the Brief
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Monitoring aquatic environments and groundwater

In-depth knowledge of aquatic environments is a prerequisite in order to protect and restore their «good status», in compliance with the European water framework directive (WFD[1]). It is with that objective in mind that, starting in 2006, French authorities modified their monitoring systems, for rivers, lakes, estuaries, coastal waters and groundwater. The data collected via these monitoring programmes are used to assess the status of water bodies and thus guide preservation policies.

The Water framework directive enhances national monitoring of aquatic environments

The preservation of water quality and of sufficient quantities of water resources is of the utmost importance for life on the planet and to meet the many human needs (drinking water, agriculture, industry, recreational activities, etc.). Confronted with the development of urban areas and industry in the 1960s, the French government became aware of the need to monitor aquatic environments and to assess their degradation. The resulting knowledge rapidly became indispensable in orienting policies to manage and protect water resources and to check the efficiency of the action.

The 1964[2] Water law resulted in the establishment of the first national monitoring networks for the quality and quantity of surface water and groundwater. Subsequently, monitoring efforts were significantly reinforced to meet the requirements imposed by EU and French regulations.

> The first national inventory[3] on the level of surface-water pollution was carried out in 1971 by the Water agencies at approximately one thousand sites **monitoring the quality of rivers and lakes**. This system was progressively stabilised and then reorganised into the national basin network (RNB) in order to standardise monitoring strategies throughout France. Overseas, the monitoring system was established in the 1990s.

> **Hydrometric monitoring points were established on rivers** toward the end of the 1800s in order to predict floods and determine the hydroelectric potential of each river. Starting in 1980, the responsibility for monitoring discharges and water levels in rivers was gradually transferred to the Ecology ministry which now funds approximately 3 600 monitoring points.

> **Chemical monitoring of littoral waters** started in 1974 with the national marine observation network (RNO), managed by Ifremer (Research institute for exploration of the sea) for the Ecology ministry. Samples were initially taken from water, then expanded to include animals (fish and shellfish) and sediment, at approximately 100 monitoring points, including overseas. This activity was subsequently transferred to the observation network on littoral chemical contamination

[1] Directive 2000/60/EC (23 October 2000), transposed into French law notably by Law 2004-338 (21 April 2004).
[2] Law 61-1245 (16 December 1964) and Ordinance 69-50 (10 January 1969).
[3] See *Progress in monitoring river quality*, Onema, 2010.

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Public water information system

in 2008. This improved network (more frequent measurements and more monitored substances) was then reinforced with other networks including the national monitoring network for water and sediment quality in maritime ports (REPOM), launched in 1997, and the monitoring network for coastal habitats and living communities (REBENT), launched in 2000. These networks are complemented by special networks along the coasts. Examples are the Breton estuary network in the Loire-Bretagne basin, as well as the lagoon-monitoring network (RSL) and the biological integrator network (RINBIO) in the Rhône-Méditerranée-Corse basin.

> The initial **networks for groundwater[4] quality** were launched in the 1970s, notably to monitor the increasing nitrate pollution of groundwater bodies. Then new networks were created to meet the water-quality goals of the 1992[5] Water law. Following the establishment of common monitoring methods in 1999, the national network for groundwater quality monitoring (RNES-Q) with over 2 000 monitoring points was set up.

> Finally, **monitoring of groundwater levels** was launched in the 1950s on a certain number of large aquifers (e.g. in the Adour-Garonne basin). During the 1970s, BRGM (French geological survey), tasked with monitoring groundwater levels throughout continental France, set up monitoring networks on all the large aquifer systems.

Similar to qualitative monitoring, the 1992[5] Water law put into high gear the creation of the national network for groundwater quantitative monitoring (RNES-P) with almost 2 200 monitoring points.

Then, to reorganise and clarify the European regulatory system comprising an array of laws on different types of water (surface and groundwater), water uses (drinking water, bathing, etc.) and pollutants (hazardous substances, nitrates), the EU adopted the Water framework directive (WFD) in October 2000. The WFD[6] targets sustainable use of water in each river-basin district and sets environmental objectives:

> ensure that water quality is not degraded;

> restore good water status. For surface water, this includes chemical status (substance concentrations) and ecological status (composition of fauna and flora species, habitat quality). For groundwater, it includes quantitative status (water levels) and chemical status (substance concentrations);

> achieve objectives pertaining to protected zones (drinking-water abstractions, bathing waters, etc.);

> reduce or phase out the release of certain substances and pollutants;

> reverse long-standing, significant upward trends in pollutant concentrations in groundwater.

The WFD was incorporated into French law by the 2006[7] Water law and essentially expanded on existing water-management principles in France. It also introduced a number of major innovations, including:

> mandatory results based on environmental objectives set for each water body in all types of aquatic environment, according to a strict timetable;

> mandatory periodic reporting on the results obtained, any delays noted and failures;

> public consultations to reinforce the transparency of water policy and encourage participation.

Water bodies are the assessment unit

A water body is a hydrographic unit (surface water) or a hydrogeologic unit (groundwater), having fairly consistent characteristics (geology, morphology, hydrologic regime, etc.) and for which a single environmental objective may be set.

The categories of water bodies are rivers, lakes, coastal waters, transitional waters (estuaries and lagoons) and groundwater.

The 11 523 surface water bodies comprise 229 790 kilometres of river, 1 964 square km of lakes, 26 562 km² of coastal waters and 2 840 km² of transitional waters. The 574 groundwater bodies span 1 092 890 square kilometres.

Monitoring organised upon management cycles

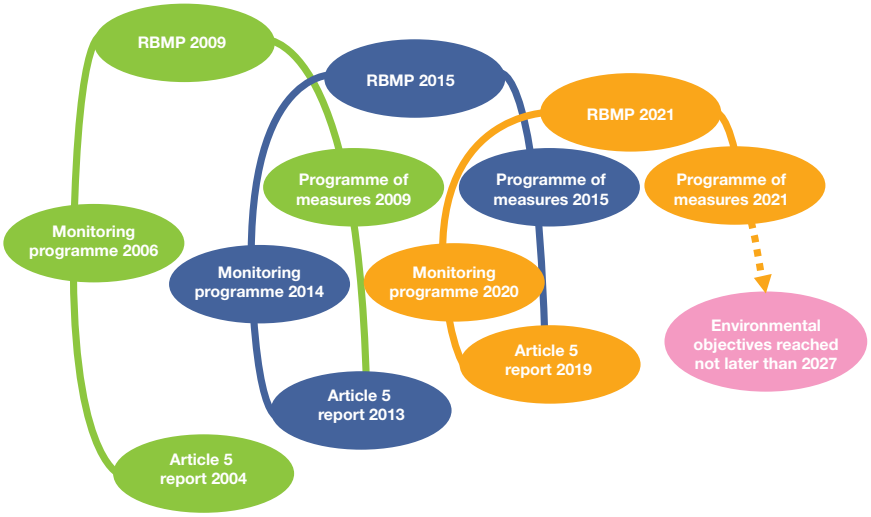
The WFD set up a common implementation method for the 27 Member States, divided into 6-year management cycles based on four main documents:

> the **article 5 report** presents a snapshot of the various activities and water uses in a country, with data on the resulting impacts which serve to identify the problems requiring action;

> the **monitoring programme** describes the system set up to monitor state of the aquatic environments;

> the **management plan** sets the environmental objectives. In France, this is the river-basin management plan (RBMP, SDAGE in French), a planning tool that has existed since the 1992[5] Water law;

> the **programme of measures** lists the measures designed to reach the set objectives.



N.B. Each colour represents a management cycle. The dates indicate when each document must be adopted by the relevant authorities.

[4] See *Groundwater monitoring over the decades*, Onema, 2013.
[5] Law 92-3 (3 January 1992).
[6] Directive 2000/60/EC (23 October 2000), transposed into French law notably by Law 2004-338 (21 April 2004).
[7] Law 2006-1772 (30 December 2006).

The monitoring programme is essential for the other phases in each cycle because knowledge is required to set objectives and determine the necessary means. A comprehensive overview of the status of the various water categories is produced and serves to monitor any changes. It is not possible to monitor everything everywhere, which is why samples are taken from water bodies that are sufficiently numerous and representative. The result is an overall assessment of water status. The EU has set a general framework concerning the monitored quality elements and parameters, monitoring frequencies and methods, etc., but there is a degree of flexibility for the Member States to adapt the system to their specific situations. The system comprises four main parts having different purposes.

> **Surveillance monitoring** is a permanent network to assess the overall status (qualitative and quantitative) of surface and groundwater. The purpose is to obtain general knowledge.

> **Operational monitoring** is a temporary network to assess the status of water bodies at risk of not achieving the environmental objectives and to monitor their evolution in response to the programmes of measures.

> **Investigative monitoring** is carried out on surface waters to detect the reasons why a water body has not achieved good status or to determine the impacts of accidental pollution.

> **Additional monitoring** is implemented to assess the impact of any pressures weighing on surface waters in two types of protected zones, namely Natura 2000 zones and drinking-water abstraction.

Exploratory campaigns

In some cases, measurement campaigns are carried out in addition to the WFD monitoring in order to acquire new knowledge. For example, to monitor emergent substances:

> a first campaign was carried out in 2011 on groundwater in continental France;

> a second campaign was carried out in 2012 on surface water in continental France and in the overseas territories, as well as on groundwater in the overseas territories.

The data from the measurement campaigns[10] are now undergoing analysis by scientists on the national level and the results will be presented in 2014.

WFD requirements have been clarified by a number of legislative and government addressing all water categories and the various types of monitoring. The ordinance dated 25 January 2010[8] established the water-status monitoring programme to ensure consistent application throughout the country. More recently, the instruction dated 29 January 2013[9] clarified the implementation rules for the monitoring programme for rivers and lakes.

The initial monitoring programmes were designed in each river-basin district in 2006 for the 2010 to 2015 management cycle. Actual implementation started in 2007 by adapting the existing networks. Once established, the monitoring programmes were approved by the coordinating Prefects and subsequently updated on a regular basis, i.e. at least once per management cycle, within one year following the updating of the article 5 report.

In addition, the river basins may have their own additional networks to acquire knowledge on a more local scale or on specific topics, e.g. nitrates, pesticides or for monitoring of restoration projects.

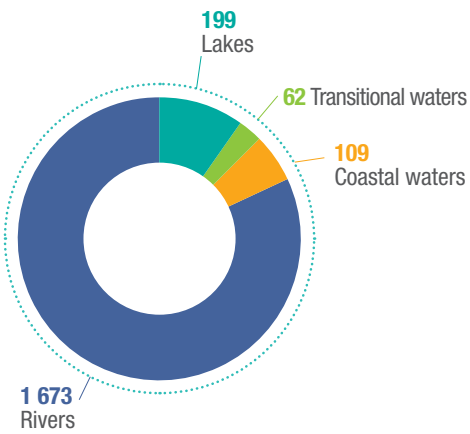
Monitoring for surface waters

The **surveillance-monitoring network (RCS) for surface water** was deployed in 2007 at 2 043 permanent monitoring points covering all of France (continental and overseas territories). Monitoring points were selected to acquire general knowledge on aquatic environments and not specifically to monitor pollution. The criteria used to define the network dealt essentially with the size of the river basin, taking care to cover all types of water bodies and to avoid sites close to pollution sources and installations, e.g. dams. A majority (82%) of surveillance-monitoring points are located on rivers. Overseas, the insular nature of the territories means there is a higher percentage of monitoring points for coastal and transitional waters, approximately 33% compared to 6% in continental France.

	Rivers	Lakes	Transitional waters	Coastal waters	Total
Continental France	1 566	197	46	72	1 881
Overseas territories	107	2	16	37	162
All of France	**1 673**	**199**	**62**	**109**	**2 043**
%	82%	10%	3%	5%	100%

Distribution of surface-water surveillance-monitoring points by category of water body

Source: March/October 2010 report to the EU (Onema) – WIS-FR partners.



[8] Ordinance (25 January 2010) modified, setting up a water-status monitoring programme.
[9] Circular (29 January 2013) concerning implementation of the Ordinance (25 January 2010) modified, setting up a water-status monitoring programme for surface freshwater (rivers, canals and lakes).
[10] http://www.onema.fr/2campagnes-d-analyse-sur-des-centaines-de-molecules-emergentes (in French).

If calculated in terms of river lengths, the national surveillance-monitoring network has a monitoring point every 137 kilometers. The ratio is one monitoring point for 10 square kilometers of lake, one for 245 km² of coastal waters and one for 46 km² of transitional waters.

Monitoring frequencies and cycles are calculated to provide sufficient data for a reliable assessment of water status. Measurement parameters and minimal frequencies are defined in the January 2010[11] ordinance. Monitoring covers all quality elements:

> biological quality elements, i.e. fauna (fish, crustaceans, etc.), flora (e.g. algae);

> hydromorphological quality elements, i.e. discharge, bank condition, width of the river bed, continuity of flow, etc.;

> general physical-chemical (temperature, oxygen, nutrients, etc.) and chemical quality elements (various substances).

Some flexibility is accorded to the river basins to increase or decrease monitoring frequencies (if justified) in order to take into account the specificities of each territory.

Surface water bodies

Source: March/October 2010 report to the EU (Onema) – WIS-FR partners

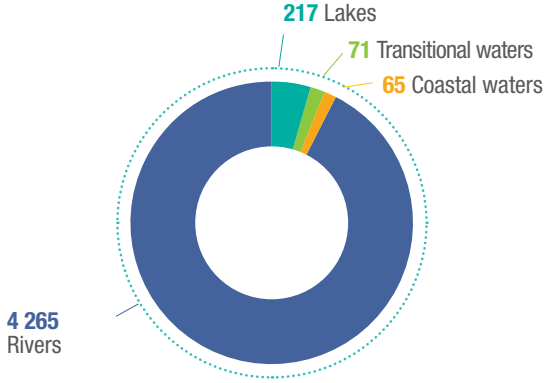
		Continental France	Overseas territories	All of France
Rivers	Number	9 799	1 025	10 824
	Number monitored	3 783	97	3 880
	% monitored	**39%**	**9%**	**36%**
Lakes	Number	434	5	439
	Number monitored	311	2	313
	% monitored	**72%**	**40%**	**71%**
Transitional water bodies	Number	84	12	96
	Number monitored	77	9	86
	% monitored	**92%**	**75%**	**90%**
Coastal water bodies	Number	120	44	164
	Number monitored	92	34	126
	% monitored	**77%**	**77%**	**77%**
Total	Number	10 437	1 086	11 523
	Number monitored	4 263	142	4 405
	% monitored	**41%**	**13%**	**38%**

The measurements carried out at monitoring points are used for the assessments of the surface water bodies where they are located. In addition, the measurements at certain monitoring points are extrapolated to other water bodies having similar characteristics. For example, 38% of all 11 523 water bodies are monitored directly. This proportion varies according to the water category, i.e. 36% for rivers (close to the national average given the high number of monitoring points for rivers), but 71% for lakes, 90% for transitional waters and 77% for coastal water, reflecting the smaller number of water bodies.

Distribution of surface-water operational-monitoring points by category of water body

Source: March/October 2010 report to the EU (Onema) – WIS-FR partners

	Rivers	Lakes	Transitional waters	Coastal waters	Total
Continental France	4 246	217	71	54	4 588
Overseas territories	19	0	0	11	30
All of France	**4 265**	**217**	**71**	**65**	**4 618**
%	92%	5%	2%	1%	100%



Surface-water operational monitoring started gradually in 2008 and 2009, before reaching a total of 4 618 monitoring points. Rivers account for 92% of the monitoring points and lakes for 5%.

If calculated in terms of river lengths, the national operational-monitoring network has a monitoring point every 54 kilometers.

Operational monitoring covers the quality elements most sensitive to anthropogenic pressures (abstractions, pollution, point or nonpoint-source agricultural and industrial releases, etc.) that often result in good status not being reached. For example, in addition to measurements of chemical concentrations, benthic macroinvertebrates are also monitored because they are highly sensitive to toxic substances and are thus the biological element best suited to detecting this type of pressure.

[11] Ordinance (25 January 2010) modified, setting up a water-status monitoring programme.

Among the 4 618 operational-monitoring points, 25% are already included in the surveillance-monitoring system. In the total of 5 506 monitoring points for surface waters, 16% contribute exclusively to surveillance monitoring, 63% to operational monitoring and 21% are assigned to both. The situation is very different in the overseas territories where 82% contribute to surveillance monitoring, 17% to both networks and only 1% to operational monitoring. Where possible and relevant, the use of a single monitoring point for different purposes is a means to save financial and human resources.

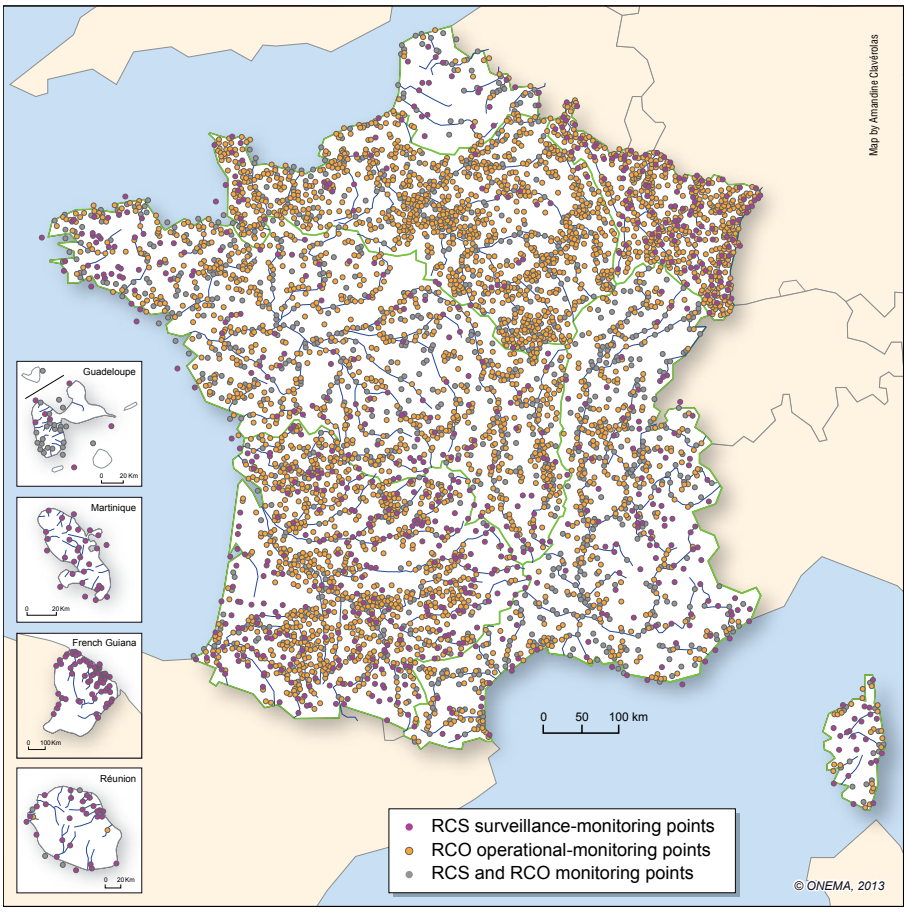
The two other parts of the WFD monitoring system are more limited in scope. For example:

> **investigative monitoring** was applied in the Meuse basin to detect the causes of chloroform pollution. Abnormally high values for the substance were detected in 2011;

> **additional monitoring** has been set up for drinking-water abstraction points in surface waters and supplying more than 100 cubic metres per day on average, as part of a general monitoring programme by the Health ministry[12].

Distribution of surface-water monitoring points for surveillance and operational monitoring

Source: March/October 2010 report to the EU (Onema) – WIS-FR partners

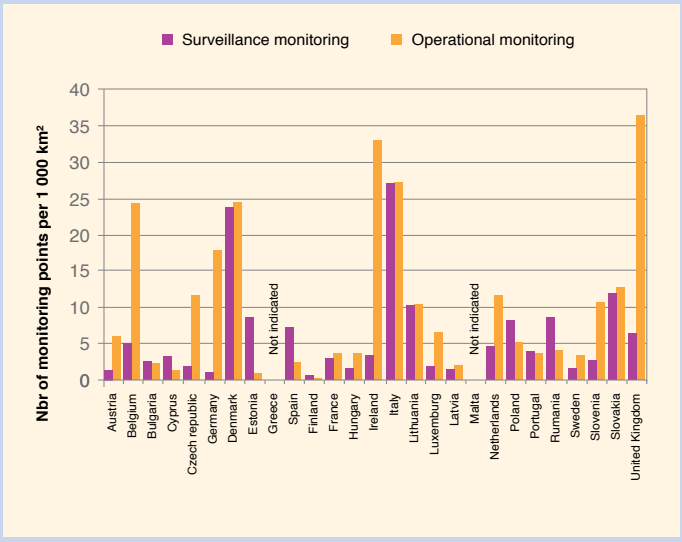


Surface-water monitoring in Europe

In the EU, the 27 Member States monitor their surface waters at 57 300[13] monitoring points, of which 75% are located on rivers, 12% on lakes, 2% in coastal waters and 10% in transitional waters. The term «monitoring point» can vary among the Member States and should be used with caution, however the distribution of points in the EU would seem to correspond closely to the size of each country. To compare the different national monitoring systems, the European commission calculated the number of surface-water monitoring points for all water categories per thousand square kilometres. France ranks 15th for surveillance monitoring (3 points per 1 000 km²) and 16th for operational monitoring (4 points per 1 000 km²). The highest densities were noted in the United Kingdom and Ireland. The number of monitoring points per 1 000 km² for each part of the monitoring system reveals that the countries designed their systems differently in that two-thirds of the countries opted for more operational-monitoring points. The approach depends on the strategy selected by each Member State, in addition to the requirements for water bodies at risk of not achieving good status and the existing pressures.

Density of surface-water monitoring points (per 1 000 km²) in the Member States

Source : WISE - 2007



N.B. The term «monitoring point» varies among Member States and should be used with caution.

[12] Ordinance (21 January 2010) modifying the Ordinance (11 January 2007) concerning the public-health programme to sample and analyse water supplied by a distribution network.

[13] *Report from the Commission to the European Parliament and the Council in accordance with the article 18.3 of the WFD on programmes for monitoring of water status*, COM(2009)156, April 2009.

Monitoring for groundwater

Similar to surface waters, surveillance monitoring of groundwater started in 2007, however, it comprises two networks, one for chemical aspects (the actual groundwater surveillance-monitoring network) and the other for quantitative aspects, e.g. groundwater levels, discharge volumes (the quantitative-monitoring network).

The **surveillance-monitoring network for groundwater** was deployed at 1 775 permanent measurement points covering all of France.

Distribution of groundwater surveillance-monitoring points

Source: March/October 2010 report to the EU (Onema) – WIS-FR partners

Continental France	1 716
Overseas territories	59
All of France	**1 775**

The ordinance dated 25 January 2010[14] set a guideline value for the minimum density of monitoring points for each type of groundwater body. For example, one monitoring point for 500 km² of unconfined groundwater (in contact with the surface) and one monitoring point for 3 000 km² of confined groundwater, as well as sedimentary and alluvial aquifers. The average coverage in France is thus one monitoring point for 616 km² of groundwater (582 km² in continental France and 1 583 km² in the overseas territories).

Two minimum frequency levels are recommended for the control of groundwater quality:

> a complete characterisation every six years covering all monitoring points and all water parameters, during the first year of the WFD management cycle;

> analyses once or twice each year on a limited number of substances, with a sample drawn during a high-flow period and another during a low-flow period for unconfined groundwater, and a single sample per year drawn from confined groundwater.

These frequencies are adaptable if more information is needed.

The **quantitative-monitoring network** was deployed at 1 674 monitoring points. Similar to the surveillance-monitoring network, guideline values for minimum densities were set for each type of water body.

Distribution of groundwater quantitative-monitoring points

Source: March/October 2010 report to the EU (Onema) – WIS-FR partners

Continental France	1 584
Overseas territories	90
All of France	**1 674**

Operational monitoring, for chemical parameters, has been progressively deployed since 2008 at 1 445 monitoring points. The average density is one monitoring point for 756 km² of groundwater bodies (715 km² in continental France and 1 945 km² in the overseas territories).

Distribution of groundwater operational-monitoring points

Source: March/October 2010 report to the EU (Onema) – WIS-FR partners

Continental France	1 398
Overseas territories	48
All of France	**1 446**

The quality elements are selected to enable monitoring of the impact of pressures to which water bodies are subjected. Measurement frequencies must be sufficient to detect the effects of pressures taking into account the hydrogeologic characteristics of the water bodies, with a minimum of one per year (WFD requirement).

Groundwater bodies

Source: March/October 2010 report to the EU (Onema) – WIS-FR partners.

Similar to surface waters, not all groundwater bodies are directly monitored, but the proportion is much higher. A full 94% of all 574 groundwater bodies are monitored directly, including 89% by the surveillance-monitoring network, 78% by the quantitative-monitoring network and 48% by the operational-monitoring network.

The higher percentages compared to surface waters are due to the limited number of groundwater bodies and their very large relative size.

	Continental France	Overseas territories	All of France
Number	534	40	574
Number monitored	502	38	540
% monitored	94%	95%	94%

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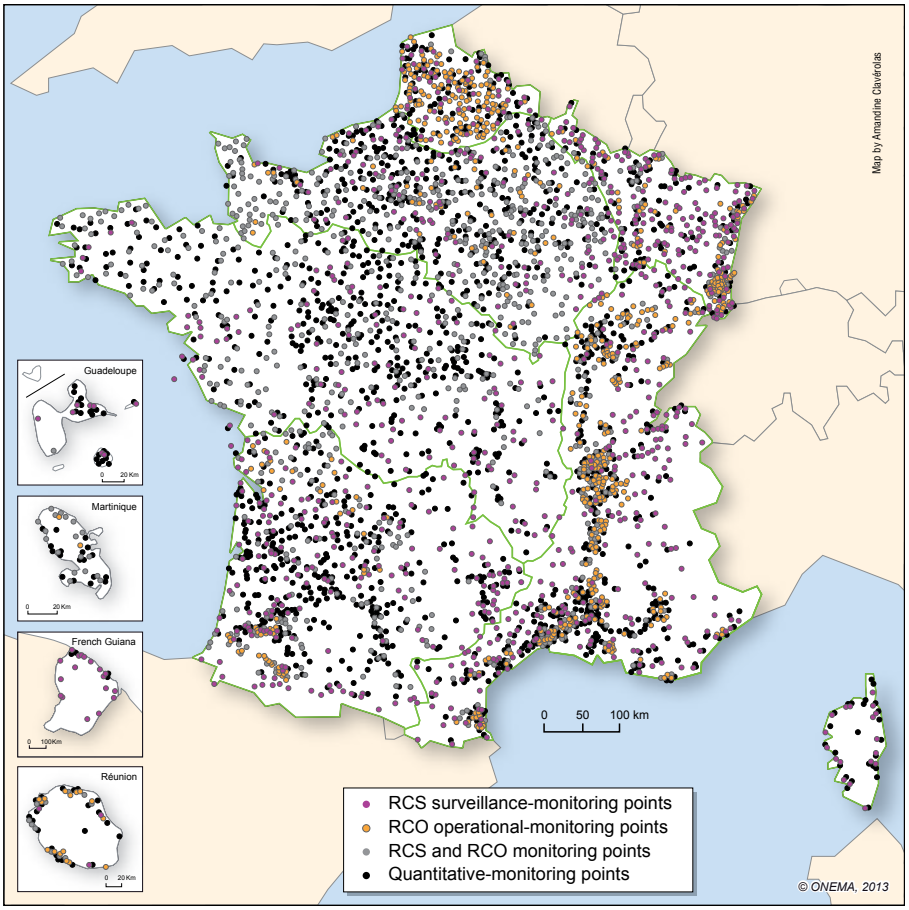
[14] Ordinance (25 January 2010) modified, setting up a water-status monitoring programme.

Similar to the system for surface waters, some monitoring points serve for both surveillance monitoring and operational monitoring, as well as quantitative monitoring. Of the 3 883 monitoring points for groundwater, 15% contribute exclusively to surveillance monitoring, 21% to operational monitoring and 39% to quantitative monitoring.

Distribution of groundwater monitoring points for surveillance and operational monitoring

Source: March/October 2010 report to the EU (Onema) – WIS-FR partners

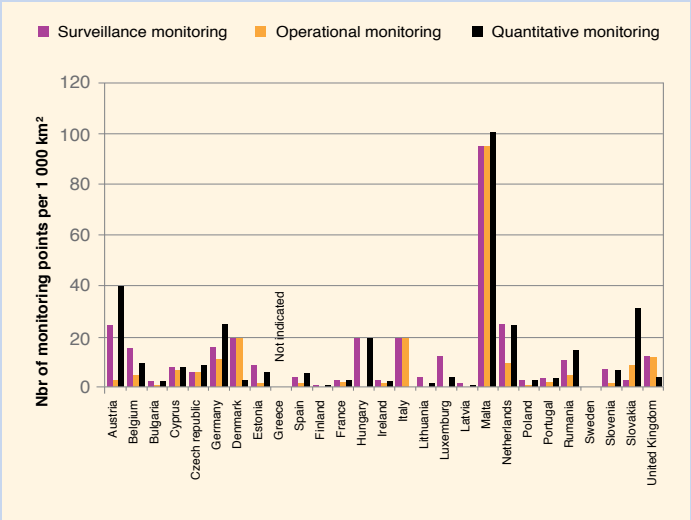


Groundwater monitoring in Europe

Comparisons between European[15] countries are difficult due to the significant differences in the surface areas of water bodies. The main observation is that monitoring-point densities are much higher in central Europe (Germany, Austria, Hungary, Rumania, France), where groundwater is extensively used for drinking water, than in Northern Europe. France ranks 17th for chemical surveillance monitoring (3 points per 1 000 km²), 15th for quantitative monitoring (3 points per 1 000 km²) and 12th for operational monitoring (2 points per 1 000 km²).

Density of groundwater monitoring points (per 1 000 km²) in the Member States

Source : WISE - 2007



N.B. The term «monitoring point» varies among Member States and should be used with caution.

[15] *Report from the Commission to the European Parliament and the Council in accordance with the article 18.3 of the WFD on programmes for monitoring of water status,* COM(2009)156, April 2009.

Monitoring is a complex process with numerous participants

The role and responsibilities of each participant in water monitoring are stipulated in the National master plan for water data (SNDE[16]), itself part of the national water information system WIS-FR. The latter federates the main public stakeholders in the water field and organises the collection, storage, use and dissemination of the data.

> The production of monitoring data is organised on the river-basin district level, under the joint responsibility of the Basin regional directorate for the environment (basin DREAL) and the Water agency (or Water office in the overseas territories).

> The Water agencies are in charge of producing and organising the monitoring data for all water quality elements, aquatic ecosystems and pressure assessments. The basin DREALs are responsible for quantitative data production.

> The Water agencies and basin DREALs call on a number of entities producing data from water and aquatic-environment monitoring systems.

The main producers of data from water and aquatic-environment monitoring systems

Source : SNDE[16]

	Physical-chemical / Chemical	Hydrobiology (fauna and flora)	Hydromorphology	Quantitative data
Rivers	Water agencies and offices	Water agencies, DREAL/DRIEE, Onema[18]	Water agencies, Onema	DREAL/DRIEE, SN, Schapi[19], DDT(M), Météo-France (SPC[20])
Lakes	Water agencies and offices	Water agencies, DREAL/DRIEE, Onema	Water agencies, Onema	
Coastal waters	Water agencies, Ifremer[21], DDT(M)[22] (SPEL[23])	Water agencies, Ifremer, DDT(M) (SPEL)	Water agencies	
Transitional waters	Water agencies, Ifremer, DDT(M) (SPEL)	Water agencies, Ifremer, DDT(M) (SPEL),	DDT(M) (SPEL)	
Groundwater	Water agencies and offices, local governments			BRGM[24], DREAL/DRIEE, local governments

N.B.
(1) Data producers may be government agencies or subcontractors.
(2) For operational monitoring, local governments may also be involved.
(3) In developing national monitoring methods, research institutes are often obliged to collect data over brief periods, however that does not make them data producers.
(4) The cells in the table with no data indicate that the type of monitoring is not implemented for the given water category, e.g. no quantitative data are collected on lakes.

However, WFD monitoring is not limited to data production. A great deal of work must first be put into designing measurement methods and protocols, then later in interpreting and disseminating the data.

To ensure that the data remain consistent and comparable between countries and over time, the WFD requires that the methods used to collect, process and analyse samples comply with applicable (national and international) standards. The advent of new, notably biological quality elements that must be monitored requires that the Member States create and/or adapt existing protocols to the specific conditions in their country. In France, development of these protocols is coordinated by the national reference laboratory Aquaref. Example of a specific method that had to be developed concerned better integration of the physical component in the assessment of river status. The Ecology ministry, Onema, Irstea[25], CNRS and the Water agencies worked together on a protocol, called Carhyce, to characterise the hydromorphology of rivers. The protocol, used by all monitoring participants, serves to collect the data required to assess the impact of pressures weighing on environments and to insert the biological measurements in their local physical context.

Accredited compliance with methods and protocols is a key factor in obtaining reliable data. To ensure data quality, the analyses must be carried out by laboratories according to the rules contained in the regulations, notably the October 2011[26] ordinance. The procedure for laboratories covers the entire data-production process, i.e. sampling (collection, conditioning, transport and storage of samples), analysis of a parameter or a biological quality element, and transmission of the results.

Finally, monitoring data are stored in national databanks, i.e. ADES[27] for groundwater, Naïades[28] for the quality of rivers and lakes, HYDRO[29] for river discharges and QUADRIGE[30] for littoral waters. Data storage must be carried out in compliance with the formats and specifications stipulated by Sandre[31], the National service for water-data and reference-dataset management, in order to ensure consistency and ease of use by all stakeholders. The data are then made available to the public on the www.eaufrance.fr site.

[16] Ordinance (26 July 2010) approving the national water data framework.
[17] www.eaufrance.fr/comprendre/les-donnees-sur-l-eau (in French).
[18] National agency for water and aquatic environments.
[19] Hydrometeorology and flood-prevention support group.
[20] Flood-forecasting service.
[21] French research institute for research and exploitation of the sea.
[22] Departmental Ecology ministry services (in particular the SPC and SPEL).
[23] Water police for littoral waters.
[24] French geological survey.

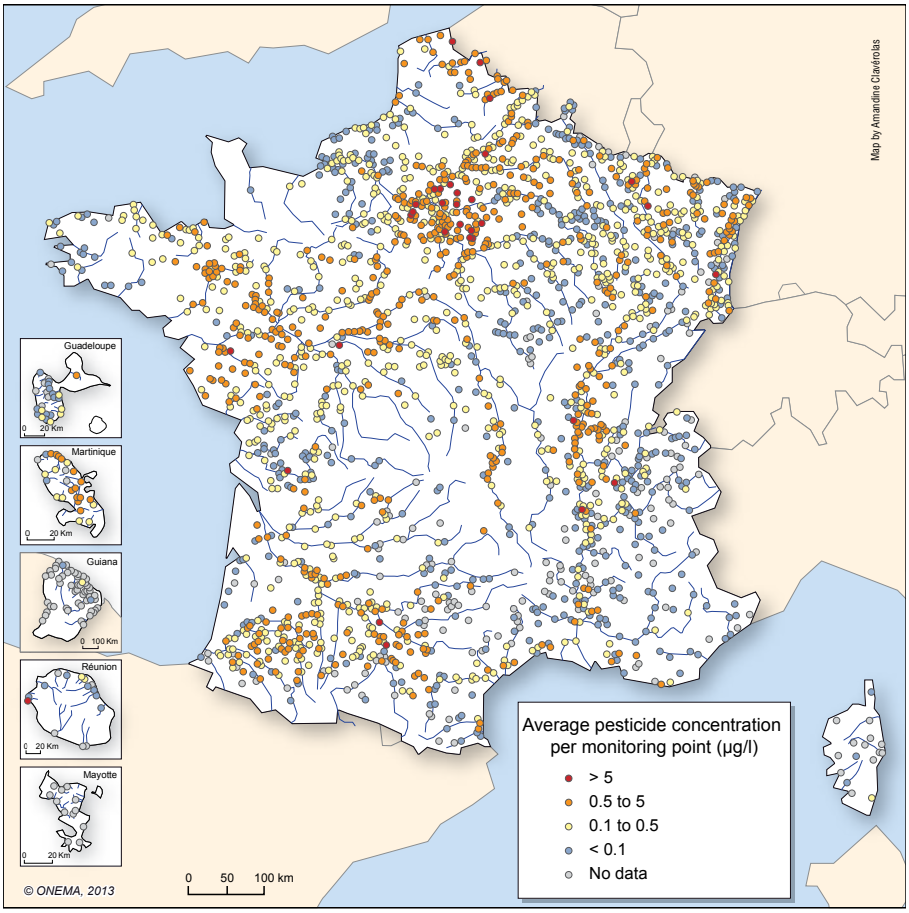
Understanding monitoring results before taking action

Monitoring aquatic environments generates millions of data records each year. Once produced, the information must be interpreted, notably to determine the overall status of water in France. The results serve in particular to check for degradation of water resources and that set objectives are reached. Below are other examples of how the results are used.

The results assist in detecting environmental contamination, e.g. monitoring data are used to measure pesticide concentrations in rivers and groundwater, thus identifying the most contaminated zones and informing on the impacts of farming practices and the role of infrastructure, etc. Another example concerns monitoring of nitrate concentrations in groundwater, which again informs on the impacts on farming practices and may induce local authorities to shut down abstraction of water intended for human consumption.

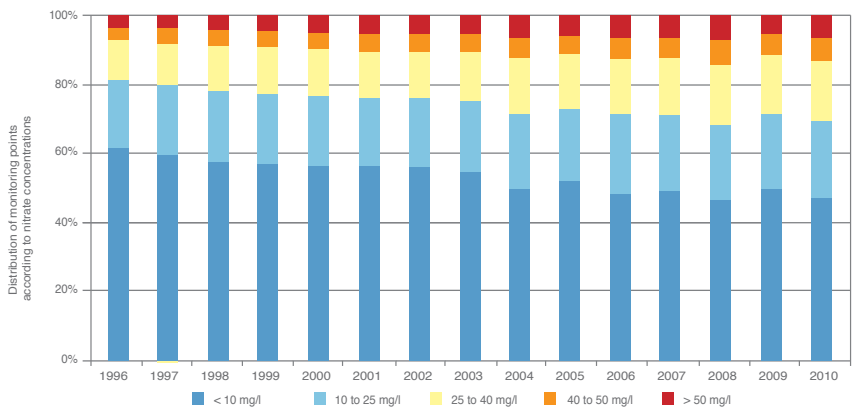
Pesticide concentrations in rivers in 2010

Source: CGDD/SOeS (data provided by Water agencies and offices)



Distribution of groundwater monitoring points according to nitrate concentrations

Source: CGDD/SOeS (data provided by Water agencies and offices, Health and Ecology ministries, regional and departmental councils, water boards)



[25] National institute for research in environmental and agricultural science and technology (formerly Cemagref).

[26] Ordinance (27 October 2011) concerning certification conditions for laboratories carrying out analyses in the field of water and aquatic environments. These conditions are presented on the Lab'eau site, www.labeau.ecologie.gouv.fr.

[27] www.ades.eaufrance.fr

[28] The Naïades database is still in the development phase.

[29] www.hydro.eaufrance.fr

[30] www.quadrige.eaufrance.fr

[31] www.sandre.eaufrance.fr

The results also assist in detecting the presence of certain aquatic species, e.g. threatened species. According to the latest edition of the IUCN (International union for the conservation of nature) red list[32], 15 species of freshwater fish that may disappear from French waters, i.e. one out of five. They include the European eel, Atlantic salmon, Allis shad, Pike, etc. It is acknowledged that the disappearance of a species may have major and unforeseeable consequences on the population dynamics of other species through a cascade effect and can facilitate the installation of alien species. Monitoring activities can also provide data on biodiversity and contribute to informing on the conservation status of species by providing knowledge on populations, e.g. on fish or macroinvertebrates.

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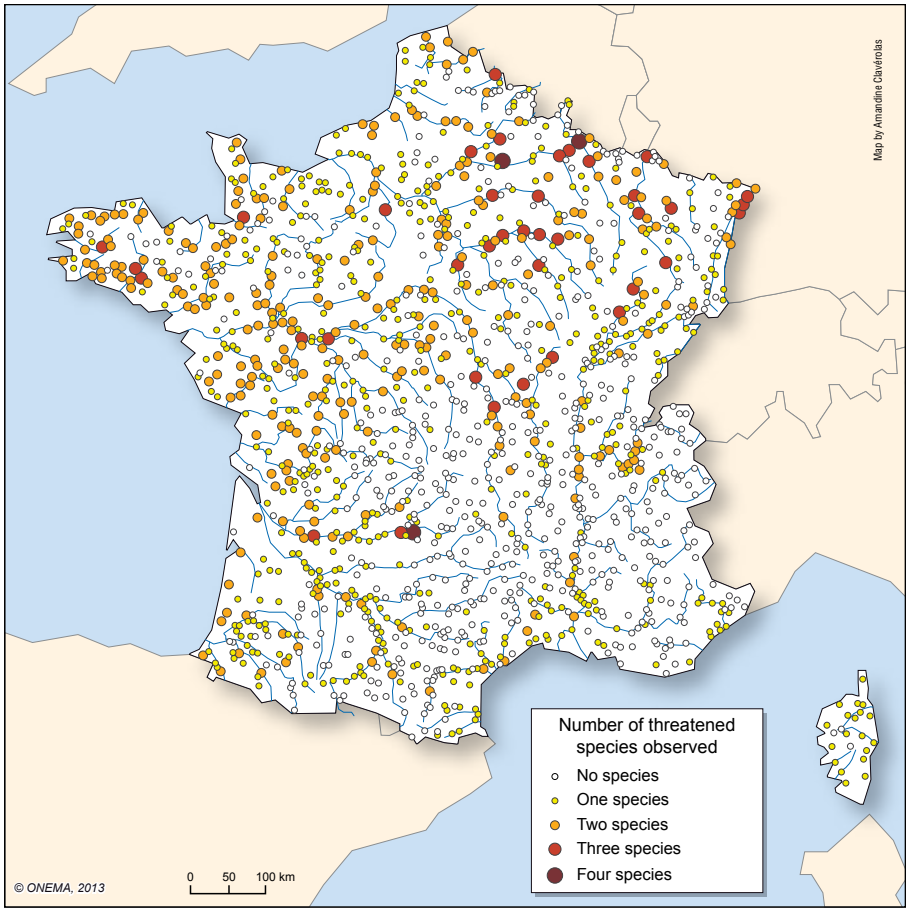
The results assist as well in estimating resource quantities. Measurements on river discharges and groundwater levels supply information required to allocate resources to various uses, i.e. abstractions for drinking water, irrigation and industry. Similarly, these data are crucial in providing flood protection for the population.

Threatened species observed in rivers in 2009-2010

Source : BDMAP (Onema)



Evolution of Fontainebleau groundwater levels from 1972 to 2013

Source: ADES (BRGM) and WIS-FR partners - May 2013

The knowledge on aquatic environments gained through monitoring enables managers and the administrative authorities to select the priority actions required to restore the quality of environments, fight against pollution and preserve the water resources necessary for life and economic activities.

[32] *The Red List of threatened species in France, in the chapter on freshwater fish in continental France, IUCN France*, MNHN, SFI & ONEMA (2010).

Data reporting and access

The European commission requires that the Member States draft and send reports on WFD implementation. This makes it possible to assess implementation compliance with EU legislation and make recommendations, propose new measures or revise the legislation in order to improve policy effectiveness. Failure to comply may result in litigation if the Member States do not correct the situation within a reasonable time delay.
On the national level, the reporting process is an integral part of policy management serving to secure implementation compliance, to check policy consistency and to assess its effectiveness. In France, the river basins send their reports in the form of data sets to Onema, which checks for data consistency, then consolidates the data prior to transmission, via the Ecology ministry, to the European commission.
The reports also serve to inform the public by providing details on the work accomplished and on the progress made in improving aquatic environments. Dissemination of the reports is mandatory to ensure compliance with the requirements of the Aarhus[33] convention concerning access to information, participation of the public in decision-making processes and access to the legal system for environmental issues. The report data are fed into WIS-FR[34] (Water information system for France) and subsequently into WISE[35] (Water information system for Europe).

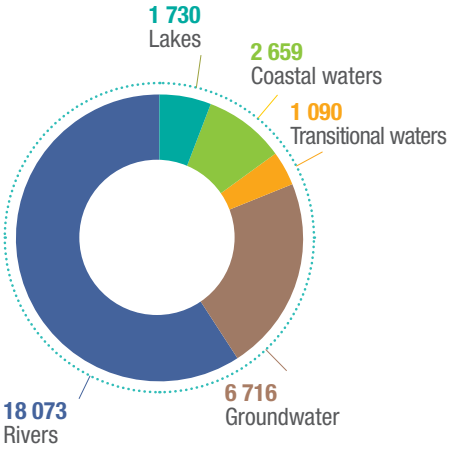
An annual budget of 30 million euros

According to a survey[36] by the Ecology ministry on the river basins in 2011, taking into account the entire monitoring system (from the collection of samples to their analysis and data validation[37]) for all water categories, in both continental France and the overseas territories, WFD monitoring represents a total average annual budget of 30.5 million euros[38] (not including VAT). Compared to the total cost of 27 billion euros for the programmes of measures in the 2010-2015 period, monitoring represents just 0.7%.

Within the monitoring budget, monitoring of surface waters represents 78%, including 59% for rivers. In terms of costs per water body, costs are higher for coastal and transitional waters, as well as for groundwater. This is because they are generally larger and, in compliance with national regulations, they require more monitoring points. They also require more and often expensive technical resources, e.g. boats for littoral waters. Among the river basins, costs per square kilometer are similar for the basins in continental France. They are higher in the overseas territories, notably due to the lack of local laboratories (samples must be sent to Europe), occasionally difficult access to water bodies and the higher percentage of littoral waters.

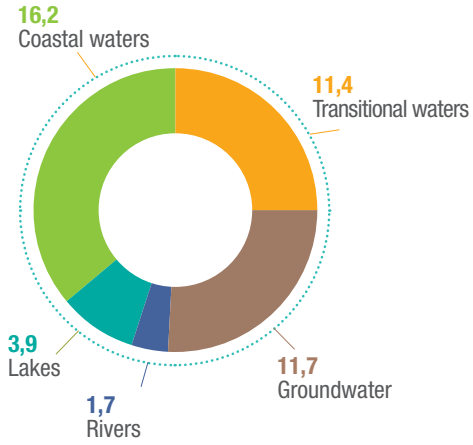
Average annual costs in France, 2007 to 2010, per water category, in thousands of euros

Source: Ecology-ministry survey, data from the Water agencies, 2007 to 2010



Average annual costs in France, 2007 to 2010, per water body and water category, in thousands of euros

Source: Ecology-ministry survey, data from the Water agencies, 2007 to 2010



[33] Law 2002-285 (28 February 2002).
[34] The data delivered to the EU commission are available at www.rapportage.eaufrance.fr.
[35] www.water.europa.eu/
[38] Costs are difficult to evaluate (notably because the surveyed agencies calculate full-time equivalent jobs differently) and the resulting figures are imprecise, however the overall volumes are accurate.
[37] This does not include data analysis or communication and information work.
[38] According to a survey by the Ecology ministry, for the period 2007 to 2010, the total cost is approximately 122 million euros, to which another 59 million euros must be added for additional networks.

Future monitoring programmes

The monitoring programmes will be revised by the end of 2014, following the updating of the Article 5 reports, and implementation of the new programmes will begin in 2015. Information on the new monitoring programmes will be sent to the European commission at the start of 2016, as part of the new RBMPs (river-basin management plans) for 2016 to 2021. To meet the above deadlines, the technical details will be determined and a government ordinance issued in 2014.

The General council for the environment and sustainable development (CGEDD) issued recommendations for the revision of the monitoring programmes, after consulting all stakeholders, in particular the Water and biodiversity directorate of the Ecology ministry, the Water agencies, DREALs, Onema, etc. The recommendations concern:

> management of the monitoring programme;

> better organisation of monitoring networks;

> enhanced reliability of the data-production system;

> better use of monitoring results.

[39] *Revising the water-monitoring strategy in France, Report no. 008376-01, CGEDD,* June 2013 (in French).

[40] For example, the recommendations made by the Onema scientific council may be found at http://www.onema.fr/IMG/pdf/Saisine-surveillance-CS-Onema12-04-2013.pdf.

Note on methods

The information presented briefly here was prepared using a method implemented jointly by Onema, IOWater and the members of a national working group (GVI) comprising the Water agencies and offices, the Water and biodiversity directorate of the Ecology ministry, basin DREALs, SOeS and research institutes such as BRGM, Ifremer and Ineris. Numerical and mapping data were drawn exclusively from:

> the data, collected in the river basins and consolidated on the national level, contained in the March 2010 report to the European commission. The report included information on previous steps in WFD implementation, e.g. boundaries and the list of competent authorities, plus, for each basin, the management plan, programme of measures, Article 5 report, list of protected zones and monitoring programme. (France met the March 2010 deadline, but sent a follow-up report containing additional information and corrections in October 2010). The data is accessible on the www.rapportage.eaufrance.fr site;

> a survey on WFD monitoring costs (2007 to 2010), carried out in 2011 by the Ecology ministry using a questionnaire sent to each river basin. The questionnaire covered all WFD monitoring on all water categories. The instructions stipulated that cost subtotals were to be calculated for the various data-production operations (collection, substance detection and analysis). The calculated costs did not include VAT. They covered the first years during which the monitoring programmes were launched, at a time when the river basins had not all achieved the same level of progress;

> the report of the European commission to the European parliament and the Council, published in compliance with article 18, paragraph 3, of the 2000/60/EC Water framework directive, concerning water-status monitoring programmes (2009) on the basis of data reported in 2007.

For more information

Data on the monitoring programmes may be found at: www.rapportage.eaufrance.fr

Find this document on the internet at: www.eaufrance.fr/IMG/pdf/surveillance_201308_EN.pdf or www.documentation.eaufrance.fr

eaufrance The French water-information portal at www.eaufrance.fr

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the Brief

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