EEA/NSV/10/002

European Topic Centre
Inland, coastal, marine waters

Ecological and chemical status and pressures in European waters

Thematic assessment for EEA Water 2012 Report

ETC/ICM Technical Report 1/2012

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The European Topic Centre on inland, coastal and marine waters (ETC/ICM) is a consortium of European institutes under contract to the European Environment Agency: BGR, CENIA, Deltares, DHI, Ecologic, HCMR, ICES, IFREMER, Indra, INGV, IWRS, NERC-CEH, NIVA, NTUA, SAHFOS, SYKE, SZIU, TC Vode, UBA and VITUKI.

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Layout/editing: Eva Hasíková, Miluše Rollerová, and Shane Hume

Legal notice

The report is based on data delivered by the Member States via WISE up to May 2012 and in some cases information is available in digital versions of RBMPs. Member States and Stakeholders comments to the draft technical reports on ecological and chemical status and pressures and hydromorphology during the consultation in February and March 2012 have been included as far as possible. Where data are available, it has been dealt with, and is presented, to the best of our knowledge. Nevertheless inconsistencies and errors cannot be ruled out.

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ISBN 978-80-85087-97-0

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Contents

Abbreviations

AWB – Artificial water body
EEA – European Environmental Agency
ETC/ICM – European Topic Centre on Inland Coastal and Marine Waters
EU – European Union
GEP – Good ecological potential
GES – Good ecological status
HMWB – Heavily modified water body
MS – Member States
RBD - River Basin District
RBMP - River Basin Management Plan
WBs - water bodies
WFD – Water Framework Directive
WFD-CIS – Water Framework Directives Common Implementation Strategy

Executive summary

Background, context and main aim linked to the Blueprint report and the WFD article 18

2012 is the European year of water in which the European Commission published its 'Blueprint to safeguard Europe's water resources' comprising reviews of the Water Framework Directive (WFD) (2000/60/EC), water scarcity and drought, and adaptation to climate change policies. The first reporting of the River Basin Management Plans (RBMPs) under the WFD was due at the end of 2009. Most Member States have reported their RBMPs and delivered an enormous amount of data on status and pressures to the Water Information System for Europe (WISE) WFD database. This report - Ecological and chemical status and pressures of European waters - is based on an assessment of the RBMP data reported by Member States together with other related sources of information and has been done by the European Topic Centre for Inland, Coastal and Marine Waters (ETC-ICM) in close collaboration with the EEA. The main aim of the report has been to provide an assessment of the status of Europe's waters and the pressures affecting them. The report is used as a background report for the EEA 2012 'State of Europe's water' assessments, which reflects the cooperation with the Commission on the assessment of implementation of the WFD as laid out in Article 18 of the WFD. This article states that:

'The EU 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 (two years after the Member States have delivered the RBMPs). The report shall among others include the following:

- A review of progress in the implementation of the directive
- A review of the status of surface water and groundwater in the Community undertaken in coordination with the European Environment Agency.

Constraints on confidence due to data gaps and methodology issues

The quality of the assessment relies on the quality of the Member States' reports and data delivery. There are examples of very good, high quality reporting. However, there are many reporting gaps or contradictions that can lead to wrong and/or incomplete assessments.

Due to delays in the development of national classification systems in many Member States, only a few biological quality elements could be used for assessing ecological status of water bodies for the first RBMPs. Many water bodies have been classified without actual monitoring of biology or chemical pollutants, mainly using expert judgment based on the information compiled in the pressure and impact analyses (WFD article 5). Thus, the confidence in the classification of the ecological and chemical status was often low in the first RBMPs. However, compared to the situation before the WFD, there has been a significant improvement of the knowledge base and increased transparency by bringing together information on status, pressures and impacts on water bodies at river basin level.

Caution is advised concerning country and river basin district (RBD) comparisons, as results may be affected by the methodology approach used by a particular individual Member State. Likewise, it is not advisable to draw detailed conclusions on the chemical status results, as there was a lack of chemical monitoring and of comparability of the information on chemical status of water bodies among Member States. Nevertheless, it is the authors' opinion that the main European overview of the ecological status Europe's waters and the pressures affecting them reflects the reality emerging from the current state of knowledge.

Ecological and chemical status, pressures and impacts

The WFD requires that all the issues mentioned above are addressed in order to ensure that by 2015 all water bodies have good status. For surface waters, there are two separate classifications, ecological and chemical status. Groundwater bodies are classified according to their chemical status and quantitative status. For a water body to be in overall good status, both chemical status and ecological or quantitative status must be at least good.

The European Union (EU) Member States have via the RBMPs reported information from more than 127 000 surface water bodies: 82% of them rivers, 15% lakes, and 3% coastal and transitional waters, as well as from more than 13 000 groundwater bodies. The results are presented below.

Ecological status

- More than half of the surface water bodies in Europe are reported to be in less than good ecological status or potential, and will need mitigation and/or restoration measures to meet the WFD objective.
- River water bodies and transitional waters are reported to have worse ecological status or potential and more pressures and impacts compared to water bodies in lakes and coastal waters.
- The pressures reported to affect most surface water bodies are pollution from diffuse sources, in particular from agriculture, causing nutrient enrichment, and hydromorphological pressures resulting in altered habitats.
- The worst areas of Europe concerning ecological status and pressures in freshwater are in central and north-western Europe, while for coastal and transitional waters, the Baltic Sea and Greater North Sea regions are the worst.

A large proportion of water bodies, particularly in the regions with intensive agriculture and high population density have poor ecological status and are affected by pollution pressures. The situation calls for increased attention to achieve good water quality and ecological status. Despite some progress in reducing agricultural inputs of pollutants, diffuse pollution from agriculture is a significant pressure in more than 40% of Europe's water bodies in rivers and coastal waters, and in one third of the water bodies in lakes and transitional waters. The RBDs and Member States with a high proportion of water bodies affected by diffuse pollution are found in north-western Europe in particular, and correspond to the regions with high fertilizer input and high river nitrate concentration. Discharges from wastewater treatment plants and industries and the overflow of wastewater from sewage systems still cause pollution: 22% of water bodies still have point sources as a significant pressure.

Hydromorphological modifications causing altered habitats are the other most commonly occurring pressures in rivers, lakes and transitional waters, affecting around 40% of river and transitional water bodies and 30% of the lake water bodies. The hydromorphological pressures are mainly attributable to hydropower, navigation, agriculture, flood protection and urban development. Further information on hydromorphological pressures and impacts are available in a separate Hydromorphology assessment report available at the ETC-ICM web-site (EEA ETC/ICM, 2012).

Chemical status

The information provided in the RBMPs on chemical status is not sufficiently clear to establish a baseline for 2009. The chemical quality of water bodies has improved significantly in the last 30 years, but the situation as regards the priority substances introduced by the WFD is not clear. The assessment of chemical status presents a large proportion of water bodies with unknown status. Monitoring is clearly insufficient and inadequate in many Member States, where not all priority substances are monitored and the number of water bodies being monitored is very limited. The results from the first RBMPs showed that:

- Poor chemical status for groundwater, by area, is about 25% across Europe. A total of 16 Member States have more than 10% of groundwater bodies in poor chemical status; this figure exceeds

50% in four Member States. Excessive levels of nitrate are the most frequent cause of poor groundwater status across much of Europe.

- Poor chemical status for rivers, lakes, and transitional and coastal waters does not exceed 10%, aggregated across Europe as a whole. Notably, the chemical status of many of Europe's surface waters remains unknown, ranging between one third of the lakes and more than half of the transitional waters.
- A total of 10 Member States report poor chemical status in more than 20% of rivers and lakes with known chemical status, whilst this figure rises to above 40% in five Member States.
- Polycyclic aromatic hydrocarbons (PAHs) are a widespread cause of poor status in rivers. Heavy metals are also a significant contributor to poor status in rivers and lakes, with levels of mercury in Swedish freshwater biota causing 100% failure to reach good chemical status. Industrial chemicals such as the plasticiser di (2 ethylhexyl) phthalate (DEHP) and agro-chemical pesticides also constitute widespread causes of poor chemical status in rivers.
- Six Member States report poor chemical status in transitional waters to be more than 50% of the water bodies with known chemical status. PAHs, the antifouling biocide tributyltin (TBT) and heavy metals are the most common culprits.
- Six Member States report all their coastal waters as having good chemical status, although in five others, poor chemical status exceeds 90% of the water bodies with a known chemical status. A variety of pollutant groups contribute to poor status in coastal waters, reflecting a diverse range of sources.

Ecologic status and water quality

Pollutants in many of Europe's surface waters have led to detrimental effects on aquatic ecosystems and the loss of freshwater flora and fauna. Implementation of the Urban Waste Water Treatment Directive, together with comparable non-EU legislation, has led to improvements in wastewater treatment across much of the continent. This has resulted in reduced point discharges of nutrients and organic pollution to freshwater bodies. Clear downward trends in water quality determinants related to urban and industrial wastewater are evident in most of Europe's surface waters, although these trends have leveled in recent years, and is more conspicuous in rivers than it the other water categories.

Despite improvements in some regions, diffuse pollution from agriculture remains a major cause of the poor water quality currently observed in parts of Europe, contributing 50-80% of the total nitrogen load and approximately half of the total phosphorus load on Europe’s freshwaters.

Ecological status is clearly correlated with nutrients in all surface water categories. Much lower nutrient concentrations are found in water bodies with high and good ecological status than in those with moderate or worse ecological status.

Projections of trends in river water bodies currently in moderate or worse ecological status indicate that good status may be achieved in 2027 for phosphorus (if the current trend continues), but not for nitrate.

The results show the need for further nutrient reduction measures, in particular addressing diffuse source pollution from agriculture, which can be implemented through the WFD RBMPs and through full compliance with the Nitrates Directive.

1. Introduction

1.1. EEA 2012 state of Europe's water reports

Europe's waters are affected by several pressures including water pollution, water scarcity, floods; and by major modifications affecting morphology and water flow. To maintain and improve the essential functions of our water ecosystems, we need to manage them well. This can only succeed if we adopt the integrated approach introduced in the Water Framework Directive (WFD) and other water policies. Europe has via the WFD and other water policies strong water legislation in place and the challenge now is to see how it works in practice.

2012 is the European year of water in which the European Commission published its "Blue-print to safeguard European waters" comprising reviews of the WFD, water scarcity and drought and vulnerability and adaptation policies. To accompany and inform the Blue-print the EEA has throughout 2012 produced a set of reports on the "State of Europe's water". The reports are developed in close cooperation and coordination with the European Commission DG Environment's assessment of the WFD River Basin Management Plans (RBMPs) and the other work preparing the Blue-print to safeguard Europe's water resources.

The Commission has published its third WFD implementation report as required by Article 18 of the WFD. This third implementation report is formed by the Communication from the Commission to the European Parliament and to the Council on the Water Framework Directive implementation report (EC, 2012a), plus this Commission Staff Working Document on the European Overview of the implementation (EC, 2012b) and another Commission Staff Working Document (EC, 2012c) with a set of annexes describing the results of the assessment by the Commission of the RBMPs relating to each Member State.

The EEA 2012 State of Europe's water assessments consist of three thematic assessments and an overarching synthesis and integrated report.

- Efficient Use of Water Resources (World Water Forum, Marseilles, March 2012)
- Vulnerability (Water scarcity and drought, floods, water quality) – Autumn 2012
- European waters – assessment of status and pressures – Autumn 2012

In addition, a number of EEA/ETC-ICM technical background reports and documents by the ETC ICM are published, these report will contain more detailed information and results on the assessment of information from RBMPS on status and pressures

- WFD: Ecological and chemical status and pressures – Autumn 2012
- WFD: Hydromorphology – Autumn 2012
- Water scarcity and drought, Floods etc.

This report is compiled from information on the status of European rivers, lakes and coastal water bodies as reported from EU-Member States in the first round of RBMPs under the WFD. This work by the EEA reflects the cooperation with the EU Commission on the assessment of implementation of the WFD as laid out in Article 18 of the WFD according to which:

The EU 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 (two years after the Member States have delivered the RBMPs). The report shall among others include the following:

- *a review of progress in the implementation of the Directive;*

- *a review of the status of surface water and groundwater in the Community undertaken in coordination with the European Environment Agency.*

The information from the RBMPs is accompanied by information on the status of European waters, which the EEA has collected since the mid-1990s within its EIONET (European Information and Observation NETwork). This information following the agreement in the agencies regulation, gives in addition and complementary to the WFD information a certain trend analysis and with this helps providing a baseline for future evaluation of the WFD achievements and underlying directives.

The RBMPs are comprehensive documents that cover many aspects of water management, consisting of hundreds to thousands of pages of information. They were published in the national languages. The assessment of the plans is therefore a very challenging and complex task that involves dealing with extensive information in more than 20 languages. The quality of the EEAs assessments relies on the quality of the Member States' reports and data delivery. Bad or incomplete reporting can lead to wrong and/or incomplete assessments.

1.1.1. Geographical settings

Europe has an extensive network of rivers and streams summing to several million kilometres of flowing waters, and more than a million lakes cover the European continent. The European Union has a long coastline[(1)] and several hundreds of transitional waters in the form of fjords, estuaries, lagoons, and deltas. Each body of water has its own characteristics.

River Basin Districts

The implementation of the WFD has resulted in the designation of 111 river basin districts (RBDs) across the EU (Map 1.1). Since 40 river basin districts are international, there are around 180 national RBDs or national parts of international RBDs. The international RBDs cover more than 60% of the territory of the EU. An important feature of the WFD is a planning mechanism, referred to as international river basin plans, by which Member States should co-operate to ensure that environmental objectives targets are met.

Europe's seas include the Baltic, North East Atlantic, Black, and Mediterranean Seas. The North East Atlantic includes the North Sea, but also the Arctic and Barents Seas, the Irish Sea, and the Celtic Sea, Bay of Biscay and Iberian Coast.

[(1)] Coastal waters represent the interface between land and ocean, and in the context of the Water Framework Directive coastal waters include water, that has not been designated as transitional water, extending one nautical mile from a baseline defined by the land points where territorial waters are measured.

Map 1.1 Map of river basin districts and sea regions used in the report

International and national river basin districts and sea regions	
International river basin district	Regional sea coastline
National river basin district	Black Sea
International river basin district outside EU-27	Mediterranean Sea
National river basin district outside EU-27	Celtic Sea, Bay of Biscay and the Iberian Coast
International river basin district boundary	Greather North Sea
Country boundary	Baltic Sea
EU-27 boundary	Outside EU-27

Source: Administrative boundaries: European Commission - Eurostat/GISCO and WISE River basin districts (RBDs) processed by the ETC/ICM.

1.2. European water policies

The main aim of EU water policy is to ensure that throughout the EU a sufficient quantity of good quality water is available for people's needs and for the environment. Since the 1970s, through a variety of measures, the EU has worked hard to create an effective and coherent water policy.

The first directives, adopted in the mid-1970s, established a series of quality standards aimed at protecting human health and the living environment, including surface water used for drinking water, bathing water, fish waters, shellfish waters, groundwater and water for human consumption. In the same "generation" of legislation, a directive that set standards for the discharge of dangerous substances into the aquatic environment was for many years the main instrument to control emissions from industry (see also EC (2008a)).

However, the quality standard approach proved insufficient for protecting Europe's polluted waters. When eutrophication became a major problem in the North and Baltic seas and parts of the Mediterranean in the late 1980s, the EU started to focus on the sources of pollutants. This led to the Directive on Urban Wastewater Treatment (UWWT) which requires Member States to invest in infrastructure for collecting and treating sewage in urban areas while the Nitrates Directive requires farmers to control the amounts of nitrogen fertilisers applied to fields. And the Directive on Integrated

Pollution Prevention and Control (IPPC) adopted a few years later aims to minimise pollutants discharged from large industrial installations.

The Water Framework Directive (WFD), which came into force on 22 December 2000, establishes a new framework for the management, protection and improvement of the quality of water resources across the European Union (EU). The WFD calls for the creation of River Basin Districts. In the case of international districts that cover the territory of more than one EU Member State the WFD requires coordination of work in these districts.

EU Member States should aim to achieve good status in all bodies of surface water and groundwater by 2015 unless there are grounds for derogation. Only in this case achievement of good status may be extended to 2021 or by 2027 at the latest. Good status means that certain standards have been met for the ecology, chemistry, morphology and quantity of waters. In general terms 'good status' means that water only shows slight change from what would normally be expected under undisturbed conditions. There is also a general 'no deterioration' provision to prevent deterioration in status.

The Water Framework Directive establishes a legal framework to protect and restore clean water in sufficient quantity across Europe. It introduces a number of generally agreed principle and concepts into a binding regulatory instrument. In particular, it provides for:

- Sustainable approach to manage an essential resource: It not only considers water as a valuable ecosystem, it also recognises the economy and human health depending on it.
- Holistic ecosystem protection: It ensures that the fresh and coastal water environment is to be protected in its entirety.
- Ambitious objectives, flexible means: The achievement of "good status" by 2015 is ambitious and will ensure satisfying human needs, ecosystem functioning and biodiversity protection. At the same time, the Directive provides flexibility in achieving them in the most cost effective way and introduces a possibility for priority setting in the planning.
- The right geographical scale: The natural area for water management is the river basin (catchment area).
- Polluter pays principle: The introduction of water pricing policies with the element of cost recovery and the cost-effectiveness provisions are milestones in the application of economic instruments for the benefit of the environment.
- Participatory processes: WFD ensures the active participation of all businesses, farmers and other stakeholders, environment NGOs and local communities in river basin management activities.
- Better regulation and streamlining: The WFD and its related directives (Groundwater Daughter Directive (2006/118/EC); Floods Directive COM(2006)15) repeal 12 directives from the 1970s and 1980s which created a well-intended but fragmented and burdensome regulatory system. The WFD creates synergies, increases protection and streamlines efforts.

Implementation of the Directive is to be achieved through the river basin management planning process which requires the preparation, implementation and review of a river basin management plan (RBMP) every six years for each RBD identified. This requires an approach to river basin planning and management that takes all relevant factors into account and considers them together. There are five main elements of the process:

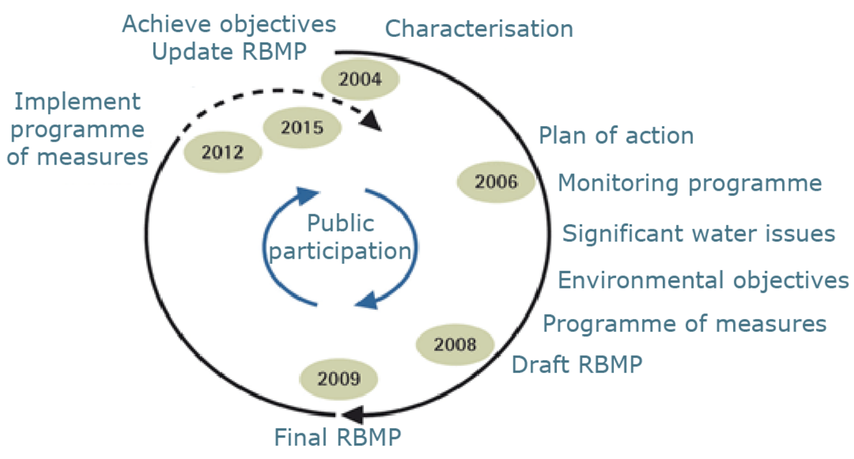
- Governance and public participation;
- Characterisation of the river basin district and the pressures and impacts on the water environment;
- Environmental monitoring based on river basin characterisation;
- Setting of environmental objectives; and
- Design and implementation of a programme of measures to achieve environmental objectives. An important aspect of the measures are full implementation of the Urban Waste Water Treatment Directive (UWWTD) and Nitrates Directive (NiD) on reducing pollutants that reduce pollution and will improve water quality and aid, the achievement of good status under the WFD.

RBMPs are plans for protecting and improving the water environment and have been developed in consultation with organisations and individuals. River basin planning is a gradual cyclical process that involves public participation throughout. RBMPs follow a series of steps shown in Fig. 1.1.The river basin planning process started more than ten years ago with the implementation of the WFD in national legislation and establishing the administrative structures. The next steps in 2004 were analyses of the pressures and impacts affecting the water environment in the river basin district. The findings were published in 2005 in the characterisation report required by Article 5 of the WFD.

In 2006 monitoring programs within the RBDs had to be established. The WFD monitoring network will enable to identify problems and resolve them, thereby improving the water environment. The reports and consultation on Significant Water Management Issues (SWMIs) in 2007 and 2008 were important steps leading towards the production of the first RBMPs.

The RBMPs describe the measures that must be taken to improve the ecological quality of water bodies and help reach the objectives of the WFD. The WFD requires via the RBMPs a Programme of Measures (PoM) to be established for each RBD. The measures implemented as part of the programme should enable water bodies to achieve the environmental objectives of the WFD. The PoM must be established by December 2009 and be made operational by December 2012.

Figure 1.1 The WFD river basin planning process



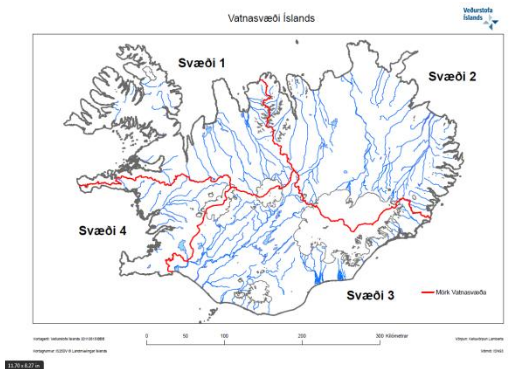
Source: Based on EC, 2003a.

European countries that are not members of the EU, have over the last years developed similar river basin activities as introduced by the WFD in the EU Member States (Text Box 1.1)

Text Box 1.1 River management plans in selected non-EU countries

Turkey: *Basin Protection Action Plans* have been prepared by the General Directorate of Water Management with the same vision as WFD RBMPs. The 25 Basin Protection Action Plans aims at; protection of the water resources potential in every condition, best use of water resources, prevention of pollution and improving the quality of polluted water resources. A new EU supported project “River Basin Management Plans for five Basins” which has a 6.6 million € budget will be started in 2013.
Source: Cicek, 2012.

Iceland: In 2007, the Icelandic parliament voted for adaptation of the WFD of the EU with the objective to fulfill its requirements before 2017. Iceland has identified one RBD and four sub-basins and several coastal waters.
Source: Guðmundsdóttir, 2010.



As a non-EU member, **Switzerland** is not bound to implement the WFD. However the Swiss legal system sets comparable targets regarding water protection and management. In contrast to the WFD, which is based on planning periods with specified targets, the Swiss legislation formulates binding requirements including a set of national limits which must be met at all times.
As a member of the international commissions of the Rhine River Basin and of the Lakes of Constance, Geneva, Lugano and the Lago Maggiore, Switzerland collaborates with its neighboring states to achieve water protection goals and to implement endorsed programmes, and thus indirectly adopts certain principles of the WFD.
Source: EEA, 2010a.

Norway is connected to the European Union as an EFTA country, through the Agreement on the European Economic Area (EEA) . The WFD was formally taken into the EEA-agreement in 2009, granting the EFTA countries extended deadlines for the implementation.
The WFD was transposed into the Norwegian Regulation on a Framework for Water Management in 2007. Norway performed a voluntary implementation of the WFD in selected sub-districts across the country from 2007 until 2009, thus gaining the experience of River Basin Management planning. River Basin Management Plans for the selected sub-districts were adopted by the County Councils in 2009, and approved by the national Government in June of 2010.
River Basin Management Plans (RBMPs) covering the entire country will be prepared from 2010 until 2015, synchronized with the time schedule of the second cycle of implementation in the EU.
Source: Vannportalen, 2012.

Sava River is the third longest and the largest by discharge tributary of the Danube River. It runs through four countries (Slovenia, *Croatia, Bosnia and Herzegovina,* and *Serbia*), and also has part of its catchment in *Montenegro* and *Albania*.
The International Sava River Commission (ISRBC) is working togeher with countries on the development of the Sava RBMP, in line with the EU Water Framework Directive. A consultation of the draft Sava RBMP has run from December 2011 to April 2012.
Source: Sava Commission, 2012.

2. Data overview

2.1. River Basin Management Plans (RBMPs)

According to the WFD River Basin Management Plans should since 22.12.2009 be available in all River Basin Districts across the EU. There are however serious delays in some parts of the EU, and in some countries consultations are still on-going.

By May 2012, 23 EU Member States had their RBMPs adopted. Four Member States, Portugal, Spain, Greece and Belgium (the Walloon and Brussels parts) had not yet finalised the consultation of the RBMPs and therefore had no adopted RBMPs.

2.2. WISE-WFD data reporting and database

Member States have in addition to the River Basin Management Plans (RBMPs) reported a comprehensive set of data related to the results of the RBMPs such as ecological status for each individual water body or significant pressures affecting a water body. The WFD-CIS Guidance Document No. 21 "Guidance for reporting under the Water Framework Directive" (EC, 2009) provides the specification of the data that have to be reported by Member States in relation to RBMPs.

2.2.1. Status of WISE-WFD database

Most of the Member States with adopted RBMPs have reported data from the RBMPs to the WISE-WFD database. Greece and Portugal have reported data from their RBMPs to the WISE-WFD database, but do not yet have adopted RBMPs. *All data reported to the WISE-WFD database by primo May 2012 have been included into the analysis presented on ecological and chemical status and pressures.*

The data reported by Member States have had a first quality assurance and quality control (QA/QC) and have then been transferred into the WISE-WFD database. The EEA has been using the WISE-WFD database version May 2012. This database contained information from 27 Member States and covers more than 127 000 surface water bodies and 13 300 groundwater bodies.

2.2.2. Reported River Basin Districts

By May 2012 data from 161 River Basin Districts (RBDs) have been reported by Member States and incorporated into the WFD-WISE database (Table 2.1). There are still missing reporting from some countries and RBDs. The smaller and medium size Member States generally have 1-5 RBDs, while Spain, the United Kingdom, France, Greece, Sweden, Finland, Germany, Poland and Portugal have 8 to 25 RBDs.

Table 2.1 Overview of reported RBDs per Member State

Member States	RBDs	Member States	RBDs
Austria	3	Latvia	4
Belgium Flanders	2	Lithuania	4
Bulgaria	4	Luxembourg	2
Cyprus	1	Malta	1
Czech Rep.	3	Netherlands	4
Denmark	4	Poland	10
Estonia	3	Portugal	10
Finland	8	Romania	1
France	13	Slovenia	2
Germany	10	Slovak Rep.	2
Greece	14	Spain	15
Hungary	1	Sweden	10
Ireland	7	United Kingdom	15
Italy	8		
Total reported RBDS			**161**

Note: Missing countries and (RBDs) Belgium: Wallonia & Brussels (6); Spain (9) and Norway (9).
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_SIZE_AVERAGE.

Size of RBDs

The size of the RBDs varies considerably from very small ones below 1,000 km^2 to the largest one, the Danube with over 800 000 km^2 (Table 2.2). Obviously, the international RBDs are generally larger. The average size of current reported (national) RBDs is about 30 000 km^2. There are 48 and 30 RBDs with an area greater than 15 000 and 50 000 km^2, respectively. These two size categories cover 27 % and 62 % of the reported area. More than half of the population are found in the RBDs larger than 50 000 km^2.

Table 2.2 Reported RBDs divided by the size of the RBDs

Size of RBD (km2)	Number of RBDs	Sum of area (1000 km^2)	Sum of population (million)
< 5000	37	68	15
5-15000	46	464	46
15-50000	48	1273	162
> 50000	30	2933	258
Total	**161**	**4739**	**481**

Source: WISE-WFD database, May 2012.

There are 14 international RBDs with an area of the RBDs greater than 40 000 km^2 (Table 2.3). The international Danube RBD is by far the largest RBD and consists of eight national RBDs. The Rhine and Elbe internal RBDs consist of six and four national RBDs. Most of the other international RBDs are composed of two national RBDs.

Table 2.3 International River Basin Districts greater than 40 000 km²

International River Basin District	IRBD Area (*)	RBDs	Country (Area in km² of national RBD)
Danube	585675	9 (*)	RO (239100); HU (93011); AT (80565); DE (56295); BG (47235); SK (47084); CZ (22000); SI (16422) ; PL (385)
Elbe	199427	4	DE (148268); CZ (50000); AT (921); PL (238)
Vistula	185126	2 (*)	PL (183176); SK (1950)
Rhine	159617	6 (*)	DE (102100); NL (28500); FR (23359); LU (2526); AT (2365); BE (767)
Oder	134615	3	PL (118015); DE (9600); CZ (7000)
Douro	98075	2	ES (78856); PT (19219)
Seine	96607	2	FR (96527); BE (80)
Tajo	81310	2	ES (55645); PT (25665)
Guadiana	67139	2	ES (55528); PT (11611)
Nemunas	50959	2 (*)	LT (48444); PL (2515)
East Aegean/Thrace	47040	2 (*)	BG (35237); GR (11803)
Torne river	40168	3	SE (25400); FI (14587); NO (181)

Note: (*) In addition, there are parts of the RBD in non EU Member States.
Source: WISE-WFD database, May 2012.

There are 26 national RBDs (plus 18 being part of international RBDs, Table 2.3) greater than 40 000 km², with six of them being larger than 100 000 km² (Table 2.4). Some of the large districts consist mainly of one large river (e.g. the Loire, Rhône, and Ebro river basin), while other districts are composed of several river system such as the Swedish Bothnian Bay and Bothnian Sea RBDs or the Scottish RBD.

Table 2.4 National River Basin Districts greater than 40 000 km²

Country	River Basin District	Area		Country	River Basin District	Area
France	FRG: Loire Bretagne	169204		Finland	FIVHA4: Oulujoki-Iijoki	68084
Sweden	SE1: Bothnian Bay	147000		Norway (*)	NO1105: Finnmark	64382
Sweden	SE2: Bothnian Sea	140000		Finland	FIVHA: Vuoksi	58158
France	FRD: Rhône Mediterranée	123491		Spain	ES050Guadalquivir	57228
France	FRF: Adour Garonne	118897		Finland	FIVHA2: Kymijoki-Gulf of Finland	57074
UK	UK01: Scotland	113920		Finland	FIVHA5:Kemijoki	54850
Spain	ES091: Ebro	85570		Sweden	SE4: South Baltic Sea	54000
France	FRK: Guyane	83846		Germany	DE4000: Weser	49000
Finland	FIVHA3: Kokemäenjoki	83357		Norway (*)	NO5101: Glomma	47683
Italy	ITB: Padan (Po river)	74000		Norway (*)	NO1102: Troendelag	47229
Sweden	SE5:Skagerrak and Kattegat	69500		Estonia	EE1: West-Estonian	45375
Norway (*)	NO1103: Nordland	68291		Spain	ES080: Jucar	42851
Italy	ITF: South Appennines	68200		Italy	ITA: Eastern Alps	40851

Notes: (*) Norwegian RBDs are not included in the further assessment.
In addition, there are 18 national RBD being part of International RBDs (see Table 2.3).
Source: WISE-WFD database, May 2012.

2.3. EEA WISE-SoE data collection

The EEA base its water quality data on a representative sub-sample of national monitoring results, which EEA member countries report voluntarily each year to the EEA. The EEA has mainly collected annual values (e.g. average, median, minimum and maximum) but in some cases the EEA also have collected seasonal (summer and winter) values. In the context of the implementation of the WFD the annual data flow for water quality has been transferred into the WISE 'State of the Environment' (SoE) voluntary data flow (WISE-SoE). With this the WISE-SoE data flow remains one of the EIONET Priority Data Flows, but gains full integration into the reporting under WISE and complementarity with data collected under the WFD.

Data are transferred on an annual basis from the countries to the EEA and are stored in Waterbase. At the end of 2011, Waterbase contained water quality information on

- more than 10 000 river stations in 37 countries,
- more than 3500 lake stations in 35 countries,
- more than 5000 coastal stations in 28 countries, and
- quality data from around 1500 groundwater bodies.

Some of the water quality data are from countries not reporting under the WFD (e.g Switzerland). The different Waterbase datasets are available through the following Website http://www.eea.europa.eu//themes/water/dc.

The data reported in the WISE-WFD and the WISE-SoE databases should make it possible to compare the water quality data with the data on ecological and chemical status and pressure information for the individual water bodies. There have been several obstacles for making this match between the two databases *inter alia* due to Member States' reporting different water body identifications in the two reporting streams. However, for water bodies with matching IDs in the two databases, analyses and assessments linking ecological status and water quality have been done and are presented in chapter 7.

2.4. Water bodies

The WFD requires that waters within each river basin district be differentiated into water categories: groundwater, rivers, lakes, transitional waters and coastal waters. These waters are then further sub-divided depending on their type, based on natural factors (such as altitude, longitude, geology and size) that might influence ecological communities. This division forms the basis of water bodies. Water bodies are the basic management units for reporting and assessing compliance with the WFDs environmental objectives.

The EU Member States now have reported 13 300 groundwater bodies and more than 127 000 surface water bodies: 80% of them rivers, 15% lakes and 5% coastal and transitional waters (Table 2.5). All Member States have reported groundwater bodies; 26 Member States, all reporting Member States except Malta have reported river water bodies, 24 Member States have reported lake water bodies, and 16 and 22 Member States have reported transitional and coastal water bodies, respectively.

Table 2.5 Number of Member States, RBDs, water bodies, and length or area, per water category

Category	Member States	RBDs	Number of water bodies	Total length or area	Average length/area
Rivers	26	157	104 311	1.17 million km	11.3 km
Lakes	24	144	19 053	88 000 km^2	4.6 km^2
Transitional	16	87	1010	19 600 km^2	19 km^2
Coastal waters	22	114	3033	358 000 km^2	118 km^2
Groundwater	27	148	13 261	3.8 million km^2	309 km^2 (*)

Note: (*) Based on 127 RBDs with reported areas of groundwater bodies.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_SIZE_AVERAGE and http://discomap.eea.europa.eu/report/wfd/GWB_DENSITY_ECOSYS_TRB.

In total there are a reported 1.2 million kilometres of rivers, 88 000 km^2 of lakes and more than 375 000 km^2 of transitional and coastal waters. The total area of reported groundwater bodies is 3.8 million km^2. Groundwater bodies have been designated for different horizons; thus groundwater bodies may overlay other groundwater bodies.

Table 2.6 lists for the number of RBDs, surface water bodies per category; and total and average river lengths and area of lakes, transitional and coastal waters for the Member States that have reported.

2.4.1. River water bodies

Category	Member States	RBDs	Number of water bodies	Length	Average length
Rivers	26	157	104 311	1.17 million km	11.3 km

Europe has an extensive network of rivers and streams. In total more than 104 000 river water bodies with a length greater than 1.17 million kilometres has been reported by Member States. Five countries, Denmark, Sweden, France, UK and Germany, reported 60% of the river water bodies, while three countries, France, Germany, Poland and the UK accounted for nearly half of the river length (Table 2.6).

The average size of the more than 104 000 reported river water bodies is 11.3 km long. Three Member States, Latvia, Bulgaria and Portugal, had river water bodies more than triple the size of the EU average. Austria, Denmark, Ireland and Sweden had relatively small river water bodies with an average length less than 5 km and less than half the EU average. If a Member State reports relatively large river water bodies for example it may have several river water bodies longer than 50 km, it may be difficult to characterize the status (e.g. sections of the water body may have a different status).

Member States like Denmark, Ireland and Austria have a three to four times higher density of river water bodies than the EU average of around 23 river water bodies per 1000 km^2 of the Member State territory. Five countries have a relative higher river length (length per 1000 km^2) than the EU average. Some countries like Latvia, Finland, The Netherlands, Greece and Spain have a lower density of river water bodies per km^2 and river length per km^2 than the EU average. If a Member State has a low coverage of the rivers in a country, the characterization of status and pressures may not be fully representative for the rivers in the Member State.

Table 2.6 Number of RBDs, surface water bodies, and river lengths, area of lakes, transitional and coastal waters per country

Country	Rivers			Lakes			Transitional			Coastal			Total
	Nb	Avg L	Total L	Nb	Avg A	Total A	Nb	Avg A	Total A	Nb	Avg A	TotalA	Nb
Austria	7339	4	31392	62	15	934	0			0			7401
Belgium Flanders	177	14	2472	18	2	40	6	7	42	2	715	1429	202
Bulgaria	688	37	25568	43	2	75	15	7	109	13	110	1428	759
Cyprus	216	12	2579	18	2	28	0			26	33	865	255
Czech Rep.	1069	17	18596	71	4	249	0			0			1140
Denmark	16881	1	12047	940	0	462	0			162	252	40875	17983
Estonia	645	19	12106	89	22	1966	0			16	906	14501	750
Finland	1602	18	28875	4275	7	28172	0			276	115	32570	6078
France	10824	22	241684	439	4	1964	96	30	2840	164	163	26652	11523
Germany	9072	14	126158	712	3	2399	5	163	814	74	309	22843	9863
Greece	1033	11	11480	29	31	889	29	39	1129	233	165	38390	1324
Hungary	869	22	18802	213	6	1267	0			0			1082
Ireland	4565	5	21037	807	3	2628	190	6	1068	111	119	13183	5673
Italy	7644	10	78813	300	7	2158	181	7	1235	489	39	18930	8614
Latvia	204	38	7751	259	3	825	1	934	934	6	214	1283	470
Lithuania	832	17	14251	345	2	809	4	129	515	2	57	115	1182
Luxembourg	102	0		0			0			0			102
Malta	no rivers									9	395	3555	9
Netherlands	254	19	4756	450	7	3046	5	137	684	15	793	11889	724
Poland	4586	24	111483	1038	2	2293	9	215	1936	10	67	666	5643
Portugal	1611	35	55725	122	6	742	53	15	813	57	275	15690	1843
Romania	3262	23	74473	131	8	993	2	391	781	4	143	572	3399
Slovak Rep.	1760	11	18944	0			0			0			1760
Slovenia	135	19	2620	14	3	38	0			6	67	404	155
Spain	4298	17	74834	327	16	5281	201	14	2848	186	84	15624	5012
Sweden	15563	5	79466	7232	4	29192	21	9	180	602	58	34623	23418
United Kingdom	9080	11	99749	1119	2	1933	192	19	3716	570	111	63399	10961
EU	104311	11.3	1175000	19053	4.6	88000	1010	19	19600	3033	118	350 000	127325

Note: Nb: number of water bodies; Average (Avg) and total L (length) of river water bodies in km; Average (Avg) and total A (area) of lakes, transitional and coastal water bodies in km^2.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_SIZE_AVERAGE.

2.4.2. Lake water bodies

There are more than 500 000 natural lakes larger than 0.01 km^2 (1 ha) in Europe (EEA 1995). About 80% to 90% of these are small with a surface area of between 0.01 and 0.1 km^2, whereas around 16 000 have a surface area exceeding 1 km^2. Twenty four European lakes have a surface area larger than 400 km^2.

Many natural European lakes appeared 10 000 to 15 000 years ago; when the ice sheet covered all of northern Europe. In central and southern Europe ice sheets only stretched as far as mountain ranges. As a rule, the regions comprising many natural lakes were affected by the Weichsel ice. For example, countries like Norway, Sweden, and Finland have numerous lakes that account for approximately 5% to 10% of their national surface area. In central Europe, most natural lakes lie in mountain regions. Lakes at high altitude are relatively small whereas those in valleys are larger, for example Lac Léman, Bodensee, and Lago Maggiore in the Alps. European countries which were only partially affected by the glaciation period (Portugal, Spain, France, Belgium, southern England, central Germany, the Czech Republic, and the Slovak Republic) have few natural lakes. In these areas man-made lakes such as reservoirs and ponds are often more common than natural lakes.

Lakes are often split into two main types (shallow and deep lakes) as they tend to have different sensitivities to pressures such as water pollution. High quality shallow lakes are characterised by healthy submerged plant communities and associated diverse communities of invertebrates, fish and wetland birds. Phytoplankton is also present but typically in low levels. Naturally characterised by clear water, these systems have frequently shifted into turbid, phytoplankton-dominated states lacking macrophytes, primarily caused by nutrient pollution (eutrophication). Deep lakes are mainly found in mountainous regions and under natural conditions they are characterised by very low nutrient loads. Macrophytes are restricted to a narrow belt along the shores and phytoplankton abundance is low. Eutrophication in deep lakes causes enhanced primary production by phytoplankton, in severe cases algal blooms and oxygen depletion (particularly in the deep zones) may affect all processes and species.

Twenty-four Member States have reported lakes, no lakes have been reported from Malta, Luxembourg and Slovakia. In total around 18 000 lake water bodies with a total area greater than 88 000 km^2 has been reported by Member States. Two countries, Sweden, and Finland, reported more than 60% of the lake water bodies and two-thirds of lake area.

Category	Member States	RBDs	Number of water bodies	Length or area	Average area
Lakes	24	144	19 053	88 000 km^2	4.6 km^2

The average area of the more than 19 000 reported lake water bodies is 4.6 km^2 – the average size is markedly influenced by the very large lakes. Four Member States (Austria, Estonia, Greece and Spain) have average size of lake water bodies greater than 10 km^2.

Half of the reported lakes are less than 1 km^2 in area and more than 87% of the reported lake water bodies have an area less than 5 km^2 (Table 2.7). Only 78 of the reported lake water bodies have an area greater than 150 km^2; Finland and Sweden have reported 28 and 16 lake water bodies greater than 150 km^2, and Lithuania and Spain reported 9 and 8 large lake water bodies.

Table 2.7 Number of lake water bodies according to size of water bodies

	Area of lakes in km^2					
	<0.5	0.5-1	1-5	5-25	25-150	> 150
Number of lake water bodies	4249	4300	6693	1745	388	78
Percentage	24 %	25 %	38 %	10 %	2.2%	0.4%

Some Member States (e.g. Sweden and Finland) have divided their large lakes into several water bodies, while other Member States (e.g. Austria) only have one water body for each of their lakes.

2.4.3. Transitional water bodies

Transitional waters are those waters between the land and the sea and include fjords, estuaries, lagoons, deltas and rias. They often encompass river mouths and show the transition from freshwater to marine conditions. Depending on the tidal influence from coastal waters, but also on the freshwater influence from upstream, transitional waters are often characterised by frequently changing salinity.

Transitional waters are the sites of major cities and harbours (ports) and these waters historically have been degraded by port activities, by pollution from urban, industrial and agricultural areas, and by land claim for sea defences, building and agriculture.

Sixteen Member States reported from 87 RBDs transitional water bodies. In total 1010 transitional water bodies with an area greater than 19 000 km^2 has been reported by Member States. Five countries; United Kingdom, Spain, France. Italy and Ireland; reported more than 90% of the transitional water bodies and more than 70% of the transitional waters area.

Category	Member States	RBDs	Number of water bodies	Total area	Average area
Transitional	16	87	1010	19 600 km^2	19 km^2

The average size/area of the reported transitional water bodies is 19 km^2. The average size of the transitional water bodies is greater than 100 km^2 in five Member States (Table 2.6).

2.4.4. Coastal waters

Coastal waters represent the interface between land and ocean, and in the context of the Water Framework Directive coastal waters include water, that has not been designated as transitional water, extending one nautical mile from a baseline defined by the land points where territorial waters are measured.

All European coastal waters have, to a varying degree, been affected by eutrophication and this has led to nuisance and toxic algal blooms, loss of benthic habitats by shading out benthic vegetation and eradication of benthic fauna due to oxygen depletion as well as fish kills.

Twenty-two Member States reported more than 3000 coastal water bodies from 114 RBDs. The total area of the reported coastal waters is more than 350 000 km^2. The average area of the reported coastal water bodies is 118 km^2. In two Member States (Estonia and the Netherlands) the average area is greater than 700 km^2.

Category	Member States	RBDs	Number of water bodies	Total area	Average area
Coastal waters	22	114	3033	358 000 km^2	118 km^2

2.4.5. Groundwater bodies

All Member States have reported groundwater bodies. In total 13 300 groundwater bodies from 148 RBDs have been reported. Sweden and Finland reported 3021 and 3804 groundwater bodies and thus accounted for more than half of the groundwater bodies. Compared to the other Member States the average size of groundwater bodies in Sweden and Finland is 7 km^2 while the average size of the groundwater bodies for the other Member States is nearly 700 km^2.

Category	Member States	RBDs	Number of water bodies	Total area	Average area
Groundwater	27	148	13 261	3.8 million km^2	309 km^2 (*)
GWBs in Sweden and Finland	3		6825	0.05 million km^2	7 km^2
GWBs except SE & FI	23		6463	3.75 million km^2	685 km^2 (*)

Notes: (*) based on 127/112 RBDs with reported area of groundwater bodies.
For 22 RBDs groundwater body areas have not been reported.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/GWB_STATUS.

The total area of reported groundwater bodies is 3.8 million km^2. Groundwater bodies have been defined for different horizons, and some groundwater bodies may overlay other groundwater bodies.

2.4.6. Heavily modified and artificial water bodies

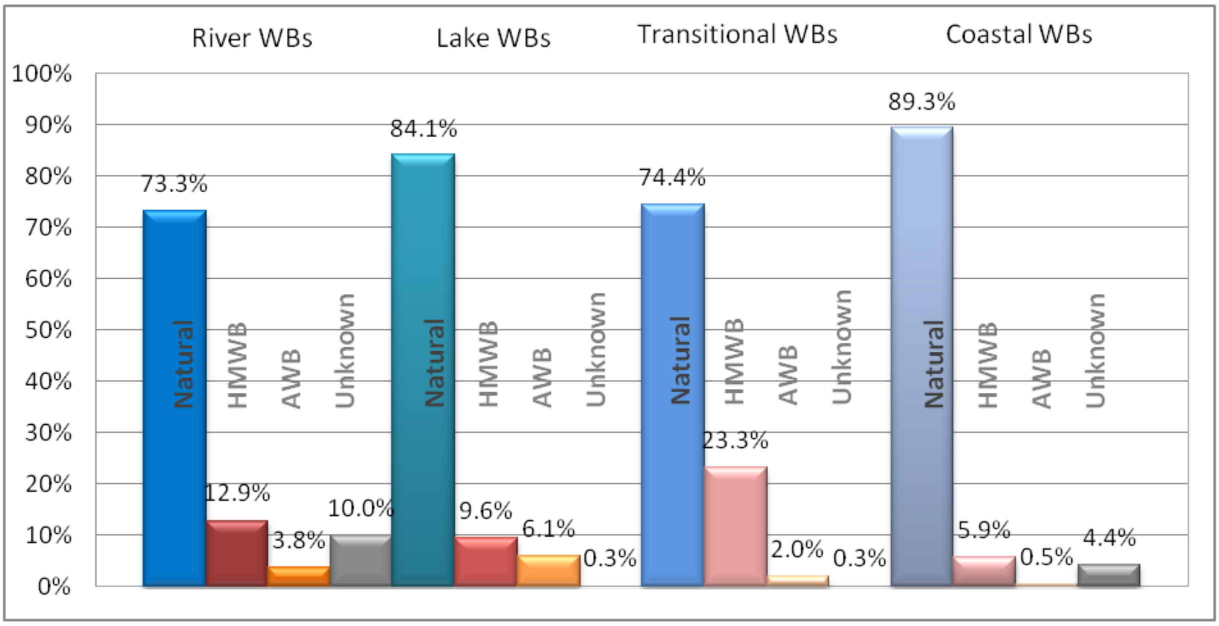
The WFD allows Member States to designate some of their surface waters as *heavily modified water bodies* (HMWB) or *artificial water bodies* (AWB). Member States will need to meet the good ecological potential (GEP) criterion for ecosystems of HMWBs and AWBs rather than good ecological status as for natural type water bodies. The objective of GEP is similar to good status but takes into account the constraints imposed by social and/or economic uses.

In many river basins, the upper stretches in mountain, highland and often forested areas remain largely in their natural state, but the lower stretches often passing large cities are modified by embankments and other public works and they are designated as heavily modified waters. Other examples of heavily modified water bodies are inland waterways, reservoirs on rivers, or lakes with heavy water level regulation and impounded river reaches. Heavily modified transitional and coastal waters have often been altered by dredging or land reclamation due to urban, transport and agricultural developments. Artificial water bodies can be, for example, canals or open-cast mining lakes.

Overall 16.4% of European water bodies have during the first RBMPs been designated as HMWBs or AWBs (16.7% of rivers, 15.7% of lakes, 25.4% of transitional waters and 6.4% of coastal waters – Fig. 2.1). This is probably a minimum estimate as some Member States indicate that the designation process has not been completed. Two Member States, Denmark and Italy, have reported most of the water bodies to be of an unknown natural, HMWB or AWB status.

More than 6% of the lake (reservoirs) and around 4% of river (canals and reservoirs) water bodies have been identified as artificial; while only a few of the transitional and coastal waters are listed as being AWBs.

Figure 2.1 Percentage of natural, heavily modified (HM), artificial (A) and unknown status for river, lake, transitional and coastal water bodies (WBs)



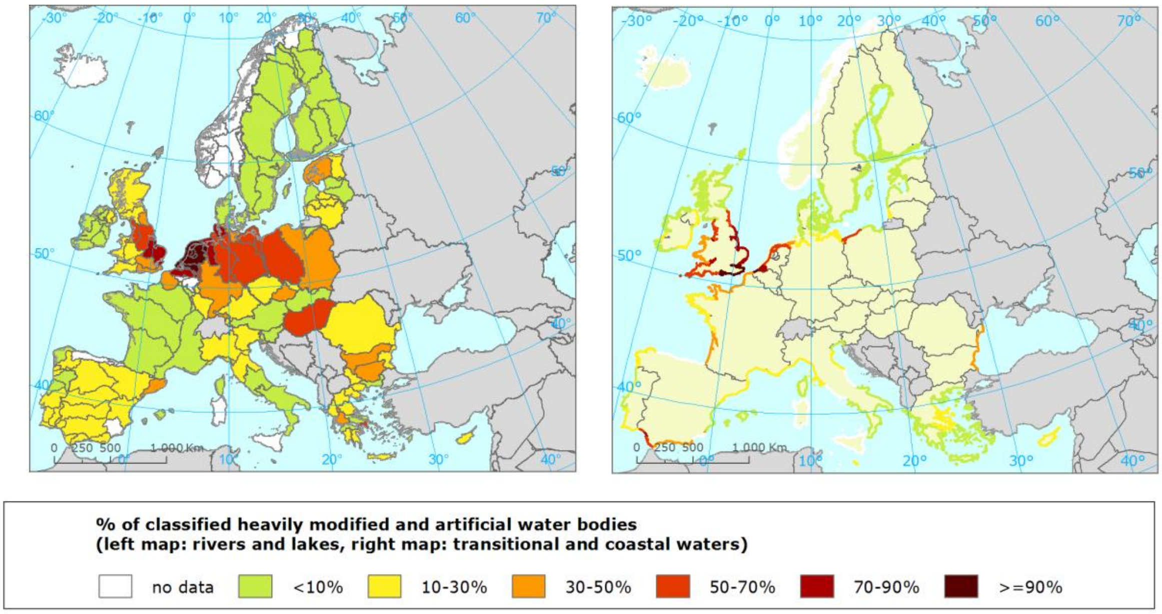
Notes: See EEA technical report for more details on HMWBs and AWBs (EEA ETC/ICM, 2012). All water bodies are included.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_HMWB_AWB.

The countries (and RBDs) with the highest percentage (more than 50%) of HMWBs and AWBs for rivers are the Netherlands, Belgium, Hungary and Germany, while countries such as Finland, France, Slovakia, Sweden and Ireland designated only 5% or less of their river water bodies in these two types

(Map 2.1). In the case of lakes the highest percentage (above 60%) of designated HMWBs or AWBs are in Belgium, The Czech Republic, The Netherlands, Bulgaria, France, The United Kingdom, Hungary and Italy. The lower end of such rank (less than 5%) is represented by Sweden, Estonia, Latvia, Ireland and Finland.

Heavily modified and artificial water bodies are clearly associated with densely populated, urbanised areas with industrial areas and ports. In mountainous regions a high proportion of HMWBs can be found in RBMPs with many reservoirs and much water storage for hydropower and irrigation. The coastal zones of the North Sea have a high proportion of designated coastal and in particular transitional HMWBs and AWBs.

Map 2.1 Proportion of heavily modified and artificial water bodies for rivers and lakes and transitional and coastal waters



Notes: See EEA technical report for more details on HMWBs and AWBs (EEA ETC/ICM, 2012). All water bodies are included.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_HMWB_AWB.

3. Methodology

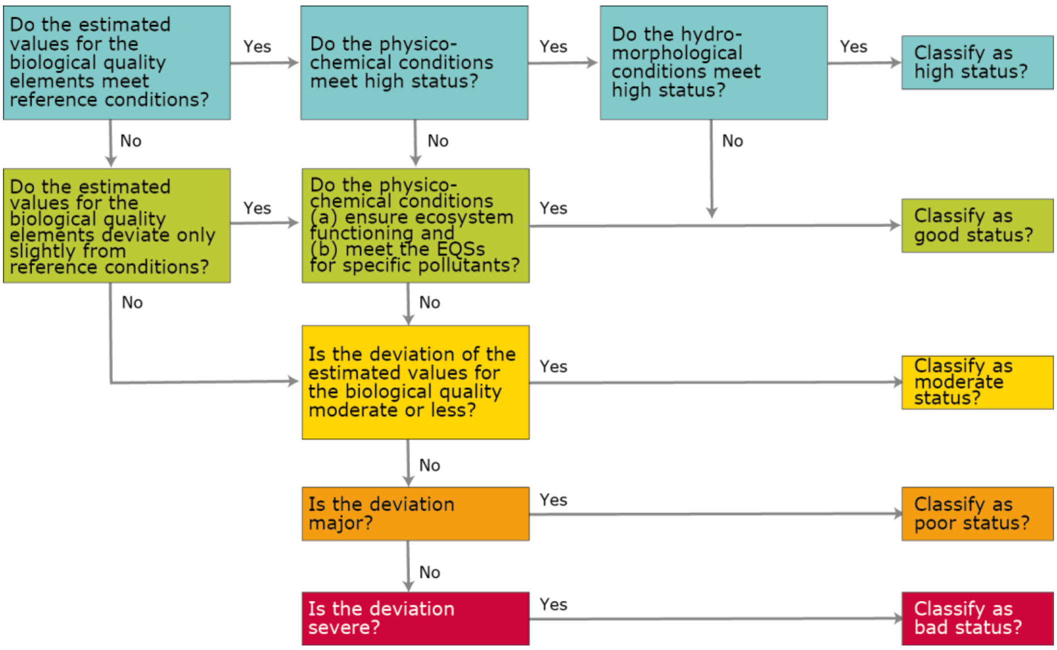
3.1. WFD principles for classification of ecological status and potential

3.1.1. Principles for classification of ecological status in natural water bodies

The WFD defines "good ecological status" in terms of a healthy ecosystem based upon classification of the biological elements (phytoplankton, phytobenthos, benthic fauna and fish) and supporting hydromorphological, physico-chemical quality elements and non-priority pollutants. Biological elements are especially important, since they reflect the quality of water and disturbance of environment over longer period of time. The ecological status is reported for each water body. Water bodies are classified by assessment systems developed for the different water categories (river, lake, transitional and coastal waters) and the different natural types within each water category.

The ecological status classification scheme includes five status classes: high, good, moderate, poor and bad. 'High status' is defined as the biological, chemical and morphological conditions associated with no or very low human pressure. This is also called the 'reference condition' as it is the best status achievable - the benchmark. These reference conditions are type-specific, so they are different for different types of rivers, lakes or coastal waters in order to take into account the broad variation of ecological conditions in Europe. For a water body to be classified as having 'good' ecological status, none of the biological or physico-chemical quality elements can be more than slightly altered from their reference conditions. For water bodies in 'moderate' status, one or more of the biological elements may be moderately altered. In 'poor' status, the alterations to one or more biological quality elements are major and, in 'bad' status, there are severe alterations such that a large proportion of the reference biological community is absent.

Figure 3.1 Classification of ecological status



Source: EC, 2005a.

Biological quality elements

The biological quality elements required for assessment of ecological status (WFD Annex V) are:

- Rivers and Lakes: Phytoplankton, phytobenthos, macrophytes, benthic fauna, fish

- Transitional and Coastal waters: Phytoplankton, macroalgae, angiosperms, benthic fauna, fish (fish only in transitional waters)

The WFD requires that standardised methods are used for the monitoring of the quality elements, and that the good status class boundaries for each biological quality element are intercalibrated across Member States sharing similar types of water bodies. Further information on the intercalibration process and results are given in Text Box 3.1 below.

Text Box 3.1 Intercalibration of national classification systems for assessment of ecological status

The WFD requires that the national classification systems for assessing ecological status for all the required biological quality elements (BQEs) should be intercalibrated. The aim of the intercalibration is to ensure that the good status class boundaries given by each country's biological methods are comparable and WFD compliant relative to the normative definitions in Annex V. Through the intercalibration process, the national classification systems should be adjusted to ensure that the good status boundaries are set at the same distance from reference conditions for each biological quality element in all Member States sharing the same type of water bodies. The first phase of intercalibration was completed by the end of 2007. Due to delays in the development of the national systems in many Member States, the results from this first phase do not cover all the BQEs required and provide only partial results for others. The delays were most severe for transitional waters, which were not even included in the first phase of the intercalibration process, but there were also major gaps for coastal waters, as well as for lakes. For rivers, most Member States had developed assessment systems for at least two BQEs (macroinvertebrates and diatom phytobenthos) in time for the first phase of the intercalibration, although some of these methods may not fulfil all the WFD requirements. The comparability across Member States of the ecological status reported in these first RBMPs is therefore quite uncertain for several BQEs. For more information on the first Official Decision of the Intercalibration exercise and the Technical Annexes to this Decision for Rivers, Lakes and Coastal Waters, see EC (2008b).

To fill the gaps from phase 1 and improve comparability, the 2nd phase of Intercalibration took place from 2008 to 2011. These last results are not incorporated in the first River Basin Management Plans, but are to be included in the second cycle of reporting in 2015. The results have been peer reviewed as a basis for formal adoption of the results in 2012.

Chemical and physico-chemical quality elements

The general chemical and physico-chemical quality elements describe water quality and are considered as supporting elements to biological communities. General chemical and physico-chemical quality elements relevant for rivers and lakes are transitional and coastal waters are (i) transparency (not for rivers), (ii) thermal conditions, (iii) oxygenation conditions, (iv) nutrient conditions and (v) acidifying substances (for rivers and lakes only). In a high ecological status, the condition of each element must be within the range of conditions normally associated with undisturbed conditions. Within a good ecological status, the Directive requires that the general physico-chemical quality elements comply with standards established by the Member State to protect the functioning of the ecosystem and the achievement of the values specified for the biological quality elements as in a good status rating.

Specific pollutants

Member States are required to identify 'specific pollutants' (i.e. those pollutants being discharged in significant quantities) from the Directive's general list of the main types of pollutants. For good ecological status, the environmental quality standards established for specific pollutants must not be exceeded. Environmental quality standards for the specific pollutants have been set in such a way that, where the standards are met, no adverse effects on aquatic plants and animals should occur.

Hydromorphological quality elements

For high status to be achieved, WFD requires that there are no more than very minor human alterations to the hydromorphological quality elements. At good, moderate, poor and bad status, the required values for the hydromorphological quality elements must be such as to support the required biological quality element values for the relevant class. Each of the four surface water categories is ascribed specific hydromorphological quality elements (Table 3.1).

Table 3.1 Hydromorphological quality elements to be used for the assessment of ecological status or potential based on the list in WFD Annex V. 1.1

Morphological conditions	
Rivers • river depth and width variation • structure and substrate of the river bed • structure of the riparian zone Lakes • lake depth variation • quantity, structure and substrate of the lake bed • structure of the lake shore	Transitional waters • depth variation • quantity, structure and substrate of the bed • structure of the intertidal zone Coastal waters • depth variation • structure and substrate of the coastal bed • structure of the intertidal zone
Hydrological regime	
Rivers • quantify and dynamics of water flow • connection to ground water bodies Lakes • quantify and dynamics of water flow • residence time • connection to the groundwater body	Transitional waters • freshwater flow • wave exposure Coastal waters • direction of dominant currents • wave exposure

Combination of quality elements to overall ecological status of a water body

The WFD requires that the overall ecological status of a water body be determined by the results for the biological or physicochemical quality element with the worst class determined by any of the biological quality elements. This is called the “one out - all out” principle. The rationale of this principle is to avoid averaging the impacts on different quality elements due to different pressures and therefore overlook some significant pressures, and also to provide sufficient protection of the most sensitive quality element to a significant pressure.

The process of ecological classification is described in Fig. 3.1.

3.1.2. Principles for classification of ecological potential for artificial and heavily modified water bodies

The WFD has different requirements for natural waters and for artificial or heavily modified waters. The artificial and heavily modified water bodies should be designated according to conditions established in WFD article 4.3). For water bodies that have been designated as heavily modified or artificial the ecological potential (GEP) should be determined. The objective of GEP is similar to good status but takes into account the constraints imposed by social and/or economic uses. Ecological potential for HMWBs and AWBs is either based on the same QEs as for ecological status after adjusting for the impacts of the hydromorphological pressures underlying the designation of the water body as being heavily modified or artificial, or on the level of measures taken to mitigate the impacts of all other pressures on those water bodies.

3.2. Ecological status classification in RBMPs: Confidence and data quality

3.2.1. European overview of quality elements monitored

Due to delays in the development of national classification systems in many Member States, only a few biological quality elements could be used for assessing ecological status of water bodies for the first RBMPs. The assessment systems available at the time of delivering the RBMPs were mainly for benthic invertebrates in rivers and coastal waters, for diatoms in rivers and for phytoplankton chlorophyll a in lakes. Most of the assessment systems are relevant mainly to assess impacts of pollution pressures causing nutrient and organic enrichment, whereas hydromorphological pressures causing altered habitats have mainly been assessed in rivers using fish as an indicator of ecological status. For transitional waters there were almost no assessment systems available in time to be used in the first RBMPs. There were also large differences in the level of development of assessment methods across Europe, with the most serious gaps found in the Mediterranean and Eastern Continental / Black Sea regions. For more information, see EC (2008b).

An additional weakness in the national systems used for ecological status assessment of water bodies in the first RBMPs is that the class boundaries for the supporting quality elements (e.g. nutrients, organic matter etc.) in many cases are not well linked to the class boundaries for the biological quality elements, and in some cases may be quite relaxed compared to the responses of the biological quality elements (Claussen and Arle, 2012).

For ecological potential of heavily modified and artificial water bodies, the assessment systems applied have either been the same as those for ecological status (for example in terms of phytoplankton chlorophyll in Mediterranean reservoirs or fish in Alpine rivers), been adjusted to account for the heavy hydromorphological impacts on the biological quality elements in the heavily modified and artificial water bodies (for example benthic fauna in Danish rivers) or been based on expert judgement considering possible measures that could be used to improve the ecological potential.

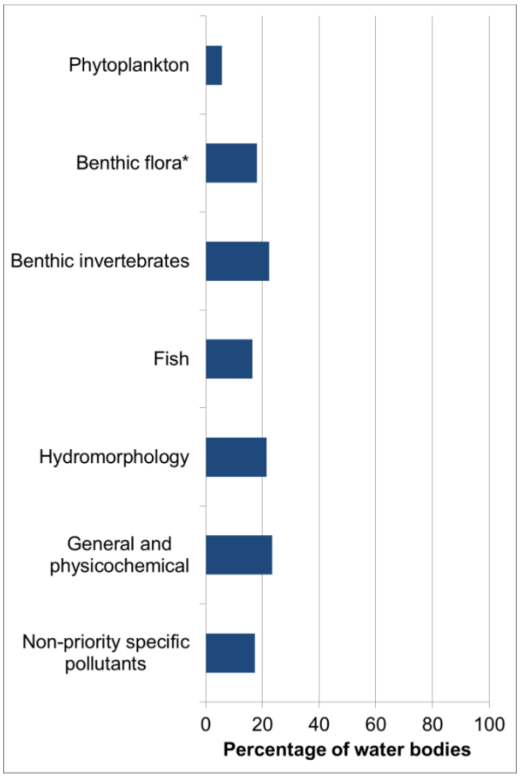
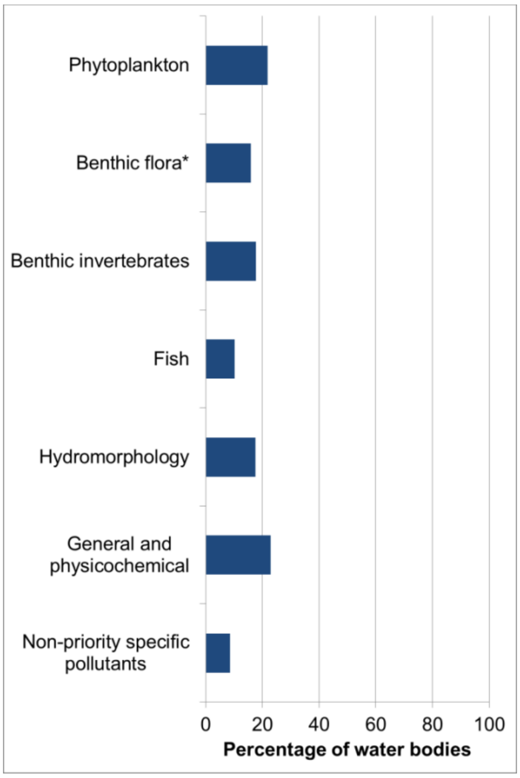
The overview of quality elements monitored for classification of the ecological status or potential (Fig. 3.2) reflects the level of development and implementation of the national monitoring and classification systems described above. The proportion of water bodies monitored for the different QEs is quite small in relation to the total number of water bodies, although several countries monitor a considerably higher proportion of their water bodies than the EU average level shown in Fig. 3.2. The small proportion monitored at EU level indicates that the majority of water bodies have been classified by grouping, using a few representative monitored water bodies to classify a larger group of non-monitored water bodies. This grouping has been done to a larger extent for Member States with a high number of water bodies than for those with low number of water bodies. If this grouping is applied to water bodies of the same type exposed to the same type and level of pressures, the classification of non-monitored water bodies would still be WFD compliant, according to the WFD CIS guidance on monitoring.

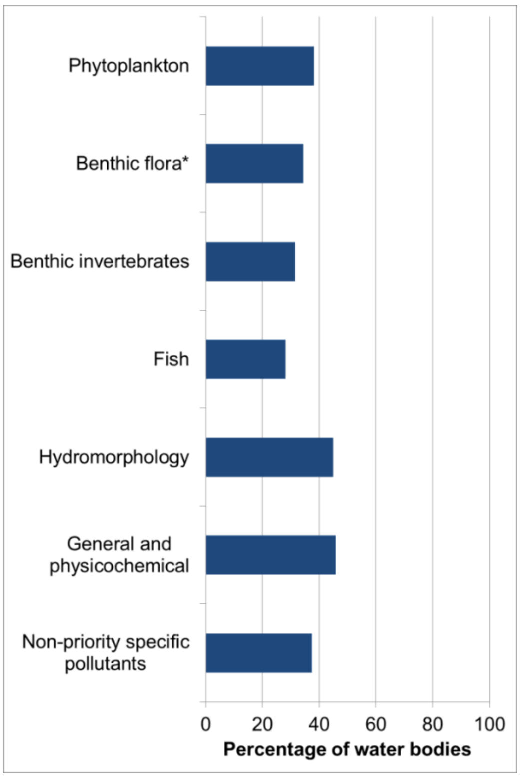
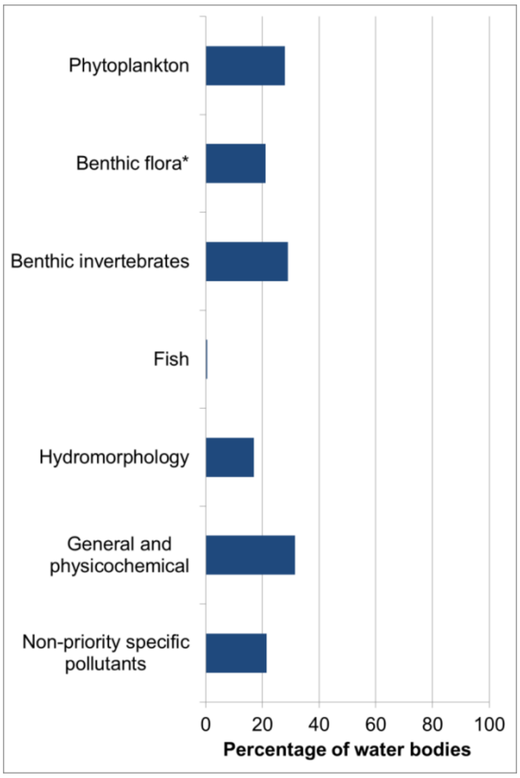
Another reason for the low proportion of quality elements monitored is that many water bodies have been assessed using expert judgement based on the information compiled in the pressure and impact analyses (WFD article 5) in this first cycle of RBMPs. In many cases this was the only solution, due to gaps in the classification system, and probably also incomplete implementation of the WFD monitoring systems.

River water bodies are monitored for the different quality elements in less than 25% of all water bodies, illustrating the practice of grouping and/or expert judgement for classifying non-monitored water bodies. This grouping is justified by the very large number of river water bodies in many Member States. At EU level, the most commonly monitored quality elements are macroinvertebrates (22%), as well as the supporting quality elements for hydromorphology (21%) and for general physico-chemical quality (23%). Benthic flora and fish, as well as non-priority specific pollutants are monitored in 16-18% of the total number of river water bodies, while phytoplankton is rarely monitored as a basis for classification of ecological status in rivers. Although the proportions are low, the absolute number of European rivers being monitored with biological quality elements is still substantial, ranging from 23 000 for benthic invertebrates, 19 000 for benthic flora to 17 000 for fish.

For lakes, phytoplankton and general physico-chemical quality elements are the most commonly monitored quality elements, but are only reported to be monitored in ca. 22% of all water bodies. In many cases the phytoplankton monitoring is based only on chlorophyll a, which was the only part of this quality element that was fully developed for classification by most Member States for the first RBMPs. The other biological quality elements, fish, benthic flora and benthic invertebrates are monitored only in respectively 10%, 16% and 18% of the water bodies. Thus, the classification of lakes is also based on grouping and/or expert judgement for the majority of the classified water bodies. The proportions correspond to between 1800 and 4000 lakes being monitored with biological quality elements for classification of ecological status across Europe.

Figure 3.2 European overview of the different quality elements monitored as percentage of total number of water bodies

Rivers	Lakes
	

Transitional waters	Coastal waters
	

Notes: (*) Benthic flora means benthic algae, macrophytes or other aquatic flora for rivers and lakes, and macroalgae, angiosperms or other aquatic flora for transitional and coastal waters.
Quality Elements monitored is based on data reported at station level or at subprogramme level by each Member State, using stations data for all Member States having reported QEs at this level (except EE where sub-programme level was chosen because EE reported only station level for one RBD, but subprogramme level for all RBDs) and subprogramme level for Member States not reporting QEs at station level, but only at subprogramme level (DK, HU, IE, LT, LV, PL, SK).The percentage for each QE is calculated against the total number of water bodies (=100%) for each Member State summarised for all Member States, i.e. total number of water bodies reported where quality elements were identified are for rivers: 104311, for lakes: 18015, for transitional waters: 1001, for coastal waters: 2998. “Monitored” means water bodies with at least one monitoring station for that particular QE.
Source: WISE-WFD database, June 2012.

For transitional waters, the picture is different from that for rivers and lakes. A larger proportion of water bodies is reported to be monitored, and the most commonly monitored quality elements are the supporting elements (hydromorphological and physico-chemical), which are monitored in ca. 45% of the total number of water bodies. Also the non-priority specific pollutants are commonly monitored (ca. 37%), while the most commonly used biological quality element is phytoplankton, for which 38% of the water bodies are monitored. The other biological quality elements are monitored in ca. one third of all water bodies. The reason why the proportion monitored water bodies in transitional waters is higher than for in rivers and lakes is probably related to the much lower total number of transitional water bodies. They may also be less comparable in terms of types and pressures, thus grouping and expert judgement is less needed and also more difficult to apply for classifying the transitional waters.

For coastal waters, phytoplankton (probably mainly chlorophyll a), macroinvertebrates and general physico-chemical quality elements are most commonly monitored, corresponding to ca. 30% of all coastal water bodies. These quality elements have also been traditionally monitored in coastal waters to assess nutrient- and organic enrichment (and secondary impacts of nutrient enrichment). The other major quality elements are monitored in ca. 20% of the classified water bodies. Thus, the classification of coastal waters is also based on grouping and/or expert judgement to a large extent.

3.2.2. Confidence in classification of ecological status or potential in different countries

Most Member States have classified all their water bodies (Fig. 3.3), although some countries have a substantial proportion of water bodies that are delineated, but not classified. At the EU level 86% of a total of 123215 river and lake water bodies are classified, while 77% of a total of 4037 transitional and coastal water bodies are classified. The Member States with a substantial proportion of unclassified water bodies for rivers and lakes are Poland (79%), Finland (54%), Italy (48%), Hungary (39%) and Greece (38%). For transitional and coastal waters the countries with a substantial proportion of unclassified water bodies are Italy (90%), Poland (60%), Denmark (49%), Ireland (39%).

The reasons for not classifying all water bodies are unclear, but may be related to low confidence or gaps in assessment systems for certain quality elements or certain types of water bodies. The WFD allows grouping of water bodies for classification, meaning that water bodies can be classified based on monitoring data from other water bodies that are of the same type and exposed to the same level and type of pressures. Grouping has been extensively applied by many Member States in the first RBMPs, but it is unclear what level of confidence has been chosen for grouped water bodies. It is also unclear which quality elements are reported to be used as basis for classification for grouped water bodies that are not monitored.

For Poland the reason for not classifying all water bodies is that only monitored water bodies have been classified (i.e. no extrapolation/grouping and no expert judgement has been used). This is also why Poland report high confidence for all the classified water bodies (see also Fig. 3.6). For Finland most monitoring effort in the first RBMP was focused on water bodies exposed to significant pressures, so most of the unclassified water bodies are in near pristine condition, representing sparsely populated areas without significant pressures.

Member States have reported the confidence of classification as high, medium or low, but the basis for choosing these confidence categories is not harmonised across the EU. However, from the descriptions reported by the Member States on how these categories have been used, there are some general principles applied by many Member States:

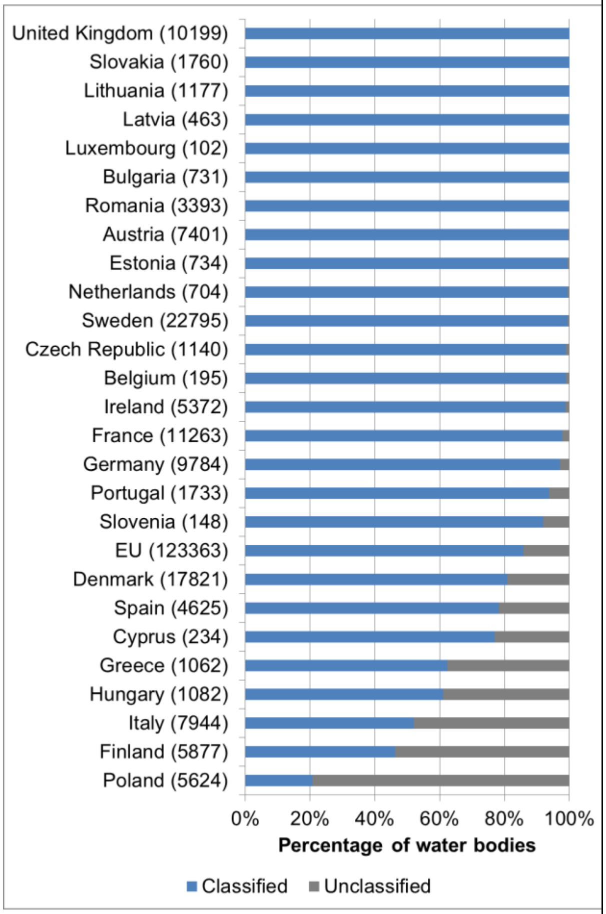
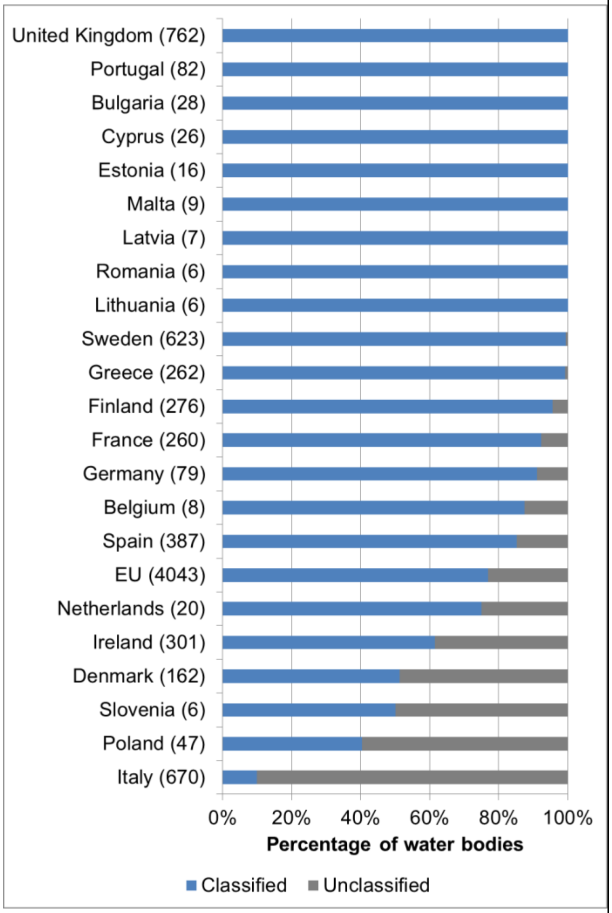
- high confidence: classification based on monitoring of at least one biological quality element and some supporting quality elements, as well as other criteria, such as using intercalibrated methods, data based on a high number of samples, water bodies with EQRs not too close to class boundaries.

- medium confidence: classification based on monitoring of at least one supporting quality element, or when failing one of the other criteria needed to report high confidence

- low confidence: classification is done without monitoring data, based on expert judgement, or when failing all the other criteria required for high confidence

For some water bodies no information of confidence is reported.

Figure 3.3 Proportion of classified water bodies of the total number of water bodies for rivers and lakes (left) and for transitional and coastal waters (right)

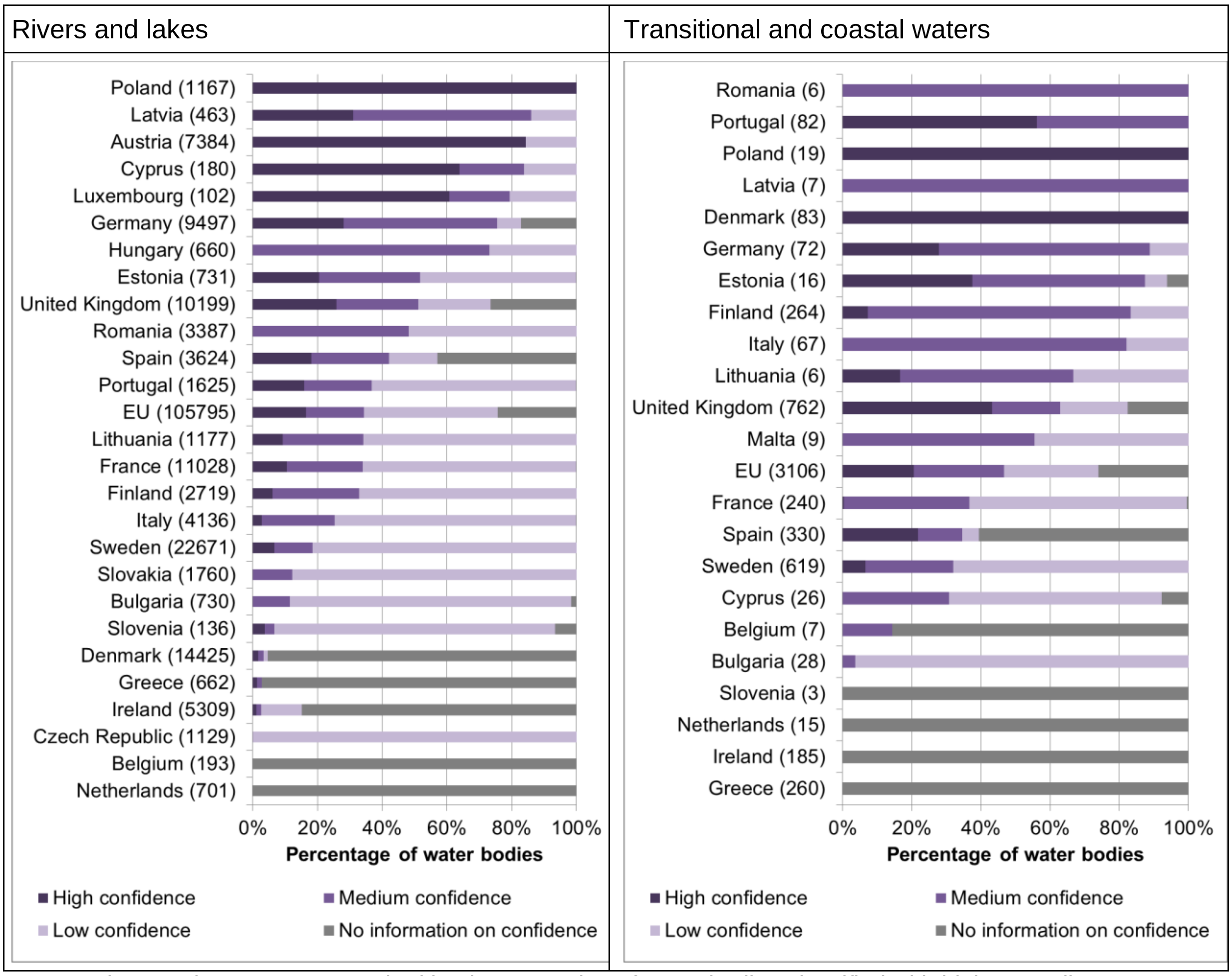
Rivers and lakes	Transitional and coastal waters
	

Notes: The Member States are ranked by the percentage of classified water bodies. The total number of water bodies is given in brackets for each Member State. The total number of water bodies does not include water bodies in Member States/RBDs for which there is no reporting (see table 2.1). "Classified" means water bodies with status class bad to high. "Unclassified" means water bodies with status class "Unknown" or "Not applicable". For Finland, the number of water bodies includes the Aaland RBD.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

The confidence in classification reported in the RBMPs is generally low (Fig. 3.4). For rivers and lakes only one third of the classified water bodies at the EU level have been classified with medium or high confidence. For transitional and coastal water the confidence in classification at the EU level is reported as medium or high for half of the classified water bodies. For all water categories this corresponds roughly to the proportion of water bodies monitored with at least one biological quality element (Fig. 3.4). The difference between the Member States on the confidence reported is large, ranging from high confidence for all classified water bodies to low or no information on confidence.

Poland has reported high confidence for all their classified water bodies, whereas they have only classified 21% of their water bodies in rivers and lakes and 40% in transitional and coastal waters. This is because Poland has only classified a water body if they have high confidence in the classification (see further information related to Fig. 3.3 above). Some Member States have not provided information on confidence for all or almost all of their classified water bodies, e.g. the Netherlands, Belgium, Ireland, Greece and Denmark (the latter mainly for rivers).

Figure 3.4 Member States own assessment of confidence in classification of ecological status or potential of rivers and lakes (left) and transitional and coastal waters (right)



Notes: The Member States are ranked by the proportion of water bodies classified with high or medium confidence. The number of classified water bodies is given in brackets for each Member State. For Finland, the number of water bodies includes the Aaland RBD.
Source: WISE-WFD database, May 2012.

The reasons for reporting low confidence may be related to gaps in assessment systems for certain quality elements or certain types of water bodies, or lack of monitoring data.

The large proportion of water bodies classified with low confidence or with no information on confidence suggests that the classification results are quite uncertain for the majority of water bodies in these first RBMPs. In many cases the classification is probably based merely on expert judgement and/or on results of the pressure and impact analyses rather than on biological monitoring data and WFD-compliant classification systems.

Although the knowledge base to classify the ecological status has not been optimal for the first RBMPs due to missing methods, status class boundaries and monitoring, there has nevertheless been a significant improvement of the knowledge base and increased transparency by compiling together information on all characteristics, pressures and impacts on water bodies compared to the situation before the WFD.

3.3. *Basis for classification of chemical status of surface waters and groundwater*

3.3.1. Principles for classification of chemical status

Chemical status is assessed by compliance with environmental standards for chemicals that are listed in the WFD (Annex X) and the Environmental Quality Standards (EQS) Directive 2008/105/EC. These chemicals include priority substances, priority hazardous substances and eight other pollutants carried over from the Dangerous Substances Daughter Directives. Chemical statuses are recorded as good or fail to achieve good status.

3.3.2. Surface Water

The WFD reporting guidance proposed that Member States grouped the reporting of priority substances into four categories; heavy metals, pesticides, industrial pollutants and 'other pollutants' (EC, 2009). The latter category included a mix of individual chemical types including polycyclic aromatic hydrocarbons (PAHs) and tributyltin compounds. Inconsistency in reporting was apparent between Member States, however, with some reporting a mix of pollutant groups and individual pollutants, whilst others reported either individual pollutants or groups only. Moreover, different matrices (i.e. water column, sediment and biota) have sometimes been used to assess the risk of particular chemicals across different Member States, meaning that the results arising are not always directly comparable.

3.3.3. Groundwater

Reporting with respect to WFD groundwater chemical status required a grouping into three categories; nitrate, certain pesticides and the Annex II pollutants covering arsenic, cadmium, lead, mercury, ammonium, chlorides, sulphates, trichloroethylene and tetrachloroethylene. Inconsistency in reporting was apparent between Member States, however, with some reporting a mix of pollutant groups and individual pollutants, whilst others reported either individual pollutants or groups only. Moreover, the definition of pollutants and their associated threshold values (as required under the Groundwater Directive) vary markedly between Member States (EC, 2010a).

3.4. *Pressures and impacts*

Significant pressures and impacts

To achieve good ecological status, Member States will have to address the pressures affecting water bodies. The WFD requires that Member States collect and maintain information on the type and magnitude of significant pressures and impacts on their water bodies. The common understanding of a 'significant pressure' is any pressure that on its own, or in combination with other pressures, may lead to failure to achieve the WFD objectives of achieving good status. Pressures are emissions of pollutants (e.g. point and diffuse source emissions of nutrients, organic matter, hazardous substances, wet and dry deposition of long-range transboundary air pollution), emission of cooling water, physical changes made to water bodies changing their hydrological and/or morphological characteristics, water abstraction and biological pressures such as introduction or accidental spreading of invasive species. *Impacts* in the WFD sense means effects of these pressures on water bodies in terms of various kinds of environmental problems occurring in water, such as nutrient enrichment, organic enrichment, acidification, salinization, temperature increase, altered habitats, contamination with chemicals, water scarcity etc.

The full list of pressures and impacts is given in WFD CIS guidance no. 3 (EC, 2003b).

The first identification of pressures and impacts (WFD Article 5) was the basis for the overview of Significant Water Management Issues that was reported in 2007 and used for establishing the first RBMPs. The identification of significant pressures and impacts was further developed in the RBMPs.

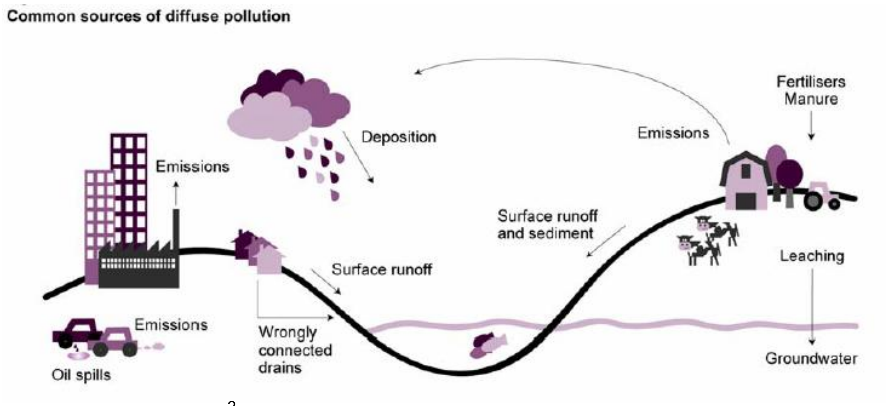
Pollution and water quality

Clean unpolluted water is essential for our ecosystems. Plants and animals in freshwaters 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 pollutants, including sewage effluent, as well as farm and food-processing wastes consume oxygen, suffocating fish and other aquatic life. Excess nutrients can create eutrophication, characterised by problematic algal blooms, depletion of oxygen and loss of life in bottom waters, increased plant growth, and an undesirable disturbance to the balance of organisms present in the water. Also pollution with hazardous substances and chemicals can threaten aquatic ecosystems and human health.

Many human activities result in water pollution, with the main sources being discharge from urban waste water treatment, industrial effluents and losses from farming. During the last century increased population growth and increased wastewater production and discharge from urban areas and industry (point sources) resulted in a marked increase in water pollution. Due to improved purification of waste water and changed industrial production and processes, pollution discharges are today partly decoupled from population growth and economic growth.

Agriculture/farming is a key source of diffuse pollution, but urban land, forestry, atmospheric deposition and rural dwellings can also be important sources (Fig. 3.5). Modern-day agricultural practices often require high levels of fertilisers and manure; leading to high nutrient surpluses that are transferred to water bodies through various diffuse processes.

Figure 3.5 Overview of different diffuse sources



Source: Environment Agency, 2007[2].

Sources for hazardous substances are pesticides and veterinary medicines from farmland, discharge of heavy metals and some industrial chemicals, and via wastewater from consumer products such as body care products, pharmaceuticals and cleaning agents.

Mining exerts a localised but significant pressure upon the chemical and ecological quality of water in parts of Europe, particularly with respect to the discharge of heavy metals (Johnston et al. 2008). Landfill sites and contaminated land from historical industrial and military activities can be a source of pollution to the aquatic environment.

Intensive aquaculture can be a significant local source of discharges of nutrients and cause eutrophication. Feed spills and excrement are not collected but are released directly into the water.

Once released to freshwaters, pollutants can be transported downstream and ultimately discharged to coastal waters together with direct discharges from cities and industries. Shipping, harbour and port

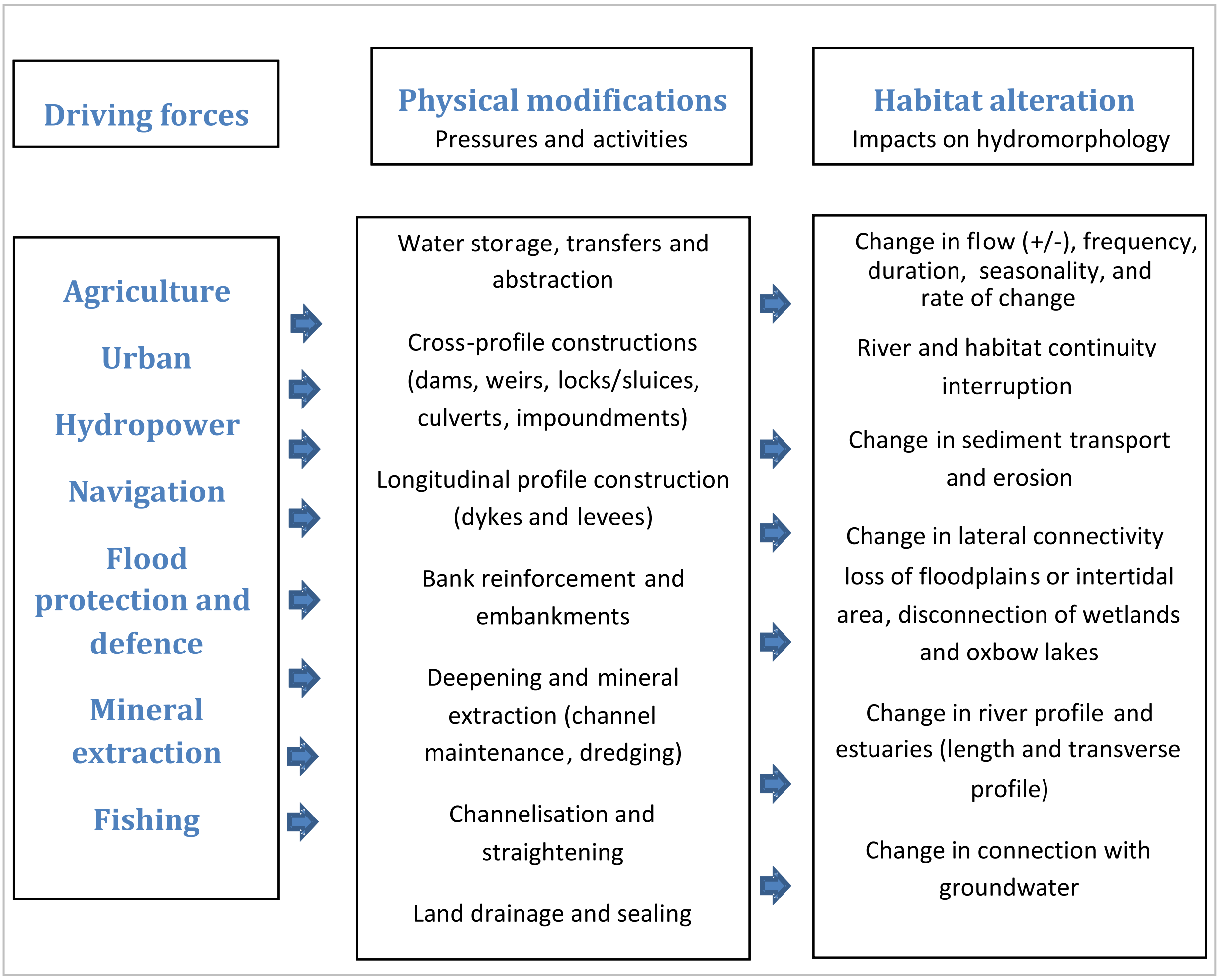
[2] Contains Environment Agency information © Environment Agency and database right.

activities, offshore oil exploration and aquaculture all emit a variety of pollutants adding to the pollution of transitional and coastal waters.

Hydromorphology

For decades, sometimes centuries, humans have altered European surface waters (straightening and canalisation, and disconnection of flood plains, land reclamations, dams, weirs, bank reinforcement, etc.) to enable agriculture and urbanisation, produce energy and protect against flooding. The activities result in damage to the morphology and hydrology of the water bodies, in other words to their hydromorphology, and results in altered habitats with severe impacts significantly on the status of the aquatic environments.

Figure 3.6 Conceptual overview of the relation between drivers, hydromorphological pressures and habitat and flow alterations



There are many human activities considered as *driving forces* that result in *hydromorphological pressures* and eventually *habitat alterations* (Fig. 3.6).

Agricultural and forestry activities are in many places affecting the hydromorphological status of European water bodies. Water storage and abstraction for irrigated agriculture have, in particular in Southern Europe changed, the hydrological flow regime of many river basins. In Northern Europe, many landscapes have been ditched and lakes drained for agriculture and forestry. Intensification of agriculture included many land reclamation projects affecting transitional and coastal waters and affected many rivers that were straightened, deepened and widened to facilitate land drainage and to prevent local flooding.

Urban developments have affected many rivers, lakes and coastal waters. During the last centuries rivers in Europe have been sealed in concrete, habitats have been lost, hydromorphological processes have been and are still strongly interrupted, lakes have been isolated or even filled and the coastal waterfront has been heavily developed. Impervious sewage collection systems have changed the water flow regime.

Reservoirs are human-made lakes created by the damming of rivers to serve one or more purposes, such as hydropower production, water supply for drinking, irrigation and flood protection. During the last two centuries there has been a marked increase in both the size and number of large storage capacity reservoirs, especially with the development of hydropower and large basin management. There are currently about 7000 large dams in Europe. In addition, there are thousands of smaller dams. In 2008 hydropower provided 16% of electricity in Europe and hydropower currently provides more than 70% of all renewable electricity.

Marine shipping and inland waterway transport plays an important role in the movement of goods in Europe. Many thousands of kilometres of waterways connect hundreds of cities and industrial regions. Navigation activities and/or navigation infrastructure works are typically associated with hydromorphological pressures. Deepening including channel maintenance, dredging, removal or replacement of material is a major activity.

Flood defence works may cause significant pressures on hydromorphology. Today many sections of the major rivers and estuaries have dykes. The building of dykes resulted in the loss of floodplains and marshes as retention spaces for flood water.

In many cases, *minerals are extracted* from surface water. Gravel and sand extraction have occurred in several European river basins resulting in widespread channel adjustments in the last 100 years.

Hydromorphological pressures, often connected with *construction, marine transportation and tourism*, alter the coastal zone, causing considerable changes in physical features of the coast including sediment transport and erosion.

Invasive Alien Species

Biological pressures related to Invasive Alien Species (IAS) have been identified as a significant pressure in several of the RBMPs. IAS are non-native plants or animals which compete with, and may even over-run, our natural aquatic plants and animals. Introduction of IAS may alter both species composition and the numbers of different species in surface waters. Escaped farmed salmon for instance, represents a serious risk to wild salmon stocks.

Climate change

It is increasingly being recognised that climate change will have a significant impact on the aquatic environment in Europe (EEA, 2008; Kundzewicz et al., 2007; EEA ETC/W, 2010a; EEA, 2012a). Climate change is projected to lead to major changes in yearly and seasonal precipitation and water flow, flooding and coastal erosion risks, water quality, and the distribution of species and ecosystems. Models indicate that at a general level the south of Europe will show a significant drying trend and the north of Europe a wetter trend. There are many indications that water bodies, which are already under stress from human activities, are highly susceptible to climate change impacts and that climate change may hinder attempts to prevent deterioration and/or restore some water bodies to good status. Although climate change is not explicitly included in the text of the WFD, the step-wise and cyclical approach of the river basin management planning process makes it well suited to adaptively manage climate change impacts.

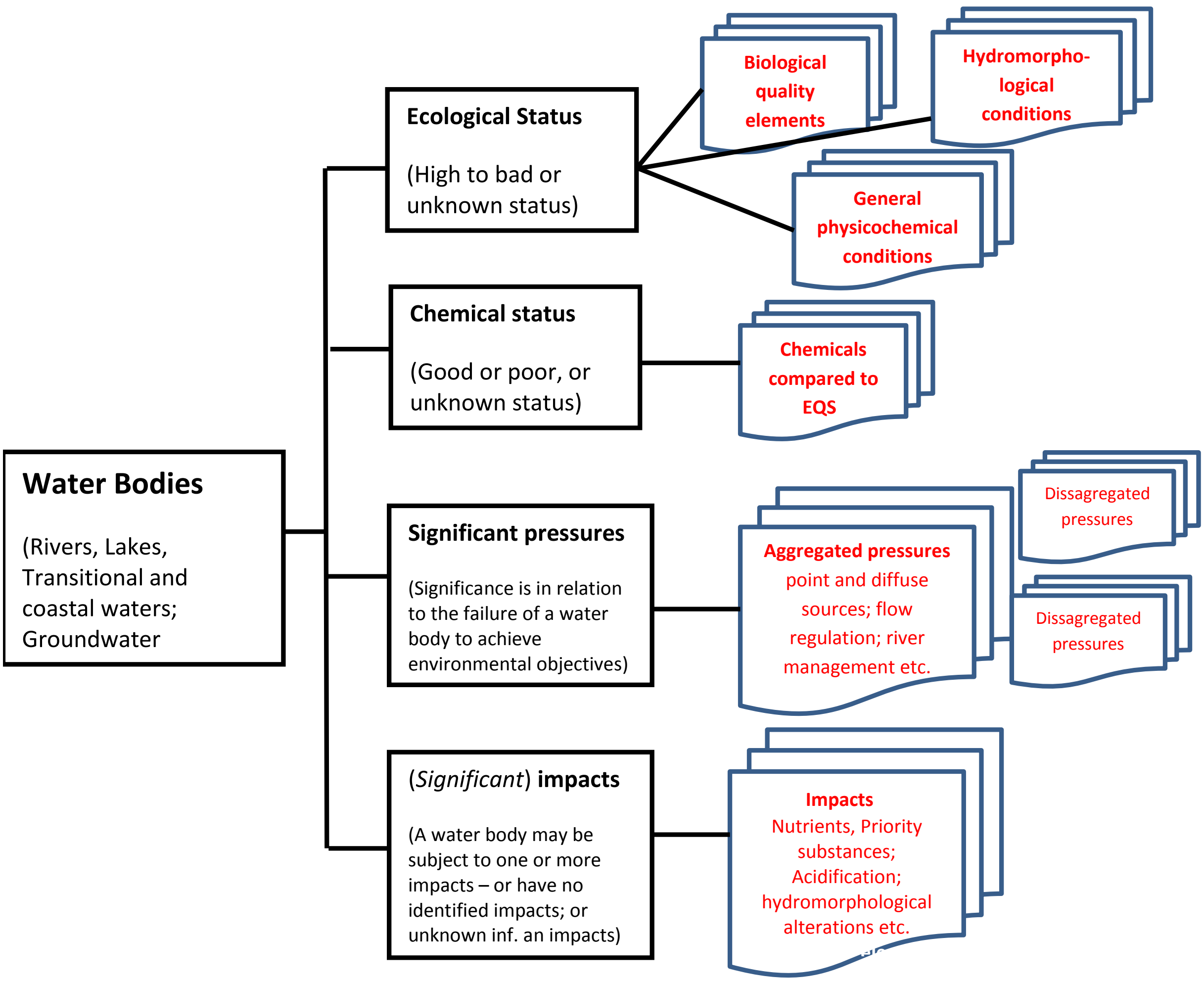
3.5. *Methodology issues in relation to data handling*

In the following is described some of the methodology issues, quality issues and shortcomings in relation to analysing the data in the WISE-WFD database. The analysis is based on the set of information which is reported for each water body (Fig. 3.7).

- *Ecological status for natural water bodies*. This information is based on more detailed information on which biological quality elements (e.g. macroinvertebrates; phytoplankton); physico-chemical quality elemenets (general water quality information e.g. nitrate and phosphorus and specific pollutants) and hydromorphological quality elements have been used for classification. While the reporting requirements refer to the QEs used for classification of monitored water bodies, Member States may have classified more water bodies according to a particular QE due to grouping.
- *Ecological potential for HMWBs and AWBs.* This is either based on the same QEs as for ecological status after adjusting for the impacts of the hydromorphological pressures underlying the designation of the water body as being heavily modified or artificial, or on the level of measures taken to mitigate the impacts of all other pressures on those water bodies.
- *Chemical status*. This is based on priority substances. Chemical status is assessed by compliance with environmental standards for chemicals that are listed in the WFD (Annex X) and the Environmental Quality Standards (EQS) Directive 2008/105/EC. These chemicals include priority substances, priority hazardous substances and eight other pollutants carried over from the Dangerous Substances Daughter Directives. Chemical status is recorded as good or failing to achieve good status.
- *Significant pressures* such as pressures related to diffuse sources or water flow regulation. More than one pressure may apply to a water body. According to the WFD reporting guidance, significance is defined by each MS according to their interpretation of the WFD provisions.
- *Significant impacts* such as nutrient enrichment; contamination by priority substances; acidification; and alteration of habitats etc. A water body may be subject to more than one impact. According to the WFD reporting guidance, significance is defined by each MS according to their interpretation of the WFD provisions.

A water body may have no significant pressure or impact because it is in good (or high) status. However, no reported pressures or impacts may also mean that pressures and impacts have not been reported or identified.

Figure 3.7 Conceptual overview of reported information in relation to a water body



Notes:
Ecological status: only applicable for surface waters, but not for groundwater.
Significant pressures: Member States are required to report on the significant pressures on surface and groundwater water bodies. Significance is in relation to the failure of a water body to achieve environmental objectives. More than one pressure may apply to a water body. Significant pressures have been reported at different levels of aggregation. For example, point source discharges might be reported at three levels of aggregation: 1 Point Source, 1.1 Point - UWWT_General and 1.1.1 Point - UWWT_2000.
Significant impacts: Number and percentage of water bodies that are reported as being subject to the indicated significant impacts. A water body may be subject to more than one impact.

3.5.1. Data handling

Unclassified water bodies – unknown status, pressure and impact

Some water bodies have been reported with unknown or not applicable ecological status/potential (unclassified water bodies), or no information on significant pressures (no pressures) or impacts (no impacts). In most cases unclassified water bodies do not have information on pressure and impacts. All analyses done in the following chapters are based on water bodies which are classified with respect to ecological status or potential only.

No differentiation between ecological status and potential

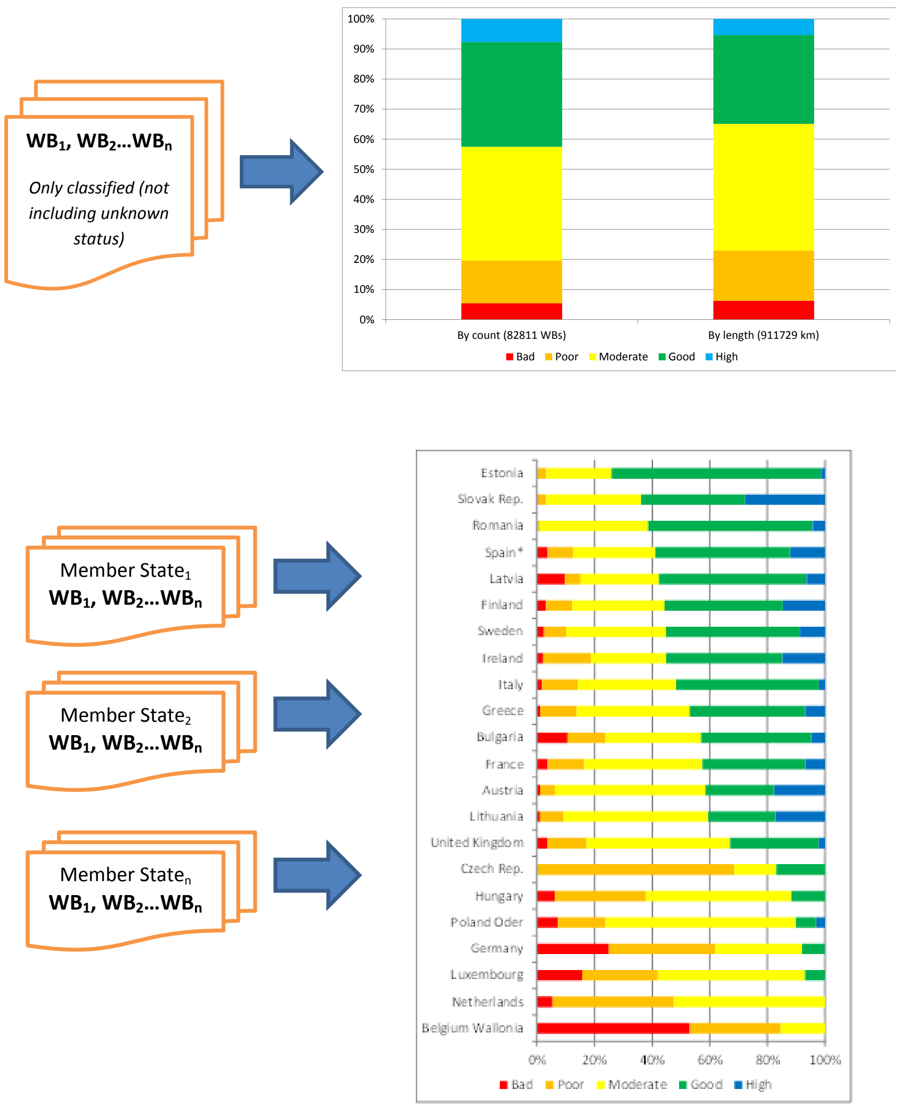
In the analyses in this report, no distinction has been made between ecological status and potential. The criteria for classification of natural (status) and artificial or heavily modified water bodies (potential) vary, but the ecological conditions they reflect are assumed to be comparable having the same deviation from reference conditions or from maximum ecological potential, after adjusting for the effects of the physical modifications in case of the HMWB or AWBs. The main aim of this report is to provide a holistic picture of Europe, not focusing on the differences between the natural vs the HMWBs and AWBs, and not dealing with the large variation in the proportion of HM and AWBs between Member States. Moreover, presenting the natural and the HMWBs and AWBs in separate diagrams would largely increase the number of diagrams in the report. The differences between the ecological status of natural water bodies vs the ecological potential of HMWBs and AWBs are provided in the separate Hydromorphology assessment report (EEA ETC/ICM, 2012).

3.5.2. Aggregation of data

The basic information unit is water bodies. For each water body is attached information on status, pressures and impact. This information has been aggregated to European, country and RBD level and is presented as (Fig. 3.8):

- Percentage, number or length/area of water bodies in the different classes of ecological and chemical status.
- Percentage, number of water bodies affected by different significant pressures and impacts.

Figure 3.8 Aggregation of status to European overviews (upper panel) and for country comparison



3.5.3. How to read the diagrams in chapters 4 and 5

- The diagrams are based on only water bodies with classified ecological status or potential.
- The percentage high and good status (blue or green colour) or water bodies without pressures or impacts (blue colour) are always presented to the right of the bar charts.
- Diagrams with country comparison are always ranked by the percentage of water bodies not achieving good status (red, orange and yellow colour).
- This ranking by percentage of water bodies not achieving good status are kept when presenting percentage of water bodies affected by different pressures or impacts.
- Pressure information has been aggregated to main pressure groups (see the notes to the diagrams).

4. Ecological status, pressures and impacts in different countries and sea regions

4.1. Introduction

This chapter provides information at the Member State level on ecological status, pressures and impacts with sub-chapters for each water category: Rivers, Lakes, Transitional and Coastal waters. The information is based on data that has been reported by Member States along with their first River Basin Management Plans (WFD Article 13 reports).

Each water category is presented in the same way, showing two sets of figures using all classified water bodies in each country:

1. Three separate bar plots with one bar per country showing
   a. Ecological status class distribution, countries are ranked from top to bottom with those with the highest proportion of water bodies in good and high ecological status on top and those with the lowest proportion in good and high status at the bottom
   b. Proportion of water bodies with any pressure reported (red colour) and with no pressures reported (blue colour). Countries with no pressures reported for any water body have no bar in the figure.
   c. Proportion of water bodies with any impact reported (red colour) and with no impact reported (blue colour). Countries with no impacts reported for any water body have no bar in the figure.
2. Four separate bar plots with one or two bars per country showing the pressures and impacts that are most often reported.
   a. Point source and diffuse source pressures
   b. Organic enrichment and nutrient enrichment impacts
   c. Contamination impacts, including contamination by priority substances and contaminated sediments
   d. Hydromorphological pressures, including water flow regulation, river/transitional/coastal management, other morphological alterations, and water abstraction, and altered habitats (impacts)

For each water category the ranking of the countries is the same in all these plots and follows that given by the ecological status plot.

For the transitional and coastal waters the Member States are grouped into sea regions (for delineation of sea regions, please see chapter 1).

Uncertainties are described in section 4.6.

For each water category there are also some case studies included, see section 4.7.

4.2. Rivers

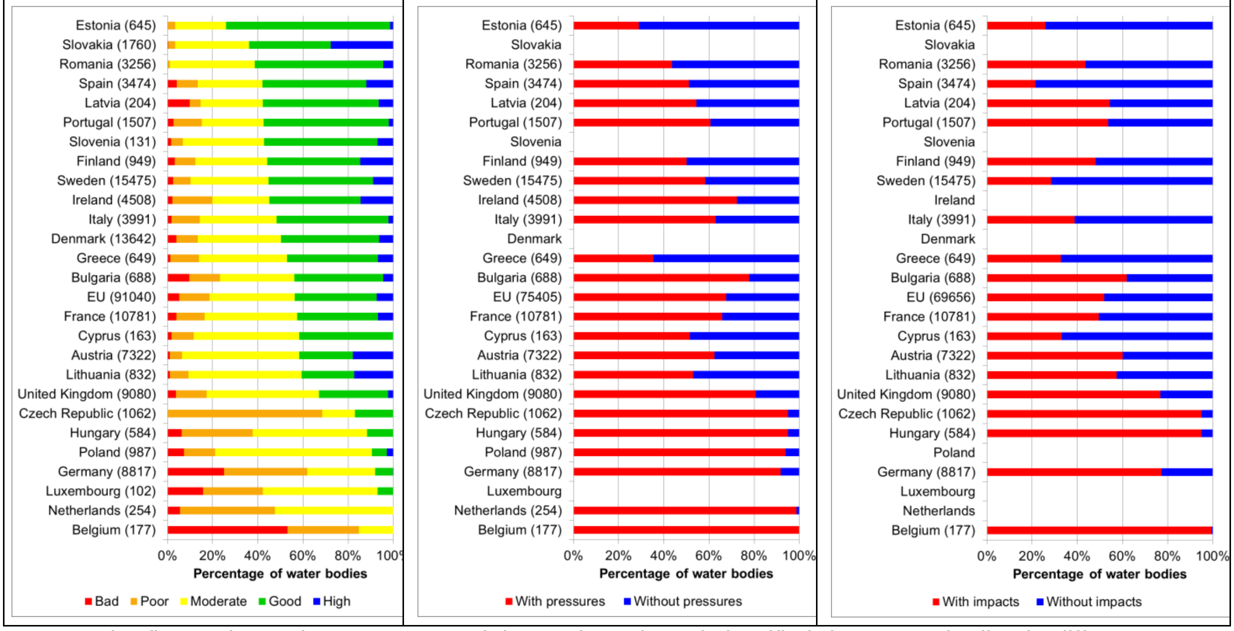
4.2.1. Main assessment of ecological status and main pressures and impacts

Europe has an extensive network of rivers and streams. In total more than 100 000 river water bodies with a length greater than 1.2 million km has been reported by Member States. Five countries, France, UK, Germany, Sweden and Denmark reported nearly 60% of the river water bodies, while four countries, France, Germany, Poland and the UK accounted for nearly half of the river length.

The average length of the more than 100 000 reported river water bodies is 11 km. Three Member States, Latvia, Bulgaria and Portugal have river water bodies with an average length of more than 30 km. Four Member States, France, Hungary, Poland and Romania have reported river water bodies with an average length twice as long as the EU26 average. Austria, Denmark, Ireland and Sweden have relatively short river water bodies with an average length less than 5 km, which is less than half the EU26 average. Further information is provided in chapter 2 and table 2.6.

Figure 4.1 Ecological status or potential, pressures and impacts of classified river water bodies in different Member States

a) Rivers – ecological status or potential	b) Rivers - pressures/no pressures	c) Rivers – impacts/no impacts



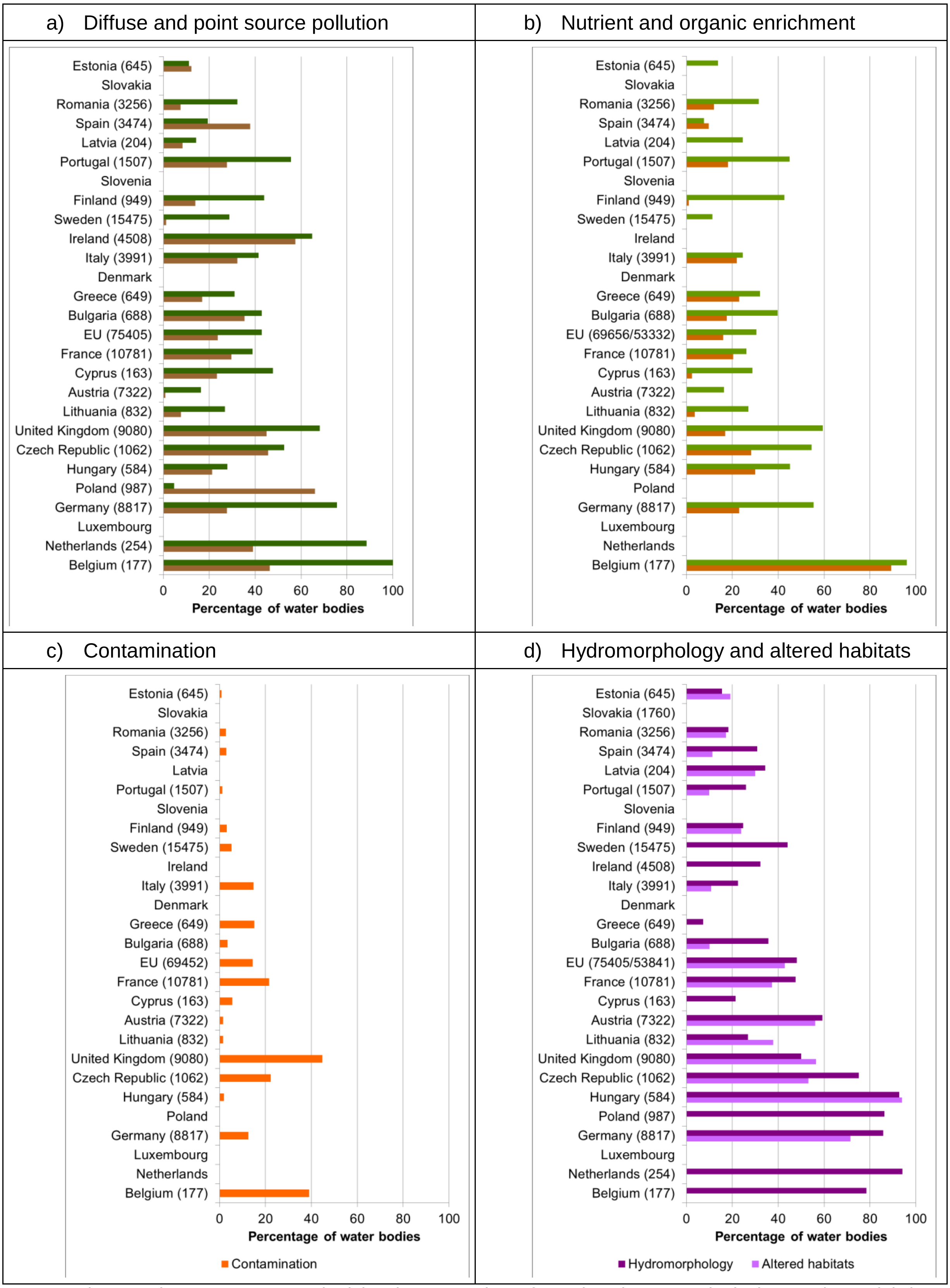
Notes: The figure shows the percentage of the total number of classified river water bodies in different status classes (a), with and without pressures (b), and with and without impacts (c). The Member States are ranked by the proportion of good or better ecological status/potential. The number of classified river water bodies is given in brackets for each Member State. Empty rows in the pressures and impacts plots mean that no data on pressures and/or impacts are reported from those Member States. These Member States are also excluded from the overall EU results. Swedish surface water bodies where the pressure or impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by pressures or impacts (see text). See appendix for further details.

Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

Main messages

- 51 300 river water bodies (56% of the total number), or 630 000 km (64% of the total river length) are reported to have less than good ecological status or potential.
- The main causes for the poor ecological status/potential are diffuse and point sources coming from agriculture, from urban wastewater and industrial emissions, causing nutrient and organic enrichment, as well as hydromorphological changes causing altered habitats.
- The worst ecological status, pressures and impacts in rivers are found in Central European Member States with high population density and intensive agriculture, while Northern Europe shows a far better situation due to lower pressures and impacts. In Eastern and Southern European Member States there is larger variability in river status among the countries.

Figure 4.2 Proportion of classified rivers exposed to different main pressures and impacts in different Member States



Notes: The Member States are ranked by the proportion of good or better ecological status/potential (see Fig. 4.1a). The number of classified river water bodies is given in brackets for each Member State. Empty rows mean that no data on the specific pressure and/or impact are reported from those Member States. These

Member States are also excluded from the overall EU results. Swedish surface water bodies where the diffuse sources pressure or the contamination impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by this pressure or impact (see text). See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

Specific assessment

Many of the Central-European Member States with high population density and intensive agriculture generally have only a small proportion of their river water bodies in good or better ecological status or potential (lower part of Fig. 4.1a). A high proportion of river water bodies with good ecological status or potential is mainly reported in Northern Europe (Sweden, Finland, Ireland), in two of the Baltic countries (Estonia and Latvia) and in some southern and eastern European Member States (Spain, Portugal, Romania, Slovakia, Slovenia). The large differences reported between some neighbouring Member States, e.g. Latvia and Lithuania, the Czech Republic and Slovakia, as well as between Hungary, Romania and Bulgaria may partly be caused by different assessment approaches.

The proportion of river water bodies with no significant pressure (Fig. 4.1b) or no impacts (Fig. 4.1c) generally followed the ranking of Member States based on at least good ecological status, i.e. Member States having more than 50% of the river water bodies in good ecological status generally also had a high proportion of river water bodies s without pressures and with no identified impacts. In contrast, the Member States with a large proportion of water bodies in less than good ecological status generally have the majority of river water bodies with significant pressures and impacts.

The proportion of river water bodies affected by diffuse pollution (Fig. 4.2a), nutrient enrichment (Fig. 4.2b), as well as hydromorphological pressures and altered habitats (Fig. 4.2d), generally corresponds to the proportion in good ecological status (Fig. 4.1a).

The most important pollution pressure comes from diffuse sources, causing nutrient enrichment impacts in the majority of rivers in most of the Member States having the worst ecological status (lower part of Fig. 4.1a), with the notable exception of Poland who reported very low diffuse pressures. Most Member States with better ecological status report a lower proportion than the EU average of 35% to be affected by diffuse pressures and nutrient enrichment.

Some Member States still have important point source pollution, e.g. Poland and Belgium (Flanders), which is due to lower degree of urban waste water treatment. This pollution is causing quite massive organic enrichment impacts in their rivers, explaining the poor ecological status. Most Member States, however, have much less point source pollution due to substantial urban waste water treatment over the past decade(s), thereby causing organic enrichment in only a minority of rivers.

Contamination by priority substances coming from both point and diffuse source pollution is affecting less than 25% of rivers in most Member States, except in two Member States (UK and Belgium) (Fig. 4.2c). In Sweden, all the water bodies are subject to the impact contamination by priority substances, mainly due to mercury in biota. This has little impact on ecological status, although it affects chemical status (Chapter 5.3.2. and chapter 6).

Hydromorphological pressures causing altered habitats is the other major pressure in European rivers, affecting the majority of water bodies in Member States with a large proportion of rivers in moderate or worse ecological status or potential (Fig. 4.2d). In the Member States with better ecological status or potential this pressure and impact affect less than 50% of the classified rivers, but is still an important problem in many rivers.

4.3. Lakes

4.3.1. Main assessment of ecological status and main pressures and impacts

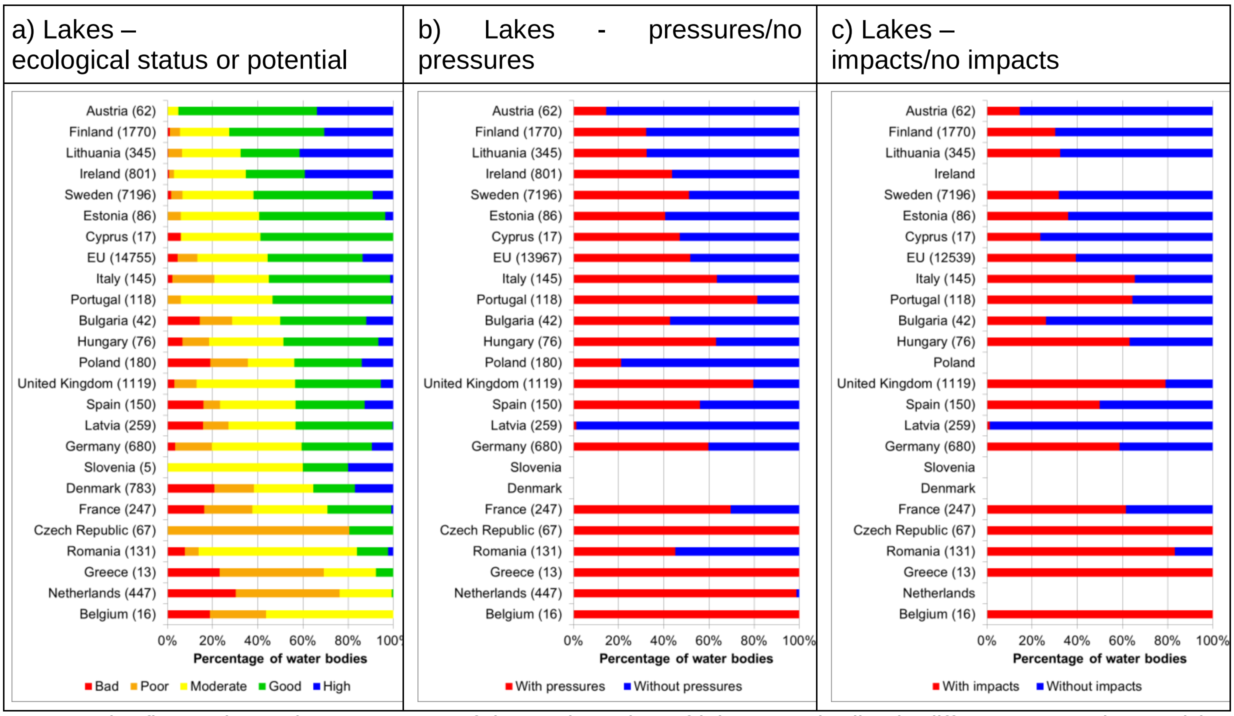
In total around 19 000 lake water bodies with a total area of 88 000 km^2 has been reported by 24 Member states. Two countries, Sweden, and Finland, reported more than two thirds of the lake water bodies and lake area.

The average area of the reported lake water bodies is 4.6 km^2. Four Member States (Austria, Estonia, Greece and Spain) have an average size of lake water bodies greater than 10 km^2. Half of the reported lakes are less than 1 km^2 in area and more than 87% of the reported lake water bodies have an area less than 5 km^2. Only 78 of the reported lake water bodies have an area greater than 150 km^2; more than half of these are found in Finland and Sweden.

Main messages

- For lakes, 6500 water bodies (44% of the total number) are reported to be in less than good ecological status or potential.
- The main pressures responsible for the degraded ecological status or potential in these lakes are diffuse sources, causing nutrient enrichment, as well as hydromorphological changes causing altered habitats.
- The worst ecological status, pressures and impacts in lakes are found in Central European Member States with a high population density and intensive agriculture, while Northern Europe and Austria shows a far better situation due to lower pressures and impacts.

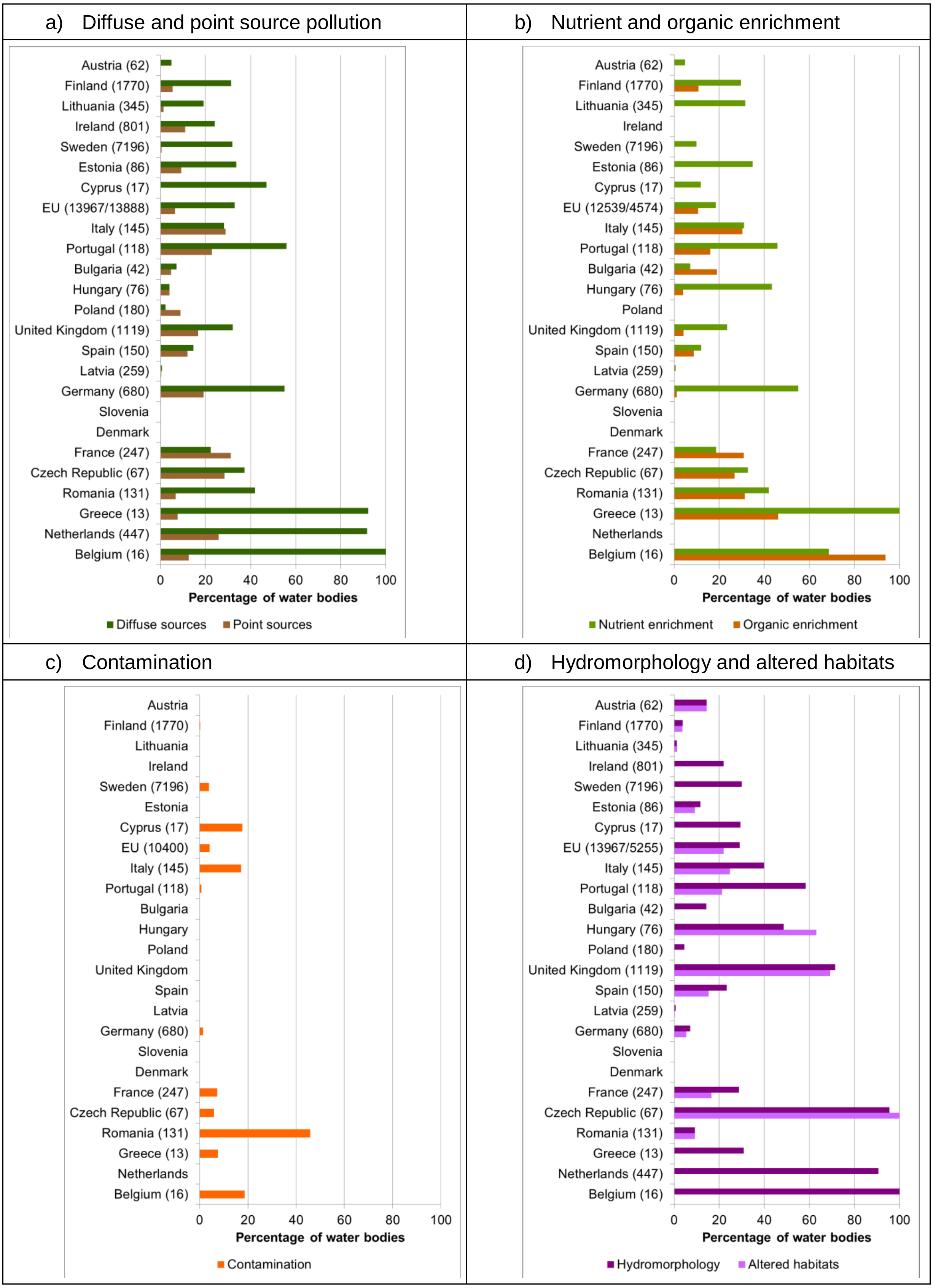
Figure 4.3 Ecological status or potential, pressures and impacts of classified lake water bodies in different Member States



Notes: The figure shows the percentage of the total number of lake water bodies in different status classes (a), with and without pressures (b), and with and without impacts (c). The Member States are ranked by the proportion of good or better ecological status/potential. The number of classified lake water bodies is given in brackets for each Member State. Empty rows in the pressures and impacts plots mean that no data on pressures and/or impacts are reported from those Member States. These Member States are also excluded from the overall EU results. Swedish surface water bodies where the pressure or impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by pressures or impacts (see text). See appendix for details.

Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

Figure 4.4 Proportion of classified lakes exposed to different main pressures and impacts in different Member States



Notes: The Member States are ranked by the proportion of good or better ecological status/potential (see Fig 4.3a). The number of classified lake water bodies is given in brackets for each Member State. Empty rows mean that no data on the specific pressure and/or impact are reported from those Member States. These Member

States are also excluded from the overall EU results. Swedish surface water bodies where the diffuse sources pressure or the contamination impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by this pressure or impact (see text). See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

Specific assessment

For lakes, there are close to 6500 water bodies (44% of the total number), or close to 31 900 km^2 (39 % of total lakes surface area) reported to be in less than good ecological status or potential (Fig. 4.3a). The main causes for the poor ecological status or potential in these lake water bodies are diffuse sources coming from agriculture, causing nutrient enrichment, as well as hydromorphological changes causing altered habitats.

Many of the Central-European Member States generally have more than half of their lake water bodies in less than good ecological status or potential, corresponding to a generally high level of pressures and impacts due to high population density and intensive agriculture (lower part of Fig. 4.3a). In Member States in Northern Europe (Sweden, Finland, Ireland), and in two of the Baltic countries (Estonia and Lithuania) where the level of pressures and impacts are lower, the majority of lake water bodies are reported to be in good or better ecological status or potential. The highest proportion of lake water bodies with good ecological status or potential is reported in Austria, probably reflecting the positive effect of ring-canals installed in the 1970s for capturing sewage and other nutrient emissions (Sampl et al., 1989).

The most important pollution pressure comes from diffuse sources, causing nutrient enrichment impacts in the majority of lakes in most of the Member States having the worst ecological status (Fig. 4.4). Diffuse pollution / nutrient enrichment are important also in Member States with better ecological status of their lake water bodies (Fig. 4.4a, b).

Point source pollution causing organic enrichment of lakes is generally reported to affect fewer lake water bodies in most Member States compared to the fairly large proportion of lakes affected by diffuse pollution and nutrient enrichment. This is due to substantial urban waste water treatment over the past decade(s). However, organic enrichment is still reported to be an important impact in Member States with poor ecological status in a high proportion of lake water bodies, e.g. Belgium and Greece.

Contamination by priority substances coming from both point and diffuse source pollution is a minor impact in most Member States, except in Belgium and the UK, where this impact is reported for 40-50% of the lake water bodies (Fig. 4.4c). In Sweden, all the lake water bodies are subject to diffuse pressures of priority substances and contamination impact, mainly due to mercury in biota, but this has little impact on ecological status, although it affects chemical status. Therefore these data have been excluded from the analyses of pressures and impacts affecting ecological status.

Hydromorphological pressures causing altered habitats is the other major pressure in European lakes, affecting the majority of water bodies in Member States with a large proportion of lakes in moderate or worse ecological status or potential (Fig. 4.4d). In Member States with ecological status or potential better than the EU average, this pressure and impact affect less than 30% of the classified lakes.

4.3.2. Ecological status, pressures and impacts of Europe's largest lakes

The largest lakes of Europe are the lakes Ladoga and Onega in Russia. Within the EU, the largest lakes are Vänern, Vättern and Mälaren in Sweden, Lake Saimaa in Finland, Lake Peipsi in Estonia/Russia, and Lake Ijsselmeer in the Netherlands. All these lakes have a surface area more than 1000 km^2.

Many large, deep lakes in Europe were degraded in the 1960s to 1980s in terms of nutrient enrichment caused by point source emissions, but have now been largely restored due to improved urban waste water treatment following the implementation of the UWWTD and other restoration measures. The case studies in chapter 4.7 on Lago Maggiore, Lake Vänern and Lake Balaton illustrate this improvement in the latter decades, although some impacts still remain in certain parts of these lakes.

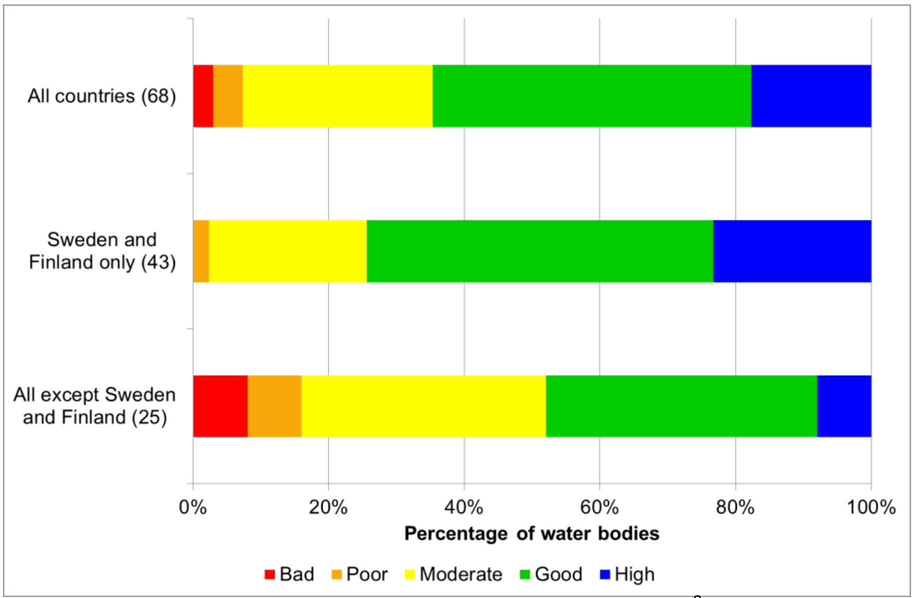
Based on the Member States reporting of lake water bodies in the river basin management plans, there are 67 classified lake water bodies with a surface area larger than 150 km^2. One third of these are in less than good ecological status or potential (Fig. 4.5).

Most of the large lake water bodies are found in Sweden and Finland, and the large majority of these (74%) are in good or better ecological status or potential. Only half of the large lake water bodies in the rest of Europe (excluding Sweden and Finland) are in good or better ecological status or potential.

The only large lake water body reported to be in poor status in Sweden and Finland is the Swedish lake Hjälmaren. Lake Hjälmaren is a shallow, lowland lake suffering from nutrient enrichment caused by run-off from large agricultural areas surrounding the lake and sewage water from the town Örebro in the westernmost part (ILEC, 2012a).

Parts of other large lakes, such as eutrophied shallow bays receiving diffuse or point source pollution may also be in less than good status, but these do not appear among the large lake water bodies shown in Fig. 4.5 because they are delineated as separate water bodies with surface area less than 150 km^2.

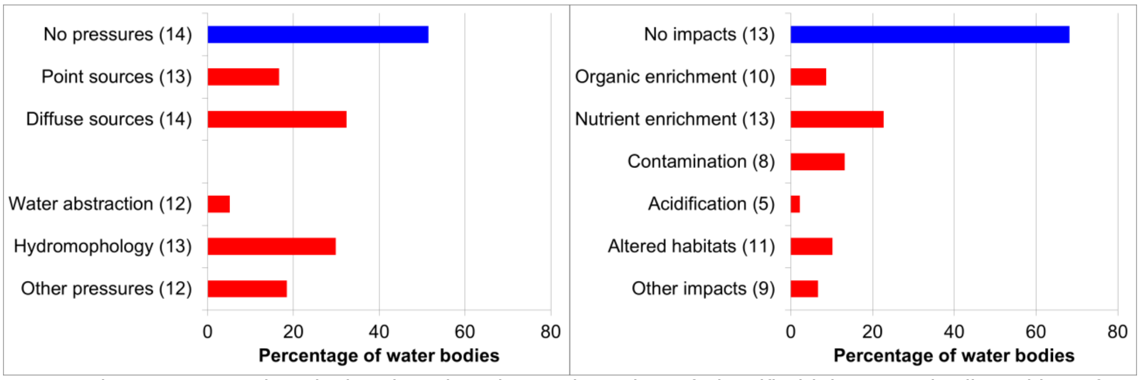
Figure 4.5 Ecological status or potential of classified lake water bodies with surface area more than 150 km^2



Note: The number of classified large lake water bodies > 150 km^2 is given in brackets.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

Slightly more than half of the large lake water bodies (53%) are reported to have no significant pressures (Fig. 4.6), while close to 80% are reported to have no impacts, indicating that some of the pressures have little impact on these large lake water bodies. Particularly the hydromorphology pressures seem to cause little impact, as 30% are exposed to hydromorphology pressures, but only 10% are reported to have altered habitats. The explanation is that Sweden has not reported altered habitats as an impact. Also for point and diffuse source pollution and “other pressures”, the proportion of exposed water bodies are higher than the impacted water bodies, probably because those pressures affect only smaller parts of these large lake water bodies. Diffuse source pollution causing nutrient enrichment is nevertheless the most important pressure and impact in large lakes, implying that reduction of diffuse pollution is required to restore all large lakes back to good status.

Figure 4.6 Pressures (left) and impacts (right) reported in large lake water bodies



Notes: The percentage is calculated against the total number of classified lake water bodies with surface areas more than 150 km^2 in Member States reporting the specific pressure or impact type (or any pressure or impact for the blue bars). The number of Member States included is indicated in brackets. For comparison, the total number of Member States with classified large lake water bodies is 14. "Hydromorphology" denotes the combination of the aggregated pressure types "Water flow regulations and morphological alterations of surface water", "River management", "Transitional and coastal water management" and "Other morphological alterations". A water body is defined as affected by any of the pressure types in the figures if it is reported with the aggregated pressure type and/or any of the corresponding disaggregated pressure types. The impact type "Contamination" means surface water bodies with the impact contamination by priority substances and/or contaminated sediment. The impact type "Other impacts" means surface water bodies with at least one of the impacts "Saline intrusion", "Elevated temperatures" or "Other significant impacts". Swedish surface water bodies where the pressure or impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by the relevant pressure or impact (see text). See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

4.4. Transitional waters

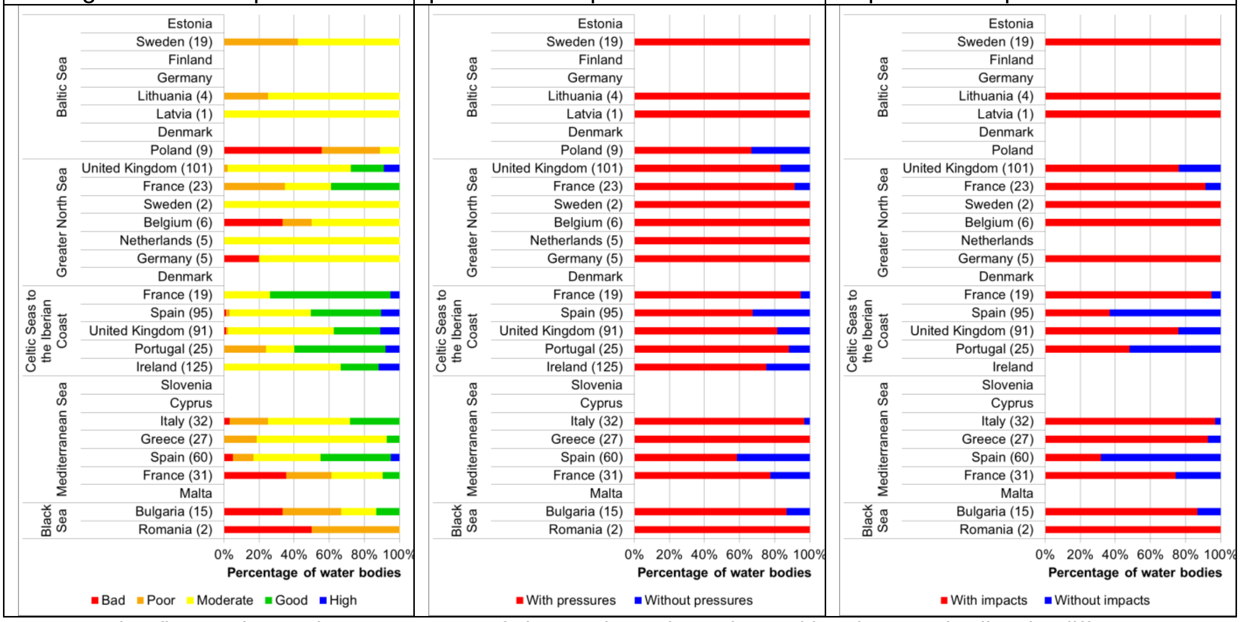
4.4.1. Main assessment of ecological status and main pressures and impacts

Main messages

- A large majority of transitional water bodies are in less than good ecological status in most Member States and sea regions, due to extensive multiple pressures and impacts.
- Both diffuse and point source pollution causing nutrient and organic enrichment, contamination by priority substances, as well as hydromorphological pressures causing altered habitats are all responsible for the degraded ecological status in transitional waters.
- For transitional waters in the Celtic Sea to the Iberian Coast the situation is less severe with close to half of the water bodies in good ecological status or potential, probably due to a better water exchange.

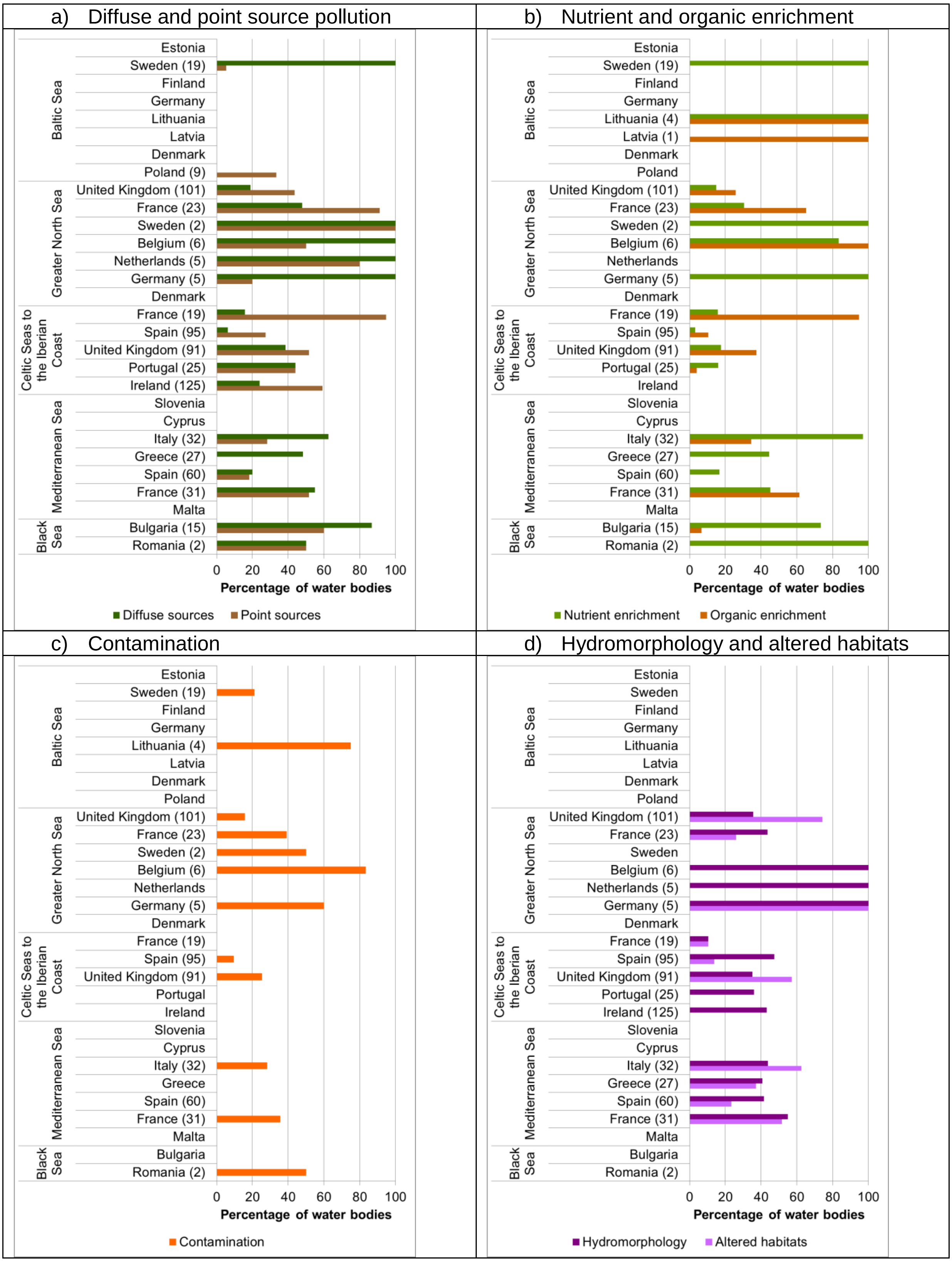
Figure 4.7 Ecological status or potential, pressures and impacts of classified transitional water bodies in different sea regions and Member States

a) Transitional waters - ecological status or potential	b) Transitional waters - pressures/no pressures	c) Transitional waters - impacts/no impacts



Notes: The figure shows the percentage of the total number of transitional water bodies in different status classes (a), with and without pressures (b), and with and without impacts (c) in Member States bordering Sea regions. The Member States are ranked by the proportion of *coastal* water bodies in good or better ecological status/potential within each sea region (see Fig. 10a). The number of classified transitional water bodies is given in brackets for each Member State. Member States not reporting or not having transitional waters have been included in the current diagram to ensure the comparability with the coastal diagrams included in the next section. Where ecological status or potential has been reported, empty rows in the pressures and impacts plots mean that no data on pressures and/or impacts are reported from those Member States. Swedish surface water bodies where the pressure or impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by pressures or impacts (see text). See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

Figure 4.8 Proportion of classified transitional waters exposed to different main pressures and impacts by sea regions and Member States



Notes: The Member States are ranked by the proportion of *coastal* water bodies in good or better ecological status/potential within each sea region (see Fig. 10a). The number of classified transitional water bodies is given in brackets for each Member State. Empty rows mean either that ecological status or potential has not been reported (see Fig. 4.7a) or that no data on the specific pressure and/or impact are reported from those Member

States. Swedish surface water bodies where the diffuse sources pressure or the contamination impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by this pressure or impact (see text). For Lithuania the diffuse and point source pressures were reported under the "Other pressures" category, due to lack of quantitative information on share of the two different pressure types (point, diffuse). .See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

All classified transitional water bodies in eight Member States (Sweden, Lithuania, Latvia, Poland, Netherlands, Germany, Belgium (Flanders) and Romania) are reported to be in less than good ecological status or potential (moderate, poor or bad) (Fig. 4.7a). A high percentage (> 80%) of transitional water bodies in less than good status is also reported by Greece and France in the Mediterranean and by Bulgaria and Romania in the Black Sea. In most Member States and sea regions the proportion of water bodies subject to pressures and impacts mostly corresponds to the proportion in less than good ecological status or potential (Fig. 4.7b, c).

Specific assessment of ecological status or potential

Baltic Sea

The worst ecological status or potential in European transitional waters is found in the Baltic Sea region (data from Sweden, Lithuania, Latvia and Poland), where all reported transitional water bodies are classified as less than good. Poland reported 50% of their transitional waters to be in bad status.

Greater North Sea

Transitional water bodies draining to the Greater North Sea are predominantly in less than good status (moderate and less), with the exception of 30-40% of the transitional water bodies in UK and France with good or better status.

Celtic Sea to the Iberian Coast

The best situation for classified transitional water bodies is reported in the region of the Celtic Sea to the Iberian coast, where more than 74% of the French water bodies (Loire RBD only), 60% of water bodies in Portugal and 53% of the Spanish water bodies are in good or better ecological status or potential. Another positive result in this region is that there are almost no water bodies reported to be in bad status, and also very few in poor status. For the UK and Ireland however, a large proportion of transitional water bodies are reported to be in moderate status.

Mediterranean Sea

In the Mediterranean Sea, all Member States with data for transitional water have reported a majority of water bodies to be in less than good ecological status or potential. The situation is worst in France with more than 90% of the classified transitional water bodies reported to be in less than good status and more than 60% in poor or bad status. In Spain the situation is better with more than 40% of the classified transitional water bodies in good or better status or potential.

The proportion of water bodies exposed to pressures reported from Spain and France in the region of the Celtic Seas to the Iberian Coast is higher than those reported for the same Member States for water bodies along the Mediterranean Sea, while the picture for the ecological status or potential is the opposite, with better status in the water bodies in the region of the Celtic Seas to the Iberian Coast than in water bodies along the Mediterranean. This paradox may be related to the more exposed nature of the transitional water bodies along the Atlantic coast of France and Spain than along their Mediterranean coasts, ensuring a better dilution of the pollution causing less ecological effects.

Black Sea

For the EU part of the Black Sea a large majority of the transitional water bodies in Bulgaria and Romania are reported to be in poor or bad status or potential, and only 13% are reported to be in good status (Bulgaria) (Fig. 4.7a).

Specific assessment of different pressures and impacts

Pollution pressures and impacts

In the Baltic Sea, Sweden, Lithuania and Latvia reported impacts by nutrient and organic enrichment (Fig. 4.8), reflecting the well-known eutrophication problem (HELCOM 2010a). No information on pressures and impacts are reported from other Baltic Sea Member States.

In the Greater North Sea, point and diffuse source pollution are equally important, as point sources are reported in 44% of transitional water bodies, while 42% of waters are influenced by significant diffuse sources. In Sweden, the Netherlands, Belgium Flanders and Germany all classified transitional water bodies are exposed to significant diffuse sources pollution, while 80%-100% are exposed to point source pollution. Point sources are also significant in 20-50% of the transitional water bodies in the other Greater North Sea countries.

In the Celtic Seas to the Iberian Coast 24% of the transitional water bodies are influenced by significant diffuse sources. The proportion of water bodies impacted by nutrient enrichment ranges from 5% in Spain to 19% in UK. Point sources are reported to affect half of the transitional water bodies, ranging from 30-60% in Spain, UK and Ireland to 90% in France. Organic enrichment is reported mainly by France (90%) and to a lower extent by the UK (37%).

In the Mediterranean Sea, significant diffuse sources are reported in 41% of the transitional water bodies, ranging from 50-60% in Italy, Greece, France and only 20% in Spain. Nutrient enrichment is also significant in 44% of transitional waters, ranging from less than 20% in Spain, 45% in France and Greece to almost 100% in Italy. Point source pollution is a significant pressure in only 24% of the classified transitional water bodies, ranging from 20-50% in Spain, Italy and France. There is a general agreement between the proportion of diffuse pressures/impacts by nutrient enrichment and pressures by point sources/organic enrichment impacts reported by Mediterranean countries.

In the Black Sea area, both diffuse and point source pollution pressures are significant in ~90% (diffuse sources) and 60% (point sources) of the transitional water bodies. Impacts by nutrient enrichment are reported in 70% of the water bodies, but only less than 10% are reported to be impacted by organic enrichment.

Contamination

Contamination impacts are reported to be most severe in the Greater North Sea and least severe in the Celtic Sea to Iberian Coast. However, major gaps in reporting of this impact prevent further assessment of this impact in other sea regions. Evaluation of the effects of contamination on chemical status is given in chapter 6.

Hydromorphological pressures and altered habitats

Significant hydromorphological pressures causing altered habitats are reported to affect a large proportion of the transitional waters in the Greater North Sea, especially in Begium, the Netherlands and Germany, where all the transitional water bodies are affected. This pressure is also important in the Celtic Seas to the Iberian Coast and in the Mediterranean Sea. In the Celtic Seas to the Iberian Coast most of the Member States reported hydromorphological pressures and altered habitats in 30-50% of the transitional water bodies, except France where only 10% are reported to be affected by this pressure and impact. In the Mediterranean Sea 30-50% of the classified transitional water bodies are subject to significant hydromorphological pressures causing altered habitats.

None of the Member States in the Baltic Sea and Black Sea reported information on hydromorphological pressures and altered habitats.

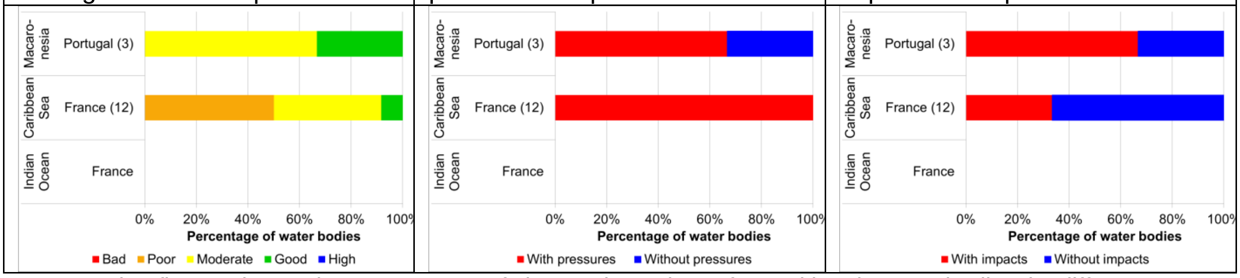
Overseas areas

Portugal reported three transitional water bodies in Macaronesia (The Azores and Madeira). Two of these waters are in less than good status (Fig. 4.9a), corresponding to exposure to significant pressures and impacts (Fig. 4.9b, c). Hydromorphological pressures and altered habitats are the only pressure and impact reported for all the water bodies in less than good status.

France reported 12 transitional water bodies in the Caribbean Sea. 92% of these water bodies are reported to be in less than good status (Fig. 4.9a). All water bodies are reported to have significant pressures (Fig. 4.9b, c), due to pollution from diffuse sources and point sources. It is not clear why the proportion of water bodies with impacts are so much lower than the proportion in less than good status and the proportion exposed to significant pollution pressures. No hydromorphological pressures and altered habitats are reported in the area.

Figure 4.9 Ecological status or potential, pressures and impacts of classified transitional water bodies by overseas sea regions and Member States

a) Transitional waters - ecological status or potential	b) Transitional waters - pressures/no pressures	c) Transitional waters - impacts/no impacts



Notes: The figure shows the percentage of the total number of transitional water bodies in different status classes (a), with and without pressures (b), and with and without impacts (c). The sea regions/Member States are ranked by the proportion of *coastal* water bodies in good or better ecological status/potential (see Fig. 12a). The number of classified transitional water bodies is given in brackets for each Member State. Member States not reporting or not having transitional waters have been included in the current diagram to ensure the comparability with the coastal diagrams included in the next section.

Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

4.5. Coastal waters

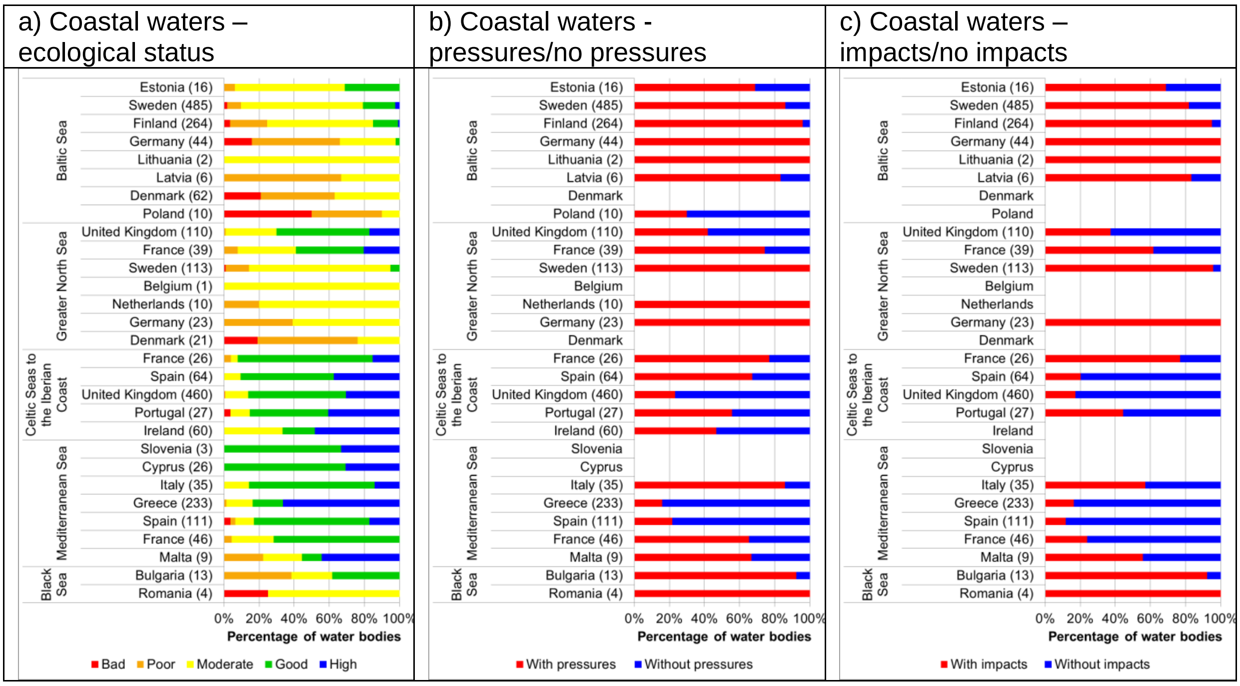
4.5.1. Main assessment of ecological status and main pressures and impacts

Main messages

The worst ecological status in coastal waters is reported in the Baltic Sea, followed by the North Sea and the Black Sea. In the coastal waters in the Mediterranean and the open Atlantic coast (Celtic sea to the Iberian coast) a higher proportion of the coastal water bodies have high or good ecological status. The distribution of pressures and impacts mostly corresponds to reported ecological status; in general coastal waters with a high proportion of water bodies in good status also have a high proportion of water bodies without pressures and impacts.

- Pollution is reported as pressure affecting 80% of the coastal water bodies in the Baltic Sea and more than half of the water bodies in the Greater North Sea. Also in the other sea regions several Member States have a high proportion of coastal water bodies affected by pollution sources. A lower proportion of water bodies affected by pollution pressures are found for the open Atlantic coast (Celtic sea to the Iberian coast).
- Generally a higher proportion of water bodies are affected by diffuse polution sources compared to point sources. The pollution pressures result in a large proportion of the water bodies being impacted by organic and in particular nutrient enrichment.

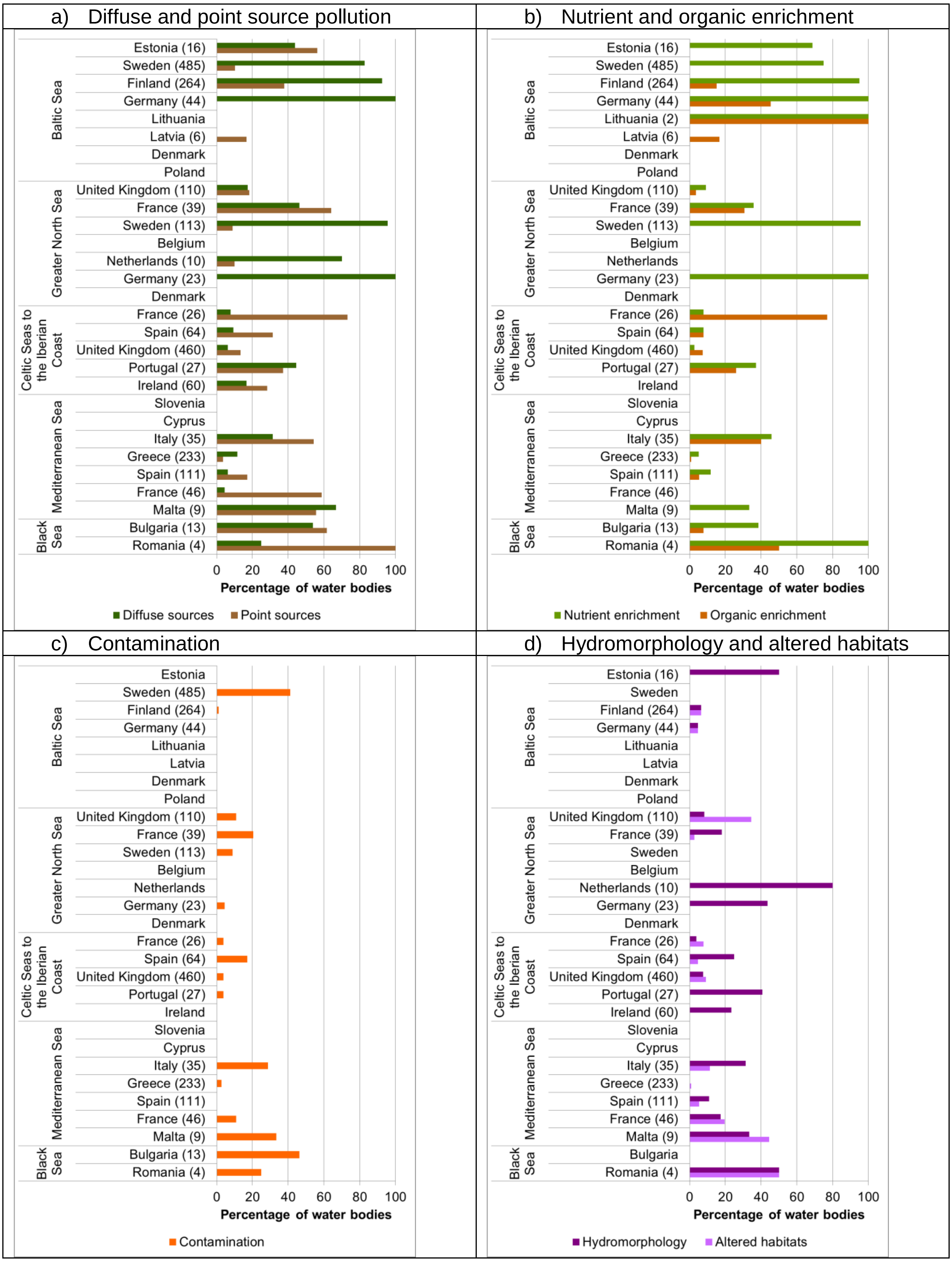
Figure 4.10 Ecological status or potential, pressures and impacts of classified coastal water bodies by sea regions and Member States



Notes: The figure shows the percentage of the total number of coastal water bodies in different status classes (a), with and without pressures (b), and with and without impacts (c). The Member States are ranked by the proportion of good or better ecological status/potential within each sea region. The number of classified coastal water bodies is given in brackets for each Member State. Empty rows in the pressures and impacts plots mean that no data on pressures and/or impacts are reported from those Member States. Finnish data includes water bodies in the Aaland RBD. Swedish surface water bodies where the pressure or impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by pressures or impacts (see text). See appendix for further details.

Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

Figure 4.11 Proportion of classified coastal waters exposed to different main pressures and impacts in different sea regions and Member States



Notes: The Member States are ranked by the proportion of good or better ecological status/potential within each sea region (see Fig. 10a). The number of classified coastal water bodies is given in brackets for each Member State. Empty rows mean that no data on the specific pressure and/or impact are reported from those Member States. Finnish data includes water bodies in the Aaland RBD. Swedish surface water bodies where the diffuse

sources pressure or the contamination impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by this pressure or impact (see text). See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

Specific assessment

All coastal water bodies in 8 out of 21 Member States (Lithuania, Latvia, Denmark, Poland, Belgium, the Netherlands, Germany (the part draining into the Greater North Sea) and Romania) are in less than good status (moderate, poor or bad) (Fig. 4.10a). Cyprus is the only country where all coastal waters are reaching good and high status.

The worst situation is reported in the Baltic Sea countries, where 83% of coastal water bodies are reported to be in less than good ecological status. Only around 2-30% of coastal water bodies in Germany, Finland, Sweden and Estonia are in good/high status. Also in the Greater North Sea, the ecological conditions of the coastal water bodies are not good for most of the Member States, except in France and the UK, who report good or better status for close to 60% and 70% of their coastal water bodies respectively.

The best ecological status of coastal waters is found in the Celtic sea to the Iberian coast, where waters from Spain, the UK, France, Portugal and Ireland are reported. In this area, 70-90% of coastal waters are reaching the environmental objective. Overall, only 15% of the waters are in poor or bad status in this region. Similarly, 60-90% of coastal water bodies in the Mediterranean Sea are reported to be in good/high status.

In the EU part of the Black Sea the situation for the coastal water bodies is also quite problematic with 60% of the coastal water bodies in Bulgaria being in moderate and poor status, whereas all the coastal water bodies in Romania fail to achieve good status (Fig. 4.10a).

Most coastal waters are subject to significant pressures and impacts, yet to lesser extent than transitional waters. The distribution of pressures and impacts mostly corresponds to reported ecological status, except for Poland, where significant pressures are reported for a low proportion of coastal water bodies, even though all water bodies are reported to be in less than good status. On the contrary, Italy, in which most of coastal water bodies (85%) are in good or high status, reported a high percentage of waters being exposed to significant pressures and impacts (Fig. 4.10b, c). The same is true for the French Atlantic coast (Greater North Sea region and Celtic Sea to Iberian Coast region), where the large majority of coastal water bodies are reported to have good status, but only a minority is reported to be without significant pressures or impacts.

Diffuse sources are reported as significant in 78% of the coastal water bodies in Baltic Sea and 53 % in the Greater North Sea (Gig. 4.11). Diffuse pollution pressures appear to be most significant in Finland, Sweden and Germany (Baltic Sea). In the Greater North Sea, Germany (100%), Sweden (96%), and the Netherlands (70%) report significant diffuse pressures for the large majority of their coastal water bodies, in contrast to France and in particular the UK, where this pressure is reported to be of less importance. 75% of coastal waters in the Baltic Sea and 49% in the Greater North Sea are impacted by nutrient enrichment (no data from the Netherlands and Belgium included). Although all of Germany’s coastal waters are affected by diffuse pressures, the proportion of coastal water bodies affected by nutrient enrichment is 23% in the Greater North Sea, and 44% in the Baltic German coastal water bodies.

In both the Baltic Sea and the Greater North Sea only 17% of coastal water bodies are reported to be affected by pressures from point sources, and even fewer coastal water bodies (7%) are reported to be subject to organic enrichment (Fig. 4.11b).

Point sources are reported as significant in 20% of coastal water bodies in the Celtic Seas to the Iberian Coast (mostly in France). The proportion impacted by organic enrichment in this part of the French coast is high (77%), consistent with 73% affected by point sources. Diffuse pressures (as well as nutrient enrichment impacts) do not seem to be important in coastal water bodies of the Celtic Seas to the Iberian Coast.

In the Mediterranean Sea, point sources are reported as significant for half of the water bodies in Italy, France and Malta, although only Italy reports corresponding organic enrichment. Only Malta reports a high proportion of coastal water bodies to be exposed to significant diffuse sources. In Italian coastal waters, diffuse source pollution are reported for one third of their coastal water bodies, while half of the water bodies are subject to nutrient enrichment. No organic or nutrient enrichment was reported by France in the Mediterranean, despite a high percentage of significant point sources.

In the Black Sea, both Bulgaria and Romania reported relatively high proportions of coastal water bodies to be exposed to pollution pressures from point and diffuse sources, as well as nutrient and organic impacts, although the impacts are not quite consistent with the pressures (Fig. 4.11a, b).

Contamination impacts are reported to be most severe in Bulgaria, where half of the water bodies are affected. Other Member States reporting significant contamination impacts are Sweden, Italy, Malta and Romania (Fig. 4.11c). However, major gaps in reporting of this impact prevent further assessment of this impact in other Member States and sea regions. The effects on contamination on chemical status are given in chapter 6.

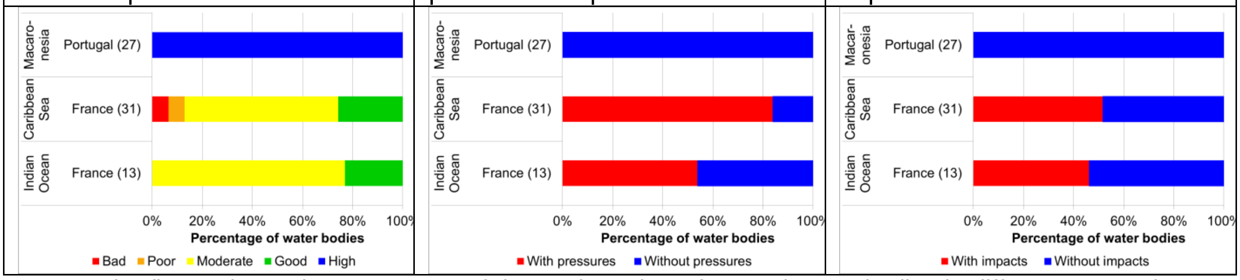
Hydromorphological pressures and altered habitats are reported to affect a relatively low proportion of coastal water bodies in most Member States and sea regions, although nine Member States reported significant hydromorphological pressures in 20-50% of their coastal water bodies (Fig. 4.11d). The worst situation concerning these pressures is found in the Netherlands, where 80% of the coastal water bodies are reported to be exposed to hydromorphological pressures.

Overseas areas

Portugal reported 27 coastal water bodies in Macaronesia (the Azores and Madeira). All of these waters are in good status (Fig. 4.12a, b, c), without significant pressures and impacts.

Figure 4.12 Ecological status or potential, pressures and impacts of classified coastal water bodies by overseas sea regions and Member States

a) Coastal waters - ecological status or potential	b) Coastal waters - pressures/no pressures	c) Coastal waters - impacts/no impacts



Notes: The figure shows the percentage of the total number of coastal water bodies in different status classes (a), with and without pressures (b), and with and without impacts (c). The sea regions/Member States are ranked by the proportion of good or better ecological status/potential. The number of classified coastal water bodies is given in brackets for each Member State.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

France reported 31 coastal water bodies in the Caribbean Sea (French Guyana, Guadalupe and Martinique), where 74% are in less than good status, similarly to French waters in the Indian Ocean (La Reunion), where 77% of coastal waters are in less than good status. Half or more of the water bodies in these areas are reported to be have significant pressures and impacts (Fig. 4.12a, b, c) from point and diffuse sources causing nutrient and organic enrichment.

4.6. Uncertainties of results

The basis for assessing ecological status or potential of water bodies in the first RBMPs is quite weak in some Member States, causing uncertainty in the results described below. The comparability across Member States and RBDs is therefore limited.

Different and/or incomplete assessment and monitoring approaches contribute to uncertainty of results. The large differences in the proportion of water bodies in less than good status between some neighbouring Member States are thus uncertain and should be interpreted with care, e.g. difference of status of rivers in Lithuania and Latvia, or in Hungary and Romania (Fig. 4.1). The high proportion of water bodies in good or better ecological status reported for coastal and transitional waters from southern Italy are also uncertain, as the classified water bodies only constitute 10% of all the transitional and coastal water bodies.

Different assessment approaches also contribute to uncertainties concerning large differences between water categories in the same Member State, e.g. in Romania, where less than 20% of the lake water bodies (Fig. 4.3), but more than 60% of the river water bodies (Fig. 4.1) are reported to be in good or better ecological status or potential. In Lithuania, the situation is opposite with better status in the lakes than in the rivers: close to 70% of the lakes water bodies, but only 40% of the river water bodies are reported to be in good ecological status or potential. These differences may however also have natural explanations related to the geographical location of lakes versus rivers in these countries.

Due to incomplete reporting or mistakes in the reporting of pressures and impacts by countries, it is not always possible to establish a link between pollution sources and nutrient/organic enrichment. For example, Latvia has not reported any significant pressures or impacts for close to 100% of their lake water bodies, in spite of having more than half of their lake water bodies in less than good ecological status or potential. Poland reports lower pressures on their lake water bodies (less than 20% with pressures) than the ecological status reporting would suggest (less than 50% in good or better status). Lithuania reported that the two coastal water bodies are both impacted by nutrient and organic enrichment, yet no corresponding information on pressures is available. The situation is reverse for the Netherlands, where significant pressures are reported from point/diffuse sources, but no impact related to organic and nutrient enrichment. Although the proportion of Italian transitional water bodies influenced by diffuse pressures is slightly above 60%, nutrient enrichment is reported to 95% of transitional water bodies. In Spain more than 40% are influenced by hydromorphological pressures, whereas only 5% are impacted by altered habitats. Portugal reported 36% of transitional water bodies with significant hydromorphological pressures, but no altered habitats. These inconsistencies may also be caused by lack of information on pressures and/or impacts.

In Italy, the north-south distinction with better status and less pressures in the north than in the south needs further clarification, as a large proportion of the population and industry and most of the intensive agriculture is located in the Po RBD. The better status and fewer pressures in water bodies in the Alpine area of the Po may contribute to explain why this RBD is not worse than the southernmost RBD. The drier climate in the south may also contribute to worsen the status there, due to water abstraction pressure and concentration of pollutants.

4.7. *Case studies*

4.7.1. Northern Europe

The Swedish North Baltic RBD

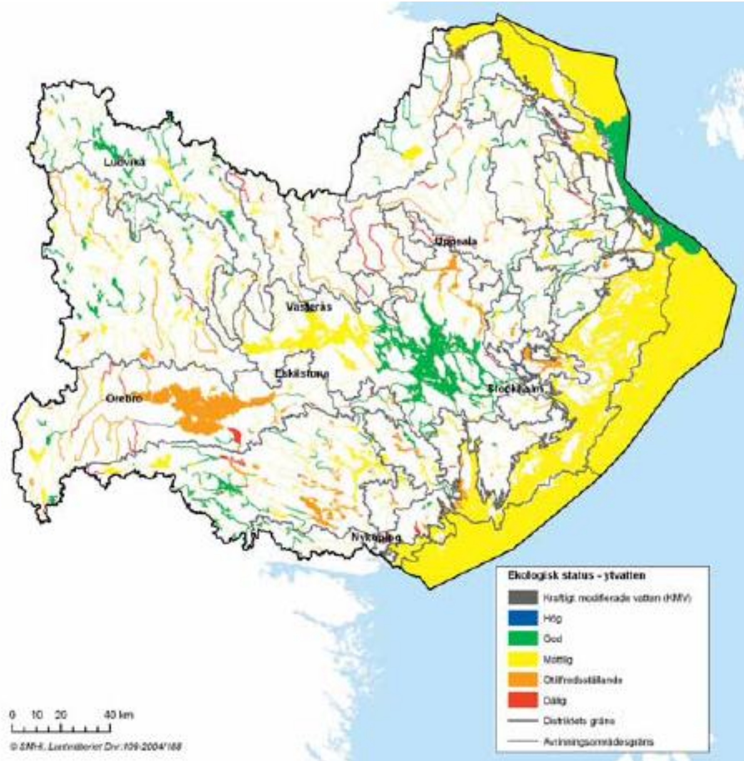
Source: Vattenmyndigheten Norra Östersjön och Länsstyrelsen Västmanlands län, 2009 (Chapter 7 Status 2009).

Key messages

- The North Baltic River Basin District is the part of Sweden with the highest pressures and impacts due to many large cities (e.g. Stockholm, Uppsala and Örebro) and large areas with intensive agriculture.
- According to the first river basin management plan as much as 75% of the 1111 natural surface water bodies have been reported to be in moderate or worse ecological status, including the large lake Hjälmaren.
- Nutrient enrichment mainly from diffuse source pollution is the main pressure and impact in lakes, transitional and coastal waters, while hydromorphological pressures, in particular migration barriers for fish, is an important additional pressure and impact in the rivers.

Main diagram

Ecological status of surface waters in the North Baltic RBD, Sweden.



Source: Vattenmyndigheten Norra Östersjön och Länsstyrelsen Västmanlands län, 2009 (Chapter 7 Status 2009).

The Swedish large lake Vänern

Source: Vänerns Vattenvårdsförbund, 2011.

Key messages

- With a size of 5600 km^2 Vänern is the largest lake within the European Union, and among the 30 largest in the world. The lake is a lowland lake with a mean depth of 27 m (max depth 106 m).
- Around 300 000 inhabitants live around the lake and use it as their freshwater source. The lake is the largest water power regulation dam in Sweden with a volume of 153km^3, and it is commercially used both for transport and for fishing. The lake is also important for recreation both for tourists and for those living in the area.
- The current algal biomass in the off-shore waters is low (2-3 µg/l chlorophyll a), reflecting the low phosphorus concentrations (6-8 µg/l), corresponding to good ecological status.
- While the main basin satisfies the WFD requirement of good ecological status, there are 15 local bays with less than good ecological status, due to nutrient enrichment causing elevated algal biomass, affecting the local flora and fauna.

Danish small lakes

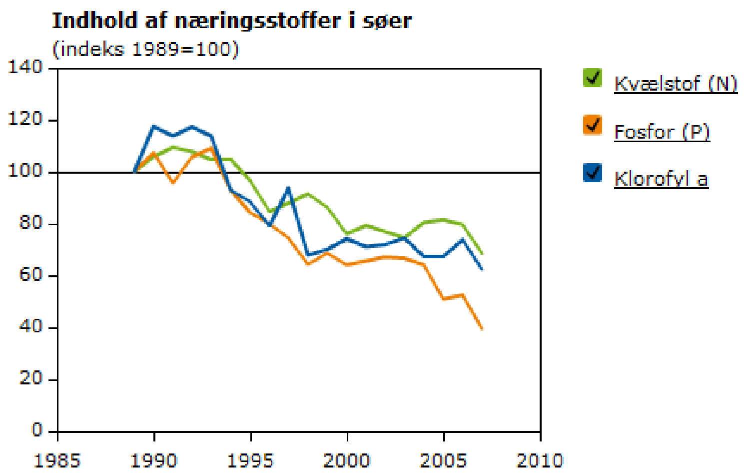
Source: Normander et al., 2009; Jensen et al., 2011.

Key messages

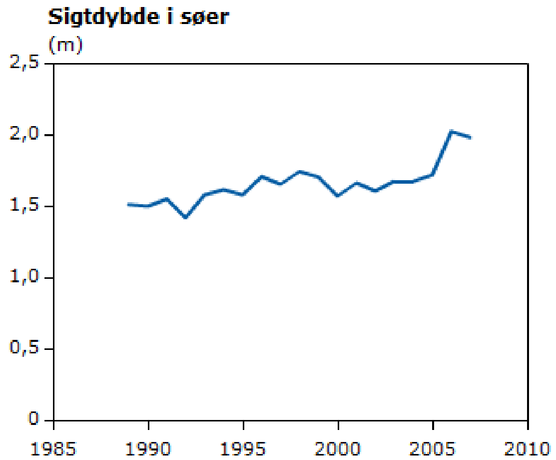
- Since the 1990s there has been a significant improvement in the water quality of the Danish lakes, with marked reductions in nutrient concentrations and chlorophyll and an improvement in water transparency.
- However, the majority of Danish lakes do not yet achieve good ecological status and an additional reduction in nutrient loading is needed for most of the lakes to achieve good ecological status.

Main diagram

Trend in concentration of nitrogen (green), phosphorus (orange) and chlorophyll (blue) in 20 Danish lakes.



Trend in water transparency (Secchi depth) in 20 Danish lakes.



Source: Normander et al., 2009.

The Baltic Sea

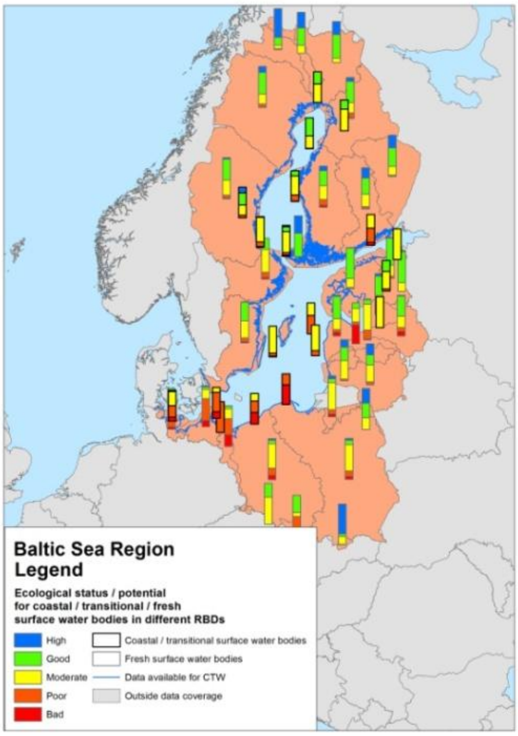
Source: HELCOM, 2010a, 2011.

Key messages

- The Baltic Sea is a semi-enclosed brackish water area with persistent vertical water layers and a water residence time of 25 years. These characteristics makes it a very sensitive area with low self-purification capacity. The Baltic Sea receives waters from all the 14 countries in the catchment, bringing large amounts of nutrients, organic substances and toxic pollutants. Accumulation and impacts of human activities are aggravated by natural characteristics of the Baltic Sea.
- Coastal areas are mainly affected by point-source pollution. Open-sea areas are affected by fishing, riverine pollution and atmospheric nitrogen deposition. Another important issue is also disturbance of the seabed by construction, dredging and disposal of dredged material, which creates large impacts on local environments, whereas bottom trawling affects large areas of the sea.
- The HELCOM Initial Holistic Assessment shows that the environmental status of the Baltic Sea is generally impaired. Most of the transitional and coastal waters reported in the WFD RBMPs are in less than good status, while half of the fresh waters reported are in good or high status, indicating pressures from non-EU countries in the catchment, or delayed recovery due to the natural characteristics of the Baltic Sea.

Main diagram

Ecological status or potential of surface waters in the RBDs in Baltic Sea region.



Note: The ecological status or potential is shown for inland surface water bodies (rivers and lakes) and transitional and coastal water bodies for the RBDs in the Baltic Sea catchment.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

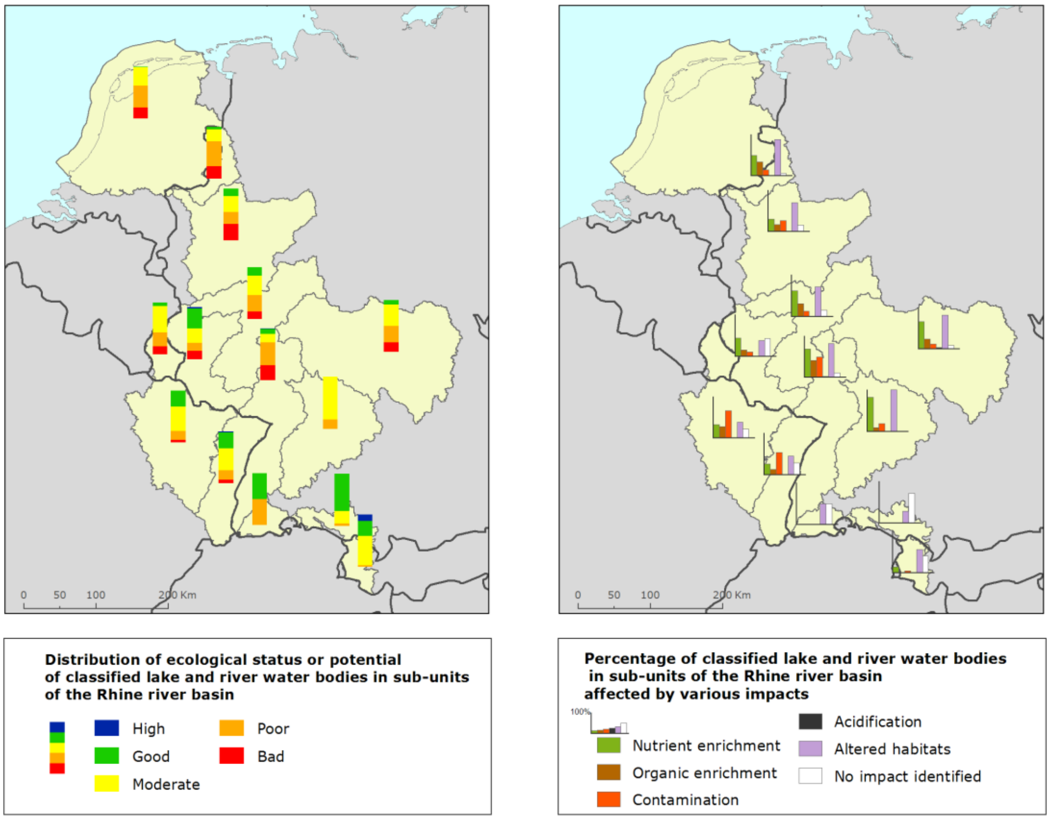
4.7.2. Case studies Central Europe

The Rhine RBD

Key messages

- The river Rhine connects the Alps to the North Sea. The river has a length of 1300 km, and its catchment area covers approximately 200000 km^2 spread over nine states (seven EU Member States). The catchment area has 58 million inhabitants (Rhine Commission, 2012).
- The ecological conditions/status decline downstream from the Alps to the river mouth in the Netherlands. The upper parts have mostly good status, although hydromorphological pressures mainly for hydropower purposes disrupt river continuity, causing altered habitats and moderate or worse ecological conditions in a significant proportion of the water bodies. In the middle and lower parts most of the water bodies have moderate or worse ecological conditions due to nutrient enrichment impacts, as well as altered habitats caused by hydromorphological pressures related to flood protection, maintenance of the navigation channel, water level regulation measures and hydropower. Contamination impact is seen in French and middle German sub-basins.
- Further measures to restore river continuity and reduce nutrient enrichment are needed to achieve the WFD good status or good potential for most of the Rhine water bodies, as well as for the transitional and coastal waters beyond the river mouth.

Main diagram



Notes: The Netherlands and Luxembourg did not report impacts. The impact type "Contamination" means surface water bodies with the impact contamination by priority substances and/or contaminated sediment.

Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

The Schelde estuary in the Netherlands/Belgium

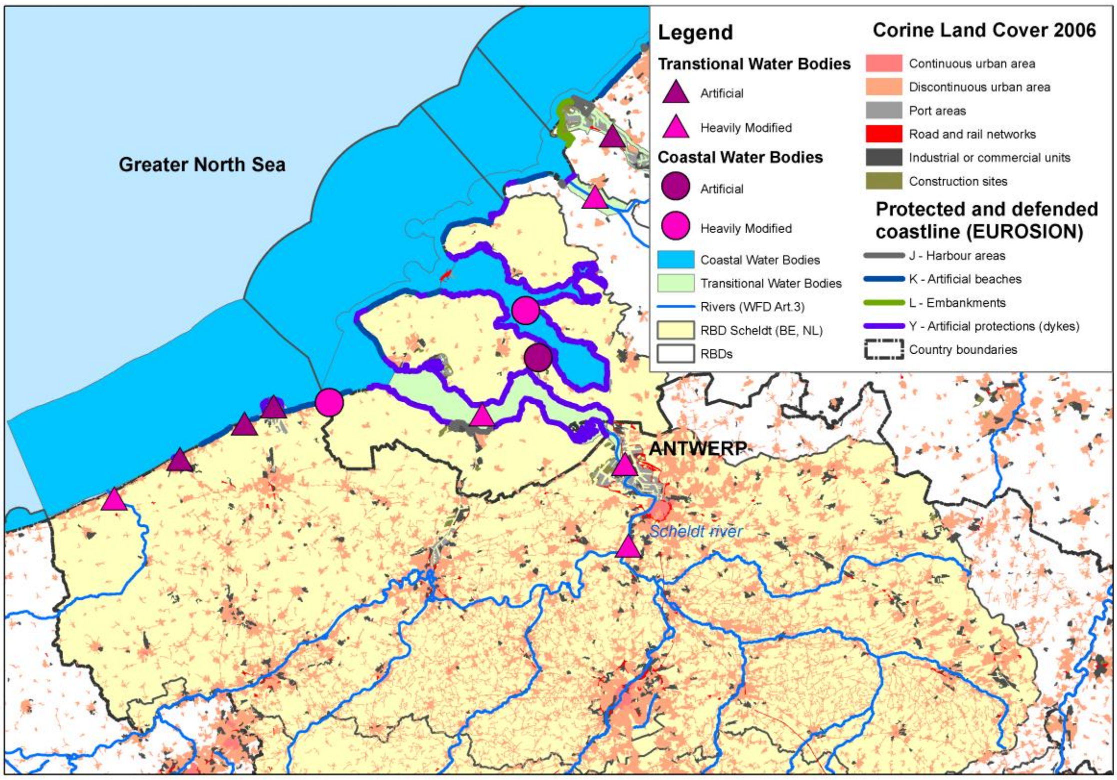
Source: Case study provided by Theo Prins and Claudette Spiteri, Deltares, the Netherlands.

Key messages

- RBD Scheldt encompasses parts of Belgium and the Netherlands and a small part of NW France. This estuary has a large tidal range and consists of a mixture of channels and large tidal flats that are exposed during low tide. After the flood disaster of 1953 it was decided to improve flood protection in the Scheldt estuary. Most transitional water bodies with exception of the Western Scheldt, have been closed off completely or have a reduced exchange with the North Sea. Therefore these water bodies were converted into basins with a strongly regulated hydrological regime and salinity.
- Main pressures in the RBD are related to use of hard infrastructure for coastal protection and erosion management. The transitional and coastal waters in the Dutch and Belgian parts of the Scheldt RBD are among the most heavily navigated in the world, containing two major shipping routes in the North Sea, with the port of Antwerp, the second largest sea port in Europe in the upper Scheldt estuary.
- As a result of the massive hydromorphological and other pressures, there is hardly any water body with a good ecological status/potential.

Main diagram

HMWB/AWBs in the RBD Scheldt (Belgium and the Netherlands).



Source: Based on Corine Land Cover 2006 (EEA, 2011a), EUROSION data 2004 (EC, 2005b) and WISE-WFD TC reference layer (ETC/ICM, draft version, May 2012).

Dutch small lakes

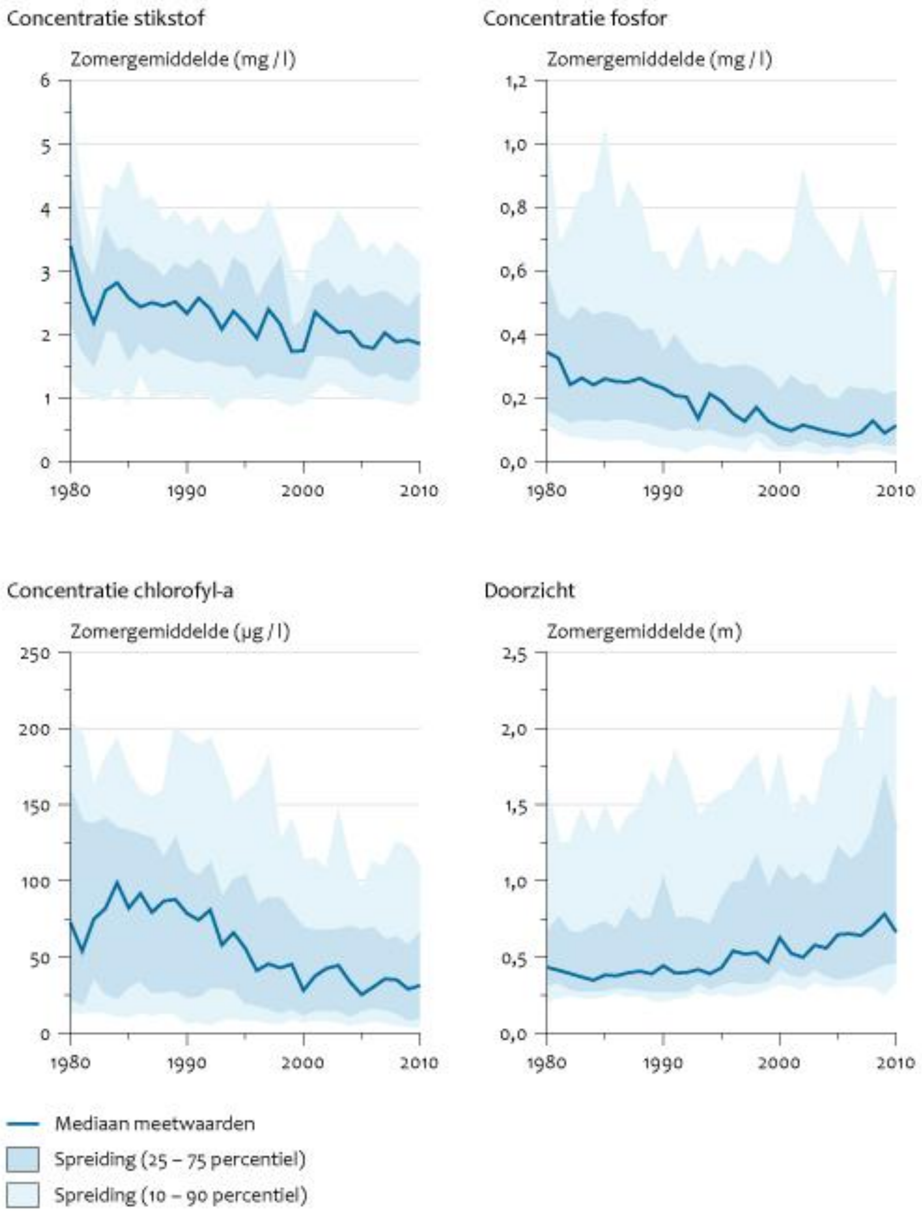
Source: CBS, PBL, Wageningen UR, 2012.

Key messages

- The eutrophication in Dutch lakes and ponds has greatly reduced since 1985, but the concentrations of nitrogen, phosphorus and chlorophyll are still high. In recent years water quality has not improved very much.
- Mainly due to eutrophication 444 out of 447 Dutch lake water bodies have less than good ecological status and potential.

Main diagram

Water quality in Dutch lakes: Nitrogen (upper left), phosphorus (upper right), chlorophyll a (lower left) and water transparency (lower right).



Source: CBS, PBL, Wageningen UR, 2012.

German rivers

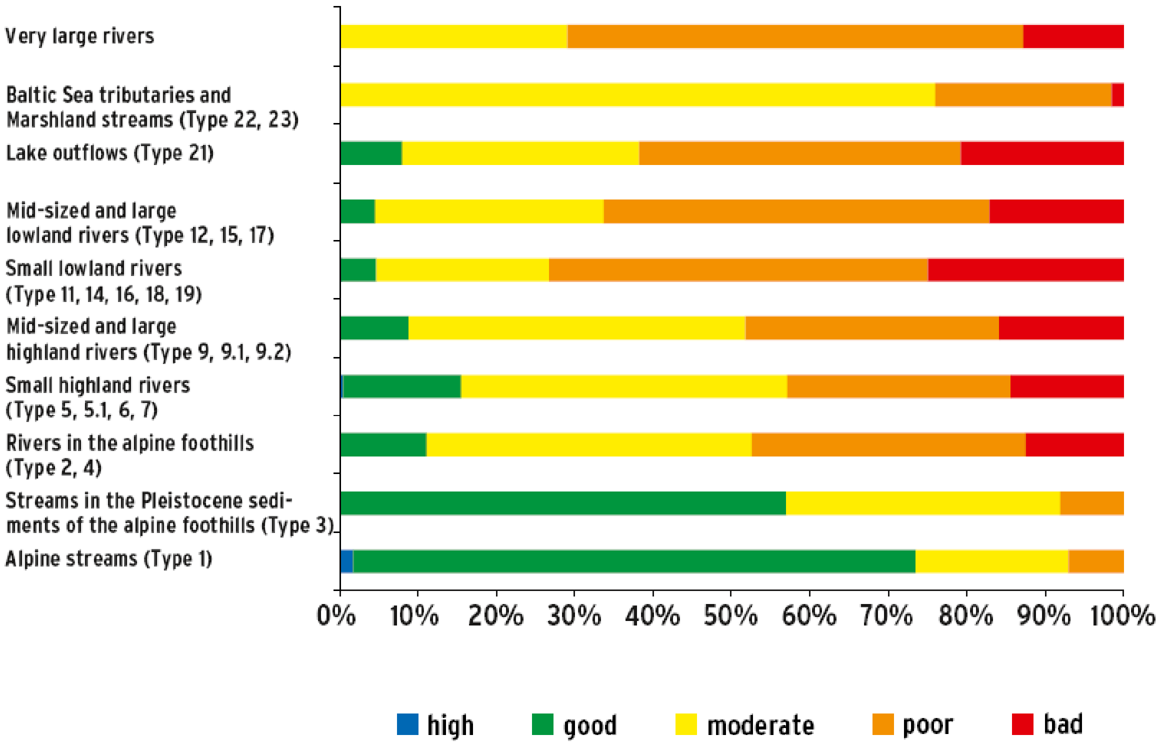
Source: BMU/UBA, 2010 (Part 2 Water Quality).

Key messages

- Germany has in the RBMPs identified 9070 river water bodies with a total length of around 127 000 kilometres. The assessment of natural river water bodies reveals that only 14% of the total river length is high or good ecological status. None of the large rivers have high or good ecological status.
- The most common reason for failing to achieve a "good ecological status" are changes in hydromorphology in natural river water bodies, and the high levels of nutrient pollution.
- More than 60% of the natural river water bodies of the Alps and of the Pleistocene sediments in the Alpine foothills have at least "good" ecological status. For rivers of the alpine foothills and Central German Highlands, only 20% are classified as "good" status, while 30 to 50% are classed as "moderate". Among North German lowland streams and rivers, the proportion of good status is less than 10% and more than 70% of the river has poor or even bad status.

Main diagram

Percentage distributions of ecological status classes in natural German river water bodies per common groups of river types.



Source: BMU/UBA, 2010 (Part 2 Water Quality, Chapter 6.8; Data source: Berichtsportal WasserBLIcK/BfG, as at 22 March 2010).

The Danube RBD

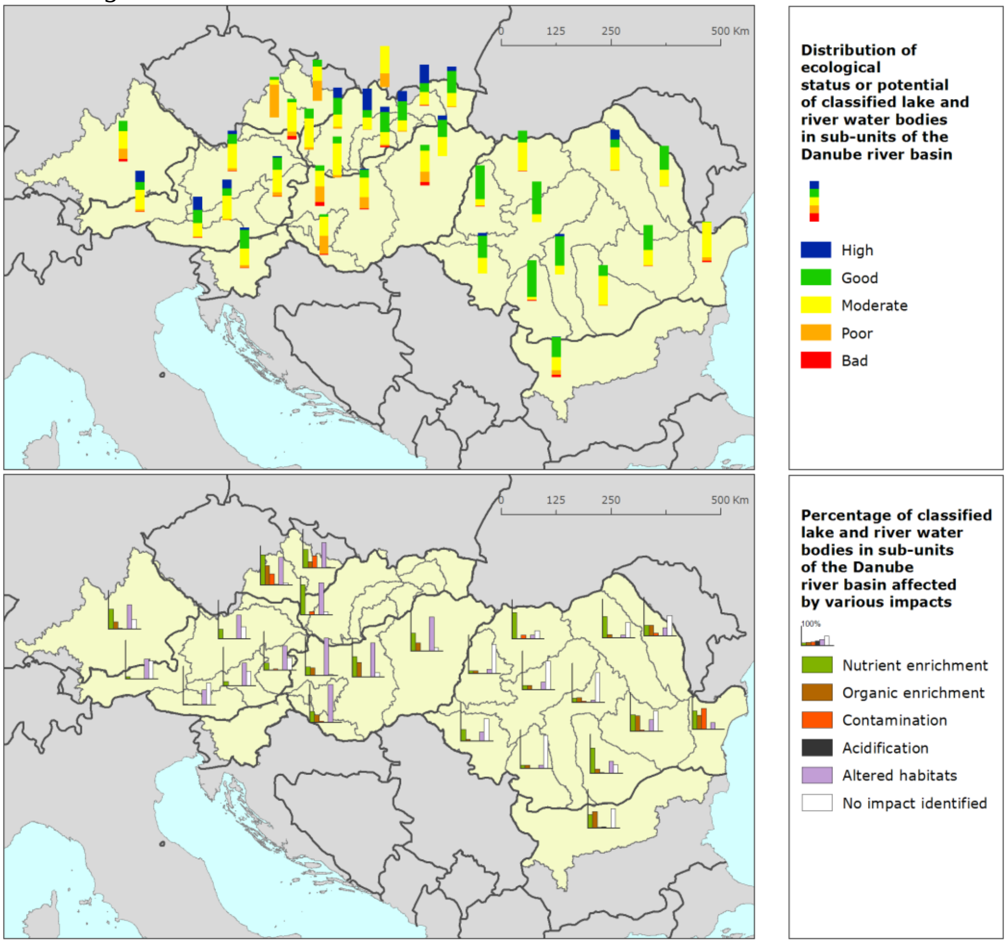
Key messages

- The Danube River Basin is Europe's second largest river basin, with a total area of 801463 km². It includes the territories of 19 countries with a population of 83 million. The Danube river originates in Southern Germany and flows southeast for 2872 km, before emptying into the Black Sea via the Danube Delta in Romania (ICPDR, 2009).

- The current ecological status or potential of the Danube reporting in the WFD RBMPs is best in the higher altitude tributaries of southern Austria, Slovakia, western Romania than in the main stem of the Danube, which is flowing through more densely populated lowland areas with intensive agriculture in southern Germany, eastern/northern Austria, the Czech Republic, Hungary, southern and eastern Romania.

- The major impacts reported are altered habitats in the western part of the river basin and nutrient enrichment in the north-western part, as well as in the lowland parts of Romania, corresponding to the sub-basins with moderate or worse status. The sub-units with high proportion of water bodies with no impacts also corresponds to the areas with better ecological status.

Main diagram



Notes: Poland, Slovakia and Slovenia did not report impacts. The impact type "Contamination" means surface water bodies with the contamination by priority substances and/or contaminated sediment.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

Lake Balaton, Hungary

Source: ILEC, 2012; Hajnal and Padisak, 2008; Tátrai et al., 2008, Hungarian Ministry of Environmental Protection and Water Management and Ministry of Health, 2012.

Key messages

- Lake Balaton in Hungary is a calcareous, large, but very shallow lake with a surface area of 593 km^2 and a mean depth of 3 m (max depth 12 m). The annual commercial fish catch is 1200 tons. The picturesque landscape attract 2 million tourists annually.
- The sewage discharge from rapidly developing towns in the watershed, the growing use of fertilizers in agriculture and large animal farms increased the nutrient loading to the lake from the 1970s to the mid-1990s. A rapid eutrophication became apparent by increased production and biomass of phytoplankton. Blooms of blue-green algae were frequent in the most polluted western part of the lake with biomass of 10-50 mg/l.
- A restoration program was implemented in the 1990s with diversion of most of the municipal sewage, a reservoir was constructed to retain the nutrients carried by the Zala River and pollution due to liquid manure was reduced. The algal biomass has been largely reduced since the mid 1990s, but is still above the WFD target for very shallow calcareous lakes. (it is unclear what the Q-index is showing)

Main diagram

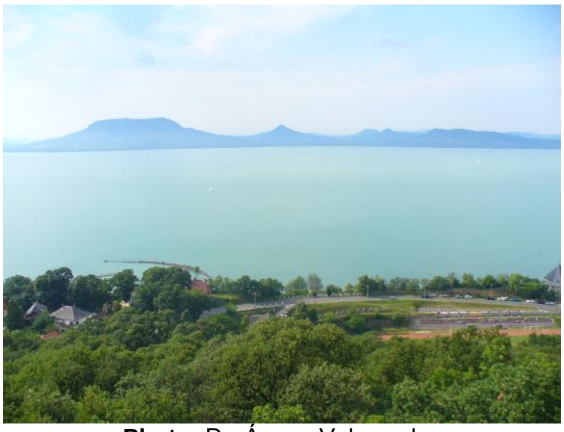
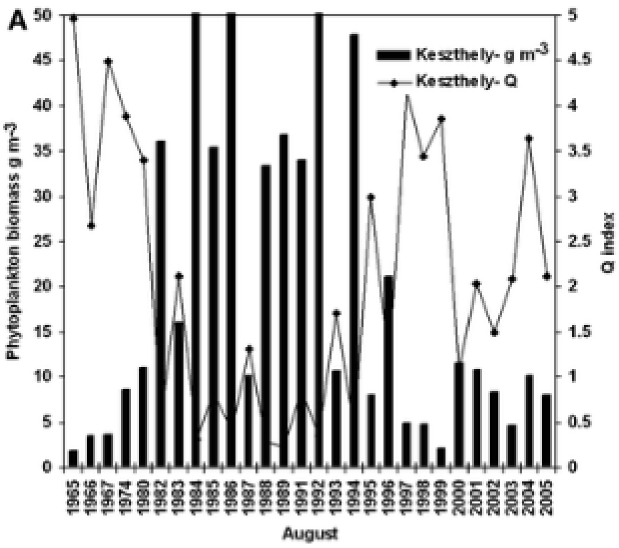


Photo: Dr. Ágnes Vehovszky.



Source: Hajnal and Padisak, 2008, Fig. 3.
With kind permission from Springer Science+Business Media B.V.

4.7.3. Case studies Southern Europe

Lago Maggiore, Italy

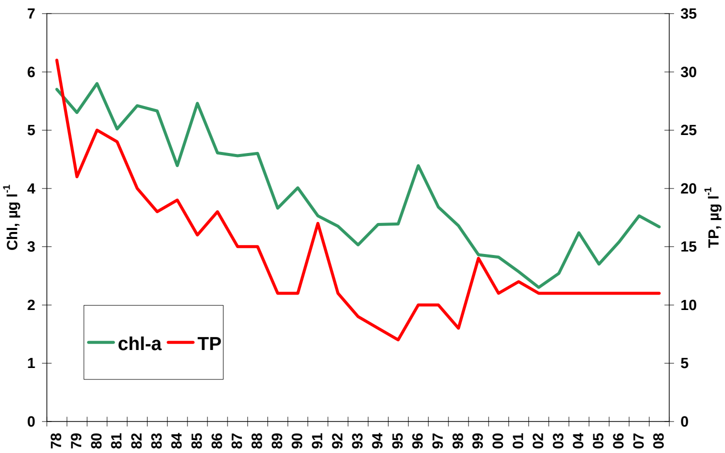
Source: Case study provided by Giuseppe Morabito, CNR-Pallanza, Italy for EEA ETC/W (2010b).

Key messages

- Lago Maggiore in Northern Italy close to the Alpine region is a naturally oligotrophic lake with a surface area of 213 km2 and a mean depth of 177 m (max depth 370 m).
- The lake was exposed to increasing nutrient pollution from urban waste water in the 1960s and 1970s, resulting in harmful bluegreen algal blooms.
- Due to urban waste water treatment, the lake has been gradually restored during the 1980s and 1990s and is now in good ecological status in terms of phytoplankton biomass. Also the composition of phytoplankton has been restored from total dominance by bluegreen algae and large diatoms to a more diverse phytoplankton community consisting of mostly smaller sized phytoplankton species.

Main diagram

Photo: Gabriele Tartari, CNR Istituto Studio Ecosistemi, Pallanza, Italy.



Source: Case study figure made by Giuseppe Morabito, CNR-Pallanza for EEA ETC/Water (2010b). The good/moderate boundary for chlorophyll a for this lake type is 4 µg/l, according to Poikane (2009).

Po river and impacts on the Adriatic Sea

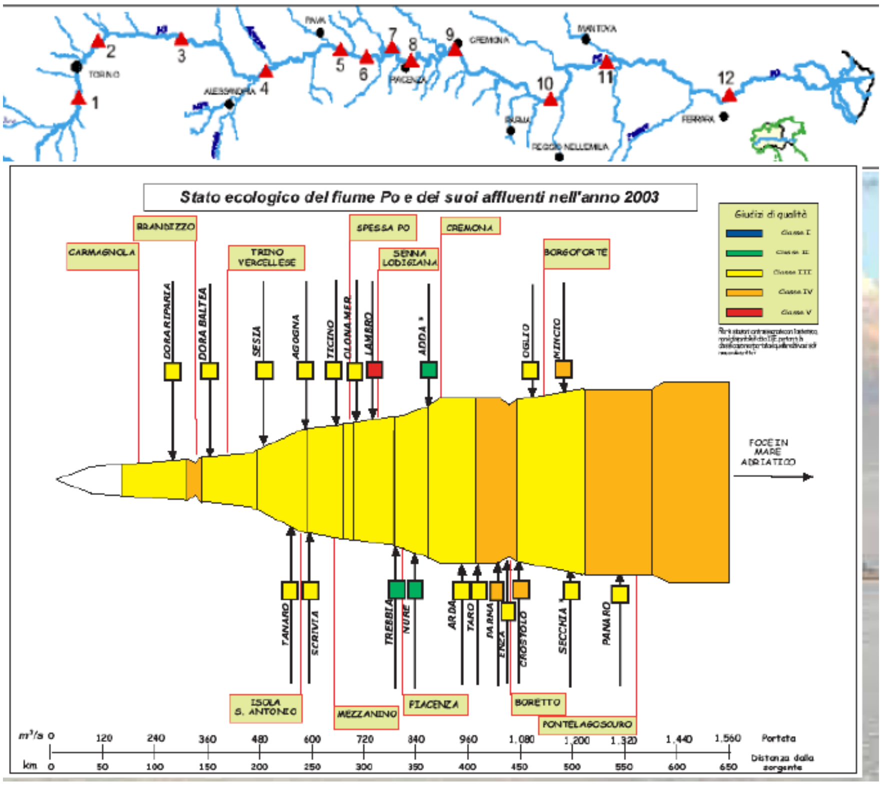
Source: World Water Assessment Programme, 2009; Mozetič et al., 2010; WISE-WFD database, May 2012 (detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS).

Key messages

- The longest river in Italy, the river Po, flows eastward across northern Italy from the Alps to the Adriatic Sea near Venice. The 652 km long river has a 74 000 km^2 drainage area of which 55% is mountainous and the remaining 45% is located in the Po valley lowland plain of rich soil. The Po river brings roughly half of the total freshwater input to the northern Adriatic Sea.
- The Po is heavily impacted by nutrient enrichment, organic enrichment, altered habitats and water abstraction due to a combination of large areas with intensive agriculture, increasing urbanisation, and flood protection structures. Groundwater resources continue to contain high concentrations of nitrates due to fertilizer use in agriculture, while excessive exploitation has caused salt intrusion into coastal aquifers. The large nutrient load also affects the northern Adriatic Sea in terms of degradation of macroalgae and benthic fauna and frequent phytoplankton blooms.
- The whole river basin, except a few minor tributaries, had less than good ecological status in 2003 (World Water Assessment Programme, 2009). According to the Po RBMP 45% of the river water bodies are now reported in good or better status. New sewage networks and wastewater treatment plants, especially in the Milano area has probably contributed to this improvement. Lower inputs of nutrients is also reflected in decreasing phytoplankton biomass in the Northern Adriatic Sea (Mozetič et al., 2010).

Main diagram

Ecological status of the Po river and its tributaries from the source (left side) to the mouth (right side).



Source: Bortone, 2009.

Spanish transitional and coastal waters in the Basque country

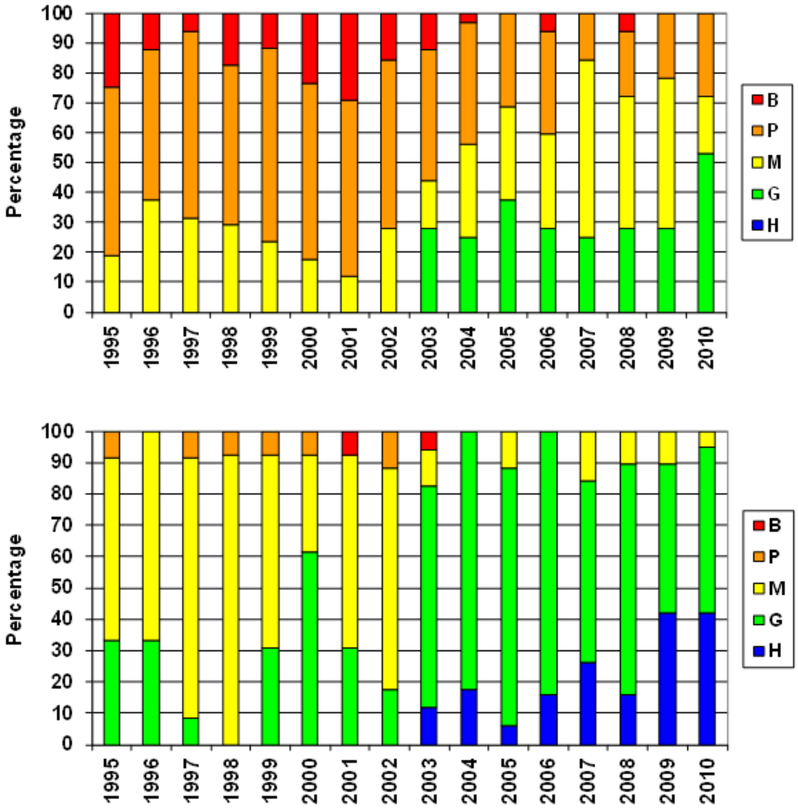
Source: Case study provided by Angel Borja, AZTI-Tecnalia; Marine Research Division; Herrera Kaia, Portualdea s/n; 20110 Pasaia (Spain).

Key messages

- The Basque Country (northern Spain) has 12 small estuaries and 150 km of coastal waters divded into 18 water bodies (14 transitional and 4 coastal). The data from 2004-2008 have been used to assess the ecological status of these water bodies as a basis for the first river basin management plan for this river basin district.
- The Basque Country is an industrialized area, which historically has supported high levels of pollution and diverse hydromorphological changes.
- Both the transitional waters and the coastal waters were quite degraded in the 1990s, due to various pressures from dredging, land reclamation, discharges of polluted waters, engineering works. However, from 2003 onwards, a substantial improvement in their ecological status has taken place in response to a variety of mitigation and restoration measures, e.g. better waste water treatment and recovery of degraded wetlands.

Main diagram

Ecological status of the Basque sampling stations (as a percentage), determined using an integrative method, which includes physico-chemical, chemical and biological quality elements (see Borja et al., 2004, 2009), in transitional (upper panel) and coastal (lower panel) water bodies.



Greek lagoons

Source: Case study provided by Sofia Reizopoulou and Kalliopi Pagou, Hellenic Centre for Marine Research, Institute of Oceanography, Greece.

Key messages

- Coastal lagoons in Greece are enclosed water bodies situated in coastal areas, with a wide range of temperatures and salinities and limited water exchange. The most important variable influencing species distribution and diversity is the degree of water exchange with the sea and the nutrient load introduced through fresh water inputs. The most extensive lagoon systems are located in Western and Northern Greece. Coastal lagoons and surrounding wetlands comprise of a high variety of biotopes and vegetation types. The habitat types such as riparian floodplains and surrounding wetlands present a unique diversity of invertebrates, reptiles and amphibians. Thousands of migrating birds congregate in these lagoons, which are a source of food and place of rest during spring migration.
- The biodiversity and productivity of the lagoons in Greece are threatened by severe anthropogenic pressures such as damming, pollution, water flow modifications, fish farming, overfishing and alien species. The increased damming of rivers led to reduced river flow and terrestrial sediment input. An increased nutrient and pollutant influx is associated with agriculture and urban development. A considerable loss of the wetlands surrounding the coastal lagoons due to the increase of agricultural activities led to a decline of water retention and purification capacity of these ecosystems.
- Eutrophication has dramatically increased over the last decades, due to human activity in the catchment areas. The nutrient enrichment led to a replacement of sea-grasses by opportunistic green macroalgae, whereas the loss of sea-grass beds and the degradation of the water quality caused a decrease in species diversity and a decline in fish abundance.

Main diagram

Amvrakikos lagoons

Photo: Aerophotographs N.D. Karabelas, AKTIA FOUNDATION OF NIKOPOLIS.

4.8. *Appendix with notes for figures and tables*

Figure 4.1 /4.2/4.3/4.4/4.6/4.7/4.8/4.10/4.11

Member States are excluded from the calculations when no data on a specific pressure and/or impact are reported for the water category in question. In all the listed figures except Fig. 4.6 this means that certain rows are missing in the pressures/impacts plots. Exclusion of certain Member States also affects the calculations for the EU total. It is impossible to differentiate between Member States not reporting a specific pressure or impact, or Member States for which the specific pressure or impact is not affecting any water bodies. In most cases the former is likely to be true, as it is usually unrealistic that not a single water body is affected. But for certain pressures/impacts (e.g. acidification) it is possible that no water bodies are affected. For transitional and coastal waters, where the number of water bodies in certain countries is low, it is also possible that all are in fact unaffected. In all figures the number of classified water bodies is given in brackets behind the Member State name when the Member State has reported the specific pressure or impact. In very few cases a number is given in brackets even if there is no bar (this goes only for Figs. 4.2, 4.8, 4.10 and 4.11). This means that it has been confirmed that no water bodies are affected by the specific pressure or impact. In Figs. 4.8 and 4.11 it has also been assumed that when a Member State generally has reported a specific pressure or impact, no data for certain parts of the Member State means that the water bodies here are actually not affected. In all other cases, no number is given in brackets, indicating that no data is reported. This will then, in very few cases, include Member States where no water bodies of that water category are affected by the specific pressure or impact. In such cases the proportion of water bodies affected by the specific pressure or impact for EU total will be underestimated, as the total number of classified water bodies in the Member States defined as not reporting is subtracted from the total number of classified water bodies in the EU.

Ireland only reported impacts for one RBD, so Irish water bodies are removed both from the number of water bodies affected and from the number of total classified water bodies in all impacts plots. For Sweden, wherever the pressures or impacts reporting is related to airborne mercury pollution only, the water bodies are considered not to be affected by pressures or impacts, respectively (see text). For pressures overall (Figs. 4.1, 4.3, 4.7 and 4.10 and “no pressures” in Fig. 4.6) this occurs when the aggregated diffuse pressure type is the only pressure and the impacts description indicates diffuse pollution from mercury only. For impacts overall (Figs. 4.1, 4.3, 4.7 and 4.10 and “no impacts” in Fig. 4.6) this occurs when contamination by priority substances is the only impact (Sweden did not report the impact type “contaminated sediments”) and the impact description does not indicate contamination by other priority substances than mercury. For the diffuse sources pressure (Figs. 4.2, 4.4, 4.6, 4.8 and 4.11) this occurs when the aggregated diffuse pressure type is the only diffuse pressure type and the impact description indicates diffuse mercury pollution only. For the impact contamination (Figs. 4.2, 4.4, 4.6, 4.8 and 4.11) this occurs when water bodies are reported with the impact contamination by priority substances, but the impact description does not indicate contamination by other priority substances than mercury. The numbers of such redefined water bodies are:

Figure 4.1b: Pressures: 6441

Figure 4.1c: Impacts: 11070

Figure 4.2a: Diffuse sources: 11033

Figure 4.2c: Contamination: 14669

Figure 4.3b: Pressures: 3507

Figure 4.3c: Impacts: 4903

Figure 4.4a: Diffuse sources: 4895

Figure 4.4b: Contamination: 6915

Figure 4.6: No pressures: 1, Diffuse sources: 8, No impacts: 9, Contamination: 10

Figure 4.7b: Pressures: Greater North Sea: 0, Baltic Sea: 0

Figure 4.7c: Impacts: Greater North Sea: 0, Baltic Sea: 0

Figure 4.8a: Diffuse sources: Greater North Sea: 0, Baltic Sea: 0

Figure 4.8c: Contamination: Greater North Sea: 1, Baltic Sea: 15

Figure 4.10b: Pressures: Greater North Sea: 0, Baltic Sea: 68

Figure 4.10c: Impacts: Greater North Sea: 5, Baltic Sea: 88

Figure 4.11a: Diffuse sources: Greater North Sea: 5, Baltic Sea: 84

Figure 4.11c: Contamination: Greater North Sea: 103, Baltic Sea: 286

Figure 4.2/4.4/4.8/4.11

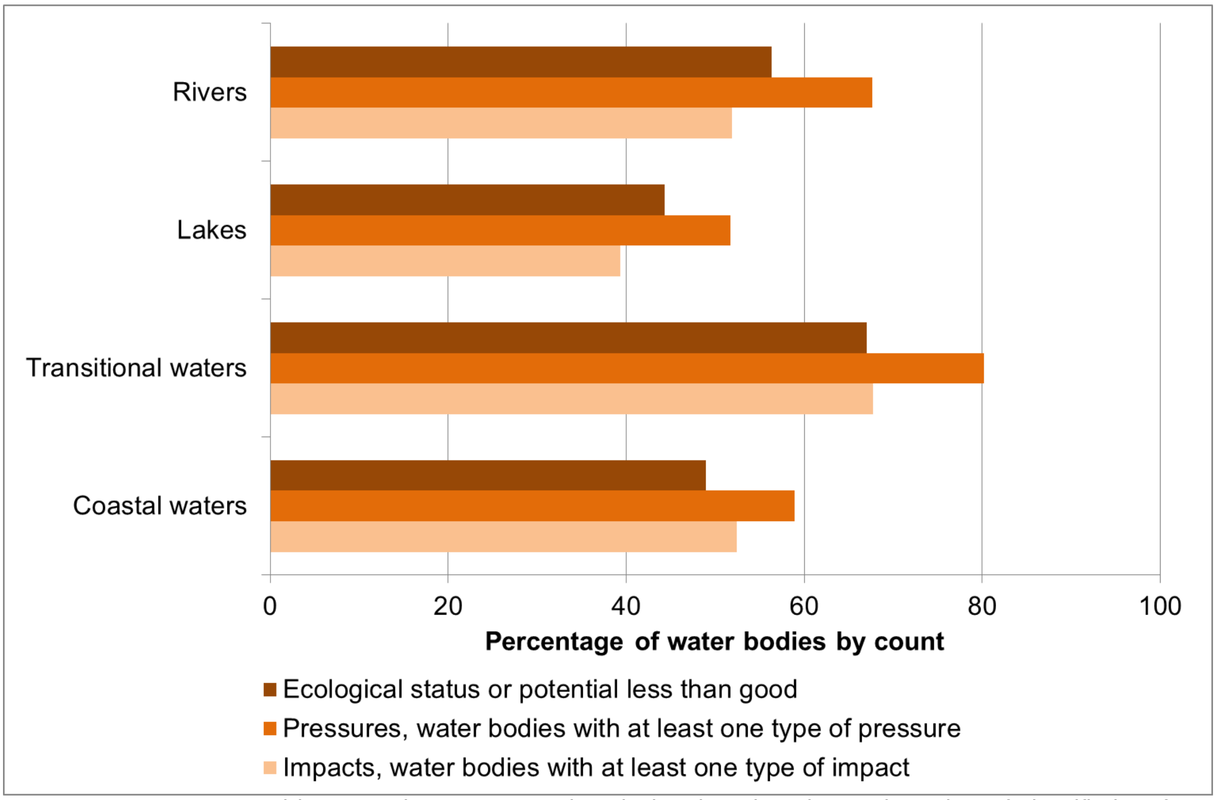
A water body is defined as affected by any of the pressure types in the figures if it is reported with the aggregated pressure type and/or any of the corresponding disaggregated pressure types. “Hydromorphology” denotes the combination of the aggregated pressure types “Water abstraction”, “Water flow regulations and morphological alterations of surface water“, “River management“, “Transitional and coastal water management“ and “Other morphological alterations“. The impact type “Contamination” means surface water bodies with the impact contamination by priority substances and/or contaminated sediment.

5. European overview of ecological status, pressures and impacts

5.1. *Key messages*

- More than half of the surface water bodies in Europe are reported to be in less than good ecological status or potential, and will need mitigation and/or restoration measures to meet the WFD objective.
- River water bodies and transitional waters are reported to have worse ecological status or potential and more pressures and impacts than water bodies in lakes and coastal waters.
- The pressures reported to affect most surface water bodies are pollution from diffuse sources causing nutrient enrichment, and hydromorphological pressures causing altered habitats.
- The worst areas of Europe concerning ecological status and pressures in freshwater are in Central Europe, in particular in Northern Germany, the Netherlands and Belgium, while for coastal and transitional waters the Baltic Sea and Greater North Sea regions are the worst.

Figure 5.0 Proportion of classified water bodies in less than good ecological status or potential, with pressures and with impacts in different water categories (rivers, lakes, transitional waters and coastal waters)

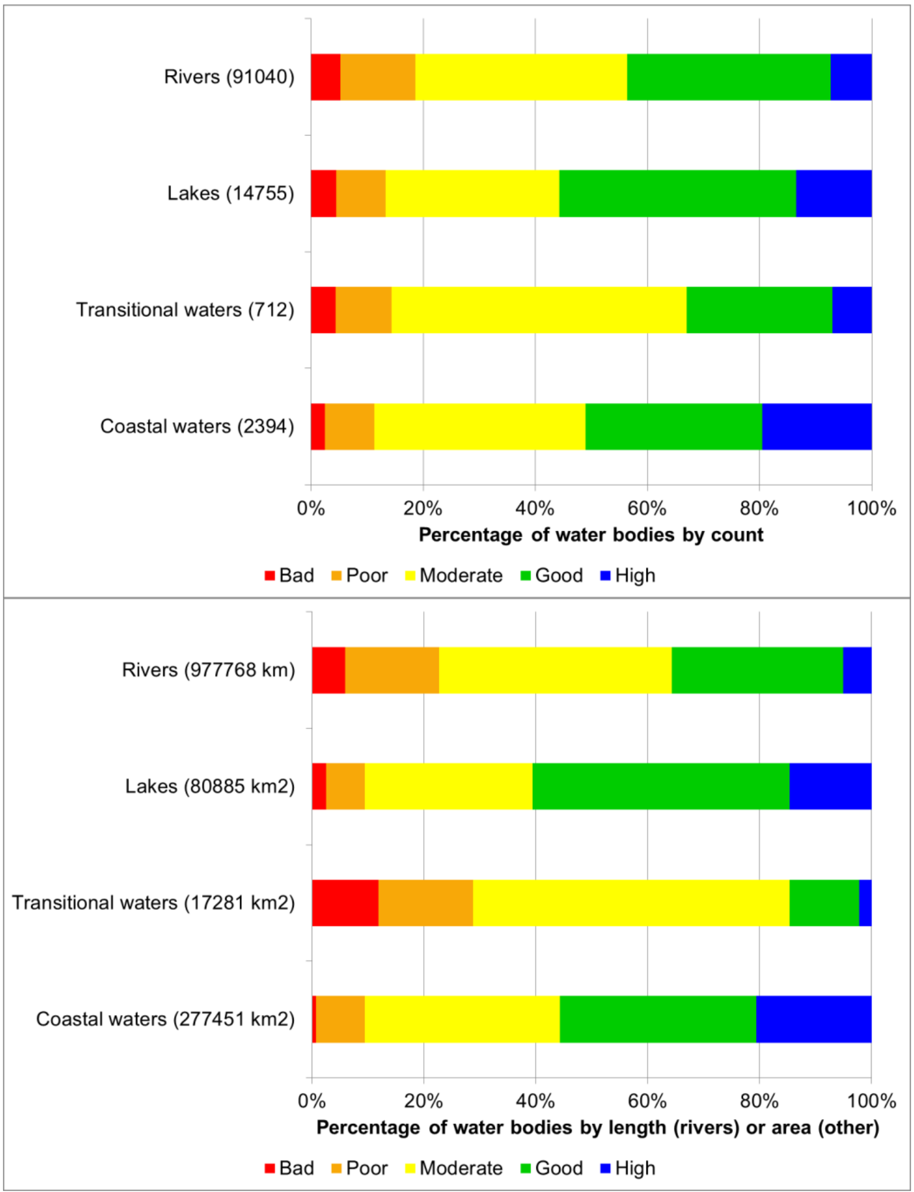


Notes: For pressures and impacts, the percentage is calculated against the total number of classified surface water bodies in countries reporting pressures or impacts. Swedish surface water bodies where the pressure or impact reporting is considered only to be related to airborne mercury contamination are defined as not having pressures or impacts (see text). See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

5.2. *Ecological status or potential for different water categories*

Overall, more than half (55 %) of the total number of classified surface water bodies in Europe are reported to have less than good ecological status/potential. All these water bodies thereby need management measures to restore their ecological status or potential to fulfil the WFD objective. A higher proportion of water bodies with moderate or worse ecological status/potential is reported for rivers and transitional waters (56-67%) than for lakes and coastal waters (44-49%) (Fig. 5.1).

Figure 5.1 Distribution of ecological status or potential of classified rivers, lakes, transitional and coastal waters



Notes: Upper panel shows percentage of the total number of classified water bodies (with total number given in brackets). Lower panel shows percentage of the total length (in km for classified rivers) or surface area (in km^2 for classified lakes, coastal and transitional waters) (total length or surface area given in brackets). See chapter 3 for methodology used for assessing ecological status or potential and appendix notes for Fig. 5.0 on countries reporting and water bodies classified. For length/area issues see appendix.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

For rivers, 51 300 water bodies (56% of the total number), or 630 000 km (64% of total river length) are reported to have less than good ecological status or potential. For lakes, 6 500 lake water bodies (44% of total number) or close to 31 900 km^2 (39% of total surface area) are reported to be in less than good ecological status or potential. The reason why lakes are better than rivers is probably related to the large proportion of lakes in Sweden and Finland, where the population density is low and there are large natural areas. The rivers are more evenly distributed throughout Europe with a larger proportion of rivers in densely populated and cultivated areas in Central Europe. However, also within countries lakes are generally reported to have better status than rivers (see chapter 4).

The worst water category is transitional waters, where 67% of the total number of water bodies or 85 % of the total surface area is reported to be in less than good ecological status/potential. In coastal waters, the situation is somewhat better with 49% of the total number or 44% of the total surface area reported to be in less than good ecological status or potential. The reason why transitional waters are so much worse than coastal waters is related to their proximity to land-based pollution sources, including accumulated loads of pollutants from rivers and coastal cities. Moreover, transitional waters are exposed to extensive hydromorphological pressures caused by land reclamation, flood protection, as well as large harbours causing altered habitats in these water bodies.

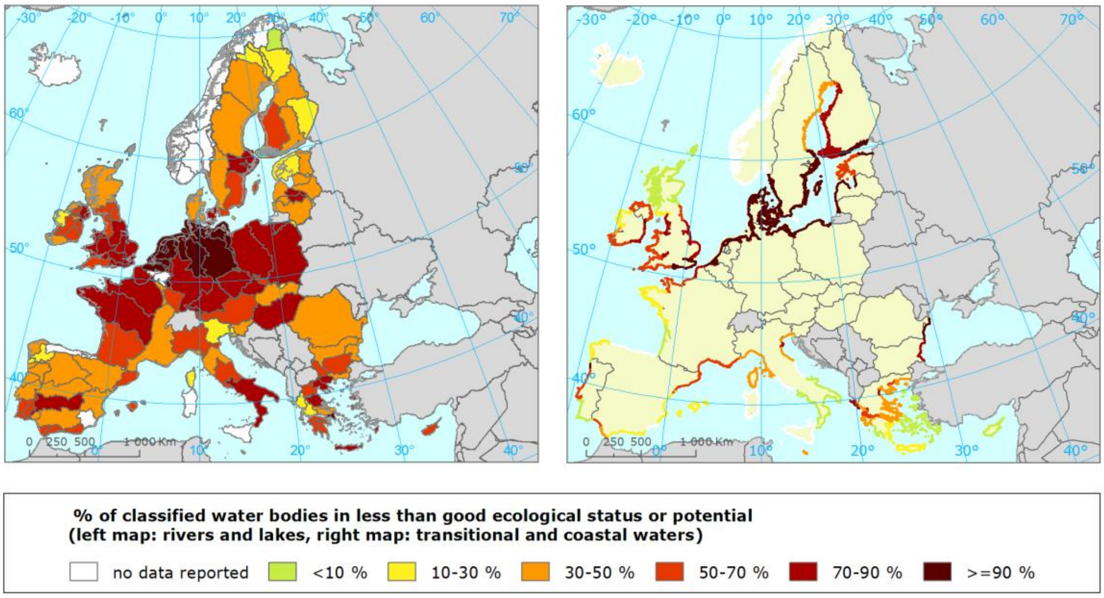
Rivers and transitional waters are both worse as proportion of length or area than as proportion of total number (comparing the upper and lower panels of Fig. 5.1 for each water category), whereas for lakes and coastal waters the picture is the opposite. This means that for lakes and coastal waters the large water bodies are generally in a better status than the smaller ones, whereas the largest rivers and transitional water bodies are in a worse status than the smaller ones. The reason for this difference may be that the largest lakes and coastal waters have larger volumes of water and thus dilute the pollution to a larger extent than smaller water bodies, whereas large rivers and transitional waters are subject to more uses and are often located in areas with more pressures than the smaller ones.

5.3. Ecological status or potential in different river basin districts

The main differences in ecological status or potential between Member States / RBDs shown in Map 5.1 below reflect the general situation in Europe, although there are some uncertainties in the details (see section 4.6). Further details on the basis of the assessment done by the different Member States are outlined in chapter 3 above. More information will become available in the Commission report in the autumn of 2012 (EC, 2012b).

The worst ecological status or potential in **river and lake water bodies** are reported in RBDs in Northern Germany, the Netherlands and Belgium (Flanders), where more than 90% are reported to be in less than good ecological status/potential (Map 5.1, see also chapter 4 for country specific results). Other problem areas are in Poland, Southern Germany, the Czech Republic, Southern England, Northern France, Hungary, as well as several single RBDs in other Member States, where 70-90% of freshwater bodies are reported to be in less than good status/potential. The ecological conditions are reported to be slightly better in the southern part of Germany compared to the northern part, probably reflecting the more mountainous landscape with lower population density, less industry and relatively less agricultural activity in combination with higher precipitation and deeper lakes (see case study in chapter 4.7). The map also illustrates the high variability in ecological conditions within single Member States, e.g. the UK, Italy and Spain, and shows that even in Member States with the majority of water bodies in good or better status, there are regions that are less good (e.g. the Bothnian Sea RBD in Finland, and the south Baltic and north Baltic RBDs in Sweden).

Map 5.1 Proportion of classified surface water bodies in different River Basin Districts in less than good ecological status or potential for rivers and lakes (left panel) and for coastal and transitional waters (right panel)



Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

For **coastal and transitional waters**, the worst areas where more than 90% of the water bodies are reported to have less than good ecological status are in the Baltic region (Denmark, Southern Sweden, a part of the Finnish coast, Lithuania, Poland and Germany) and in the Greater North Sea region (Denmark, north-western Germany, the Netherlands, Belgium (Flanders) and the south-eastern coast of the UK). Also in the EU part of the Black Sea (Romania, Bulgaria) the situation is poor with more than 70% of classified water bodies reported to be in less than good ecological status or potential.

The best ecological status or potential in coastal and transitional waters in Europe are found in Scotland and around the Mediterranean islands of Greece and Cyprus, as well as in the French part of the Bay of Biscay, southern Portugal and in southern Italy, where more than 90% of the coastal and transitional water bodies are reported to be in good or better ecological status or potential. The results reported from southern Italy are however quite uncertain, as the classified water bodies only constitute 10% of all the transitional and coastal water bodies (see also section 4.6). Another area with large numbers of water bodies in high and good status is the French coast of Brittany, the southern tip of Greece and most of the Spanish coast, including the Balearic Islands. Coastal waters in high status are also in the Portugese overseas area – Macaronesia.

5.4. Main pressures and impacts affecting ecological status for all water categories

5.4.1. Water bodies without pressures and impacts

The proportion of water bodies with no identified pressures and impacts ranges from 20-50% in the different water categories (Fig. 5.2).

The water category with the lowest proportion of classified water bodies reported without significant pressures is transitional waters (only 20%), followed by rivers (30%), coastal waters (40%) and lakes, where half of the classified water bodies are without significant pressures.

The proportion of water bodies reported without significant impacts reflects the pattern shown for water bodies without pressures in terms of differences between the water categories. Whereas only 30% of the classified water bodies are reported without significant impacts in transitional waters, the situation is better in rivers and coastal waters where half of the water bodies are reported without impacts. Lakes are the best water category with as many as 60% of the classified water bodies reported without impacts.

This pattern is consistent with the differences found between the water categories for ecological status or potential (see section 5.2 above). For all water categories there are slightly higher proportions of water bodies reported without impacts than without pressures, suggesting that some of the pressures reported do not have significant impacts. Dilution of pollution loads, as well as resilience of aquatic ecosystems to pressures may partly explain why some of the water bodies exposed to significant pressures do not show significant impacts. Reporting bias may also contribute to these differences.

5.4.2. Pollution pressures and water quality impacts

Pollution pressures comprise all emissions to surface waters from point and diffuse sources, including nutrients, organic matter, acidifying substances and hazardous substances from local, regional or long-range trans-boundary pollution sources.

In general, lakes are reported to have less pollution pressures and water quality impacts than the other water categories, corresponding to the pattern found for ecological status/potential (Fig. 5.1). This is true for Europe as a whole, as well as for most Member States (see chapter 4).

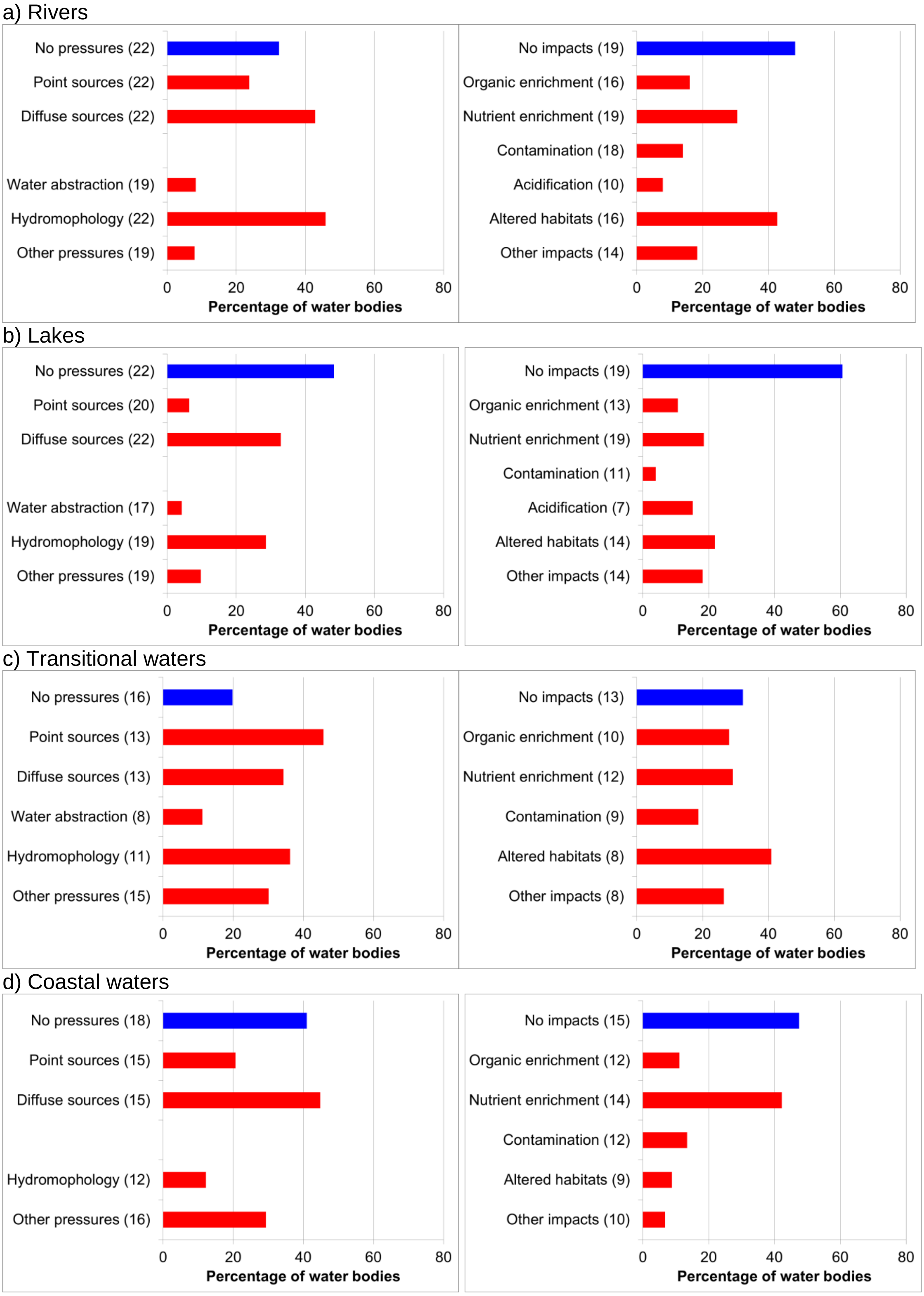
Pollution pressures from diffuse sources are reported for a larger proportion of water bodies than pollution from point sources for all the water categories, except transitional waters (see next paragraph). The proportion of classified water bodies reported to be exposed to significant diffuse pollution ranges from one third in lakes and transitional waters to 40-45% in rivers and coastal waters (Fig. 5.2). The relatively low proportion of lake water bodies reported with diffuse pressures is caused by the high number of water bodies in Sweden and Finland located in remote areas with low population density and only small areas of intensive agriculture.

Text Box 5.1 Reporting of Swedish mercury pollution
All Swedish surface water bodies have been reported to be affected by diffuse pollution sources and impacted by contamination by priority substances due to mercury pollution. As this mercury pressure and impact may be less relevant for the ecological status, and also prevent the comparison with other Member States; the Swedish water bodies where the pressure and/or impact reporting is related to diffuse mercury pollution only, are redefined as unaffected.

Point source pollution is reported to be a significant pressure in more than 40% of the classified water bodies in transitional waters and in ca. 20-25% of rivers and coastal waters, but is less important in lakes (only 10%), due to improved urban waste water treatment during the past decades (more information in chapter 7). The high proportion of point source pollution reported for transitional waters indicates that there are remaining challenges related to urban and industrial waste water in many estuaries and coastal lagoons in Europe.

The most important impacts of these pollution pressures is nutrient enrichment causing eutrophication (Fig. 5.2). Coastal waters is the water category with the highest proportion of water bodies suffering from nutrient enrichment (42%), while lakes are the least affected water category with less than 20% reported to suffer from nutrient enrichment. For rivers and transitional waters 30% are reported to be affected by nutrient enrichment. As for diffuse pollution, the low proportion of lakes affected by nutrient enrichment is due to the high number of lakes found in the northern parts of Sweden and Finland. Organic enrichment is reported to affect between 10-15% of all classified water bodies in rivers, lakes and coastal waters, but is more important in transitional waters, where the proportion of affected water bodies is close to 30%. The latter is consistent with the high proportion of transitional water bodies exposed to point source pollution.

Figure 5.2 Percentage of total number of classified water bodies with identified significant pressures (left) and impacts (right) for a) rivers, b) lakes, c) transitional waters, d) coastal waters



Notes: The percentage is calculated against the total number of classified surface water bodies in Member States reporting the specific pressure or impact type (or any pressure or impact for the blue bars). The number of Member States included is indicated in brackets. For comparison, the total number of Member States with classified surface water bodies is 25, 23, 21 and 16 for rivers, lakes, coastal waters and transitional waters, respectively. "Hydromorphology" denotes the combination of the aggregated pressure types "Water flow regulations and morphological alterations of surface water", "River management", "Transitional and coastal water management" and "Other morphological alterations". A water body is defined as affected by any of the pressure types in the figures if it is reported with the aggregated pressure type and/or any of the corresponding disaggregated pressure types. The impact type "Contamination" means surface water bodies with the impact contamination by priority substances and/or contaminated sediment. The impact type "Other impacts" means surface water bodies with at least one of the impacts "Saline intrusion", "Elevated temperatures" or "Other significant impacts". Swedish surface water bodies where the pressure or impact reporting is considered only to be related to airborne mercury contamination are defined as not affected by the relevant pressure or impact (see text). See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_IMPACT_STATUS.

Acidification from long-range transported diffuse pollution is reported to affect 10% of river water bodies and 17% of lake water bodies in the Member States reporting this impact. Further information on acidification status and trends are included in chapter 7.
Contamination by priority substances and contaminated sediments are seemingly minor impacts in all water categories, affecting less than 20% of all classified water bodies, after excluding Sweden. The low percentage may be an artefact of the choices made by Member States on how to assess chemical status in the first river basin management plan in terms of chosen substances, standards (old vs. new EQS directive) and matrices (water or biota or sediment). For further information, see chapter 6.

5.4.3. Hydromorphological pressures and altered habitats

Hydromorphological pressures comprise all physical alterations of water bodies modifying their shores, riparian/littoral zones, water level and flow. Examples of such pressures are damming, embankment, channelization and non-natural water level fluctuations.

Hydromorphological pressures and altered habitats are reported for a large proportion of classified water bodies, particularly in rivers (more than 40%) and transitional waters (40%) (Fig. 5.2). In lakes aproximately one third of the classified water bodies are reported to be exposed to hydromorpological pressures and 20% are reported to have altered habitats. A large part of the water bodies reported with these pressures and impacts are heavily modified or artificial (see separate EEA/ETC report on Hydromorphological alterations and pressures). In coastal waters, hydromorphological pressures and altered habitats are reported for a low proportion of classified water bodies (10%). The proportions of water bodies exposed to hydromorphological pressures are almost the same as those having altered habitats.

Hydromorphological pressures and altered habitats are the most commonly occurring pressure and impact in rivers, while in lakes and transitional waters these pressures and impacts are roughly as common as the pollution pressures and impacts. However, hydromorphological pressures and altered habitats are sometimes affecting only a minor part of a water body (for example, physical shore-line alterations in lakes or barriers in rivers), and may thus have less serious ecological consequences than pollution pressures, which often deteriorate the water quality of the whole water body.

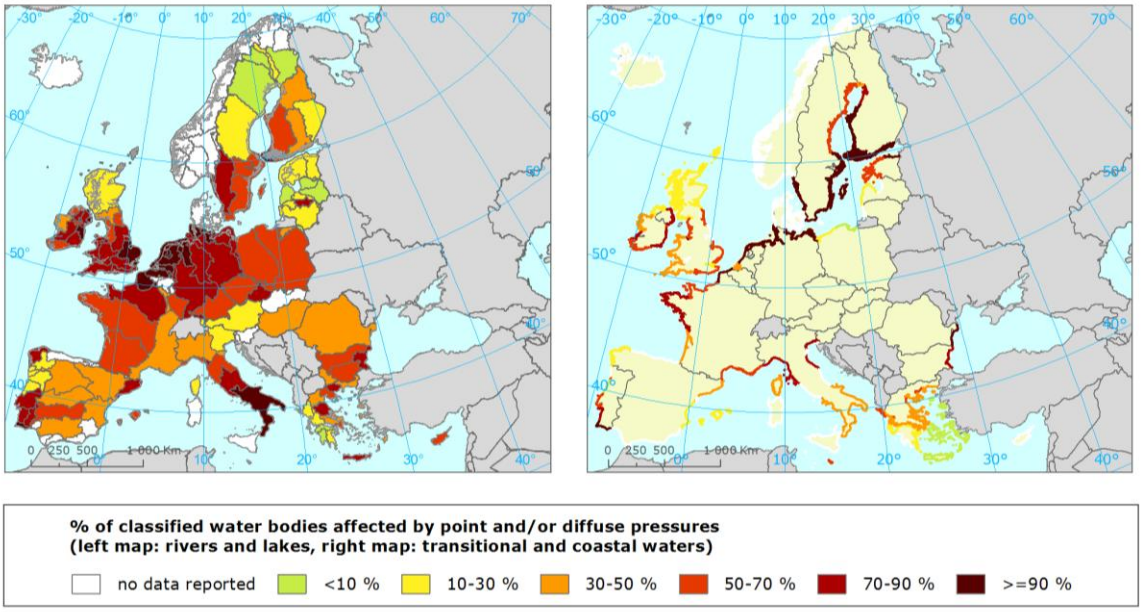
More information about hydromorphological pressures and altered habitats can be found in a separate thematic assessment report (EEA ETC/ICM, 2012 Hydromorphological alterations and pressures).

5.5. Main pressures and impacts in different river basin districts

5.5.1. Pollution pressures

The highest pollution pressures in **river and lake water bodies** are reported in River Basin Districts in the Netherlands and Belgium (Flanders), as well as in southern Italy, south-eastern England, and smaller parts of northern Germany, where more than 90% of the water bodies are exposed to pollution pressures (chapter 4 for country specific results). Other problem areas are in the rest of Germany (except the two RBDs in the southeastern and southwestern part), the Czech Republic, Southern England, Northern France, most of Ireland, southern Portugal, as well as several single RBDs in other Member States, where 70-90% of freshwater bodies are reported to be exposed to pollution pressures.

Map 5.2 Proportion of classified water bodies in different River Basin Districts affected by pollution pressures for rivers and lakes (left panel) and for coastal and transitional waters (right panel)



Notes: The percentage is based on total number of classified water bodies. A water body is defined as affected by pollution pressures if it is reported with the aggregated pressure type "Point sources" and/or "Diffuse sources" and/or any of the corresponding disaggregated pressure types. Swedish surface water bodies where the pressure reporting is considered only to be related to airborne mercury contamination are defined as not affected by pollution pressures (see text). See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS.

The general overview of pollution pressures reported for different RBDs (Map 5.2) is largely consistent with the results reported for ecological status or potential (Map 5.1). However, probably due to the impact of hydromorphological pressures (Map 5.3), the ecological status or potential in rivers and lakes in some RBDs is worse than anticipated from the pollution pressures, such as in most of the RBDs in Northern Sweden, the Baltic countries, Scotland, Poland, Austria and Hungary, as well as Brittany in France.

For **coastal and transitional waters**, the worst areas where more than 90% of water bodies are reported to be exposed to pollution pressures are in the Baltic region (southern Finland, south-eastern Sweden and north-eastern Germany), in the Greater North Sea region (south-western Sweden, north-western Germany, the Netherlands and Belgium (Flanders)), southern Portugal, as well as the Romanian part of the Black Sea region. In the Bulgarian part of the Black Sea 70-90% of their coastal and transitional water bodies are reported to be exposed to pollution pressures. Also along the coast of Brittany in France, eastern Ireland both sides of northern Italy, as well as south-western Portugal, more than 70% of classified water bodies are reported to be exposed to pollution pressures.

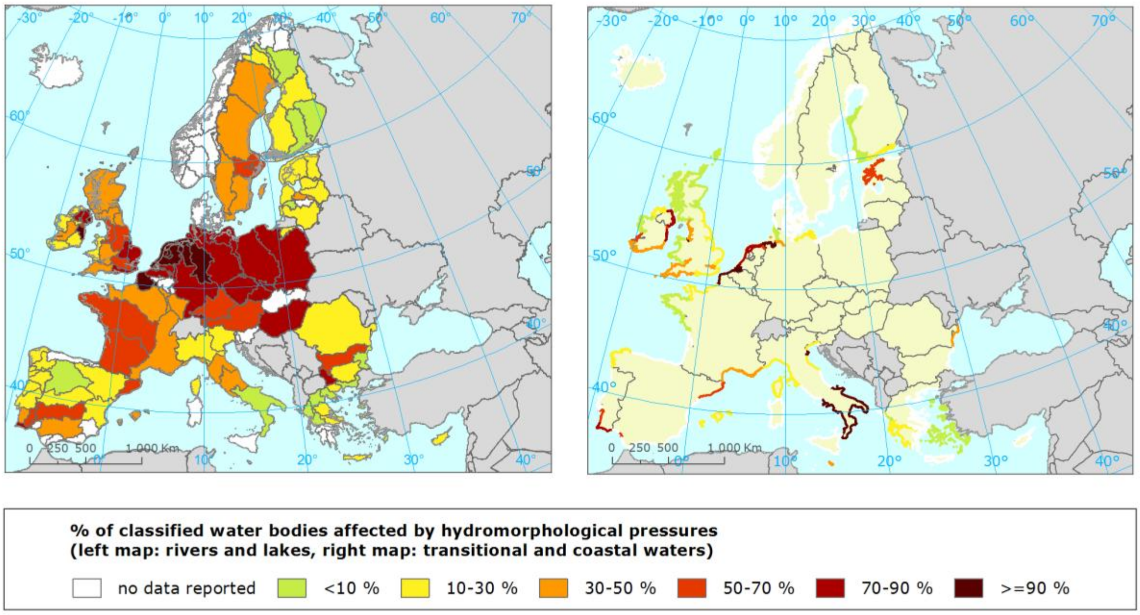
The lowest proportion of coastal and transitional water bodies exposed to pollution pressures are reported from the north-eastern coast of Poland, as well as around the Greek islands, where more than 90% of the coastal and transitional water bodies are reported to be without significant pollution pressures.

For coastal and transitional waters there is consistency between the reported pollution pressures and the ecological status or potential. In some areas, however, the ecological status or potential in these water categories is worse than what is suggested by the pollution pressures, e.g. in Poland, which can be explained by hydromorphological or other pressures, as well as by pressures coming from outside the EU. However, in other areas the ecological status or potential is better than what is suggested by the pollution pressures, e.g. in Scotland, Brittany in France most of Italy and southern Portugal. The reason can be that the pollution pressures in these areas are rapidly diluted in large, exposed coastal water bodies and therefore have less effect on their ecological status. However, also reporting mistakes and methodological artifacts may contribute to these inconsistencies (see chapter 3).

5.5.2. Hydromorphological pressures

The hydromorphological pressures in rivers and lakes are reported to be most severe in RBDs in the Netherlands, Germany, Poland, Hungary and south-east England, and less severe in RBDs in Finland, the Baltic countries, Romania, as well as in many RBDs in Spain, Portugal, Italy, Greece, Bulgaria and Cyprus. In coastal and transitional waters the hydromorphological pressure is considerably less than in freshwater bodies, and is mainly a problem along the Greater North Sea coast of Germany, the Netherlands and Belgium, as well as the in the southern coast of Italy. Further details on hydromorphological pressures can be found in the Hydromorphology Thematic Assessment report (EEA ETC/ICM, 2012).

Map 5.3 Proportion of classified water bodies in different River Basin Districts affected by hydromorphological pressures for rivers and lakes (left panel) and for coastal and transitional waters (right panel)

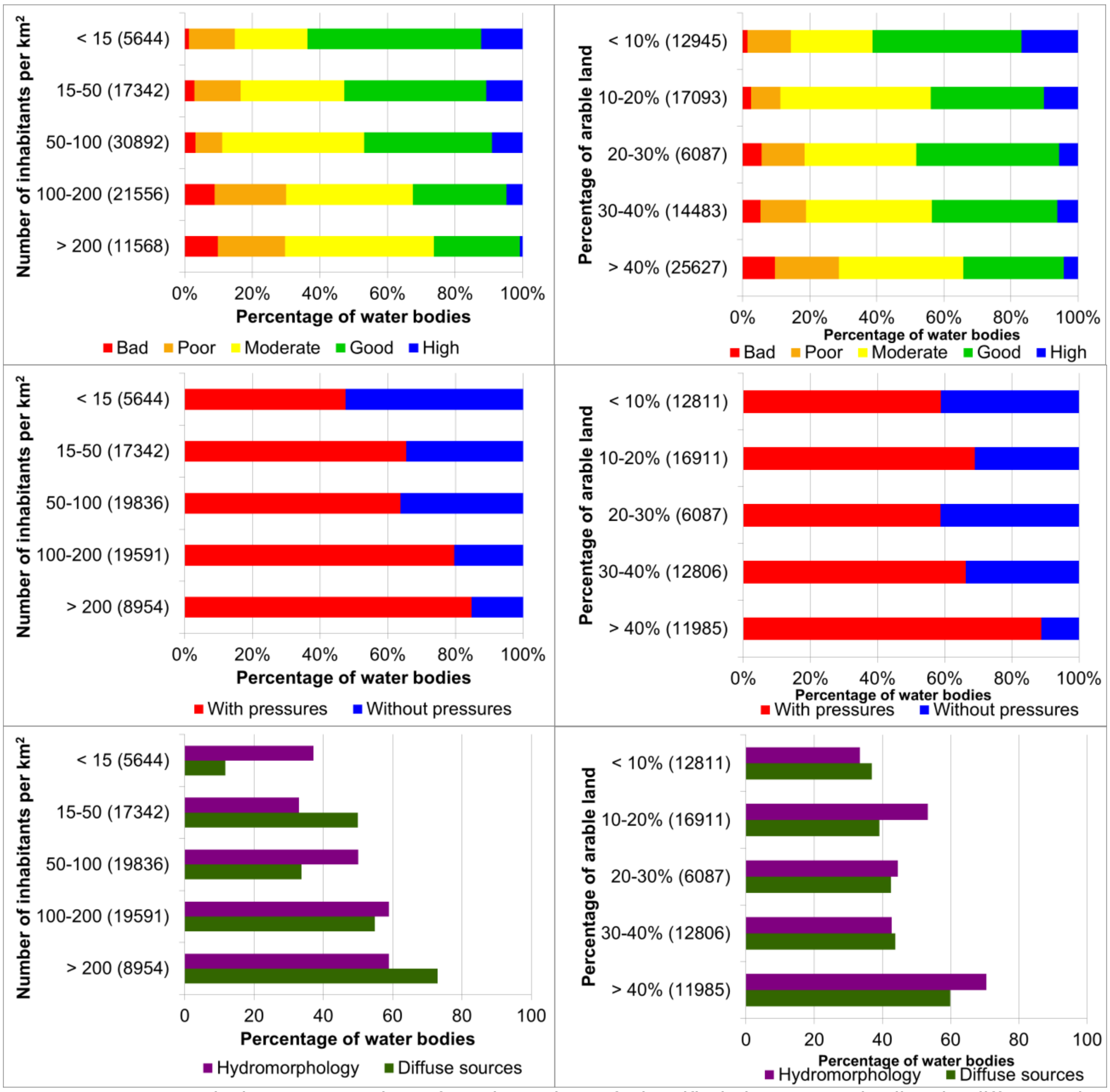


Notes: The percentage is based on total number of classified water bodies. A water body is defined as affected by hydromorphological pressures if it is reported with any of the aggregated pressure types “Water abstraction”, “Water flow regulations and morphological alterations of surface water“, “River management“, “Transitional and coastal water management“ and “Other morphological alterations“ and/or any of the corresponding disaggregated pressure types.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS.

5.6. Relationships of ecological status or potential and pressures in rivers with population density and proportion of arable land

This section takes a closer look at river water bodies. The more than 90 000 classified river water bodies have been grouped according to the overall population density and percentage of arable land in the RBDs. The results provide a crude overview of the drivers and pressures affecting the ecological status.

Figure 5.3 Ecological status and pressures in classified river water bodies in different categories of population density (left panel) and arable land in the river basin (right)



Notes: Upper panel shows proportion of total number of classified river water bodies in different classes of ecological status or potential. Middle panel shows proportion of total number of classified river water bodies with and without pressures. Lower panel shows proportion of total number of classified river water bodies with hydromorphological or diffuse pressures. The designation of river water bodies to population or arable land categories is made at RBD level, i.e. all water bodies in the same RBD are in the same category. The number of classified river water bodies in the different population density categories or arable land categories is indicated in brackets. In the pressure plots the Member States not reporting the given pressures are excluded from the number of classified water bodies. "Hydromorphology" denotes the combination of the aggregated pressure types "Water abstraction", "Water flow regulations and morphological alterations of surface water", "River management" and "Other morphological alterations". A water body is defined as affected by any of the pressure types in the figures if it is reported with the aggregated pressure type and/or any of the corresponding disaggregated pressure types. Swedish surface water bodies where the pressure reporting is considered only to be related to airborne mercury contamination are defined as not affected (see text). See appendix for further details.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/SWB_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS.

When population density and proportion of arable land increases, the ecological status or potential of river water bodies deteriorates and the pressure increases, both for diffuse pollution, as well as for hydromorphological pressures (Fig. 5.3). The ecological status or potential changes from less than 40% to ca. 70% of classified river water bodies in less than good status, when population density and proportion of arable land increases from the lowest to the highest category. At the highest levels of population density and proportion of arable land (more than 200 inhabitants per km^2 and 40% arable land), one third of the river water bodies are reported to be in poor or bad ecological status or potential. At this highest level of the two major drivers, as much as 80-90% of the river water bodies are exposed to significant pressures, with diffuse pollution and hydromorphological alterations affecting 60-70% of the classified river water bodies. This pattern is a clear indication that population density and proportion of arable land are two major drivers responsible for the pressures affecting the ecological status or potential of European rivers.

Hydromorphological pressures are reported for a substantial proportion of the classified river water bodies (30-40%) even at the lowest level of population density and proportion of arable land, which is probably related to the use of many upstream rivers in mountain areas for hydropower production.

5.7. Appendix with notes for figures and tables.

<u>Figure 5.0</u>

Table 5.0 *Proportion of classified water bodies in less than good ecological status or potential, with pressures and with impacts in different water categories.*

Water category	Rivers	Lakes	Transitional waters	Coastal waters
Ecological status or potential, % water bodies in less than good status or potential	56	44	67	49
Pressures, % water bodies with one or several pressures	68	52	80	59
Impacts, % water bodies with one or several impacts	52	39	68	52

Ecological status or potential: Surface water bodies that are not classified include water bodies in some RBDs which are not reported (see Map 5.1) and water bodies reported as unclassified (see chapter 3.1). The total numbers of classified water bodies are thus: Rivers: 91040, Lakes: 14755, Transitional waters: 712, Coastal waters: 2394.

Pressures and impacts: The Member States excluded from the number of total classified water bodies due to non-reporting are: Pressures: Denmark, Luxembourg, Slovakia, Slovenia, Belgium and Cyprus (the latter two only for coastal waters). Impacts: Denmark, Luxembourg, Slovakia, Poland, the Netherlands, Slovenia, Belgium and Cyprus (the latter two only for coastal waters). Ireland only reported impacts for one RBD, so Irish water bodies are removed both from the number of water bodies with impacts and from the number of total classified water bodies in the impacts calculation. The total numbers of classified water bodies included in the pressure and impact bars are thus:

Pressures: Rivers: 75405, Lakes: 13967, Transitional waters: 712, Coastal waters: 2281.

Impacts: Rivers: 69656, Lakes: 12539, Transitional waters: 573, Coastal waters: 2201.

For Sweden, wherever the pressures or impacts reporting is related to airborne mercury pollution only, the water bodies are considered not to be affected by pressures or impacts, respectively (see Text Box 5.1). For pressures this occurs when the aggregated diffuse pressure type is the only pressure and the impacts description indicates diffuse pollution from mercury only. For impacts this occurs when contamination by priority substances is the only impact (Sweden did not report the impact type "contaminated sediments") and the impact description does not indicate contamination by other priority substances than mercury. The numbers of redefined water bodies are thus:

Pressures: Rivers: 6441, Lakes: 3507, Transitional waters: 0, Coastal waters: 68.

Impacts: Rivers: 11070, Lakes: 4903, Transitional waters: 0, Coastal waters: 93.

Figure 5.1

In cases where length (rivers) and area (remaining water categories) data were considered suspicious, these water bodies were excluded from the analysis by length or area. These were cases when length or area was 0 or below or when data were not reported. This occurred in all water categories. In addition there were cases of unrealistically high numbers, indicating erroneous unit. For rivers, all water bodies with length >1000 km were removed. These were all Italian. No lake or transitional water bodies were removed due to too large area, but all coastal water bodies >6000 km^2 were removed. These were all from the Spanish RBD ES100. The total numbers of classified water bodies used in the by length/area analysis were thus somewhat lower than in the analysis by count (see notes Fig. 5.0), i.e.:

Rivers: 89260, Lakes: 14733, Transitional waters: 698, Coastal waters: 2350.

Figure 5.2

For the "No pressures" and "No impacts" bars, the same Member States are removed from the total number of classified water bodies as in Fig. 5.0. In the other bars, more Member States may be removed from the total classified, if they have not reported that specific pressure or impact (for most pressures and impacts these Member States can be identified in the member state plots in chapter 4). It is impossible to differentiate between Member States not reporting a specific pressure or impact, or Member States for which the specific pressure or impact is not affecting any water bodies. In the latter case, removing these Member States leads to an overestimation of the proportion of water bodies affected by the specific pressure or impact.

For the "No pressures" and "No impacts" bars, the same numbers of Swedish water bodies are redefined as in the pressures and impacts bars in Fig. 5.0, respectively. In the "Diffuse sources" bars, Swedish water bodies reported with the aggregated diffuse pressure type as the only diffuse pressure type and the impact description indicates diffuse mercury pollution only are redefined as not affected by diffuse pressures, that is:

Rivers: 11033, Lakes: 4895, Transitional waters: 0, Coastal waters: 89.

In the "Contamination" bars, Swedish water bodies reported with the impact contamination by priority substances, but the impact description does not indicate contamination by other priority substances than mercury are redefined as not affected by the impact "Contamination", that is:

Rivers: 14669, Lakes: 6915, Transitional waters: 16, Coastal waters: 389.

Map 5.2

For Sweden, water bodies are redefined as not affected by pollution pressures if the aggregated diffuse pressure type is the only pollution type reported and the impact description indicates diffuse mercury pollution only (see notes Fig. 5.0). The following numbers of water bodies are redefined (EU RBD codes):

EU RBD code	Lakes and rivers	Transitional and coastal waters
SE1	5323	47
SE1TO	886	2
SE2	8024	27
SE3	300	4
SE4	538	0
SE5	640	5
SENO1102	49	
SENO1103	121	
SENO1104	4	
SENO5101	14	

In the Cyprus "EU-summary report Articles 5 & 6" (submitted March 2005), in Table SWPI2-4, four out of 25 coastal water bodies (16%) were reported to be impacted by pollution (nutrients; BOD). However, these data were not reported in WISE, and thus were not taken into account.

Figure 5.3

Only classified river water bodies from RBDs where category data are available are included (Population: 145, Arable land: 111 RBDs). The Member States removed from the number of classified river water bodies in the pressure plots are the same as in Fig. 5.0 (for rivers, all Member States reporting pressures overall report hydromorphological and diffuse pressures). In the with/without pressures plots, all Swedish river water bodies with the aggregated diffuse pressure type only are defined as without pressures. In the "Diffuse sources" bars, Swedish water bodies reported with the aggregated diffuse pressure type as the only diffuse pressure type and the impact description indicates diffuse mercury pollution only are redefined as not affected by diffuse pressures. The numbers are given here:

Population category	Redefined as without pressures	Redefined as without diffuse pressures	Arable land category	Redefined as without pressures	Redefined as without diffuse pressures
<15	2061	3866	<10%	2061	3866
15-50	308	769	10-20%	366	966
50-100	58	197	20-30%		
100-200			30-40%		
>200			>40%		

6. European overview of chemical status, pressures and impacts

6.1. Key Messages

The chemical status of more than 140 000 surface and groundwater bodies across Europe has been reported under the WFD. Including those water bodies classified with unknown status, poor status for each of the surface water body types – rivers, lakes, transitional and coastal does not exceed 10%, aggregated across Europe as a whole, expressed by number of water bodies or 'count'. Poor status for groundwater, by area, is about 25% across Europe.

Notably, the chemical status of many of Europe‘s surface waters remains unknown, ranging between 46% for coastal waters and 55% in transitional waters. In addition, understanding of the link between pressures and chemical status remains incomplete.

Sixteen Member States have more than 10% of groundwater bodies in poor chemical status whilst this figure exceeds 50% in Luxembourg, the Czech Republic, Belgium-Flanders and Malta. Excessive levels of nitrate are the most frequent cause of poor groundwater status across much of Europe. Agriculture is the primary source of this nitrate, deriving from the input of mineral and organic fertilizers and subsequent leaching to groundwater. Pesticides and a range of other chemicals such as heavy metals are also causes of poor groundwater status across Europe. The threshold values to assess groundwater chemical status vary markedly between Member States for certain pollutants.

Ten Member States report poor chemical status in more than 20% of rivers and lakes, whilst in Hungary, Belgium-Flanders, Denmark, Poland and Sweden this figure rises to above 40% and reaches 100% in Sweden. These figures exclude, however, the many rivers and lakes across Europe with an unknown chemical status; unknown status exceeds 50% in 10 countries and 20% in all but 11 countries. Polycyclic aromatic hydrocarbons (PAHs) are a widespread cause of poor status in rivers. PAHs result from incomplete combustion processes and are subject to long-range transport in the atmosphere. As a result, subsequent deposition and adverse impacts upon aquatic environments may occur a great distance from the original point of emission. Heavy metals are also a significant contributor to poor status in rivers and lakes, with levels of mercury in Swedish freshwater biota being the cause of 100% failure to reach good chemical status. Industrial chemicals such as the plasticiser DEHP, and pesticides, are also widespread causes of poor chemical status in rivers.

Six Member States – France, Germany, Belgium-Flanders, Sweden, Romania and the Netherlands - report poor status in transitional waters (excluding those in unknown status) to be 50% or more. PAHs, the antifouling biocide tributyltin (TBT) and heavy metals are the most common cause. TBT is now banned across Europe and high concentrations locally reflect the historical use and persistence of this substance.

Six Member States report their coastal waters to be in 100% good status, although in five others – Netherlands, Sweden, Romania, Denmark and Belgium-Flanders poor status exceeds 90% of those water bodies with a known chemical status. A variety of pollutant groups contribute to poor status in coastal waters reflecting a diverse range of sources.

Those water bodies across Europe that exhibit particularly poor chemical status are, typically, subject to pollution from a range of different chemicals, including heavy metals, industrial chemicals and pesticides that derive from a variety of sources.

Some hazardous substances tend to accumulate in sediment and biota, with the result that their concentrations in these matrices are likely to be higher and, therefore, more detectable and measurable than in water. If measurements are made in the water column, the risk to the aquatic environment may be underestimated. At least one example exists of different matrices being used for the same chemical across different Member States, resulting in assessments of chemical water quality that are not directly comparable. A harmonisation at EU level is, therefore, needed.

6.2. Introduction

6.2.1. Background

Chemicals are an essential part of our daily lives. They are used, for example, to produce consumer goods, to protect or restore our health, to boost food production and are involved within a growing range of environmental technologies. Europe's chemical and associated industries have developed rapidly in recent decades, making a significant contribution to Europe's economy and to the global trade in chemicals.

Whilst synthetic chemicals clearly bring important benefits to society, some of them are hazardous, raising concerns for human health and the environment depending on their pattern of use and the potential for exposure. Certain types of naturally occurring chemicals, such as metals, can also be hazardous. Emissions of hazardous substances to the environment can occur at every stage of their life cycle and arise from a wide range of land-based and marine sources, including agriculture and aquaculture, industry, oil exploitation and mining, transport, shipping and waste disposal, as well as domestic premises. In addition, concern regarding chemical contamination arising from the exploitation of shale gas has grown recently.

Hazardous substances are emitted to water bodies both directly and indirectly through a range of diffuse and point source pathways. Their presence in fresh and marine waters and associated biota and sediment is documented by various information sources, including national monitoring programmes, monitoring initiatives undertaken by the Joint Research Centre (JRC), reporting under the Water Framework Directive (WFD), international marine conventions (e.g. HELCOM and OSPAR) and European research studies. These substances comprise a wide range of industrial and household chemicals, metals, pesticides and pharmaceuticals.

Hazardous substances can have detrimental effects on aquatic biota at molecular, cellular, tissue, organ and ecosystem level. Substances with endocrine-disrupting properties, for example, have been shown to impair reproduction in fish and shellfish in Europe, raising concerns for fertility and population survival. The impact of organo-chlorines upon sea birds and marine mammals is also well documented, as is the toxicity of metals and pesticides to freshwater biota. From a socio-economic point of view, such impacts diminish the services provided by aquatic ecosystems, and consequently the revenue that can be derived from them.

Persistent hazardous substances found in aquatic environments can bio-accumulate and sometimes bio-magnify throughout the food chain, raising implications for human health with respect to the consumption of seafood (fish, crustaceans, molluscs and marine mammals) and freshwater fish. The bio-accumulation and bio-magnification of mercury and various POPs in particular can cause health concerns for vulnerable population groups (EC, 2004; EFSA, 2005). The exceedance of regulatory levels in seafood is documented for several hazardous substances in the seas around Europe (Isosaari et al., 2006; Kiljunen et al., 2007; HELCOM, 2010b; Bilau et al., 2007).

Human exposure to hazardous substances can also potentially occur through the ingestion of contaminated drinking water. The Drinking Water Directive sets quality standards for water at the tap, based on guidelines issued by the World Health Organization (WHO), for a range of microbiological and chemical parameters. Much of Europe is now connected to municipal systems supplying treated water under quality-controlled conditions. However, reporting under the Directive (for the periods 2002–2004 and 2005-2007) indicates some non- compliance with respect to a range of chemical parameters (EC, 2007; EC, 2011a). In recent years, concern has been raised with respect to the presence of some emerging pollutants within treated municipal drinking water. Understanding of the effects of long-term human exposure to trace amounts of such substances — in concentrations of parts per billion or trillion — remains incomplete.

In some, typically rural, areas of Europe, the local population relies upon small individual or community-managed non-piped supplies of water, usually wells or boreholes. Such small-scale supplies are not covered by the Drinking Water Directive and the provision of safe drinking water can present a challenge: any chemical (or microbiological) pollution of groundwater in the vicinity of such wells will pose a threat to public health. The World Health Organization reports that chemical contamination of drinking water across the (WHO) pan-European region, whilst restricted to specific local areas, can have a significant impact upon human health (WHO, 2010).

This assessment describes the chemical status of Europe‘s inland and coastal water bodies as reported through the river basin management plans of the WFD. It draws also on other supporting information, including chemical water quality data reported by voluntary agreement to the EEA by member countries through the WISE-SoE reporting process and held in the Eionet database. In addition to highlighting current chemical status, this assessment also describes the factors causing degradation in chemical water quality, including the sources of such pollution and their emissions to water.

6.2.2. Sources, pathways and emissions

Emissions and releases of hazardous substances can occur at all stages of their life-cycle, from production, processing, manufacturing and use in downstream production sectors and by the general public to their eventual disposal. Such substances can arise from numerous sources and are emitted to fresh and marine waters via numerous pathways. The key sources and their pathways of emission are overviewed below.

Urban environment

Hazardous substances arise from various sources in the urban environment. These include household chemicals such as personal care products and medicines, a wide range of industrial chemicals, substances such as hydrocarbons and heavy metals released by the transport sector, building and construction materials, and pesticides used to control unwanted plant growth on sports grounds and buildings, in public parks and private gardens, and on roads and railways. Certain hazardous substances are released to air from industrial and waste facilities and vehicle emissions. Subsequently, their deposition to water bodies can occur both directly and indirectly, for example via soil and urban drainage systems.

Residential wastewater in Europe is predominantly collected by a sewer network and directed to municipal wastewater treatment plants. Industrial wastewaters are also typically treated, either on-site or by transfer to a municipal plant. Other urban pollutants, however, particularly those deposited from the atmosphere or released from vehicles (e.g. from wear on brakes and tyres) are, originally at least, diffuse in nature, as they are washed from impervious areas by surface run-off. Their subsequent fate depends upon whether the run-off is collected and directed to a treatment plant or discharged untreated to a receiving water body. Whilst household and industrial wastewater treatment has been implemented progressively across Europe, the process does not remove all hazardous substances, with household and industrial chemicals and pharmaceuticals, for example, being detected in treated effluent that is subsequently discharged to surface waters (Ashton et al., 2004; Gros et al., 2010; HELCOM, 2010b; Miège et al., 2009; Reemtsma et al., 2006).

In many cities across Europe, the sewage collection system has also been designed to collect run-off from streets, roofs and other impervious surfaces. The collection pipes and treatment plants of such combined systems are designed to be able to handle both sewage and urban run-off generated during rain storms, but only up to a certain level. During larger storm events, the combined flow generated can exceed the capacity of the system. When this happens, relief structures are built into the collection system to prevent sewage back-up into streets and homes, enabling the flows to bypass the treatment plants and discharge the combined waste more or less untreated to a receiving watercourse. Such combined sewer overflows (CSOs), together with discharges from separate storm water systems, typically discharge a range of pollutants including hazardous substances (Chon et al., 2010; Gounou et al., 2011; Sally et al., 2011) and can cause rapid depletion of oxygen levels in receiving waters (Even et al., 2007). In addition, the quality of coastal waters near such discharges can deteriorate very quickly.

Agriculture

Pesticides used in agriculture are widely detected in freshwater, often transported by diffuse pathways via surface run-off and leaching. Point discharges of pesticides are also important, however, and occur through accidental spillage, sprayer loading and wash-down, and inappropriate storage and disposal. Just how much pesticide pollution of freshwater occurs depends on a range of factors including the chemical nature of the pesticide, the physical properties of the landscape, and weather conditions.

Metal emissions from agriculture include cadmium, found naturally in the phosphate rock used to make fertilizer. In addition, both zinc and copper are added to animal feed as essential trace elements, and hence a proportion can be excreted and susceptible to being washed into rural streams. While metals are generally well retained in soil, there is evidence that agricultural sources can make a significant contribution to freshwater loads (RIVM, 2008a and 2008b).

Following use in livestock treatment, veterinary medicines and any metabolites may be released to soil directly, by animals at pasture, or indirectly through the application of animal manures and slurries to land as a fertilizer (Boxall et al., 2004). As a consequence, veterinary medicines may subsequently be transported to surface waters via runoff or field drains (Burkhard et al., 2005) or leach to groundwaters (Blackwell et al., 2007).

Mining

Mining exerts a localised but significant pressure upon the chemical and ecological quality of water resources in parts of Europe, particularly with respect to the discharge of heavy metals. Abandoned mines represent a particular threat since, in the absence of continued pumping, groundwater levels rise and, ultimately, discharge contaminants within the mine workings. Mine discharges threaten the attainment of good water quality in a number of locations across Europe.

Landfills and contaminated land

Landfill sites can be a source of pollution to the aquatic environment. Precipitation percolates down through the waste, picking up a range of pollutants including hazardous substances whilst water is also released from the waste itself as it degrades (Slack et al., 2005). The leachate subsequently collects at the base of the landfill where it can, potentially, contaminate groundwater. In modern landfills, leachate is collected by pipes and either treated on site, with the effluent discharged to a neighbouring watercourse, or transported to a sewage treatment plant for processing. Older landfills, however, do not incorporate such measures and as a consequence, contaminated leachate is free to flow downwards unrestricted (Baun et al., 2004). Aside from landfill sites, land can be contaminated by a range of hazardous substances released from historical industrial activities or, more recently, from unintentional leaks and spills. Such substances can include solvents, oil, petrol, heavy metals and radioactive substances. Without appropriate remedial action, ground and surface waters can also be polluted.

Transport of hazardous substances to coastal waters

Once released to rivers, hazardous substances can be transported downstream and ultimately discharged to coastal waters, although numerous processes can occur 'in-stream' to attenuate this transport. Of particular note is the deposition of substances onto the river bed. Hazardous substances attached to other particles, such as organic material and eroded soil, are particularly susceptible to this sedimentation process and, once settled on the river bed, can pose a threat to benthic biota. During periods of higher river flow, however, bed sediments and their associated contaminants can be re-suspended into the water column and transported downstream until flow declines and sedimentation occurs again. The proportion of a hazardous substance load that is ultimately discharged to estuarine and coastal waters remains susceptible to sedimentation once more. Re-suspension of hazardous substances can also occur when sediments are disturbed and displaced, for example, through dredging.

Sources emitted directly into the marine environment

In addition to the waterborne transport of substances emitted from land-based sources and deposition from the atmosphere, hazardous substances are also released directly into the marine environment. Shipping, harbour and port activities, offshore oil exploration and aquaculture all emit a variety of hazardous substances, whilst the discharge of sewage and industrial wastewater directly (i.e. not via rivers) into coastal waters can also occur.

6.2.3. Protection of Europe's fresh and marine waters from chemical pollution

The chemical status of Europe's surface waters is addressed by the Directive on environmental quality standards (EQSD) a 'daughter' directive of the WFD. The EQSD defines environmental quality standards (EQSs) in fresh and coastal waters for pollutants of EU-wide relevance known as priority substances (PSs). The EQSs associated with the PSs are defined both in terms of annual average and maximum allowable concentrations, with the former protecting against long-term chronic pollution problems and the latter against short-term acute pollution. Member States are required to monitor the PSs in surface water bodies, to report EQS exceedances and implement measures to address them. PSs designated thus far include metals, herbicides, insecticides, fungicides, biocides, volatile organic compounds, alkylphenols, PAHs and phthalates. The European Commission is required to review the list of PSs every four years and identify, where appropriate, new PSs or PHSs and any need to revise the EQSs or the status of existing PSs.

The EQSs must not only protect freshwater and marine ecosystems from possible adverse effects of hazardous substances; they must also safeguard human health, which potentially can be put at risk via drinking water or the ingestion of food originating from aquatic environments. In this way, all direct and indirect exposure routes in aquatic systems are to be accounted for when establishing the EQSs. For example, the setting of an EQS for the water column alone may be insufficient with respect to a chemical with a tendency to bio-accumulate and bio-magnify and one that may therefore pose a risk through secondary poisoning resulting from food chain transfer. Instead, in this case, a biota standard may be required alongside the water column EQS.

Some pollutants have been designated as priority hazardous substances (PHSs) due to their toxicity, their persistence in the environment and bioaccumulation in plant and animal tissues, or an equivalent cause for concern. The cessation or phase-out of discharges, emissions and losses of PHSs to the aquatic environment is required within 20 years of the date of the adoption of measures.

For substances identified as being of concern at local, river-basin or national level (known as river basin specific pollutants) but not as a PS or PHS at EU level, standards are set by national governments and the results of monitoring are considered in the assessment of ecological status under the WFD.

The WFD objectives for groundwater are laid down in Article 4 of the Directive, which requires Member States to implement the measures necessary to prevent or limit the input of pollutants into groundwater and to prevent the deterioration of the status of all groundwater bodies. Any significant and sustained upward trend in the concentration of any pollutant resulting from human activity must be reversed.

The Groundwater Directive (2006/118/EC; GWD) establishes a regime to assess groundwater chemical status, providing EU-wide groundwater quality standards in Annex I (for nitrates and pesticides) and requiring Member States to establish groundwater quality standards (referred to as "threshold values") at a national level for a range of other pollutants, as identified in Annex II of the GWD. The overall approach to this incorporates the risks identified by the analysis of pressures and impacts under article 5 of the WFD and accounts for the high natural variability of substances in groundwater due to various factors including hydrogeology, background levels and pollutant pathways. The groundwater thresholds are primarily based on two criteria, the protection of associated aquatic ecosystems and groundwater dependent terrestrial ecosystems, and the protection of water used for drinking purposes and other legitimate uses. Good groundwater chemical status is not, however, only dependent upon the non-exceedance of quality standards but upon a number of further elements, including the requirement, for example, that there is no saline intrusion into a groundwater body, and that concentrations in groundwater do not result in failure of status of associated surface waters nor any significant deterioration of the ecological or chemical quality of such bodies nor in any significant damage to terrestrial ecosystems which depend directly on the groundwater body.

A suite of other European legislation lends support to the attainment of good chemical status under the WFD. This includes REACH (EC Regulation 1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals) which aims to improve the protection of human health and the environment from the risks of chemicals. REACH attributes greater responsibility to industry with regard to managing risks and providing safety information on substances used. It also calls for the progressive substitution of the most dangerous chemicals once suitable alternatives have been found. Other legislation is specific to a particular substance or group of substances. This includes the Pesticides Framework Directive which calls for the establishment of national action plans to set objectives in order to reduce hazards, risks and dependence on chemical control for plant protection.

6.2.4. Chemical Status – reporting requirements

Surface Water

WFD reporting guidance proposed that Member States grouped the reporting of priority substances into four categories; heavy metals, pesticides, industrial pollutants and 'other pollutants'. The latter category included a mix of individual chemical types including polycyclic aromatic hydrocarbons (PAHs) and tributyltin compounds. Inconsistency in reporting was apparent between Member States, however, with some reporting a mix of pollutant groups and individual pollutants, whilst others reported either individual pollutants or groups only. Moreover, different matrices (i.e. water column, sediment and biota) have sometimes been used to assess the risk of particular chemicals across different Member States, meaning that the results arising are not always directly comparable.

Groundwater

Reporting with respect to WFD groundwater chemical status required a grouping into three categories; nitrate, certain pesticides and the Annex II pollutants covering arsenic, cadmium, lead, mercury, ammonium, chlorides, sulphates, trichloroethylene and tetrachloroethylene. Inconsistency in reporting was apparent between Member States, however, with some reporting a mix of pollutant groups and individual pollutants, whilst others reported either individual pollutants or groups only. Moreover, the definition of pollutants and their associated threshold values (as required under the GWD) vary markedly between Member States (EC, 2010a).

6.3. European overview of chemical status

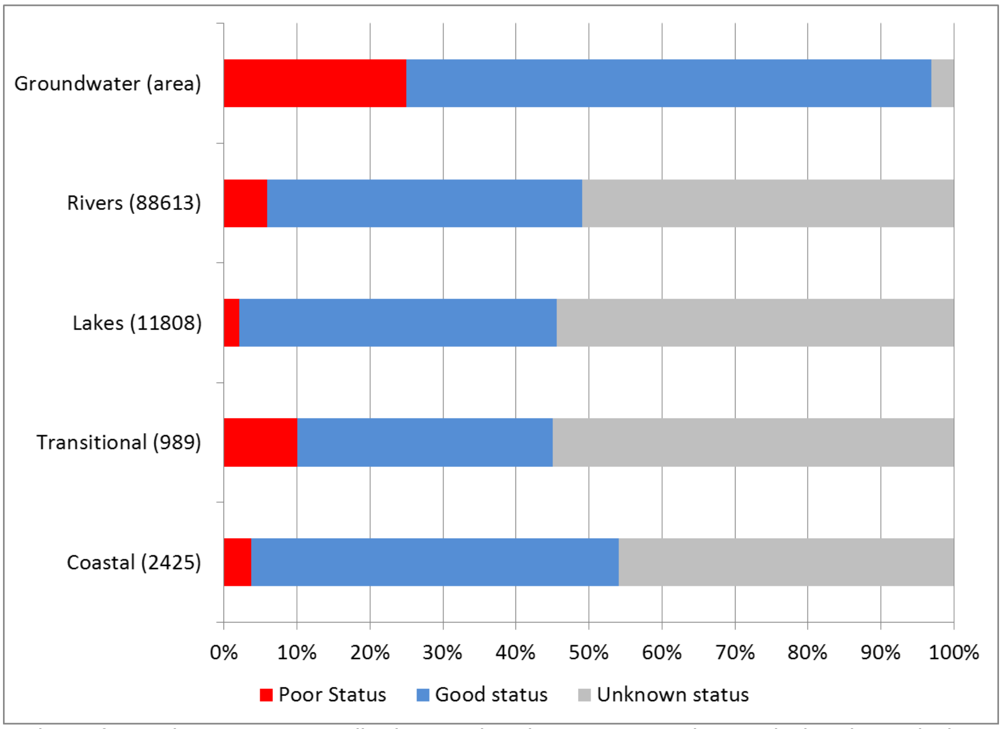
The chemical status of 123213 surface freshwater bodies (104176 rivers and 19037 lakes) has been evaluated across 26 Member States across Europe, with 43% of rivers and 44% of lakes (by count) being classified as good, and 6% and 2%, respectively, being in poor status (Fig. 6.1). Notably, the chemical status of 51% of rivers and 54% of lakes remain unknown. These overall statistics do not, however, include the results from Sweden that contributed a disproportionately large amount to the total information reported across Europe for surface waters. Additionally all such waters in Sweden are classified as being in poor status due to the levels of mercury found in biota (see textbox).

Text Box 6.1 Importance of the matrix used to evaluate chemical status
Some hazardous substances tend to accumulate in sediment and biota, with the result that their concentrations in these matrices are likely to be higher and therefore, more detectable and measurable than in the water column. If measurements are made in the water column only, the risk to the aquatic environment may be underestimated. The high levels of mercury in freshwater biota in Sweden, for example has led to a nationwide classification of poor chemical status. WFD reporting shows, however, that at least one other Member State has monitored mercury levels in the water column only. This has resulted in a substantially lower percentage of water bodies being classified in poor chemical status compared to Sweden, despite a comparable problem with mercury in soils and freshwater.

Chemical status for 1010 transitional and 3027 coastal water bodies has been reported across 16 and 21 Member States, respectively. Marked variation in the surface area of these is apparent both within and between Member States, although since this information was not reported consistently, the results are presented here by count. Poor chemical status is reported in 10% of transitional and 4% of coastal water bodies, (excluding data from Sweden) whilst good status is achieved in 35% and 51%, respectively. Of note is the amount of unknown status reported, 55% of transitional and 46% of coastal water bodies are classified in this category.

The chemical status of more than 13 000 groundwater bodies has been reported across Europe, encompassing 26 different Member States. Good chemical status is apparent in 72% of them (by surface area) whilst about 25% are in poor status (Fig. 6.1). Approximately 3% are classified as unknown. The dominant reason for poor status (62% by area, 60% by count) is the exceedance of a quality standard (threshold value) for one or more pollutants. Other important causal factors include the deterioration in quality of waters for human consumption (21% by area, 11% by count) (Table 6.1).

Figure 6.1 Percentage of rivers, lakes, groundwater, transitional and coastal waters in good, poor and unknown chemical status



Notes: Number of Member States contributing to the dataset: Groundwater (26); Rivers (25); Lakes (22); Transitional (15) and Coastal (20). Percentages shown for rivers, lakes, transitional and coastal are by water body count. Groundwater percentages, however, are expressed by area. The total number of water bodies is shown in parenthesis. Data from Sweden are excluded from surface water data illustrated in the figure. This is because Sweden contributed a disproportionately large amount of data and, classified all its surface waters as poor status since levels of mercury found within biota in both fresh and coastal waters exceed quality standards.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/GWB_STATUS and
http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

Table 6.1 Number of Member States and groundwater bodies reporting failure to achieve good chemical status due to different reasons

Reason for failure	Member States	GWBs
Exceedance of groundwater quality standards/threshold values	21	1564
Deterioration in **quality of waters** for human consumption	11	297
Saline or other intrusions	9	157
Significant **impairment of human** uses	7	273
Failure to meet **environmental objectives** in associated surface water bodies	6	189
Significant environmental **risk from pollutants** across the GWB	5	112
Significant damage to **terrestrial ecosystems** which depend directly on the GWB	3	6

Notes: The total number of groundwater bodies (GWBs) reported is 13288, hereof 10653 in good status, 1969 in poor status and 666 in unknown status. There may be more than one reason for a GWB to fail achieving good chemical status.
Source: WISE-WFD database, May 2012. Detailed data are available at
http://discomap.eea.europa.eu/report/wfd/GWB_STATUS.

6.3.1. Chemical groups causing poor status – an overview

Excessive nitrate concentration is the cause of 54% of those groundwater bodies classified as being in poor chemical status across Europe, whilst the GWD Annex II pollutants account for 34%. It should be noted; however, that more than one chemical group can cause failure to reach good status in any single water body. Pesticides are the cause of 20% of groundwater bodies in poor chemical status. In general, shallow groundwater horizons are more likely to exhibit poor chemical status than deeper horizons.

'Other pollutants' are the causal factor for nearly 52% of European rivers classified as being in poor chemical status, whilst heavy metals account for 20% and pesticides about 16%. These figures do not, however, include data from Sweden for the reasons outlined earlier. For lakes, heavy metals are the dominant pollutant, accounting for more than 60% of those in poor status. 'Other pollutants' are the causal factor for 57% of those transitional water bodies classified as being in poor chemical status, whilst heavy metals account for 43%. Pesticides and industrial pollutants each account for 16% and 20% respectively. In coastal waters, 'other pollutants' account for 53% of water bodies in poor status, followed by heavy metals accounting for 50% and industrial pollutants that account for 19%.

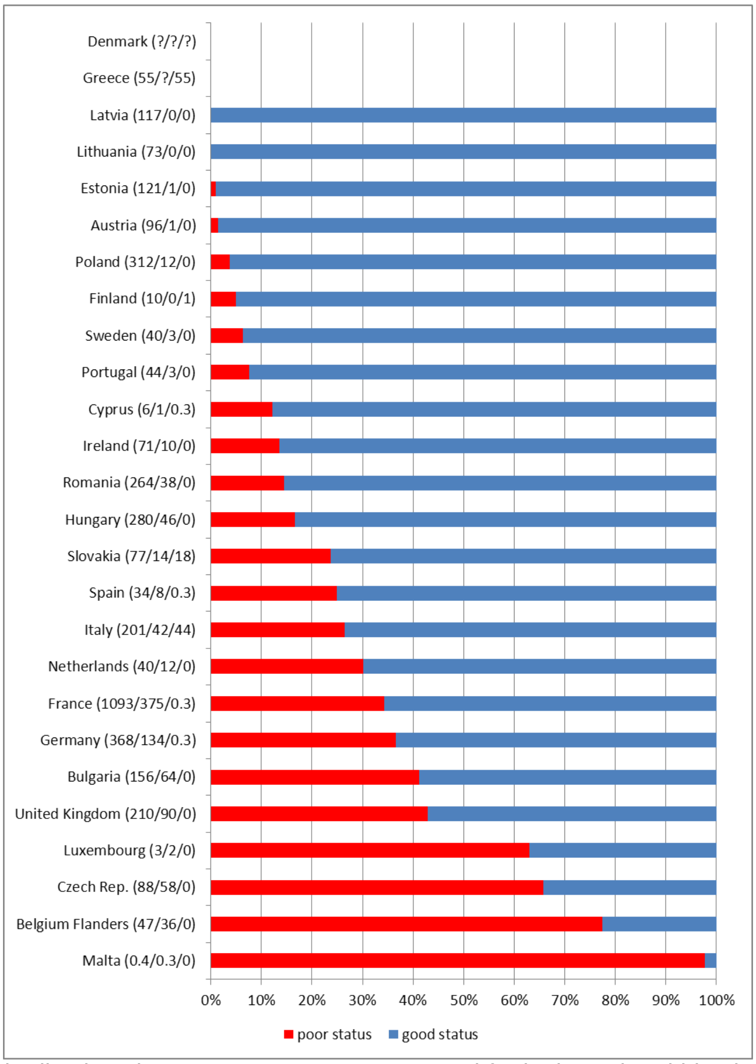
6.4. National and River Basin District Chemical Status

6.4.1. Groundwater

Only Latvia and Lithuania report 100% of groundwater bodies to be in good chemical status whilst 16 Member States have more than 10% in poor status, by area. In Luxembourg, the Czech Republic, Belgium-Flanders and Malta, more than 50% of groundwater bodies are in poor status, by area. (Fig. 6.2, Map 6.1). Few groundwater bodies across Europe remain in unknown status, although around 20% in Slovakia and Italy and 100% in Greece are classified in this category.

Nitrates, chlorides, ammonium, pesticides, arsenic and sulphates are widespread groundwater pollutants and each contributes to poor chemical status in more than 12 countries (Table 6.2). Excessive nitrate concentration is either the sole factor or a contributing one in all but one (Estonia) of those Member States that report some (>0%) poor status in groundwater, and is the major cause of failure to reach good status in 12 countries – Austria, Bulgaria, Czech Republic, Germany, Denmark, Spain, Italy, Malta, Luxembourg, Portugal, Romania and the UK. Whilst excessive nitrate concentration accounts for between 10% and 30% of poor groundwater status across much of Europe (by area), this figure rises to more than 30% (and in some cases greater than 50%) in certain locations, including the Belgian Maas RBD, the Catalan, Tagus and some southern coastal river basins in Spain, the Loire in France, central and eastern England, the Ems, Maas and Weser RBDs in Germany, all 3 RBDs in the Czech Republic and across Bulgaria. Groundwater nitrate is primarily attributable to agricultural sources (see textbox). The wide extent of high groundwater nitrate in Europe that is apparent from WFD reporting is also broadly reflected by data reported to the EEA under WISE-SoE, which shows that a number of countries have a proportion of groundwater bodies with nitrate concentrations in excess of 50mg/l (EEA, 2010b). A similar conclusion and spatial pattern of nitrate levels is also drawn from reporting under the Nitrate Directive (EC, 2010a).

Figure 6.2 Percentage of groundwater bodies in poor and good status, by area



Notes: Groundwater bodies in unknown status are not accounted for in the red and blue bars that represent the percentage poor and good status respectively. The reported total area covered by ground water bodies / the area in poor status/ the area in unknown status (in 1000 km^2) per Member State is shown in parenthesis. Denmark and Slovenia did not report the area of groundwater bodies, whilst 164 of 385 (43%) Danish groundwater bodies were reported in poor chemical status and 4 of 21 (19%) Slovenian groundwater bodies were reported in poor chemical status.

Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/GWB_STATUS.

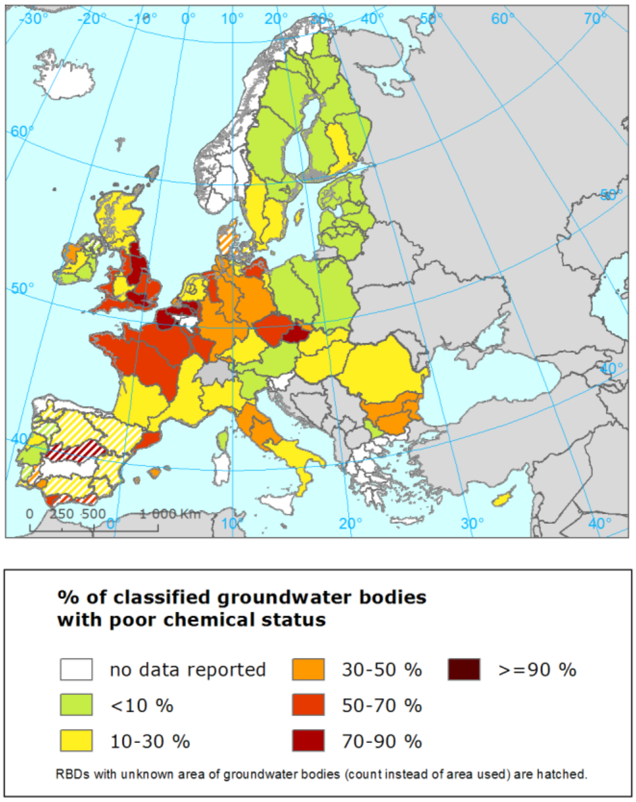
In France pesticides is the most significant causal factor of poor chemical status in groundwater, contributing to failure to achieve good chemical status in at least 30% of the classified groundwater bodies (by area) in all RBDs, with this figure rising to more than 50% in the Seine RBD. Pesticides are also problematic in the Ems RBD in Northern Germany and the Mino-Sil RBD in northern Spain. Pesticides contribute to failure to achieve good chemical status in between 5 and 15% of the classified groundwater bodies (by area) across much of central and eastern Europe, together with Italy, England, southern Sweden, southern Finland and coastal groundwater in southern Spain. WFD reporting indicates that despite now being banned, the triazine pesticides, atrazine and simazine, are the most commonly identified individual pesticides in groundwater across all Member States. Triazine pesticides are of particular concern with regard to freshwaters due to a number of their properties including a relatively high water solubility, persistence and low soil adsorption. Notably, reporting under WISE-SoE suggests that the presence of atrazine and simazine (and their transformation products) in groundwater is more widespread across Europe than is indicated through WFD reporting (see a comparison of Map 6.1 and Map 6.3) In Belgium-Flanders, Czech Republic, Cyprus, Finland, Ireland, the Netherlands, Poland and Slovakia, the Annex II pollutants are the most frequent cause of poor status in groundwater. Across all Member States, the Annex II pollutants most commonly identified are chlorides, ammonium, sulphates, tetrachloroethylene, trichloroethylene, arsenic and lead. Groundwaters in France, Spain, Czech Republic and the UK are each polluted by more than 12 different substances.

Table 6.2 Number of ground water bodies in poor chemical status due to the given pollutant in Member States

Pollutants	AT	BE	BG	CY	CZ	DE	DK	EL	ES	FI	FR	HU	IE	IT	LU	MT	NL	PL	PT	RO	SE	SK	UK
Nitrates (23/1063)	3	18	37	4	94	259	98	2	154	2	120	38	2	103	2	13	2	7	14	17	2	7	65
Pesticides (13/332)		19			2	42	19		10	23	140	6		14	2		3				42		10
Alachlor (1/1)											1												
Atrazine (4/61)					12						38											4	7
Endosulfan (1/1)									1														
Isoproturon (2/14)											13												1
Hexachlorocyclohexane (2/3)									1		2												
Simazine (5/16)					2				1		9											2	2
Trifluralin (1/2)														2									
Annex II pollutants (4/147)						104				17							3						23
Arsenic (13/73)		4			12		3		4	4	2		2	23			3		1		11	3	1
Conductivity (11/68)		7	3	2					25		1	2		19		5		1	2		1		
Cadmium (7/50)					29					2				1					1		8	1	8
Lead (9/72)					34				1	6	1		4	15					1		9		1
Mercury (5/30)					16						1		2	7							4		
Ammonium (14/142)		12	7	1	27				14	7	2	1	3	38				6	3	14		7	
Chloride (16/212)		4	1	5	48		13	2	46	28	5			23			2	1	5		9	7	13
Sulphate (13/115)		7	3	3	50				15	2	1	3		11				3	1			8	8
Trichloroethylene (9/70)					3		31		3		5	2	2	19								1	4
Tetrachloroethylene (8/106)				1	53				5		7	1		33								1	5

Note: Number of Member States / number of groundwater bodies is shown in parenthesis.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/GWB_STATUS.

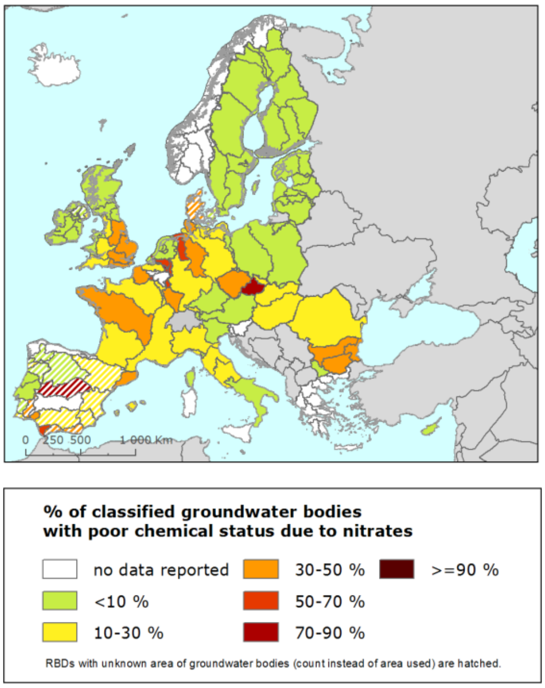
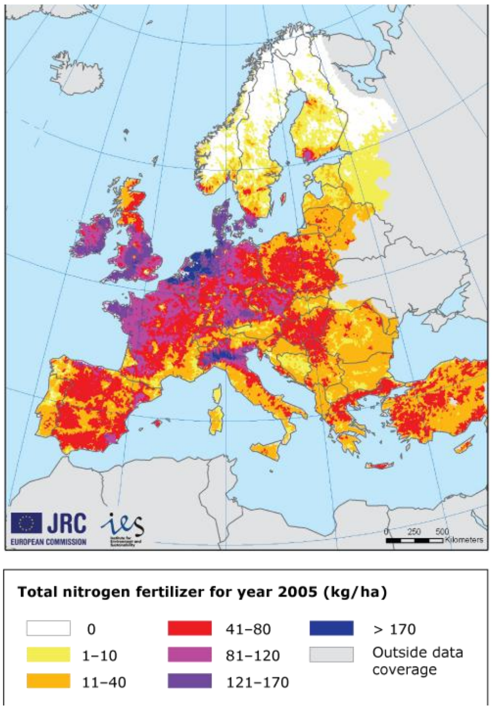
Map 6.1 Chemical status of groundwater bodies per RBD – percentage of groundwater body area not achieving good chemical status



Note: Groundwater bodies in unknown status are not included in the calculation of the percentage of poor chemical status.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/GWB_STATUS.

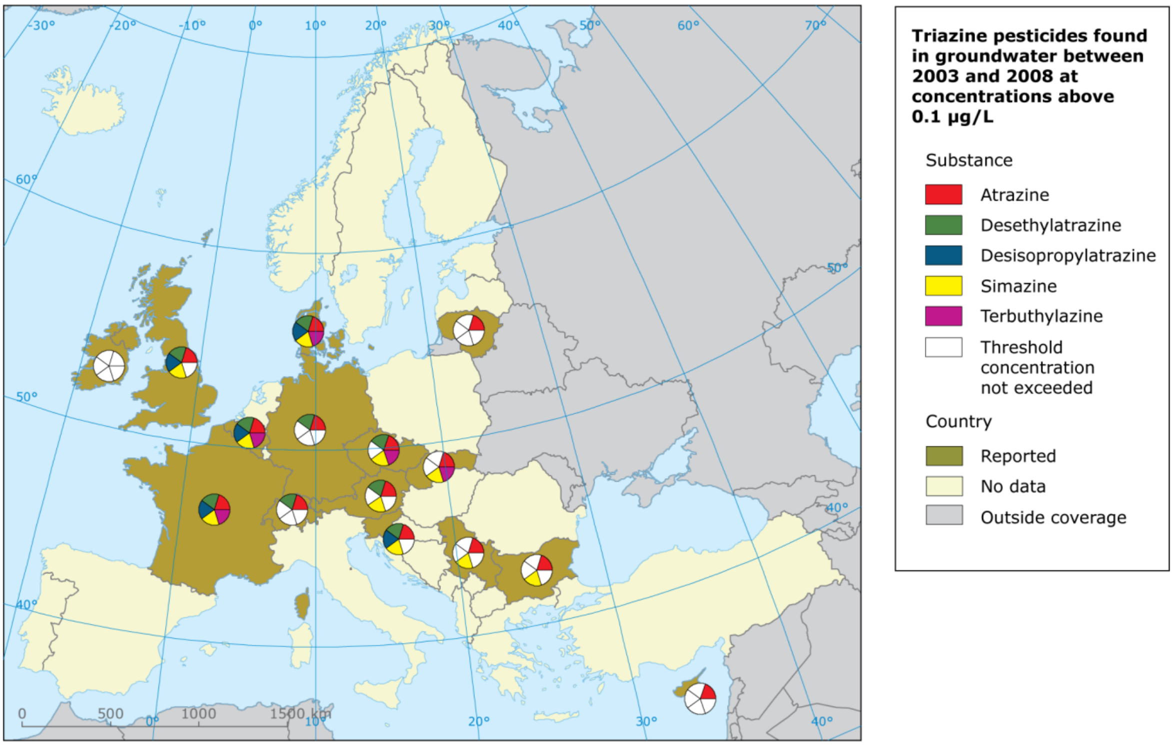
Text Box 6.2 Nitrate in Groundwater

Pollution from nitrate is a major cause of poor groundwater chemical status across Europe, with agricultural sources typically of the greatest significance. While nitrogen fixation, atmospheric deposition and the application of treated sewage sludge can all be important, the major nitrogen inputs to agricultural land are generally from inorganic mineral fertilisers and organic manure from livestock. Today, the highest total fertiliser nitrogen application rates — mineral and organic combined — generally, although not exclusively, occur in Western Europe. Ireland, England and Wales, the Netherlands, Belgium, Denmark, Luxembourg, north-western and southern Germany, the Brittany region of France and the Po valley in Italy all have high nitrogen inputs (Grizzetti et al., 2007; Bouraoui et al., 2011). Application rates are generally in excess of what is required by crops and grassland, resulting in a nitrogen surplus (Grizzetti et al., 2007). The magnitude of the surplus reflects the potential for detrimental impacts on the environment since it is available for gaseous loss to the atmosphere as ammonia, transport to the nearest surface water body or, leaching to groundwater as nitrate. It is the process of leaching of nitrate that gives rise to the poor groundwater chemical status illustrated above. Improvement in groundwater nitrate water quality will take considerable time because of transport processes in soils and groundwater and the renewal rate of groundwater which can be substantial. As a result, reported timescales for restoration of water quality reflect this time lag, ranging from 4–8 years in Germany and Hungary to several decades for deep groundwater in the Netherlands (EC, 2010b). This time lag is a key reason why some groundwater bodies may not achieve good status by 2015 or later even if all necessary measures are implemented soon by Member States.

Percentage of groundwater body area not achieving good chemical status due to nitrates	Total nitrogen input from organic and inorganic fertilizers
	
Note: Groundwater bodies in unknown status are not included in the calculation of the percentage of poor chemical status due to nitrate. **Source:** WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/GWB_STATUS.	**Source:** Bouraoui et al., 2011.

The concentrations of triazine pesticides in groundwater reported under the WISE-SoE data flow are exceeding the threshold limits for several substances in France, Belgium, Denmark, UK and the Czech Republic, Slovakia, Austria, Slovenia, while two of these substances are exceeding threshold limits in Germany, Switzerland, Bulgaria and Serbia. Atrazine is the only triazine pesticide exceeding limit values in Lithuania and in Cyprus. Ireland reports no exceedance of any of the triazine pesticide substances. This pattern corresponds roughly to the countries exceeding nitrate limit values in groundwater shown above.

Map 6.2 Triazine pesticides in groundwater between 2003 and 2008 as reported under WISE-SoE



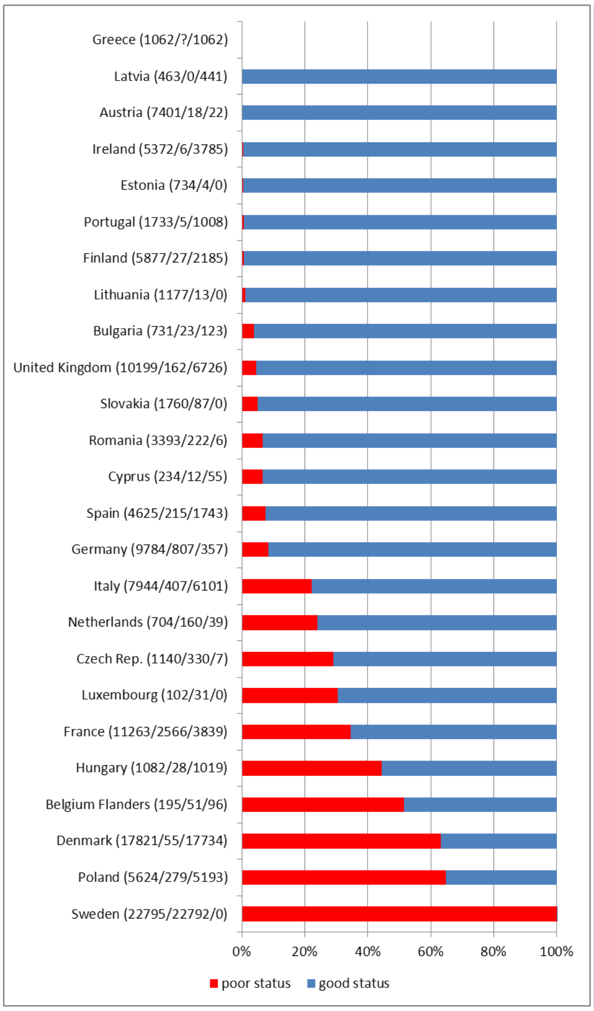
Source: EEA, 2011b.

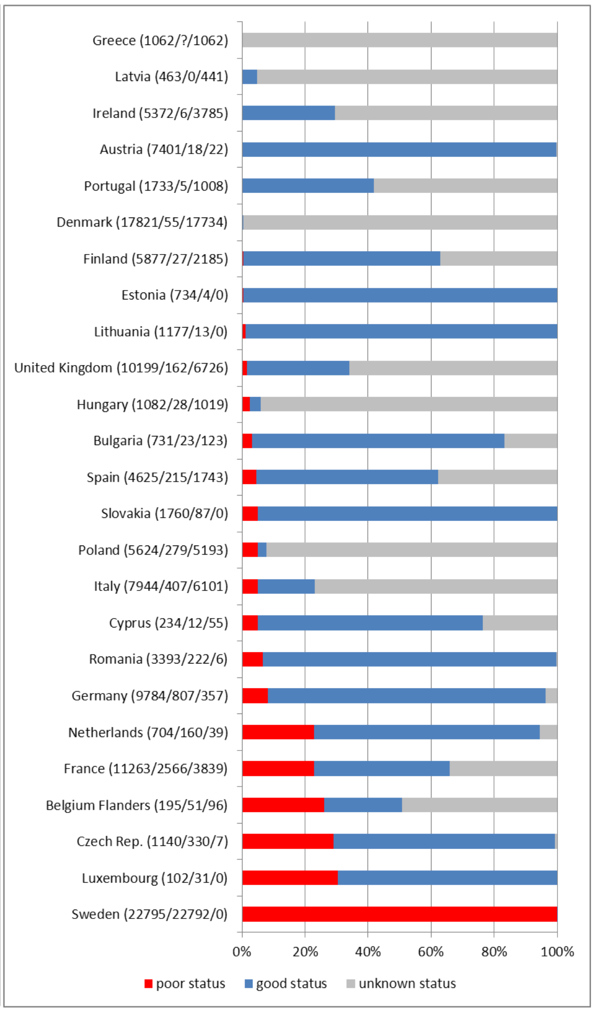
6.4.2. Rivers and lakes

Belgium-Flanders, Sweden, Hungary, Denmark and Poland report poor chemical status in more than 40% of their river and lake water bodies with known chemical status, although for the latter three Member States, most of the water bodies are in unknown chemical status. Sweden reports 100% of their river and lakes water bodies to be in poor chemical status (due to mercury, see below). Ten Member States report poor chemical status in more than 20% of river and lake water bodies (Fig. 6.3a). Austria and Latvia reports close to 100% good chemical status across all rivers and lakes, however for Latvia, this figure excludes those in unknown status that represent the vast majority. Further 13 Member States report good chemical status for their river and lake water bodies (excluding those of unknown status) to be greater than 90% (Fig. 6.3, Map 6.3).

In ten Member States, unknown chemical status is reported from more than half of their river and lake water bodies, and in Portugal, Ireland, Italy and the UK the unknown proportion range from 60-80%. Denmark, Hungary, Latvia, Poland and Greece report more than 90% of their river and lake water bodies to be in unknown chemical status.

Figure 6.3 Percentage of river and lake water bodies in poor and good status, by count of water bodies, a) excluding those in unknown status (left) and b) including those in unknown status (right)





Notes: Rivers and lakes in unknown chemical status are not accounted for in the red and blue bars that represent % poor and good status respectively, of the left hand figure. Number of water bodies per Member States/number of water bodies in poor status/number of water bodies in unknown status are shown in parenthesis.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

Table 6.3 Number of river water bodies in poor chemical status due to given pollutant in Member States

Pollutants	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	HU	IE	IT	LT	LU	NL	PT	RO	SE	SK	UK
Heavy metals - aggregated (7/340)			9			229	51		9				4			6	32					
Cadmium (15/353)	6	2		5	126				17	24	4	15	1	13		1			73	45	3	18
Lead (13/234)	11		14	5	80				39		2			6	2			1	56	11	2	5
Mercury (13/15890)		8	1	3	155				26		23	3	1	62					16	15563	26	3
Nickel (11/216)			1	4	90				32	23	1			19				1	29	3		13
Pesticides - aggregated (6/569)			1			176			1		348					20	23					
Alachlor (7/25)		3		3	2				4		7			5					1			
Simazine (1/4)									4													
Trifluralin (6/11)				3					1		2	1							1		3	
Atrazine (5/14)					2				2		1			1					8			
Chlorpyrifos (5/39)		4			3				23		8			1								
Chlorfenvinphos (3/8)		3							4		1											
Diuron (7/116)		18							17		64	2		1		4						10
Endosulfan (4/32)		3							20		7	2										
Isoproturon (7/74)		3			2		2				59	1				3						4
Hexachlorocyclohexane (6/59)		4							26		22	3							1			3
Pentachlorobenzene (4/6)					1						3								1	1		
Industrial Pollutants - aggregated (7/66)			1			35	1	4	3		9					13						
Anthracene (4/18)		1			8						2								7			
Nonylphenol (7/71)		15			2				23		11									13	1	6
Octylphenol (5/29)		1			14				10			2								2		
Tetrachlorethylene (2/2)									1			1										
Trichloroethylene (1/2)																						2
Trichloromethane (4/10)									3						2				3			2
Benzene (1/1)					1																	
Brominated diphenylether (4/13)											7			4						1	1	
1,2-dichlorethane (2/14)					9									5								
Dichloromethane (4/9)					2				3		2			2								
Di(2-ethylhexyl)phthalate (DEHP) (8/250)					2						193	1			11	3				1	33	6
Naphthalene (3/3)					1															1		1
Other pollutants - aggregated (5/1394)			1			273			2		1093						25					
Aldrin (3/7)									1										5			1
Pentachlorophenol (5/13)		2									6			1					3	1		
PAHs - unspecified (4/22)											5	5				10				2		
Benzo(a)pyrene (5/53)		3			4				1		42								3			
Benzo(b)fluoranthene (7/69)		14			6				1		29			3					14			2
Benzo(k)fluoranthene (7/83)		14			6				1		34			1					16			11
Benzo(g,h,i)perylene (9/1282)		34			134				1		1012			6		2			14		2	77
Indeno(1,2,3-cd)pyrene (9/1244)		34			135				3		970			7		5			11		2	77
Tributyltin compounds (10/170)	3	12			3		1				82			2	4			2		4		57
Trichlorobenzenes (all isomers) (1/1)					1																	
Dieldrin (3/4)											1								2			1
Endrin (3/5)															2				2			1
Isodrin (2/3)																			2			1
DDT Total (1/2)											2											
p,p-DDT (3/29)									5		2								22			
Fluoranthene (9/31)		8			2				1		9			2					1	4	2	2
Hexachlorobenzene (5/8)					3				2		1								1	1		
Hexachlorobutadiene (4/5)	2				1						1									1		
Unknown (1/34)																					34	

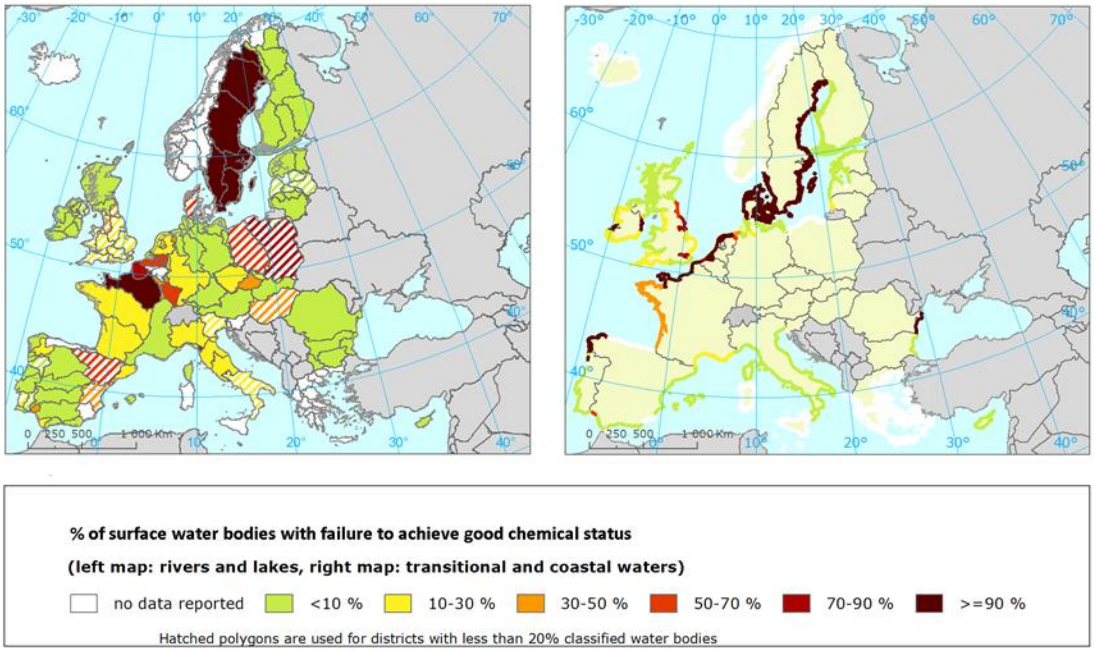
Note: Number of Member States / number of water bodies is shown in parenthesis.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

Excluding data for Sweden to avoid a distortion of results indicates that the 'other pollutants' group is the most frequent overall cause of poor status in rivers (18 Member States identified this group as problematic), but particularly in Belgium-Flanders, Germany, France and the UK. A substantial number of rivers also fail to reach good status due to this pollutant group in the Czech Republic, Netherlands and Romania. Within the 'other pollutant' grouping, PAHs (especially benzo(g,h,i)perylene and indeno(1,2,3-cd)pyrene) are identified as being problematic by eleven Member States including most of the RBDs in France, all of the UK RBDs except for Scotland, the Belgian Schelde and the Czech and German parts of the Elbe. Moreover, assessment of the WISE-

SoE data suggests that the issue of PAHs in rivers is even more widespread across Europe than that indicated by WFD reporting. PAHs result from incomplete combustion processes such as those related to the production of electricity, the transport sector, various industrial sectors and waste incineration. They are released to the atmosphere and are known to be subject to long-range transboundary atmospheric transport. As a result, subsequent deposition and adverse impacts upon aquatic environments may occur a great distance from the original point of emission, including remote mountainous regions. Addressing the impacts of such pollutants requires political initiative at the regional and global scale.

Tributyltin (TBT), used primarily as an anti-fouling biocide for boats and ships, is one of those ‘other pollutants‘ identified as problematic by ten Member States. Despite now being banned in Europe, high levels in rivers are found locally, reflecting the historical use and persistence of this substance. TBT is a particular issue in the Belgium-Schelde, the Rhone in France and the Humber and Thames RBDs in the UK.

Map 6.3 Chemical status of rivers and lakes and transitional and coastal waters per RBD – percentage of water bodies not achieving good chemical status are shown



Notes: Surface water bodies in unknown status are not included in calculation of the percentage of poor chemical status. River Basin Districts with a high proportion of water bodies with unknown chemical status are hatched.

Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

Heavy metals are identified as problematic by 21 Member States, and are the dominant cause of poor status in rivers across twelve Member States, but markedly so in Sweden, Denmark, Bulgaria, the Czech Republic, Spain, Finland, Northern and Central Italy and Romania. In the Czech Republic, for example, nickel, cadmium, lead and mercury are problematic in all three RBDs – the Danube, Elbe and Oder, whilst nickel contributes to poor status in four UK RBDs – the Humber, South West, Severn and Western Wales. Heavy metals are also a significant cause of poor status in the German Rhine. Fifteen Member States highlight cadmium as a cause of poor status. Due to its threat to both environmental and human health cadmium is classified as a priority hazardous substance. Cadmium is primarily produced as a by-product from the extraction, smelting and refining of zinc and other non-ferrous metals, although it is also found in phosphate rock used to manufacture fertilizer.

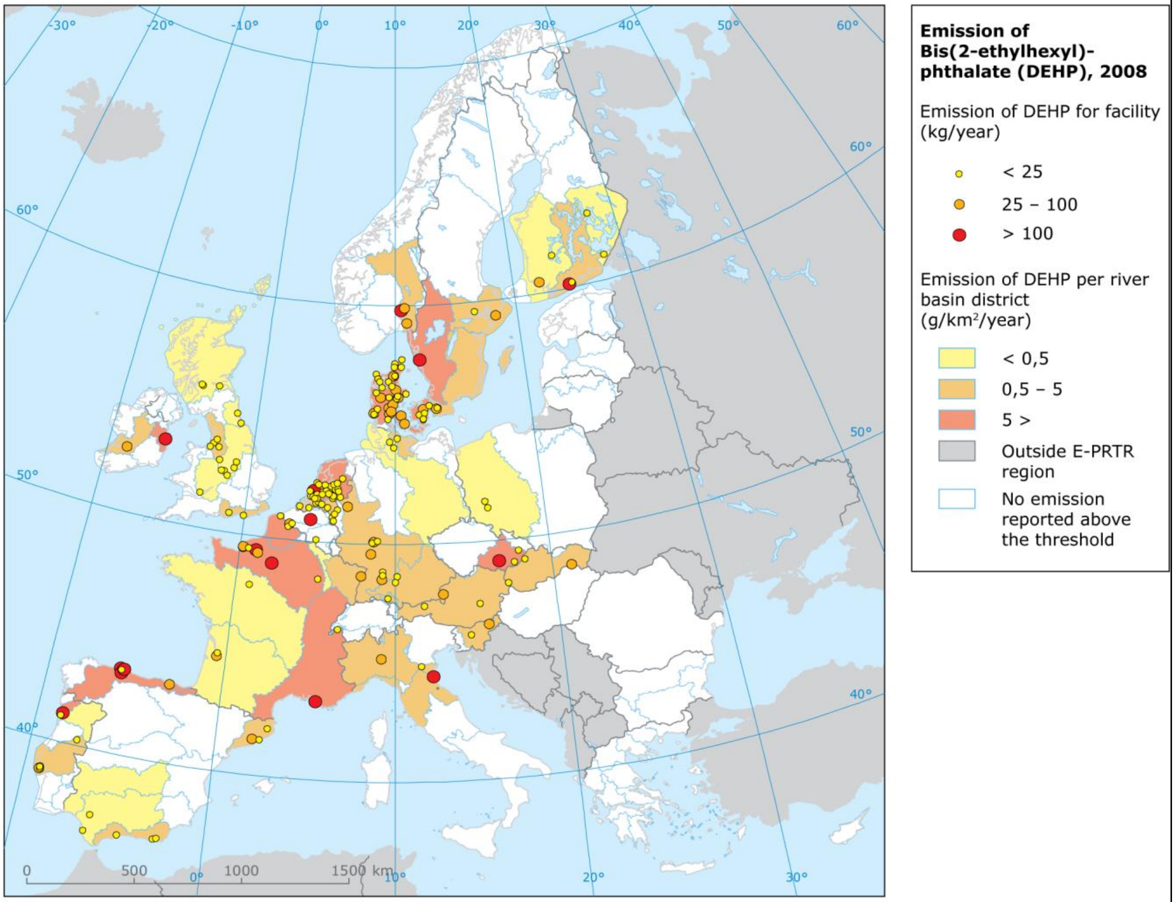
Emissions of cadmium to water occur, therefore, via both diffuse and point source pathways. Mercury is also a priority hazardous substance and is identified as problematic in 13 Member States. The exceedance of regulatory levels of mercury in aquatic biota is the cause of 100% poor status in Swedish rivers and lakes. Mercury is also a major issue in the Slovak Republic part of the Danube River, the Czech Republic and Northern and Central Italy.

Industrial Pollutants are the predominant reason for poor chemical status in rivers within Estonia, Lithuania and the Slovak Republic but are a significant factor in a number of others including Belgium-Flanders, the Czech Republic, Germany, Spain, France, Italy, Luxembourg, Romania, Sweden and the UK. Within this group, DEHP, widely used as a plasticiser (see textbox 6.3) is identified by eight Member States as being problematic. DEHP is a particular issue in the Danube RBD in the Slovak Republic and the Meuse, Rhine and Loire RBDs in France. Octylphenol, used as an intermediate in the production of chemicals used in rubber, pesticides and paints, causes poor chemical status in Belgium-Flanders, the Czech Republic, Hungary, Spain and Sweden. Nonylphenol, an industrial surfactant and a known endocrine disruptor, contributes to poor status in 12 RBD‘s in seven Member States across Europe and is a particular problem in rivers of the Belgium Scheldt and the Catalan RBD in Spain.

Pesticides are the predominant cause of poor chemical status in rivers in Luxembourg, whilst a substantial number of water bodies also fail to reach good status due to pesticides in France, Belgium-Flanders, the Czech Republic, Germany, Spain, Hungary, Italy, the Netherlands, Romania and the UK. Overall, pesticides contribute to poor status in 16 Member States. Diuron is identified as a cause of poor status in seven Member States including the North West and Thames RBDs in the UK, the Belgium Scheldt, Guadalquivir in Spain and the Seine in France. Whilst diuron has been banned as an active substance in plant protection products across most of Europe, it is still widely used as a biocide agent in construction materials and cooling systems. Other problematic pesticides identified include the herbicides alachlor and isoproturon, which together contribute to poor status in eleven Member States, whilst the banned organochlorine insecticides – endosulfan and hexachlorocyclohexane cause poor status in four and six Member States respectively, with the former being a particular issue in the Ebro RBD (Spain). The triazine herbicide atrazine, also banned EU wide, contributes to poor status in 5 Member States.

Those RBD‘s illustrating particularly poor riverine chemical status are generally subject to pollution by a range of different chemicals. This is the case, for example, in the German Rhine where ‘other pollutants‘, pesticides and heavy metals each cause poor status in more than 100 water bodies and industrial chemicals contribute to poor status in 14 water bodies. Similarly, 14 different chemicals contribute to poor status in the Jucar RBD in Spain. Poor chemical status is relatively high across the Polish Oder RBD although the causes are not reported.

Text Box 6.3 Emissions of DEHP to water



Source: EEA, 2011b.

Di(2-ethylhexyl)phthalate (DEHP) is an organic compound classified as a Priority Substance under the WFD and as a substance of very high concern under REACH. It is used as a plasticiser in polymer products (mainly in flexible PVC) including pipes and tubes, flooring and wall lining, sealants, food packaging, cables and wire sheathing, under-seal for cars, guttering, tarpaulins, clothing and footwear, toys, office supplies and medical products such as blood bags and catheters. The content of DEHP in polymer products varies but typically approximates 30%, although it migrates slowly from such products over their lifetime. A proportion of the DEHP released to the aquatic environment stems from discharge of effluent from municipal sewage treatment plants, deriving originally from the wide use of PVC in residential, commercial, medical and industrial premises and their direct connection to a sewer system. DEHP is also released into urban run-off. In this case, it originates from building materials and vehicles and is subsequently discharged to a water body directly or indirectly, via a municipal treatment plant. Storm water overflows are also a significant emission pathway (OSPAR, 2009). Data reported to the European Pollutant Release and Transfer Registry (E-PRTR) and mapped above, show that 17.9 tonnes of DEHP were emitted to water from 180 facilities in 2008, 97% of which was emitted via 143 urban wastewater treatment plants. However, given its widespread use and the high likelihood of DEHP discharges from all large municipal wastewater treatment plants, the map above suggests that reporting under E-PRTR is incomplete. Estimates from other sources indicate that diffuse emissions — not reported under E-PRTR — are also a significant source of DEHP (OSPAR, 2009).

Data reported for lakes is relatively limited across Europe with the exception of Sweden. Eight Member States report 100% good chemical status in lakes whilst in a further seven Member States poor status applies to less than 10%. Poor chemical status of 10% or greater is only observed in lakes in Cyprus, the Czech Republic, the Netherlands, Romania and Sweden.

Table 6.4 Number of lake water bodies in poor chemical status due to given pollutants in Member States

Pollutants	CY	CZ	DE	FI	FR	IT	NL	PT	RO	SE	UK
Heavy metals - aggregated (3/59)			1		6		52				
Cadmium (4/121)		3		1					75	42	
Lead (4/78)	2	1							63	12	
Mercury (5/7256)	1	3				9			11	7232	
Nickel (4/60)	1	1		1					57		
Pesticides - aggregated (2/12)					7		5				
Trifluralin (1/1)	1										
Isoproturon (1/1)											1
Hexachlorocyclohexane (1/1)					1						
Industrial Pollutants - aggregated (2/8)					4		4				
Nonylphenol (2/5)					3					2	
Brominated diphenylether (1/1)										1	
Di(2-ethylhexyl)phthalate (DEHP) (1/4)					4						
Other pollutants - aggregated (2/45)			1				44				
Pentachlorophenol (1/2)										2	
Polyaromatic hydrocarbons - unspecified (1/3)										3	
Benzo(a)pyrene (1/1)		1									
Benzo(b)fluoranthene (1/1)									1		
Benzo(g,h,i)perylene (1/8)		8									
Indeno(1,2,3-cd)pyrene (1/8)		8									
Tributyltin compounds (4/11)				1	3			1		6	
Fluoranthene (1/7)										7	

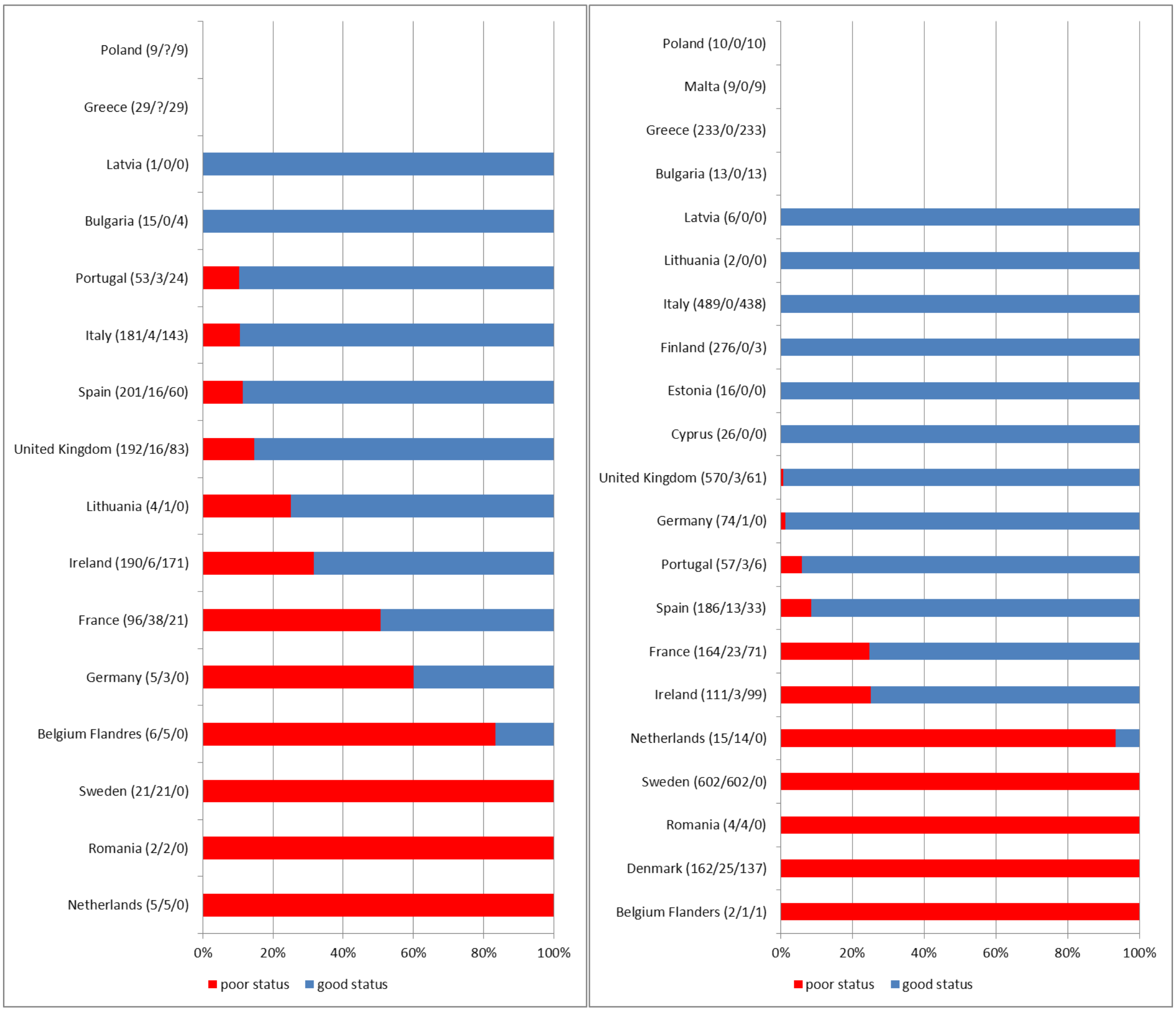
Note: Number of Member States / number of water bodies is shown in parenthesis.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

Heavy metals are identified as the dominant cause of poor status in lakes in Cyprus, Finland, Italy, Netherlands, Romania and Sweden, whilst pesticides are the dominant cause in France only. Industrial pollutants are not a dominant cause within any Member States but are identified as causing poor status in France, the Netherlands and Sweden. ‘Other pollutants‘ are a dominant cause only in the Czech Republic but are identified as being problematic in six other Member States, particularly the Netherlands. TBT contributes to poor status in the lakes of Finland, France, Portugal and Sweden. A recent survey of PAH levels in mountain lakes in Europe showed total concentrations in all lakes monitored to be above the no-effects threshold (Quiroz et al., 2010). This finding highlights the challenge of addressing substances that are largely ubiquitous, subject to transport over large distances in the atmosphere and detectable in remote regions away from human activity.

6.4.3. Transitional and Coastal Waters

Excluding those in unknown status, Latvia and Bulgaria report their transitional water bodies to be in 100% good chemical status, whilst in Portugal, Italy, Spain and the UK poor status is below 20%. Six Member States – France, Germany, Belgium-Flanders, Sweden, Romania and the Netherlands - report poor chemical status to be 50% or more (Map 6.3, Fig. 6.4).

Figure 6.4 Percentage of transitional (left panel) and coastal (right panel) water bodies in poor and good chemical status, by count of water bodies



Notes: Transitional and coastal waters in unknown chemical status are not accounted for in the red and blue bars that represent % poor and good status respectively. Number of water bodies per Member States/number of water bodies in poor status/number of water bodies in unknown status are shown in parenthesis.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

Table 6.5 Number of transitional water bodies in poor chemical status due to given pollutants in Member States

Pollutants	BE	DE	ES	FR	IE	IT	LT	NL	PT	RO	SE	UK
Heavy metals - aggregated (2/7)				6				1				
Cadmium (3/13)			9	2						2		
Lead (4/9)			2		2	4				1		
Mercury (6/36)	1		9	2	2						21	1
Nickel (4/25)			3	13		7				2		
Pesticides - aggregated (1/7)				7								
Chlorfenvinphos (1/1)	1											
Diuron (1/1)												1
Endosulfan (2/4)				3	1							
Isoproturon (2/2)	1			1								
Hexachlorocyclohexane (2/4)			2									2
Pentachlorobenzene (2/2)			1		1							
Industrial Pollutants - aggregated (1/2)				2								
Anthracene (2/2)					1					1		
Nonylphenol (2/5)	2								3			
Octylphenol (1/6)				6								
Brominated diphenylether (1/4)					4							
Di(2-ethylhexyl)phthalate (DEHP) (2/5)				4			1					
Naphthalene (1/1)										1		
Other pollutants - aggregated (4/13)		3	3	2				5				
Aldrin (1/2)										2		
Pentachlorophenol (1/2)	2											
Polyaromatic hydrocarbons - unspecified (1/4)				4								
Benzo(a)pyrene (2/2)	1									1		
Benzo(b)fluoranthene (2/3)	2									1		
Benzo(k)fluoranthene (2/3)	2									1		
Benzo(g,h,i)perylene (5/16)	4			7	2					1		2
Indeno(1,2,3-cd)pyrene (4/16)	4			8	2							2
Tributyltin compounds (6/30)	2			9	1		1				4	13
Dieldrin (1/2)										2		
Endrin (1/2)										2		
p,p-DDT (1/2)										2		
Fluoranthene (3/3)	1		1							1		
Hexachlorobenzene (1/1)										1		
Hexachlorobutadiene (1/1)						1						

Note: Number of Member States / number of water bodies is shown in parenthesis.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

'Other pollutants' are the most frequent cause of poor status in transitional waters overall, but particularly in Belgium-Flanders, Germany, France, the Netherlands and the UK. TBT is one of those 'other pollutants' identified as problematic and is the main cause of poor status in transitional waters in the Thames, Anglian, Humber, Northumbria, Southwest and Northwest RBDs of the UK, and is a contributing factor in others, including the Belgium-Schelde, the Nemunas in Lithuania, the North and South Baltic RBDs of Sweden and the Loire in France. PAHs contribute to poor status in transitional waters in Romania, France and Belgium.

Heavy metals are the most frequently reported cause of poor status in Sweden and Spain but are a particular issue in the Tinto-Odiel-Piedras RBD with mining discharges being the primary cause. Mercury is a cause of poor status in Swedish transitional waters, although the problem is not as widespread as for Swedish freshwaters and is limited in transitional waters to the Skagerrak and Kattegat, and North Baltic Sea RBDs. In France, heavy metals cause poor status in transitional waters of the Rhone, Loire and Seine RBDs. Heavy metals are also problematic in the Northern Apennines RBD in Italy and the Romanian Danube.

Some industrial pollutants are also identified as a cause of poor status in transitional waters. DEHP, for example, is a cause of poor status in the Rhône and Loire RBDs in France and the Nemunas RBD in Lithuania, whilst nonylphenol is identified as problematic in transitional waters of Portugal and Belgium. In Irish transitional waters, brominated diphenylether causes poor chemical status.

Those transitional waters with the poorest chemical quality across Europe are typically subject to pollution from a range of individual pollutants. The Seine in France, for example, reports heavy metals, pesticides and PAHs to be an issue, whilst in the Belgium-Schelde, 12 chemicals including mercury, pesticides, PAHs, TBT and the industrial chemical nonylphenol are all a cause of poor status. Similarly, the Romanian part of the Danube RBD is polluted by the heavy metals - cadmium, lead and nickel - a range of PAHs and some pesticides.

Excluding those in unknown status, six Member States report their coastal waters to be in 100% good chemical status, although 5 – the Netherlands, Sweden, Romania, Denmark and Belgium-Flanders indicate that poor status exceeds 90% (Map 6.2, Map 6.5). At least 10 substances contribute to poor chemical status in the coastal waters of Romania, Spain and France (Table 6.6).

Table 6.6 Number of coastal water bodies in poor chemical status due to given pollutants in Member States

Pollutants	BE	DE	DK	ES	FR	IE	NL	PT	RO	SE	UK
Heavy metals - aggregated (1/4)					4						
Cadmium (3/47)				4					4	39	
Lead (3/35)				4					3	28	
Mercury (5/633)	1		25	3		2				602	
Nickel (2/12)									1	11	
Pesticides - aggregated (1/2)					2						
Endosulfan (2/2)					1	1					
Hexachlorocyclohexane (1/1)	1										
Pentachlorobenzene (2/2)	1					1					
Industrial Pollutants - aggregated (1/5)					5						
Anthracene (2/4)				1					3		
Nonylphenol (1/3)								3			
Octylphenol (1/2)					2						
Brominated diphenylether (3/7)	1					3				3	
Di(2-ethylhexyl)phthalate (DEHP) (1/1)					1						
Naphthalene (1/3)									3		
Other pollutants - aggregated (4/23)		1		2	6		14				
Aldrin (1/4)									4		
Polyaromatic hydrocarbons - unspecified (1/9)										9	
Benzo(a)pyrene (3/7)	1			3					3		
Benzo(b)fluoranthene (3/9)	1			5					3		
Benzo(k)fluoranthene (3/9)	1			5					3		
Benzo(g,h,i)perylene (3/14)				7	4				3		
Indeno(1,2,3-cd)pyrene (2/12)				7	5						
Tributyltin compounds (4/33)	1				9					20	3
Dieldrin (1/4)									4		
Endrin (1/4)									4		
p,p-DDT (1/4)									4		
Fluoranthene (3/7)				1					3	3	
Hexachlorobenzene (2/8)									4	4	

Notes: Number of Member States / number of water bodies is shown in parenthesis.
Source: WISE-WFD database, May 2012. Detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS.

In the coastal waters of the Belgium Noordzee RBD a range of different chemicals contribute to poor status including mercury, pesticides, industrial chemicals and PAHs. In the coastal waters of the Danube RBD in Romania, the heavy metals – cadmium, lead and nickel – all contribute to poor status, as with the transitional waters in this RBD. Pesticides and PAH's are also problematic here.

In Sweden, cadmium, lead and mercury, although predominantly the latter, contribute to poor status in the coastal waters of six RBDs, whilst mercury is the major issue in Danish coastal waters. Heavy metals also cause poor status in the Galician coast and Tinto-Odiel-Piedras RBDs in Spain.

In Dutch coastal waters, 'other pollutants' are the sole cause of poor status. TBT causes poor status in UK and Swedish coastal waters, particularly in the North Baltic Sea RBD of the latter, and the Loire and Rhône in France.

Text Box 6.4 Riverine Loads - Linking Fresh and Coastal Waters

Input of chemical pollutants (via riverine loads and direct discharges) into the North-East Atlantic during the period 1990 to 2008

Source: OSPAR, 2009

Riverine loads and direct discharges of chemical pollutants to coastal waters are not, as a rule, widely reported across Europe, although the OSPAR regions of the North Atlantic are an exception. Here data are available for five chemicals, which include three metals (cadmium, mercury and lead), the insecticide lindane and PCBs, a group of chemicals previously widely used in electrical equipment. Despite some uncertainties in the data and the need for caution in interpretation, downward trends are detected for all five substances as regards their total inputs to the OSPAR region. For example, statistically significant downward trends in combined riverine inputs and direct discharges of mercury to the Greater North Sea and Celtic Sea regions, of about 75% and 85% respectively, are reported for the period 1990–2006. These trends observed in the OSPAR regions are attributable to a decline in emissions to water, both through the implementation of best available abatement techniques at industrial facilities and improvements in municipal wastewater treatment (OSPAR, 2009).

6.5. Conclusions

The chemical status of more than 140 000 surface and groundwater bodies across Europe has been reported under the WFD. Including those water bodies classified with unknown status, poor status for each of the surface water body types – rivers, lakes, transitional and coastal does not exceed 10%, aggregated across Europe as a whole, expressed by the number of water bodies or 'count'. Poor status for groundwaters, by area, is about 25% across Europe. Notably, the chemical status of many of Europe's surface waters remains unknown, ranging between 46% for coastal waters and 55% in transitional waters.

Excessive nitrate concentration is the single most significant cause of poor groundwater chemical status, although pesticides, heavy metals, trichloroethylene and tetrachloroethylene are also of importance. "Other pollutants" - a category that encompasses a mix of individual chemical types including PAHs and tributyltin compounds - are the causal factor for around 50% of those European river water bodies classified as being in poor chemical status. Heavy metals and pesticides also make a significant contribution to poor status in rivers, with the former being the predominant cause of poor status in lakes. A range of chemical types contributes to poor chemical status in transitional and coastal waters, declining in importance in the order; other pollutants, heavy metals and industrial pollutants. Those water bodies across Europe that exhibit particularly poor chemical status are, typically, subject to pollution from a range of different chemicals.

Asides from the critical issue of the wide extent of unknown status, interpretation of WFD chemical status has been partly hindered by the format of reporting, with some Member States reporting chemical groups, other individual chemicals, and some a mixture of the two.

Some hazardous substances tend to accumulate in sediment and biota, with the result that their concentrations in these matrices are likely to be higher and, therefore, more detectable and measurable than in water. If measurements are made in the water column, the risk to the aquatic environment may be underestimated. At least one example exists of different matrices being used across different Member States for the same chemical, resulting in assessments of chemical water quality that are not directly comparable. A harmonisation at EU level is, therefore, needed.

With the exception of nitrates and pesticides, EU-wide groundwater chemical standards have not been adopted and instead Member States are required to establish their own standards to be set as threshold values. To date the threshold values for some pollutants, e.g. arsenic, cadmium and mercury vary markedly between Member States, making a comparison of chemical groundwater status across Europe difficult for these particular substances.

Reporting on chemical status under WFD needs to follow the recently developed QA/QC Directive which lays down technical specifications for chemical analysis and monitoring of water status. The EEA's SoE-WISE reporting stream, however, can also play a key role in supporting chemical assessment, particular given that the annual reporting process enables temporal trends to be identified and also encompasses a wide range of chemicals that extends beyond those classified as priority substances under the WFD. This is particularly important given that for a number of emerging pollutants, the awareness of potential effects has developed only recently and remains incomplete. Maximising the value of reporting of chemical water quality under SoE-WISE will, however, require an improved adherence to the data dictionary, including a temporal consistency with respect to chemical type and associated units, and the reporting of data at an optimal temporal and spatial scale.

For many hazardous substances, information on industrial emissions to water must be reported under the European Pollutant Release and Transfer Register (E-PRTR). To date, however, reporting under E-PRTR is incomplete as to the spatial extent and temporal resolution of data describing emissions to water – markedly so for some substances. Moreover, the E-PRTR thresholds for reporting mean that the emissions from some smaller facilities are missed, despite the potential for such facilities to be a significant pollutant source with respect to WFD classification. It is important not only to overcome these limitations in reporting but also to improve the quantitative understanding of the sources, emissions and pathways of all hazardous substances more generally. Advances in this area will facilitate the identification of appropriate measures to address chemical pollution of aquatic environments. Moreover, the Environmental Quality Standards Directive requires each Member State to establish an inventory of emissions, discharges and losses for each river basin district (RBD) in its territory. These inventories must cover both the diffuse and point source emissions of all priority substances. Industrial emissions will be a fundamental part of the inventories and, as such, reporting under E-PRTR will represent an important component.

7. Ecological status and water quality

7.1. Key messages

- Pollutants in many of Europe's surface waters have led to detrimental effects on aquatic ecosystems and the loss of freshwater flora and fauna.
- Implementation of the Urban Waste Water Treatment Directive, together with comparable non-EU legislation, has led to improvements in wastewater treatment across much of the continent. This has resulted in reduced point discharges of nutrients and organic pollution to freshwater bodies.
- Clear downward trends in water quality determinants related to urban and industrial wastewater are evident in most of Europe's surface waters, although these trends have levelled in recent years, and is more conspicuous in rivers than it the other water categories.
- Despite improvements in some regions, diffuse pollution from agriculture remains a major cause of the poor water quality currently observed in parts of Europe, contributing 50-80% of the total nitrogen load and approximately half of the total phosphorus load on Europe’s freshwaters.
- Ecological status is clearly correlated with nutrients in all surface water categories. Much lower nutrient concentrations are found in water bodies with high and good ecological status than in those with moderate or worse ecological status.
- Projections of trends in river water bodies currently in moderate or worse ecological status indicate that good status may be achieved in 2027 for phosphorus (if current trend continues), but not for nitrate.
- The results show the need for further nutrient reduction measures, in particular addressing diffuse source pollution from agriculture, which can be implemented through the WFD RBMPs and through full compliance with the Nitrates Directive

7.2. Introduction

The quality of water in Europe is influenced by direct and diffuse pollution from urban and rural settlements, industrial emissions, as well as the agricultural sector. Due to the overall progress in the treatment of urban waste water, diffuse pollution from agriculture is now the single most important source of pollution, in particular nutrient pollution. Yet, despite the importance given to reducing pollution in recent environmental legislation, concentrations of pollutants in many European waters have remained high – illustrated by the results in the previous chapters that a large proportion of European water bodies are affected by pressures from diffuse and point source pollutants.

The status assessment in the previous chapters revealed that many European surface water bodies currently fail the Water Framework Directive’s objective of good status. To protect surface waters and groundwater from pollution and restore the ecological and chemical status, a comprehensive legislation has been established in Europe. The WFD has a clear target on reducing pollutants via the basic measures on compliance with the requirements of the Urban Waste Water Treatment Directive (UWWTD) and Nitrates Directive (NiD). Full implementation of these Directives will improve water quality and facilitate, although not necessarily guarantee, the achievement of good ecological status or potential under the WFD.

In Europe water quality has traditionally been measured and assessed using either basic physico-chemical (e.g. BOD, nutrients and oxygen level) or biological parameters or a combination of both – typically assessing organic pollution and eutrophication from point and diffuse sources. It is important to distinguish between water quality and ecological status or potential as the latter in addition to impact of pollution and water quality also include aspects such as hydromorphology and specific pollutants. Hydromorphological pressures and their impacts in terms of altered habitats also affect the ecological status of a large proportion of water bodies in Europe. A separate EEA thematic assessment provides more information on these pressure and their impacts on ecological status or potential (EEA ETC/ICM, 2012).

The European Commission, DG Environment, is currently examining the measures included in the RBMPs and evaluating if the PoMs set for the different RBMPs are sufficient for achieving the objectives of the WFD. More details can be found in the DG Staff document (EC, 2012b).

In the current chapter the focus is on describing the links between ecological status and water quality related to the effect of policies on reducing emissions to water. The main focus is on illustrating the effect of Directive 91/271/EEC concerning urban wastewater treatment and Directive 91/676/EEC relating to nitrate pollution. These two Directives are important for achieving good water quality and improve the ecological status.

7.3. Pollution from point and diffuse sources

The sources of water pollution are extremely diverse and can vary considerably with geographical location. However, while landfills, forestry, mining, aquaculture and dwellings un-connected to a municipal sewage treatment works, for example, can all be of great importance locally, two major sources contribute most to the pollution observed across Europe: urban wastewater and diffuse pollution from agriculture.

7.3.1. Point source pollution and trends in urban wastewater treatment

Point source pollution comes from urban waste water, industrial effluents and losses from farming, including fish farms. Point source pollution takes many forms. Faecal contamination from sewage makes water aesthetically unpleasant and unsafe for recreational activities, such as swimming or fishing. Many organic pollutants, including sewage effluents, as well as farm and food-processing wastes consume oxygen, suffocating fish and other aquatic life. Point source pollution also contributes to nutrient enrichment by emissions of bioavailable nutrients, e.g. phosphate and ammonium.

During the last century increased population growth and increased wastewater production, coupled with a greater percentage of the population being connected to sewerage systems, initially resulted in most European countries in increases in the discharge of pollutants into surface water. Over the past 20 to 35 years, however, the biological treatment (secondary treatment) of waste water has increased, and organic discharges have consequently decreased throughout Europe. During the last 20 years tertiary (advanced/more stringent) treatment with nutrient removal (phosphorus and nitrogen) has been introduced at many waste water treatment plants resulting in markedly lower nutrient discharge to receiving waters.

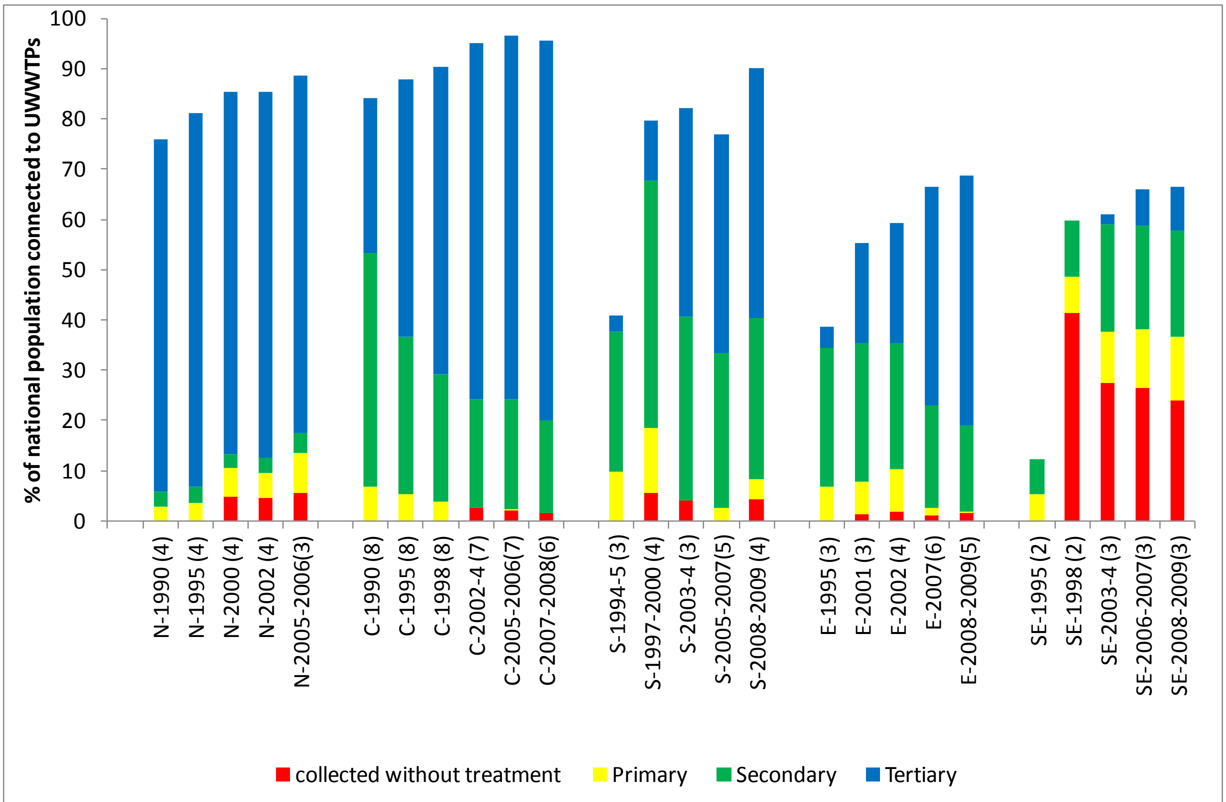
The Urban Waste Water Treatment Directive has the objective of protecting the environment from the adverse effects of discharges of urban waste water from settlement areas and biodegradable industrial waste water from the agro-food sector, by requiring Member States to ensure that such water is collected and adequately treated. Full implementation of the Directive is also a pre-requisite for meeting the environmental objectives set out in the WFD as well as in the Marine Strategy Framework Directive.

The UWWTD requires the collection and treatment of wastewater from all agglomerations of more than 2 000 people and its on-going implementation has led to an increasing proportion of the EU's population being connected to a municipal treatment works via a sewer network (see Fig. 7.1). Connection rates in northern Europe now exceed 80% of the population while in central Europe the figure is above 95%. Elsewhere in Europe, however, connection rates are lower, although in the case of the newer Member States, this is explained by the later compliance dates agreed in the accession treaties or in regions with a high proportion of the population living in rural areas.

The UWWTD requires secondary biological wastewater treatment and, therefore, the substantial removal of both biodegradable and nutrient pollution. In addition, in catchments with waters designated as sensitive to eutrophication, the legislation demands more stringent tertiary treatment to remove much of the nitrogen and phosphorus load from wastewater. Consequently, in addition to higher collection rates, the UWWTD has also driven improvements in the level of wastewater treatment over recent years.

The majority of waste water plants in northern and central Europe now apply tertiary treatment although elsewhere in the EU, particularly in the south-east, the proportion of primary and secondary treatment is higher (see Fig. 7.1). While considerable progress has been made in implementing the UWWTD, excluding the longer compliance timelines for the newer Member State, full compliance is yet to be achieved, including the lack of more stringent tertiary treatment in some sensitive areas and inadequate treatment levels in wastewater treatment plants in some larger cities (Text Box 7.1; EC, 2011b).

Figure 7.1 Changes in wastewater treatment in regions of Europe between 1990 and 2009



Notes: The numbers of countries are given in parentheses. Regional percentages have been weighted by country population.

N-North: Norway, Sweden, Finland and Iceland, only data up to 2006 available.

C-Central: Austria, Denmark, England & Wales, Scotland, the Netherlands, Germany, Switzerland, Luxembourg and Ireland.

S-Southern: Cyprus, Greece, France, Malta, Spain and Portugal (Greece only up to 1997 and then since 2007).

E-East: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovakia (for Hungary and Latvia only data up to 2007 available).

South Eastern: Bulgaria, Romania and Turkey.

The percentage values have been weighted with country population when calculating the group values. Data on population connected to collecting systems without treatment available only since late 90s.

Source: EEA, 2012b, based on data reported to OECD/EUROSTAT Joint Questionnaire 2010.

Text Box 7.1 Status of implementation of the Urban Waste Water Treatment Directive

In December 2011 the European Commission published the 6th report on the implementation of the UWWT Directive (EC, 2011b). The report covers the implementation of the Directive up to the reference year 2007/2008. Below is listed a summary of the key messages from the implementation report.

For the reference year 2007/2008, Member States reported 22,626 agglomerations (72% in EU-15 and 28% in EU-12) larger than 2,000 person equivalents (p.e.), generating a total pollution load of around 550 million p.e.

A breakdown taking into account the different size ranges shows that:

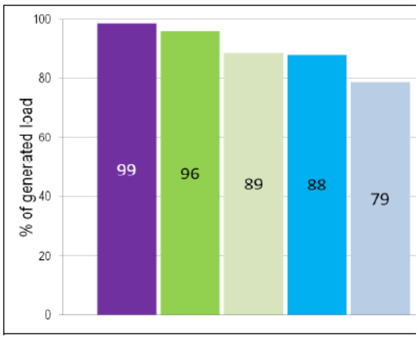
- 2% of agglomerations are larger than 150 000 p.e. (i.e. 586 big cities/big discharges) generate 43% of the pollution load (equivalent to around 248 million p.e.).
- 32% of agglomerations range between 10 000 and 150 000 p.e., generating 45% of the pollution load.
- 66% of agglomerations range between 2 000 and 10 000 p.e., generating 12% of the pollution load.

Waste water collecting systems were in place for 99% of the total pollution load of the EU-15 and for 65% of the total generated load of the EU-12. Most EU-15 Member States had largely implemented this provision except for Italy and Greece which have 93% and 87% of the generated load collected in collecting systems, respectively.

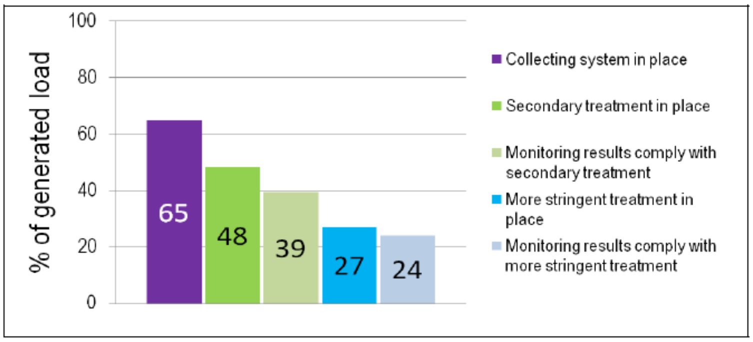
Secondary treatment was in place for 96% of the load for the EU-15 and for 48% of the load for the EU-12. As the infrastructure in place cannot always achieve quality standards in line with the Directive's requirements (possible reasons: inadequate capacity, performance or design etc.), 89% of the total generated load for the EU-15 and 39% of the total generated load for the EU-12 were reported to work adequately showing compliant monitoring results for secondary and more stringent treatment respectively.

More stringent treatment was in place for 89% of the load for the EU-15 and for 27% of the generated load for the EU-12. As the infrastructure in place cannot always achieve quality standards in line with the Directive's requirements (the same reasons as for secondary treatment), 79% of the total generated load for the EU-15 and 24% of the total generated load for the EU-12 were reported to work adequately.

Average share of generated load collected in collecting systems, treated by secondary treatment and more stringent treatment for EU-15 (left panel) and EU-12 (right panel)



EU-15



EU-12

Notes: EU-15 refers to Member States which joined the EU before the 2004 enlargement: Austria, Belgium, Denmark, Germany, France, Finland, Greece, Ireland, Italy, Luxemburg, Portugal, Spain, Sweden, The Netherlands and the UK (due to missing/late reporting the UK is not included).

EU-12 refers to Member States who acceded to the EU in 2004 and 2007 enlargements: Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria and Romania.

For EU-15 Member States all deadlines in the Directive have expired. Therefore proper waste water collection and treatment has to be in place for all agglomerations within the scope of the Directive. For the EU-12 Member States, transitional periods were granted by their Accession Treaties. None of these transitional periods exceed the year 2015 except for some small agglomerations (less than 10,000 p.e.) in Romania, which have to comply by the end of 2018.

Source: EC, 2011b.

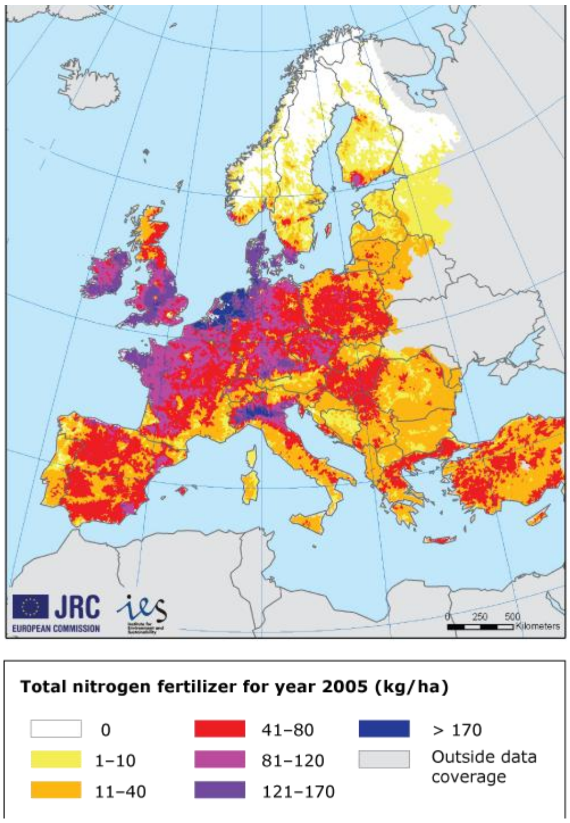
7.3.2. Diffuse nutrient pollution

Modern-day agricultural practices often entail the high use of fertilisers and manure, leading to high nutrient surpluses that are transferred to water bodies as diffuse pollution. Agriculture is the largest contributor of nitrogen pollution, and contributes with half of the total phosphorus load to European waters (EEA, 2005; Kronvang et al., 2009). Despite this progress in reducing agricultural inputs of nutrients, the diffuse pollution from agriculture is still significant and needs increased attention to achieve clean water.

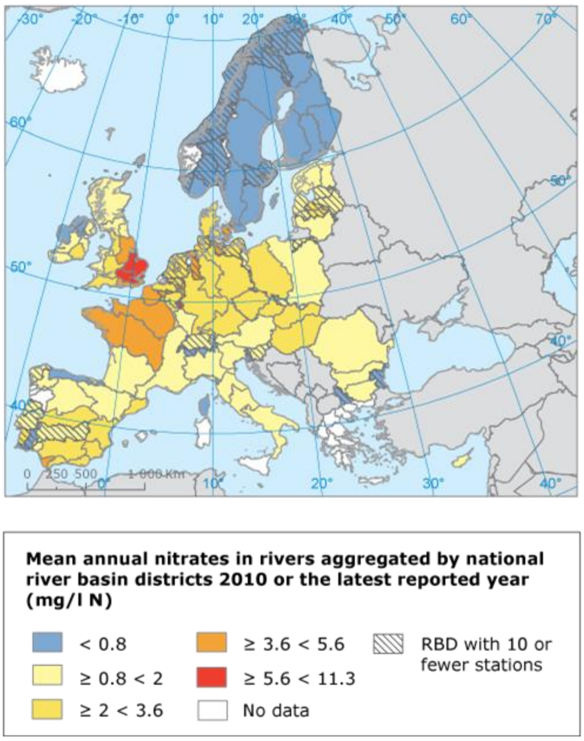
In Europe, mineral fertilisers account for almost half of all nitrogen input into agricultural soils, while manure is the other major input. Today, the highest total nitrogen application rates generally, although not exclusively, occur in Western Europe (Map 7.1a) (Grizzetti et al., 2007; Bouraoui et al., 2011). There is generally a high correlation between nitrogen application and the level of nitrate in rivers (Map 7.1b).

Map 7.1 Total nitrogen application to agricultural soil and river nitrate concentration

a) Total nitrogen application, manure and mineral fertilizer for the year 2005



b) Annual average river nitrate concentration (mg/l NO_3-N) in 2010, averaged by river basin district



Source: Bouraoui et al., 2011.

Notes: This map shows the mean annual concentrations of nitrate (NO_3) as mg/l NO_3-N, measured at Eionet-River monitoring stations during 2010 or the last year of reporting. All data are annual means.
Source: EEA, 2012c.

7.4. Impacts of pollution on water quality

7.4.1. European overview of status and trends in water quality in rivers and lakes

Implementation of the UWWTD has led to a reduction in the wastewater discharge of pollutants to receiving waters. The economic recession of the 1990s in central and eastern European countries also contributed to this fall, as there was a decline in heavily polluting manufacturing industries and introducing the "polluter pays" principle for all users. Clear downward trends in water quality determinants related to urban and industrial wastewater are evident in most of Europe's surface waters, although these trends have levelled in recent years.

The following results are extracted from the EEA CSIs (EEA, 2012d, 2012e, 2012f).

The quality of EU bathing waters has improved significantly since 1990. In 2011, more than 90% of bathing areas complied with mandatory values (Fig 7.2c).

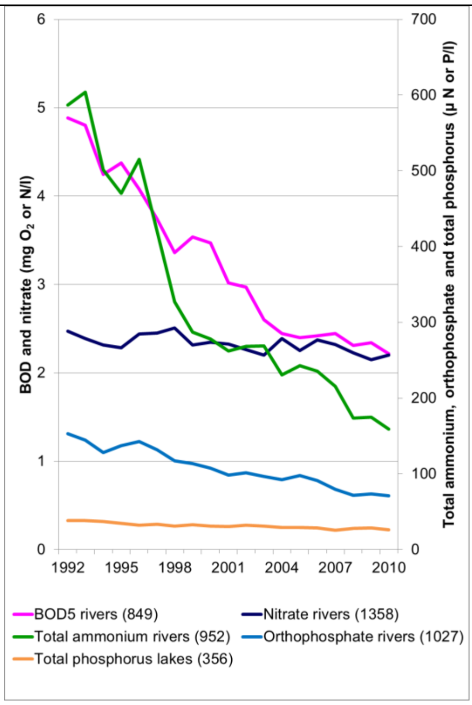
The emission of some hazardous chemicals has also been reduced, as evidenced, for example, by a decline in the discharge of heavy metals from waste water treatment plants in the Netherlands (Fig. 7.2d) and to the River Seine (Meybeck et al., 2007).

In European rivers, the oxygen demanding substances measured as BOD and total ammonium have decreased by 55% (from 4.9 mg/l to 2.2 mg O_2/l) and 73% (from 587 to 159 µg N/l), respectively, from 1992 to 2010 (Fig. 7.2a). The decrease is due mainly to improved sewage treatment resulting from the implementation of the Urban Wastewater Treatment Directive and national legislation. The economic downturn of the 1990s in central and eastern European countries also contributed to this fall, as there was a decline in heavily polluting manufacturing industries. In recent years, however, the downward trends in BOD across Europe have generally levelled. This suggests that either further improvement in wastewater treatment is required or that other sources of organic pollution, for example from agriculture, require greater attention, or both (Fig. 7.2a). RBDs with the highest BOD concentrations (class 4 & 5: >= 3 mg O_2/l) are found in Belgium, Bulgaria, Romania and southern Italy (Map 7.2a).

Countries with more than 50% of all river stations within the category of the lowest **total ammonium** concentrations (class 1: < 0.04 mg N/l) for 2008/09 or the latest reported year are the Northern European countries Sweden, Finland, Norway and Iceland, as well as Ireland, the UK, Switzerland, Austria, Slovenia, Croatia, Bosnia and Herzegovina, Cyprus and Spain. Countries with 20% or more stations within the category of the highest total ammonium concentrations (class 5: >= 0.4 mg N/l) are Romania, Greece, Luxembourg, Albania, Belgium and Kosovo under UNSCR 1244/99 (Map 7.2b).

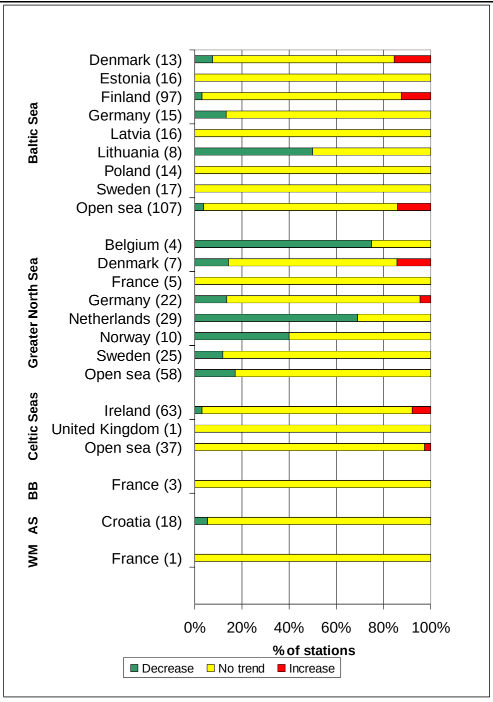
Figure 7.2 Changes in water quality variables related to wastewater treatment

A) Biochemical Oxygen Demand (BOD5), total ammonium, nitrate and orthophosphate concentrations in rivers and total phosphorus concentration in lakes between 1992 and 2010



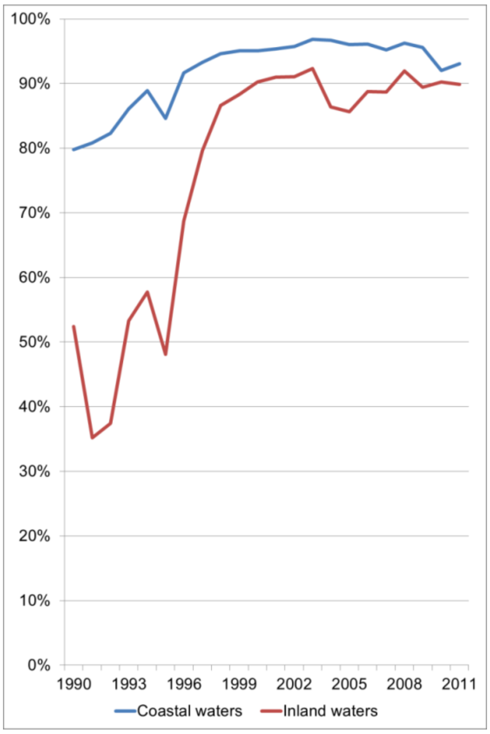
Source: EEA, 2012d and 2012e.

B) Change in winter orthophosphate concentrations in coastal and open waters of the North East Atlantic, Baltic, Mediterranean and North Seas



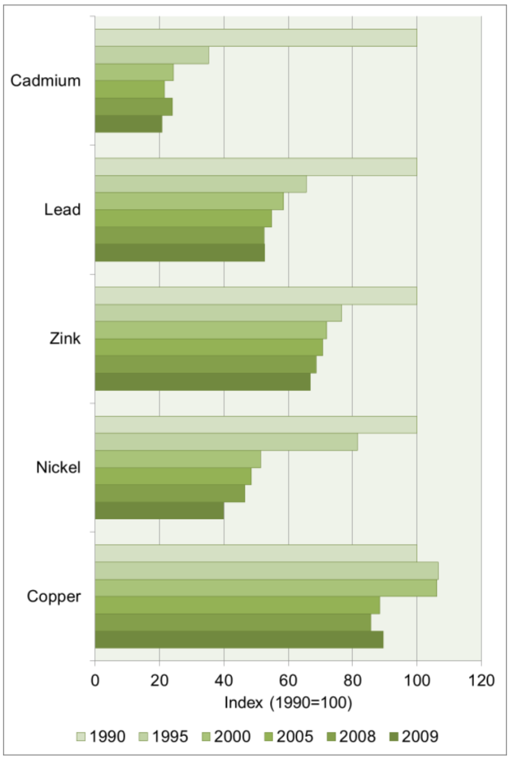
Source: EEA, 2012g.

C) Percentage of bathing waters complying with mandatory quality requirements, EU results based on more than 21 000 beaches



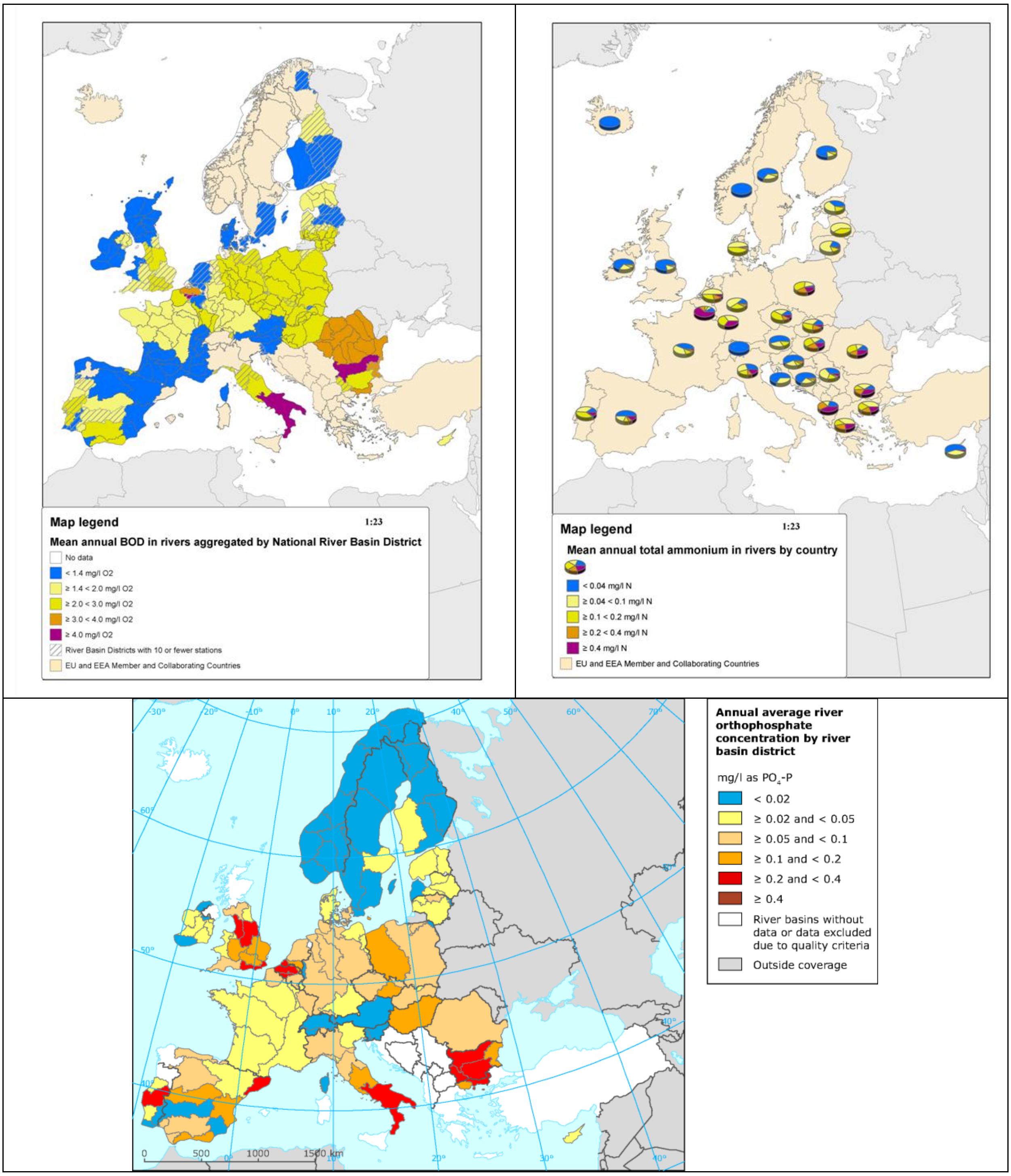
Source: EEA, 2012f.

D) Emission of heavy metals from waste water treatment plants **– Netherlands**



Source: CBS, PBL, Wageningen UR, 2011.

Map 7.2 Annual average river concentration of a) BOD (mg O_2/l), b) total ammonium and c) orthophosphate (mg/l as PO4-P) in 2008/09, by RBDs (BOD and PO_4) or country (NH_4), based on WISE-SoE dataflow



Source: EEA, 2012c.

Average **orthophosphate** concentrations in European rivers have decreased markedly over the last two decades, being more than halved between 1992 and 2010 (54% decrease, Fig. 7.2a). Also average lake phosphorus concentration decreased over the period 1992-2010 (by 31%, Fig. 7.2a), the major part of the decrease occurring in the beginning of the period, but is still on-going. The decrease in phosphorus concentrations reflects both an improvement in wastewater treatment and a reduction in phosphorus in detergents.

Relatively low concentrations of phosphorus in rivers and lakes are found in Northern Europe (Norway, Sweden, and Finland), the Alps and the Pyrenees, predominantly reflecting regions of low population density and/or high levels of wastewater collection and treatment (Map 7.2c).

In contrast, relatively high concentrations (greater than 0.1 mg/l P) are found in several regions with high population densities and intensive agriculture, including: Western Europe (southeast UK, the Netherlands, Belgium, western Germany, France), Southern Europe (southern Italy, central Spain and mid-Portugal), Eastern Europe (Hungary, Slovakia, the Czech Republic, Poland), and South-Eastern Europe (Bulgaria, Former Yugoslav Republic of Macedonia, Serbia, Turkey). Given that phosphorus concentrations greater than 0.1-0.2 mg/l P are generally perceived to be sufficiently high to result in freshwater eutrophication, the observed high values in some regions of Europe are of particular concern.

Mean annual orthophosphate concentrations (PO4-P) exceed 0.2 mg/l in some river basins across Europe (see Map 7.2c) and, whilst values vary with water body type, far lower concentrations are suggested as a threshold to prevent eutrophication. Current concentrations in certain rivers therefore suggest that substantial improvements will be required for good ecological status to be achieved under the WFD.

At European level there has been an 11% decrease in concentrations of **nitrate in rivers** since 1998, from 2.8 to 2.5 mg N/l (Fig. 7.2a). Agriculture is the largest contributor of nitrate pollution, but due to the EU Nitrate Directive (91/676/EEC) and national measures taken during the last 10-15 years, the nitrogen pollution from agriculture has been reduced in some regions. This reduced pressure is reflected in lower river nitrate concentrations.

Nitrate-concentrations in groundwater exceeded the compliance threshold of 50 mg l^{-1} under the Nitrates, Groundwater and Drinking Water Directives in ca. 10 % of reported stations over the 2001-2008 period (CSI20). Most of these stations are located in western and southern regions. High NO_3 concentrations in groundwater are found in particular in Spain, Belgium, Germany, Romania, Cyprus, Italy and Malta. The time series indicate increasing concentrations in the south-eastern region, possibly coupled to water scarcity and drought issues.

7.4.2. Nutrient concentrations and ecological effects in transitional and coastal waters

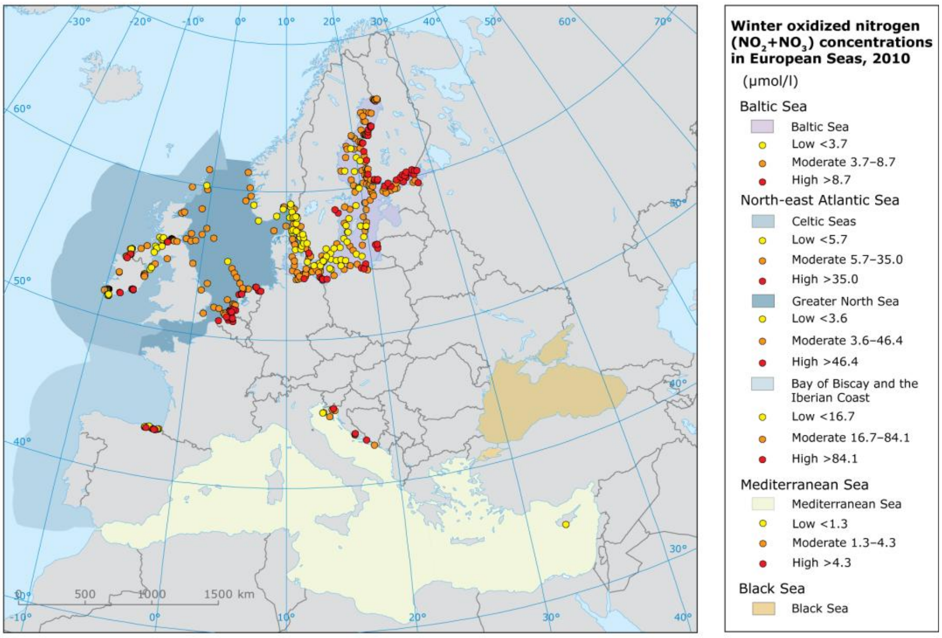
Based on the EEA indicators of nutrients (CSI21, EEA, 2012g) and chlorophyll-a (CSI23, EEA, 2012h) in transitional, coastal and marine waters, there is clear evidence of nutrient enrichment:

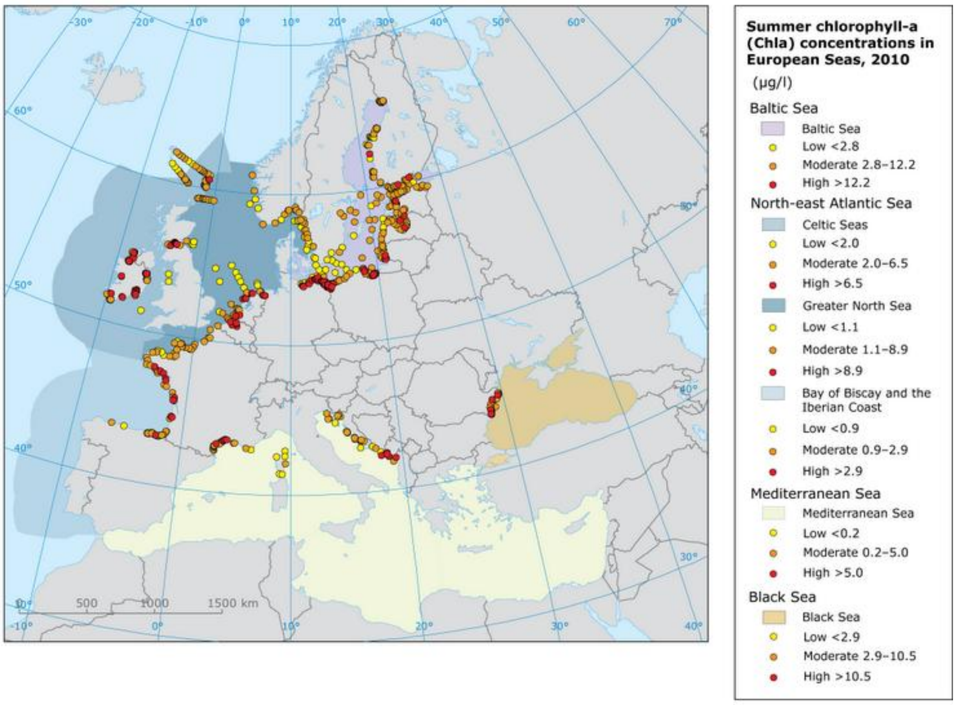
- within the coastal zones, bays and estuarine areas of some parts of the North East Atlantic region, particularly those near major European river deltas;
- in the Baltic Proper and the Gulf of Finland as well as coastal areas of the Baltic Sea;
- in areas close to river deltas or large urban agglomerations in the Mediterranean Sea;
- in the Black Sea, although improvement has been significant since 1990 (Oguz and Velikova, 2010).

In spite of measures to reduce nutrient concentrations in European seas, 84% of measurement stations show no change in nitrogen concentrations and 83% show no change in phosphorous concentrations (see Fig. 7.2b). Oxygen depletion is particularly serious in the Baltic and Black seas. For 87% of the stations, there is no change in chlorophyll-a concentrations.
Winter oxidized nitrogen concentrations have fallen significantly at 21% of 268 stations in the Baltic Sea and at 8% of stations in the North Sea. The stations with decreasing trends are in Denmark, Finland, Germany, the Netherlands, Norway and Sweden, and in the open parts of the Baltic Sea (Fig. 7.2b). Little improvement is seen in other seas.

In 2010, the highest chlorophyll-a concentrations were observed in the Gulf of Riga in Latvia, the Curonian lagoon influenced by the Nemunas River in Lithuania, the Scheldt estuary in Belgium, and at the mouth of the Seine and Loire rivers in France (Map 7.3).

Map 7.3 Winter oxidised nitrogen (NO_2 + NO_3) and summer chlorophyll-a in coastal and marine waters





Source: EEA, 2012g and 2012h.

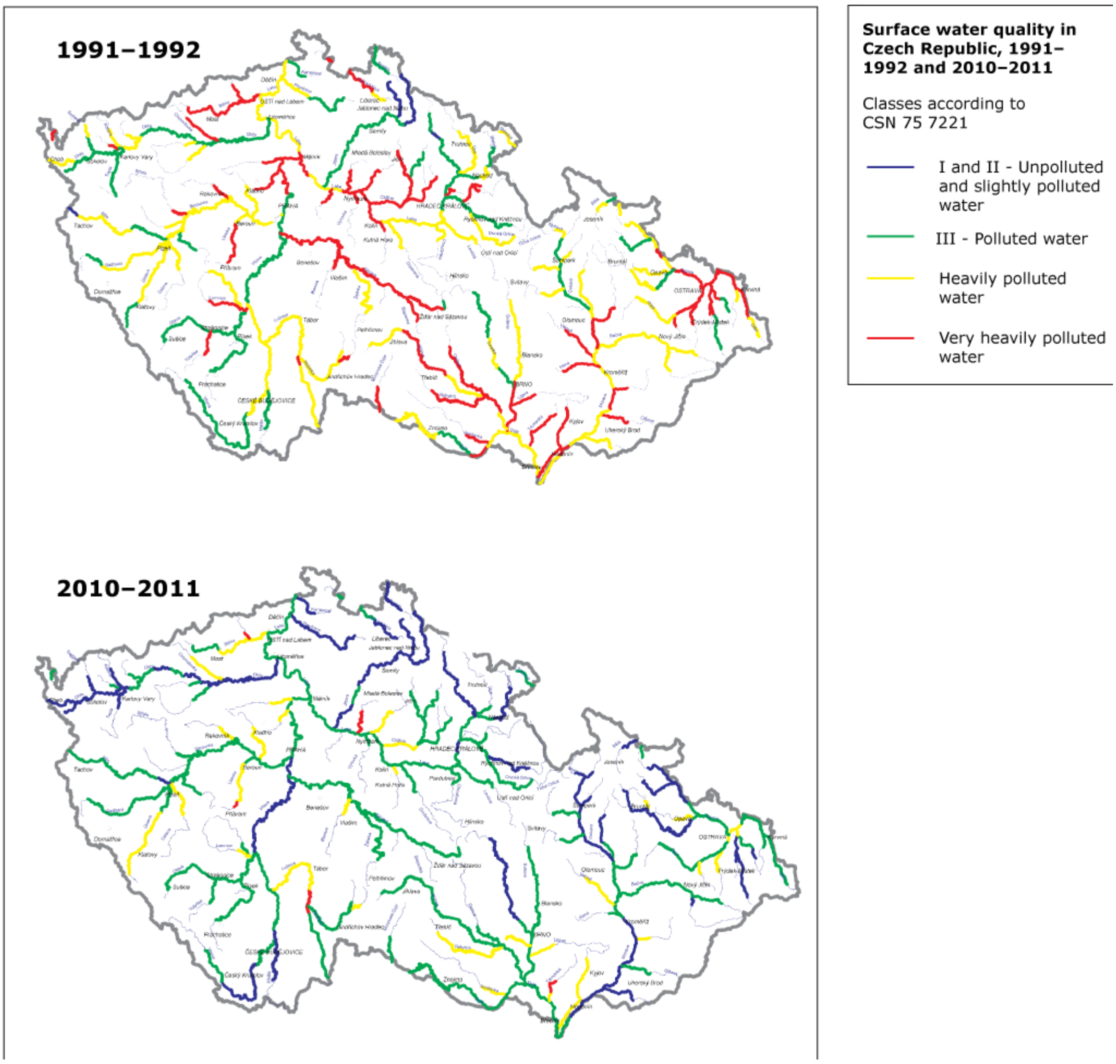
7.4.3. Case studies: trends in water and biological quality in rivers

The previous section described major improvement on water quality over the last decades. This is also partly reflected in biological indicators related to water quality and pollution effects. In many countries there have during the last 20 years been significant improvements in river water and biological quality (See the following examples from the Czech Republic and the improvement in the Rhine and the Elbe).

Czech Republic

The major improvement on water quality over the last decades is also partly reflected in biological indicators related to water quality and pollution effects. In the Czech Republic, for example, significant improvements in river water quality have occurred since the early 1990s based on a classification scheme incorporating indicators for BOD, nutrients and macro-invertebrate communities (Map 7.4).

Map 7.4 Comparison of the water quality in rivers in the Czech Republic, 1991–1992 (top) and 2010–2011 (bottom)



Notes: Methodology for the maps: Traditionally, surface water quality is classified into 5 categories (shown in the legend). The basic classification for the maps is the aggregate of the following indicators: BOD_5, COD_{Cr}, N-NH_4^+, N-NO_3^-, Ptotal and the saprobic index of macroinvertebrate communities (the final class is the worst class of these indicators).
Source: ISSaR, 2011.

Improved water quality in the Rhine and Elbe Rivers

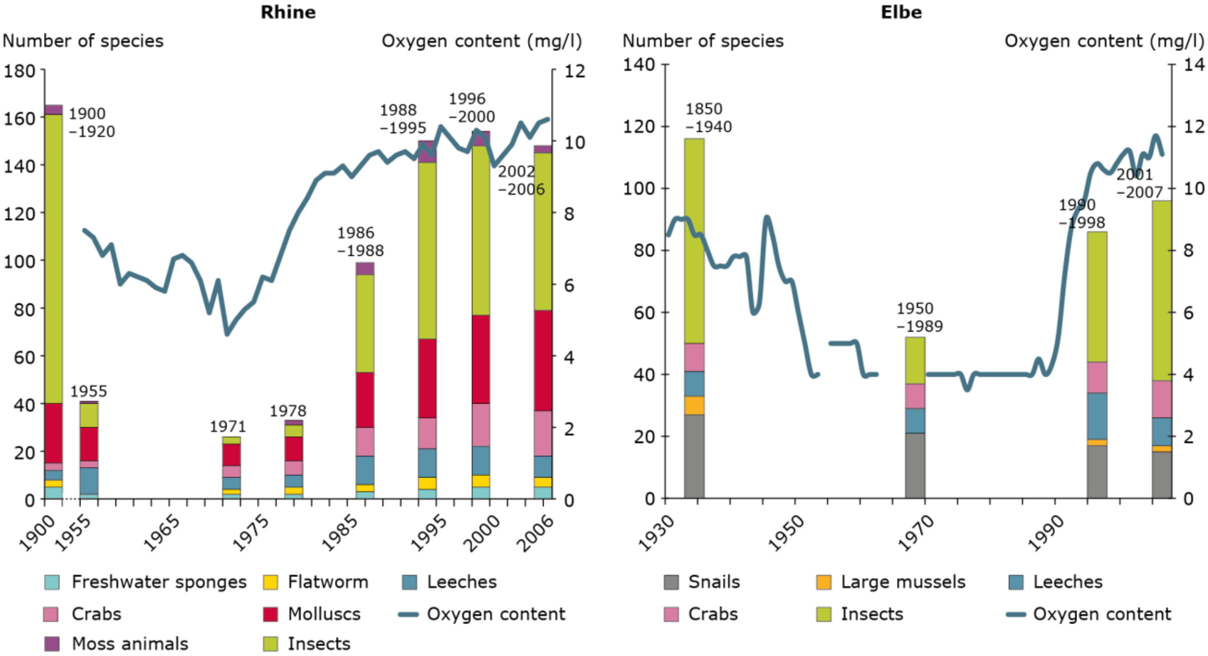
Source: BMU/UBA, 2010 (Part 1 Fundamentals, p. 54-57).

Recovery of aquatic fauna in rivers

In some rivers the aquatic fauna and oxygen balance in water bodies have been recorded since at least the beginning of the last century. One hundred years ago the Rhine was inhabited by some 165 species of macrozoobenthos, while in around 1930 the Elbe was inhabited by around 120 species (Fig. 7.3, BMU/UBA, 2010). As pollution increased and oxygen levels fell, the numbers of species have declined dramatically since the mid-1950s. By 1971, few species remained in the two river sections.

Improved oxygen conditions associated with improved wastewater treatment in the Rhine led to a turnaround from the mid-1970s onwards, while in the Elbe the situation did not improve until after German reunification in the early 1990s. Some of the characteristic river species that had been considered extinct or heavily decimated have now returned, but a large number of typical species remain absent, no doubt partly due to the fact that their habitats no longer exist due to structural impoverishment. Additionally, large numbers of non-native species have now replaced the typical species.

Figure 7.3 Historical development of the biotic community and average oxygen levels of the River Rhine near Emmesrich and the Elbe near Magdeburg



Source: BMU/UBA, 2010; adapted from Schöll, F., 2009a and 2009b.

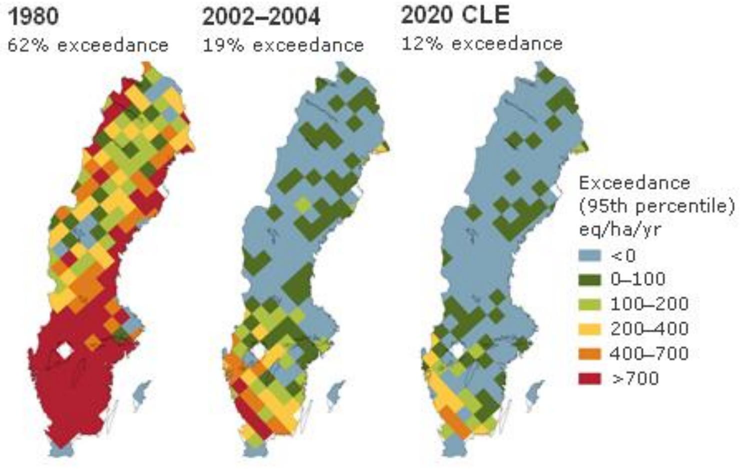
Text Box 7.2 Acidification

Source: Skjelkvåle and de Wit, 2011, WISE-WFD database, May 2012 (detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_PRESSURE_STATUS).

Acidification has been reported in the RBMPs to affect 1650 (9%) of lake water bodies and 3500 (3%) of river water bodies (Norway not included).

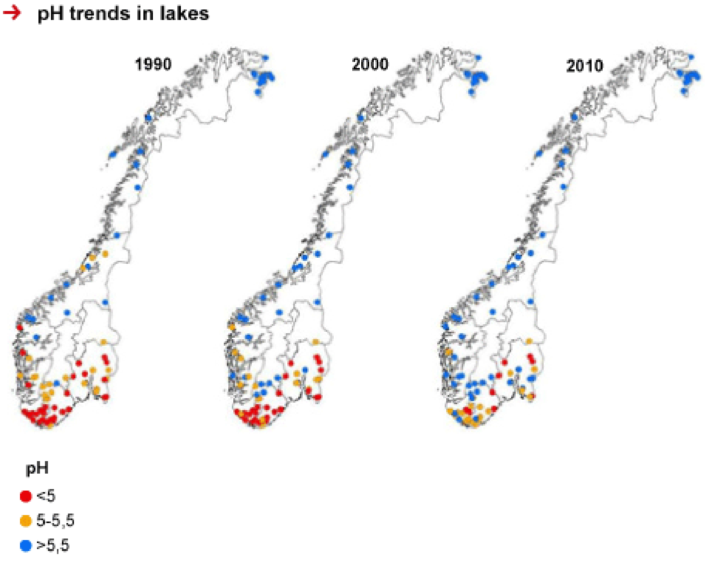
- The largest impact of acidification in rivers and lakes are found in Norway, Sweden, the United Kingdom, Ireland, and the Czech Republic.
- Acidification has been largely reduced over the past decades and biological recovery has started in most areas, although full recovery will not be achieved without further reductions in sulphate and nitrate deposition.

Sweden: Exceedance of critical loads of acidifying pollutants in 1980, 2002-2004 and projections for 2020.



Source: EEA, 2010c.

Norway: Trends in pH in Norwegian lakes from 1990-2010



SOURCE: Norwegian Institute for Water Research, 2011 / www.environment.no

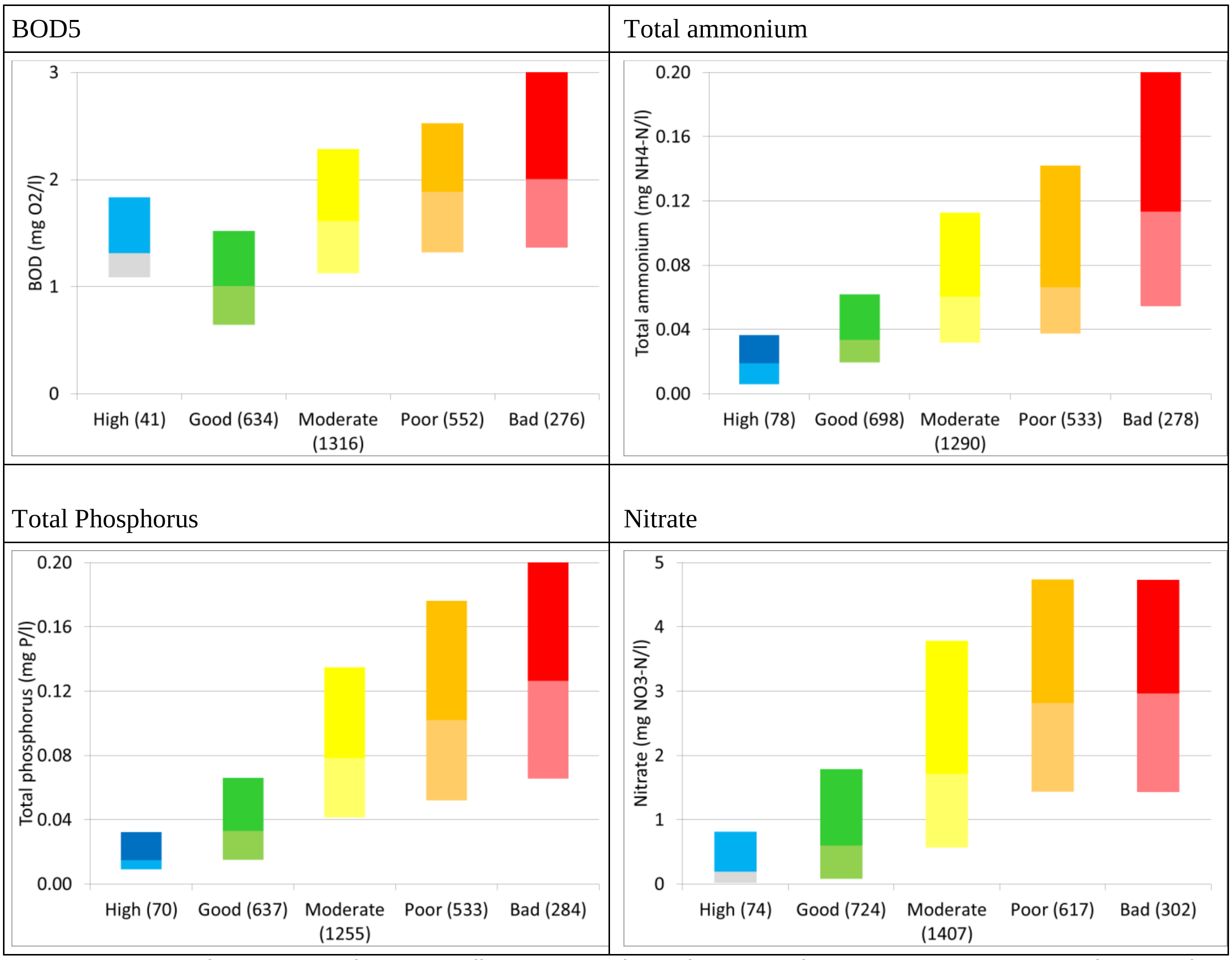
7.5. *Relationship between ecological status and water quality*

In order to assess the importance of water quality for ecological status, this section links the information reported on water quality in rivers and lakes via WISE-SoE to the information reported via the WISE-WFD RBMP reporting on ecological status of water bodies.

7.5.1. Relationship between ecological status and current water quality

River water bodies being classified as having high or good ecological status generally have a much lower concentration of pollutants (BOD5, total ammonium, total phosphorus, and nitrate) and better water quality than water bodies classified as having moderate to poor ecological status (Fig. 7.4).

Figure 7.4 Rivers: Concentration range (1st quartile, median and 3rd quartile) of annual average nutrient and organic matter concentrations in river water bodies in different classes of ecological status or potential (high to bad)



Notes: Average of mean annual water quality concentration values over the years 2005-2010. Based on results from 3368 river stations in 16 Member States, dominated by river stations in France (1416 stations) and the UK (555 stations). No matching stations were found for Bulgaria, Czech Republic, Cyprus, Greece, Lithuania, Luxembourg.
Source: WISE-WFD database, May 2012 (detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS) and EEA Waterbase Rivers Version 12 (EEA, 2012i).

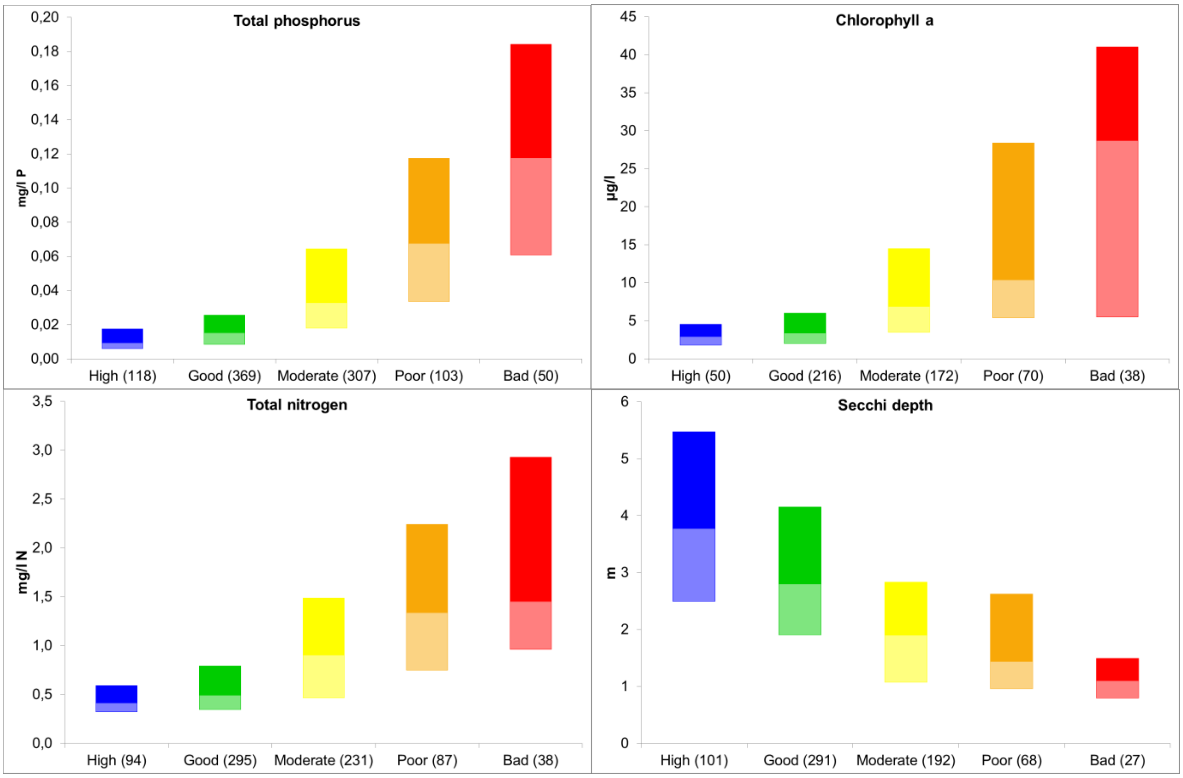
- River water bodies classified as having high ecological status have generally low concentrations of pollutants with mean annual median nitrate, total phosphorus, and total ammonium concentrations being lower than 0.1 mg NO_3-N/l, 0.02 mg P/l and 0.02 mg NH_4-N/l, respectively.
- Nutrient pollutant concentrations increase from high to bad ecological status or potential.

- River water bodies classified as having good ecological status have mean annual median nitrate, total phosphorus, and total ammonium concentrations of 0.5 mg NO_3-N/l, 0.03 mg P/l and 0.03 mg NH_4-N/l, while those in moderate ecological status have mean nutrient concentrations that are 2-3 times higher.

The results presented in Fig. 7.4 indicate that in many rivers it is necessary to reduce the pollutant levels by 70% to achieve the good ecological status objective of the WFD.

For lake water bodies there are clear relationships between ecological status and water quality parameters (Fig. 7.5). Lakes being classified as having high or good ecological status have a much lower concentration of pollutants (total phosphorus and total nitrogen) and phytoplankton biomass and much better water clarity than water bodies classified as having moderate to bad ecological status.

Figure 7.5 Lakes: Concentration range (1st quartile, median and 3rd quartile) of annual average nutrient and chlorophyll concentrations and Secchi depth in different classes of ecological status or potential (high to bad)



Notes: Average of mean annual water quality concentration values over the years 2005-2010 compared with the ecological status/potential for the water bodies in which the stations lie.
Based on results from 17-20 Member States, with 947 stations for Total phosphorus, 745 stations for Total Nitrogen, 546 stations for chlorophyll a, and 679 stations for Secchi depth.
Source: WISE-WFD database, May 2012 (detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS) and EEA Waterbase Lakes Version 12 (EEA, 2012j).

- Lake water bodies classified as having high ecological status have generally low concentrations of nutrients with mean annual median total phosphorus, and total nitrogen concentrations being 0.01 mg P/l, 0.4 mg N/l, respectively.
- The annual median biomass of phytoplankton in lakes classified to be in high ecological status is 3µg chlorophyll/l and their median water clarity measured as Secchi depth is 4 m.
- Lake water bodies classified as having good ecological status have annual median total phosphorus, total nitrogen, chlorophyll a concentrations and Secchi depth being 0.02 mg P/l, 0.5 mg N/l, 3µg chlorophyll/l and Secchi depth being 3m, while those in moderate ecological

status have median nutrient and chlorophyll concentrations that are 1.5-2 times higher and Secchi depth of 2 m.

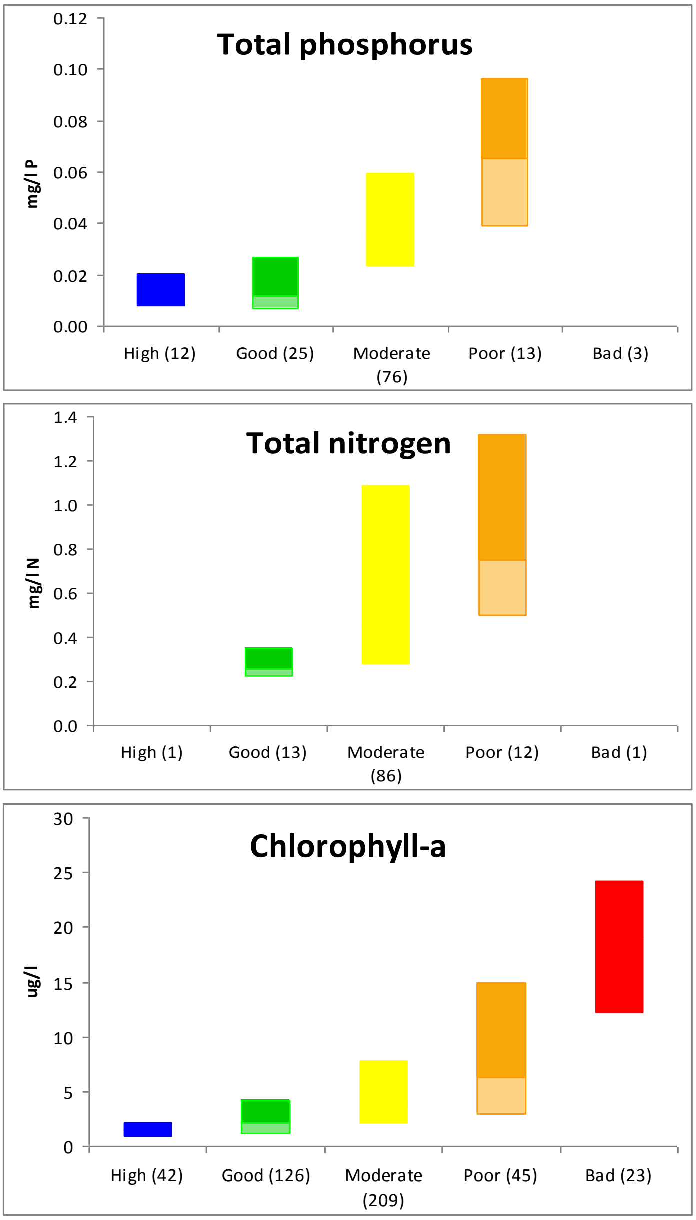
The results presented in Fig. 7.5 indicate that in many lakes it is necessary to reduce the nutrient levels by at least 50% to achieve the good ecological status objective of the WFD.

The range of nutrient and chlorophyll concentrations are also increasing from high to bad ecological status, reflecting the impacts of other pressures on lakes in moderate or worse ecological status. This wider range found among lakes classified as having moderate or worse ecological status compared to high and good status lakes may also be caused by different sensitivity to nutrient enrichment in different lake types (e.g. alkalinity and depth).

Transitional and coastal water bodies generally show a clear relationship between ecological status class, nutrient (total nitrogen and total phosphorus) and chlorophyll concentration (Fig. 7.6). Water bodies classified as having high or good ecological status have much lower nutrient concentrations and phytoplankton biomass, indicated by chlorophyll a.

- Transitional and coastal water bodies classified in high and good ecological status generally have low concentrations of total phosphorus, with an annual median of 0.01 mg P/l.
- While the difference in the annual median for total phosphorus between high and good ecological status is minimal, the annual median for the moderate and poor status classes increases 3- and 6-fold respectively.
- Transitional and coastal water bodies classified as having good ecological status have an annual median total nitrogen of 0.3 mg N/l. The range of total nitrogen concentration in water bodies having moderate and poor status is wider than the other classes and also wider than for total phosphorus. Also, the two concentrations ranges in water bodies in moderate and poor status are largely overlapping. This means that various natural (such as background concentrations) and anthropogenic factors result in variable concentrations in different sea regions. However, due to the lack of data, it is not possible to differentiate between different sea regions. In addition, the failure of water bodies to achieve good ecological status is not solely based on nutrient concentrations, but may be attributed due to other prevalent factors, such as hydromorphological pressures causing habitat alterations.
- The median chlorophyll a concentration increases steadily between 1 - 6 μg/l for water bodies in high to poor ecological status. In the case of bad ecological status, the median chlorophyll a concentration is 19 μg/l. Due to the lack of data, it is not possible to relate the concentration of nutrients directly to chlorophyll a. However, the current measurements show that water bodies that are currently in poor or bad status are characterized by elevated chlorophyll-a concentrations.

Figure 7.6 Transitional and Coastal waters: Concentration range (1st quartile, median and 3rd quartile) of annual average nutrient and summer average chlorophyll a concentrations in different classes of ecological status or potential (high to bad)



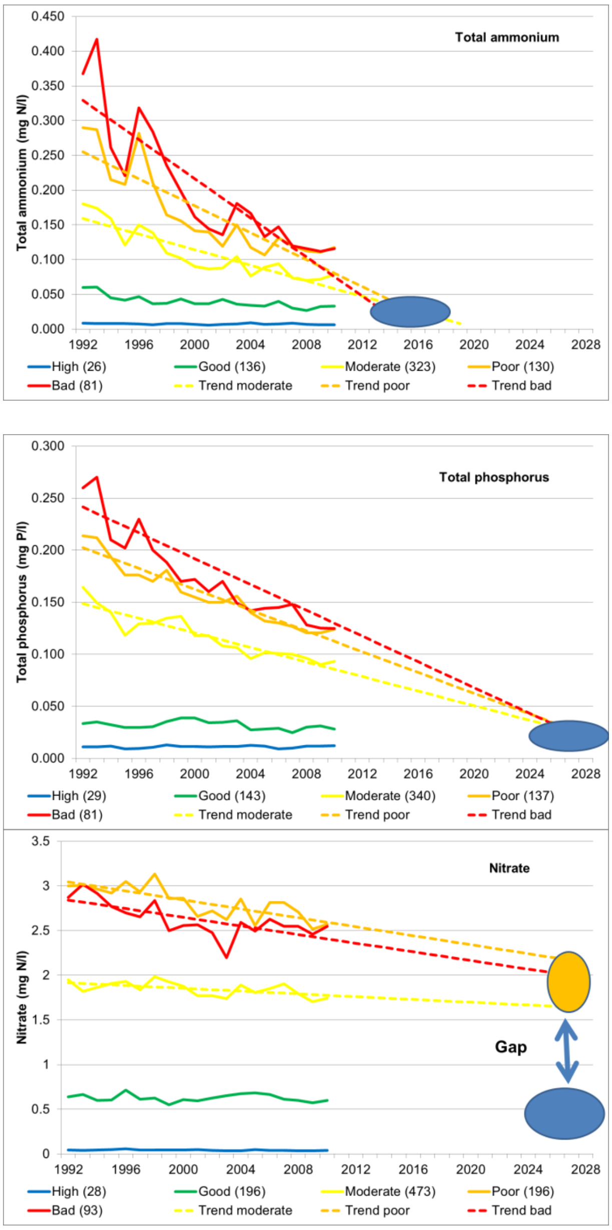
Notes: Average of mean annual water quality concentration values over the years 2005-2009. Based on results from 10 Member States, with 129 stations for total phosphorus, 113 stations for total nitrogen and 445 stations for chlorophyll a. Measurements for total phosphorus in water bodies in bad status and for total nitrogen in water bodies in high and bad status are omitted due to insufficient data.
Source: WISE-WFD database, May 2012 (detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS) and EEA Waterbase Transitional, coastal and marine waters Version 8 (EEA, 2012k).

7.5.2. Time trends in nutrient concentrations in rivers and lakes in relation to current ecological status

Time series of nutrient concentrations are plotted for river and lake stations that were classified in the different ecological status classes according to the RBMPs to illustrate the trends in nutrient concentrations since the early 1990s for these stations. These trends should not be interpreted to mean that these stations have had the same ecological status class over time, but is only meant to illustrate the improvement in water quality that has happened over the past two decades, especially for stations that are reported to be in less than good ecological status in the first RBMPs.

Although other pressures e.g. hydromorphological changes also affects the ecological status, the time trends illustrate that the improvement that has occurred in the nutrient concentrations is still not sufficient to achieve good ecological status (Figs 7.7 and 7.8).

Figure 7.7 Trend in median total ammonium, total phosphorus and nitrate concentration of river water bodies grouped by the ecological status/potential class



Notes: Concentrations are expressed as median of annual mean concentrations. Up to 3-year gaps of missing values have been interpolated or extrapolated. Only complete series with no missing values after this interpolation/extrapolation are included. The number of time series/river stations is shown in parenthesis. The trend 1992-2010 for each of the ecological quality classes has been linear extended to 2027 – or when the concentration level became negative.

Source: WISE-WFD database, May 2012 (detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS) and EEA Waterbase Rivers Version 12 (EEA, 2012i).

Linear projections of this trend for rivers indicate that for total ammonium and total phosphorus water quality compared to good ecological status may be achieved in around 2015 and 2027 (Fig. 7.1a, b) if the current trend continues, meaning that the implementation of the UWWTD and other emissions reduction policies have been continued.

For nitrates the current decreasing trend is too small to approach the level of water quality comparable to at least good ecological status in 2027; this can be translated into the additional measures that are needed to reduce diffuse pollution if the majority of water bodies should have nitrate levels comparable to high or good ecological status in 2027.

The above linear projections are a simple projection of continued implementation and upgrading of current measures. If the measures planned in the RBMPs are stricter and they are being implemented in the first RBMP period the improvement in water quality may be faster. Opposite if there are low ambitions in the RBMPs and delays in implementing the measures, the above projections may be too optimistic.

For lakes, there are too few consistent time series to allow reliable projections.

Figure 7.8 Lakes: Time series of annual median nutrient concentrations for monitoring stations in lake water bodies reported to be in different classes of ecological status or potential (high to bad) in the RBMPs. The number of stations is 286 for total phosphorus and 83 for total nitrogen

Notes: Concentrations are expressed as the median of the annual mean concentrations. For total phosphorus, up to 3-year gaps of missing values have been interpolated or extrapolated. Only complete series with no missing values after this interpolation/extrapolation are included. For total nitrogen, only complete data series are included. Number of time series/ lake stations is shown in parenthesis.

Source: WISE-WFD database, May 2012 (detailed data are available at http://discomap.eea.europa.eu/report/wfd/SWB_STATUS) and EEA Waterbase Lakes Version 12 (EEA, 2012j).

The results show the need for further nutrient reduction measures, in particular addressing diffuse source pollution from agriculture, which can be implemented through the WFD RBMPs and through full compliance with the Nitrates Directive.

In many water bodies, also measures reducing hydromorphological alterations of habitats are needed to achieve the WFD good status objective.

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ISBN 978-80-85087-97-0