European waters
Assessment of status and pressures 2018

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Executive summary

The main aim of EU water policy is to ensure that a sufficient quantity of good-quality water is available for both people's needs and the environment. The Water Framework Directive (WFD), which came into force in 2000, established a framework for the assessment, management, protection and improvement of the quality of water resources across the EU. Since December 2015, EU Member States have been publishing the second river basin management plans (RBMPs) for achieving the environmental objectives of the WFD. These plans are updates of the first RBMPs, which were published in 2009.

By spring 2018, 25 Member States had reported to the Water Information System for Europe (WISE).

In 2018, the European Commission will publish its report on the assessment of the second RBMPs and will start the process of evaluating the WFD (EC, 2017a). To accompany and inform this process, the EEA has produced this report on the state of Europe's water. In addition, the Water Information System for Europe (WISE) Freshwater visualisation tool presents more, and more detailed, results ([1]).

Key messages

- Of the different water bodies recognised by the Water Framework Directive (WFD) across Europe, groundwaters generally have the best status. Good chemical status has been achieved for 74 % of the groundwater area, while 89 % of the area achieved good quantitative status.
- Around 40 % of surface waters (rivers, lakes and transitional and coastal waters) are in good ecological status or potential, and only 38 % are in good chemical status.
- In most Member States, a few priority substances account for poor chemical status, the most common being mercury. If mercury and other ubiquitous priority substances were omitted, only 3 % of surface water bodies would fail to achieve good chemical status. Improvements for individual substances show that Member States are making progress in tackling the sources of contamination.
- Overall, the second RBMPs show limited change in status, as most water bodies have the same status in both cycles. The proportion of water bodies with unknown status has decreased and confidence in status assessment has grown. Improvements are usually visible at the level of individual quality elements or pollutants but often do not translate into improved status overall.
- The main significant pressures on surface water bodies are hydromorphological pressures (40 %), diffuse sources (38 %), particularly from agriculture, and atmospheric deposition (38 %), particularly of mercury, followed by point sources (18 %) and water abstraction (7 %).
- Member States have made marked efforts to improve water quality or reduce pressure on hydromorphology. Some of the measures have had an immediate effect; others will result in improvements in the longer term.
- It can be expected that, by the time the third RBMPs are drafted (2019-2021), some of the several thousand individual measures undertaken in the first and second RBMPs should have had a positive effect in terms of achieving good status.

([1]) https://www.eea.europa.eu/themes/water/water-assessments

Improvements in monitoring and assessment

The results show that, with the second RBMPs, the quantity and quality of the available evidence on status and pressures has grown significantly. Many Member States and river basin districts (RBDs) have invested in new or better ecological and chemical monitoring programmes, with a greater number of monitoring sites and the inclusion of more chemicals and quality elements. Surface waters and groundwater have been monitored at more than 130 000 monitoring sites over the past six years. In the second RBMPs, this has resulted in both a marked reduction in the proportion of water bodies with unknown status and clearly increased confidence in status assessments.

According to the WFD, EU Member States were to aim to achieve good status in all bodies of surface water and groundwater by 2015, unless there were grounds for exemption. Only in those cases was it possible to extend the achievement of good status to 2021 or 2027 or to set less stringent targets. Achieving good status involves meeting certain standards for the ecology, chemistry and quantity of waters. In general, good status means that water shows only a slight change from what would normally be expected under undisturbed conditions (i.e. with a low human impact).

European waters remain under pressure from a range of human activities. These pressures often act at the same time and affect the good functioning of ecosystems, contribute to biodiversity loss and threaten the valuable benefits that water brings to society and the economy.

Ecological status of surface waters

Ecological status and potential is an assessment of the quality of the structure and functioning of surface water ecosystems, including rivers, lakes, transitional waters and coastal waters. It shows the influence of both pollution and habitat degradation. Ecological status is based on biological quality elements and supporting physico-chemical and hydromorphological quality elements.

On a European scale, around 40 % of the surface water bodies are in good or high ecological status or potential, with lakes and coastal waters having better status than rivers and transitional waters. There has been limited change in ecological status since the first RBMPs were reported.

The status of many individual quality elements that make up ecological status is generally better than the ecological status as a whole. The analysis shows that the ecological status of some biological quality elements has improved from the first to the second RBMPs.

Chemical status of surface waters

For surface waters, good chemical status is defined by limits (environmental quality standards (EQS)) on the concentration of certain pollutants found across the EU, known as priority substances. In the second RBMPs, 38 % of surface water bodies are in good chemical status, while 46 % have not achieved good chemical status and for 16 % their status is unknown.

In many Member States, relatively few substances are responsible for failure to achieve good chemical status. Mercury causes failure in a large number of water bodies. If the widespread pollution by ubiquitous priority substances, including mercury, is omitted, the proportion of water bodies in good chemical status increases to 81 %, with 3 % that have not achieved good status and 16 % whose status is unknown. The main reasons for failure to achieve good status are atmospheric deposition and discharges from urban waste water treatment plants.

Since the publication of the first RBMPs, Member States have made progress in tackling priority substances, leading to a reduction in the number of water bodies failing to meet standards for substances such as priority metals (cadmium, lead and nickel) and pesticides.

Pressures on surface waters

The main significant pressures on surface water bodies are hydromorphological pressures (affecting 40 % of water bodies), diffuse sources (38 %), particularly from agriculture, and atmospheric deposition (38 %), particularly of mercury, followed by point sources (18 %) and water abstraction (7 %). The main impacts on surface water bodies are nutrient enrichment, chemical pollution and altered habitats due to morphological changes.

Chemical and quantitative status of groundwater

The WFD requires Member States to designate separate groundwater bodies and ensure that each one achieves

(2) See the specific criteria on chemical and quantitative status in Annex V of the WFD (EU, 2000).

'good chemical and quantitative status' (2). To meet the aim of good chemical status, hazardous substances should be prevented from entering groundwater, and the entry of all other pollutants (e.g. nitrates) should be limited.

Good quantitative status can be achieved by ensuring that the available groundwater resource is not reduced by the long-term annual average rate of abstraction. In addition, impacts on surface water linked with groundwater or groundwater-dependent terrestrial ecosystems should be avoided, as should saline intrusions.

In the EU, 74 % and 89 % of the area of groundwater bodies, respectively, is in good chemical and quantitative status. This is a small improvement in status from the first RBMPs.

Nitrates are the main pollutant, affecting over 18 % of the area of groundwater bodies. In total, 160 pollutants resulted in failure to achieve good chemical status. Most of these were reported in only a few Member States, and only 15 pollutants were reported by five or more Member States.

In the EU, agriculture is the main cause of groundwater's failure to achieve good chemical status, as it leads to diffuse pollution from nitrates and pesticides. Other significant sources are discharges that are not connected to a sewerage system and contaminated sites or abandoned industrial sites.

Water abstraction for public water supply, agriculture and industry is the main significant cause of failure to achieve good quantitative status.

Groundwater and surface water status (3) and overall progress since the first RBMPs

Overall, the second RBMPs show limited change in all four measures of status (4), as most of the water bodies had the same status both cycles. However, fewer water bodies with unknown status means an increase in both the proportion with good status and the proportion with less good status. The analysis of the second RBMPs shows that there has been progress in the status of single quality elements and single pollutants.

There are several possible explanations for the limited improvement in groundwater and surface water status from the first to the second RBMPs:

- First, additional biological and chemical monitoring was implemented after 2009 and the classification methods were improved.
- Second, for some water bodies, some quality elements have improved in status, but there has been no improvement in their overall ecological status.
- Third, the second RBMPs generally show status classification up to 2012/2013, and at that time many measures were only in the process of being implemented; therefore, there may be a lag-time before pressures are reduced and status improves.
- Finally, some pressures may have been unknown in 2009, and so the measures implemented may not have been sufficient or as effective as expected in reducing these.

Pressures and measures

There are ample possibilities for improving water management to achieve the objectives of the WFD through the stringent and well-integrated implementation of existing legislation and the introduction of supplementary measures that reduce the pressures that cause failure to achieve good status. The following paragraphs summarise the challenges in water management and the measures needed to progress towards good status.

Point and diffuse source pressures

A range of pollutants in many of Europe's waters threaten aquatic ecosystems and may lead to public health concerns. Reducing pollution to meet the objectives of the WFD requires several other directives and regulations to be implemented.

Over the past few decades, clear progress has been made in reducing emissions from point sources. The implementation of the Urban Waste Water Treatment Directive (UWWTD), together with national

(3) 'Groundwater status' is the general expression of the status of a body of groundwater, determined by the poorer of its quantitative and chemical status; 'surface water status' is the general expression of the status of a body of surface water, determined by the poorer of its ecological and chemical status.
(4) Surface water ecological and chemical status and groundwater chemical and quantitative status.

legislation, has led to improvements in waste water treatment across much of the European continent. These positive trends reflect increased connections to sewers, improvements in waste water treatment and reductions in some substances at source.

Agricultural production is a major source of diffuse pollution, mostly as a result of excessive emissions of nutrients and chemicals such as pesticides. Other drivers include rural dwellings, run-off from urban areas and forestry. EU action on curbing diffuse nutrient pollution has a long history. Member States currently use a large number of measures, including farm-level nutrient planning, fertiliser standards, appropriate tillage, nitrogen fixing and catch crops, buffer strips and crop rotation. In the EU during the last few decades, there has been a steady decrease in the use of mineral fertiliser and in nutrient surpluses originating in agriculture. The average level of nitrate concentration in European rivers decreased by 20 % between 1992 and 2015, while in 2011 groundwater nitrate concentrations had almost returned to their 1992 level.

The contamination of European waters with hazardous substances is a major environmental concern that has been addressed by a number of EU legislative measures and policies. Reducing hazardous substances in water requires not only the strong implementation of current legislation, but also the adoption of more sustainable ways to produce and use chemicals, both in Europe and beyond.

Improved efforts to reduce these chemicals in waste water treatment plants by improving waste water treatment should go hand in hand with clear efforts to reduce them at source by raising consumer awareness and adjusting consumption, as well as through longer term initiatives, such as those aiming to create a non-toxic environment and a circular economy.

Although recent decades have seen considerable success in reducing the number of pollutants discharged into Europe's waters, challenges remain in terms of urban and industrial waste water and pollution from agricultural sources. The implementation in all Member States of existing EU water emission legislation, including the UWWTD and the Nitrates and Environmental Quality Standards Directives, will improve the quality of water. Waste water treatment must continue to play a critical role in the protection of Europe's surface waters, and investment will be required in many European countries to upgrade waste water treatment and maintain infrastructure. In some regions, diffuse pollutants, from agriculture in particular, remain a major cause of poor water quality, and measures to tackle these may be required.

Hydromorphological pressures

For decades, humans have altered European surface waters (e.g. straightening and channelisation, disconnection of flood plains, land reclamation, dams, weirs, bank reinforcements) to facilitate agriculture, produce energy and protect against flooding. These activities have resulted in damage to the morphology and hydrology of water bodies.

The second RBMPs show that the most commonly occurring pressures on surface water bodies are hydromorphological, affecting 40 % of all such bodies. In addition, 17 % of European water bodies have been designated as heavily modified (13 %) or artificial (4 %) water bodies.

The WFD requires action in those cases where the hydromorphological pressures affect ecological status and prevent the WFD's objectives from being achieved. If the morphology is degraded or the water flow is markedly changed, a water body with good water quality will not reach its full potential as an aquatic ecosystem.

The restoration of hydromorphological conditions includes:

- employing measures related to river continuity, such as removing obstacles and installing fish passes;
- employing measures focused on restoring aquatic habitats, such as improving physical habitats;
- managing sediment in a way that ensures that it is transported along the length of rivers;
- reconnecting backwaters and wetlands to restore lateral connectivity between the main river channel, the riparian area and the wider floodplain;
- implementing natural water retention measures that restore natural water storage, for example inundating flood plains and constructing retention basins;
- restoring the natural water flow regime through, for example, setting minimum flow and ecological flow requirements (EC, 2015a);
- developing master or conservation plans for restoring the population of threatened fish species.

Implementation of measures

For a river basin to achieve the objective of good status, the WFD requires an assessment of all pressures and the development of a Programme of Measures to tackle these. The first RBMPs described several thousand individual measures, and by now, many of these will have been completed. However, some have been delayed, or even not been started, mainly because of funding constraints, and others have been difficult to implement.

It is expected that by the time the third RBMPs are drafted (2019-2021), some of the several thousand individual measures undertaken in the first and second RBMP cycles should have resulted in positive effects towards achieving good status.

Integrated water management

Sustainable and integrated water management plays a substantial role in the United Nations' 2030 Agenda for Sustainable Development, the EU's Seventh Environment Action Programme (7th EAP; EC, 2014) and the achievement of the EU's biodiversity strategy (EC, 2012a). The following paragraphs highlight three areas that offer substantial opportunities to improve implementation of and support for the achievement of the WFD objectives.

Concern has grown over the last few decades about the rate at which biodiversity is declining and the consequences of this for the functioning of ecosystems and the services they provide. Many opportunities exist for improving implementation and maximising synergy between environmental policies relevant for the protection of the water environment. EU policies on water and the marine environment, nature and biodiversity are closely linked, and together they form the backbone of environmental protection of Europe's ecosystems and their services.

The use of management concepts such as the ecosystem services approach and ecosystem-based management can offer ways to improve coordination by setting a more common language and framework to evaluate trade-offs between the multiple benefits that healthy water bodies offer.

Nowadays, water management increasingly includes ecological concerns, working with natural processes. This is in line with the objective of the 7th EAP 'to protect, conserve and enhance the Union's natural capital'. It is also consistent with Target 2 of the EU's biodiversity strategy, which aims to ensure maintenance of ecosystems and their services by establishing green infrastructure and restoring at least 15 % of degraded ecosystems by 2020 (EC, 2012a).

Restoring aquatic ecosystems through, for example, 'making room for the river', river restoration or floodplain rehabilitation, 'coastal zone restoration projects' and integrated coastal zone management has multiple benefits. Synergy between policies can also be an important factor.

The WFD and RBMPs have led to a significant shift in Member States' water management, have increased the availability of information to the public, and are providing a much better understanding of status and pressures, as well as of measures to reduce pressures and achieve status improvements.

From the assessment of status, and in particular from the assessment of pressures and impacts, it is evident that activities in sectoral areas such as agriculture, energy and transport are the driving forces behind the achievement, or non-achievement, of good status. The WFD is an important policy for achieving this, and its good status objective defines these boundaries of sustainability. Managing water in a green economy means using water in a sustainable way in all sectors and ensuring that ecosystems have both the quantity and the quality of water they need to function. It also means fostering a more integrated and ecosystem-based approach that involves all relevant economic sectors. This integration throughout the river basin can be enhanced by, for example, better cooperation between competent authorities, and increased involvement of stakeholders and early participation of the public.

Europe 2020 is the EU's strategy for economic growth in Europe (EC, 2010). It envisages the development of a 'greener', more environmentally friendly economy. Sustainable water management is a critical element of this because healthy and resilient ecosystems provide the services needed to sustain human well-being. For this reason, we need to ensure that economic sectors, such as agriculture, energy and transport, also adopt management practices that keep water ecosystems healthy and resilient.

1 EEA State of Water assessment and EU water policy context

Key messages

- The Water Framework Directive (WFD) required EU Member States to achieve good status in all bodies of surface water and groundwater by 2015, unless there are grounds for exemption. Achieving good status involves meeting certain standards for the ecology, chemistry and quantity of waters.
- The data reported for the second river basin management plans (RBMPs) show that the quantity and quality of available evidence on status and pressures has grown significantly as a result of considerable investments by Member States in monitoring and assessment. As an indication, surface waters and groundwater have been monitored at more than 130 000 sites over the past six years.
- This has resulted in markedly improved RBMPs, providing a better understanding of the ecological, chemical and quantitative status, the pressures causing failure to achieve good status, and the measures required to achieve good status.
- Member States have reported status and pressures for 13 400 groundwater bodies and 111 000 surface water bodies: 80 % are rivers, 16 % are lakes and 4 % are coastal or transitional waters.
- The delineation of about 90 % of the surface water bodies (by number of water bodies) and around 70 % of the groundwater bodies (by area) was unchanged from the first to the second RBMPs.
- The results in this report provide a European overview of the data reported by the second RBMPs and the status of and pressures affecting Europe's waters. Caution is needed when comparing results between Member States and between first and second RBMPs, as the results can be significantly affected by the methodology applied by individual Member States.

1.1 Context

The main aim of the EU's water policy is to ensure that a sufficient quantity of good-quality water is available both for people's needs and for the environment. Since the first water directives in the 1970s, the EU has worked to create an effective and coherent water policy. The Water Framework Directive (WFD; EU, 2000), which came into force in 2000, established a framework for the assessment, management, protection and improvement of the status of water bodies across the EU. In addition, the objectives for water from the EU's Seventh Environment Action Programme (7th EAP; EC, 2014), together with those from its biodiversity strategy 2020 (EC, 2012a) and the Blueprint to safeguard Europe's water resources (EC, 2012b), are key components of the maintenance and improvement of the essential functions of Europe's water-related ecosystems, including coastal and marine areas, and of ensuring that they are well managed.

Since December 2015, EU Member States have been publishing the second river basin management plans (RBMPs) for achieving the environmental objectives of the WFD. These are an update and a further development of the first RBMPs. In 2018, the European Commission will publish its report on the assessment of the second RBMPs. The Commission has also started the process of evaluating the WFD, with the publication of the evaluation roadmap Fitness check on the Water Framework Directive and the Floods Directive (EC, 2017a). To accompany and inform this process and to fulfil the requirement of WFD Article 18 ([5]), the EEA has produced this report on the state of Europe's water and presented more detailed WFD results in the Water Information System for Europe (WISE). This report is a follow-up of the EEA water assessments published in 2012 (EEA, 2012a, 2012b).

The report aims to present results on:

- the status of EU waters, based on the second RBMPs;
- the pressures that are causing less than good status;
- the progress that was achieved during the first RBMP cycle (2010-2015).

The report presents results on the status of surface waters and groundwater in Europe, providing overviews at EU, Member State and river basin districts (RBDs) levels.

Chapter 1 introduces the EU water policy context and sets the scene for the state of water (SoW) assessments. It addresses the data sources and geographical scope of the report and provides an overview of water bodies, including heavily modified and artificial water bodies. The chapter also describes the specific challenges of comparing the data from the first and the second RBMPs and the constraints that need to be considered when doing this.

Chapters 2 to 5 deal with the status assessments of surface waters (ecological status and chemical status) and groundwater (chemical status and quantitative status). These chapters follow a common narrative. Each chapter introduces the status assessment, describes the status of EU waters as reported in the second RBMPs, investigates the pressures that cause less than good status and then compares the status in the first and second RBMPs.

Chapter 6 brings the results together in an analysis of drivers, pressures and impacts, and provides an overview of the improvements achieved since the first RBMPs. It addresses the main pressures responsible for not (yet) achieving good status in all European waters. The chapter discusses, in more detail, pollution from point and diffuse sources and its relationship to water quality, as well as how habitats have been altered and hydrology modified as a result of water abstraction. The chapter concludes with an outlook on the future challenges in water management.

1.1.1 Assessing the status of water

EU Member States were to aim to achieve good status in all bodies of surface water and groundwater by 2015, unless there are grounds for exemption. Only in these cases could the achievement of good status be extended to 2021 or, at the latest, 2027. Achieving good status involves meeting certain standards for the ecology, chemistry and quantity of waters. In general, 'good status' means that water shows only a slight change from what would normally be expected under undisturbed conditions ([6]). There is also a general 'no deterioration' provision to prevent a decrease in status. An overview of the WFD's assessment of the status of surface waters and groundwater is illustrated in Figure 1.1.

Ecological status according to the WFD assesses ecosystem health as expressed by biological quality elements — phytoplankton, macrophytes, phytobenthos, benthic invertebrate fauna and fish — supported by hydromorphological and physico-chemical parameters: nutrients, oxygen condition, temperature, transparency, salinity and river basin-specific pollutants (RBSPs). The Directive specifies which elements are to be assessed for each water category and requires that biological and supporting quality elements achieve at least good status.

The aim of the WFD is to ensure that both surface water and groundwater bodies across Europe are in good chemical status. The goal for surface waters is defined by limits on the concentration of certain

([5]) WFD Article 18, Commission Report.
1. The Commission shall publish a report on the implementation of this Directive at the latest 12 years after the date of entry into force of this Directive and every six years thereafter and shall submit it to the Parliament and the Council.
2. The Report shall include the following: a) a review of progress in the implementation of the Directive, b) a review of the status of surface water and groundwater in the Community undertaken in coordination with the European Environment Agency.

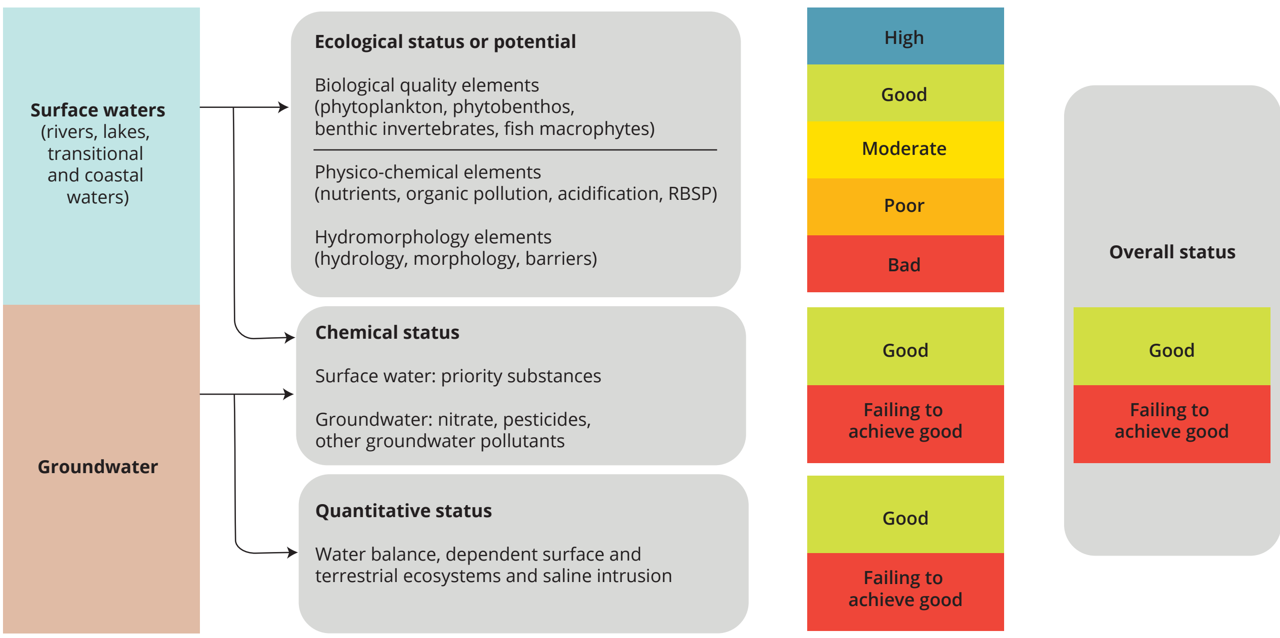
([6]) WFD Annex V: Normative definition of 'good ecological status' — The values of the biological quality elements for the surface water body type show low levels of distortion resulting from human activity, but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions.

pollutants present across the EU, known as priority substances. Good surface water chemical status means that the concentrations of all priority substances do not exceed those permitted by the environmental quality standards (EQS) established in the Environmental Quality Standards Directive 2008/105/EC (EU, 2008a). EQS are set to protect the most sensitive species, as well as humans (who can be affected by secondary poisoning).

Good groundwater chemical status is achieved when concentrations of specified substances do not exceed those permitted by relevant standards and when concentrations do not prevent associated surface water bodies from achieving good status or cause significant damage to terrestrial ecosystems that depend directly on the groundwater in question (EC, 2018a).

Good groundwater quantitative status is achieved by ensuring that the available groundwater resource is not exceeded by the long-term annual average rate of abstraction (EC, 2018a). Accordingly, the level of groundwater should not lead to any reduction in the ecological status of connected surface waters or in groundwater-dependent terrestrial ecosystems. Furthermore, reversals in the direction of flow should not result in saline (or other) intrusions.

Figure 1.1 Assessment of status of surface waters and groundwater according to the WFD



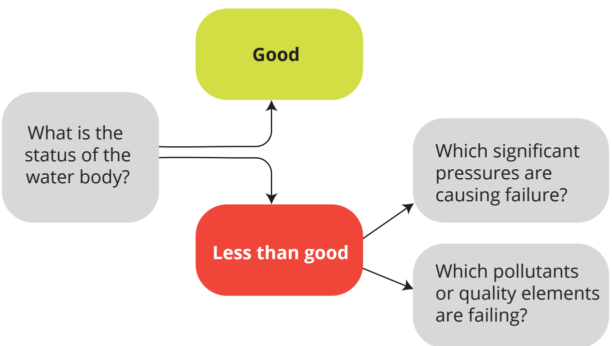
1.1.2 Significant pressures and impacts

Europe's waters are affected by several pressures, including water pollution, water abstractions, droughts and floods. Major physical modifications to land (e.g.drainage, soil erosion and floodplain changes) and to water bodies (e.g. channelisation and barriers) also affect morphology and water flow.

The WFD requires the identification of significant pressures from point sources of pollution, diffuse sources of pollution, modifications of flow regimes through abstractions or regulation and morphological alterations, as well as any other pressures (Figure 1.2). 'Significant' means that the pressure contributes to an impact that may result in failing to meet the requirements of Article 4(1) Environmental Objectives (of not having at least good status). In some cases, the pressure from several drivers, e.g. water abstraction from agriculture and households, may in combination be significant.

The identification of significant pressures and their resulting impacts (which in turn lead to reduced status) can involve different approaches: field surveys, inventories, numerical tools (e.g. modelling) or expert judgement, or a combination of tools.

Figure 1.2 Flow diagram of the link between status and pressures



By now, many of the several thousand individual measures in the first RBMPs have been completed. However, some measures have not yet been fully completed, mainly because of funding constraints, while others have been difficult to implement.

Further and detailed information on the WFD and second RBMPs can be found on the European Commission's home page on the WFD, in the Commission's WFD reports, from JRC (Joint Research Centre) and from the EEA.

Further and detailed information on assessing the status of waters is available in the Commission's Water Notes.

Common implementation strategy (CIS) guidance documents and WFD reporting guidance: EC, 2009a; EC, 2016a; EEA, 2016a.

1.2 Data sources, geographical coverage, and methodology

This report is compiled from information on the status of European surface water and groundwater bodies as reported by EU Member States to WISE. By spring 2018, 25 Member States had reported to WISE. The WISE-SoW database includes data from the first and second RBMPs. The WFD data were reported in accordance with the WFD reporting guidance, which was revised in 2016 (EC, 2016a).

The implementation of the WFD has resulted in the designation of 180 RBDs across the EU and 31 RBDs internationally. RBMPs have been produced for all of the RBDs. Each RBMP consists of many documents, maps and datasets. The main RBMP document, which often is 200-300 pages long, provides detailed information on water body status and pressures affecting status, monitoring programmes and the Programme of Measures (PoM) to be implemented during that management cycle. In addition, RBMPs often include several appendices and, in some cases, Member States have established interactive map services or information systems to provide detailed information about individual water bodies.

This report presents only the key results, while more detailed WFD results are presented in an interactive tool in WISE-Freshwater WFD ([7]). Links to the WISE-Freshwater WFD are provided below the diagrams and in small text boxes, with links to additional dashboards provided in the relevant sections of the report.

Greece, Ireland, Lithuania and Norway ([8]) have not yet reported the data for their RBMPs and are therefore not included into the results presented in this report. The four countries have been in progress of reporting and when their reporting is finished the results will be included into the WISE-freshwater visualization tool. In addition information on their second RBMPs can be found in Box 1.1.

Box 1.1 Countries that have not reported yet under the WFD

Greece has not adopted their second RBMPs plans, while they have a national WFD homepage ([9]) and a data visualization tool ([10]).

Ireland: National WFD homepage ([11]) and the data visualisation tools and maps for water quality in Ireland is available on the Catchments website ([12]). The latest Irish Water Quality report was published in 2017 (EPA, 2017) and the River Basin Management Plan 2018–2021 in April 2018 (EPA, 2018).

Lithuania: National WFD homepage including RBMPs ([13]) and map service ecological status ([14]).

Norway: National WFD homepage ([15]) , second RBMPs ([16]) and data visualisation tool ([17]).

European countries that are not EU Member States have developed similar river basin activities to those introduced by the WFD in Member States (Box 1.2).

([7]) https://www.eea.europa.eu/themes/water/water-assessments
([8]) Norway is a member of the European Free Trade Association (EFTA). According to the European Economic Area (EEA) agreement, Norway will fully implement the WFD with a specific timetable agreed.
([9]) http://wfdver.ypeka.gr/en/home-en
([10]) http://wfdgis.ypeka.gr/?lang=EN
([11]) http://www.epa.ie/water/watmg/wfd
([12]) https://www.catchments.ie
([13]) http://vanduo.gamta.lt/cms/index?rubricId=ac0b650a-77c8-4d43-b453-42a0cb916a38
([14]) https://www.arcgis.com/apps/PublicInformation/index.html?appid=7c30964d89f442a684ea5f99f8b8c8b6
([15]) http://www.vannportalen.no/english
([16]) http://www.vannportalen.no/plandokumenter/planperioden-2016---2021
([17]) https://vann-nett.no/portal

Box 1.2 Information from EEA countries not reporting under the WFD

Switzerland

Switzerland is not bound to implement the WFD. However, the Swiss legal system sets comparable targets regarding water protection and management, and Swiss legislation has binding requirements, including a set of national limits that must always be met. As a member of the International Commissions for the Protection of the Rhine and of the commissions for the protection of Lake Constance, Geneva and as well for the protection of the Swiss-Italian transboundary waters, Switzerland collaborates with its neighbouring states to achieve water protection goals and to implement endorsed programmes. In the framework of these commissions Switzerland supports EU-member states in coordinating their activities to implement the WFD in international water basins. Water management in Switzerland is described in the water homepage of the Federal Office for the Environment (FOEN, 2018); and OECD environmental performance review for Switzerland (OECD, 2017).

Switzerland was one of the first countries to implement a national policy to reduce micropollutants in municipal sewage treatment plant effluents, consistent with the polluter-pays principle. Many micropollutants have been detected in Swiss surface waters, and these can have adverse effects on aquatic ecosystems and possibly on human health (OECD, 2017). Switzerland has embarked on an innovative approach to the rehabilitation of its rivers. Around 40 % of rivers have been altered, with adverse consequences for nature and the landscape (OECD, 2017). By the end of 2018, the cantons must provide sufficient space for all surface waters to ensure their natural functioning; there must be a reduction in the negative impact of hydropower production on downstream waters by 2030; and some 25 % of waters with poor morphological status must be rehabilitated over the longer term.

Turkey

Turkey, as candidate country to the EU, has been actively working on developing the RBMPs in accordance with the WFD requirements and practices since 2014. In that context, 25 RBDs have been delineated in the country and RBMPs have been completed for four RBDs (SYGM, 2018). RBMPs for seven RBDs are under preparation, and it is aimed to have prepared 25 RBMPs by the year of 2023 (Sahtiyancı, Ö.Hande, GDWM, 2014). In addition, flood management plans were prepared for four RBDs while drought management plans were prepared for five RBDs. Water management in Turkey is described at the General Directorate of Water Management (SYGM, 2018) and the General Directorate of State Hydraulic Works (DSİ, 2018) water homepages.

Turkey has also developed a national basin management strategy (2014-2023) with the view of ensuring the sustainable management of water resources including ecological, economic and social benefits of river basins (OSİB, 2018) In addition to this, Turkey has revised its National Implementation Plan for WFD, which was first prepared in 2010, and Turkey's National Water Management Plan is being prepared by the General Directorate of Water Management (SYGM, 2018).

Iceland

In 2007, the Icelandic parliament voted to adopt the WFD. Iceland identified one RBD, four sub-basins and several coastal waters (OECD, 2014). Work is under way to identify heavily modified and artificial water bodies and to assess their ecological status in accordance with the WFD (EAI, 2014).

The quality of freshwater and groundwater in Iceland is extremely good. No rivers or coastal waters are considered at risk of not achieving good chemical status. Only one lake (Tjörnin) and one groundwater body are considered at risk. Water management in Iceland is described at the Environment Agency of Iceland's water management home page ([18]) and in OECD Environmental Performance Reviews for Iceland (OECD, 2014).

([18]) http://www.ust.is/default.aspx?pageid=d208529c-862d-4ac8-a1bd-c396babea2d4

Box 1.2 Information from EEA countries not reporting under the WFD (cont.)

West Balkan countries (EEA Cooperating countries)

For the West Balkan EEA cooperating countries, water management, status and pressures are described at national water homepages and in UNECE environmental performance reviews.

- Albania, water homepage ([19]) and 2nd Environmental Performance Review of Albania (UNECE, 2012).
- Bosnia-Herzegovina, water homepage ([20]) and 2nd Environmental Performance Review of Bosnia and Herzegovina (UNECE, 2011a).
- Former Yugoslav Republic of Macedonia, water homepage ([21]) and 2nd Environmental Performance Review of the former Yugoslav Republic of Macedonia (UNECE, 2011b).
- Kosovo under UNSCR 1244/99, water homepage ([22]).
- Montenegro, water homepage ([23]) and 3rd Environmental Performance Review of Montenegro (UNECE, 2015a).
- Serbia, water homepage ([24]) and 3rd Environmental Performance Review of Serbia (UNECE, 2015b).

Sava RBMPs

The Sava River is the third-longest tributary of the Danube and runs through Slovenia, Croatia, Bosnia and Herzegovina, and Serbia, with part of its catchment in Montenegro and Albania.

The International Sava River Commission is working with these countries on the development of the Sava RBMP, in line with the WFD. The second International Sava RBMPs are available at: Sava RBMP and background documents ([25]); and Sava RBMP (International Sava River Basin Commission, 2014 ([26])).

1.2.1 Surface water and groundwater bodies

In the context of the WFD, the 'water environment' includes rivers, lakes, transitional waters, groundwater and coastal waters out to 1 nautical mile (12 nautical miles for chemical status, i.e. for territorial waters). These waters are divided into units called water bodies.

The EU Member States have now reported 13 400 groundwater bodies and 111 000 surface water bodies: 80 % are rivers, 16 % are lakes and 4 % are coastal and transitional waters (Table 1.1). All Member States have reported river and groundwater bodies, 23 (all reporting Member States except Luxembourg and Slovakia) have reported lake water bodies, 14 have reported transitional water bodies and 20 have reported coastal water bodies. In the second RBMPs, seven Member States have delineated 46 territorial waters, i.e. water bodies from 1 to 12 nautical miles.

([19]) http://turizmi.gov.al
([20]) http://www.fmoit.gov.ba
([21]) http://www.moepp.gov.mk/?page_id=2348
([22]) www.ammk-rks.net
([23]) https://epa.org.me
([24]) www.sepa.gov.rs
([25]) http://www.savacommission.org/srbmp/en/draft
([26]) http://www.savacommission.org/dms/docs/dokumenti/srbmp_micro_web/srbmp_approved/sava_river_basin_management_plan_approved_eng.pdf

Table 1.1 Number of Member States, RBDs, water bodies, and length or area, per water category

Category	Member States	Number of water bodies	Total length or area	Average length/area
Groundwater	25	13 411	4.3 million km^2	323 km^2
Rivers	25	89 234	1.2 million km	13.1 km
Lakes	23	18 165	81 800 km^2	4.5 km^2
Transitional waters	14	782	14 600 km^2	19 km^2
Coastal waters	20	2 835	290 000 km^2	102 km^2
Territorial waters	7	46	214 000 km^2	13 400 km^2

Source: Results are based on the WISE-SoW database including data from 25 Member States (the 28 EU Member States (EU-28 except Greece, Ireland and Lithuania)). Groundwater bodies: Number and Size and Surface water bodies: Number and Size.

The number of water bodies varies considerably between Member States depending on the size of their territory but also on their approach to delineating water bodies. Sweden has by far the largest number of surface water bodies, followed by France, Germany, the United Kingdom and Italy. With a naturally large number of lakes, Sweden and Finland have the most lake water bodies. Coastal water bodies are the most numerous in Italy, Sweden and the United Kingdom.

A similar variation in the approach to delineation can be seen for groundwater bodies. Ideally groundwater bodies should be represented with three-dimensional information on their extent, i.e. volume, and location. However this information is rarely available from Member States. Hence the results presented is based on information of the size and location of the polygons that represent the projection areas of the groundwater bodies at the terrain surface, in accordance with the WFD reporting guidance (EC, 2016a).

France reported that it has 30 % of the total groundwater body area in the EU, and Germany and Spain have 9 % each. Some Member States have considered occurrence of groundwater bodies in different horizons, overlaying may occur. In those cases, the sum of groundwater areas may be larger compared to a situation where groundwater bodies are represented in single horizons only.

The average size of groundwater bodies also differs considerably. In Sweden and Finland, the average area is 7 km^2, while in the other Member States the average area is nearly 700 km^2. Due to this difference in the size of groundwater bodies EEA has in the presentation of groundwater results used the area of groundwater bodies for assessment of status and pressures.

Some Member States have re-delineated some of their water bodies for the second RBMPs. About 90 % of surface water bodies are unchanged from the first to the second RBMPs. About 10 % have been deleted, markedly modified (split or aggregated) or newly created. In most countries, there were only minor changes in the number and length or area of surface water bodies, however, some Member States completely revised their delineation and replaced some or all surface water bodies with new ones.

The area made up of reported groundwater bodies was nearly the same in both RBMPs. Around 70 % of the groundwater bodies (by area) had not changed, while 29 % of those from the first RBMPs had been deleted and replaced by new ones.

In terms of the results from the two RBMPs, the EEA has in general compared only those water bodies that are unchanged or have only minor changes that do not hamper the comparison. For groundwater status by aggregated groundwater area have been compared. For water bodies that have been deleted, aggregated, split or newly created, a direct comparison is not possible.

Further and detailed information on delineation of RBDs and water bodies is available using the WISE-Freshwater WFD.

1.2.3 *Designation of heavily modified and artificial water bodies*

In the case of water bodies that have undergone significant hydromorphological alteration, the WFD allows Member States under certain conditions to designate surface waters as heavily modified water bodies, with the environmental objective being 'good potential' rather than status. For artificial water bodies, there is a similar objective.

In many river basins, the upper stretches in mountainous areas, highland areas and often forest areas remain largely in their natural state except when hydropower and irrigation reservoirs have changed the system. However, lower stretches, often passing large cities and intensive agricultural land, are modified by embankments and other public works. Those in lowland areas are more frequently designated as heavily modified waters. Other examples of heavily modified water bodies are rivers with hard, engineered flood defences, inland waterways for navigation and reservoirs on rivers or lakes. Heavily modified transitional and coastal waters have often been altered by land reclamation or dredging to allow for port facilities and urban, transport and agricultural developments.

Overall, 17 % of European water bodies were designated as heavily modified (13 %) or artificial (4 %) water bodies during the second RBMPs. Around 30 % of transitional water bodies and 14 % and 10 % of rivers and lakes, respectively, were designated as heavily modified. The main reasons for designating European water bodies as heavily modified are land drainage, urban infrastructure and agriculture, as well as water regulation and flood protection measures.

Artificial water bodies are man-made rather than natural structures and include canals, reservoirs and open-cast mining lakes. More than 6 % of lakes and around 4 % of rivers have been identified as artificial. However, only a few transitional and coastal waters are listed as such.

Further and detailed information on designation of natural, heavily modified and artificial water bodies is available using the WISE-Freshwater WFD.

1.2.4 *Improvements in monitoring and assessment*

The data reported for the second RBMPs show that the quantity and quality of available evidence on status and pressures has grown significantly because of considerable investments in monitoring and assessment. This has resulted in markedly improved RBMPs that provide a better understanding of the status (ecological, chemical and quantitative), the pressures causing failure to achieve good status and the required measures.

Surface waters and groundwater have been monitored at more than 130 000 monitoring sites over the past six years (Table 1.2). The number of surface water monitoring sites, quality elements and pollutants assessed has generally increased from before the first RBMPs. More specific information on Member States' monitoring activities, and changes in these, can be found in the European Commission's 5th WFD implementation reports (EC, forthcoming).

Table 1.2 Overview of monitoring sites and monitored water bodies

	Monitoring sites	Monitored water bodies
Surface water ecological status	92 243	51 762 (46 %)
Surface water chemical status	36 221	26 481 (28 %)
Groundwater chemical status	47 726	6 095 (47-86 % ([a]))
Groundwater quantitative status	37 151	4 863 (36-77 % ([a]))

Notes: A monitoring site may be used for both ecological and chemical monitoring or for both chemical and quantitative monitoring. The percentages indicate the proportion of surface water or groundwater bodies being monitored.

([a]) Percentage calculated excluding groundwater bodies from Finland and Sweden.

Source: WISE SoW database, 25 Member States (EU-28 except Greece, Ireland and Lithuania).

The second RBMPs show a marked reduction in water bodies with 'unknown' status and improved confidence in assessment. For surface water bodies, the proportion in unknown ecological status and chemical status fell from 16 % to 4 % and from 39 % to 16 %, respectively, while, for groundwater bodies, the proportion in unknown chemical status and quantitative status decreased to only 1 %.

The confidence in the status assessments ([27]) has also improved. In the first RBMPs, Member States reported less than one third of surface water bodies' ecological status with high or medium confidence, whereas in the second RBMPs this has improved to 58 %. The confidence in surface water body chemical status is relatively low compared with the other status assessments, with only 41 % of the water bodies in the second RBMPs being reported with high or medium confidence. The confidence in groundwater chemical and quantitative status assessments is good, with two thirds of the water bodies being reported with high or medium confidence.

Confidence also increases with the intercalibration (EC, 2008a) of ecological status. The number of intercalibrated biological assessment methods has generally increased three-fold since 2008, making the results from Member States more comparable than those from the first RBMPs (see also Chapter 2). This is important for ensuring that the same level of protection apply to all water bodies in the EU.

1.3 Assessment methods

The results in this report provide a European overview of the data reported in the second RBMPs and of the status of, and pressures affecting, Europe's waters. Caution is advised when comparing Member States and when comparing the first and second RBMPs, as the results are affected by the methods Member States have used to collect data and often cannot be compared directly. The following sections describe some issues that may affect the interpretation of results.

1.3.1 Difficulties in assessing change from the first to the second RBMPs

Comparisons between the two RBMPs are difficult for several reasons. First, the WFD reporting guidance was significantly revised and extended in 2016 to improve the level of information reported (EC, 2016a). There have also been many changes in how Member States implement the Directive, e.g. in water body re-delineation and the improvement of assessment methods.

1.3.2 Status classification up to 2012/13

The second RBMPs generally show the results of status classification up to 2012/2013. At that time many measures were only in the process of being implemented and so their effects would not yet have been seen. It also takes time (referred to as lag-time) for plant and animal communities and groundwater bodies to recover after measures are implemented. Therefore, the impact of measures from the first RBMPs on the status reported in the second RBMPs may be expected to be small.

1.3.3 Comparability of status assessments

The overall WFD objective for all water bodies is 'good' water status. 'Good' encompasses chemical and ecological status for surface waters and chemical and quantitative status for groundwater. Each of these status assessments includes several quality elements/pollutants/determinants. The WFD uses the 'one out, all out' principle when assessing water bodies (i.e. the worst status of the elements used in

([27]) The CIS reporting Guidance No 35 (EC, 2016a) defines confidence as low = no monitoring data; medium = limited or insufficiently robust monitoring data; and high = good monitoring data and good understanding of the system.

the assessment determines the overall status of the water body), and the progress achieved in some quality elements/determinants may be hidden by a lack of progress in others.

This may result in an overly pessimistic view of the progress achieved by WFD implementation for those Member States that have more developed, and comprehensive, assessment schemes that include many elements. In some cases, the lack of development of assessment methods in the first cycle, or from incomplete intercalibration, may also have made the results from the first RBMPs less accurate.

In this report, the results of the ecological and chemical status assessments are supported by the analysis of status assessments at the level of quality elements or individual pollutants. Caution is needed when using the results for Member State comparisons. Member States' results depend on their monitoring activities and the number of quality elements used or chemicals assessed. The results must be interpreted together with the results on confidence in status and the details on quality elements and pollutants and their threshold values. The WISE-Freshwater WFD visualisation tool has further information and the Commission's 5th WFD implementation report will also describe the different approaches Member States have taken.

1.3.4 Full implementation of standards for chemical status assessment

Directive 2008/105/EC on Environmental Quality Standards (EU, 2008a) is in full force for the second RBMPs and means stricter standards for some priority substances than in the first RBMPs. The Directive also requires Member States to report an inventory of emissions, discharges and losses in their second RBMPs.

During our analysis, it became clear that Member States have used a variety of approaches to determine chemical status (see also Chapter 3):

- Extrapolation of monitoring results: several Member States (Austria, Belgium, Germany, Sweden and Slovenia), have found that all monitoring samples showed levels of mercury that do not meet the EQS, and extrapolated the assessment 'failing to achieve good' to all surface water bodies.

- Using different standards for chemical status: according to the WFD 2016 reporting guidance (EC, 2016a), Member States should have reported chemical status for 2015 using the standards laid out in Directive 2008/105/EC (EU, 2008a), but some reported it using the stricter standards in the 2013 Priority Substances Directive (EU, 2013a).

With regard to the Groundwater Directive (GWD, EU, 2006a), in the second RBMPs an assessment of trends in groundwater pollutants was possible for the first time by comparing the monitoring results with those in the first RBMPs.

1.3.5 Changes in reporting requirements in first and second RBMPs

As well as the changes mentioned above, the reporting of the second RBMPs brings new elements into play. Some of these are a result of legislation that was not in full force when the first RBMPs were adopted; others can enable a comparison with the first RBMPs, thereby allowing an assessment of progress towards objectives.

Box 1.3 lists some of these new elements relevant to the current assessments. They provide possibilities for new assessments, but the results cannot be compared with those of the first RBMPs.

Box 1.3 Key changes in the reporting guidance between the first and second RBMPs

Heavily modified water bodies:

- Report the water use and type of physical modification for which the water body has been designated.

Pressures and impacts:

- Use new list of drivers, pressures and impacts common to surface waters and groundwater.

Ecological status:

- Provide status information at the more detailed quality element level (including reference year).
- Provide information on the change in class since the first RBMP was reported, if available. Changes in class should be reported as consistent (i.e. real) or as due to changes in methodology, e.g. monitoring and/or assessment methods.
- Report the RBSPs causing failure.

Surface water chemical status:

- Report the failure of individual substances.
- Provide a qualitative indication of the confidence in the chemical status assessment.
- Indicate the substances that have improved from poor to good chemical status since the first RBMP was reported.
- Indicate if the more stringent EQS introduced in 2013 for seven substances change the status of water bodies.

Groundwater chemical status:

- Report individual substances causing failure to achieve good status.
- Provide a qualitative indication of the confidence in the classification of quantitative and chemical status (optional).
- Report substances failing to meet quality standards or exceeding threshold values but not assessed as chemical status failures, i.e. cases in which Article 4(2)c of the GWD applies.

Objectives and exemptions:

- Report whether the water body is expected to achieve good status in 2015 and, if not, by when.
- Report the drivers behind exemption at water body level for ecological status and groundwater quantitative status and at substance level for surface water and groundwater chemical status.

Source: EC, 2016a.

2 Ecological status and pressures

Key messages

On a European scale, around 40 % of the surface water bodies are in good or high ecological status or potential, with lakes and coastal waters having better status than rivers and transitional waters.

The status of many individual elements (biological quality elements and supporting physico-chemical and hydromorphological quality elements) that make up the ecological status is generally better than the overall ecological status.

The overall ecological status has not improved since the first RBMPs, but has improved for some biological quality elements from the first to the second RBMPs.

The main pressures are point and diffuse source pollution, and various hydromorphological pressures. Diffuse source pollution affects 38 % of surface water bodies and point source pollution affects 18 %, while hydromorphological pressures affect 40 %.

The main impacts of the pressures on surface water bodies are nutrient enrichment, chemical pollution and altered habitats due to morphological changes.

Member States have made marked efforts to improve water quality and hydromorphology. Some of the measures have immediate effect; others will result in improvement in the longer run. Effects are usually visible at the level of individual quality elements but often do not translate into an overall improved ecological status.

2.1 Introduction

Ecological status ([28]) is an assessment of the quality of the structure and functioning of surface water ecosystems. It shows the influence of pressures (e.g. pollution, habitat degradation and climate change) on the identified quality elements. Ecological status is determined for each of the surface water bodies of rivers, lakes, transitional waters and coastal waters, based on biological quality elements and supported by physico-chemical and hydromorphological quality elements (Figure 2.1). The overall ecological status classification for a water body is determined, according to the 'one out, all out' principle, by the element with the worst status out of all the biological and supporting quality elements.

([28]) In the analyses in this report, no distinction has been made between ecological status (of natural water bodies) and ecological potential (of heavily modified and artificial water bodies (HMWBs and AWBs). Specific results on the ecological potential of HMWBs and AWBs can be obtained from the WISE Freshwater visualisation tool. Good ecological potential is the environmental objective for HMWBs and AWBs. Its achievement requires improvements to be made to the physico-chemical, hydromorphological and biological conditions as far as possible without impairing the non-substitutable water uses that were the reason for the designation of HMWB or AWB. However, good chemical status should be achieved for HMWB and AWB in the same way as for natural water bodies. In several countries the classification criteria for HMWBs and AWBs (ecological potential) are still under development.

Figure 2.1 Assessment of ecological status of surface water bodies

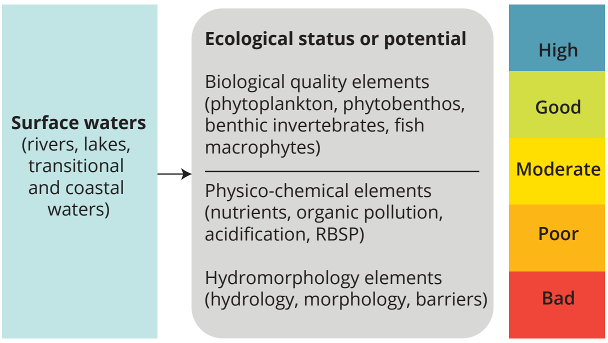
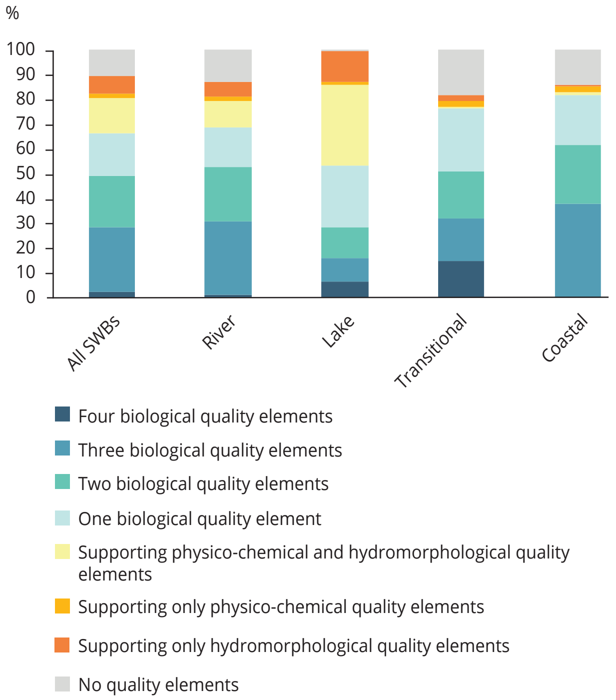


Figure 2.2 Percentage of classified water bodies using different quality elements, second RBMPs



Note: Count of surface water bodies.
All SWBs, all surface water bodies.

Source: Results based on WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Number of quality element used, by category.

2.1.1 *Significant pressures causing less than high or good ecological status*

Water bodies in moderate, poor or bad ecological status or those at risk of deterioration require mitigation and restoration measures to achieve the WFD good status objective. To plan such measures, the pressures causing water bodies to fail to achieve good ecological status must be identified.

These pressures include point sources of pollution, diffuse sources of pollution, water abstraction, and hydrological and morphological alterations. Types of impacts include nutrients, organic and chemical pollution, altered habitats and acidification.

2.1.2 *Better understanding and knowledge of ecological status*

During the first RBMP cycle (2010-2015), Member States introduced a vast network of monitoring sites and assessed the ecological status of their water bodies. From 2008 to 2017, the number of intercalibrated ecological assessment methods increased from around 100 to nearly 400. Overall, this has reduced the proportion of water bodies with unknown ecological status from 16 % to 4 %, and the confidence in classification has improved, from one third of water bodies reported with high or medium confidence in the first RBMPs to 58 % of water bodies in the second RBMPs (see also Chapter 1).

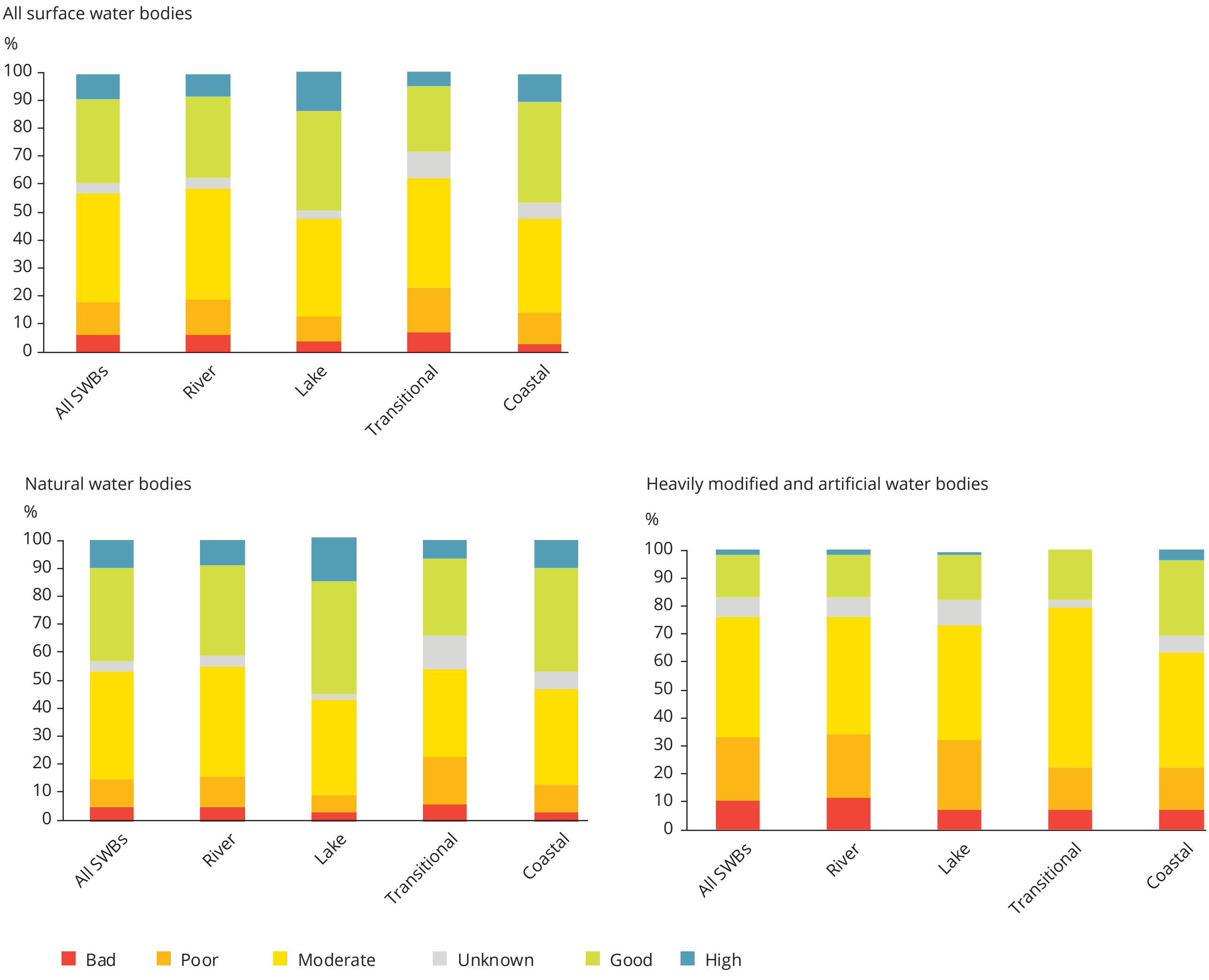
In the second RBMPs, two thirds of all water bodies are classified based on at least one biological quality element (Figure 2.2). For most of the remaining water bodies, their ecological status is based on only supporting physico-chemical and/or hydromorphological quality elements, and 12 % of water bodies have ecological status without any quality elements.

Overall, these improvements mean that the results of the ecological status classification are now a better indication of the general health of the water environment. However, the improved status assessment in the second RBMPs makes it difficult to compare status in the first and second RBMPs. Caution is advised when drawing detailed conclusions regarding changes observed between the two and also when comparing results between Member States (see also Chapter 1).

2.2 Ecological status in the second RBMPs

Overall, around 40 % of the surface water bodies are in good or better ecological status, while 60 % did not achieve good status (Figure 2.3). Lakes and coastal waters are in better status than rivers and transitional waters. The ecological status of natural water bodies is generally better than the ecological potential of heavily modified and artificial water bodies.

Figure 2.3 Ecological status/potential of rivers, lakes, transitional and coastal waters in the second RBMPs

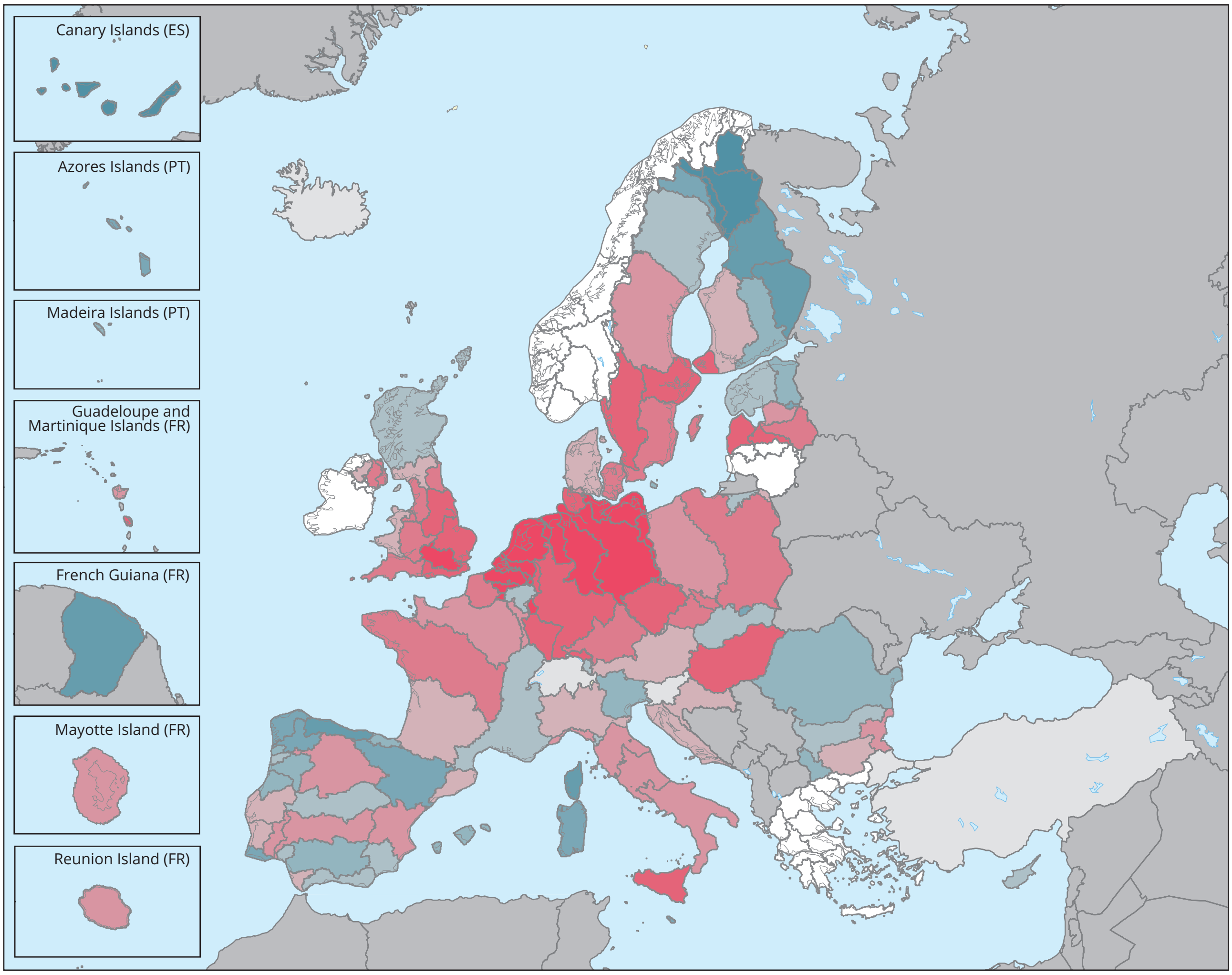


Notes: All SWBs means all surface water bodies, comprising rivers, lakes, and transitional and coastal waters. The classification of rivers by length and of the other water categories by surface area shows a similar distribution of status classes to the classification by number of water bodies (see below links), except that a lower proportion of the area of transitional waters is classified as being in high or good quality status.

Source: Results are based on WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Ecological status or potential and chemical status, by category.

The northern countries, particularly the northern Scandinavian region and Scotland, as well as Estonia, Romania, Slovakia and several RBDs in the Mediterranean region have a high proportion of water bodies in high or good ecological status or potential (Map 2.1). In contrast, many of the central European RBDs, as well as Hungary, have the highest proportion of water bodies that are not in good ecological status or potential.

Map 2.1 Percentage of water bodies in Europe's RBDs that are not in good ecological status/potential: second RBMPs



Percentage of number water bodies not in good ecological status or potential per river basin district (RBD) in second RBMPs

0% 100% RBD areas without data No data Outside coverage

Source: Results are based on WISE-SoW database including data from 24 Member States (EU-28 except Greece, Ireland, Lithuania and Slovenia). Water bodies failing to achieve good status, by RBD; see also Surface water bodies: Ecological status or potential (group) and Surface water bodies failing to achieve good status by RBD .

In general, highland rivers and lakes have better status than lowland water bodies ([29]). Mid-altitude and siliceous water bodies also have better status than lowland and calcareous water bodies. In many cases, the downstream sections of large European rivers have less than good status, while the status of large European lakes is much better than the average status of all lakes.

In coastal and transitional waters, the best ecological status is found from the Celtic Sea to the Iberian coast and in the Mediterranean, while the worst status is found in the Baltic and Black Seas.

Further and detailed information on ecological status results is available using the WISE-Freshwater WFD.

2.3 Status of quality elements

Ecological status is determined for rivers, lakes, and transitional and coastal waters based on biological quality elements and supporting physico-chemical and hydromorphological quality elements (Box 2.1).

Box 2.1 Biological and supporting quality elements

Phytoplankton are free-floating microscopic algae that are very sensitive to the level of nutrients in a given water body. Phytoplankton may cause water to become green, brown or red, depending on the dominant species. Phytoplankton consist of many different groups of algae, e.g. green algae, diatoms and dinoflagellates, as well as the potentially toxic cyanobacteria, which may create blooms in nutrient-enriched lakes and restrict the use of water for drinking and recreation.

Aquatic benthic flora comprises phytobenthos and macrophytes in rivers and lakes and macroalgae and angiosperms in coastal and transitional waters. Aquatic flora is particularly susceptible to elevated nutrient concentrations in water.

Phytobenthos are small algae that grow on rocks and other substrates, including bacterial tufts and coats, if the water body is enriched with organic matter from waste water.

Aquatic plants (macrophytes and angiosperms) grow mainly on soft substrate in shallow waters in rivers, lakes, and transitional and coastal waters, while large algae (macroalgae) grow on rocky substrate along the shores of coastal and transitional waters.

Benthic invertebrates are small animals that inhabit the bottom, as well as nearshore areas, of streams, rivers, lakes, and coastal and transitional waters. They include aquatic insects, crustaceans, snails and mussels, and are a key source of food for fish. Benthic invertebrates are susceptible to many pressures, such as organic enrichment causing oxygen deficiencies, alterations to habitats, acidification, fine sediments and emissions from agricultural pesticides.

Fish are particularly susceptible to hydromorphological pressures, revealing the impacts of interruptions in longitudinal continuity, riverbank constructions, large flow fluctuations, and water abstraction. Such habitat alterations affect fish abundance, species composition or age structure. In addition, salmon and many other fish species that migrate from the sea to river headwaters to spawn are dependent on river continuity. Hence, changes in fish composition and abundance often reveal lost river continuity (e.g. due to barriers or dams). Fish are also very sensitive to acidification and oxygen depletion.

Hydromorphological elements support the biological elements. They generally consist of (1) the hydrological regime (e.g. quantity and dynamics of water flow and connection to groundwater bodies) and (2) the morphological conditions (e.g. depth and width variation, structure and substrate of the bed, and structure of the riparian zone). In rivers, they also include continuity (i.e. the presence of barriers or other transversal structures).

Physico-chemical quality elements support the biological quality elements. They generally consist of (1) light and thermal conditions, (2) oxygenation conditions, (3) salinity, (4) nutrient conditions and (5) RBSPs. In rivers and lakes, they also include acidification condition.

Source: Based on BMUB/UBA (2016).

([29]) Surface water bodies: Ecological status or potential, by broad types.

Although a large proportion of water bodies are not classified for each single quality element (grey bars in Figure 2.4), more than two thirds are classified with at least one biological quality element (Figure 2.2). The most frequently classified biological quality elements are, for rivers, benthic invertebrates, phytobenthos/other aquatic flora/macrophytes and fish; for lakes, phytoplankton; and for transitional and coastal waters, phytoplankton and benthic invertebrates.

The ecological status for individual quality elements is much better than the overall ecological status classification. For rivers, for example, 50-70 % of the classified water bodies have high or good status for several biological quality elements, while the overall ecological status is high or good for less than 40 % of rivers. For the physico-chemical and hydromorphological quality elements, more than two thirds of the classified water bodies have at least good ecological status.

Figure 2.4 Ecological status/potential of biological and supporting quality elements in rivers, lakes, and transitional and coastal waters

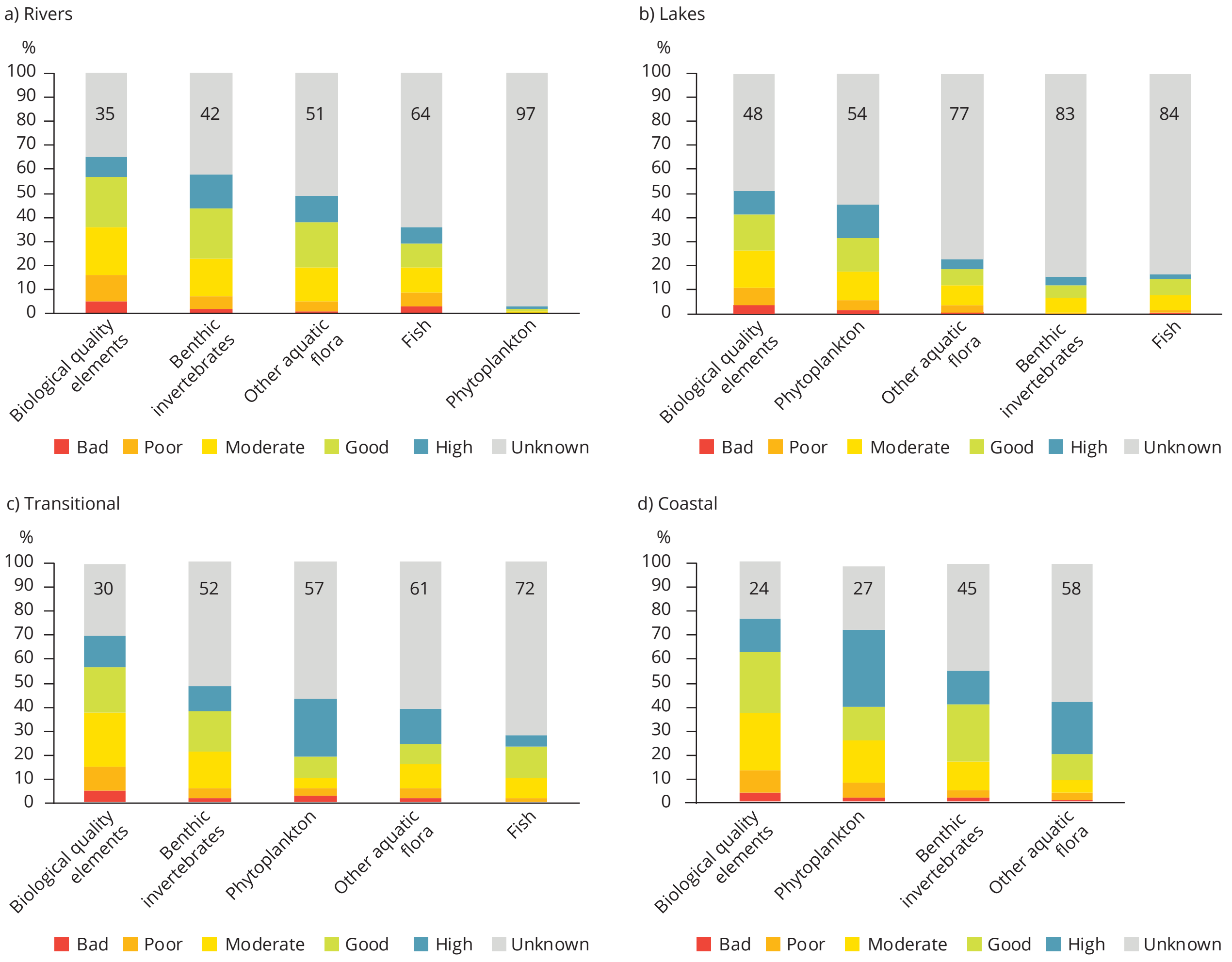


Figure 2.4 Ecological status/potential of biological and supporting quality elements in rivers, lakes, and transitional and coastal waters (cont.)

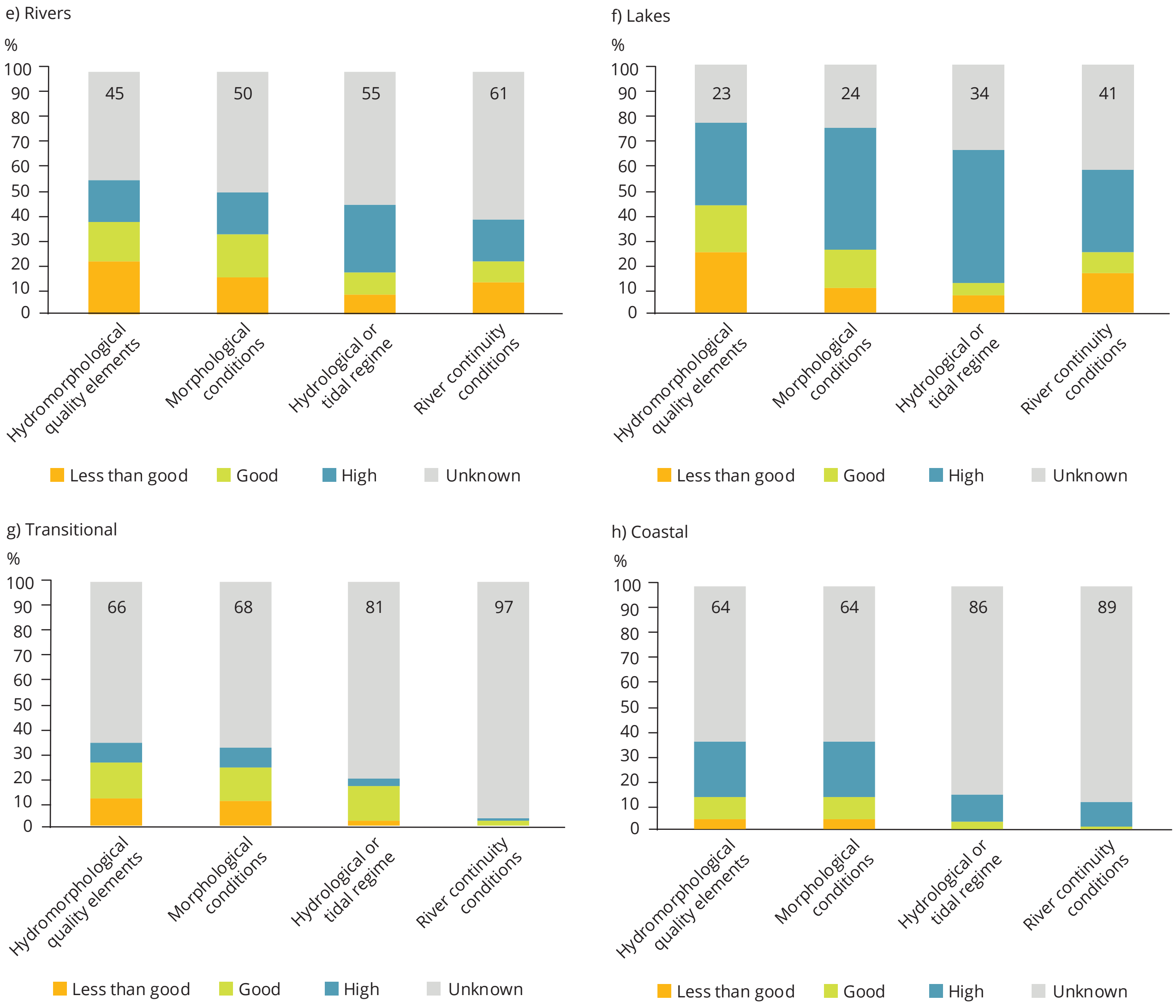
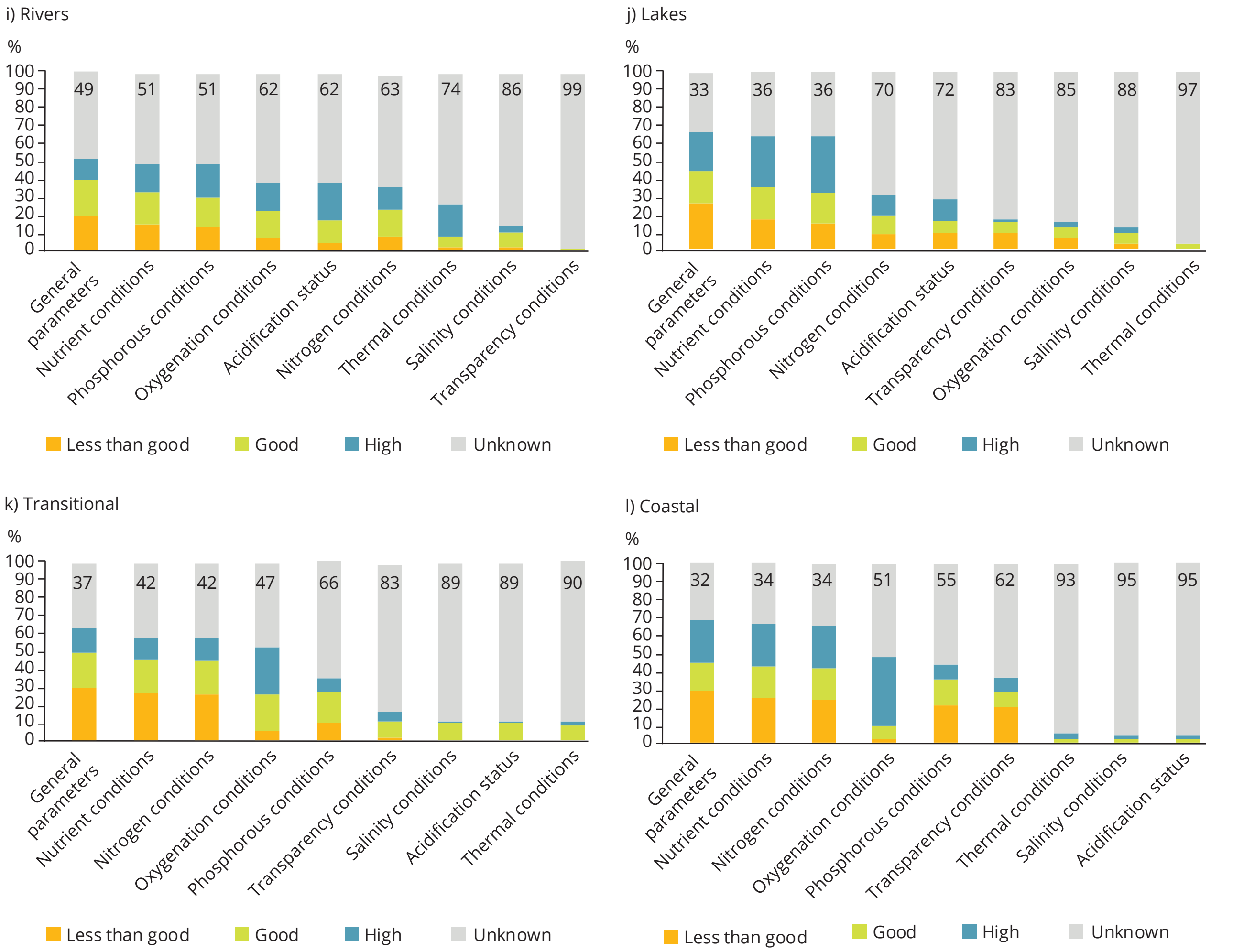


Figure 2.4 Ecological status/potential of biological and supporting quality elements in rivers, lakes, and transitional and coastal waters (cont.)

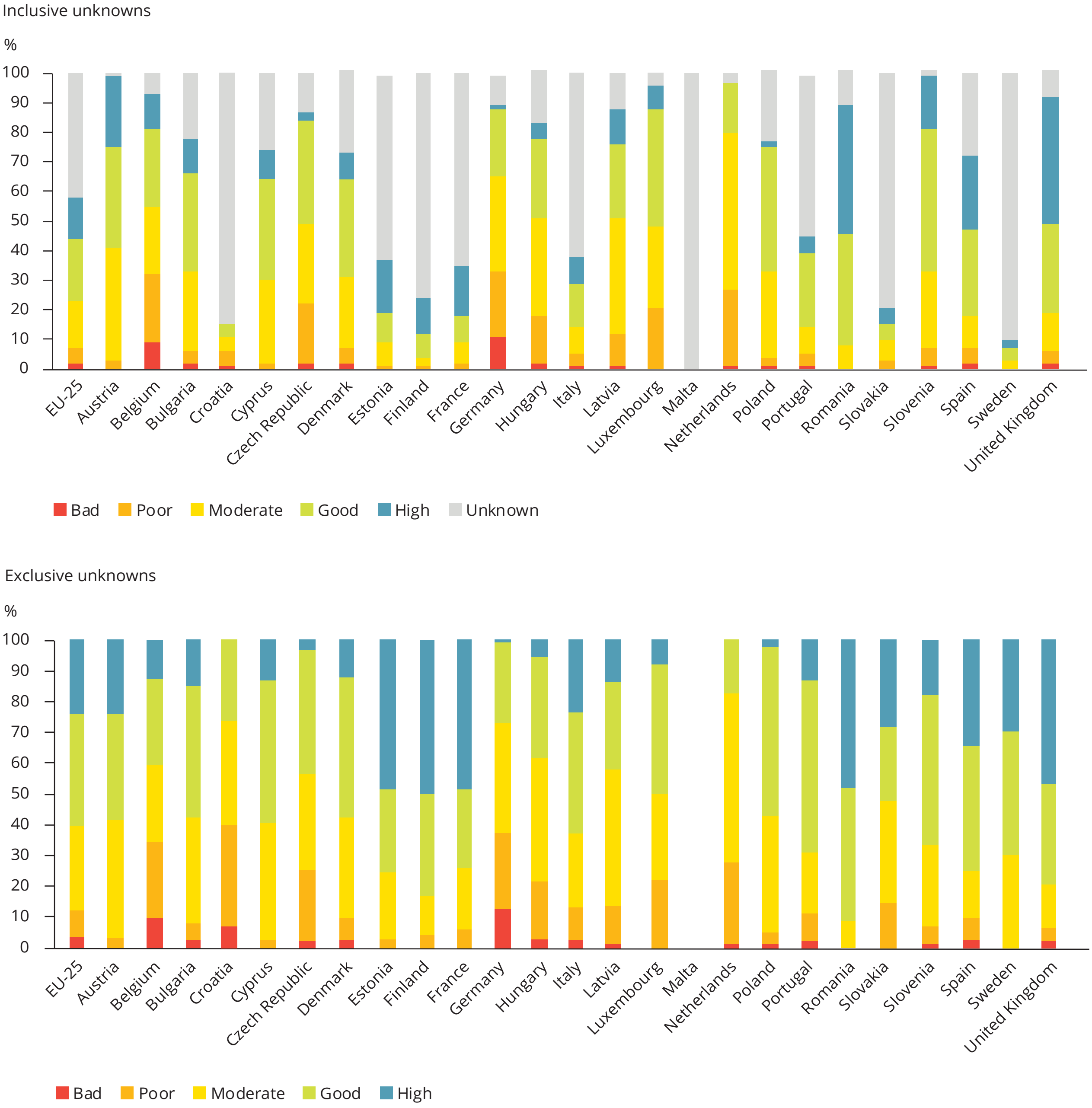


Notes: Ecological status for biological quality and supporting elements in water bodies classified for overall ecological status (100 %). The grey bars denote water bodies not classified for that particular quality element.
The first bar in each diagram represent the overall classification for the group of quality elements, calculated using the one out all out principle (the number of quality elements available per water body varies).

Source: Results are based on WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: QE group status, by category and Surface water bodies: QE status, by category.

For one of the biological quality elements (benthic invertebrates in rivers), Figure 2.5 illustrates the differences in ecological status according to Member State. In several Member States, more than half of the river water bodies have not been assessed for benthic invertebrates (Figure 2.5, top). The rivers with the best ecological status for benthic invertebrates are found in Romania, Finland and the United Kingdom, while those with the worst are found in the Netherlands, Germany and Croatia (Figure 2.5, bottom). The WISE-Freshwater tool makes it possible to explore similar results for other quality elements and categories.

Figure 2.5 Ecological status/potential for benthic invertebrates in rivers in Member States: inclusive unknowns (top) and exclusive unknowns (bottom)



Notes: Classification of ecological status for benthic invertebrates in rivers including the water bodies with unknown status for this biological quality element (grey bars) (top panel) and excluding water bodies without unknown status (bottom panel).

Source: Results are based on WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: QE status, by quality element and country.

Further and detailed information on quality elements results is available using the WISE-Freshwater WFD.

2.3.1 River basin-specific pollutants

Ecological status includes the assessment of RBSPs ([30]). A total of 5 % of surface water bodies did not achieve good ecological status owing to RBSPs, while 40 % were reported as being in good or high ecological status for RBSPs, although the status of RBSPs was unknown for a significant proportion (55 %).

About 150 RBSPs were reported as causing failure to achieve good ecological status in at least one water body. Those most frequently reported as causing failure were the metals zinc, in 1 503 water bodies, and copper, in 845. The other types of substances causing most failures were ammonium and elements such as arsenic and selenium. AMPA, a breakdown product of glyphosate, is the most frequently occurring pesticide-related substance (causing 185 water bodies to fail to achieve good status), followed by MCPA. As individual substances, most RBSPs caused fewer than 100 waterbodies to fail to achieve good ecological status.

There are differences between countries in the numbers of substances defined as RBSPs (between five and over 300), as well as in the EQS applied. This means that comparisons between countries should be undertaken with care.

Of the thousands of chemicals in use and potentially present in surface waters, relatively few have been identified as causing failure. From the information reported, it is not known how many other chemical pollutants are present in surface waters and whether their concentrations should cause concern. Further discussion on chemicals is provided in Chapter 3 and Chapter 6.

Further and detailed information on RBSP results is available using the WISE-Freshwater WFD.

2.4 Change in ecological status between first and second RBMPs

The quality of ecological status classification has largely improved from the first to the second RBMPs. There is a marked reduction in water bodies of unknown status, a marked improvement in confidence in classification and a large increase in intercalibrated biological assessment methods. This complicates the comparison of status between the first and second RBMPs.

The overall ecological status/potential of water bodies has not improved since the first RBMPs (Figure 2.6). In fact, the results show a slight reduction in the proportion of water bodies in good or better ecological status or potential for all categories. Nonetheless, around 20 % (16 000 surface water bodies) have improved in ecological status/potential class since the first RBMPs, generally by one class but sometimes by two or three classes

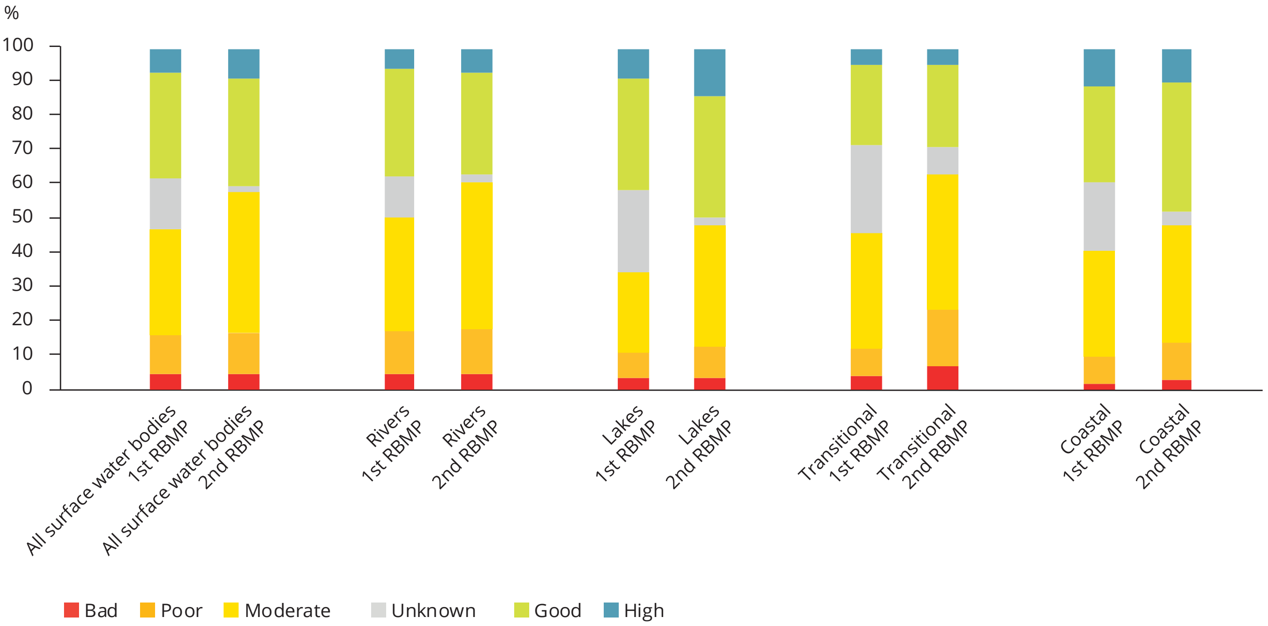
A closer look at the change in quality elements shows some improvement (Figure 2.7). The improvements are seen in all the most commonly used biological quality elements in rivers and in phytoplankton in transitional waters, but they are less clear in phytoplankton in lakes and in benthic invertebrates in coastal and transitional waters. For phytoplankton in coastal waters, there is even a slight deterioration.

Most of the changes are not reported as consistent, but rather are due to changes in methodology. However, many countries have not reported on consistency, so it is unclear how the changes should be interpreted.

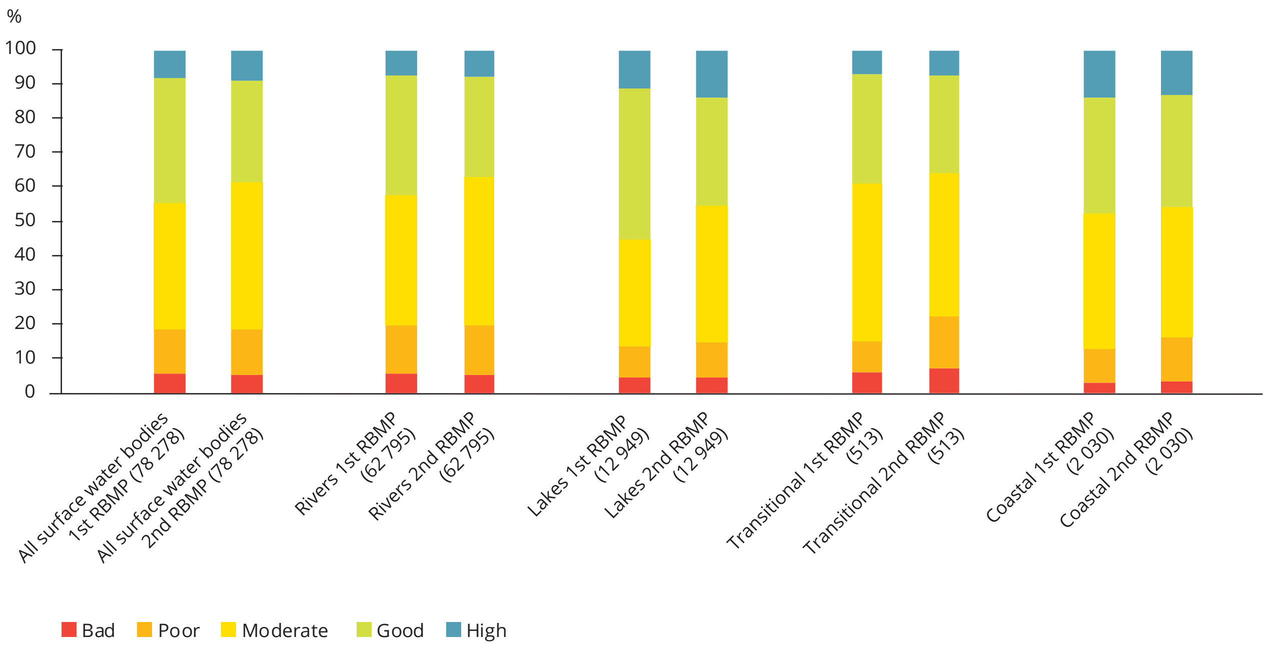
([30]) Member States identify RBSPs being substances discharged in significant quantities into a water body. The environmental quality standard (EQS) is set by Member States; this is often at a national level but can be at the level of the RBD. If the EQS is not met, a water body cannot be in good or high status. The comparability of the number of substances set as RBSPs and the value of the EQS can vary between Member States. This contrasts with priority substances, where identification and EQS are set at EU level, and are considered under chemical status (Chapter 3).

Figure 2.6 Ecological status or potential of all surface waters, rivers, lakes, and transitional waters and coastal waters in the two RBMPs: a) with both known and unknown ecological status and b) with known ecological status in first and second RBMPs

a) Both known and unknown ecological status



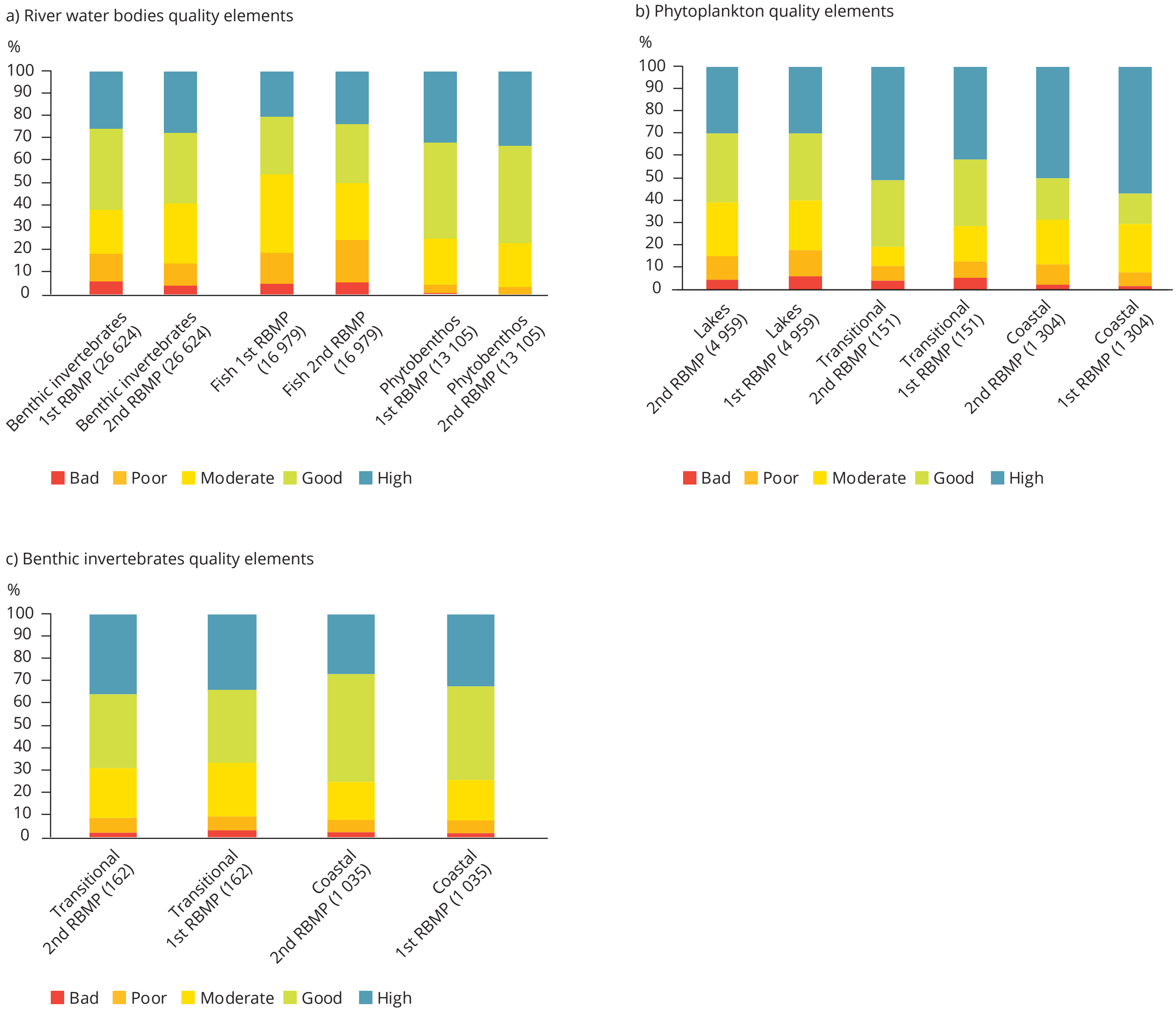
b) With known ecological status in first and second RBMP



Notes: In both a) and b), water bodies that are unchanged from the first to the second RBMPs are included.
a) illustrates that the status for some of the unknowns in the first RBMPs is now known.
b) compares only water bodies that had known ecological status in both the first and the second RBMP cycle.

Source: Results are based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Ecological status or potential, by category in the second and first RBMPs.

Figure 2.7 **Ecological status or potential for major biological quality elements in surface waters in the first and second RBMPs**



Notes: The numbers in parentheses are the numbers of water bodies classified for the single biological quality elements and that are comparable between the two cycles of RBMPs.

Source: Results are based on WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: QE status in the 2nd and 1st RBMP, by category.

2.5 Pressures and impacts

The main significant pressures on surface water bodies are hydromorphological pressures (40 %), diffuse source pollution (38 %), particularly from agriculture and atmospheric deposition (38 %), particularly related to mercury, followed by point sources (18 %) and water abstraction (7 %) (Figure 2.8 (a)). The main impacts on surface water bodies are nutrient enrichment, chemical pollution and altered habitats due to morphological changes.

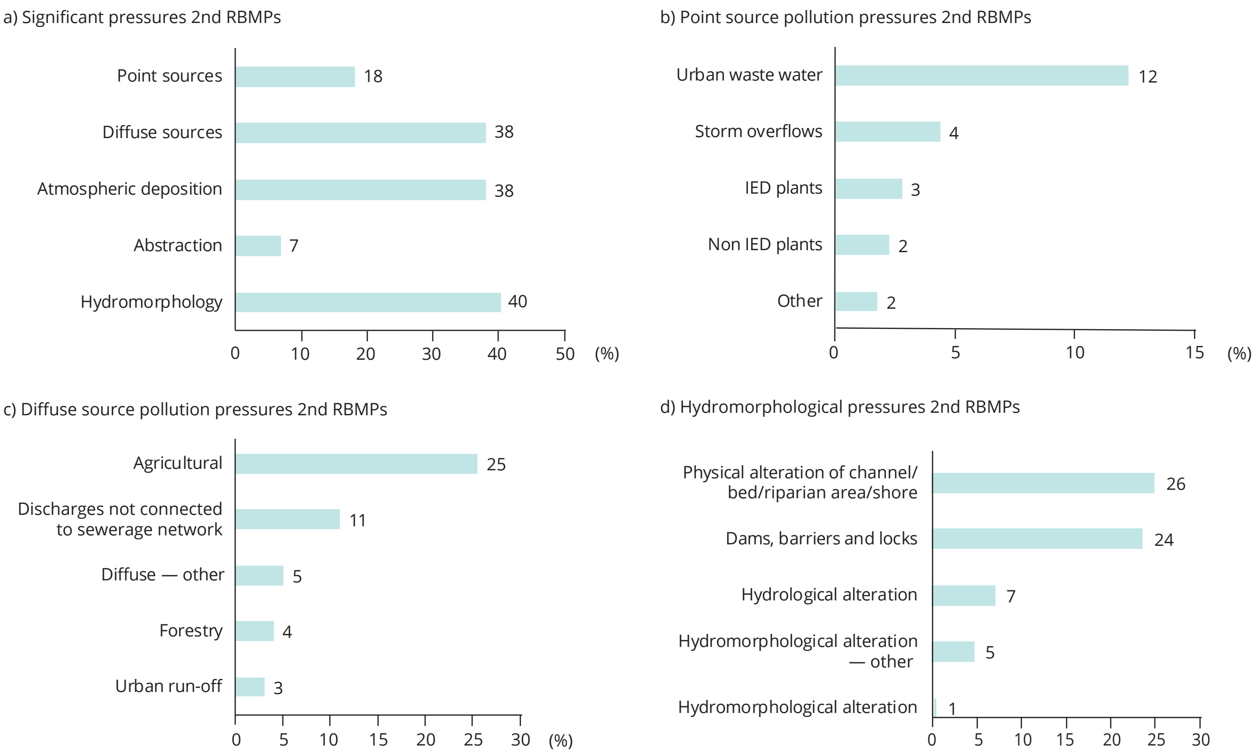
Diffuse source and point source pollution affect 38 % and 18 % of surface water bodies, respectively. A relatively higher proportion of transitional and coastal waters than rivers and, in particular, lakes are affected by pollution pressure. The main driver of point source pollution pressures is urban waste water treatment, followed to a lesser degree by industrial plants and storm overflow. The main driver of diffuse source pollution is agriculture, and discharges that are not connected to sewage treatment plants.

Hydromorphological pressures comprise all physical alterations to water bodies (including continuity interruptions) that modify their channels, shores, riparian zones and water levels/flows, such as dams, embankments, channelisation and flow regulation. These activities may cause damage to the morphology and hydrology of water bodies and result in altered habitats, with significant impacts on ecological status.

Hydromorphological pressures affect around 40 % of surface water bodies, with the highest proportion reported for rivers and transitional waters. They are subdivided into further categories of pressures: physical alterations in the channel, bed, riparian zone or shore (26 %) affect the largest proportion of water bodies, followed by structures that have an impact on longitudinal continuity (dams/barriers and locks, 24 %). Hydrological alterations affect a smaller proportion (7 %).

Further and detailed information on pressures and impact results is available using the WISE-Freshwater WFD.

Figure 2.8 Proportion of water bodies affected by a) main pressures, b) detailed point source, c) diffuse source and d) hydromorphological pressures



Notes: Proportion of water bodies with specific pressures; for example, point sources affect 18 % of water bodies, and the main point source pressure is discharges from urban waste water treatment plants, which affect 12 % of all surface water bodies. A water body may be affected by more than one pressure; therefore, the sum of percentages is greater than 100 %. IED plants are industrial emissions covered by the Industrial Emissions Directive (EC, 2018e).

Source: Results are based on WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Significant pressures.

3 Chemical status of and pressures on surface waters

Key messages

- A total of 38 % of surface water bodies in the EU are in good chemical status.
- In most Member States, a few priority substances account for poor chemical status, the most common being mercury. If mercury and other ubiquitous priority substances were omitted, only 3 % of surface water bodies would fail to achieve good chemical status.
- The main pressures leading to failure to achieve good chemical status are atmospheric deposition and discharges from urban waste water treatment plants. Atmospheric deposition leads to contamination with mercury in over 45 000 water bodies failing good chemical status. Inputs from urban waste water treatment plants lead to contamination of over 13 000 water bodies with polyaromatic hydrocarbons (PAHs), mercury, cadmium, lead and nickel.
- Comparing chemical status in the two RBMPs is complicated because there was more pollutant monitoring for the second RBMPs, and some Member States reported mercury as causing all of their surface water bodies to fail to achieve good chemical status.
- A comparison of the chemical status reported in the first and second RBMP periods shows that the proportion of water bodies with unknown chemical status has dropped significantly, from 39 % to 16 %.
- During the first RBMP cycle, Member States made progress in tackling several other priority substances, such as metals (cadmium, lead and nickel) and several pesticides, suggesting that some effective measures were implemented.
- The outlook for chemical status in Europe's waters is challenging; since 2015 stricter standards for some priority substances have been coming into force, and new substances will be added to the priority substances list for the third RBMP.

3.1 Introduction

Chemicals are in products that we use in many ways to try to improve our quality of life, from food production and health protection to transport and heavy industry. At some point in their lifetime, chemicals can enter the water cycle, whether by deliberate discharge following waste water treatment or as a result of processes such as leaching from soils into groundwater, run-off from surfaces or atmospheric deposition (including the 'raining out' of small particles taken up into the atmosphere) (Box 3.1). Some chemicals can be very harmful through direct toxicity, as well as through sublethal effects that affect an organism's healthy functioning, or they can become problematic as they accumulate up the food chain. Once harmful chemicals are in the environment, it can be very difficult both to clean them up and to prevent their migration to areas far from where they were originally used. Therefore, much source control legislation for chemicals, such as the REACH regulation (Registration, Evaluation, Authorisation & Restriction of Chemicals, EU, 2006c) and the Regulation on Biocidal Products (EU, 2012), is aimed at minimising the release of harmful substances into the environment. Monitoring under the WFD provides key feedback on the success of measures intended to restrict harmful releases (Chapter 6).

The WFD aims to ensure the good chemical status of both surface water and groundwater bodies across Europe. For surface waters this goal is defined by limits on the concentrations of certain pollutants found across the EU, known as priority substances (EU, 2008a). In addition, there may be other chemicals discharged in significant quantities within an RBD. These RBSPs are part of the assessment of good ecological status (Chapter 2).

Good chemical status means that no concentrations of priority substances exceed the relevant EQS established in the Environmental Quality Standards Directive 2008/105/EC (EU, 2008a; as amended by the Priority Substances Directive 2013/39/EU, EU, 2013a). EQS aim to protect the most sensitive species from direct toxicity, including predators and humans via secondary poisoning.

The WFD seeks to progressively reduce emissions, discharges and losses of priority substances to surface waters. Under the WFD, losses, discharges and emissions to water of a particularly harmful subset of these, priority hazardous substances, should be completely phased out within 20 years, and uses of these substances have been significantly restricted.

A smaller group of priority hazardous substances were identified in the Priority Substances Directive as uPBT (ubiquitous ([31]), persistent, bioaccumulative and toxic). uPBT substances persist in the environment, can be transported long distances and pose long-term risks to human health and ecosystems. Owing to widespread environmental contamination, achieving concentrations at or below the EQS for this group of substances can be particularly challenging.

([31]) Definition of 'ubiquitous': present, appearing or found everywhere.

Box 3.1 How chemicals can get into water

Information on the sources and emissions of many priority substances remains incomplete. Examples of uses and pathways into the water environment of some of the substances causing frequent failure to achieve good chemical status are listed below:

- Mercury is used in thermometers, dentistry, batteries, paints and fluorescent lights, although most of these uses have now been restricted. However, the most significant anthropogenic pathway for release into the environment is the burning of fossil fuels. Approximately 60 % of the mercury atmospherically deposited in Europe comes from legacy or natural sources, for example during volcanic eruptions.

- Cadmium is used in batteries, pigments and stabilisers. Like mercury, it is released into the environment via the burning of fossil fuels and waste. Emissions into water also arise from the use of phosphate fertilisers that contain cadmium as a contaminant and metals production.

- Brominated diphenyl ethers (pBDE) are used in many household goods — from cushions to computers — to prevent the spread of fires. Treated items shed particles that mix into household dust, and most of this is thought to reach the environment through drainage from washing machines to sewers, or by mixing with rainfall.

- PAHs are produced naturally from burning substances containing carbon, such as petrol, diesel, coal, wood and plastics, and can reach the water environment via atmospheric deposition, road run-off and discharges from waste water treatment plants.

- Tributyltin (TBT) was widely used as an antifouling agent in paints for ships and boats until 1989, when the EU restricted its use on small boats because of its proven harm to the environment and shellfisheries.

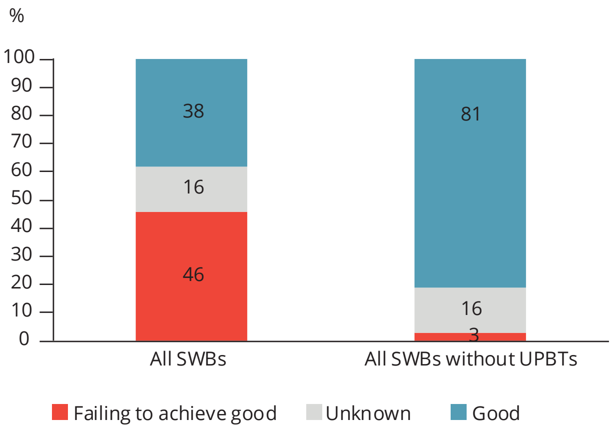
Sources: AMAP,2015, 2018; WHO, 2010.

3.2 Chemical status of surface waters

Reporting under the second RBMP shows that 38 % of surface water bodies are in good chemical status (by number of water bodies), while 46 % are not achieving good status and the status of 16 % is unknown (Figure 3.1). While the proportion of water bodies in good status is more or less similar in rivers and in transitional and coastal waters, at 40-58 %, that of territorial waters and lakes is considerably lower (15-24 %). The lower quality of lakes is driven by widespread mercury contamination in Finland and Sweden, which between them account for two thirds of the 18 153 lakes reported in the RBMPs.

The uPBTs are mercury, pBDEs, tributyltin and certain PAHs ([32]). The widespread presence of mercury and, to a lesser extent, pBDE leads to significant failure to achieve good chemical status, as can be seen in Figure 3.1 and Map 3.1b, which shows that the omission of the uPBTs results in 3 % of surface water bodies not being in good chemical status.

Figure 3.1 **Chemical status of surface water bodies, with and without uPBTs**

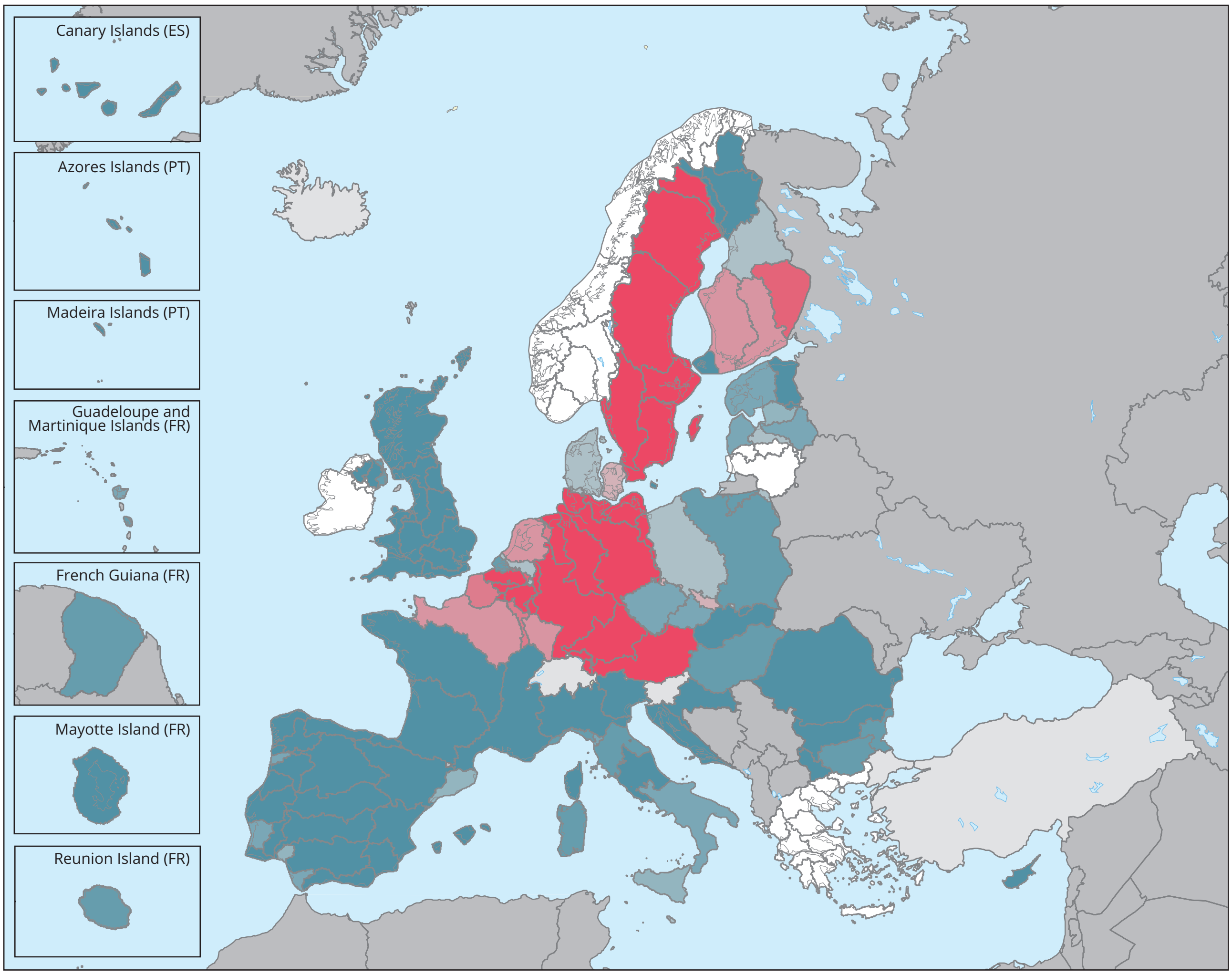


Note: All SWBs, All surface water bodies.
For some surface water bodies in Poland (1 265) and Italy (265), there is no information on the priority substances causing failure and it is therefore not possible to identify whether the failure is caused by uPBTs or other priority substances.

Source: Results are based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Chemical status with and without uPBT, by category.

([32]) Benzo(a)pyrene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, benzo(b)fluoranthene and benzo(k)fluoranthene.

Map 3.1a Chemical status per RBD with uPBTs



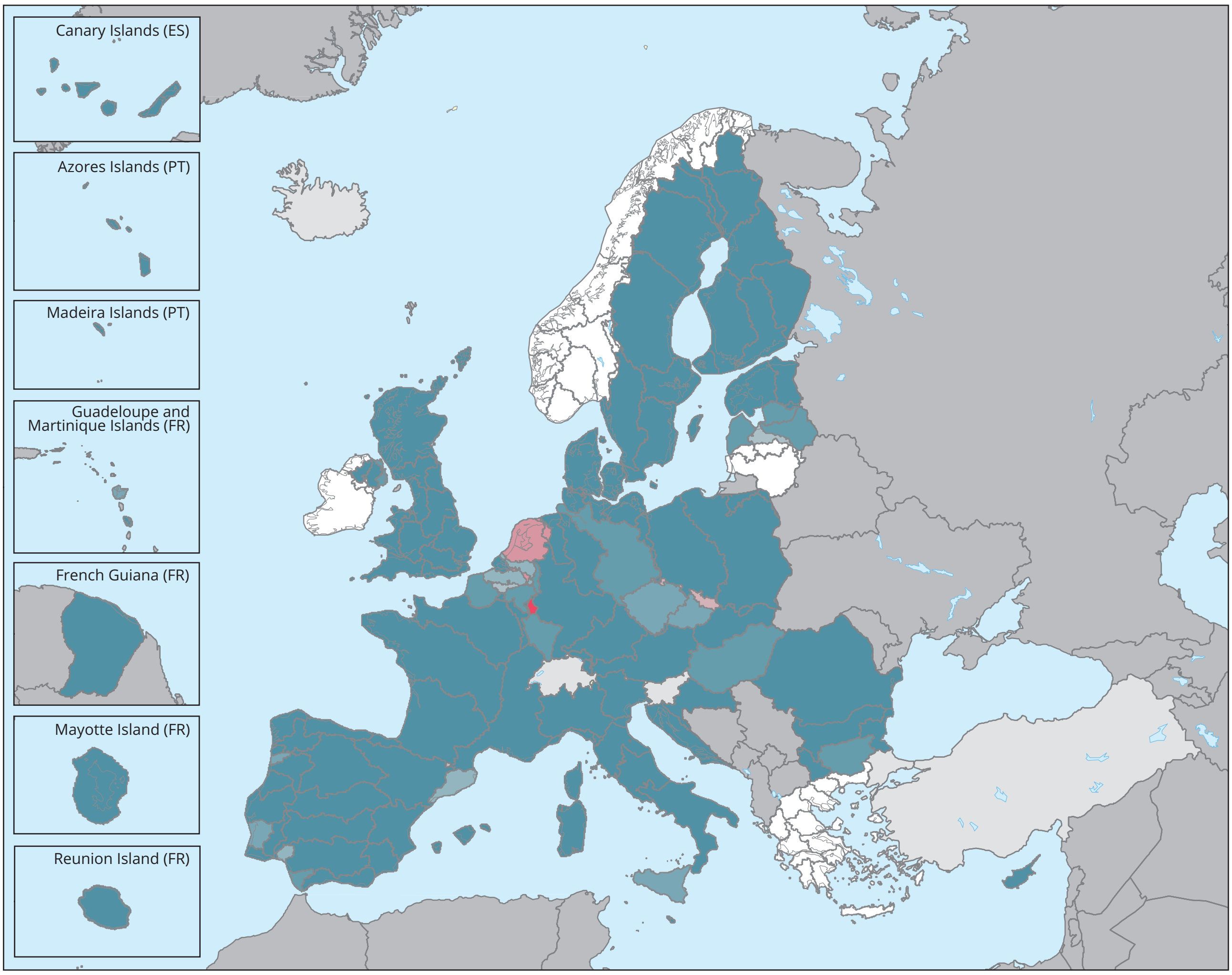
Percentage of number water bodies not in good chemical status with uPBT per river basin district (RBD) in second RBMPs

0% 100% RBD areas without data No data Outside coverage

Note: uPBT: ubiquitous, persistent, bioaccumulative and toxic substance.

Source: Results are based on the WISE-SoW database including data from 24 Member States (EU-28 except Greece, Ireland, Lithuania and Slovenia). Surface water bodies: Chemical status with and without uPBT maps, by RBD.

Map 3.1b Chemical status per RBD without uPBTs



Percentage of number water bodies not in good chemical status without uPBT per river basin district (RBD) in second RBMPs

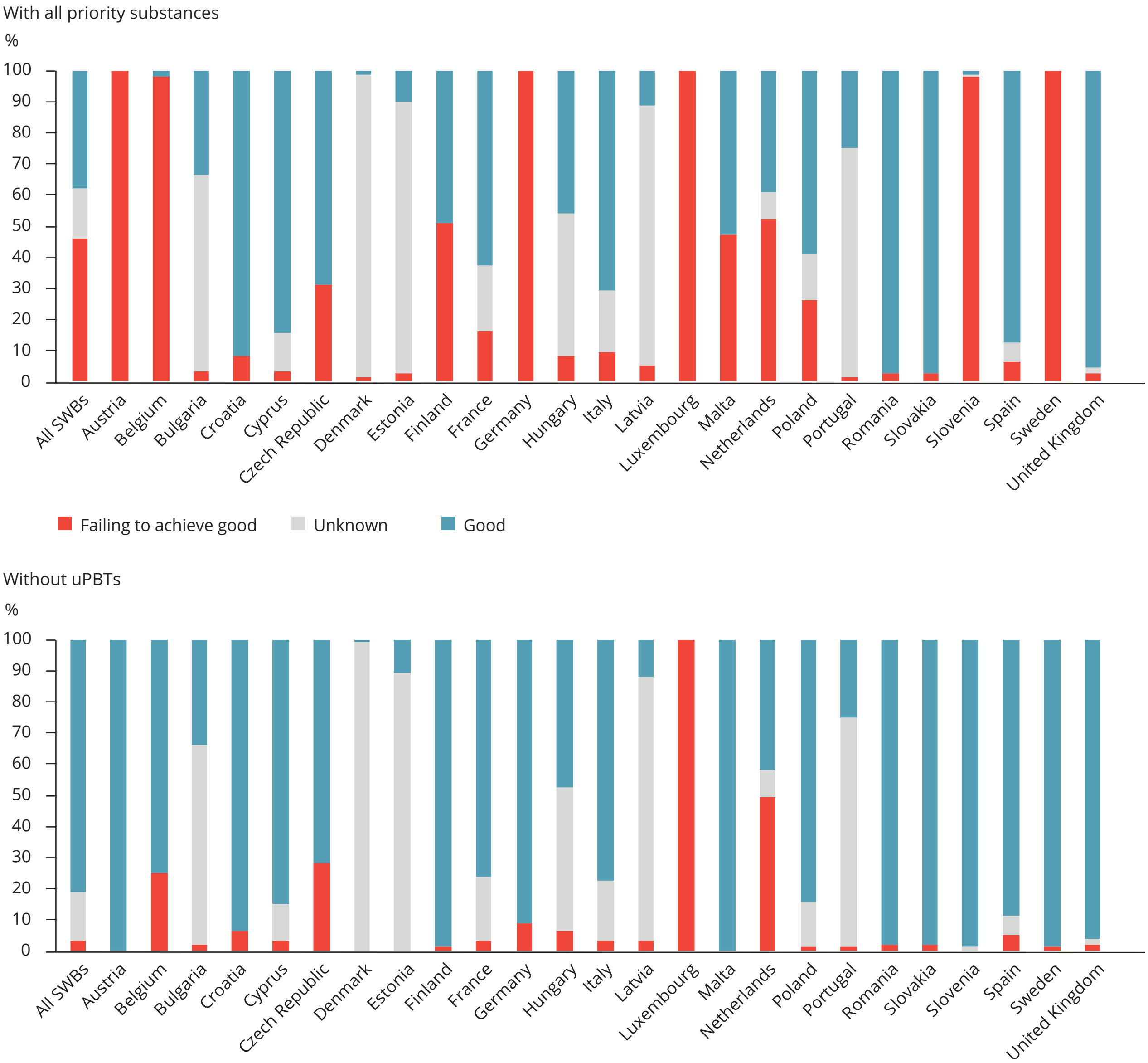
0% 100% RBD areas without data No data Outside coverage

Note: uPBT: ubiquitous, persistent, bioaccumulative and toxic substance.

Source: Results are based on the WISE-SoW database including data from 24 Member States (EU-28 except Greece, Ireland, Lithuania and Slovenia). Surface water bodies: Chemical status with and without uPBT maps, by RBD.

There are substantial differences between Member States. Some report that over 90 % of their surface water bodies are in good chemical status, while others report this for fewer than 10 % (Figure 3.2). In addition, the proportion of water bodies whose status is reported as 'unknown' differs widely between Member States. For several, there is a marked change in the proportion of water bodies failing to achieve good chemical status when those failing as a result of uPBTs are omitted.

Figure 3.2 Chemical status of all surface water bodies, with all priority substances (top) and without uPBTs (bottom)



Note: For some surface water bodies in Poland (1 265) and Italy (265), there is no information on the priority substances causing failure, and it is therefore not possible to identify whether the failure is caused by uPBTs or by other priority substances.

Source: Results are based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Chemical status with and without uPBT, by country.

Some variation between Member States might be expected owing to differences in, for example, population density, industry or geography, but such extreme variation needs to be understood. Member States have interpreted information in different ways, leading to some variation. For example, some Member States applied the revised — generally stricter — EQS set out in the 2013 amendment to the Priority Substances Directive (e.g. Netherlands and Sweden), whereas most countries used those from the 2008 Directive. However, the major contribution to variability seems to arise from the approach taken to monitoring, modelling and extrapolating results and from the choice of monitoring matrix: water, sediment or biota (e.g. fish). Some countries extrapolated failure to meet the standard at monitoring sites to all water bodies, while others reported failure only where failure was confirmed (Table 3.1). Typically, measurements of mercury in biota extrapolated to all similar water bodies lead to widespread failure to meet the EQS.

Luxembourg failed to achieve good chemical status for any of its surface water bodies, as it applied the 2013 EQS for fluoranthene, whereas neighbouring countries applied the 2008 standard.

Table 3.1 Broad approaches to chemical status reporting, based on results shown in Figure 3.2

With uPBTs	Without uPBTs	Approach taken	Countries using this approach
Widespread (50-100 %) failure to achieve good chemical status	Few failures to achieve good chemical status	Extrapolation of monitoring results: usually mercury in biota	Austria, Belgium, Finland ([a]), Germany, Luxembourg ([b]), Malta ([c]), Slovenia, Sweden
Frequent (30-50 %) failure to achieve good chemical status	Frequent/widespread failure to achieve good chemical status	Other priority substances identified as causing failure to achieve good chemical status	Czech Republic, Luxembourg ([d]), Netherlands
Widespread good chemical status	Widespread good chemical status	Extrapolation not widely applied: status shows confirmed status only	Croatia, Cyprus, France, Italy, Poland, Romania, Slovakia, Spain, United Kingdom
Frequent/widespread unknown chemical status	Frequent/widespread unknown chemical status	Extrapolation not widely applied: status shows confirmed status only	Bulgaria, Denmark, Estonia, Hungary, Latvia, Portugal

Notes: ([a]) Finland widespread failure in south; ([b]) Luxembourg, when applying the 2008 EQS; ([c]) Malta failure of all coastal waters; ([d]) Luxembourg, when applying the 2013 EQS.

Further and detailed information on chemical status is available using the WISE-Freshwater WFD.

3.3 Chemical substances causing failure to achieve good status

Chemicals legislation focuses on controlling the use of a particular substance, supported by regulations on the control of emissions. Chemical status under the WFD provides an overview of contamination and the effectiveness of measures. If a priority substance is causing failure, either pollution prevention is not yet delivering the required environmental objective, or the contamination results from historical sources. In the case of some substances, chemical pollution may be a local issue that can be controlled within the RBD. However, when several Member States report that a substance is not meeting the standard for good status, and a significant number of water bodies are failing the standard, the issue may be of wider concern, particularly where persistent, bioaccumulative and/or toxic substances are concerned.

Table 3.2 shows the 'top 15' most frequently reported priority substances found in surface water bodies, a list that includes all of the uPBTs. Looking at the number of water bodies, it is clear that mercury and brominated diphenyl ethers are the main substances responsible for failure to achieve good chemical status. The other substances listed cause failure in relatively small numbers of water bodies. Table 3.2 shows that large numbers of records from a particular Member State can have a significant impact on lists of most frequently reported substances failing a standard. Therefore, in terms of understanding the relevance of a pollutant

Table 3.2 Priority substances causing failure to achieve good chemical status in over 100 water bodies (out of a total of 111 062 surface water bodies)

Priority substance	Type/use of chemical	Number of water bodies not achieving good chemical status	Number of Member States with water bodies not achieving good chemical status for the listed substance	Contributed by one Member State if that dominates (% of water bodies not achieving good chemical status)
Mercury ([a])	Metal	45 973	24	50
Brominated diphenyl ethers ([a])	Flame retardant	23 331	8	99
Benzo(g,h,i)perylene + indeno(1,2,3-cd) pyrene ([a])	PAH	3 091	15	47
Benzo(a)pyrene ([a])	PAH	1 630	12	65
Fluoranthene	PAH	1 390	14	40
Cadmium	Metal	1 014	20	—
TBT ([a])	Biocide	663	15	—
Nickel	Metal	654	20	—
Lead	Metal	462	19	—
Benzo(b)fluoranthene + benzo(k)fluoranthene ([a])	PAH	460	10	41
Isoproturon	Pesticide	199	8	45
4-Nonylphenol	Surfactant	188	10	52
Anthracene	PAH	123	11	59
Hexachlorocyclohexane	Pesticide	120	11	—
DEHP	Plasticiser	102	11	—

Note: ([a]) Substance is a uPBT.

Source: Results are based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Priority substances – overview.

Table 3.3 Priority substances that cause few failures to achieve good chemical status (fewer than 15 out of 111 062 surface water bodies)

Priority substance	Type/use of chemical	Number of water bodies where good chemical status not achieved	Number of Member States reporting that good chemical status not achieved
Pentachlorobenzene	Industrial	14	4
Trifluralin	Herbicide	12	6
Chlorfenvinphos	Pesticide	10	4
Atrazine	Herbicide	9	4
Dichloromethane	Industrial	8	4
Tetrachloroethylene	Degreasing, dry cleaning	6	3
Simazine	Herbicide	5	2
Alachlor	Herbicide	5	3
Chloroalkanes C10-13	Industrial	5	4
Trichloroethylene	Industrial	4	2
Trichlorobenzene	Industrial	3	3
Pentachlorophenol	Pesticide, disinfectant	3	3
1,2-dichloroethane	Industrial	1	1
Carbon tetrachloride	Refrigeration, fire-fighting	1	1

Source: Results are based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Priority substances – overview.

at a European scale, a larger number of countries reporting a particular substance is indicative of more widespread issues.

Some priority substances cause few or no failures to achieve good chemical status, suggesting that efforts to control these have been effective. Table 3.3 shows those affecting fewer than 15 water bodies.

3.4 Chemical pressures

Priority substances can be emitted into water bodies through a range of pathways and from a variety of sources, including industry, agriculture, transport, mining and waste disposal, as well as from our own homes (Figure 3.3). Significant levels of some priority substances have built up from historical use, and this legacy pollution may persist long after polluted discharges and inputs have ended. In addition, some priority substances occur naturally, such as metals and PAHs, for which the objective is to achieve near-natural 'background' concentrations.

Chemicals used in industrial processes and products sometimes enter sewers and, via waste water treatment plants, are discharged into water bodies. The burning of fossil fuels and waste leads to the emission of some hazardous substances, which can travel a long way through the atmosphere before being deposited in water. Pesticides used in agriculture have been widely detected in groundwater and surface water. Mining can exert locally significant pressure on the chemical quality of water resources in parts of Europe, particularly with respect to the discharge of heavy metals. Landfill sites and contaminated land from historical industrial and military activities can be a source of pollution of the aquatic environment. Shipping, harbour and port activities, and aquaculture can also lead to the emission of a variety of chemical pollutants.

Figure 3.3 Sources of water pollution

Source: EEA.

Across Member States, the main pressure reported to cause failure to achieve good chemical status was mercury contamination resulting from atmospheric deposition. Inputs from urban waste water treatment plants were a less significant factor, although these led to contamination with PAHs, mercury, cadmium, lead and nickel.

For the first time, Member States had to provide a list of priority substances emitted into each river basin. The intention was to provide a baseline by which to assess whether emissions were being reduced, and, in the case of priority hazardous substances, if progress was being made towards the cessation of emission targets (WFD Art. 6(6)). However, there were variable levels of reporting and the data were difficult to compare, partly because of the range of approaches used.

Further and detailed information on pressures and impact results is available using the WISE-Freshwater WFD.

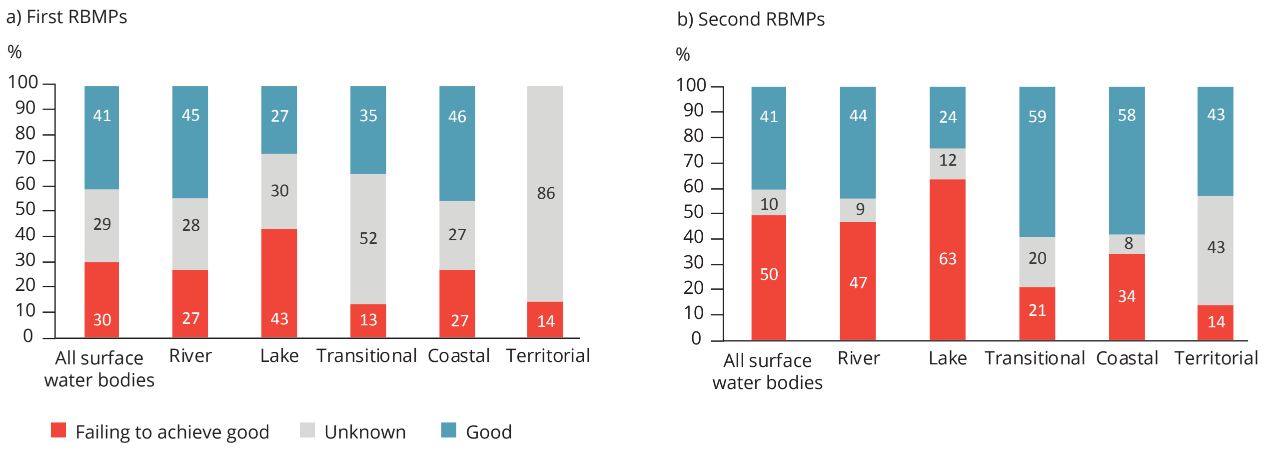
3.5 Changes between the first and second RBMPs

A comparison of the chemical status reported in the first and second RBMPs shows that the proportion of water bodies with unknown status has dropped significantly. Chemical status has improved in transitional and coastal waters, remained similar in rivers and declined slightly in lakes (Figure 3.4). Consequently, knowledge on chemical status has improved, but, in return, a larger number of water bodies have been classified as failing to achieve good chemical status.

However, it seems that Member States are making significant progress in tackling certain individual priority substances, apart from mercury, pBDEs and PAHs. In several cases, one third of water bodies had improved levels of particular substances between the first and second RBMP cycles (Figure 3.5).

In the case of cadmium, nickel and lead, 943 water bodies improved in status during the first RBMP cycle, compared with 2 137 continuing to fail during the second cycle. With regard to pesticides ([33]), 571 water

Figure 3.4 Change in chemical status of surface water bodies, by water category



Note: Figure shows proportion of surface water bodies in good and failing to achieve good chemical status. The overall percentage is different from that in Figure 3.2 because similar water bodies need to be compared in each period. Based on all water bodies reported in the first and second RBMPs, the proportion of those with unknown status decreased from 39 % to 16 %.

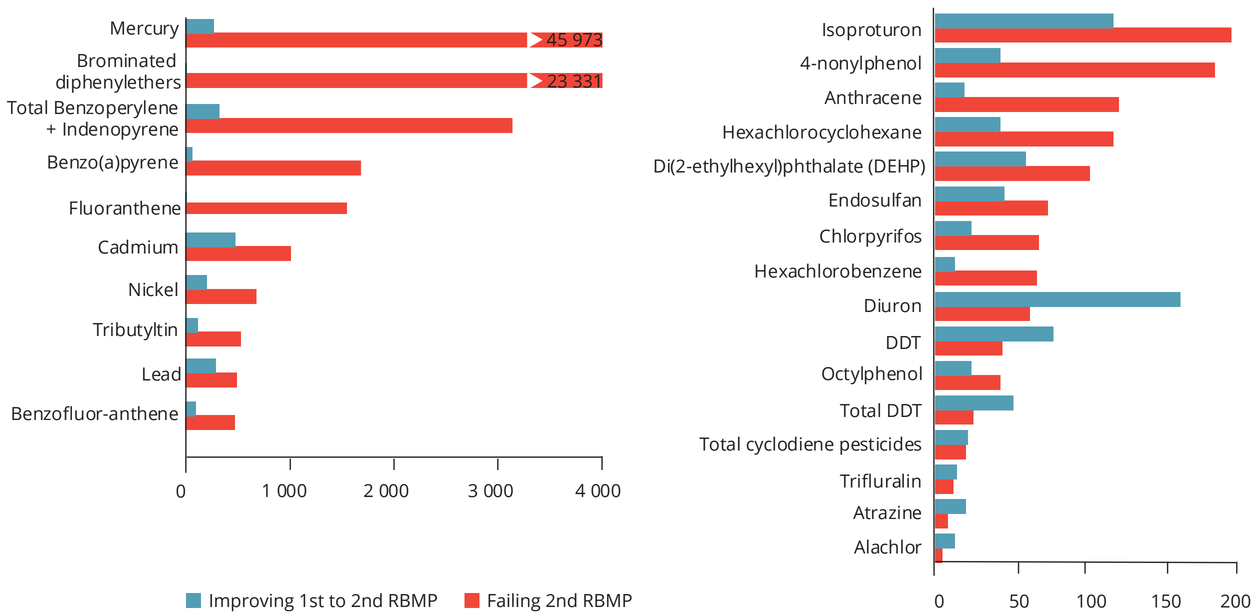
Source: Results are based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Chemical status, by category.

([33]) Alachlor, atrazine, chlorfenvinphos, chlorpyrifos, total cyclodienes, p,p'DDT, total DDT, diuron, endosulfan, hexachlorobenzene, hexachlorohexane, isoproturon, pentachlorophenol, simazine and trifluralin.

bodies improved from failing to good, compared with 621 water bodies failing to achieve good chemical status in the second RBMPs. If this rate of development continues during the next RBMP cycle, the number of water bodies failing to achieve good status as a result of priority pesticides may become very small.

Chemicals designated as priority substances in 2001(and listed with EQS in 2008) have long been recognised as harmful to, or via, the aquatic environment. They are a small subset of the thousands of chemicals in daily use, and in many cases restrictions have been in place for decades. More recent concerns, for example newly identified harmful substances or issues such as toxicity of mixtures of chemicals, are not reflected in the list of priority substances reported in the second RBMPs. However, some indication of the ongoing challenges with chemicals is provided by the reports from countries that have applied the new and revised standards under the Priority Substances Directive. These standards, which are to be met by 2021, have already been applied by Sweden, where none of the water bodies met the revised biota standard for polybrominated diphenyl ethers. In Luxembourg, none of the surface waters met the revised standard for fluoranthene (a PAH) and, similarly, the Netherlands expects this to be the case in the next RBMP reports.

Figure 3.5 Numbers of water bodies that have improved levels of a priority substance since the first RBMP cycle and the number that failed to have improved in the second RBMPs



Note: Member States reported if a priority substance improved from failing to achieve good to good chemical status since the first RBMPs. These numbers are compared with the number of water bodies failing in the second RBMPs. The diagram has been split into two to account for differences in the number of water bodies. Mercury and brominated diphenyl ethers caused failure in 45 973 and 23 331 water bodies, respectively.

Source: Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania).

4 Groundwater chemical status and pressures

Key messages

- A total of 74 % of EU groundwater bodies (by area) are in good chemical status.
- Through pollution from nitrates and pesticides, agriculture is the main pressure causing failure to achieve good chemical status in groundwater. Nitrates affect over 18 % of the area of groundwater bodies.
- In total, 160 pollutants caused failure to achieve good chemical status. Most were reported in only a few Member States, and only 15 were reported by five or more Member States.
- There has been only limited improvement in groundwater chemical status between the first and second RBMPs because of sustained pressure from agriculture and long recovery time.

4.1 Introduction

Groundwater provides a major source of drinking water for many EU citizens as well as the steady base flow of rivers and wetlands. Maintaining this flow and keeping it free of pollution is vital for both humans and surface water ecosystems.

Pressures on groundwater chemical quality may arise mainly from diffuse pollution, which is caused by nitrates applied to land in fertiliser or manure and by pesticides and presents a significant and widespread challenge. Nitrogen pollution can also occur in areas where there is no sewerage system. Contaminated industrial sites, waste sites and old mines can lead to contamination from organic pollutants and metals such as arsenic, lead and copper. Substances may also be of natural origin, e.g. when the bedrock contains high concentrations of metals and salts such as sulphates and fluorides. In coastal areas, saltwater may intrude into the groundwater aquifer from which freshwater is abstracted, e.g. for drinking water supply.

Once pollutants are in groundwater, recovery from this can take years or even many decades because of residence times and the slow degradation of pollutants. The time to recovery will depend on many factors, such as the nature of the hydrogeological setting, the rate of groundwater recharge and the properties of the pollutant.

The WFD requires Member States to designate separate groundwater bodies and ensure that each one achieves good chemical status (EC, 2018d). The level of groundwater in each body is addressed by groundwater quantitative status (Chapter 5).

Good groundwater chemical status is achieved when:

- there is no sign of saline intrusion in the groundwater body;
- the concentrations of pollutants do not exceed those permitted under the applicable groundwater quality standards or threshold values, including those for drinking water protected areas;
- the concentrations of pollutants do not result in failure to achieve ecological or chemical status of associated surface waters, nor in any significant damage to terrestrial ecosystems that depend directly on the groundwater body.

For groundwater to be of good quality, appropriate measures need to be implemented to, for example, keep it free of hazardous substances. In addition, Member States must prevent deterioration of status, reverse any significant and sustained upward trends in groundwater pollutant concentrations, and, as with priority substances in surface water, progressively reduce pollution.

The chemical status of groundwater is assessed as good or failing to achieve good chemical status according to its compliance with EU standards for nitrates (50 mg/l ([34])) and pesticides ([35]) (0.1 µg/l for individual pesticides; total maximum 0.5 µg/l), and with Member States' established 'threshold values' for other groundwater pollutants. These values can be set at the level of the groundwater body, national river basin or international river basin, with criteria ([36]) broadly requiring that:

- Concentrations do not present a significant environmental risk.
- Provisions do not apply to high concentrations of naturally occurring substances.
- Consideration is given to the impact on, and interrelationship with, associated surface waters and directly dependent terrestrial ecosystems and wetlands.
- Knowledge about human toxicology and ecotoxicology is taken into account.

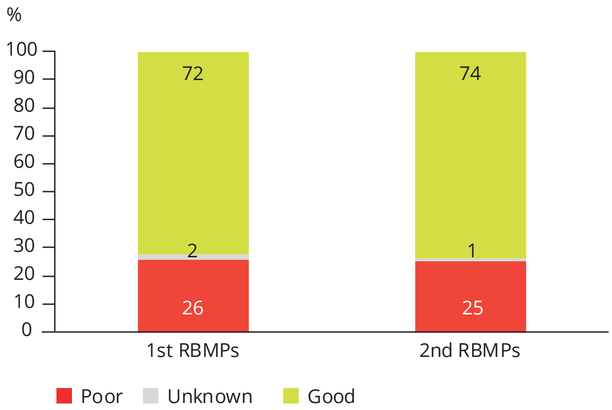
In the presentation of groundwater results, EEA has used the area of groundwater bodies as a basis for assessing status and pressures. Groundwater results presented in this report are based on information of the size of the polygons that represent the projection areas of the groundwater bodies at the terrain surface, in accordance with the WFD reporting guidance (EC, 2016a).

4.2 Groundwater chemical status

4.2.1 Status in the second RBMPs

Member States' reports in the second RBMPs show that 74 % of EU groundwater bodies (by area) are in good chemical status and 25 % have poor chemical status, with 1 % of unknown status (Figure 4.1).

Figure 4.1 Chemical status of groundwater bodies, by area, reported in first and second RBMPs



Note: Proportion of groundwater body area in good and poor chemical status. Total groundwater body area (EU-25) is 4.3 million km^2.

Source: Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Groundwater bodies: Number or size, by chemical status and Groundwater water bodies: Chemical status, by geological formation.

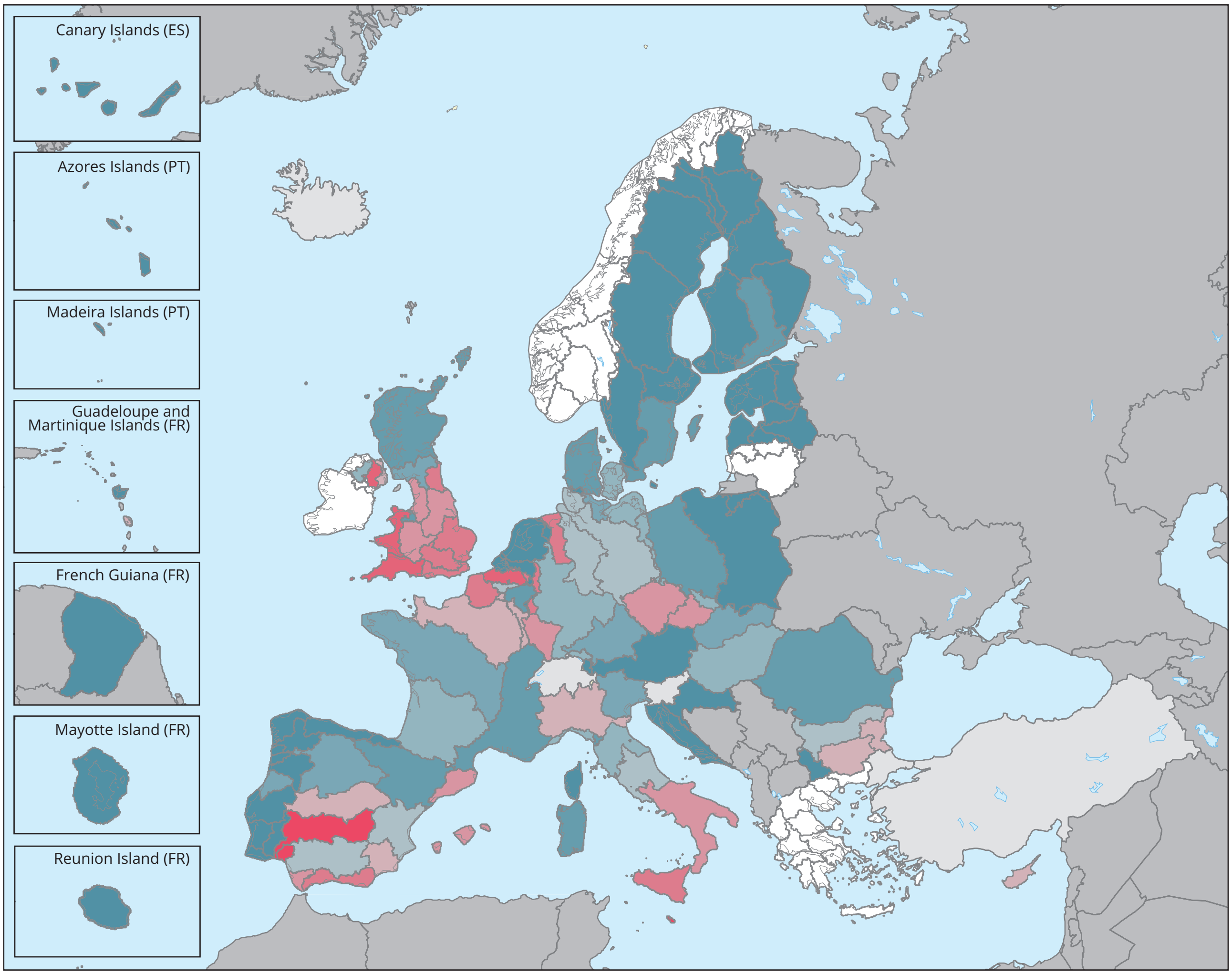
([34]) Note that some Member States set more stringent standards for nitrates (i.e. below 50 mg/l) and pesticides.
([35]) Pesticides are to be understood as defined in the Groundwater Directive (2006/126/EC), article 3, para. 1, litra a) and annex II, para. 1: Pesticides are active substances in pesticides, including their relevant metabolites, degradation and reaction products. 'Pesticides' means plant protection products and biocidal products as defined in Article 2 of Directive 91/414/EEC and in article 2 of Directive 98/8/EC, respectively.
([36]) Specific criteria are set out in Annex II of the GWD (EU, 2006a).

Member States should identify whether a groundwater body is at risk of not meeting the objectives for good chemical status by the end of the plan period. The aim is to assess the effort needed if a body is to achieve good chemical status and to prevent any deterioration of existing good status. In the second RBMPs, the overall proportion of groundwater body area at risk of not achieving good status was higher, at 31 %, than the proportion in poor chemical status (25 %) ([37]), although there was significant variation between countries, from no water bodies at risk to 99 % at risk.

Lowest groundwater quality is focused in areas where there is intensive agricultural production, and, in some cases, where there is or has been heavy industry (Map 4.1).

Further and detailed information on groundwater chemical status results is available using the WISE-Freshwater WFD.

Map 4.1 River basin groundwater chemical status



Percentage of area of groundwater bodies not in good chemical status per river basin district (RBD) in second RBMPs

0% – 100% | RBD areas without data | No data | Outside coverage

Source: Results are based on the WISE-SoW database including data from 24 Member States (EU-28 except Greece, Ireland, Lithuania and Slovenia). Groundwater bodies failing to achieve good status, by RBD.

([37]) Groundwater bodies at risk.

4.2.2 *Intercomparability of groundwater chemical assessment*

The proportion of groundwater area in Member States that is in good chemical status ranges from 3 % to 100 %. Similarly to RBSPs (Chapter 2.3), Member States identify substances that put groundwater bodies at risk of failing good chemical status and set 'threshold values' (at the level of Member State, RBD or groundwater body) as a benchmark for good chemical status. This can lead to a range of approaches; for example, some Member States have considered threshold values for over 90 pollutants, while others have assessed status using fewer than 10.

The monitoring of more substances could lead to a greater chance of failing to achieve good chemical status. In addition, the range of concentrations for which threshold values are set can vary quite widely, with differences in methodologies for establishing threshold values and natural background levels, variability in the receptors to be protected, and differences in methodologies for calculating average values. Together, these factors mean that caution should be used when comparing groundwater chemical status between countries.

4.2.3 *Change in status between first and second RBMPs*

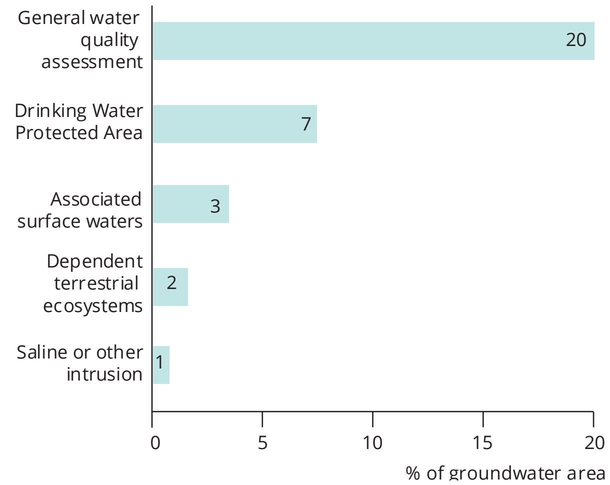
There has been little change in the chemical status of groundwater bodies since the first RBMPs, with an increase in good chemical status of two percentage points at EU level (Figure 4.1). This might be because it can take a long time to observe changes in groundwater quality after pressure-reducing measures have been introduced, or because effective measures have not yet been taken, particularly in deep hydrogeological structures. There may also have been changes to the relevant pollutants selected for, and in the threshold values used in, assessments, making it difficult to directly compare the RBMPs.

4.3 Reasons for failure to achieve good chemical status

The most common reason given for failure to achieve good chemical status was 'general water quality'. This takes into consideration significant impairment of human uses and environmental risk from pollutants across the groundwater body, but it does not include an assessment of more stringent objectives, such as those for drinking water or for dependent terrestrial ecosystems and associated surface waters.

The second most common reason for failure was not meeting the requirements for drinking water protected areas; other reasons were less significant (Figure 4.2).

Figure 4.2 Reasons for failure of chemical status, by area



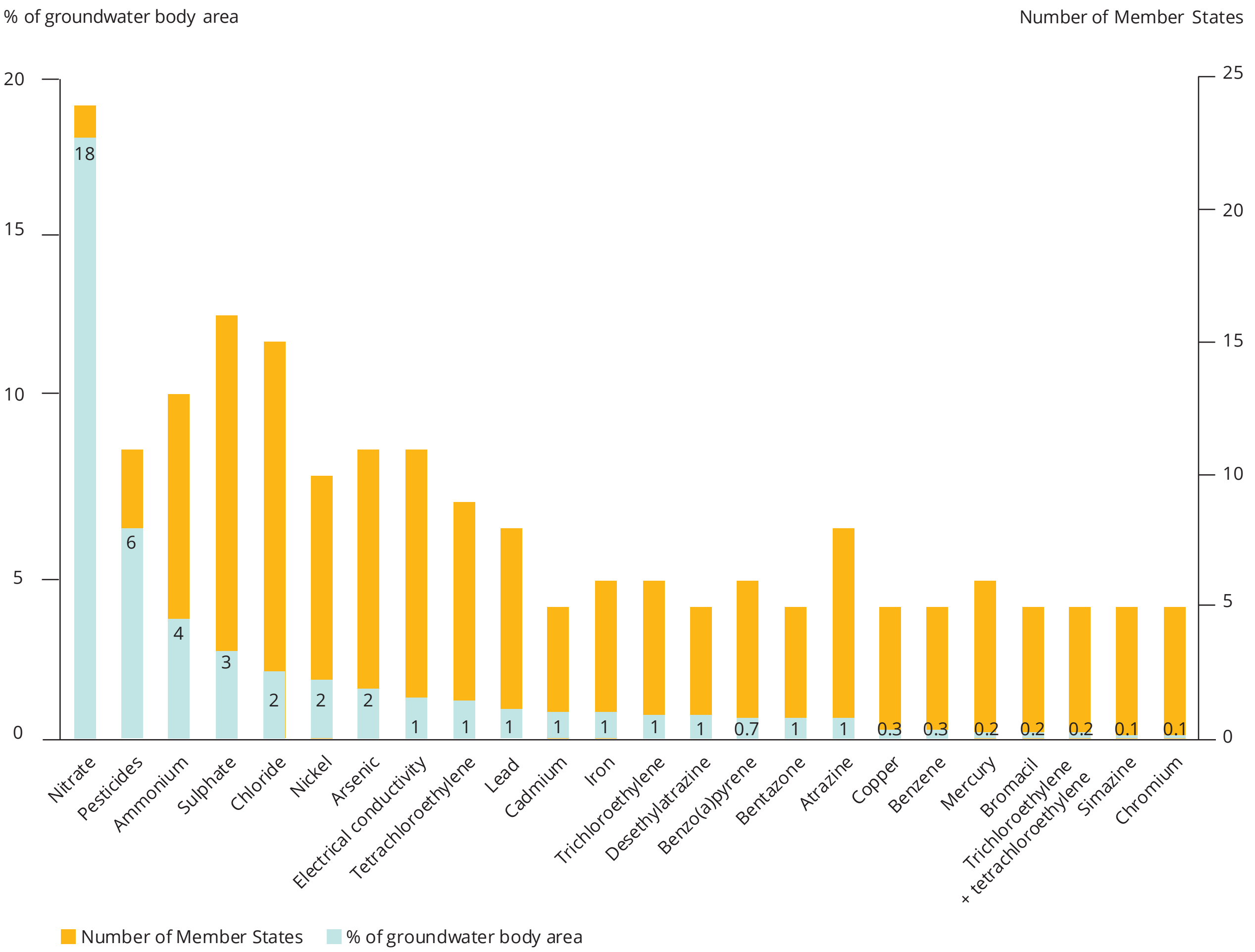
Source: Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Groundwater bodies: reasons for failure to achieve good chemical status and Groundwater bodies: reasons for failure to achieve good chemical status — overview.

4.3.1 *Pollutants causing failure to achieve good status*

In total, 160 chemicals were reported as causing poor chemical status. Some of these (iron, potassium, bicarbonate, calcium, magnesium, sodium and hardness) may be considered by some countries to characterise the natural background conditions of the aquifer, and so in those places are not necessarily classified as anthropogenic pollutants. Electrical conductivity may be attributed to saline intrusions (whereby freshwater abstraction draws in salt water), as only Member States with coastal areas reported this as a reason for failure.

Nitrates are the pollutants that most commonly cause poor chemical status; they are the predominant groundwater pollutant throughout the EU (reported by 24 Member States and causing failure in 18 % of groundwater body area) (Figure 4.3). Pesticides are another major source, reported as causing failure in 6.5 % of groundwater bodies (by area).

Figure 4.3 Groundwater pollutants causing poor chemical status in at least five Member States



Notes: Pollutants causing failure shown by proportion of total groundwater body area. The substances shown have caused failure in groundwater in at least five Member States.

Source: Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Groundwater bodies: Pollutants — overview and Groundwater bodies: Pollutants.

The list of substances most frequently leading to groundwater body poor chemical status is dominated by those used in agriculture (e.g. nitrates) and arising from salt intrusion (e.g. chloride). In addition, some industrial chemicals lead to failure, such as tetrachloroethylene, used as a solvent, and metals such as arsenic, nickel and lead, which arise from, for example, mining, contaminated sites and waste water.

Further and detailed information on groundwater pollutants is available using the WISE-Freshwater WFD.

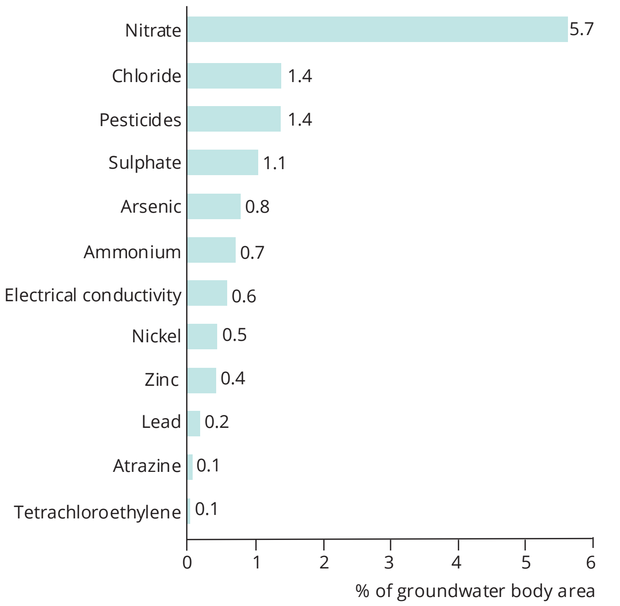
4.3.2 Significant upward trend and reversal of the trend in pollutants

The WFD requires that significant and sustained upward trends in pollutants should be identified and reversed (Art. 4.1.b.iii). A significant trend is one that could lead to a groundwater body failing to meet its environmental objectives before 2021 if measures are not put in place to reverse it. As only a few countries reported any upward trends in the first RBMPs, it is difficult to examine any changes in trend in the second RBMPs.

The total groundwater body area with an identified upward trend (9.9 % of area) is nearly double that with a trend reversal (5.9 % of area).

Significant and sustained upward trends were identified for 58 pollutants, mainly nitrates, which were detected in 19 Member States (Figure 4.4). Other substances with upward trends are similar to those in Figure 4.3.

Figure 4.4 Pollutants with an upward trend by area of groundwater bodies

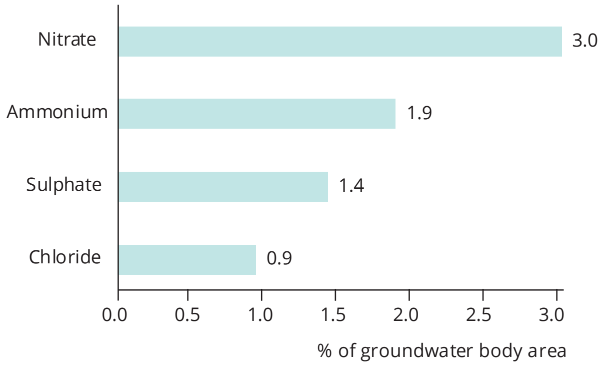


Note Substances shown are causing failure in at least four Member States.

Source: Results based on WISE-SoW database including data from 25 Member States (EU28 except Greece, Ireland and Lithuania). Groundwater bodies: Pollutants — Upward trend

In contrast, 14 Member States reported trend reversals for 65 pollutants (Figure 4.5), mainly nitrates, ammonium, sulphates and chlorides.

Figure 4.5 Pollutants with a trend reversal by area of groundwater bodies



Note Substances shown are causing failure in at least four Member States.

Source: Results based on WISE-SoW database including data from 25 Member States (EU28 except Greece, Ireland and Lithuania). Groundwater bodies: Pollutants — Trend reversal.

As groundwater chemical data for second-cycle RBMPs were mainly collected during 2010-2012, and because it is likely to take time for the effect of measures to be seen, an increased reversal in the trend in existing pollutants may be expected in future years.

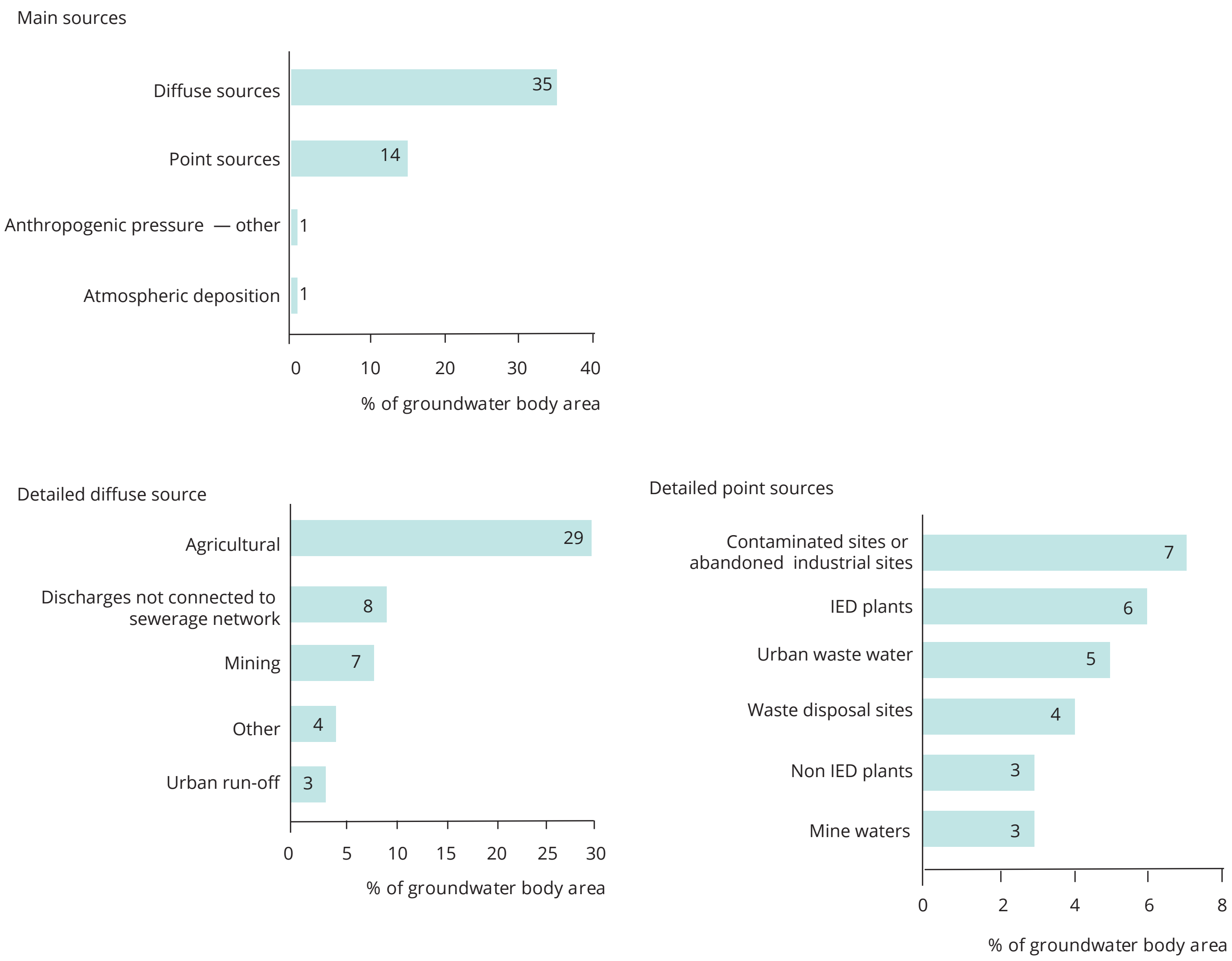
4.4 Pressures and impacts on groundwater chemical status

Most countries report that diffuse sources of pollution are a pressure on groundwater. Of 25 Member States, 20 reported both point and diffuse source pressures, with four reporting only diffuse source pressures. Diffuse sources affect 35 % of groundwater bodies by area (Figure 4.7). Diffuse pollution from agriculture is the major pressure causing poor chemical status, affecting 29 % of groundwater bodies (by area). Other pressures affect a relatively small proportion of groundwater body area (Figure 4.7).

The main impacts reported were chemical (22 % of groundwater bodies by area) and nutrient (18 %) pollution ([38]).

([38]) Groundwater impacts; Groundwater bodies: Significant impacts.

Figure 4.6 Main pressures identified in relation to groundwater chemical status



Note: Proportion of groundwater body area affected by the main pressure groups and by detailed pressures for diffuse sources and point source pressures. Note the differences in the scale of the X-axis. IED plants are industrial emissions covered by the Industrial Emission Directive (EC, 2018g).

Source: Results based on WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Groundwater bodies: Significant pressures — overview and Groundwater bodies: Significant pressures.

5 Groundwater quantitative status and pressures

Key messages

- In the second RBMPs, around 90 % of the area of groundwater bodies is reported to be in good quantitative status. However, in southern Member States of the EU, namely Cyprus, Malta and Spain, there are significant problems with the quantitative status of groundwater bodies.
- The main pressures causing failure to achieve good quantitative status are water abstraction for public water supply, agriculture and industry.
- Groundwater quantitative status has improved by about 5 % since the first RBMPs were reported.

5.1 Introduction

Groundwater is the water below the Earth's surface in the fractures of rock formations and in soil pore spaces. Groundwater aquifers are embedded in geological layers and the groundwater body is a distinct volume of groundwater within an aquifer or aquifers.

Groundwater bodies are characterised by their geology and productivity. More than half are porous aquifers, followed by fissured aquifers, and they are generally highly to moderately productive. Fractured aquifers, including karst, and local and limited aquifers, are less common. Groundwater provides the steady base flow of rivers and wetlands.

Overall, in terms of European water balance, groundwater aquifers receive around 11 % of total precipitation as deep percolation but provide around 42 % of the total water abstraction in Europe, most of which is used for public water supplies and agricultural activities. In Europe, about 50 % of drinking water is taken from groundwater (Zal et al., 2017), and many large cities depend on it for their water supplies.

The WFD requires good quantitative status to be achieved by ensuring that the available groundwater resource is not exceeded by the long-term annual average rate of abstraction. Accordingly, the groundwater level may not be subject to:

- any diminution in the ecological status of surface water linked with groundwater;
- significant damage to groundwater-dependent terrestrial ecosystems;
- any flow reversals that lead to saline or other intrusions.

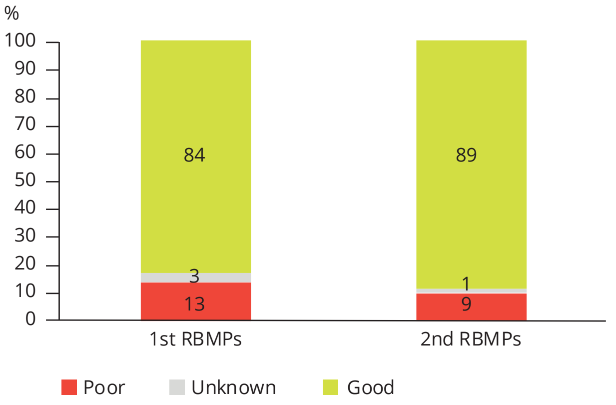
Groundwater bodies are classified as being in good, poor or unknown quantitative status. Change in status by area per country between the first and second RBMPs has been used to analyse the improvements in groundwater quantitative status. For groundwater bodies in poor quantitative status, the reasons for poor status, significant pressures and impacts are described.

5.2 Groundwater quantitative status

5.2.1 Status in second RBMPs

Almost 90 % of the area of groundwater bodies has good quantitative status, 9 % of the total area of groundwater bodies has poor quantitative status, while around 1 % of the groundwater body area has unknown status (Figure 5.1).

Figure 5.1 Groundwater quantitative status by area between the first and second RBMPs



Notes: Proportion of groundwater body area in good status and failing to achieve good status. The total groundwater body area (EU-25) is 4.3 million km^2.

Source: Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Groundwater bodies: Number or size, by quantitative status and Groundwater bodies: Quantitative status, by geological formation.

Six Member States reported that all of their groundwater bodies were in good quantitative status, while Cyprus and Malta reported the highest proportion of groundwater bodies in poor status (Table 5.1), at 57 % and 80 %, respectively. However, both of these countries depend heavily on groundwater resources to meet their water needs, with Malta abstracting around 60 % from this source and Cyprus abstracting almost half (Zal et al., 2017).

Fourteen Member States reported that between 75 % and 99 % of the total area of groundwater bodies were in good quantitative status, while three gave a figure of between 50 % and 75 % (Table 5.1).

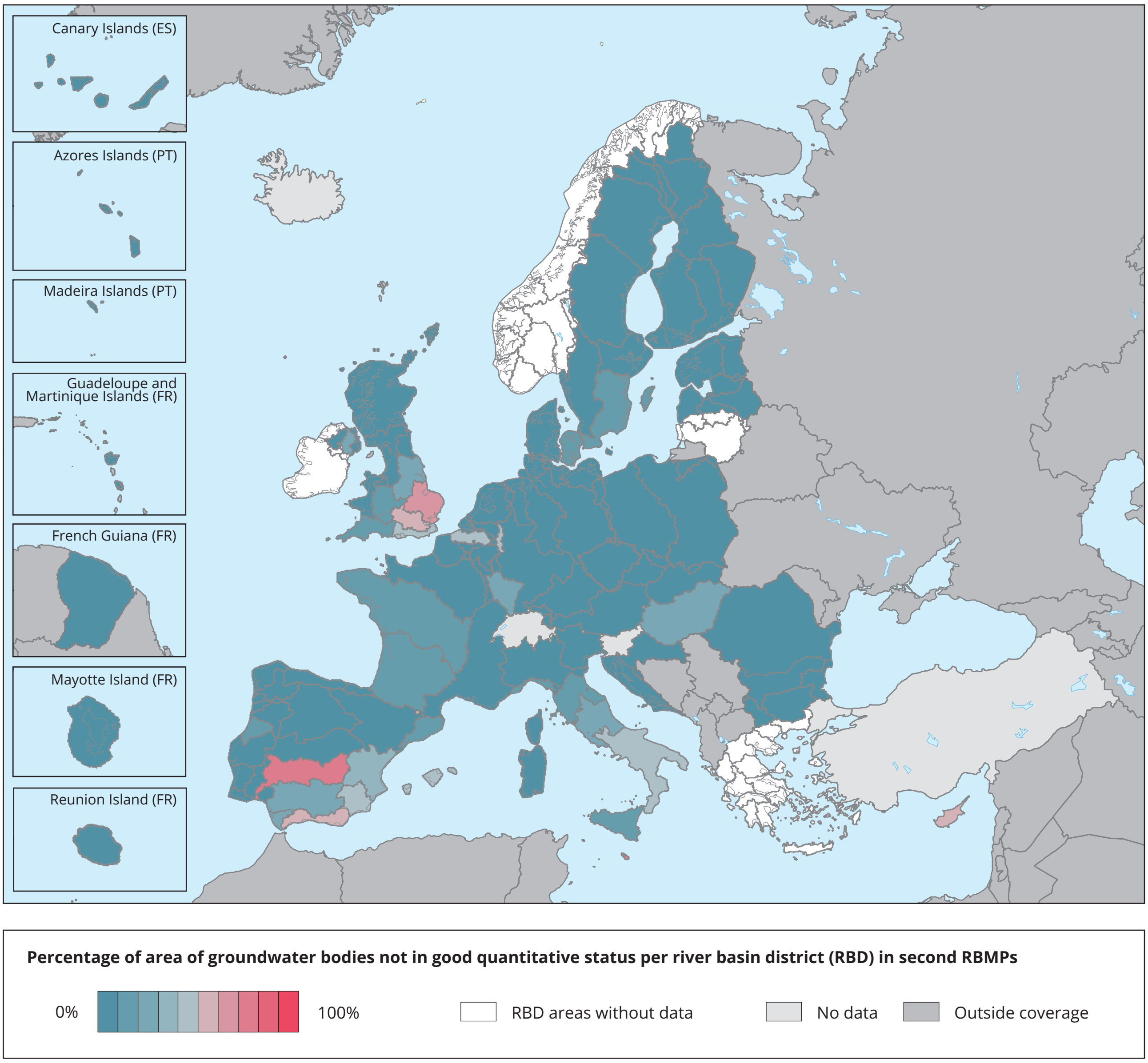
Table 5.1 Proportion of good quantitative status of groundwater bodies, by area

% of groundwater bodies in good quantitative status, by area	Member States
100 %	Austria, Latvia, Luxembourg, Netherlands, Romania, Slovenia
75-100 %	Croatia, Denmark, Estonia, Bulgaria, Portugal, Germany, Poland, Finland, Sweden, Czech Republic, France, United Kingdom, Spain, Italy
50-75 %	Hungary, Slovakia, Belgium
< 50 %	Cyprus, Malta

Source: WISE-SoW database data from 25 Member States (EU-28 except Greece, Ireland and Lithuania).

In around 70 RBDs, all groundwater bodies are in good quantitative status. Only one RBD reported that none of its groundwater bodies had achieved good quantitative status (Map 5.1).

Map 5.1 Percentage of the area of groundwater bodies not in good quantitative status in Europe's RBDs in the second RBMPs



Source: Results based on the WISE-SoW database including data from 24 Member States (EU-28 except Greece, Ireland, Lithuania and Slovenia). Groundwater bodies failing to achieve good status, by RBD.

5.2.2 *Change in status between the first and second RBMPs*

Overall, more than 80 % of all groundwater bodies in Europe had good quantitative status in the first RBMPs. An improvement in status of around 5 % was observed between the first and second RBMPs, while the proportion in poor quantitative status decreased from 13 % to 9 %. Knowledge about groundwater quantitative status has increased in recent years and now only around 1 % of groundwater bodies (across four Member States) are in unknown status. Around 70 % of quantitative status assessments are marked as having been reported with high- or medium-level confidence.

Further and detailed information on groundwater quantitative status results is available using the WISE-Freshwater WFD.

5.3 Pressure and impacts on quantitative status

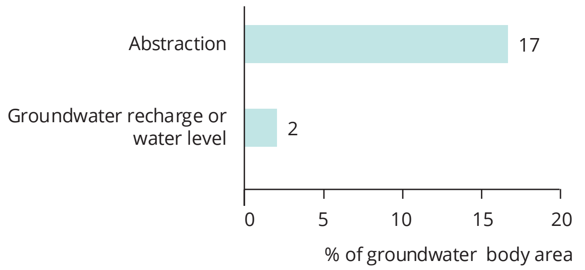
In groundwater body areas in poor quantitative status (9 %) [39], the main reasons are water balance/lowered water table (75 %), deterioration of associated surface waters (24 %) and dependent terrestrial ecosystems (20 %), and saline intrusion (9 %). There may be more than one reason why a groundwater body has failed to achieve good status.

The main pressures that affect groundwater bodies are abstraction and change in groundwater level (Figure 5.3). Overabstraction affects 17 % of the total groundwater body area. The main significant pressures causing failure to achieve good quantitative status are water abstraction for public water supply, agriculture and industry.

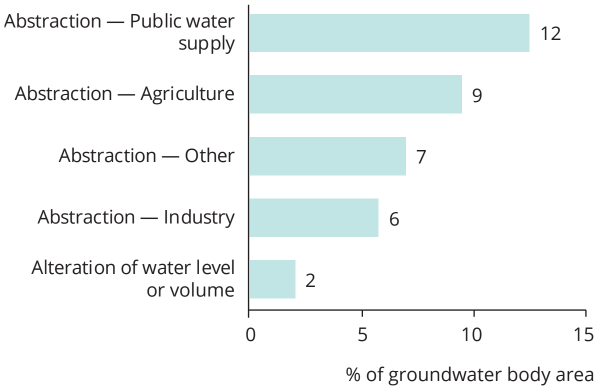
The area of groundwater bodies affected by water abstraction increased from the first to the second RBMPs (Table 5.2). The proportion of groundwater area affected by abstraction for public water supply has decreased by nine percentage points since the first RBMPs, while the proportion affected by abstraction for agricultural, industrial and other uses is similar in both RBMPs. The changes in pressures may be due to better understanding of the abstraction pressures during preparation of the second RBMPs, or due to actual changes in abstraction.

Figure 5.3 Significant pressures causing failure to achieve good quantitative status

a) Main pressures in relation to quantitative status



b) Detailed abstraction pressures



Source: Results based on WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Groundwater bodies: Significant pressures.

Table 5.2 Changes in abstraction pressures between first and second RBMPs for areas of groundwater bodies failing to achieve good quantitative status

RBMPs	Public water supply	Agriculture	Industry	Other
First (3 044)	23 % (700)	9 % (287)	6 % (189)	7 % (212)
Second (4 338)	12 % (526)	9 % (399)	6 % (243)	7 % (294)

Notes: Total area of groundwater bodies (as percentage and absolute value within parentheses: 1 000 km²) affected by abstraction pressures against total area of groundwater bodies.

Source: Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Groundwater bodies: Significant pressures.

(39) Groundwater bodies: reasons for failure to achieve good quantitative status.

6 Current water status, progress achieved and future challenges

Key messages

- The status of groundwater across Europe is generally better than that of surface waters. Good chemical and quantitative status was achieved for 74 % and 89 % of the area of groundwater bodies. Around 40 % of surface water bodies have good ecological status and good chemical status.
- Overall, the second RBMPs show limited change in status, as most water bodies have the same status in both cycles. However, fewer water bodies with unknown status means an increase in both the proportion in good status and the proportion in less than good status.
- The analysis of the second RBMPs shows that there has been progress in the status of some quality elements and pollutants from the first RBMPs. In particular, the ecological status of some biological quality elements has improved.
- A total of 38 % of surface water bodies in the second RBMPs are in good chemical status. Without taking into account ubiquitous priority substances, particularly mercury, 3 % of surface water bodies failed to achieve good chemical status. In most Member States relatively few priority substances are responsible for poor chemical status. Improvements in the status of individual priority substances show that Member States are making progress in tackling the sources of contamination.
- The main significant pressures on surface water bodies are hydromorphological pressures (40 %), diffuse sources (38 %), particularly from agriculture, and atmospheric deposition, particularly of mercury (38 %), followed by point sources (18 %) and water abstraction (7 %).
- Diffuse sources, particularly from agriculture (35 %), and point sources (14 %) are the main pressures on groundwater chemical status, while pressures from water abstraction (17 %) are the main cause of poor quantitative status.
- Member States have made marked efforts to improve water quality and hydromorphology. Some measures have had an immediate effect; others take more time to show positive effects, and some will result in improvements only in the longer term.
- It can be expected that by the time the third RBMPs are drafted (2019-2021), some of the several thousand individual measures undertaken in the first and second RBMPs will have resulted in positive effects towards achieving good status.

6.1 Status and overall progress since the first RBMPs

The results reported in the previous chapters show that, with the second RBMPs, the quantity and quality of the available information has grown significantly. Many Member States and RBDs have invested in new or better ecological and chemical monitoring programmes, with more monitoring sites established, more quality elements assessed and more chemicals analysed. These improvements in monitoring and assessment mean that the status classification results now allow a better interpretation of the general health of the water environment.

The status of groundwater across Europe is generally better than that of surface waters (Figure 6.1) ([40]). Good chemical and quantitative status was achieved for 70 % and 86 % of the area of groundwater bodies. Around 40 % of surface water bodies have good ecological status and 41 % have good chemical status.

The proportion of water bodies with unknown status decreased from the first to the second RBMPs. For surface water bodies, the proportion in unknown ecological status and chemical status fell from 16 % to 4 % and from 39 % to 16 %, respectively, while, for groundwater bodies, the proportion in unknown chemical status and quantitative status decreased to only 1 %.

Overall, the second RBMPs show limited change in all four measures of status ([41]), as most of the water bodies have the same status in both cycles (Figure 6.1). However, owing to fewer water bodies with unknown status, both the proportion in good status and the proportion in less good status has increased.

The analysis of the second RBMPs shows that there has been progress in the status of single quality elements and single pollutants. The ecological status of some biological quality elements has improved from the first to the second RBMPs.

In the second RBMPs, 38 % of surface water bodies are in good chemical status. A very low proportion of surface water bodies (3 %) are reported as failing to achieve good chemical status if ubiquitous substances, especially mercury, are omitted, and in most Member States only a few priority substances (mainly PAHs and heavy metals such as cadmium, lead and nickel) are responsible for most of the observed poor chemical status. The improvements in the status of several priority substances show that Member States are making progress in tackling the sources of contamination.

There are several possible explanations for the limited improvements in status from the first to the second RBMPs.

- Additional biological and chemical monitoring was put in place after 2009, the classification methods were improved, and, in some cases, Member States applied stricter standards or standards in a matrix other than water (e.g. biota).

- Some water bodies have improved status in some quality elements but no improvement in overall ecological status.

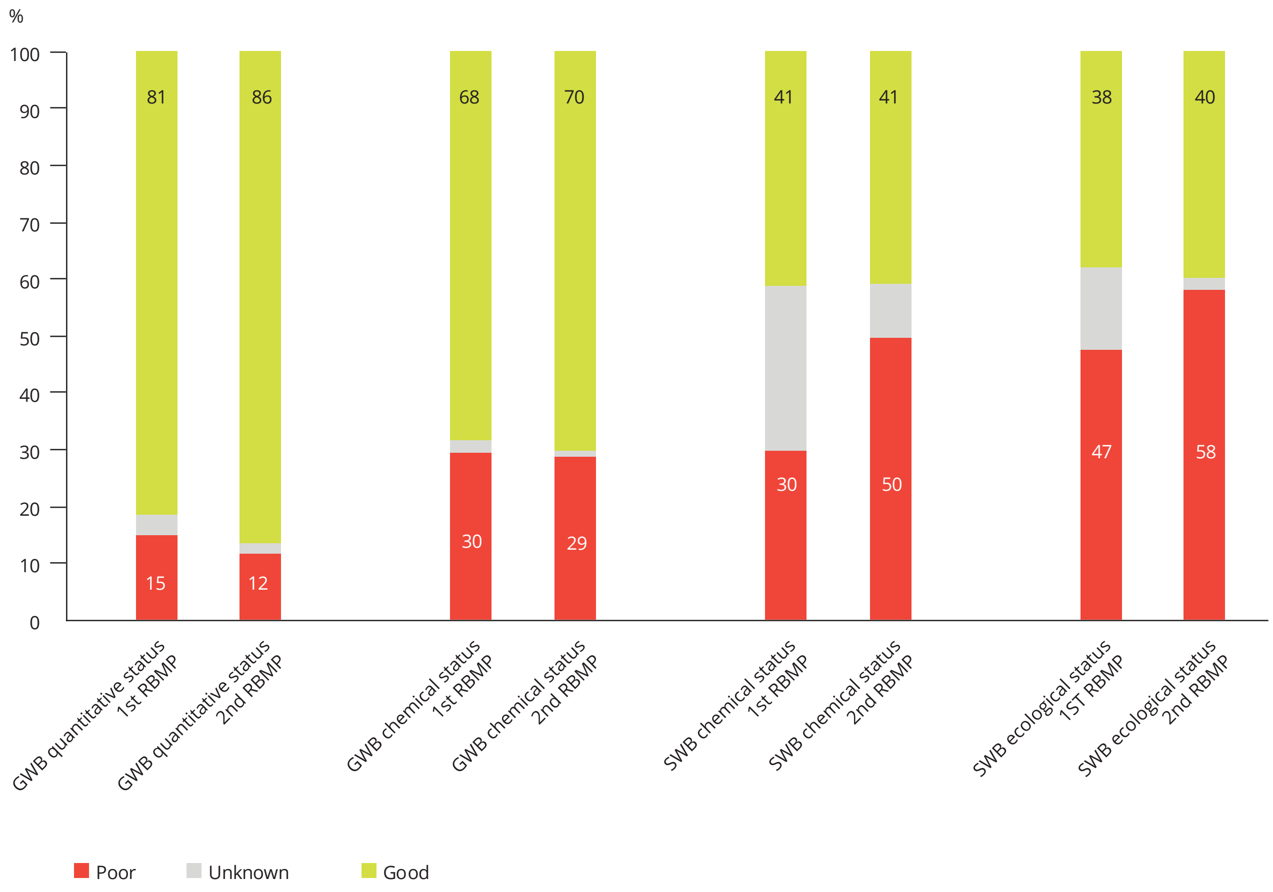
- The second RBMPs often show status classification up to 2012-13, at which time many measures were still in the process of being implemented; therefore, there may be a lag-time before the pressures are reduced and the status improves.

- Finally, it may be that some pressures were not known in 2009, or that the measures implemented were not sufficient or as effective as expected.

([40]) The percentages listed in this and the following paragraph are slightly different from the values given in Figure 6.1 as these refer to all water bodies in the second RBMPs, while Figure 6.1 only present results for water bodies that are unchanged between first and second RBMPs.

([41]) Surface water ecological and chemical status and groundwater chemical and quantitative status.

Figure 6.1 Comparison of status (quantitative, chemical and ecological) in the first and second RBMPs



Notes: GWB: Groundwater bodies; SWB: Surface water bodies; Ecological status: Good = High and good ecological status/potential and Poor = moderate, poor and bad status/potential. Status for surface water bodies is based on count of water bodies (92 200 water bodies), while status of groundwater bodies is by the area of groundwater bodies (3.04 million km^2). Only water bodies that are comparable between the two cycles of RBMPs are compared. Therefore, the percentages for the second RBMPs are slightly different from the previous chapters as they in the previous chapters are based on all water bodies reported in the second RBMPs.

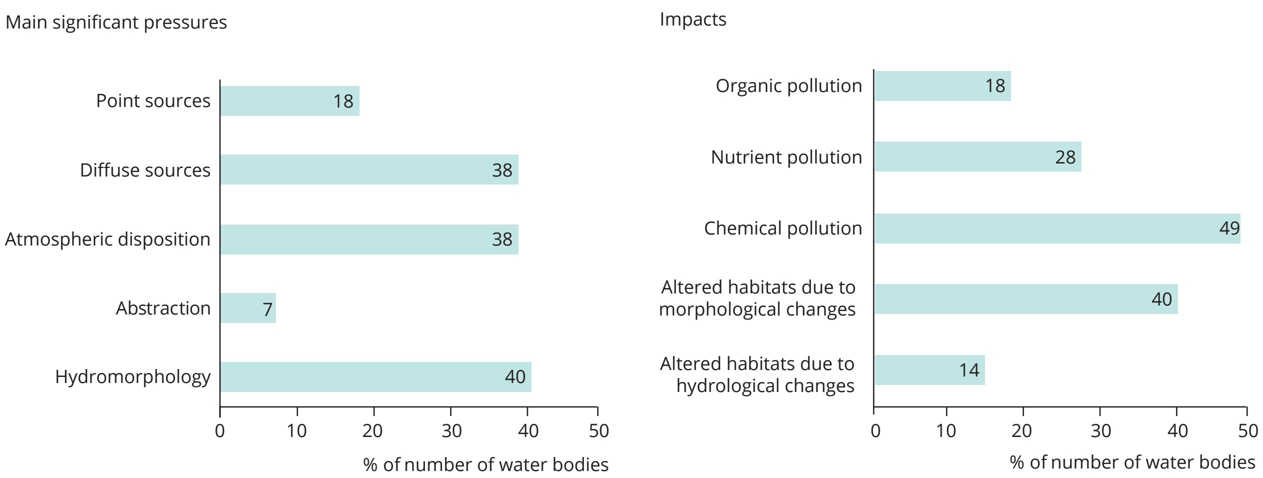
Source: Results based on WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Number and Size, by Ecological status or potential; Surface water bodies: Number and Size, by Chemical status; Groundwater bodies: Number or Size, by Chemical status and Groundwater bodies: Number or Size, by Quantitative status.

6.1.1 *Pressures and impacts causing failure to achieve good status*

The main significant pressures on surface water bodies are hydromorphological pressures (40 % of number of water bodies), atmospheric deposition (38 %) and diffuse source pollution (38 %), followed by point source pollution (18 %) and water abstraction (7 %) (Figure 6.2). Atmospheric deposition is mainly reported for water bodies failing good chemical status owing to the presence of mercury.

The main impact on surface water bodies is chemical pollution (49 %), followed by altered habitats due to morphological changes (40 %) and nutrient pollution (28 %).

Figure 6.2 Overview of the proportion of surface water bodies having a) main significant pressures and b) impacts in the second RBMPs



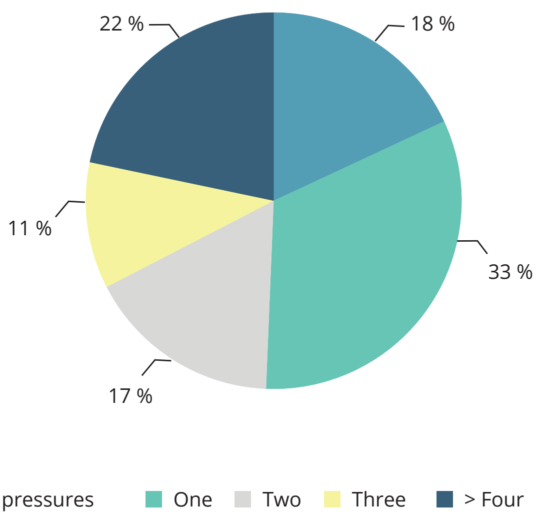
Notes: Pressures from diffuse sources do not include atmospheric deposition. The diagrams show the proportion (%) of water bodies affected by each pressure and impact type in the second RBMPs, considering only those bodies where ecological status has been classified (111 000 water bodies).

Source: Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Significant pressures and Surface water bodies: Significant impacts.

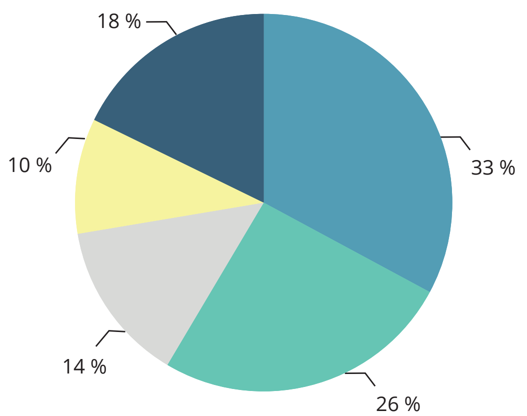
Around 18 % of surface water bodies have no identified significant pressures, while 33 % of surface water bodies are affected by one pressure and 50 % are affected by multiple pressures (Figure 6.3). If water bodies with only pressure from atmospheric deposition are excluded, then one third of the remaining water bodies have no significant pressures, corresponding well to the 40 % of water bodies that are in high and good ecological status.

Figure 6.3 Proportion of surface water bodies impacted simultaneously by single, multiple or no pressures at all

a) All pressures



b) All pressures excluding those from atmospheric deposition



Notes: b) gives a better indication of the proportion of water bodies affected by no pressure or multiple pressures in terms of ecological status.

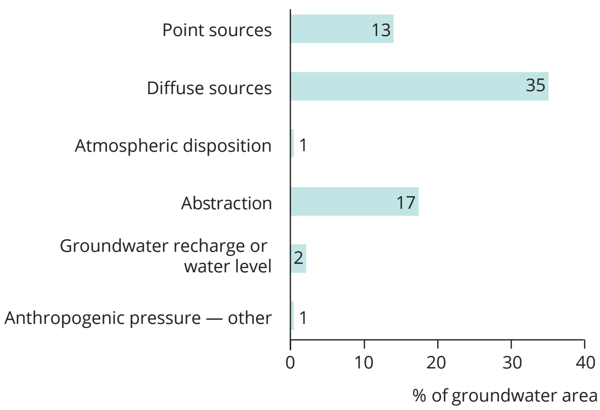
Source: Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Surface water bodies: Number of pressures, by category.

For groundwater, the main pressures on chemical status are diffuse source pollution (35 % of groundwater body area) and point source pollution (14 %), while the main pressure on quantitative status is water abstraction (17 %) (Figure 6.4).

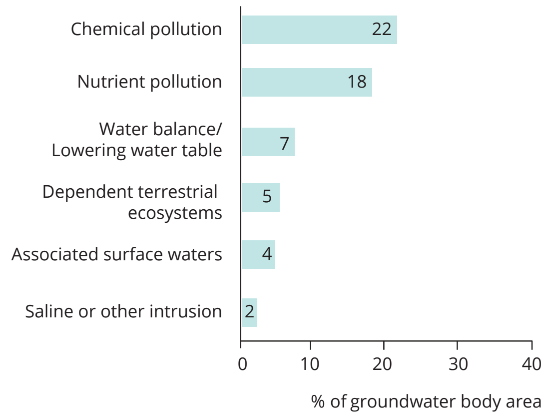
The primary impact on groundwater is from chemical pollution (22 % of groundwater body area), followed by nutrient pollution (18 %), while different impacts are identified on quantitative status.

Figure 6.4 Overview of the proportion of the area of groundwater bodies in the second RBMPs with a) main significant pressures and b) main significant impacts

a) Pressures



b) Impacts



Notes: Pressures from diffuse sources do not include atmospheric deposition. The diagrams show the proportion (%) of groundwater body area affected by each main pressure and impact for the second RBMPs (4.2 million km^2).

Source: Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). Groundwater bodies: Significant pressures and Groundwater bodies: Significant impacts.

From the first to the second RBMPs, an increase can be seen in the proportion of water bodies being affected by significant pressures. Statements in the digital versions of the RBMPs indicate that this is due not to an actual increase in pressures but to a better knowledge of the pressures affecting water bodies. By contrast, there is evidence that some pressures decreased during the first RBMP cycle, which has led to improvements in water quality (Section 6.2) and hydromorphology (Section 6.3).

6.1.2 Implementation of measures

The WFD requires an assessment of the significant pressures, when a water body is not in good status, the development of a targeted PoM. Member States described many measures in the first RBMPs, the most frequently reported being constructing or upgrading urban waste water treatment plants, encouraging best practice measures in agriculture to reduce nutrient pollution, implementing measures to improve river continuity and habitat quality, and ensuring adequate drinking water protection, as well as conducting studies and research projects to improve the knowledge base and reduce uncertainty (EC, 2015b).

In December 2012, Member States reported on their progress in implementing the PoMs from the first RBMPs (EC, 2015b). Already at that time the challenge of fully implementing all of the measures was obvious, as only around one quarter were reported as completed. In 2012, the implementation of most measures (66 % of basic and 54 % of supplementary measures) was still ongoing, while that of other measures had not even started (11 % and 17 % of basic and supplementary measures, respectively).

The interim progress reports in 2012 from Member States on the Programme of Measures (PoMs) indicated that, in the majority of RBDs, basic measures would not be sufficient to tackle the key pressures and that supplementary measures would need to be taken (EC, 2015b). Supplementary measures have been reported as particularly necessary for tackling the main pressures on EU water bodies, namely diffuse pollution from agriculture and hydromorphological pressures. At the same time, only 10 % of the supplementary measures for diffuse pollution sources and hydromorphology had been completed by 2012 (75 % were ongoing and 15 % had not yet started) (EC, 2015b).

By now, many of the several thousand individual measures in the first RBMPs will have been completed. Some of the measures have had immediate effects; others take more time for the positive effects to show, and some will result in improvements only in the longer term. However, some measures have been delayed or even not started mainly because of funding constraints, while other measures have been difficult to implement. It can be expected that by the time the third RBMPs are drafted (2019-2021), many of the measures undertaken in the first and second RBMPs will have resulted in positive effects towards achieving good status.

In the following sections (6.2 and 6.3), an overview of the main issues/pressures is provided (point sources, diffuse sources, chemicals, hydromorphology and water abstractions), along with examples of key measures that have been implemented in recent years.

6.2 Pollution and water quality

A range of pollutants in many of Europe's waters threatens aquatic ecosystems and may raise concerns for public health. These pollutants arise from various sources, including agriculture, industry, households and the transport sector. They are emitted into water via numerous diffuse and point pathways. Once released into freshwater, pollutants can be transported downstream and, ultimately, discharged into coastal waters, together with direct discharges from cities, industrial discharges and atmospheric deposition.

Clean, unpolluted water is essential for our ecosystems. Aquatic plants and animals react to changes in their environment caused by changes in water quality. Pollution takes many forms:

- Faecal contamination from sewage makes water aesthetically unpleasant and unsafe for recreational activities such as swimming.
- Many organic materials, including sewage effluent and farm and food-processing wastes, consume oxygen, suffocating fish and other aquatic life.
- Excess nutrients can create eutrophication, a process characterised by increased plant growth, problematic algal blooms, depletion of oxygen, loss of life in bottom water, and undesirable disturbance of the balance of organisms present in the water.
- Pollution through hazardous substances and chemicals can threaten aquatic ecosystems and human health.

Reducing pollution to meet the objectives of the WFD requires Member States to correctly implement and enforce several other directives and regulations. These include the Urban Waste Water Treatment Directive

(UWWTD, EU, 1991a), the Nitrates Directive (EU, 1991b), the Directive on Sustainable Use of Pesticides (EU, 2009a), the Industrial Emissions Directive (EU, 2010) and the REACH regulation (EU, 2006b), all of which play a key role in tackling point and diffuse source pollution.

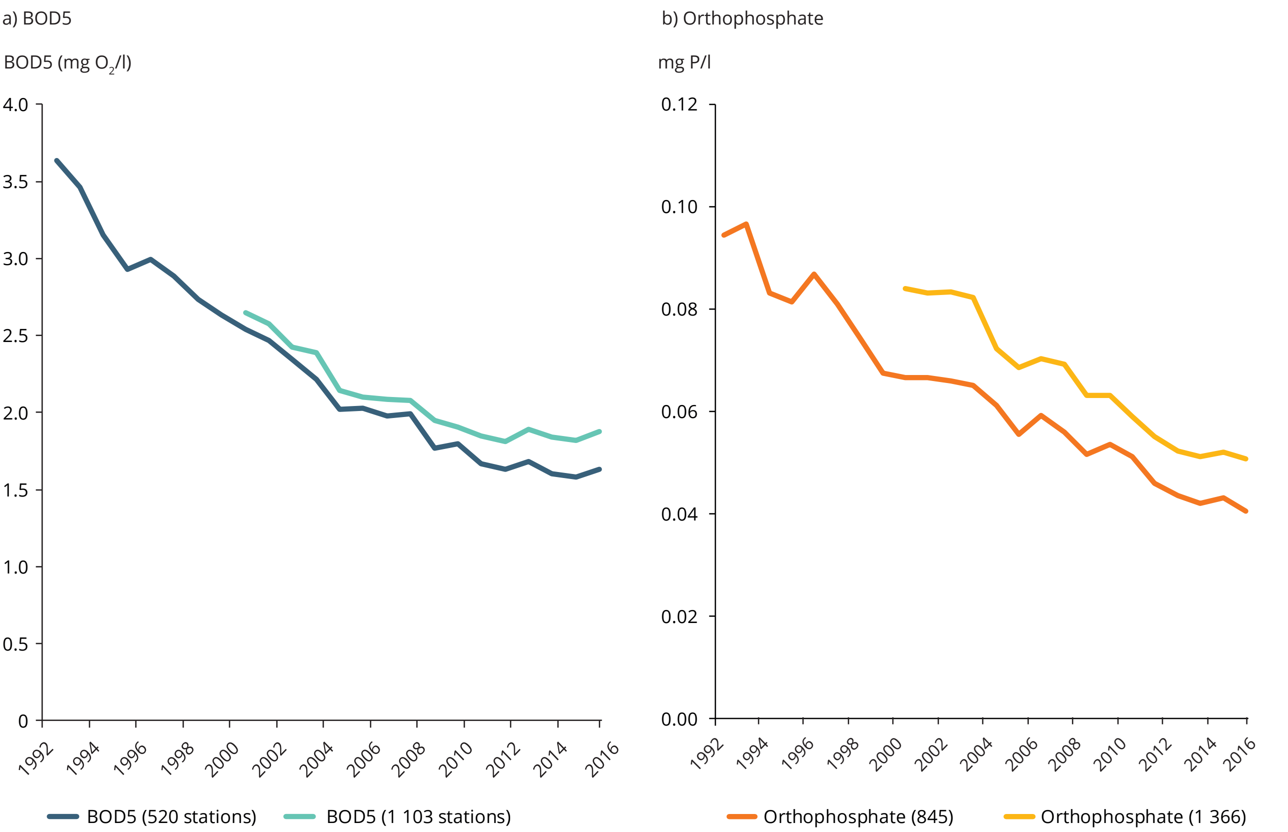
6.2.1 Point source pollution

The point source pressures on surface waters relate mostly to effluent discharges of pollutants from urban waste water, followed, to a lesser degree, by discharges from storm water overflows, industrial sites and aquaculture, while the point source pressures affecting groundwater relate more to the leaching of hazardous substances from landfills and contaminated sites. During the previous century, increased population and increased waste water production and discharge from urban areas and industry resulted in a marked increase in water pollution from point sources.

In the second RBMPs, Member States identified 18 % of surface water bodies as affected by point source pollution pressures, with transitional and coastal waters more affected than rivers and lakes. The main driver of point source pollution in the second RBMPs is urban waste water, being the source for around 68 % of surface water bodies affected by point sources. Furthermore, point sources are a significant pressure for 14 % of groundwater body area, with the main sources being contaminated sites, including industrial sites, waste disposal sites and mining areas, together with urban waste water.

Downward trends in concentrations of water pollutants associated with urban and industrial waste water are evident in most of Europe's surface waters (Figure 6.5). In European rivers and lakes, concentrations of pollutants associated with waste water discharge, such as biological oxygen demand (BOD), ammonium and phosphate, have decreased markedly over the past 25 years. The improvement is also reflected in the quality of EU bathing waters, which has improved significantly since 1990 (EEA, 2016a). In 2017, 96 % of bathing sites had good water quality (EEA, 2018).

Figure 6.5 Trends in a) biological oxygen demand (BOD5) and b) orthophosphate in European rivers



Note: The diagram depicts two time series: the longer time series has fewer stations (520) and the shorter time series has more (1 103).

Source: EEA, 2015a, updated.

Note: The diagram depicts two time series: the longer time series has fewer stations (845) and the shorter time series has more (1 366).

Source: EEA, 2015b, updated.

6.2.2 Measures for improved waste water treatment

Over the past few decades, clear progress has been made in reducing emissions into surface waters. The implementation of the UWWTD (EU, 1991a), together with national legislation, has led to improvements in waste water treatment across much of the European continent (EEA, 2016c, 2017b). These positive trends are due to increased connection to sewers, improvements in waste water treatment and a reduction in substances at source, such as lowering the phosphate content in detergents. Table 6.1 illustrates some examples of point source measures implemented during the past few years.

Table 6.1 Examples of measures to reduce point source discharges

RBD or country	Measures
Danube iRBD	Sewerage systems and urban waste water treatment plants have been constructed, upgraded or extended at almost 900 sites (2009-2015; ICPDR, 2015)
Bucharest, Romania	After the urban waste water treatment plant (UWWTP) started operating in 2011, concentrations of organic and nutrient pollution indicators significantly decreased (2011-2015; EEA, 2016d)
St Petersburg, Russia	After the UWWTP started operating in St Petersburg in 2005, inputs of nutrients in the Eastern Gulf of Finland significantly decreased; in addition, several UWWTPs have been set up in Poland and Latvia in recent years (Port of Helsinki, 2016)
Germany	Total phosphorus discharges decreased by circa 70 % from 1983 to 2014, mainly due to improved waste water treatment (UBA, 2017)

6.2.3 Diffuse source pollution

In Europe, diffuse source pollution is mostly due to excessive emissions of nutrients (nitrogen and phosphorus) and chemicals such as pesticides. In the second RBMPs, Member States identified that diffuse pollution affects 38 % of surface water bodies ([41]) and 35 % of the area of groundwater bodies. Agricultural production is a major source of diffuse pollution. Other drivers include rural dwellings (emissions from households that are not connected to sewerage systems) and run-off from urban areas and forested land. Nutrient enrichment causes eutrophication, which in turn leads to the loss of aquatic biodiversity and a reduction in fish stocks. Excessive nutrient enrichment can be dangerous for human health, e.g. owing to toxic algal blooms, and can impair the use of water for drinking and bathing.

Average levels of nitrate concentration declined by 20 % in European rivers between 1992 and 2015, while by 2011 groundwater nitrate concentrations had almost returned to the levels in 1992 (Figure 6.6). The decline in nitrate concentration reflects the effects of measures to reduce agricultural emissions of nitrates, as well as improvements in waste water treatment. Decreasing trends are more visible in rivers, which react quickly to changes in nutrient surplus; in contrast, the comparatively long residence time of groundwater may cause delays in recovery, in the order of years to decades, between applying nutrient control measures and observing measurable improvements in water quality.

6.2.4 Measures to reduce diffuse nutrient pollution

The EU has a long history of taking action on curbing diffuse nutrient pollution (EC, 2009b; Ibisch et al., 2016). Measures taken in the last few decades, including those under the Nitrates Directive (EU, 1991b), have resulted in a reduction in the use of mineral fertiliser, and nutrient surpluses of agricultural origin have progressively decreased in the EU (Figure 6.7). Between 2000 and 2013, agricultural nitrogen surplus decreased by 7 %, while phosphorus surplus decreased by 50 % (EC, 2017b).

Nevertheless, the overall level of fertilisation remains high in parts of Europe. Large variations exist between Member States in nitrogen and phosphorus surplus (Eurostat, 2016a) and, on average, fertiliser use has started increasing again in the last few years.

Nutrient balances at river basin level are now used in several countries to define nutrient load reduction targets to support the achievement of WFD objectives. Member States have taken measures at the national level or at the level of the river basin (e.g. general binding rules, taxes, manure surplus management), while other measures are more local (e.g. protection of specific drinking water areas).

([41]) Not including water bodies affected by atmospheric deposition.

Figure 6.6 Trend in water quality: nitrates in a) groundwater and b) rivers

Note: The diagram depicts two time series: the longer time series has fewer stations (400) and the shorter time series has more (1 242).

Source: EEA, 2015b.

Note: The diagram depicts two time series: the longer time series has fewer stations (1 044) and the shorter time series has more (1 565).

Source: EEA, 2015b, updated.

Some Member States have also focused action on 'priority catchments' that are at higher risk of nutrient enrichment. These catchments tend to receive a greater number of awareness-raising campaigns and investments.

During the implementation of the first RBMPs, there were several examples of Member States strengthening action to reduce nutrient pollution from agriculture (Table 6.2). Member States are implementing different kinds of measures, e.g. using farm-level nutrient planning, setting fertiliser standards (e.g. timing), using appropriate tillage, using nitrogen-fixing and catch crops, setting aside buffer strips and using crop rotation.

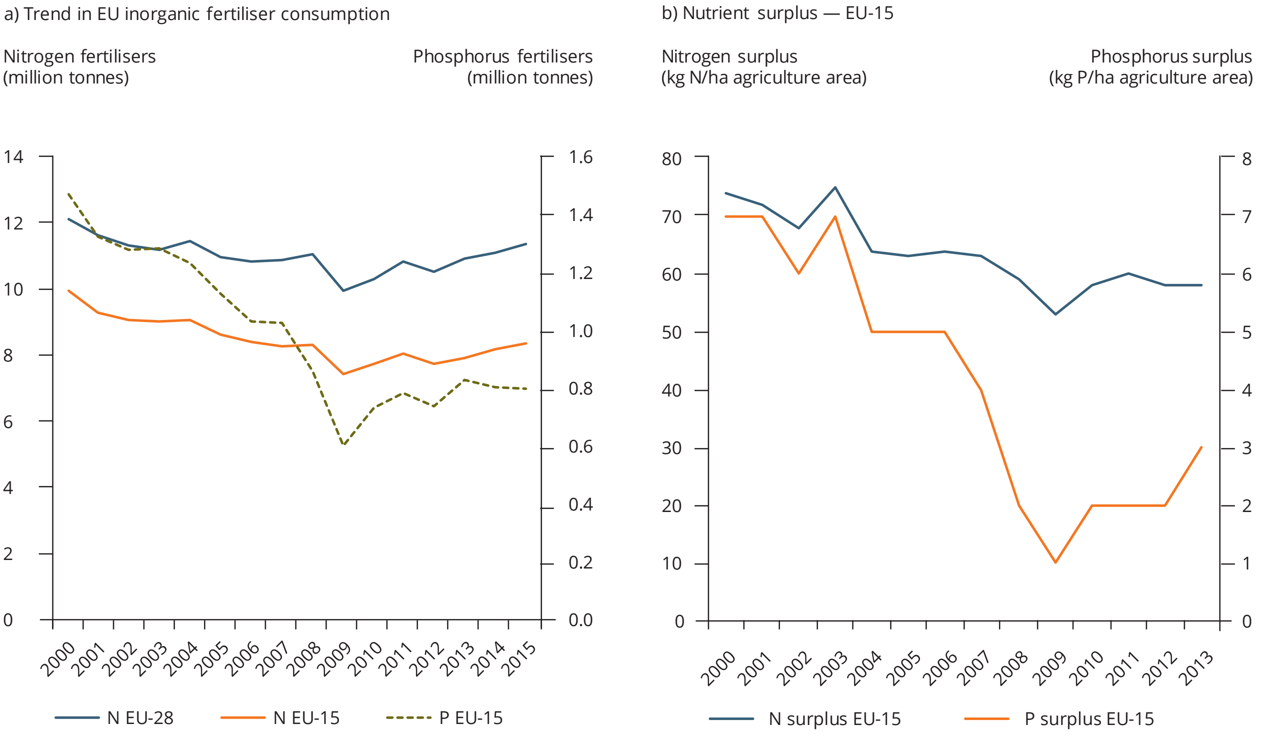
Other measures include livestock management through improved feeding (reduced phosphate compounds) and reduced grazing, as well as optimised manure management (increased manure storage, reduced use), and manure surplus management. Manure storage, in particular, can improve the timing of application to minimise the risk of excessive leaching into the water environment.

Most of these measures are compulsory in areas designated as nitrate vulnerable zones under the Nitrates Directive, which focuses on nitrate emissions from fertilisers, manure use in crop production and manure storage in areas where livestock are kept.

Several Member States are also supporting targeted green infrastructure such as constructed wetlands, sediment boxes and run-off ponds that capture and retain nutrient losses through agricultural drainage. River restoration and less intensive land uses such as afforestation are also increasingly recognised as effective means to tackle diffuse pollution pressures, as they increase nutrient retention and recycling.

Despite ongoing action to curb diffuse pollution from agriculture, the European Commission estimated that measures taken under the Nitrates Directive alone are not enough to tackle significant pressures from diffuse sources and achieve good ecological status (EC, 2015b). Recently it was also reported that in the context of the Nitrates Directive further efforts are needed to adapt measures to specific regional pressures and pollution hotspots (EC, 2018i).

Figure 6.7 Trend in fertiliser use and nutrient surplus



Notes: Only the long-term trend is available for the EU-15 Member States, except for nitrogen fertiliser use; however, the EU-15 account for the majority of fertiliser use (80 %) in the EU-28.

Source: Eurostat, 2018a, 2018b.

Table 6.2 Examples of measures to reduce pollution from diffuse sources

RBD or country	Measures
Baltic Sea	Some Nordic countries (Denmark, Finland and Sweden) and the Baltic States (Estonia, Latvia and Lithuania) have introduced a wide range of measures to reduce diffuse pollution from agriculture (Andersen et al., 2014)
Nitrate Directive implementation in north-western EU Member States	The impact of the Nitrate Directive implementation in the north-western EU Member States was reviewed for the period 1995-2008. The most significant environmental effect since 1995 has been a major contribution to the decrease in the soil nitrogen balance (N surplus). This decrease has been accompanied by a modest decrease in nitrate concentrations since 2000 in fresh surface waters in most countries (van Grinsven et al., 2012)
Denmark	A series of policy action plans have been implemented since the mid-1980s with significant effects on the surplus, efficiency and environmental loadings of nitrogen. Over the last 30 years the nitrogen leaching from the field root zone has been halved, and nitrogen losses to the aquatic and atmospheric environment have been significantly reduced (Dalgaard et al., 2014)
Leipzig, Germany	A reduction in groundwater nitrate concentration from 40 mg to 20 mg per litre was achieved by incentivising organic farming and implementing hydrological measures in drinking water protected areas (BMUB/UBA, 2016)
Schleswig-Holstein, Germany	In some cases, nitrogen use has halved (i.e. from 120 to 60 kg/ha) at the level of individual farms (BMUB/UBA, 2016)
French Loire-Bretagne RBD	Identification of priority catchments and focus on drinking water protected areas. Increase in the number of balanced manure plans on phosphorus from 53 % to 81 % between 2009 and 2012 (Agence de l'eau Loire-Bretagne, 2015)
Ireland	In addition to application standards required by the Nitrates Directive, no organic or chemical fertiliser or soiled water can be applied when heavy rain is forecast within 48 hours or when the ground slopes steeply and there is a risk of water pollution (Amery and Schoumans, 2014)

6.2.5 Chemical pollution

In the WFD, the risks from and impacts of pollution with chemical substances contribute to three status assessments: (1) surface water chemical status based on priority substances (Chapter 3), (2) ecological status as regards RBSPs (Chapter 2), and (3) groundwater chemical status (Chapter 4).

The main findings were:

- The proportion of surface water bodies in the EU that are in good chemical status is 38 %, while 46 % are not achieving good chemical status and 16 % of the water bodies have unknown chemical status. In many Member States, relatively few substances cause failure to achieve good chemical status. Mercury causes failure in a large number of water bodies. If widespread pollution by ubiquitous substances including mercury is disregarded, the proportion in good chemical status improves to 81 % of all surface water bodies and 3 % do not achieve good chemical status (16 % have unknown status). The main pressures leading to failure to achieve good chemical status are atmospheric deposition and discharges from urban waste water treatment plants.

- Several Member States (Austria, Belgium, Germany, Luxembourg, Slovenia and Sweden) extrapolated the results for failure to reach good chemical status to almost all surface water bodies, because the EQS for mercury was exceeded in all monitored waterbodies.

- At the EU level, only 5 % of surface water bodies failed to achieve good ecological status as a result of RBSPs identified by Member States, with zinc and copper being the main RBSPs causing failure.

- A total of 74 % of the area of groundwater bodies in the EU is in good chemical status. Of the 160 pollutants causing failure to achieve good status, 15 are reported by more than five Member States. Nitrates are the predominant groundwater pollutant throughout the EU, followed by pesticides. In addition, salt intrusion (e.g. chloride), some chemicals used industrially (e.g. tetrachloroethylene) and/or metals (e.g. arsenic, nickel and lead) cause problems in some Member States. Agriculture is the main pressure causing failure of groundwater chemical status. Other significant pressures are pollution from contaminated sites or abandoned industrial sites and discharges that are not connected to a sewerage system.

Chemical pollutants are or have been emitted into water bodies through a range of pathways and from a variety of sources, including industry, agriculture, transport, mining and waste disposal, as well as from our own homes. Significant levels of some priority substances have built up from historical use and this legacy pollution may persist in water bodies long after pollutant discharges and inputs have ended.

Of the thousands of chemicals in daily use, relatively few are reported under the WFD. There is a gap in knowledge at European level over whether any of these other substances present a significant risk to or via the aquatic environment, either individually or in combination with other substances. In addition, information on the sources and emissions of many pollutants remains incomplete, limiting the scope for identifying and targeting appropriate measures.

6.2.6 Effect of regulation of chemicals

Contamination caused by chemical pollutants is a major environmental concern in European waters and, consequently, has been addressed by several EU legislative measures and policies (EC, 2018c): Industrial Emissions Directive (EU, 2010), REACH (EU, 2006b), Plant Protection Products Regulation (EU, 2009b), Biocidal Products Regulation (EC, 2012). Reducing hazardous substances in water requires implementation of the current legislation but also adopting more sustainable production and use of chemicals, both in Europe and beyond.

Improved efforts to retain these chemicals in waste water treatment plants with better waste water treatment should go hand in hand with clear efforts to reduce them at source. Such measures can range from raising consumer awareness, to encouraging industries to adjust the composition of their products, to, over the longer term, fundamentally reviewing our use of chemicals and product design; for instance, moving towards using products that can be easily repaired or recycled (Ellen MacArthur Foundation, 2017). Table 6.3 and Box 6.1 show examples of measures to reduce or better understand releases of chemicals to the environment.

Reducing the emissions of priority substances and phasing out priority hazardous substances. The WFD requires the adoption of measures to control the discharges, emissions and losses of priority and priority hazardous substances into the aquatic environment: necessitating progressive reduction in the case of priority substances and cessation or phase out in the case of priority hazardous substances. A decline has been observed in the occurrences of some pesticides stemming from bans or restrictions on their use (e.g. atrazine and diuron; Section 3.5); in other cases, it may take time to see the effects of measures, as some priority substances are persistent and will stay in waters for decades.

Land contaminated with pollutants, for example at abandoned mining areas, old industrial sites or old fuel stations, can cause damage as the pollutants slowly leach into the water environment. Appropriate remedial actions are removal of contaminated material to be treated or incinerated, settling ponds and local treatment plants.

Table 6.3 Examples of measures on regulating chemicals

RBD or country	Measures
EU	The Sustainable Use of Pesticides Directive (EU, 2009a) is an important instrument to help achieve good water status. It reduces the risks and impacts of pesticides on human health and on the environment and it promotes integrated pest management
France	In France, ANSES has implemented the Ecophyto Plan, aimed at reducing agricultural pesticide use by 50 % by 2018. Environmental taxes on sales of pesticides ('redevances pour pollutions diffuses') have been introduced to achieve this objective (ANSES, 2018)
England	In England, one of the measures in the first RBMPs was a GBP 25 million investigation programme by the water industry, the focus of which was to gain an improved understanding of the risks arising from waste water treatment works discharges (UKWIR Chemicals Investigation Programme, 2011)

Box 6.1 Reduction of mercury in the River Lippe, North Rhine-Westphalia

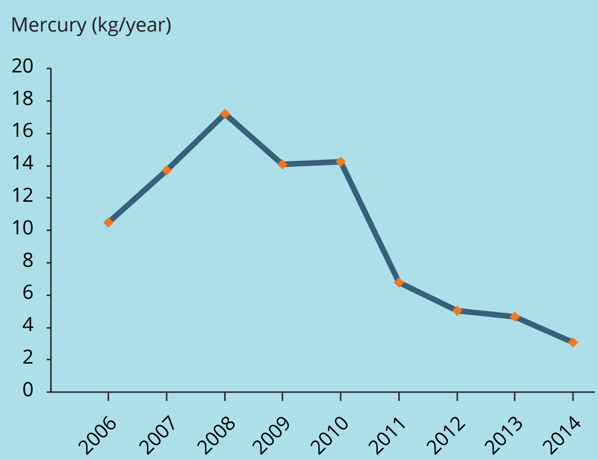
The River Lippe (bottom left) is a tributary of the Rhine, with rural catchment upstream of Hamm and industrial and mining catchment downstream.

The EQS for mercury was not being achieved, so in 2012 additional monitoring programmes were started to better identify discharges and assess status. Improved data were used in modelling, showing the pollutant pathways:

- industrial discharger and power plants: 30-45 %;
- municipal sewage plants: 6-12 % (more than 90 plants);
- diffuse sources: 30-45 %.

Pollution permits were revised for power plants and the chemicals park, rain water systems improved and the chlor alkali production process closed down. These measures led to a reduction in mercury load between 2008 and 2014 (Figure 6.8).

Figure 6.8 Annual loads of mercury at Wesel (Lippe)



Source: State Agency for Nature, Environment and Consumer Protection of North Rhine-Westphalia (LANUV NRW, 2017).

Photo: Lippeverband, © Dr. Baoquan Song.

6.3 Altered habitat and hydrology, including water abstraction

For decades, humans have altered the shape of water bodies and the flow of river courses to farm the land, facilitate navigation, construct hydropower plants and protect settlements and agricultural land against flooding. For these purposes, rivers have been straightened, channelised and disconnected from their floodplains; land has been reclaimed, dams and weirs have been built, embankments have been reinforced, and groundwater levels have changed. These activities have resulted in altered habitats, changed flows, interruptions in river continuity, loss of floodplain connectivity and severe impacts on the status of the aquatic environment. These changes have caused damage to the morphology and hydrology of the water bodies, i.e. to their hydromorphology.

6.3.1 Hydromorphological pressures

Hydromorphological pressures are the most commonly occurring pressure on surface waters, affecting 40 % of all such bodies. The main impact relevant to hydromorphological pressures in the context of reporting is 'altered habitats'.

The most common hydromorphological measures applied in the first RBMPs were fish passes for upstream migration, removing barriers, establishing ecological flow, remeandering, reconnecting backwaters, restoring bank structure, instream structures (large pieces of wood, boulders) and, in some cases, sediment transport management (EC, 2012d).

In the following sections, the hydromorphological pressures are briefly reviewed and examples are given of the recent implementation of some of these key hydromorphological measures in European countries.

6.3.2 Barriers, obstacles and transverse structures: examples of measures to make barriers passable

There are several hundred thousand barriers and transverse structures in European rivers. Some of these are large dams for hydropower production or irrigation storage reservoirs, but the majority are smaller obstacles. Obstacles in rivers cause disturbances and have impacts on river continuity, which vary according to the height and location of the barrier. A major impact on a river could be caused by a single, very damaging structure or by the accumulated effects throughout the length of the river of a series of small structures, which may have only a small impact individually.

In more than half of water bodies affected by hydromorphological pressures, this is because of physical structures (barriers, dams, locks) that have an impact on longitudinal continuity. Barriers are mainly used for hydropower, flood protection and irrigation purposes. However, most barriers reported in the second RBMPs have unknown uses or are even obsolete.

Several European river basins have master plans or conservation plans for restoring the population of threatened fish species (salmon, sturgeon, eel etc.) as well as river continuity. These plans often form the basis of the RBMP measures against obstacles and transverse structures. Table 6.4 illustrates examples of measures implemented during recent years (first RBMP cycle).

6.3.3 Hydromorphological pressures other than continuity interruption and examples of measures

In addition to structures that interrupt longitudinal continuity (barriers on the river network), humans have made many physical changes to rivers, lakes and estuaries, such as changes to the size and shape of natural river channels for land drainage and navigation, and modifications to the beds (via either concrete or a change in sedimentation/erosion), banks and shores of water bodies. These modifications alter natural flow levels and sediment dynamics in surface water bodies and lead to the loss of habitats and impacts on recreational uses.

For almost 60 % of the water bodies affected by hydromorphological pressures, these are caused by physical alterations in the channel, bed, riparian zone or shore. The main drivers of the physical alterations reported for water bodies in the second RBMPs are flood protection and agriculture.

The restoration of bank structures, reconnection of backwaters or floodplains and restoration wetland are among the most common measures applied to achieve hydromorphological improvements. In many rivers, habitat quality at the river banks is poor due to bank fixation. Removal of bank fixation is a prerequisite for many other measures such as re-meandering or widening, as well as for initiating later channel migration and dynamics. Furthermore, tree planting and/or preserving riparian zones aim to reverse the impacts of land use change by improving channel stability, aquatic habitat and terrestrial biodiversity.

Wetlands and floodplains play a particularly important role in the ecological integrity of aquatic ecosystems and they are significant in ensuring or achieving the

Table 6.4 Examples of measures to make barriers passable

RBD or country	Measures
Rhine iRBD	480 measures aimed at improving river continuity were implemented from 2000 to 2012 (ICPR, 2015)
Danube iRBD	From 2009 to 2015, more than 120 fish migration aids were constructed, and 667 barriers remained unpassable out of a total of 1 030 (ICPDR, 2015)
Elbe iRBD	Measures to improve continuity were completed in 60 locations and planned in 88 locations in the International RBD priority network from 2009 to 2015 (ICPE, 2015)
France, Rhône RBD	208 out of 788 priority barriers were made passable from 2010 to 2015 (Rhône-Mediterranée district, 2016)
France, Seine RBD	For 254 out of 5 474 barriers, measures were implemented to improve river continuity from 2013 to 2015 (Seine RBD, 2016)
Austria	More than 1 000 barriers were made passable for fish from 2009 to 2015 (BMLFUW, 2017)
Netherlands	Around 600 barriers were made passable from 2008 to 2015 (Kroes et al., 2015)
UK: England and Wales	229 obstructions across England and Wales were made passable from 2009 to 2014 (NASCO, 2015)
UK: Scotland RBD	Access for fish to 70 water bodies (out of 306 water bodies affected by migration barriers) was secured by the removal of barriers to fish migration from 2009 to 2015 (SEPA, 2015)

good ecological status of adjacent water bodies. Wetlands and floodplains also play a significant role in flood retention. The current situation for European floodplains is critical, with 95 % of the original floodplain area having been converted to other uses. Many of the remaining European floodplains are far from pristine and have lost much of their natural function. For example, of the former 26 000 km² of floodplain area along the Danube and its major tributaries, about 20 000 km² has been isolated by levees (Tockner et al., 2008).

Reconnecting backwaters, such as oxbows and side channels, and wetlands aims to restore the lateral connectivity between the main river channel, the riparian area and the wider floodplain and to revitalise natural processes.

In addition, measures implementing the Floods Directive and developing flood risk management plans can significantly contribute to the restoration of disconnected wetlands and floodplains. Table 6.5 gives examples of measures implemented in recent years.

Table 6.5 Examples of measures addressing other hydromorphological pressures

RBD or country	Measures
Rhine iRBD	Reactivation of floodplains from c. 80 km² in 2005 to c. 125 km² in 2012. Increase in structural diversity of banks from c. 50 km bank length in 2005 to c. 100 km bank length in 2012. Reconnection of alluvial areas from c. 35 areas reconnected in 2005 to 80 alluvial areas reconnected in 2012 (ICPR, 2015)
Danube iRBD	More than 50 000 ha of wetlands/floodplains have been partly or totally reconnected, and their hydrological regime improved, 2009-2015 (ICPDR, 2015)
Austria	Approximately 250 water body restructuring activities were carried out to improve hydromorphological conditions in the largest waters of the so-called priority restoration zones, 2009-2015 (BMLFUW, 2017)
France: Rhône RBD	Morphological restoration works carried out on more than 160 km of rivers. Wetland restoration increased from 7 332 ha restored in 2010 to 16 069 ha restored in 2015 (Rhône-Mediterranée district, 2016)
UK: Scotland RBD	Physical conditions of 36 water bodies improved out of 255 water bodies affected by modifications to their beds, banks or shores, 2009-2015 (SEPA, 2015)

6.3.4 Hydrological alterations, including examples of measures (ecological flows)

Hydrological alterations are pressures that alter the flow regime and/or the water levels of surface water and groundwater. Where water flows and levels are not in good condition, this can affect the abundance and diversity of aquatic plants and animals by reducing the extent, quality, diversity and connectivity of aquatic habitats.

The main pressures on flows and levels come from water abstractions (for public water supply, agriculture or industry) and reservoirs used mainly for hydroelectricity generation and irrigation. Impounded river sections may also be the result of barriers on rivers, which serve uses other than hydropower. Impoundments — in addition to interrupting river/habitat continuity — alter the upstream flow conditions of rivers. A specific type of hydrological pressure related to hydropower comes from hydropeaking activities. Hydropeaking relates to hydropower generation for the provision of peak electricity supply, resulting in artificial water level fluctuations.

Hydrological alterations affect 7 % of all surface water bodies. One of the key measures to mitigate hydrological impacts from water abstractions or hydromorphological pressures is establishing ecological flows. Table 6.6 illustrates examples of ecological flow (or minimum flow) measures implemented during the first RBMPs.

Table 6.6 Examples of measures addressing other hydromorphological pressures

RBD or country	Measures
Austria	Minimum flow was ensured for c. 200 residual water stretches, 2009-2015 (BMLFUW, 2017)
Danube iRBD	Ecological flow requirements for the achievement of good ecological status/potential have already been achieved for 13 out of 144 significant water abstractions identified in the Danube international RBD, 2009-2015 (ICPDR, 2015)
Spain	Minimum flow was ensured for 3 200 water bodies, an increase of more than 800 water bodies since the first RBMPs, 2009-2015 (MAMAPA and CEDEX, 2017)

6.3.5 Water abstractions

Water scarcity and droughts are an increasing problem in many areas of Europe, at least seasonally. The environment needs water to sustain aquatic ecosystems and ecosystem services. Excess water abstraction affects surface and groundwater, altering the hydrological regime and degrading ecosystems and leading to severe ecological impacts that affect not only biodiversity and habitats, but also the quality of water and soil (e.g. affecting water temperature, reducing the dilution capacity of pollutants or causing saline intrusions).

Total water abstraction decreased by around 7 % between 2002 and 2014 (EEA, 2017c). Agriculture and public water supply are the main pressures on renewable water resources. In the EU, the amount of water abstracted for agricultural use (24 %) varies widely; in southern countries the proportion is 65 % (and can be as much as 80 %), most of which is used for crop irrigation. In the spring of 2014, the agricultural sector used 66 % of the total water used in Europe, and around 80 % of this occurred in the Mediterranean region. In 2013, the total irrigable area in the EU-27 ([42]) was 18.7 million ha, an increase of 13.4 % compared with 2003 (Eurostat, 2016b), and 10.2 million ha was irrigated. The highest proportions of irrigable areas at country level are found, unsurprisingly, in some southern Member States, with Greece and Malta having 44.9 % and 38.6 %, respectively. Cyprus, Italy and Spain follow, with 34.9 %, 33.9 % and 31.1 %, respectively.

Water abstractions are a key pressure on many water bodies, in particular during temporary periods of drought or in water scarcity-prone areas. Abstractions are a significant pressure for 7 % of surface water bodies in the second RBMPs, with higher regional importance in southern Europe (e.g. in Spain, Italy and France). Abstractions (mainly for agriculture and public water supply) and artificial recharge are the main pressures on groundwater bodies in poor quantitative status.

6.3.6 Measures to reduce impact of overabstraction

In the past, European water management has largely focused on increasing supply by, for example, drilling new wells, constructing dams and reservoirs, desalination, and building large-scale water-transfer infrastructures. However, as Europe cannot endlessly

([42]) The 27 Member States of the EU up to 30 June 2013.

increase water supply, measures to reduce demand could include the use of economic instruments; water loss controls; water reuse and recycling; increased efficiency of domestic, agricultural and industrial water use; and water-saving campaigns supported by public education programmes. Water savings would bring additional benefits, for example by reducing pollution discharges and energy consumption.

Water efficiency — wasting less water and increasing productivity per volume — is essential for building resilience into our systems and adapting to climate change. Water efficiency is an economic and environmental opportunity that serves sectors and functions that use water, helps economic growth and, at the same time, safeguards the environment. To realise a boost in water efficiency, both technological development and improved governance for water are needed, together with monitoring methodologies such as 'environmental accounting'.

Under the WFD, Member States are obliged to implement water pricing policies that provide adequate incentives to use water resources efficiently. In many countries, water pricing and metering, together with water saving measures, have been highly effective in changing consumer behaviour (Box 6.2).

Box 6.2 Pricing and non-pricing measures for managing water demand in Europe (EEA, 2017e)

Based on a study of a set of case studies, it was found that EU water policies encouraged Member States to implement better management practices, notably water pricing policies (e.g. levies or tariffs on water use) in combination with other measures, such as encouraging the use of water-saving devices on shower heads or taps or undertaking education and awareness campaigns. A mix of the two has been used across Europe, with varied results. The assessment concluded that national and local water management strategies should focus on designing the most effective combination to get the best results in reducing household water consumption and improving efficient use. The demand for water continues to increase, especially for domestic consumption. The increased intensity and frequency of droughts and water scarcity was identified as the key challenge for five (Cyprus, France, Italy, Romania and Spain) of the eight countries studied. Overexploitation of groundwater resources was also cited, as demand for water rises not only for the residential and tourist sectors but also for others such as industry and agriculture.

Various practices can be implemented to ensure that the agricultural sector uses water more efficiently. These include changing the timing of irrigation so that it closely follows crop water requirements, adopting more efficient techniques such as drip irrigation systems, and implementing the practice of deficit irrigation — an optimisation strategy in which irrigation is applied during the drought-sensitive growth stages of a crop.

Water leakage from supply systems in parts of Europe is substantial; countries face major challenges in the construction and maintenance of water-related infrastructure, and it is important to invest in the detection and repairing of leaks.

Additional water supply infrastructures — such as water storage, water transfers or the use of alternative sources — may be considered when other demand options have been exhausted. Water reuse can have two important benefits: it effectively increases the available water resources and it minimises waste water outflow. Treated waste water is currently reused in some southern European countries, primarily for irrigation: crop cultivation, public gardens, parks and golf courses.

Drought management is an essential element of water resource policy and strategies. Drought management plans, based on the characterisation of possible droughts in a basin, their effect, and possible mitigation measures, should be prepared on a river basin scale and before emergency schemes need to be applied. Drought management plans, by promoting sustainable water use, are closely linked with the WFD objectives.

Land management and land use planning are essential to the management of water resources in water-scarce areas. Throughout Europe, important wetlands, which help to store water, have been drained. One priority should be to retain rainwater where it falls, enabling water infiltration through the re-establishment of wetlands and the increased recharge of aquifers.

6.4 Integrated water management

Water is an essential resource for human health, agriculture, energy production, transport and nature, but securing sustainable management of water and of aquatic and water-dependent ecosystems and ensuring that enough high-quality water is available for all purposes, remains one of the key challenges of our time in Europe.

The results from the second RBMPs show that European waters remain under pressure from multiple sources: water pollution, overabstraction and structural change from various sectors and human activities. These pressures affect the functioning of water-related ecosystems, contribute to biodiversity loss, and threaten the long-term delivery of ecosystem services and benefits to society and the economy. To ensure sustainable management of water resources, further policy action will be needed to improve the coherence between economic, societal and environmental goals.

Several European policies are in place in support of the EU WFD, which, together with the Floods Directive, GWD, Environmental Quality Standards Directive, UWWTD, Nitrates Directive and Bathing Water Directive, provides powerful and essential tools for managing water quality in the EU.

Sustainable and integrated water management plays a substantial role in the UN's 2030 Agenda for Sustainable Development, the EU's 7th EAP (EC, 2014; EU, 2013b), and the achievement of the EU's biodiversity strategy (EC, 2011, 2012a). Based on the review of the first RBMPs, the Blueprint to safeguard Europe's water resources called for an increase in the rate of implementation of integrated water management in Europe (EC, 2012b). Three areas offering substantial opportunities to improve implementation of, and support for the achievement of, WFD objectives are highlighted below.

6.4.1 Protection of Europe's aquatic ecosystems and their services

Many opportunities exist for improving the implementation of and maximising synergy between environmental policies relevant to the protection of the water environment. EU policies on water and the marine environment, nature and biodiversity are closely linked, and together they form the backbone of environmental protection of Europe's ecosystems and their services.

The aim of the nature directives (Birds (2009/147/EC) and Habitats (92/43/EEC) — EC, 2018f), the biodiversity strategy 2020 (EC, 2012a), the Marine Framework Strategy Directive (EU, 2008b) and the WFD is to ensure healthy aquatic ecosystems, while at the same time maintaining a balance between water and nature protection and the sustainable use of natural resources. The implementation of and knowledge generation via the directives partly runs in parallel, and there is not enough coordination between the processes (EC, 2016b). There is thus much scope for more integration concerning monitoring, objectives and targets, as well as in the planning processes on a national level and on an RBMP or protected area level.

Regarding EU-level assessment, there is potential to make some assessments integrating data and information from the nature directives (conservation status, trends in species/habitats, pressures and threats; Natura 2000), the Invasive Alien Species Regulation and the status and pressures from the WFD.

The use of management concepts such as the ecosystem services approach and ecosystem-based management can offer ways to improve coordination by setting a more common language and framework. This framework may be used to evaluate multiple benefits that healthy water bodies offer and outline synergies and trade-offs in management and related policies (Blackstock et al., 2015; Rouillard et al., 2015).

6.4.2 Restoring degraded water ecosystems

Until 20-30 years ago, the focus of physical water management in many parts of Europe was on providing flood protection, facilitating navigation and ensuring the drainage of agricultural land and urban areas.

Nowadays, water management increasingly includes ecological concerns, working with natural processes. This is in line with the objective of the 7th EAP, 'to protect, conserve and enhance the Union's natural capital'. It is also consistent with Target 2 of the EU's biodiversity strategy, which aims to ensure maintenance of ecosystems and their services by establishing green infrastructure and restoring at least 15 % of degraded ecosystems by 2020. This target means that degraded aquatic ecosystems must also be restored. The above-mentioned integration between policies can be important in restoring aquatic ecosystems.

Restoring aquatic ecosystems, such as 'making room for the river', river restoration or floodplain rehabilitation, 'coastal zone restoration projects' and integrated coastal zone management, has multiple benefits for the water ecosystems. The EU-wide green infrastructure strategy (EEA, 2017d, EC, 2018g) includes rivers and floodplains as important elements, and aims to reconnect existing nature areas and improve the overall quality of ecosystems. It also includes natural water retention measures (NWRMs; EC, 2013, 2018h) that aim to increase soil and landscape water retention and groundwater recharge. Nature-based solutions and their corresponding measures not only help restoration, but also have clear co-benefits by promoting cost-efficient flood risk reduction via green infrastructure solutions (EEA, 2017d).

Small inland water bodies (streams and ponds) are abundant in most European countries. In Europe, 80 % of the millions of kilometres of river network are small rivers, commonly known as headwaters, creeks, streams, brooks or wadeable rivers, and there are many hundreds of thousands of small lakes and ponds (Kristensen and Globevnik, 2014). Small water bodies are ecologically very important. They support specific and important hydrological, chemical and biological processes. Unfortunately, because of human activities, the ecological condition of small water bodies is poor in many parts of Europe. Coordinated activities with protected habitats under the nature directives and WFD activities should help to ensure the protection of these valuable water bodies.

6.4.3 Integration of water aspects into sector policies

The WFD and RBMPs have led to a significant shift in Member States' water management and increased the availability of information to the public; they are providing a much better understanding of status and pressures, as well as of the measures to reduce pressures and achieve improvement in status.

From the assessment of status, and from the assessment of pressures and impacts, it is evident that the driving forces behind the achievement or non-achievement of good status are activities in sectors such as agriculture, energy or transport. This integration throughout the river basin is enhanced, for example, by better cooperation between competent authorities, increased involvement of stakeholders and early participation of the public. Recent policy reviews (Rouillard et al., 2016) have shown that there is still much scope to further mainstream environmental policy actions into sectors such as agriculture, energy and transport to reduce the driving forces behind aquatic biodiversity loss.

Agricultural production has become increasingly intensive, with high inputs of fertilisers and pesticides leading to the emission of large amounts of pollutant loads into the water environment. In northern Europe, many lowland agricultural streams have been straightened, deepened and widened to facilitate land drainage and to prevent localised flooding. Water storage and abstraction for irrigated agriculture has changed the flow regime of many river basins and lowered groundwater levels, particularly in southern Europe. To achieve good status, it will be essential to address agricultural pressures, while maximising the beneficial effects of good land management.

Poorly planned and managed forests are known to exert pressure on the water environment. Environmental problems can arise if woodland is planted in unsuitable locations. Well-planned and managed forest can be of significant benefit to the local and global environment and may play an active role in rehabilitating degraded and contaminated land, act as a sink for or protect against potential sources of diffuse pollutants, and, arguably, reduce flood risk.

Some activities related to energy production, such as hydropower, the use of cooling water and the growing of energy crops, result in pressures on water management. The more than 25 000 hydropower plants in Europe have been identified as one of the main drivers affecting the status of rivers and resulting in loss of connectivity, altered water flow and sediment transport.

In several EU Member States, an increase in hydropower generation is needed to achieve the 2020 Renewable Energy Directive target of 20 % of energy production from renewable sources. This increase in generation can be achieved by increasing the efficiency of hydropower at existing sites but also by building new hydropower plants. It is important to ensure that existing and forthcoming EU policies to promote hydropower are compatible with the WFD and to clearly consider the impacts on water bodies.

Around 40 000 km of inland waterways play an important role in the transport of goods in central Europe. These waterways are generally seen as more environmentally friendly than using road transport. However, navigation activities and/or navigation infrastructure works are typically associated with changes in morphology (channel maintenance, dredging, channelisation and straightening, bank reinforcement) and hydrology, spread of invasive alien species and pollution (oil spills, and antifouling paints and other substances used to prevent the attachment of unwanted organisms to ships).

Therefore, despite the advantages of these sectors and policies for society, there is a need to strike a balance between the benefits to and the impacts on aquatic ecosystems. Europe 2020 is the EU's strategy for economic growth in Europe, and it envisages the development of a 'greener', more environmentally friendly economy (EC, 2010). Sustainable water management is a critical element of this green economy because healthy and resilient ecosystems provide the services needed to sustain human well-being and, thus, our economy. Therefore, we need to ensure that economic sectors, such as agriculture, energy and transport, also adopt management practices that can keep water ecosystems healthy and resilient.

The WFD is an important policy to achieve this. The good status objective under the WFD defines these boundaries of sustainability. Managing water in a green economy means using water in a sustainable way in all sectors and ensuring that ecosystems have both the quantity and the quality of water needed to function. It also means fostering a more integrated and ecosystem-based approach that involves all relevant economic sectors as well as society as a whole.

Abbreviations

7th EAP	Seventh Environment Action Programme
AWB	Artificial water body
CIS	Common implementation strategy
DMP	Drought management plan
EEA	European Environment Agency
EQS	Environmental quality standards
EU	European Union
EU-28	The 28 EU Member States as of 1 July 2013
GWD	Groundwater Directive
HMWB	Heavily modified water body
IED	Industrial Emissions Directive
NWRM	Natural water retention measure
PAH	Polyaromatic hydrocarbon
pBDE	Polybrominated diphenyl ethers
PoM	Programme of Measures
RBD	River basin district
RBMP	River basin management plan
RBSP	River basin-specific pollutant
SoW	State of water
TBT	Tributyltin
UN	United Nations
uPBT	Ubiquitous, persistent, bioaccumulative and toxic
UWWTD	Urban Waste Water Treatment Directive
WFD	Water Framework Directive
WISE	Water Information System for Europe

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