19 000 for benthic flora to 17 000 for fish. For lakes, the proportions correspond to between 1800 and 4000 lakes being monitored with biological quality elements for classification of ecological status across Europe (Solheim *et al*., 2012).

Classification

The ecological classification is as follows: Ecological status/potential is recorded on the scale of high, good, moderate, poor or bad. “High” denotes largely undisturbed conditions, and the other

classes represent increasing deviation from this natural condition. The ecological status classification for the water body is determined using the worst scoring quality element (also known as the "one out, all out" principle).

The WFD requires that standardised methods are used for the monitoring of quality elements, and that the good status class boundaries for each biological quality element are intercalibrated across Member States sharing similar types of water bodies. The aim of the intercalibration has been to ensure that the good status class boundaries given by each country's biological methods are consistent and WFD compliant.

Due to delays in the development of national classification systems in many Member States, only a few biological quality elements could be used for assessing the ecological status of water bodies for the first RBMPs. Many water bodies have been classified without actual monitoring of biology or chemical pollutants, and by using expert judgement partly based on the information compiled in the pressure and impact analyses (EEA, 2012a).

Figure 2 shows the distribution of ecological status or potential for the different types of water bodies (rivers, lakes, transitional waters, and coastal waters). Overall, more than half of the total number of classified surface water bodies in Europe are reported to hold less than good ecological status or potential, and will need mitigation and/or restoration measures to meet the WFD objective. River water bodies and transitional waters are reported to have worse ecological status or potential and more pressures and impacts compared to water bodies in lakes and coastal waters.

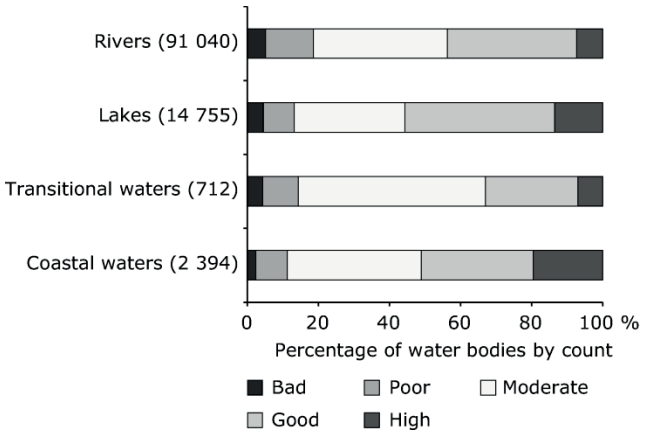

Fig. 2 Distribution of ecological status or potential of classified rivers, lakes, coastal and transitional waters (number of water bodies in brackets) (EEA, 2012a, Figure 4.1).

Link of ecological status and pressures

There is a strong correlation between the ranking of Member States by proportion of good or high ecological status, and the proportion of river water bodies per Member State affected by diffuse pollution and hydromorphological pressures (Fig. 3, EEA, 2012a).

A large proportion of water bodies, particularly in the regions with intensive agriculture and high population density, have poor ecological status and are affected by pollution pressures. The worst ecological status or potential in river and lake water bodies is reported in RBDs in north-western Europe. For coastal and transitional waters, RBDs with a high proportion of water bodies in poor ecological status are found bordering the Baltic Sea and the Greater North Sea. Also, in the EU part of the Black Sea (Romania and Bulgaria), the situation is generally poor, with more than 70% of classified water bodies reported to be of less than good status (EEA, 2012a).

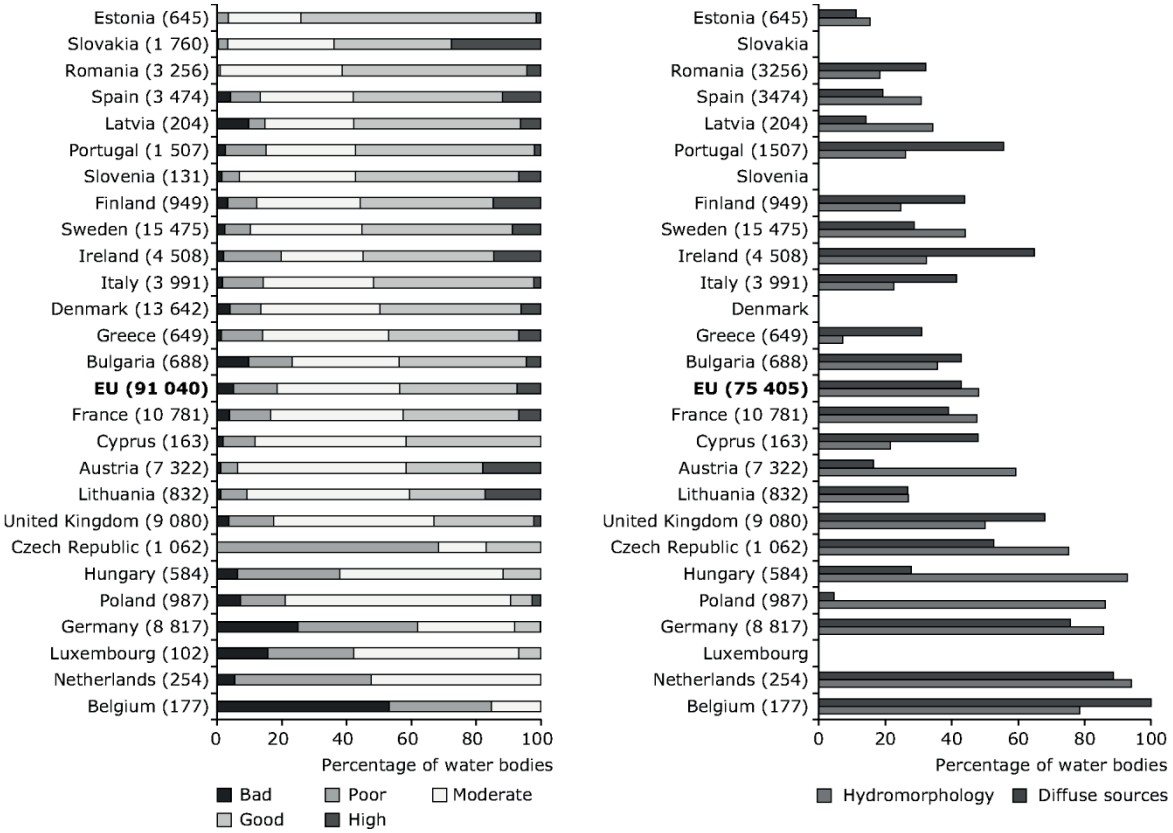

Fig. 3 Ecological status or potential of classified river water bodies in different Member States (a), and proportion of river water bodies affected by diffuse pollution and hydromorphology pressures (b) (number of water bodies in brackets) (EEA, 2012a, Figure 4.5(b)).

RESULTS ON CHEMICAL STATUS OF SURFACE AND GROUNDWATER

Chemical status is assessed under the Water Framework Directive by compliance with environmental standards for chemicals that are listed in the WFD (Annex X) and the Environmental Quality Standards (EQS) Directive (2008/105/EC). These priority substances include metals, pesticides and various industrial chemicals. The Groundwater Directive establishes a regime to assess groundwater chemical status, providing EU-wide quality standards for nitrate and pesticides, and requires standards to be set at national level for a range of pollutants. Chemical statuses are either recorded as good, or, if they fail to achieve good status, they are recorded as being in poor status.

Priority substances

WFD reporting guidance proposed that Member States group the reporting of priority substances into four categories: heavy metals, pesticides, industrial pollutants and “other pollutants”. The latter category included a mix of individual chemical types including PAHs and TBT compounds. However, inconsistency in reporting was apparent between Member States, with some reporting a mix of pollutant groups and individual pollutants, and others reporting either individual pollutants or groups only. Moreover, different matrices (i.e. water column, sediment and biota) were sometimes used to assess the risk of particular chemicals across different Member States, meaning that the results are not always directly comparable.

Chemical status classification of groundwater and surface waters

The assessment of chemical status presents a large proportion of water bodies with unknown status. Monitoring is clearly insufficient and inadequate in many Member States, where not all priority substances are monitored and the number of water bodies being monitored is very limited. Therefore, the results should be interpreted cautiously, since chemical monitoring as reported in the first RBMPs was incomplete, and information is not always comparable between States.

Groundwater The chemical status of more than 13 000 groundwater bodies has been reported across Europe, encompassing 25 different Member States (Fig. 4). Good chemical status is apparent in 72% of them (by surface area) whilst about 25% are of poor status. Approximately 3% of groundwater bodies are classified as having unknown chemical status. Of the instances of poor chemical status, 60% are accounted for by an exceedence of a quality standard (threshold value) for one or more pollutants. Other important causal factors include the deterioration in quality of waters for human consumption and saline intrusion.

Surface freshwater bodies The chemical status of 123 000 surface freshwater bodies (104 000 rivers and 19 000 lakes) has been evaluated across 26 Member States across Europe, with 43% of rivers and 44% of lakes (by count) being classified as good, and 6% and 2%, respectively, being of poor status. However, these overall statistics do not include the results from Sweden which were not comparable due to a methodological difference in the EQS for mercury (Fig. 4).

Notably, the chemical status of 51% of the rivers and 54% of the lakes remains unknown. The main reasons for the high percentage of surface water bodies with reported unknown chemical status are that the status assessment methods have not yet been fully developed, or that there were not enough monitoring data in this first RBMP cycle.

Chemical status for more than 4000 transitional and coastal water bodies has been reported across 16 and 22 Member States, respectively. Poor chemical status is reported in 10% of transitional and 4% of coastal water bodies, whilst good status is reported in 35% and 51%, respectively. The proportion of "unknown" status water bodies reported is notable: 55% of transitional and 46 % of coastal water bodies (EEA, 2012a; Solheim *et al*., 2012).

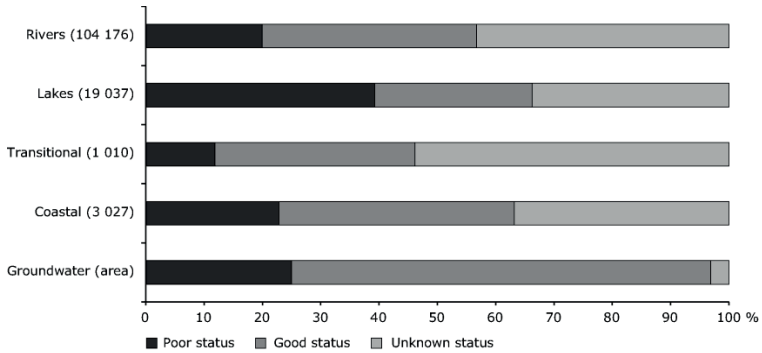

Fig. 4 Percentage of rivers, lakes, groundwater, transitional and coastal waters in good, poor and unknown chemical status (number of water bodies in brackets) (EEA, 2012a, Figure 5.1)

Excessive nitrate concentration accounts for between 10% and 30% of poor groundwater status across much of Europe (by area) (Table 1). Groundwater nitrate is primarily attributable to agricultural sources (Solheim *et al*., 2012).

The Annex II pollutants are the most frequent cause of poor status in groundwater. Across all Member States, the Annex II pollutants most commonly identified are chlorides, ammonium, sulphates, tetrachloroethylene, trichloroethylene, arsenic and lead.

Table 1 Number of groundwater bodies in poor chemical status due to the given pollutant in Member States (Solheim *et al*., 2012, Table 6.2).

Pollutants	AT	BE	BG	CY	CZ	DE	DK	EL	ES	FI	FR	HU	IE	IT	LU	MT	NL	PL	PT	RO	SE	SK	UK
Nitrates	3	18	37	4	94	259	98	2	154	2	120	38	2	103	2	13	2	7	14	17	2	7	65
Pesticides		19			2	42	19		10	23	140	6		14	2		3				42		10
Alachlor											1												
Atrazine					12						38											4	7
Endosulfan									1														
Isoproturon											13												1
Hexachlorocyclohexane									1		2												
Simazine					2				1		9											2	2
Trifluralin														2									
Annex II pollutants						104				17							3						23
Arsenic		4			12		3		4	4	2		2	23			3		1		11	3	1
Conductivity		7	3	2					25		1	2		19		5		1	2		1		
Cadmium					29					2				1					1		8	1	8
Lead					34				1	6	1		4	15					1		9		1
Mercury					16						1		2	7							4		
Ammonium		12	7	1	27				14	7	2	1	3	38				6	3	14		7	
Chloride		4	1	5	48		13	2	46	28	5			23			2	1	5		9	7	13
Sulphate		7	3	3	50				15	2	1	3		11				3	1			8	8
Trichloroethylene					3		31		3		5	2	2	19								1	4
Tetrachloroethylene				1	53				5		7	1		33								1	5

RESULTS ON QUANTITATIVE STATUS OF SURFACE AND GROUNDWATER

The Water Framework Directive was not designed to directly address water quantity issues. It considers water resource aspects explicitly only in addressing good groundwater quantitative status. However, water scarcity and extreme hydrological events in the form of droughts and floods are contributory factors to not meeting good ecological status and good ecological potential.

Groundwater quantitative status

The definition of good groundwater quantitative status according to the WFD requires that the level of groundwater in the groundwater body is such that the available groundwater resource is not exceeded by the long-term annual average rate of abstraction.

Of the total number of groundwater bodies reported in the WFD River Basin Management Plans, only 6.37% (782 out of 12 268 classified groundwater bodies) are classified as being in poor quantitative status in 2009. Only a few countries, namely Spain, UK, Belgium, Czech Republic, Denmark, Italy and Malta have groundwater quantity problems; these are mainly found in specific RBDs and not across the whole country, with the exception of Cyprus where approximately 70% of its groundwater bodies are of poor status (Fig. 5). More specifically, the RBDs of the Thames and South East in the UK, Zeeland in Denmark, and Guadalete and Barbate in Spain have 50–70% of their groundwater bodies in a poor status. The RBDs of Humber, North West and Anglian in the UK, Jutland and Funen in Denmark, Guadalquivir, Andalusia Mediterranean Basins, and Jucar in Spain, Elbe in the Czech Republic, Maas River Basin District in Germany, Scheldt in Belgium and Southern Appenines in Italy have 30–50% of their groundwater bodies in a poor status, while 21 RBDs (scattered in the UK, ES, FR, IT, HU, PL, CZ, DE, BG) have 10–30% of their groundwater bodies in a poor status (Kossida *et al*., 2012).

Ecological flow

The local "ecological flow" is the quantity of water needed at different times of the year to maintain a water ecosystem. Only in half of RBMPs assessed is there a clear indication that specific measures are being taken to achieve a natural flow regime and to ensure ecological flows. Ecological flows are an important element for achieving good hydromorphological status; they reflect the volumes and flow regimes that are required for the ecosystem and all relevant functionalities (EEA, 2012a).

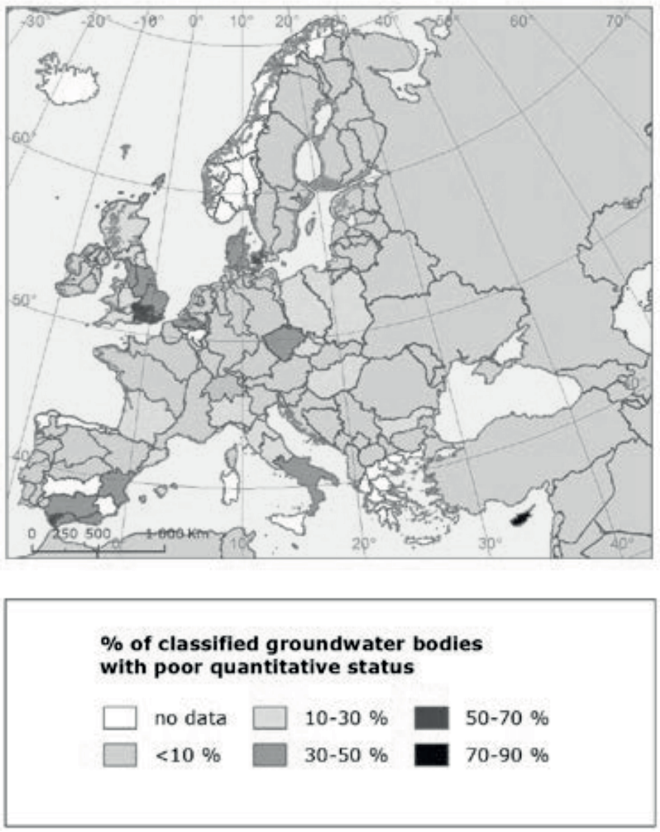

Fig. 5 Percent of Groundwater bodies in poor quantitative status in 2009 per RBD (Kossida *et al*., 2012, Map 2.12) Data source: WISE-WFD database, version of 13 June 2012.

Pressures on water resources

Water vulnerability is caused by three major drivers: change in land use, water abstraction and climate change. Agriculture accounts for 33% of total water use in Europe, and this dependence on water can reach up to 80% in parts of Southern Europe. Climate change has a more indirect effect on water quantity than land-use change or abstraction (EEA, 2012c).

Based on the WFD reporting, three significant pressures are affecting groundwater quantitative status. The most commonly reported pressures are water abstraction (present in 11% of classified GWBs and 66% of GWBs, which are in a poor quantitative status), followed by saltwater intrusion (in 12% of GWBs in poor status). Finally other pressures are responsible for about 5% of the GWBs in poor quantitative status (Kossida *et al*., 2012).

DISCUSSION

The analysis of the reported data shows that more than half of the surface water bodies in Europe are reported to be in less than good ecological status or potential, and will need mitigation and/or restoration measures to meet the WFD objective. The information on chemical status is incomplete, but shows poor chemical status for groundwater bodies by area of about 25% across Europe, caused mostly by excessive levels of nitrate. Pressures on water bodies come mostly from diffuse sources of pollution and hydromorphological alterations. For the latter, no regular data reporting exists at European level within the annual State of Environment reporting. Improved knowledge is needed with regard to hydromorphology, water quantity accounting and ecological flow, ecological status and typology, as well as chemical status.

Information needs on pressures from pollution and hydromorphological alterations

Diffuse and point-source pollution still threaten the status of EU waters, despite the progress achieved under legislation on nitrates, wastewater treatment, industrial emissions, priority substances and plant protection products. Better nitrogen reduction from agriculture is necessary as well as better information on the emissions of nutrients and priority substances to water bodies.

The large amount of hydromorphological alterations that water ecosystems were subjected to over the past several hundreds of years, but particularly in the recent 50 years, reflects the great deal of work still required to enable ecosystems to function in all their structural aspects.

It is generally not clear how the proposed hydromorphological measures are expected to contribute to the improvement of ecological status or potential. Measures that can be taken under the jurisdiction of water authorities or funded by nature conservation programmes are relatively easy to implement, such as the removal of old structures (weirs, barriers and bank reinforcements), establishment of fish ladders, or habitat restoration. Other measures are more difficult to establish, for instance, when developed by water authorities but needing more coordination with one or other economic stakeholders. This is especially true if the measure implies restrictions on uses or financial costs, such as reduced hydropower production or restrictions on water uses (EEA, 2012a).

Information needs on ecological and chemical status

The knowledge base to classify the ecological and chemical status was not optimal for the first RBMPs, due to missing methods, status class boundaries or Environmental Quality Standards (EQS) and monitoring. However, compared to the situation before the Water Framework Directive, there has been a significant improvement of the knowledge base and increased transparency by bringing together information on all characteristics, pressures and impacts on water bodies at basin level.

It is not advisable to draw detailed conclusions on the chemical status results: in the first RBMPs there was a lack of chemical monitoring and of comparability of the information on chemical status of water bodies among Member States. The information provided in the RBMPs on chemical status is not sufficiently clear to establish a baseline for 2009. The chemical quality of water bodies has improved significantly in the last 30 years, but the situation as regards the priority substances introduced by the WFD is not clear.

Information needs to fill the WFD gap on water resources management

Too little or too much water impacts almost all economic sectors, including agriculture, energy supply, drinking water supply, industry and tourism; but managing water resources sustainably also means ensuring that ecosystems have the quality and quantity of water required to function and maintain natural processes. Drought management plans and flood risk management plans are supposed to be integrated into River Basin Management Plans so as to bring resource aspects as far as possible into the Water Framework Directive.

Water quantity and water quality are closely linked, and good ecological status also depends on the quantitative water resource aspects, as well as on its quality. Water resource management needs to be an integrated part of the RBMP. In more arid river basins, e.g. in the Mediterranean, drought management plans are already partly integrated into RBM planning.

The "Blueprint to safeguard Europe's waters" (COM, 2012) puts particular emphasis on the better implementation of existing policies in order to improve this aspect of water management. In particular, it emphasizes, the stringent implementation of the WFD with regard to resource aspects, and the harmonised establishment of ecological flows and drought management plans:

- Hydromorphological pressure in river basins should be reduced by restoring river continuity, for instance by using green infrastructure. This can also reduce the EU's vulnerability to floods and droughts.
- Implementation of ecological flow and water accounts: Over-allocation of water must be corrected and the needs of nature respected: the ecological flow. A shared understanding of

this concept needs to be developed as well as ways to calculate it. Water accounts will enable water managers to have a more realistic picture of water availability at the river basin or sub-catchment level.

- Application of target setting: A common methodology for water efficiency targets (e.g. improving irrigation efficiency in agriculture) needs to be developed and, where relevant, be integrated into RBMPs.

The WISE-RTD Portal has been designed to disseminate water research outcome and experiences (WISE-RTD Water Knowledge Portal, www.wise-rtd.info). Acting as a smart switchboard, WISE-RTD provides easy access to customised selections of information available on the web. In addition, Kossida *et al*. (2012, p. 87) provide an overview of major European projects with research activities relevant to water scarcity and drought.

Few projects consider the full range from the observations of water scarcity and drought to adaptation and policy. The scales of application of these studies vary greatly from case specific, to regional, to national, to European and global, and thus it is inherently understood that the underlying methodologies, especially when we move further from the basic identification of the hazard to the characterisation of impacts, vulnerability and risk, differ. Yet, they provide a valuable input to policy, if their research results can be adequately capitalised by the policy makers. There is, in particular, a need for further in depth analyses of adaptation and policies at the European, regional, national and even local level.

CONCLUSIONS

The Water Framework Directive has provided a comprehensive overview of the status and pressures to all water bodies in the 27 EU countries. The development of RBMPs and the reporting was a major effort and despite several short-comings in the data quality and comparability, it is providing for the first time comprehensive information on the status and threats to water ecosystems. It is drawing our attention to newer areas of information such as hydromorphology, typology, chemical status, ecological flow and water accounting, which need to be comparable at pan-European level.

REFERENCES

COM (2012) A Blueprint to safeguard Europe's water resources. *COM (2012) 673*, 14.11.2012, 24 pp. http://ec.europa.eu/environment/water/blueprint/pdf/COM-2012-673final_EN_ACT-cov.pdf.

EC (2000) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive) (OJ L 327, 22.12.2000).

EEA (2012a) European waters — assessment of status and pressures. *EEA Report 8/2012*, 96 pp.

EEA (2012b) European waters — current status and future challenges. Synthesis, *EEA Report 9/2012*, 52 pp.

EEA (2012c) Water resources in Europe in the context of vulnerability. EEA 2012 state of water assessment. *EEA Report 11/2012*, 92 pp.

EEA (2012d) WFD: Surface Water Viewer, http://www.eea.europa.eu/themes/water/interactive/soe-wfd/wfd-surface-water-viewer.

EEA (2012e) WFD: Ground Water Viewer, http://www.eea.europa.eu/themes/water/interactive/soe-wfd/wfd-ground-water-viewer.

Fehér, J., Gáspár, J., Veres, K.S., Kiss, A., Globevnik, L., Peterlin, M., Kirn, T., Stein, U., Prins, T., Spiteri, C., Laukkonen, E., Heiskanen, A.-S., Austnes, K., Semeradova, S., Künitzer, A. & Kristensen, P. (2012) Hydromorphological alterations and pressures in European rivers, lakes, transitional and coastal waters. *ETC/ICM Technical Report 2/2012*, 76 pp.

Kossida M., Kakava A., Tekidou A., Iglesias A. & Mimikou M. (2012) Vulnerability to Water Scarcity and Drought in Europe *ETC/ICM Technical Report 3*/2012, 102 pp.

Solheim, A.L., Austnes, K., Peterlin, M., Kodeš, V., Filippi, R., Semerádová, S., Prchalová, H., Künitzer, A., Spiteri, C., Prins, T., Collins, R. P. & Kristensen, P. (2012) Ecological and chemical status and pressures in European waters. *ETC/ICM Technical Report 1/2012*, 146 pp.