JOINT MEDITERRANEAN EUWI/WFD PROCESS

Status report on inland water quality monitoring in the Mediterranean

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Produced by the

MEDITERRANEAN Water Monitoring WORKING GROUP

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1 EXECUTIVE SUMMARY

A questionnaire survey was carried out among Mediterranean Partner Countries of the European Union to map water resources monitoring practices throughout the Region, using the water monitoring approach of the EU Water Framework Directive (WFD). The results of the survey are discussed in the context of monitoring requirements established by the WFD and implemented by EU Member States. The main characteristics of the European water quality monitoring system are briefly illustrated highlighting the role of water quality monitoring in the implementation of the WFD. Case studies describing water quality monitoring in the Jucar Basin in Spain and the evolution of national water quality monitoring strategies in France provide concrete examples of the implementation of monitoring activities under the WFD. These European experience gained during recent years can serve as a useful model for upgrading and standardizing monitoring practices in the southern Mediterranean. This is illustrated by the recent twinning programme on water quality monitoring in Egypt and the case studies of the Sebou Basin in Morocco and the Litani Basin in Lebanon where water monitoring and water resource management practices have been tested. A number of concrete recommendations are provided to promote advancement towards shared strategic objectives aiming at controlling environmental degradation in the Region while providing water with sufficient quality to maintain local life and economic activities.

Finally, it is recommended that a number of pilot studies be undertaken in the southern Mediterranean, in suitable sites selected by local MPC authorities, to test challenges and opportunities for the implementation of Integrated Water Resources Management policies on the basis of the WFD experience. These pilot experiments would support the definition of a common water quality assessment strategy that would provide an understanding of the main trends in water resource degradation at regional level and will support collective initiatives by MPCs.

2 INTRODUCTION

The “Joint Mediterranean Process” (JP) is a technical collaboration platform established between the countries bordering the Mediterranean. It aims at sharing experiences gained through the implementation of the WFD to raise awareness about Integrated Water Resources Management and to develop specific implementation tools tailored to serve management purposes within a Mediterranean context.

The WFD establishes a framework for the protection of all waters (including inland surface waters, transitional waters, coastal waters and groundwater) which:

- Prevents further deterioration of, protects and enhances the status of water resources;
- Promotes sustainable water use based on long-term protection of water resources;
- Aims at enhancing protection and improvement of the aquatic environment through specific measures for the progressive reduction of polluting discharges, emissions and releases of identified hazardous substances and the cessation or phasing-out of discharges, emissions an releases of a set of priority hazardous substances;
- Ensures the progressive reduction of pollution of groundwater and prevents its further pollution; and
- Contributes to mitigating the effects of floods and droughts.

The Joint Process articulates its activities through 6 identified working groups, whose mandates were established by approval of the Euro-Mediterranean Water Directors:

- Groundwater management
- Drought and water scarcity
- Shared water resources management
- Monitoring networks and programmes
- Wastewater reuse
- Linking rural development with water management

The working group on “Monitoring networks and programmes” is the most recently established. Its mandate was validated by the Euromed water directors in December 2007. The first objective aims at characterising monitoring activities taking place in the Mediterranean Partner Countries (MPC), in order to identify main priorities for improving water monitoring strategies and programmes.

A draft long-term Strategy for Water in Mediterranean (SWM) was proposed by the Union for the Mediterranean (UfM) but not yet officially adopted by competent national authorities. This strategy was developed along the lines established by the Millennium Development Goals (MDGs, 2000), targets set at the World Summit on Sustainable Development (WSSD, 2002), and is compatible with the Mediterranean Strategy for Sustainable Development, established by all the concerned Parties who participated in the Barcelona Convention. The SWM partners agreed on a number of shared objectives:

(i) Establishing the existing demand for water,

(ii) Promoting integrated management at river basin level,

(iii) Contributing to the achievement of the MDGs by 2015,

(iv) Promoting participation, partnership, and active cooperation at local, regional and national levels.

The SWM proposes to establish “a common policy framework for achieving integrated water resources management (IWRM)” in the region. This strategy promotes key WFD concepts, such as the ‘user-pays’ and ‘polluter-pays’ principles, and focuses on demand management rather than on the development of non-conventional water resources (e.g., large-scale desalination). In parallel to the Directive, the SWM sets target dates comprised between 2012, 2025 and beyond, for the achievement of its objectives.

The Strategy for Water in Mediterranean opened up new areas of activity for the Joint Process and its working groups. A third JP phase is planned to provide technical support for the preparation of the SWM Action Plan and to strengthen initiatives developed under the JP working groups, in particular the one on Monitoring Networks and Programmes.

The specific objective of this JP Working Group is to promote exchange between EU and non EU Mediterranean partners for promoting transfer good practices in the improvement of monitoring networks. In particular, it is considered that non-EU Member States can greatly benefit from the experience gained during WFD implementation in EU Mediterranean Countries. The focus of JP activities is on groundwater monitoring with a special focus on quantitative aspects, given that water scarcity and the wise management of groundwater resources are major issues, particularly in the Mediterranean Region. However water quality monitoring is also taken into consideration, given the direct linkage between quality and quantity.
The monitoring of surface and coastal waters represents the core activity of the WM working group, and it is integrated with groundwater management & monitoring. While the SWM aims under this topic to:
- Ensure the good quality of public water services to support access to adequate and affordable water supply and sanitation, in particular for the poor, by developing and managing drinking water and sanitation infrastructures, by fulfilling public health considerations and preventing the further deterioration of water resources quality among other needs;
- Reduce and prevent water pollution, expand the scope of water protection to include resource management, and avoid the overexploitation of water resources, by supporting all countries in reaching a good status for all waters, based upon comprehensive site-specific assessments. In addition, control the use of fertilizers and pesticides by enforcing appropriate recommended standards.

To fulfill the aforementioned objectives, the Action Plan to be developed under this working group will focus on:

- Assessing and monitoring available water resources and characterizing water demands derived from both human activities and the environment.

- Setting qualitative and quantitative targets for local, national and regional planning, with a particular focus on transboundary resources.

- Assessing the performance of monitoring networks (at local, national and regional level), and their linkage to water information systems at local, national & regional level.

- Testing IWRM concepts at local level by carrying out assessments in pilot river basins where water quality monitoring networks are well established.

The specific objective of this report is to provide a characterization of water monitoring networks and programmes in the Partner Countries from the southern Mediterranean. Thanks to the support of the DG Environment of the European Commission, the following activities were carried out in view of the preparation of this report:

- a survey of water resources monitoring activities specifically addressing non-EU countries of the Mediterranean Region (Spring/summer 2009);
- a workshop for exchanging experiences and discussing the results of the survey (October 2009, Beirut);
- the collection of complementary information and preparation of a synthesis of the survey and the draft report;
- a working group meeting to exchange experiences and finalize the report and its recommendations on 10 November 2010 in Madrid.

3 DEFINITIONS

Hereafter, a list is provided, including main concepts and definitions concerning water monitoring issues as referred to in the EU WFD, that are going to be employed in the outputs produced by the Working Group on water quality monitoring.

Water Type: inland (surface water and groundwater), transitional and coastal waters.

Surface waters: Water bodies that are above ground, comprising four different categories: rivers, lakes, transitional waters (estuaries), and coastal waters. Surface waters include also the so-called: 'heavily modified water bodies', e.g. water bodies that have been heavily modified by human intervention, e.g. reservoirs or harbors; and 'artificial water bodies', e.g., water bodies created by man at sites where no water body was present,, (e.g. ditches or canals).

Body of surface water: A discrete and significant element of surface water such as a lake, a reservoir, a stream, river or canal, part of a stream, river or canal, a transitional water or a stretch of coastal water.

Groundwater: All water which rest below the surface of the ground within the saturated zone and in direct contact with the ground or with the subsoil.

Aquifer: Subsurface layers of rock or other geological strata of sufficient porosity and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater. Aquifer types:

- Major alluvial and coastal plain sediments where groundwater-surface waters relations are likely to be complex;
- Colluvial systems situated between mountains, discharging mainly into springs and/or supporting directly river base flow;
- Consolidated sedimentary aquifers – limestones, chalk and sandstones;
- Karstic (mountain or plain) areas with or without external inflow;
- Marls and clays with local aquifers made of limestones or sands;
- Recent coastal calcareous formations and islands;
- Glacial and associated small alluvial formations;
- Extensive volcanic terrains;
- Weathered and fresh crystalline basement (including metamorphic rocks such as gneisses and schists).

Body of groundwater: A distinct volume of groundwater within an aquifer or aquifers.

Protected areas: Areas of land and/or water under special management regime, where water quality/quantity objectives are set according to provisions that are additional to the normal regulatory framework. These areas may include, among others, sites identified for the protection and maintenance of biological diversity, as well as sites considered particularly vulnerable to the impacts of diffuse pollution.

River basin: The area of land drained by a single river, stream or lake; also known as 'drainage basin' or 'watershed' (U.S. literature).

River basin district: Main management unit defined for the implementation of IWRM.

Water body: Coherent sub-unit in the river basin (district) to which the environmental objectives should be applied.

The main purpose of identifying 'water bodies' is to enable the status to be accurately described and compared to environmental objectives. "Water bodies" are therefore the units that will be used for reporting and assessing compliance with the principal environmental objectives.

Monitoring: Act of observing something and keeping a record of it. Monitoring the status of surface water, groundwater and protected areas is described under Article 8 of the WFD. Monitoring programmes for surface waters, groundwater and protected areas are required to establish a coherent and comprehensive overview of water status within each river basin district.

Reporting: The drafting of written reports which assemble information from each river basin: maps of the monitoring networks; maps of water status and, estimates of the confidence and precision attained by monitoring systems.

Pollutant: Any substance liable to cause pollution. Pollution is the introduction of contaminants into an environment that causes instability, disorder, harm or discomfort to the ecosystem i.e. physical systems or living organisms.

Quality elements: parameters used for the classification of water body ecological status. Categories of quality elements include the biological elements and hydro-morphological, chemical and physico-chemical elements. The use of non-biological indicators for estimating the condition of a biological quality element may complement the use of biological indicators but it cannot replace it.

Risk: At the simplest level, a risk can be thought of as the chance of an undesirable event happening. It has two aspects: the chance, and the event that might happen. These are conventionally called the probability and the consequence.

Confidence: The long-run probability (expressed as a percentage) that the true value of a statistical parameter (e.g. the population mean) does in fact lie within calculated and quoted limit values placed around the estimate actually obtained from the monitoring programme (e.g. the sample mean).

Precision: Most simply, precision is a measure of statistical uncertainty equal to the half width of the C% confidence interval. For any one monitoring exercise, the estimation error is the discrepancy between the answer obtained from the samples and the true value. The precision is then the level of estimation error that is achieved or bettered on a specified (high) proportion C% of occasions.

4 *MONITORING UNDER THE EU WATER FRAMEWORK DIRECTIVE*

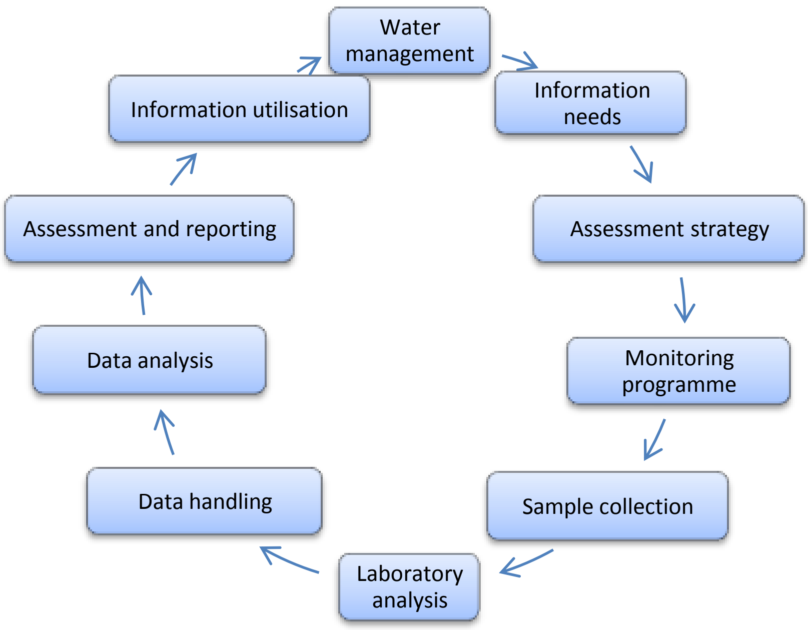
4.1 RATIONALE

The Water Framework Directive (WFD) was published in the Official Journal of the European Communities on December 22, 2000 (2000/60/EC). It compels Member States to establish a water management framework for the protection of all inland waters by subdividing the landscape into river basin districts, i.e. “area of land and sea, made up of one or more river basins together with their associated groundwater and coastal waters”. The WFD sets a clear and an ambitious objective: achieving ‘good status’ of ground-, surface and coastal waters in Europe by 2015. For management purposes, the territory of the European Union has been subdivided into river basin district, including a number of water bodies, identified on the basis of their relative homogeneity, defined as “consistent sub-units to which environmental objectives must be applied”.

‘Good status’ is defined by qualitative (ecological, chemical) and quantitative parameters. It includes:

- a reduction or suppression of discharges of certain substances classified as hazardous or priority hazardous,
- no additional degradation for surface water and groundwater,
- compliance with the objectives set for protected areas, (according to the specific requirements defined for each single protected area).

Figure 4.2.1. Water quality monitoring is a key component of the water management cycle under the WFD.



4.2 Role of water quality monitoring under the WFD

Monitoring programmes are required to establish a coherent and comprehensive overview of water quality status within each river basin district.

Water quality monitoring does not include only analyzing water samples to check if concentrations values fall within a predetermined set of standard limits. Under the WFD, monitoring is required to describe the ecological status of water bodies in comparison to a reference site, check for long-term trends, and report information useful for feeding the Programme of Measures.

At the outset, monitoring comprises a number of essential steps from the definition of key parameters to field assessment, laboratory analysis of samples, data management and finally reporting. Through these steps, monitoring needs to fulfill a number of specific targets set by the WFD, including the characterization of water body types, the classification of water quality status, the quantification of reference conditions, the assessment of long-term changes in natural conditions due to natural causes or to anthropogenic activities, the assessment of the status of water bodies subject to the implementation of measures for improvement or for preventing further degradation, as well as others assessments and quantifications required by the WFD implementation process.

As can be seen in the Figure below, monitoring activities play a central role in the implementation of key elements of the WFD strategy. By documenting current trends in water quality status, monitoring activities enable on one hand the setting of concrete environmental objectives, and on the other inform risk assessment procedures highlighting the most significant water management issues.

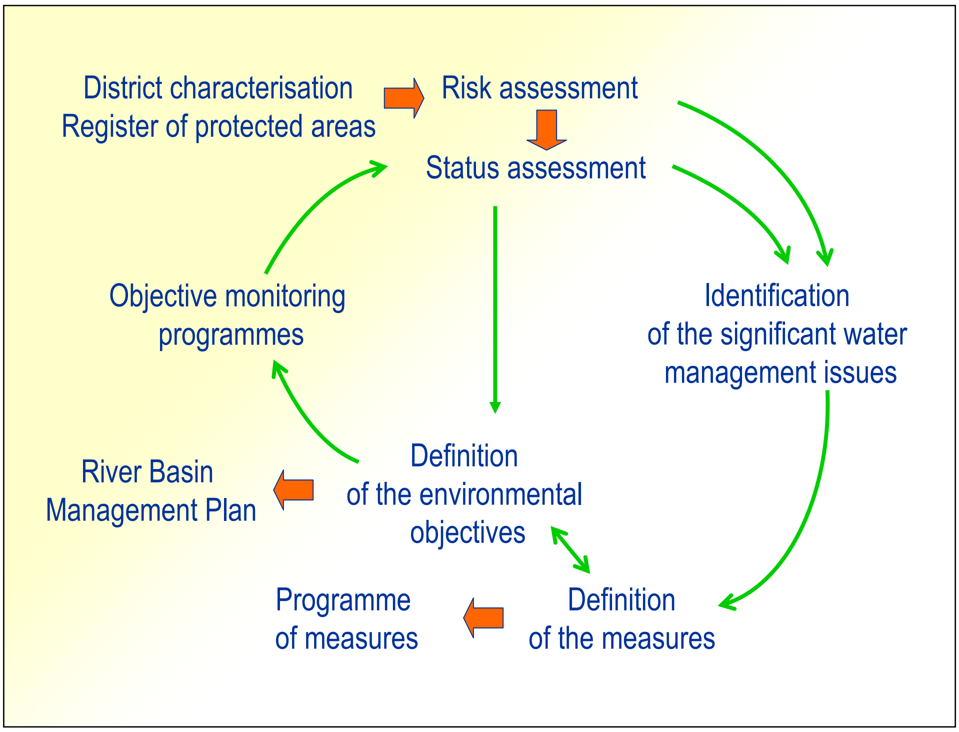


Figure 4.2.2. The WFD implementation cycle

The definition of corrective measures calls for specific monitoring activities dedicated to assess the success or failure of the Programme of measures implementation. Collectively, these activities inform the River Basin Management Plan and defined revised monitoring programmes. If early monitoring programmes may need to document a large number of parameters and potential pressures, with a progressive refinement through experience, following monitoring programmes can become more selective and more cost-efficient.

The complex role born by monitoring activities induced experts to define three main types of monitoring activities according to three main objectives.

4.3 WFD MONITORING TYPES

Surveillance monitoring is designed to provide a consistent overall picture of the ecological and chemical status of each river basin district and to support the classification of water bodies in 5 water quality classes. It shall allow evaluating long-term changes in the natural conditions or resulting from high anthropogenic activity, and inform future surveillance monitoring programmes. The optimal density of the monitoring sites is reached when a sufficient number of water bodies is included in the monitoring programme to provide an assessment of the overall surface water quality status within each sub-catchment of the river basin district. Surveillance monitoring is likely to be more extensive than other monitoring types as they represent the initial and the basic monitoring effort. Surveillance monitoring activities may be simplified and reduced on the basis of information collected during the implementation of monitoring programmes.

What to monitor?

- Parameters indicative of all biological, hydro-morphological and general physico-chemical quality elements
- Priority List substances if discharged in River Basin
- Other pollutants if discharged in significant quantities

Operational monitoring concerns sites representative of the quality of 'water bodies at risk'; i.e. unlikely to achieve their environmental objectives. This monitoring type aims at reaching an appropriate level of reliability in the classification of the 'good status' of the water body at risk and to inform managers about the presence of significant and lasting upward trends regarding the concentration of pollutants. Operational monitoring is carried out to assess changes in the status of water bodies at risk after the implementation of restoration measures.
The selection of operational monitoring sites is based on the results of a 'pressures and impacts analysis' or through the assessment of the results of the analyses made during surveillance monitoring. The parameters monitored are those that are most sensitive to the pressures exerted on the water body.

What to monitor?

- Parameters indicative of those biological and hydro-morphological quality elements most sensitive to the pressures to which the body(ies) are subject
- Only those priority substances discharged, and other significant pollutants (including nutrients) e.g. that might cause failure of Environmental objectives

Where to monitor?

- Number of monitoring stations needs to be sufficient to assess the magnitude and impact of –significant point sources,–diffuse sources and –hydro-morphological pressures
- More than one station per water body may be required
- Water bodies can be grouped as long as groups are similar in terms of:–Type–Pressures to which they are subject–Sensitivity to those pressures

Investigative monitoring is called upon in specific cases:

- Where the reason for any exceedences (in respect of the standards set through water body specific Environmental Objectives) is unknown;

➢ Where surveillance monitoring indicates that the objectives for a given water body are not likely to be achieved and operational monitoring has not yet been established, in order to ascertain the causes of failure in achieving the environmental objectives; or

➢ To ascertain the magnitude and impacts of accidental pollution.

The final objective of this monitoring type is to inform the Programme of measures and to guide its implementation for the achievement of environmental objectives and to counteract the effects of accidental pollution. Investigative monitoring will thus be designed to fit the specific cause of degradation being investigated. Accordingly, in some cases, it will be more intensive in terms of monitoring frequencies and more or less focused on specific quality elements.

Some examples of investigative monitoring:

- Pollution incidents
- Assess the potential effects related to specific activities e.g. sheep dip use
- Assess source apportionment between point/diffuse pollution in selected catchments
- Examine surface/groundwater interactions
- Assist with the issuing of licenses

4.4 CHOICE OF INDICATORS

The monitoring objectives called for by the WFD require the selection of adequate parameters for the specific purpose of the type of monitoring activity carried out. A useful concept to take into consideration in the selection of appropriate indicators is the D-P-S-I-R model (see below), through which potential events leading to a degradation of the environment can be categorized and better focused.

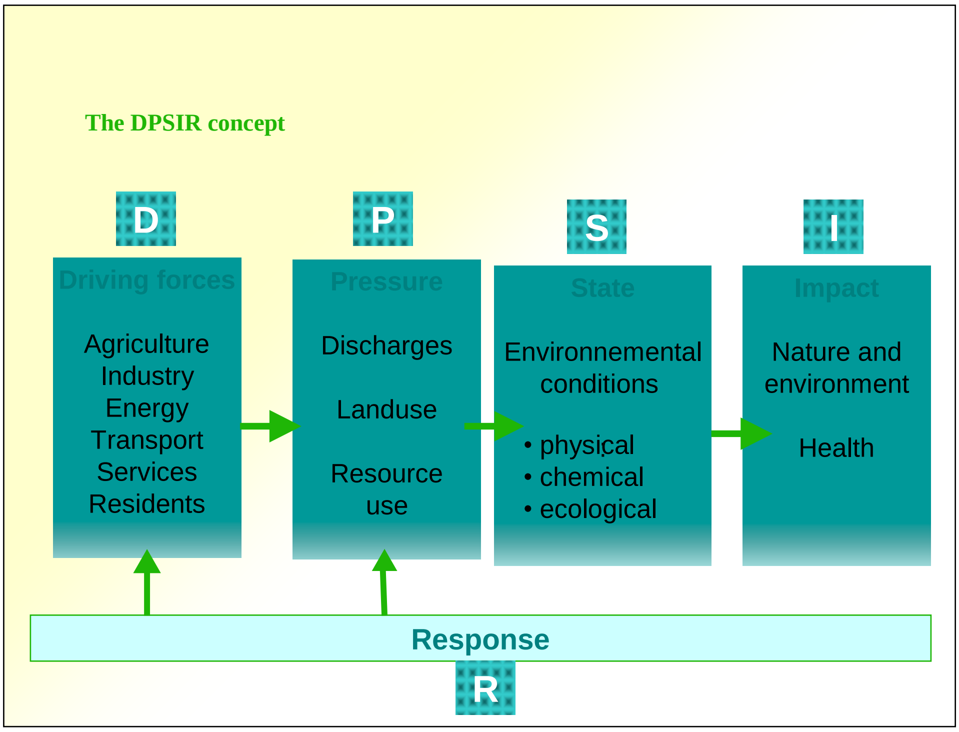


Figure 4.4.1. The D-P-S-I-R (Driving forces – Pressure – State – Impact - Response) concept illustrated

Field monitoring generally provides information on the status of the resource (S) and on some of the impacts (I) generated. In reality, each of the 5 compartments defines a different context and therefore different indicators can be selected to document its condition. To propose an effective response (R), decision-makers need to be able to follow the entire cascade of events from driving forces to the

generated pressures transferred into environmental compartments, and producing impacts on their components. By measuring indicators at each level, the transfer functions that translate drivers into pressures and these onto changes in state and finally into impacts can be derived, providing decision-makers with a complete perspective over the processes that can be responsible for water quality degradation.
While in the present report we focus on water quality data, clearly the integration of different sectors required by IWRM implies obtaining and processing information on a variety of activities described in the DPSIR chain of events.

Box 1
The EU-Egypt "Water Quality Management" Twinning Project (2008-2011) documented the main local drivers producing pressures onto the water quality status of Lake Nasser. To do this, all human activities within the Egyptian portion of the Lake Nasser catchment were described and mapped; these included 4 main categories: agriculture, residential wastewater, fishery practices and navigation. Each category was described using a number of suitable indicators identified by a compromise between the significance of the underlying processes and data availability. For example: agriculture (as a Driver) was documented by the number of heads of cattle and the surface of irrigated (and fertilized) agricultural plots. Coefficients (transfer functions) derived by experts advice were applied to calculate potential changes in state caused by the mobilization of the pressure, while field monitoring provided information on the current water quality status. The synthesis of these two aspects provided a forecast of potential impacts on the water quality status. To illustrate this by a concrete example: heads of cattle (D) were translated into kg of nitrogen moving towards the reservoir (P). The estimates show that the change in the current state conditions (S) caused by cattle husbandry are unlikely to cause a significant eutrophication (Impact) of the water body.

4.5 MONITORING PROGRAMMES FOR DIFFERENT WATER BODY TYPES

While ecological status assessment is performed in rivers, lakes, transitional waters (estuaries) and coastal waters, in the case of heavily modified water bodies as well as artificial ones, their quality status is referred to the maximum ecological potential that could be reached under their specific conditions. Groundwater is monitored with specific programmes and parameters that are uncommon for other monitoring programmes, due to its very particular nature.

The following Table resumes the variety of monitoring programmes according to water body type.

	River	Lake	Transitional water	Coastal water	Heavily modified or artificial	Ground water
Ecological status	√	√	√	√	x	x
Ecological potential	x	x	x	x	√	x
Surface water chemical status	√	√	√	√	√	√
Groundwater chemical status	x	x	x	x	x	√
Groundwater quantitative status	x	x	x	x	x	√

Table 4.5.1. Monitoring programmes according to water body type

Monitoring activities are adapted for each water body type.

- **Surface waters**

  Monitoring programmes for surface waters should cover:

  - The ecological and chemical status of natural water bodies,
  - The ecological potential and the chemical status for heavily modified and artificial water bodies.

  The assessment of *ecological status* is based first of all on the monitoring of biological quality elements, as well as of supporting hydro-morphological, chemical and physicochemical quality elements.

  Information on the type and magnitude of the significant anthropogenic pressures to which the surface water bodies in each river basin district are subject has to be collected and stored in an organized fashion. Sufficient detail needs to be provided concerning the temporal and the spatial variability of the parameters considered.

- **Groundwater**

  - Quantitative status: water level monitoring.

  The aim of water level monitoring is to check that abstraction from each groundwater body will be such that the available groundwater resource is not exceeded by the long-term annual average rate of abstraction. This is meant to prevent a significant reduction in groundwater status.

  - Chemical status: surveillance and operational monitoring.

  The assessment of chemical status is based on measurements of conductivity and pollutants' concentrations.

  The design and operation of groundwater monitoring programmes should be informed by:

  - The specific objectives applying to the groundwater body;
  - The characteristics of the groundwater body, or group of bodies;
  - The existing level of understanding (i.e. the confidence in the conceptual model/understanding) of the particular groundwater system;
  - The type, extent and range of the pressures on the body, or group of bodies;
  - The confidence in the assessment of risk from pressures on the body, or group of bodies; and
  - The level of confidence required in the assessment of risk.

  A conceptual model is drawn, representing the current understanding of the groundwater system based on information on its natural characteristics and the pressures that are exercised on it. Monitoring should provide information to test the model/and, where necessary, improve it so that an appropriate level of confidence can be achieved in the prediction and assessment of groundwater issues.

- **Protected Areas**

  These may include areas located around sources of drinking water, areas identified for the protection of habitats and species, and other areas under special management regime.

  These water bodies have to be monitored for all substances discharged in significant quantities that could affect the water quality status.

4.6 *WFD, Reporting and Dissemination*

Environmental information has been shared voluntarily in Europe for some time. Under the WFD Member States of the European Union are compelled by law to produce a series of mandatory reports on the quality of the environment.

To store, manage, and share these data a number of supporting systems has been defined, including in particular:

- **INSPIRE** (Infrastructure for Spatial Information in Europe) sets the legal framework and general rules for geographical data exchange between European Community users (geo-referenced data only). It was created by the European Directive 2007/2/EC.
- **WISE** (Water Information System for Europe): is a joint initiative of the European Commission and of the European Environment Agency aiming at modernizing and coordinating the collection and dissemination of information related to the European water policy (http://water.europa.eu/). It incorporates all of the mandatory reports submitted by member States under the “water” Directives. It includes as well information provided by EIONET-SoE reporting (“status of the environment” of the European Environmental Information and Observation Network of the European Environment Agency). The main services offered by WISE visualize the data by defining maps and figures. These data support surveys on the status of the environment including conformity evaluation, trend analyses and impact assessment studies.

WISE and INSPIRE are compatible with the Shared Information System **(SEIS**) which is currently being implemented in the European Union. This initiative aims at creating a common environmental information system, based upon modern technological tools such as Internet and satellite technologies, to maintain and improve data quality and availability (collection, sharing and interoperability).

5 EXPERIENCES WITH WFD-MONITORING IN EU-MEMBER STATES

5.1 JUCAR BASIN (SPAIN)

The Júcar Basin in Spain is characterized by a high degree of water use, a complex water allocation pattern and by increasing point and diffuse pollution. Water quality modeling was implemented using SIMGES (water allocation) and GESCAL (water quality) basin scale models. Both are part of the Decision Support System AQUATOOL, one of the main instruments combining water quantity and quality used in Spain in order to support decision-making in compliance with the WFD.

The Jucar River Basin is located in the East of the Iberian Peninsula; it covers 22,436 km^2 and includes the territory of three autonomous regions: Castilla-La Mancha, Comunidad Valenciana and Aragon. Water resources management pertains to the Jucar River Basin Authority, which includes under its responsibility an area of 43.000 km^2, with some 970.000 inhabitants (+200.000 seasonal "residents" during the tourist season).

The basin consists of three types of regions: semiarid, sub-humid and humid. The climate is Mediterranean with a mean annual precipitation of 500 mm varying from 200 mm in the South to 1000 mm in the North-West. Mean annual runoff amounts to about 75 mm representing 15% of the precipitation. The most important rivers in the basin such as the Jucar (509 km), the Cabriel and the Magro are regulated by dams, such as Alarcon, Contreras and Tous. The basin hosts the Albufera Lake, a wetland protected under the RAMSAR Convention, which receives surface as well as groundwater inflow.

Groundwater assessment identified 15 hydro-geological units or groups of aquifers, some of which are shared with other river basins (Turia, Serpis and Vinalopo). Overall, water resources amount to around 1,690 hm^3/year of which groundwater represents 70%. At the present, groundwater abstractions represent770 hm^3/year, and are used to satisfy agricultural and residential demands. The intensive use of groundwater in irrigation (90% of the total water demand); such as in the Ribera region, caused over-exploitation in some aquifers, such as in the Mancha Oriental. Water transfer schemes, such as the Jucar-Turia channel, export an annual volume of around 130 hm^3, an estimate expected to rise with the Jucar- Vinalopo channel which should transfer an additional 80 hm^3.

Following the WFD, the Jucar River Basin Plan established specific water quality standards for different uses as well as water quality discharge limits to guarantee the achievement of good status Surface and groundwater monitoring networks have been revised and equipped with automatic as well as real time monitoring devices. The Automated Information System on Water Quality (SAICA) is set-up along the rivers to provide a continuous water quality assessment. The construction of an Automatic Hydrological Information System (SAIH) allows real time intervention to control flow rates in rivers and reservoirs, automatically raising the alert for areas at risk of flooding. The functional organization is composed by four administrative units: the Water Commissariat, the Technical Directorate, the General Secretary and the Water Planning Office. The annual budget is approximately 45 M Euros.
A number of WFD guidance documents have been tested in the Jucar River Basin:

- Analysis of pressures and impacts;
- Designation of heavily modified water bodies;
- Reference conditions for inland surface waters;
- Typology and classification systems of transitional and coastal waters;
- Inter-calibration;
- Economic analysis;
- Monitoring;
- Tools on assessment, classification of groundwater;
- Best practices in river basin planning;
- Development of a shared GIS system.

5.2 Efforts to monitor the quality of watercourses in France

The Water Framework Directive was transposed into French law in 2004 marking a decisive shift in water quality monitoring strategies. In this context, the National Water and Aquatic Environment Unit (Onema: The French National Agency for Water and Aquatic Environments) developed a diagnostic assessment of stream water quality over the past 40 years.

1. Monitoring and data base management

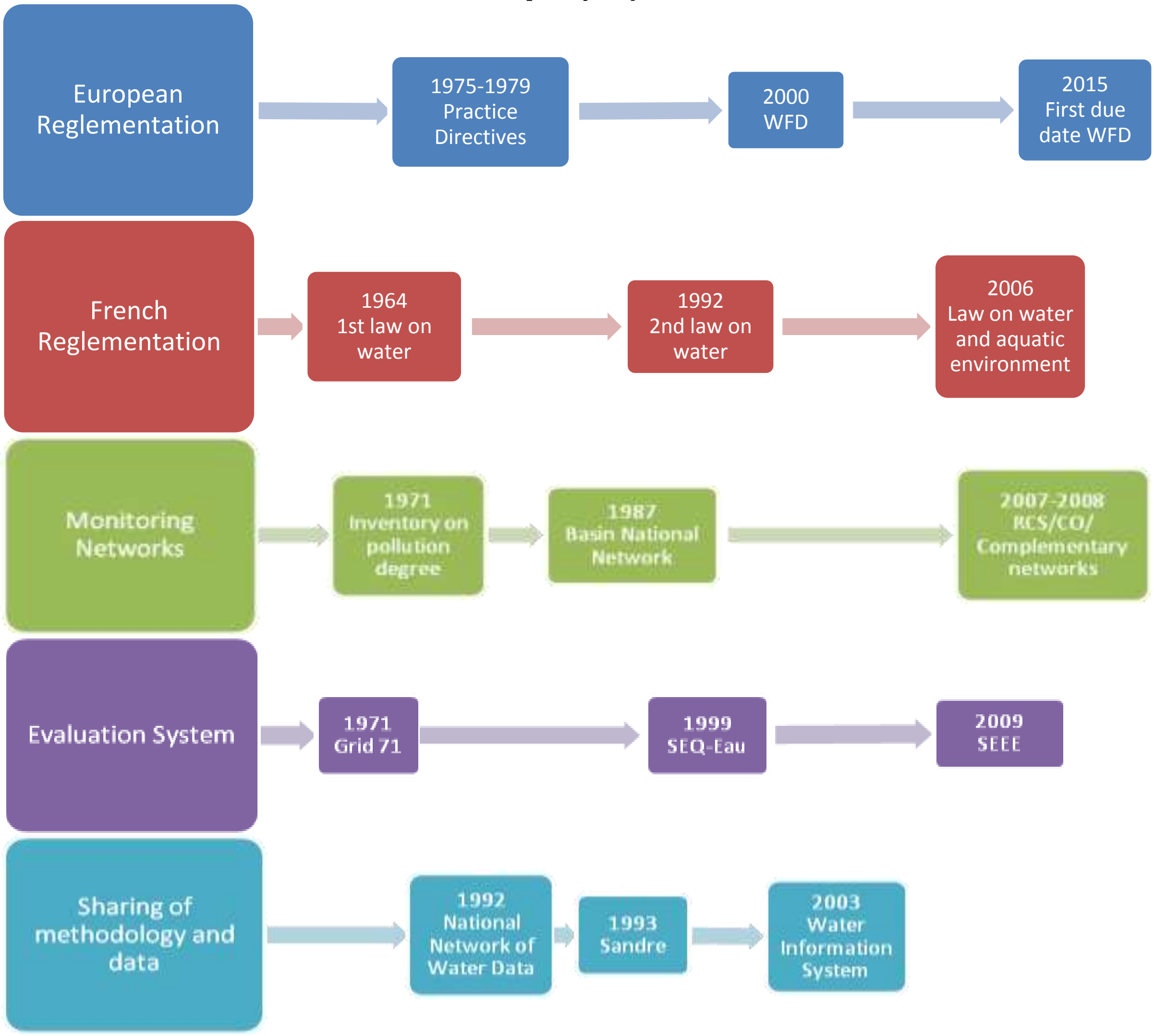
1.1. Historical context of stream water monitoring

The evolution of monitoring strategies highlighted three major periods:

• 1964-1986: early initiatives to fight against pollution and for institutional decentralization

• 1987 to 2006: new regulatory requirements and enhancement of stream water monitoring.

• Since 2007: implementation of the Water Framework Directive, resulting in the consolidation of the measurement network and in the definition of quality objectives.



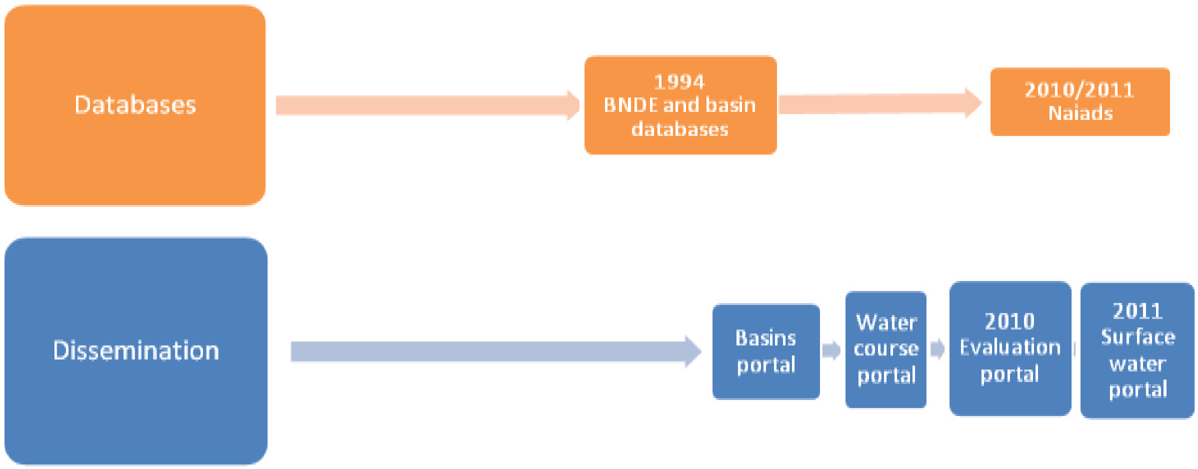


Figure 5.2.1. The evolution of monitoring strategies

1.2. Evolution of the monitoring strategy

The **analysis** of the number of stations and their distribution throughout the country shows increasing efforts undertaken by stakeholders to monitor stream water quality from the 1970s onwards, as well as major changes in terms of monitoring strategies.

- Increased number of monitoring stations: at first located on major rivers and downstream of major discharges; now spread across rivers, in metropolitan France as well as overseas (Departments d'Outre-Mer, DOM).
- Increased number of samples including water, and progressively more sediment, suspended solids and bryophytes.
- Larger number of parameters monitored, focusing initially on physico-chemistry, moving onto micro-pollutants in the 1990s, then on the biology and hydro-morphology after year 2000.

These changes are related to improvements in analytical methods and to changing regulatory requirements and associated objectives assessment.

The ONEMA established four indicators to make an assessment of the data available in the national databases:

- changes in the number of measuring stations,
- changes in the number of parameters,
- changes in the number of tests,
- evolution of available analysis records.

1.2.1. Indicators related to measuring stations:

Indicator nº1: Evolution of the number of monitoring stations

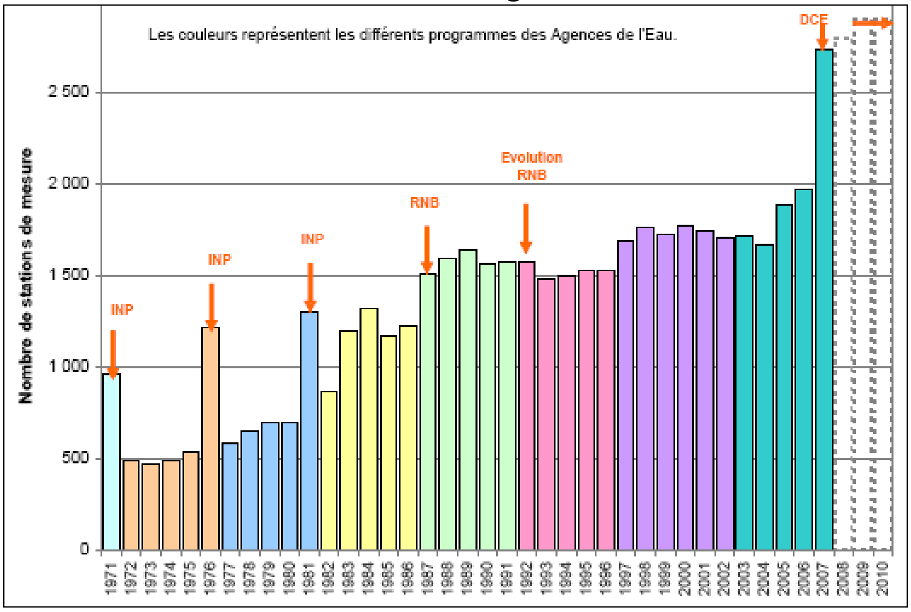


Figure 5. The Evolution of the number of monitoring stations

1.2.2. Indicators related to parameters:

Indicator nº2: Evolution of the number of parameters

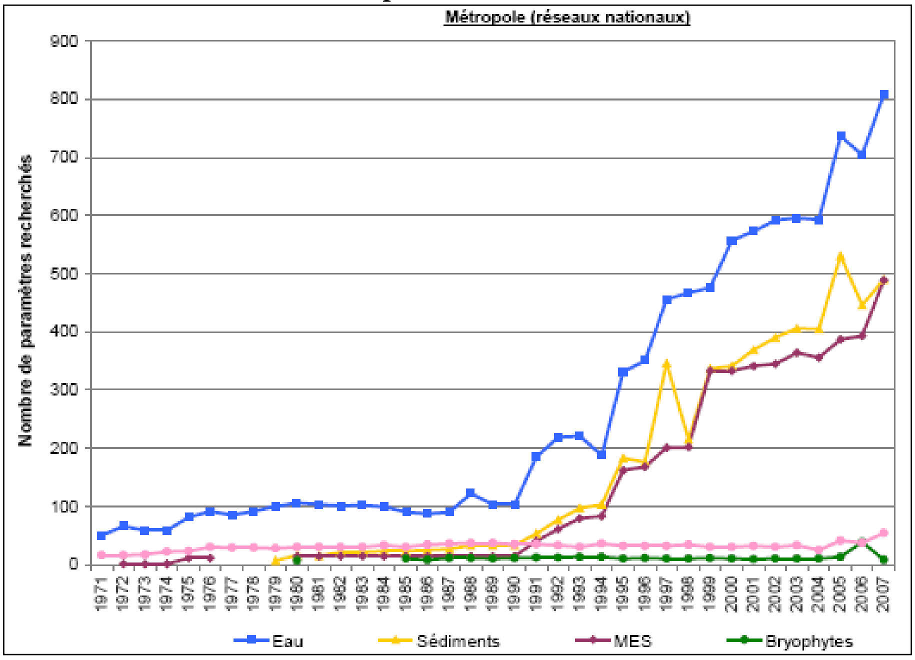


Figure 6. The Evolution of the number of parameters

1.2.3. Indicators related to analysis:

Indicator n°3: Evolution of the number of analyses performed

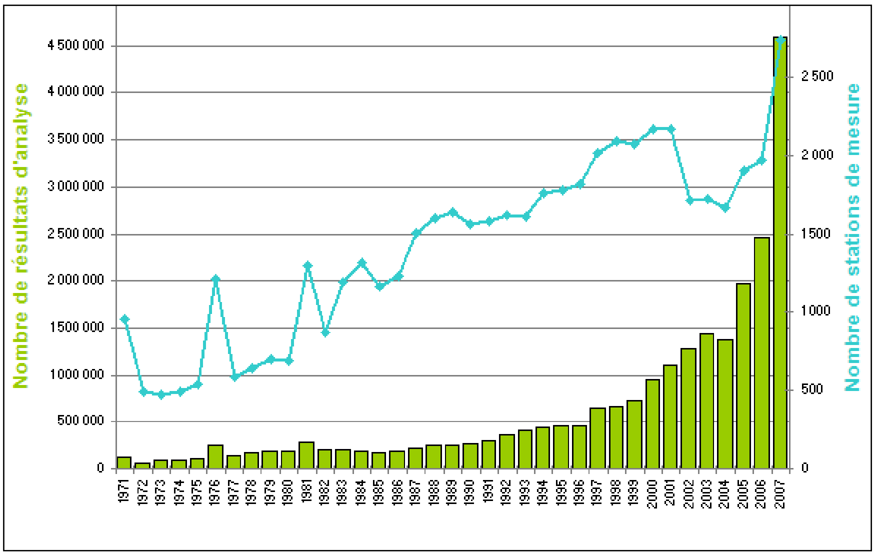


Figure 7. The Evolution of the number of analyses performed

Indicator n°4: Monitoring points and years of record

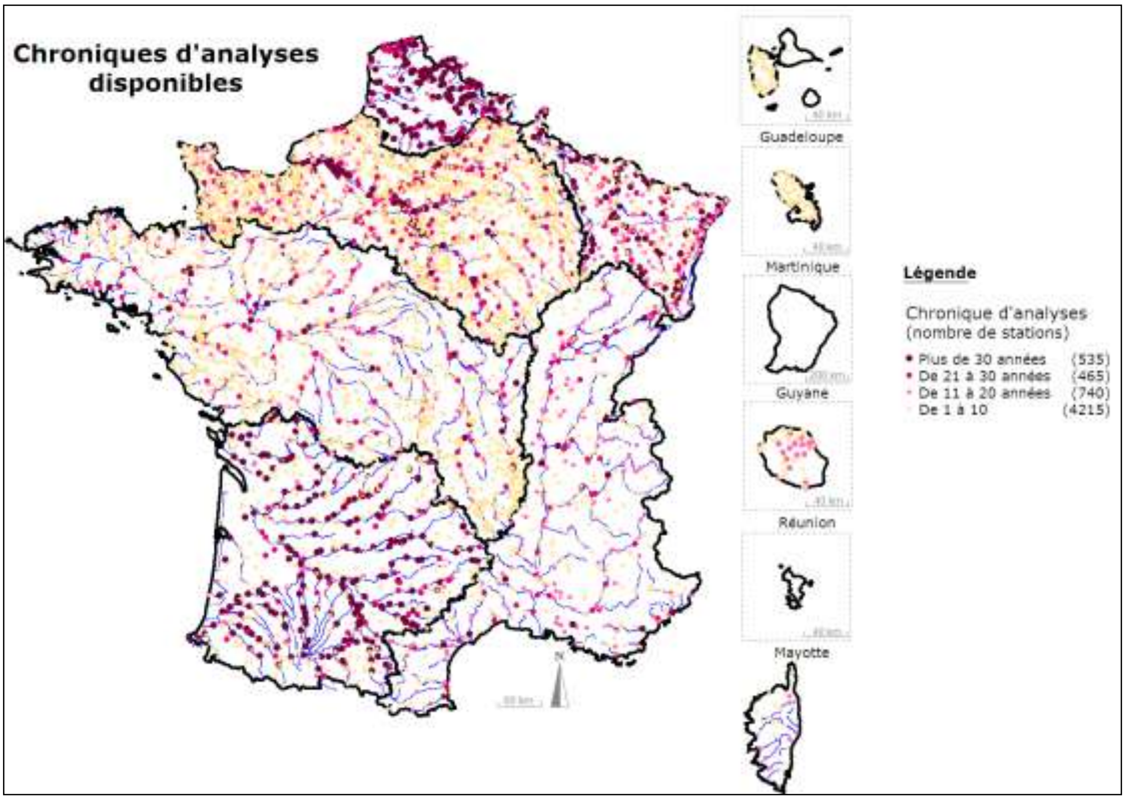


Figure 8. The monitoring points and years of record

The general trend of intensification of activities corresponded to a gradual increase in the four indicators, from 1971 to 2007, with some representative peaks:

• 1971, 1976, and 1981 during the INP campaigns.
• 1987 during the reorganization of the GNI.
• 2007 in the establishment of the first networks under the WFD.

This evolution follows the progressive implementation of regulatory requirements (EU directives and French legislation), requiring more and more environmental monitoring. Year 2007 marked a discontinuity due to changes in the spatial distribution of stations, the frequency of measurements and the amount of monitored parameters (with priority to dangerous substances and to biological quality elements). Partnerships between water agencies, DIREN / DREAL, Onema and the resident communities reorganized the networks in order to meet the requirements of the WFD.

The number of stations has progressively stabilized, on the contrary, due to the ongoing production of new synthetic substances; the number of parameters to search for is expected to increase (e.g. drug residues, cosmetics, etc.).

2. Approaches for the interpretation of water quality data

During the past forty years, a shared platform developed to support the interpretation of water quality data. It consisted of three national assessment systems:

• Grid 71 so-called "multipurpose".
• System Quality Assessment (SEQ).
• Rating System (SEEE) implementing the r evaluation of the ecological and chemical status of surface freshwater.

2.1. *Early reference values: Grid 71, an indicator of organic pollution*

The first reference values for assessing water quality emerged in 1971 with a multipurpose grid, called "grid 71", based on physicochemical parameters related to aquatic life. The parameters monitored included: organic matter, nitrogen and phosphorus. These reference parameters formed the basis for assessing water quality to quantify adverse impacts of pollution.

The results of analysis are compared with threshold values in order to classify water bodies into five quality classes. This classification allowed assigning to every river stretch a quality objective to be achieved. These objectives constituted the first reference documents for water quality management, and remained so until the approval of the SDAGE 2009.

2.2. *European standards and SEQ*

Over the years, several European Directives established Environmental Quality Standards (EQS), for several parameters.

Concerning the water sector, the most important guidelines are provided in:

• Directive 75/440/EEC of 16 June 1975 concerning the surface water quality required intended for the production of drinkable water in the Member States,
• Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water,
• Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment,
• Directive 78/659/EEC of 18 July 1978 concerning the quality of fresh waters needing protection or improvement in order to support fish life,
• Directive 86/280/EEC of 12 June 1986 on limit values and quality objectives for discharges of certain dangerous substances,
• Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution by nitrates from agricultural sources.

In the 90s, the French Ministry for the Environment and the River Basin Agencies launched a major programme for the definition of a Quality Assessment System (SEQ).

This strategy consists of three parts, each concerned with one of the major components of water quality:

• the “Water” section (SEQ-Eau), responsible for the evaluation of physico-chemical status and compliance with water uses and with natural habitat requirements,
• the "Organic" section (SEQ-Bio) responsible for assessing the status of biological communities associated with aquatic habitats,

• the "Physical Environment" section (SEQ-Physique) to assess the degree of naturalness of the physical components of aquatic habitats and the surrounding riparian zone, including the riverbed, the riverbanks and the proximal flood plain.

For each component, standard reference values and quality assessment rules have been established. Threshold values were derived from the analysis of existing regulatory frameworks, from literature searches and from expert judgment.

2.3. *Water Framework Directive and Assessment System of the Water Status (ESA)*

In 2000, the Water Framework Directive (WFD) introduced a new water management objective: achieving a 'good status' by 2015. For the first time, high relevance is given to biological indicators, next to the introduction of new standards and new evaluation rules. Important new tasks are to be born by the authorities responsible for monitoring activities:

- ❖ Expressing water quality status by attributing water bodies to established classes on the basis of an assessment of biological and of supporting quality elements;
- ❖ Evaluating water quality elements on the basis of their deviation from the 'reference condition'; corresponding to an ecological status which can be considered nearly undisturbed by human activities.

A number of "daughter directives" followed. Recently, Directive 2008/105/EC of 16 December 200 817 established environmental quality standards (EQS) in the field of water for priority substances and other pollutants mentioned in the WFD. For each substance, an annual average value (EQS MA) and a maximum allowable concentration (EQS MAC) are fixed.

In March 2009, the French Ministry of Environment published a technical guide describing the rules for assessing the ecological status and the chemical status of surface water bodies. It specifies suitable indicators, thresholds, interpretation methods and aggregation rules that comply with the requirements established by mandatory reporting tasks established under the WFD.

Following these advancements, SEQ-Water was upgraded with the definition of the Assessment System of the Water Status (ESA), expected to be soon finalized. This new initiative will integrate the assessment rules of the WFD, taking into account water body typology, the interdependence between quality elements (chemical, ecological and hydro-morphological) and the comparison with reference values.

In a second step, a literature search was conducted to gain an overview of **different approaches and existing skills** for evaluating the quality of water bodies.

The findings indicate that:
• chemical parameters are assessed against a threshold value, and often water quality is expressed with a system of quality classes (grid 71, SEQ-Eau , good condition), while a full statistical analysis of the concentration data is rarely performed;
• of the implementation of biological and hydro-morphological quality elements is less frequent, more recent and more difficult to interpret;
• no approach effectively combines the three sets of quality elements (chemical, biological and hydro-morphological) to address the concept of good status resulting from the "aggregation" of good chemical status and good ecological status;
• few approaches take into account the non independence of both geographical and temporal measures, important to correctly interpret spatial and temporal variability in water quality assessment.

6 WATER QUALITY MONITORING IN MEDITERRANEAN PARTNER COUNTRIES

To describe the status of monitoring networks and programmes in Mediterranean Partner Countries (MPC), EMWIS, with support of Aquapôle, carried out a survey among competent water authorities between April and September 2009. The survey assembled contributions from 11 countries: Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Turkey (which took part in this questionnaire).

This summary was intended to be as close as possible to the original information and texts. We are aware that some answers would require further information either because they are incomplete, or because they are not sufficiently specific. The workshops held in Beirut on 6 October 2009 and in Madrid on 10 November 2010 allowed an exchange of experiences, some clarifications on countries replies and provided some examples of monitoring networks.

6.1 - Legal and institutional framework

The institutional organizations responsible for water quality monitoring are highly specific to the situation in each country. Responsibilities are given to different authorities in consideration of the water body type (sea water, surface water, groundwater, etc.) and various water uses (drinking water production, irrigation, bathing water, etc.). In most countries, a single Ministry is in charge of water resources and represents the main body responsible for quality monitoring, however, given the importance of water resources in a large variety of government policies, water management issues are addressed by a large number of different authorities. In two cases only, the Ministry in charge of water is also in charge of Environmental protection, in other cases the Ministry of Environment focuses on aquatic habitats within protected areas and on the control of effluent discharges. The Ministry of Agriculture (8 x) and the Ministry of Health (7 x) are also in charge of water-quality related issues.
In addition to this fragmentation of responsibilities, even within a single authority, water-related issues are dealt with in many different departments (water treatment, water quality, hydraulics, industries, agriculture, dams, etc.).

Algeria	M. of Environment and Territory Development (MATET), M. of Water Resources (MRE), Sea Science and Coastal Development Institute (ISMAL), National Office for Irrigation and Drainage (ONID).
Cyprus	M. of Health, M. of Agriculture, M. of Natural Resources and Environment
Egypt	M. of Environmental Affairs (EEAA), M. of water resources and Irrigation (MWRI), M. of Health and Population
Israel	Governmental Authority for Water and Sewage (WA) M. of Environmental Protection, M. of Health
Jordan	Aqaba Special Economic Zone Authority (Red Sea), M. of Water and Irrigation, Water Authority of Jordan M. of Health M. of Agriculture, Ministry of Environment Royal Society for Conservation of Nature.
Lebanon	M. of Energy and Water, Water Establishments M. of Agriculture, M. of Environment
Morocco	M. of Energy, Mines, Water and Environment, M. of Agriculture, Rural Development and Sea Fishing ONEP Ministry of Health
Palestine	Palestinian Water Authority, M. of Agriculture, M. of Health,

	Environmental Quality Authority
Syria	M. of Irrigation, M. of Housing and construction, M. of state for Environment Affairs, M. of Agriculture
Tunisia	M. of Environment and Sustainable Development, M. of Agriculture and Hydraulic Resources and fishery M. of Health
Turkey	M. of Environment and Forestry, DSI M. of Health, M. of Transport and Communication,

Table 6.1.1. Institutional framework of water monitoring in MPCs

As for water management, we can extract from the survey that 7 countries have some experiences with private sector involvement in water utilities; integrated water resources management is considered as effective in 9 countries; water is managed in different geographical entity basis: river basins (x4), administrative units (x7), and other (x2) that are hydro-geological basins (Israel) and both river basins and administrative units (Turkey); the river network is subdivided in water bodies, according to the WFD meaning, in Morocco (tests in some river basins), and Turkey is developing a project that will do so.

Achieving good qualitative status of rivers or water bodies is an objective defined as such in the legislation of 6 countries (Algeria, Cyprus, Egypt, Jordan, Syria, and Tunisia), and most countries (x10) have a regulatory framework for the discharge of pollutants and environmental quality, Lebanon still don't.

Egypt: Four monitoring networks, two networks for operation, One for operation and surveillance and the last one for surveillance (Ministry of Environment).

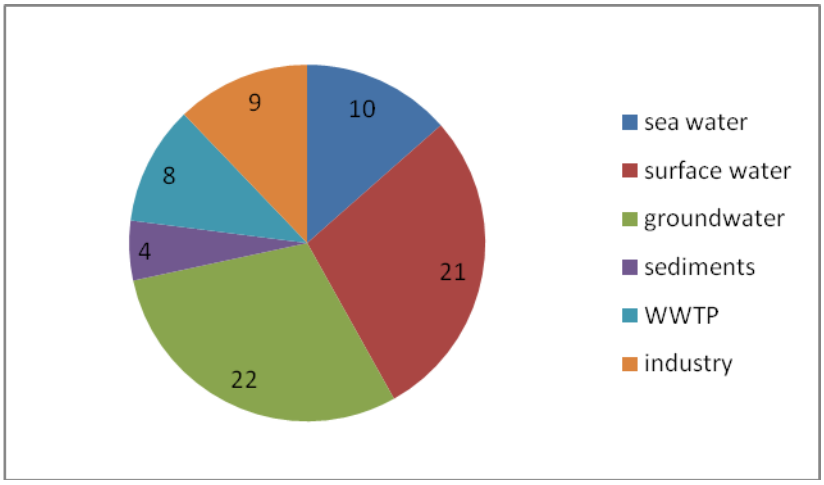
6.2 - Mechanisms and networks for monitoring (or controlling) water quality

Indentified networks in each country on the basis of the replies received (non exhaustive):

- **Algeria:** 2 main monitoring networks, ANRH (inland waters) and MATET (seawater).
- **Cyprus:** 4 public networks for monitoring and operational control which cover, one all groundwater, and the other three cover part of the lakes, part of the rivers and part of coastal waters. The water uses concern drinking water, irrigation and nature conservation.
- **Egypt:** 4 monitoring networks, 2 networks for operation (Ministry of Health and Ministry of Housing), 1 for operation and surveillance (ministry of water resources and irrigation, MWRI) and 1 for surveillance (Ministry of Environment).
- **Israel:** one public network (coastal water and industrial effluents), two networks managed through public/private partnerships (swimming pools and drinking water). The networks are responsible for surveillance, operational as well as investigative monitoring.
- **Jordan:** 1 public network (groundwater and lakes) that provides surveillance monitoring and quality control; water uses concerned include drinking water supply and irrigation.
- **Lebanon:** 10 networks (8 public and 2 private) covering groundwater, rivers, lakes, and also wetlands and coastal waters. Water uses include drinking water supply (10 networks) and irrigation (2 networks).
- **Morocco:** 2 public networks; one to conduct water quality surveys in coastal waters and in inland waters; the other for the regular monitoring of groundwater, stream water, wetlands, lakes. A public/private operational monitoring network deals with industrial discharge effluents and wastewater treatment plants.
- **Palestine:** 3 networks respectively, of which 2 are for surveillance and for operational monitoring (the first one is dedicated to WWTP effluents; and the second one to groundwater and WWTP discharges), and one exclusively for conducting water quality surveillance monitoring.
- **Syria:** 3 public networks covering inland and coastal waters.

- **Tunisia:** 7 public networks; Overall monitoring covers groundwater, rivers, wetlands, lakes, reservoirs and coastal waters.
- **Turkey:** 4 public networks including: 2 surveillance monitoring networks for inland surface waters, 1 operational monitoring network for coastal waters; and 1 network addressing the three types of monitoring strategy.

The greatest number of networks is by far for surface water and groundwater.



Overall, the greatest number of monitoring networks is focused on groundwater (22 countries) and surface water (21 countries), followed by coastal waters (10 countries), industrial effluent discharges (9 countries), WWTP effluent discharges (8 countries), and sediments (4 countries).

Figure 6.1.1. Existing networks in the aforementioned countries

The stakes most often quoted regarding the building of the networks are risk prevention, water resource scarcity, nature conservation and public health.

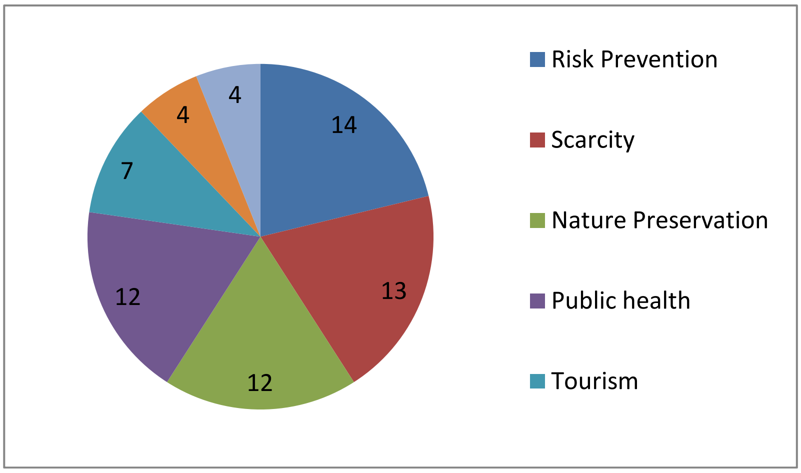


Figure 6.1.2. The priorities of the developing monitoring networks

In 9 countries, the monitoring includes standard physico-chemical and chemical parameters; many (x5) monitor hydro-morphological parameters and only one (x1) specific pollutants. All countries monitor for the presence of coliforms and for a number of parasites in drinking water. Biological elements, as defined in the WFD are not monitored on a routine basis in no MPC.

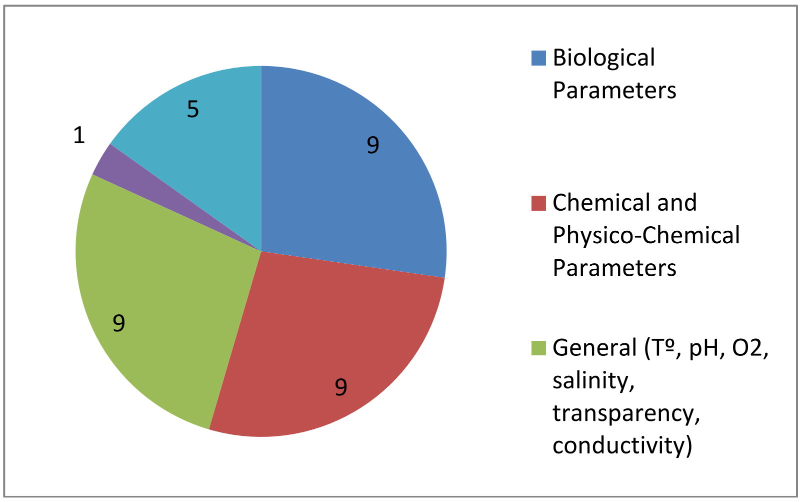


Figure 6.1.3. The monitored parameters in the developing monitoring networks

Also, 5 countries carry out a national inventory of pollutants; this happens partially in 1 country, and not at all 2 countries.

6.3 - DATA PROCESSING AND DISSEMINATION

The main features concerning data processing are the following: there is a centralised data banking in 7 countries but different for each network; data entry is manual in almost all the countries, but it is most often coupled with data-processing techniques (at least for some networks); all the countries store their data on computer media and in most countries collected data are validated (x8) but can vary according to the network;

Only in some networks of 4 countries data are integrated into a Geographical Information System.

As for data dissemination, data are accessible on the Internet in only 2 countries, partially in 3, and not in 6; data are disseminated in 3 countries, partially in 6, and not disseminated in 2; and data are used for modelling and simulation in all the countries, except for 2 networks in Lebanon.

7.1 Case study: Sebou (Morocco)

Highly dynamic agricultural and industrial activities and high demographic growth in the Sebou Basin pose an increasing pressure onto water resources. Experience from EU countries was transferred to the Sebou to promote significant advancement in water resources management.

River basin characterization

Some 522 surface water bodies and 66 groundwater bodies were identified and mapped in the basin, next to 420 springs, 53 lakes, and 13 major & 27 smaller dams. For management purposes eleven sub-basins were defined, and pressures on water quantity and quality deriving from human activities (including: agricultural, domestic, industrial) were assessed. An integrated assessment provided insight into:

i) Water quality status, simulated through pollutant balance models

ii) Quantitative status, assessed by withdrawals/recharge balances for each aquifer

iii) Ecological status and objectives for each water body based on experts' advice and available field data. Assessment of the hydro-morphological status of water bodies was added to the database.

Risk assessment brought forward the following main issues:

For groundwater bodies:

- There are high nitrate concentrations in Gharb, Mamora and Fes-Meknes aquifers mainly due to irrigation of crops (vegetable and orchards) with high fertilizers requirements.
- Withdrawals are higher than recharges in 7 out of 9 aquifers. Overall, the unbalance reaches 78 million m^3/year. Fès-Meknès, Gharb, Mamora, Taza and Bou Agba aquifers are particularly threatened. Agricultural abstractions account for more than 70% of total withdrawals.
- Coastal aquifers (Menasra and Mamora) are now under threat of saline intrusion.

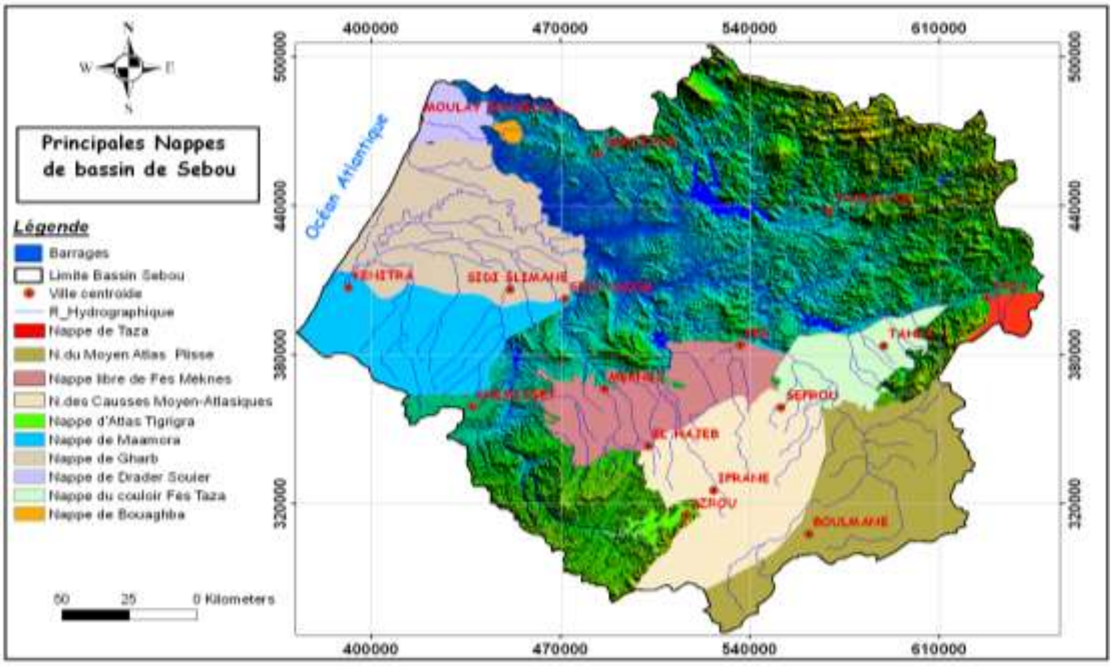


Figure 7.1.1. Groundwater aquifers within the Sebou Basin

For surface water bodies:

- The chemical quality of surface water is under the impact of mainly domestic and industrial emissions. The main parameters affected include organic matter, phosphorus, chrome, and nitrogen.
- Water quality improvements due to the construction of treatment plants will hardly offset the increase in pollutant emissions due to population growth and lack of connection to sewage networks.
- Minimal flows downstream of the dams were taken into account during their construction, but are not respected once dams are active.
- Lack of management and maintenance of existing treatment plans.
-

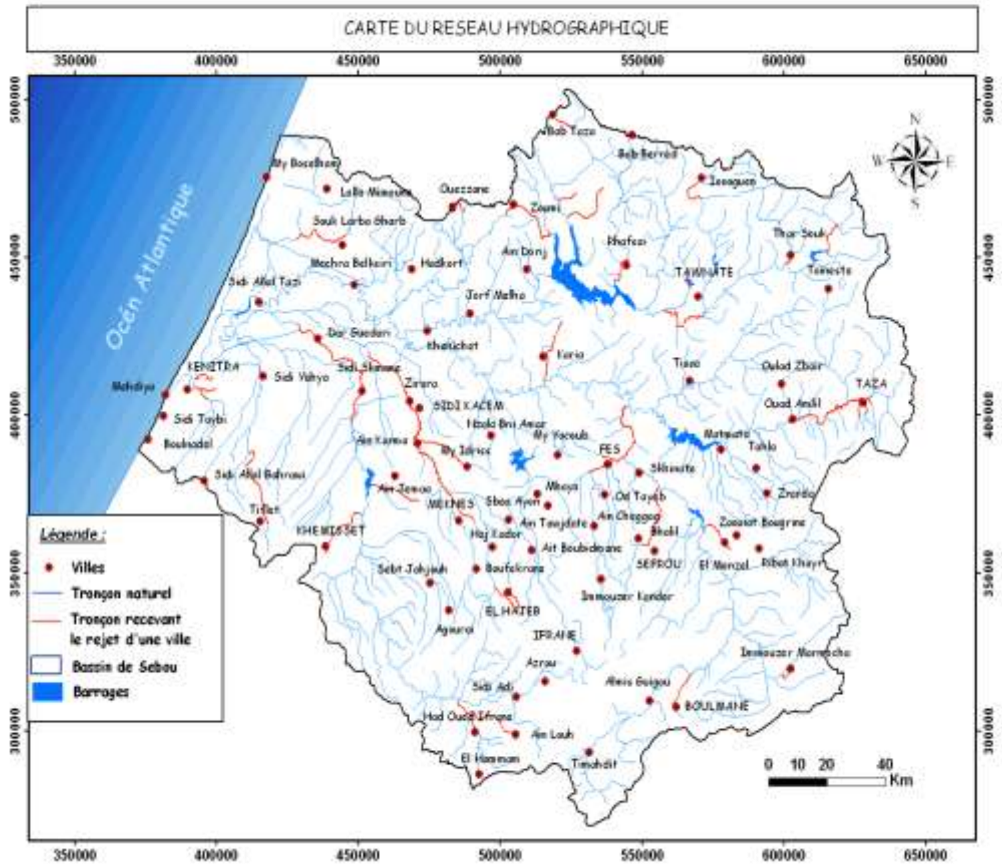


Figure 7.1.2. Hydrogrphic network in the Sebou Basin

For wetlands and protected areas:

- One of the main encroachment threats is due to the expansion of agricultural (Merja Zerga, Bergha, Halloufa) and of urban areas (Merja Fouarat, oued Tizguit). It has been estimated that 80% of the 110 endemic animal species of the basin are threatened.
- Over-abstraction of some ground- or surface water should supply some of the wetlands.
- Along *oueds* (rivers), natural vegetation is disappearing, resulting in higher bank erosion, and sedimentation in river channels and reservoirs.

Conclusion and recommendations

Significant new knowledge and tools need to be developed to help decision-making, specific needs include:

- The determination of minimum ecological flows required downstream of a dam to ensure minimum river functionalities;
- ;Hydrological models of the Sebou basin need to be developed and managed by the Sebou River Basin Agency to ensure decision support;
- Tools to estimate and simulate the impact of agricultural and domestic rural diffuse pollution on surface water quality;

- Tools to simulate the auto-depuration capacity of Moroccan rivers and reservoirs;
- Assessing the evolution of saline intrusion in coastal aquifers;
- Tools linking agricultural fertilization, irrigation practices and nitrate concentrations in groundwater;
- Tools for assessing the economic and social value of water in order to define an equitable programme of measures;
- Tools to define ecological status and ecological potential in a way robust enough to be extrapolated to other Moroccan basins. Indices using biological and hydro- morphological status and evolution are particularly highly required;
- An inventory of protected areas.

7.2 CASE STUDY: LITANI (LEBANON)

By 2020, the water balance in Lebanon is expected to become negative unless concerned entities in water management do not implements an integrated water resources management approach. Consumers face the absence of Water User Associations, bad maintenance and pollution are the major causes of water losses.

The Ministry of Energy and Water (MOEW) is responsible for implementing the national water policy, while Water Authorities are responsible for the execution of his master plan. Quantity and quality monitoring of groundwater is not carried out continuously

An enhancement of water management practices would require a revision of the legislation, new law enforcement mechanisms, research and education, more determined tariff policies and stakeholders capacity building programmes.

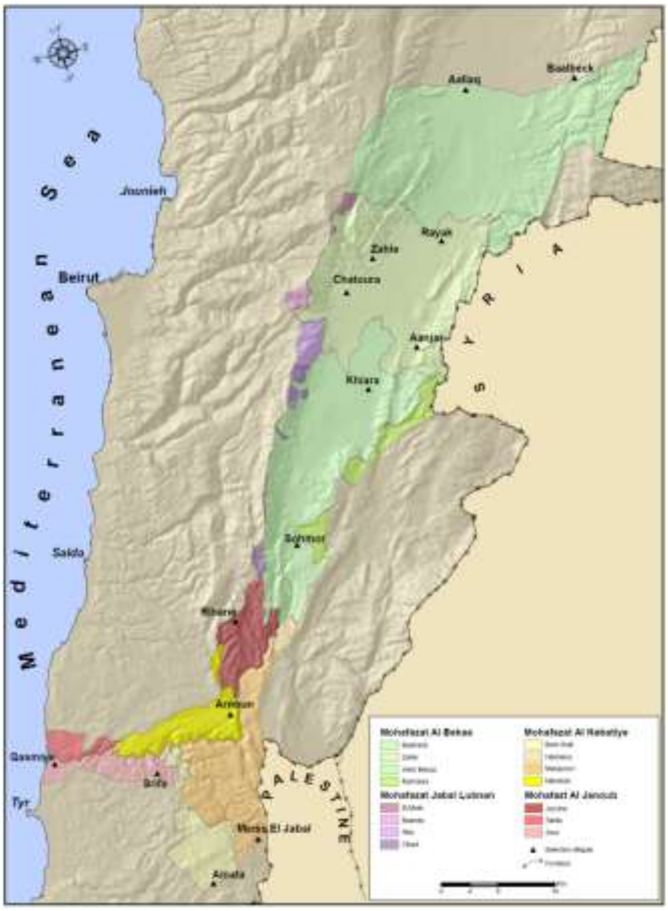


Figure 7.2.1. Litani river basin in Lebanon

Context

The Litani River Basin represents 20% of the Lebanese territory and is divided in four Mohafazats (i.e. provinces) and 263 villages and towns. The population in Litani RB will reach 470.000 inhabitants by 2020. Forty five percent of the basin is occupied by agriculture activities: 28.6% field crops, and 16% orchards.

The Litani river system can be divided into three different surface water bodies:
- the Upper Litani: the river system upstream of the Qaroun reservoir, characterized by high population density and industrialization.
- the Quaroun Reservoir: a major water management asset in the Litani River basin.
- the Lower Litani: Less densely populated sub-basin dependent on total flow diversion at the bottom of Quaroun dam. Its dry watercourse progressively gains water thanks to numerous springs along the riverbed.

Groundwater can be summarized in three important groups:

- The eastern slope of the western chain (Mont Lebanon), Yammouneh fault with numerous springs.
- The western slope of the Eastern chain (Anti-Lebanon), belonging to the Bekaa Valley
- The mid Bekaa valley, with few springs.

Protected areas include:
- Wetlands: Aammiq (280 ha) and Kfar Zabad (3 ha)
- Al Shouf Cedar Natural Reserve (55,000 ha)
- Quaroun Lake (12 Km^2) and riparian zone below 860m (about 220 ha).

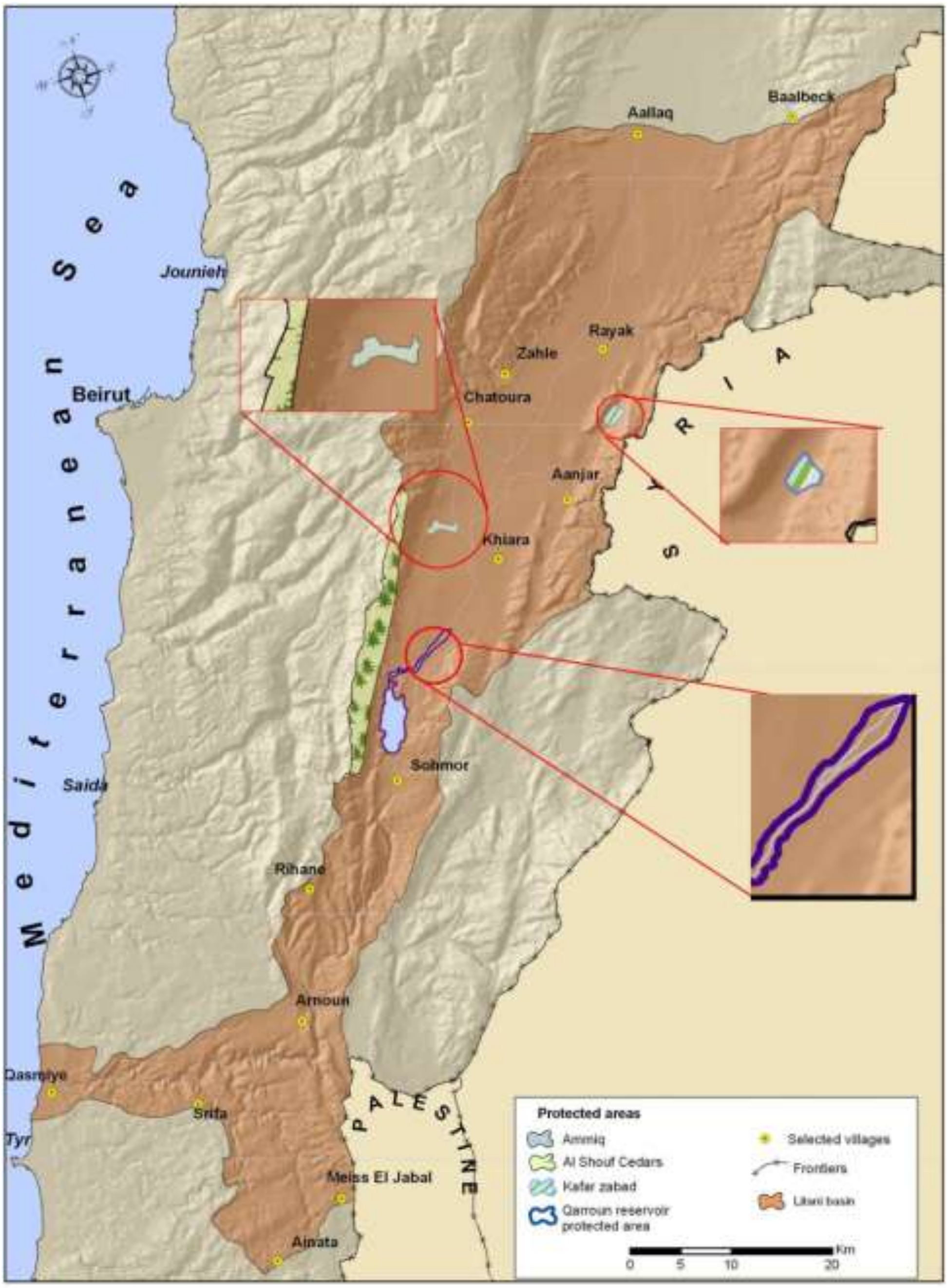


Figure 7.2.2. Lebanon landscape morphology

Main pressures and impacts

The main pressures affecting the Litani RB and their impacts include:

- Untreated sewage discharge into surface water bodies,
- Untreated industrial effluent discharges into surface water bodies,
- Landfill leachate contaminating surface and groundwater by toxic pollutants.
- Solid waste releases to nearby surface water bodies.
- Quarries and stone cutting sites.
- Irrigation dams along the river disrupting the river discharge regime.
- Pumping from the river channel in summer causing wastewater contamination of the soil and groundwater infiltration.
- Excessive use of fertilizers and pesticides in agriculture.
- Hydro-morphological alterations due to hydropower and irrigation projects.
- Groundwater overuse by pumping from wells.

Conclusion and recommendations

Preservation of water quality and quantity are essential to sustain irrigation needs within the basin.
To implement Integrated Water Resources Management (IWRM), a revision of the monitoring system is necessary. Conflict and overlapping responsibilities among management authorities hinder these objectives. The establishment of a Basin Agency is delayed by the needed legislative process. In the meanwhile, intermediate solutions are possible:

- Accelerating the creation of a High Council on Water responsible for IWRM implementation at national level.
- Enabling the Litani River Authority to monitor groundwater quality and quantity.
- Reinforcing the Litani River Authority Environmental Department.

8 IMPROVING WATER MONITORING IN MED COUNTRIES

In most countries of the southern Mediterranean, scarce water resources caused a strong focus on water quantities (resource availability and demand) rather than on water quality. Monitoring networks and historical databases do not document water quality issues. Increasing pressures due to rapid population expansion, economic development and climate change lead to the over-exploitation of existing resources, and to a significant increase in surface and groundwater pollution. Water quality degradation in southern Mediterranean countries reduces even further the scarce water resources exploitable at an affordable cost, causes an increase in water related diseases and a decrease in agricultural productivity due to soil degradation. These consequences lead to a severe degradation of the environment.

On the basis of the experience gained through the implementation of the WFD in the European context, a number of lessons can be drawn, that can be applied to develop recommendations for implementing IWRM in southern Mediterranean partner countries.

1. Establishing an institutional framework for enhancing cooperation between various institutions managing water resources is an essential target for an effective implementation of IWRM. This coordination must address:

- a redefinition of the competent authorities to avoid responsibilities overlap and conflict
- the establishment of a shared database on water quality and quantity,
- the preparation of a thorough review of the current situation at national basis,
- the establishment of recognized data validation mechanisms and data quality checks,
- the identification of opportunities to improve monitoring efficiency at lower cost (including cost savings)

2. Establishing shared water quality databases as part of National Water Information Systems helps to avoid duplication of monitoring activities and to standardize assessment protocols and data interpretation. Given the complex pattern of attribution of water management responsibilities to different national authorities that can be found in most countries, it is convenient to proceed, as a first step, with the establishment of a metadatabase including information on what data are produced by different national authorities. This mapping of available data will highlight potential duplications of activities and promote closer collaboration in data sharing among partner institutions.

3. Preparing River Basin Management plans based on participatory approaches (i.e. involving all the stakeholders including those that are cause of pressure on water resources, e.g. industry, tourism, municipalities) can greatly contribute to refine surface and groundwater characterization, impact and pressure analysis, and the definition of a programme of measures adapted to local needs. Active stakeholders represent a valuable source of information and may offer political support to decision-makers when difficult decisions need to be taken and explained to the wider constituency. As a first step, the first stakeholders that should be consulted in drafting a Programme of Measures are all the different management authorities that influence the quality status of water resources within a given site. This circle can be progressively enlarged to include further actors (NGOs, trade unions, Associations,…).

4. Developing water resources management models and simulation tools to support decision-making can effectively inform planning decisions. Such strategies could be applied to assess the impact of specific catchment processes, such as: diffuse pollution, self-purification capacity, impact of agriculture practices on groundwater, definition of ecological status and minimum ecological flows.

5. Defining a catalogue of Protected Areas is essential to complete the mapping of different management priorities within the basin. The catalogue should be reproduced on a basin map in GIS

format to offer a visual perspective that will help interpreting the relationship between the protected areas and the rest of the Basin.

6. Introducing water quality targets into transboundary water resource agreements as well as into national policy planning. Ideally each country should achieve the definition of a national water resources plan. Several southern Mediterranean countries have already done so, although the status of implementation of the plans tends to lag behind intended schedules. The major objective of such a Plan is to define environmental objectives allowing then secondary legislation to be enacted, linking these objectives to specific water quality targets. The establishment of a national plan requires an agreement among ministries that should lead to a document to be approved in Parliament, a necessary step to achieve legal status.

7. Defining communication strategies to disseminate water quality information at various levels; stemming from access to raw data for experts and professionals, to highly aggregated information for politicians and the general public. Data dissemination about the status of water resources is a highly conflictual issue, not only among southern Mediterranean countries, but worldwide. This reflects the political and economic relevance of water resources. Poor dissemination of water sector data inevitably leads to duplication of monitoring efforts and to an inefficient allocation of resources by authorities that have restrained access. The lack of information among the public leads to irrational behavior and to the lack of public support into policy implementation. By leading a careful communication strategy, public authorities can win public understanding for their action and promote political support.

8. Conducting a cost efficiency analysis of monitoring networks for their optimization, taking into account the assessment of the economic and social value of water. Independently from the introduction of tariffs or taxes for recovering the cost of water services, cost-benefit assessments of expenditure in the water sector are essential to highlight inefficiencies and to establish opportunities for more efficient water resources management. Great savings and improvements in efficiency are likely to be obtained through the optimization of monitoring activities on the basis of cost-benefit analysis applied to monitoring networks.

9. Introducing potential indicators to be used at the Mediterranean scale for the monitoring of water quality. As a first step, the choice could fall onto one of the regularly monitored parameters common in all the countries and without particular restriction on its dissemination, for example: pH. Gaining a wider geographical perspective over water resources can greatly enhance the interpretation of emerging regional trends and can support collective initiatives promoted by southern Mediterranean countries.

10. Developing capacity building in order to favor certification and inter-calibration of analytical laboratories (conducting water quality analysis). Standardization of analytical practices is an essential step in the development of a reliable shared water quality database. Virtually all partner countries from the southern Mediterranean host one or several ISO-certified laboratories that can serve as focal points for upgrading analytical practices throughout the country. Several international donors are available to offer technical and financial support to help upgrading analytical capacities in the southern Mediterranean and to promote further the certification of regional laboratories.

9 CONCLUSIONS

Southern Mediterranean countries have experienced rapid economic and demographic growth accompanied by a degradation of their natural resources. Water resources are naturally scarce in this Region, and locally can represent a limit to further economic growth and to the improvement of human health. A number of alternative water sources are being investigated, however their exploitation will be at high financial and environmental cost.

In most southern Mediterranean countries, water managers traditionally focus their attention onto water quantity rather than water quality issues. At the same time, sound management practices would recommend that all water be available at the best possible quality, to make full use of this scarce resource. Sound management of water quality makes economic sense and prevents the degradation of the environment. The relative wealth and the level of technological advancement experienced in southern Mediterranean countries make this target perfectly achievable.

The European experience with the WFD can provide useful practical suggestions on how to proceed with the implementation of a sound IWRM approach. This does not require a complete revision of the water sector legislation, provided that some major stumbling blocks can be resolved. An essential step is a redefinition of policy responsibilities among government authorities to avoid duplication of tasks and to ensure an efficient sharing of water quality and quantity information. Monitoring plays a pivotal role by assessing water quality status, by highlighting main trends, by informing the Programme of measures and by checking the effectiveness of the measures themselves. However field monitoring is not sufficient to perform all these tasks. Indicators of the main human activities acting as drivers of change need to be obtained to follow the evolution of the sector. Experts' advice allows calculating transfer functions that can translate drivers into potential impacts. To implement such a scheme at national level, political will and technical skills must converge towards the definition of participated national policies. In this context, the illustration of case studies in Spain, France, Morocco and Lebanon, allow to identify a number of concrete recommendations made for the benefit of MPCs.
It is highly recommended to run single pilot tests in each of the MPCs to provide further information on the feasibility of national IWRM policies.

A revised working group mandate with a focus on water quality issues is proposed in Annex. This mandate was prepared as part of a possible 3rd phase of the Med Joint Process, aiming at supporting the preparation of an Action Plan for implementing the Strategy for Water in the Mediterranean – SWM. This strategy includes 2 important objectives for the WG:

- Ensuring good quality of public water services, fulfilling public health considerations and preventing any further deterioration of water resources quality among other needs;
- Reducing and preventing water pollution by: expanding the scope of water protection; avoiding overexploitation of water resources, controlling the use of fertilizers and pesticides to appropriate and recommended standards. A medium term goal is to reach a good status for all waters based on a comprehensive monitoring system for water quality and quantity, as well as for ecosystems and biodiversity status.

In terms of common indicators, in a first stage it is suggested to focus on indicators related to monitoring activities rather on the status of water. Such indicators could be the amount of monitoring stations, the amount of parameters analyzed and the amount of analyzes made compared to the annual ground and surface freshwater resources. The water directors should commit themselves in the provision of such indicators on periodic basis.
Pilot activities should be carried out in local areas such as governorates or districts covering a specific water body (i.e. part of a water resource with uniform parameters). It is proposed to use the DPSIR approach described chapter 4.4. to undertake such experiments in various countries and then share the resulting experience with other countries through the working group activities and presentation to the Euromed water directors.

ANNEX A: ACRONYMS

Acronyms	Meaning
ANRH	National Agency of Water Resources
AWC	Available Water Content
CHJ	Jucar River Basin Authority
CPS	Permanent Drought Commission
DOM	Departments d'Outre-Mer
DPSIR	Driving forces – Pressure – State – Impact - Response
DSI	Devlet Su Isleri (Turkish state water works)
EEA	European Environment Agency
EEAA	Ministry of Environmental Affairs
EC	European Commission
EQS	Environmental Quality Standards
ESA	Assessment System of the State Water
EU	European Union
EUWI	European Union Water Initiative
FAO	Food and Agriculture Organisation
GES	Good Ecological Status
GIS	Geographical Information System
IGME	Spanish Geological and Mining Institute
INSPIRE	Infrastructure for Spatial Information in Europe
IPCC	Intergovernmental Panel on Climate Change
ISMAL	Sea Science and Coastal Development Institute
ISO	International Organization for Standardization
IWRM	Integrated Water Resources Management
JP	Joint Mediterranean Process
LRA	Litani River Authority
MATET	Ministry of Environment and Territory Development
MCSD	Mediterranean Commission on Sustainable Development
MDG	Millennium Development Goals
MIMAM	Directorate General for Water of the Ministry of the Environment, 1995
MOEW	Ministry of Energy and Water
MPC	Mediterranean Partner Countries

Acronyms	Meaning
MRE	Ministry of Water Resources
MSSD	Mediterranean Strategy for Sustainable Development
MWRI	Ministry of Water Resources and Irrigation
NAP	National Action Plan
ONEMA	National Agency for Water and Aquatic Environment
ONEP	National Office for Drinking Water
ONID	National Office for Irrigation and Drainage
OTS	Drought Management Plan
PDSI	Palmer Drought Severity Index
PES	Temporary Drought Plans, 2007
PHDI	Palmer Hydrological Drought Severity Index
PHN	National Hydrological Plan, 2001
RAI	Rainfall Anomaly Index
RBMP	River Basin Management Plan
RDI	Reconnaissance Drought Index
SAICA	Automated Information System on Water Quality
SAIH	Automatic Hydrological Information System
SEIS	Shared Information System
SEQ	System Quality Assessment
SPI	Standardized Precipitation Index
SWM	Strategy for Water in Mediterranean
SWSI	Surface Water Supply Index
TRLA	The Revised Text of the Water Law, 2001
UfM	Union for the Mediterranean
UNCCD	United Nations Convention for Combating Desertification
WDM	Water Demand Management
WEI	Water Exploitation Index
WFD	Water Framework Directive
WISE	Water Information System for Europe
WMO	World Meteorological Organisation
WS&D	Water Scarcity and Drought
WSSD	World Summit on Sustainable Development
WWTP	*Wastewater Treatment Plants*

ANNEX B: SOURCES

Chapter	Source
Chapter 3	GD No 07 Monitoring Policy Summary
Chapter 4	Guidance No 07 Monitoring Guidance No 15 Groundwater Monitoring Guidance No 16 Groundwater Monitoring in Drinking Water Protected Areas Guidance No 19 Surface Water Monitoring GD No 03 IMPRESS Policy Summary
Chapter 5	Les efforts de la surveillance de la qualité des cours d'eau, Katell Petit (OIEau), Avril 2010
Chapter 6	Survey Synthesis, EMWIS and Aquapôle
Chapter 7	Etat des lieux du basin du Sebou dans le cadre de la mise en place pilote des outils de la DCE, SPI-WATER, November 2010 Description of the selected non-EU river bassin Litani (Lebanon), SPI-WATER, December 2007

ANNEX C: REVISED MANDATE OF THE MED WATER MONITORING WORKING GROUP

(1st version validated 10 December 2007
Revised draft status: November 2010)

i. Background

The Joint Water Framework Directive / EU Water Initiative process (JP) aims at developing synergies between the two mechanisms to facilitate the implementation of sound water policies.

Six working groups have been set-up in the framework of the phase I (2004-2006) and II (2007-2009) of the Med Joint Process:
1. Groundwater management
2. Water Scarcity and Drought
3. Linking rural development with water management
4. Waste water reuse
5. Shared water resources management
6. Water monitoring networks and programmes

The working group on “Monitoring networks and programmes” is the most recent. Its mandate was validated by the Euromed water directors in December 2007. The first objective aims at having a better understanding of the situation in the Mediterranean Partner Countries (MPC) in order to identify the main priorities for improving the water monitoring systems.

The reasons for organising a “water monitoring” working group by EMWIS were twofold:
- In 2005 EMWIS conducted a survey on the value of some concepts of the European Union (EU) Water Framework Directive (WFD) for Mediterranean partner countries (MPC). Water Directors as well as basin organisations were surveyed. The two first concepts of interest are the characterization of basins and the monitoring activities. This underlines strong willingness and needs in terms of acquiring a better knowledge on river basins within MPC. That preliminary step is crucial before ongoing the works of planning. Generally, this survey shows a lack of awareness on WFD by MPC, but also a strong interest on the follow up of its implementation in EU Member States;
- The feasibility studies on the enhancement of National Water Information Systems, carried out in 2005 have shown that the water data collection is often a difficulty to get efficient systems. Such systems are the cornerstone for the potential development of a regional water observatory mechanism.

ii. Introduction

In most of South Mediterranean countries, due to scarce water resources, priority has always been given to the management of water quantities (availability and demand) rather than on water quality. Therefore monitoring networks and historical data banking are poorly developed on quality issues. The increasing pressures due to rapid population expansion, economic development and climate change are resulting in an over-exploitation of existing resources, and a significant increase of surface and ground water pollutions. Nowadays, the degradation of water quality in South Med countries results in less water resources exploitable at an affordable cost, an increase in water related diseases, decrease of agriculture productivity (e.g. soil degradation) and a degradation of the environment.

The analysis of current water quality monitoring networks and programmes in the MPC shows the following major challenges:

a. Lack of coordination in water quality monitoring and overlap of competencies resulting in difficulties to establish national overviews, quality checks, networks optimisations, data banking and data comparisons
b. Very limited dissemination of information collected and lack of citizen awareness on risks and water quality preservation
c. Lack of economical analyse to support decision making in designing water quality management plans
d. Need to carried out basin characterisation and management plan to optimise monitoring networks
e. Need for modelling and simulation tools to support water quality management
f. Need for common definitions and harmonisation on water quality standards.
g. Considering water quality in transboundary water resources negotiation and agreements.

The draft Strategy for Water in the Mediterranean (SWM) aims under this topic to:

- Ensure good quality public water services that provide access to adequate and affordable water supply and sanitation, in particular for the poor, by maintaining the existing and building additional drinking water and sanitation infrastructures, fulfilling public health considerations and preventing further deterioration of water resources quality among other needs;
- Reduce and prevent water pollution, expand the scope of water protection and avoid overexploitation of water resources, by aiming all countries to reach, in the medium term, a good status for all waters based on a comprehensive monitoring system for water quality and quantity, as well as for ecosystems and biodiversity status. In addition, control the use of fertilisers and pesticides to appropriate and recommended standards.

The next phase of the Med Joint Process will contribute to the Action Plan for the implementation of the SWM.

iii. Objectives and key subjects

The **overall objective** of the Working Group is to promote exchange between EU and non EU partners of the Mediterranean region and to identify good practices for the improvement of water quality monitoring networks based on the existing situation and experiences collected within the WFD-implementation process and in the Mediterranean Partner Countries. The **focus of the activity is on surface and ground water monitoring**, while coastal waters will also be part of the activity, in case it is linked to inland water management & monitoring.
In order to achieve these aims the following general actions would be undertaken:

- Step 1: Finalise the Mediterranean state of play on water quality monitoring networks and programmes
- Step 2: Launch pilot actions to demonstrate and validate the transfer of know-how related to the working group recommendations in specific South Mediterranean river basins
- Step 4: Production of reports on the pilot river basins.
- Step 5: Identification and analysis of best practices and "success stories" to provide recommendations for the SWM Action Plan.

The activity is targeted to the EU Member States and the Partner Countries covered by the MED EUWI, the European Commission and stakeholder groups.

On content, the WFD monitoring requirements implementation provides useful insights on the following **aspects of monitoring**:

- **Technical**: Dealing with issues of representativeness, frequency, types of parameters, assessment of trends; what new technologies are available and to be used for which objective (investigative, operational, surveillance monitoring, monitoring of protected areas)?;
- **Organisational** : how to analyze and improve an already existing monitoring network, how to develop a strategic, cost-effective approach to improving monitoring networks (choosing representative monitoring points, frequency etc.); how to integrate monitoring information into the design of River Basin Management Plans;
- **Financial**: what are cost-effective solutions when improving monitoring, both through low-cost technical solutions, designing « fit-to purpose » networks.

It is crucial to have strong links with the capacity building activities carried out at the regional and national level to reinforce water data management in order to ensure coherent data banking on water quality. This is ensured through EMWIS activities carried out with Med countries on a Mediterranean Water Observation Mechanism and its support to build **National Water Information Systems** (NWIS) compatible with WISE –Water Information System for Europe- in view of preparing a future Mediterranean Share Environmental Information System –SEIS-.

iv. Organisation

The activity is currently led by EMWIS, while additionally other Med countries (e.g one Med EU Member State and one MPC) for sharing the lead task are sought. Membership of the Working Group targets to representatives from the EU Member States, MEDA and Balkan countries, International Organisations and stakeholders.

Participation in the Working Group is based on active contribution of the membership to its works.

The activity is linked to the:

- WFD-CIS working group on Groundwater and chemical monitoring (WG 3);
- "Groundwater Management" activity (MED EUWI Working Group on Groundwater) under the Mediterranean EUWI/WFD Joint Process.

In addition, the work conducted by EMWIS on Water Information Systems and by the EEA on the Med extension of SEIS will be closely coordinated with the work of this WG.

This WG is also reporting to the sub-group on monitoring of the Horizon 2020 initiative related to the depollution of the Mediterranean Sea.

Synergies will be also built with the Mediterranean Pilot Basin Network and its shared waters activities.

The working group will look for funding resources from EU regional programmes (ENPI-South) for its activities, especially for testing at local levels through pilot basins, where established water quality measurements networks are set

Webpage of the working group: http://www.semide.net/topics/watmon

v. Expected outcomes and deliverables

The expected deliverables are:

- Final report including the description of the current situation, best practices, recommendations
- Workshop summary reports
- Pilot basins reports in non EU countries

vi. Contact persons

For membership application and further information, please contact:
Eric MINO - EMWIS Technical Unit - Tel: +33 492 94 22 91 - Fax: +33 492 94 22 95

The latest version of the Working Group Members is available online.

vii. Timeframe

Final report on state of play December 2010
Definition of pilot areas 2011
Final Report to EuroMed Water Directors 2011
Annual meeting end 2011
Testing recommendations in pilot areas 2011-2012
Report on pilot areas end 2012

ANNEX D: LIST OF WATER MONITORING WORKING GROUP MEMBERS

NAME	SURNAME	INSTUTION	COUNTRY
Hussein	ELGAMMAL	Water Quality Management Unit / Ministry of Water Resources and Irrigation	Egypt
Nicola	PACINI	MEDA EG/07/AA/EN09 Water Quality Management/ Ministry of Water Resources and Irrigation	Italy
Eric	MINO	EMWIS/SEMIDE	France
Jauad	EL KHARRAZ	EMWIS/SEMIDE	France
Paz	DIAZ	EMWIS/SEMIDE	France
Mohammad	ABADI	Ministry of Health/ Environmental Health Department	Jordan
Saleh	AL OURAN	Section Head of Groundwater Studies/ Ministry of Water and Irrigation	Jordan
Muhammad	SAIDAM	Royal Scientific Society/ EMARCU	Jordan
Fida'a	ABD ELFATTAH JIBRIL	Royal Scientific Society/ EMARCU	Jordan
Abeer ALI	MAHMOUD	Planning Division, Ministry of Water and Irrigation, Jordan Valley Authority	Jordan
Mohammad	BANY MUSTAFA	Ministry of Water and Irrigation	Jordan
Belkassem	DHIMI	Division des Méthodes au Secrétariat d'Etat chargé de l'Eau/ Ministère de l'Energie, des Mines, de l'Eau et de l'Environnement	Morocco
Majeda	ALAWNEH	Palestinian Water Authority	Palestine
Ana María	Alonso García	CEDEX	Spain
Leticia	MARTINEZ ETAYO	CEDEX	Spain
Onofre	GABALDO	Júcar River Basin Authority	Spain
Yousra	BEN SALAH	Direction Générale des Ressources en Eau	Tunisia
Tahar	LARBI	Agence Nationale des Ressources Hydrauliques (ANRH),	Algeria
Arnulf	SCHÖNBAUER	Austrian Environment Agency	Austria
Jean François	DELIEGE	AQUAPOLE – Université de Liège	Belgium
Xavier	DETIENNE	AQUAPOLE – Université de Liège	Belgium
Moustapha	FLEYFEL	Direction Générale de l'Exploitation - Ministère de l'Energie et de l'Eau	Direction Générale de l'Exploitation - Ministère de l'Energie et de l'Eau (Lebanon)
Chadi	BEJJANI	Direction Générale de l'Exploitation - Ministère de	Lebanon

NAME	SURNAME	INSTUTION	COUNTRY
		l'Energie et de l'Eau	
Jouaid	BOULOS	Etablissement des Eaux Beyrouth- Mont Liban (EEBML)	Lebanon
Hala	HABBOUCHI	Etablissement des Eaux Liban-Nord (EELN)	Lebanon
Siba	RAAD	Etablissement des Eaux Liban-Nord (EELN)	Lebanon
Amad	CHIDIAC	Etablissement des EauxLiban-Sud (EELS)	Lebanon
Nabil	AMACHA	Office National du Litani (ONL)	Lebanon
Mark	SAADEH	Office National du Litani (ONL)	Lebanon
Sait	TAHMİSCİOĞLU	General Directorate of State Hydraulic Works – DSI	Turkey
Reem	ABED RABBOH	Ministry of Local Administration and Environment	Syria
Khaldoon	MOURAD	Ministry of Local Administration and Environment	Syria
Doron	MARKEL	Lake Kinneret & Watershed Monitoring & Management Water Authority / National Infrastructures Ministry	Israel
Lamine	BABA SY	Observatory of Sahara and Sahel – OSS	Tunisia

ANNEX C: SURVEY SYNTHESIS

See online version and individual replies at:
http://www.semide.net/topics/watmon/meeting2009/documents

Characterisation of Monitoring networks and programmes in Mediterranean Partner Countries

Synthesis of survey answers[1]

Final version dated 2010-12-06

Preamble:

One of the first objectives of the Water Monitoring working group of the Joint Process between the EU WFD and Med-EUWI is to describe the status of water monitoring networks and programmes in Mediterranean Partner Countries. In this framework, between April and September 2009, EMWIS, with support of Aquapôle, carried out a survey among water authorities in the southern Mediterranean and Middle East. This summary reports answers to a questionnaire after a first consolidation work, including answers from 11 countries (Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Turkey). This summary is intended to be as close as possible to the original replies, but taking into account comments received from the working members in 2010. We are aware that some answers would require further information either because they are incomplete, or because they are not sufficiently specific. The workshop held in Beirut on 6 October 2009 allowed a 1st exchange of experiences, some clarifications on country replies and provided some examples of monitoring networks. Further clarifications were provided during a workshop held in Madrid on November 10.

1st section: Legal and institutional framework:

The first part of this questionnaire dealt with issues relating to the water sector regulatory framework and its role in integrated water resources management.

Q.1.1: *Responsibilities*

The distribution of institutional responsibilities related to water is specific to each country. Distribution of tasks between different Ministries is related to water body types (coastal water, inland surface water, groundwater, etc…) and to the various human uses of the resource (drinking water, irrigation, bathing, etc.…). In most cases, the Ministry in charge of water resources is the main body responsible for water quality monitoring. In two of the 9 MPCs, the Ministry in charge of water management is also in charge of environmental protection: in other cases the Ministry of Environment focuses more on conservation and the control of effluent discharges. The Ministry for Agriculture (8 countries) and the Ministry of Health (7 countries) have significant responsibility in water-quality related issues.

In addition to this fragmentation of responsibilities, even within a single authority, water-related issues are dealt with in many different departments (water treatment, water quality, hydraulics, industries, agriculture, dams, etc.). These often do not communicate sufficiently.

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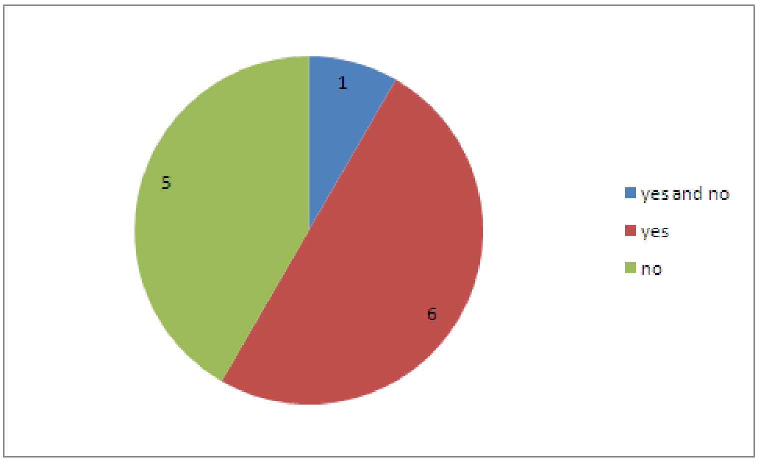
[1] Survey questionnaires as well as country replies can be found online following this link

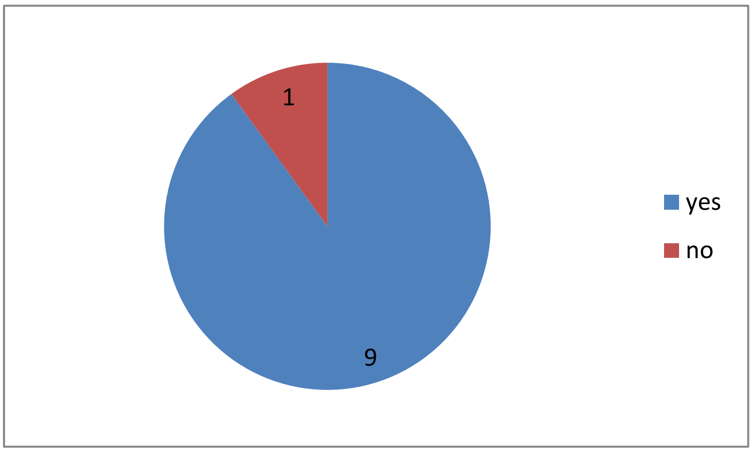
Q.1.2 Are there entirely or partially privatised water sectors (water supply, wastewater treatment,…)?



The partially privatised sectors include drinking water supply and wastewater treatment. In **Tunisia**, water supplies for irrigation and drinking water in rural areas are partly privatised: GDA (Agricultural Development Groups for services to the irrigation and rural AEP), fully privatised: bottling units.

There are entirely privatised water sectors, like in **Israel**, desalination plants and sewage treatment institutes. In **Jordan**: Aqaba Water Company, Miyahuna for Amman Governorate, Madaba for the billing, As Samara Wastewater Treatment Plant (BOT), Abu El Zegan and Zara (BOT) and Irbid (NAGWA). In **Palestine** the Jerusalem Water undertaking. In **Morocco**: the distribution and treatment of water.

Q. 1.4 Is integrated water resources management (IWRM) effective at the national, regional or local level?



IWRM is implemented in almost all the countries, sometimes since 1990 (Tunisia), or much more recently as in Israel (2007). In Turkey, IWRM is not yet implemented but a project for capacity building in the water sector is underway to harmonise water management to the European legislation, for its accession to the EU. This project which was completed at the end of 2009 led to the formulation of river management plans.

How is IWRM implemented?

Algeria: integration is taken into consideration in water laws, basin agencies structure, master plans (Master Plan for Water Resources Development), international Co-operation in the field of IWRM.

Cyprus: taken into consideration at the national level.

Egypt: a National Water Resources Plan for integrated water resources management is under implementation.

Israel: adoption of a “master plan” and establishment of a Water Authority Council involving all the Ministries in charge of water as well as representatives of the public.

Jordan: adoption of a national water master plan.

Lebanon: grouping of the various water sectors (drinking water supply, sanitation and irrigation) within only one body.

Morocco: national water plan and programme for Integrated Water Resources Development.

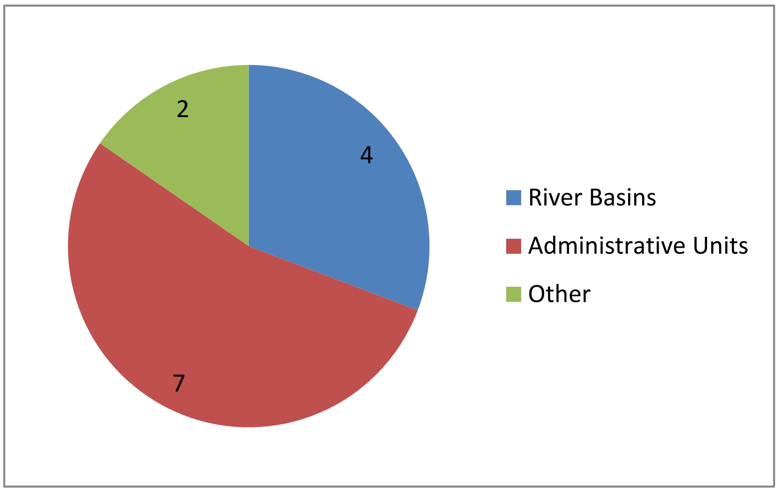
Palestine: drilling of a new well in order to enhance distribution.

Syria: creation of multi-ministerial Steering Committees for water projects. Each water project, law or initiative has a steering committee, which consists of members from different ministries in order to guarantee stakeholder participation. The project is monitored and evaluated by this committee.

Tunisia: water development plans in the North, Centre and South of the country and strategies for water resources mobilisation.

Turkey: The Republic of Turkey has been preparing the process for EU integration. A project called "Capacity Building Support to Turkey for the Water Sector" intends to assist Turkey in updating water management policies to EU water legislation, in particular the Water Framework Directive (WFD) 2000/60/EC of 23 October 2000, the Dangerous Substances Directive (DSD) 76/464/EEC of 4 May 1976, and the daughter directives. The Project lasted from December 2007 to November 2009. A Management Plan is an output of the Project.

Q.1.5 *On what geographical entity basis (unit?) is water managed?*



The countries which reported "other" are **Israel**, where water is managed on the basis of hydro-geological basins (groundwater) and **Turkey**, where water resources management is entrusted to governmental institutions which operate by river basins and administrative units. Turkey specified that the Directorate General of the State Hydraulic Works (DSI) represents the main water authority in Turkey and is responsible for the management of water allocations.

Provide the number of geographical entities, average area and the name of the institutional level, responsible for these entities.

Israel: Mainly on groundwater basins (Coast, Mountain, Western Galily) and Kinnereth basin. The average area is 4200 Km^2. Supervised by the Water Authority.

Jordan: 15 Surface Water Basins and 12 Groundwater Basins.

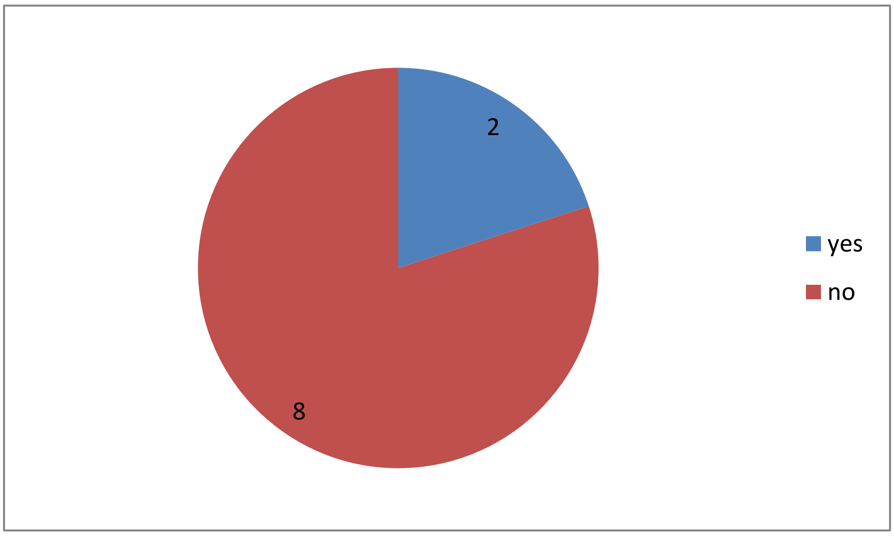
Lebanon: 5 administrative units: 4 EPRE + ONL.

Syria: Most governorates in Syria (14 governorates in total) have sub-directorates dealing with water issues: the first one for irrigation (under the authority of Ministry of Irrigation - MOI) and the second water supply and sewage (under the authority of Ministry of Housing and construction - MOHC). Some governorates have a water resources directorate.

Tunisia: 24 governorates (under the authority of the Ministry of Interior and local Development -MIDL) each one including a Regional Commissary for Agricultural Development –CRDA- (under the authority of the Ministry of Agriculture and hydraulic resources -MARH).

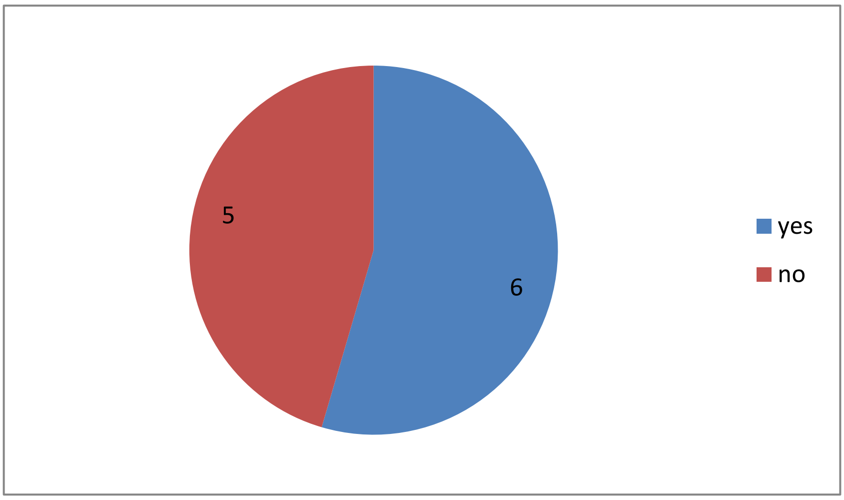
Turkey: Turkey developed its water resources policy taking into consideration the present and the future water needs for its growing population, developments at global levels as well as the on-going EU accession process. Priority is given to policies and plans which uses the full potential of Turkey's water resources in an efficient manner. The focus has been on securing the quantity and the protection of the quality of water resources. Turkey has a number of governmental institutions in the field of water management, functioning in River basin and other Administrative Units. The situation is not much different from that in most other EU Member States or Accession Countries. The General Directorate of State Hydraulic Works (DSI), is the most established water authority in Turkey and the major institution responsible for water development, management and allocation. DSI is responsible for performing basic investigations such as flow gauging, water quality monitoring, formulation of construction proposals , financing and subsequent operation of these works.

Q.1.6 *The WFD defines a water body as a section of a river, lake, coast which can be regarded as an homogeneous unit, from the view point of natural characteristics and of the pressures exerted by human activities.*
The WFD moreover specifies that all the rivers, whose catchment area is larger than 10 km², must be broken up in water bodies. Is the river network subdivided or not in water bodies, within the WFD meaning?



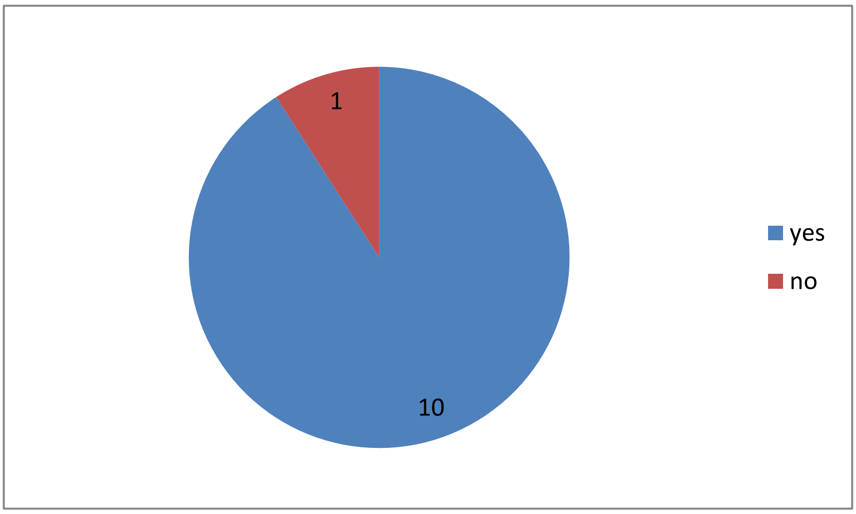
Except for **Cyprus** (216 rivers, 18 lakes and 28 coastal water areas) and **Morocco** (a non-specified number of water bodies), the water body concept is not used for sub-dividing the river network. However, **Turkey** specifies that a capacity building project in the water sector will result in the delineation of water bodies. Turkey launched the project called "Capacity Building Support to Turkey for the Water Sector" to develop its water management instruments in line with EU water legislation. By means of this project, water bodies were defined in the Büyük Menderes River Basin, and new water bodies will be defined in Sakarya, Yeşilırmak, Akarçay and Akdeniz Basins are concluded.

Q.1.7 *Does the water legislation integrate commitments of results on the good qualitative status of rivers or water bodies?*



Achieving good status in surface water bodies is an objective defined as such in the legislation of 6 countries (Algeria, Cyprus, Egypt, Jordan, Syria, and Tunisia).

Q.1.8 Is there a legal regulatory framework which defines specific national standards for the discharge of pollutants and quality of the environment?



Lebanon has no legal regulatory framework for discharges and environmental quality. In **Israel,** new standards have been defined and are waiting for adoption (2009).

Most countries have incorporated in their legislation a regulatory framework for controlling effluent discharges and environmental quality which is sometimes derived from European standards with sometimes the addition of some parameters (case of **Cyprus**).

What standards are applied?

Algeria: Executive Order No.: 06-141 u 20 Rabie El Awwal 1427 (corresponding to 19 April 2006) defining the concentration limits in industrial effluent discharges. In addition the ANRH has its own qualifications scale.

Cyprus: EU directives' standards are used at national level. For parameters that are absent from the appendices of the directives, older national standards (e.g. National Regulation 102/9) are used to protect environment quality.

Egypt: WHO standards are applied

Israel: The Water Regulation from the Ministry of Environment (Prevention of Water Pollution) (Metals and Other Pollutants), ref 5761-2000 defines limits concentration of pollutants for wastewater-. Proposals for the definition of new standards are awaiting ratification (2009).

Jordan: Jordanian standards cover treated domestic and industrial wastewater, and solid waste.

Morocco: Quality Standards for Surface Water (Rivers and lakes). Quality Standards for General and Specific Waste.

Palestine: Palestinian Standards as well as Israeli standards, WHO and EPA (USA) standards.

Syria: Syrian standards that fit with environmental law no. 50.

Tunisia: the standard NT 106.002 establishes the quality of the waste in the maritime and hydraulic public domains, and public canalisations. Concentration limits in wastewater are defined by 54 physico-chemical and bacteriological parameters, for several heavy metals and some organic micro-pollutants (hydrocarbons, pesticides, PCB/PCT and phenols).

Turkey: By Law on Water Pollution Control.

Q.1.9 What are the past, current and future national and international programmes for monitoring water quality?

Algeria: Programme for monitoring surface and ground water quality established by the ANRH and carried out with the River Basin Authorities (Agences de Bassin Hydrogéologique).

Cyprus: On-going monitoring programme for the implementation of the WFD, Article 8.

Egypt: National Water Quality Monitoring (NWQM).

Israel: On-going monitoring programme including all natural water resources, wastewater, coastal water as well as water produced by desalination, pollution from cars service stations and industrial areas. Expanding the network for monitoring pollution from service stations and building a network for monitoring industrial pollution are planned.

Jordan: .Several monitoring programmes are underway, supervised by the Jordanian Water Authority, the Jordan Valley Authority, the Ministry for Health and the Ministry for the Environment. The current monitoring programme includes all natural water sources, wastewater, coastal water, water produced from desalination plants, car service station effluents and industrial plants. It is planned to widen the network of gas station pollution monitoring and to establish a network dedicated to industrial pollution monitoring.

Lebanon: Between 1990 and 1992, a national survey of the quality of drinking water was conducted

Morocco: A national network for monitoring water resources quality was developed in 1984. On-going optimisation of this national network. National Plan for the Protection of Water Quality.

Palestine: Monitoring of water resources was carried out since 1967; groundwater resources screened for Chloride and Nitrate; since 1996 monitoring included all water resources (residential and agricultural wells and springs), parameters comprised major chemical anions and cations, Microbiology (total and faecal coliforms) as well as field measurements. Twice a year (spring and autumn), the Ministry of Health monitors consumer taps for total and faecal contamination. Currently, besides what was mentioned above, municipalities monitor the distribution networks for total and faecal coliforms, and chlorination.

Syria: Defined within the Ministry of Housing and Construction.

Tunisia: Several networks exist: for monitoring surface water quality of the main rivers; a national network is dedicated to the monitoring of groundwater quality, the parameters include dry residues and nitrates; an additional network was designed for monitoring the quality of stored surface water (dams); these are separate from the national network which monitors surface water resource quality.

Turkey: A network for monitoring water quality was set up in 1979 to include a description of the water bodies and long-term evolutionary trends of their water quality in order to better understand recent ecological changes. The number of stations gradually increased from 65 to 1,163 between 1979 and 2008, included in the regular systematic monitoring of surface and groundwater over the entire Turkish territory. Water quality monitoring stations are built according to the needs of current and future DSI projects. In the future, pending a twinning project, it is planned to implement a monitoring system in line with the WFD.

2nd section: Mechanisms and networks for monitoring (or controlling) water quality

Q.2.1 *Networks: synthesis for each country*

- **Algeria:** 2 monitoring networks are established and managed by the public sector: ANRH and MATET . The first one is dedicated to inland waters and the second one to coastal waters. ANRH provides monitoring and operational control and has operated since 1984. It includes 124 stations, measures 30 parameters and concerns 54 dams. The stakes are nature conservation, protection of public health and risk prevention (warning). International standardized procedures of measurement and treatment are used. **The coast**al waters monitoring data record is incomplete.

- **Cyprus:** 4 public networks for surveillance monitoring and control of discharge effluents were commissioned in 2007 covering all groundwater resources (84 monitoring stations), part of the lakes (11 monitoring stations and 61% coverage), part of the rivers (31 monitoring stations and 12% coverage) and part of coastal waters (8 monitoring stations and 32% coverage). Protected water uses includ drinking water, irrigation and nature conservation. The total number of measured parameters is 282: 123 and 117 the two networks operating for inland surface water, 23 for the network operating in coastal waters, and 19 for the network monitoring groundwater.
- **Egypt:** 4 monitoring networks, 2 networks dedicated to the monitoring of discharge effluents (Ministry of Health and Ministry of Housing and new communities), 1 for surface water surveillance monitoring (Ministry of water resources and irrigation, MWRI) and the last 1 for investigative monitoring (Ministry of Environment). The first network, commissioned in 1995, has 434 monitoring stations dedicated to groundwater, WWTP discharges and industrial effluents, a third network is dedicated to coastal water, WWTP discharges and industrial effluents. The first network measures 33 parameters, the standard procedures of measurement and treatment are not standardized between authorities.

- **Israel:** 3 networks including one entirely public, which monitors coastal waters and industrial effluents with 150 monitoring stations, while the other two, which are public/private partnerships, deal with swimming pools (2,400 monitoring stations) and drinking water (~2,000 monitoring stations). Each of these 3 networks provides the 3 types of control (surveillance, operational and investigative), all 3 are under the responsibility of the Ministry of Health.

- **Jordan:** 1 public network managed by a scientific institute with 13 monitoring stations and covering 63% of groundwater and 23% of lake water, providing the 3 types of monitoring (surveillance, operational and investigative). The water uses protected are drinking water supply and irrigation.

- **Lebanon:** 10 networks (8 public and 2 private) cover almost all groundwater, rivers and lakes, but also wetlands and coastal waters. Their commissioning goes back to 1970 for the oldest and to last year for the most recent 2. The concerned use is above all drinking water supply (10 networks) and also irrigation (2 networks). The number of monitoring stations varies between 1 (for 4 networks) and 75 (for 2 networks together) ,the measurement method used is either manual or telemetry. According to the networks, the procedures used are defined by different national authorities on the basis of international standards.

- **Morocco:** 2 public networks; one is dedicated to accidental pollution, covering coastal waters and inland waters; the other one dedicated to monitoring (740 stations) and concerns groundwater (45 aquifers), rivers (46), wetlands, lakes (39 dams). 1 public/private network which deals with the discharges of industries and wastewater treatment plants.

- **Palestine:** 3 networks; Water Service Provider, MOH, Palestinian Water Authority, respectively for monitoring the overall water quality status and monitoring of industrial effluents; the MOH Network monitors accidental pollution; and the PWA combines accidental pollution monitoring, monitoring of water quality status and monitoring of polluting effluents. The first network is dedicated to discharge effluents from WWTP; and the third one to groundwater and WWTP discharges. No biological parameters are measured other than total and faecal coliforms. The networks follow international standardized procedures of measurement and treatment.

- **Syria:** 3 public networks managed by 3 different Ministries (Environment, Housing, Irrigation). They cover 100% of inland and coastal waters. All three of them use national procedures for data measurement and processing.

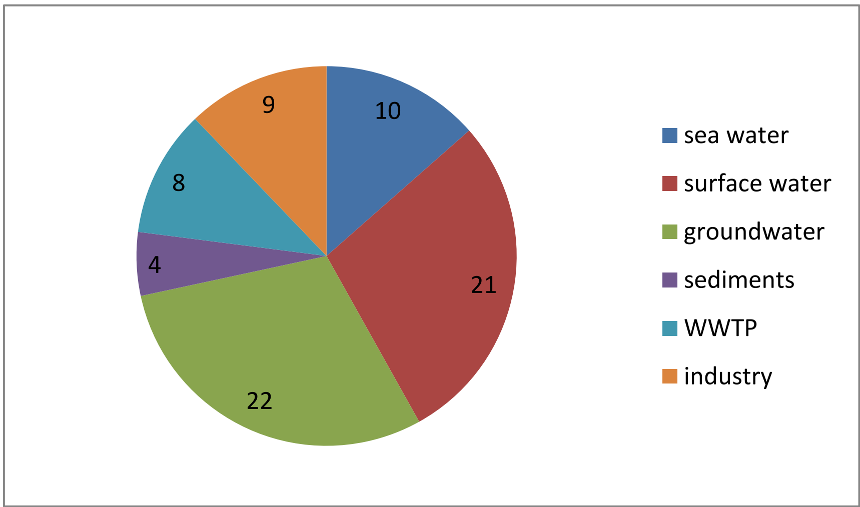
- **Tunisia:** 7 public networks, including 6 dedicated to monitoring the status of the resource, and 1 dedicated to the 3 types of monitoring. They total more than 6,400 monitoring stations, of which the oldest was commissioned in 1873, and cover 90% of groundwater and 65% of rivers, wetlands, lakes and dam reservoirs and coastal water. They are managed by the National Agency for Environmental Protection (2) and the Directorate-General of Water Resources (5). **The 3 net**works suffer from incomplete data.

- **Turkey:** 4 public networks including
  - 2 survey networks: one for inland surface waters and the other for inland surface waters and sediments
  - an operational network for detecting pollution in coastal waters
  - a network for the 3 types of monitoring

These networks cover approximately 5% of groundwater, 80% of rivers, 5% of wetlands and 15% of lakes and dam reservoirs. The number of monitoring stations is not specified.

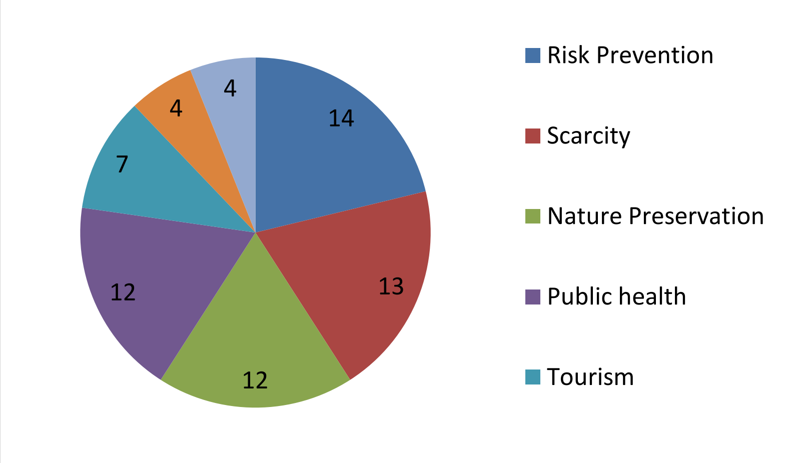
Q.2.2 *Monitored water resources:*

Total number of networks for each type of water



The greatest number of networks is by far for surface water and groundwater.

Main stakes:

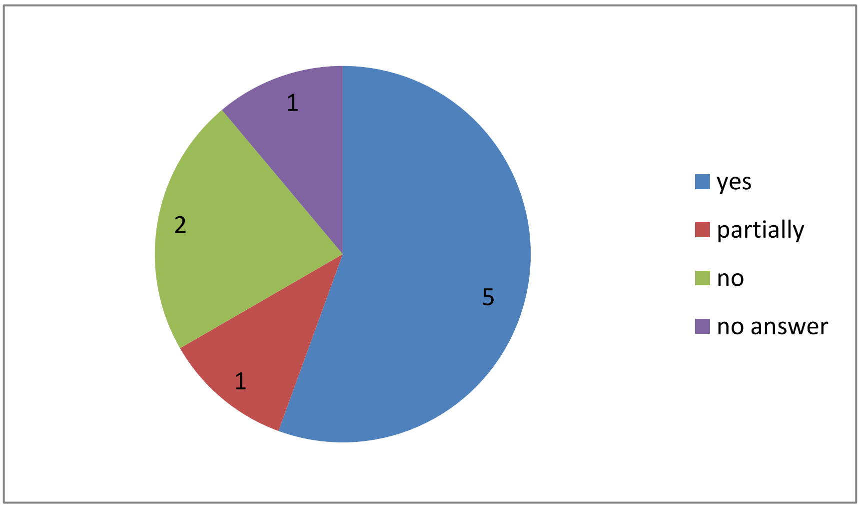


Risk prevention, water resource scarcity, nature conservation and public health are the stakes most often quoted regarding the building of the networks.

Note: Values are approximate because the stakes are not specified for all networks.

Q.2.4 *Inventory of pollutants*

The WFD insists on the importance of establishing a link between the pressures exerted on the environment and the impacts on water quality (pressure - impact relationship). This requires the availability of ***inventories*** *(or land registers) for* ***urban and industrial effluent discharges****, coming from* ***wastewater treatment plants,*** *and related to agriculture. Are there such inventories?*



If yes, for which types of discharges and are they regularly updated, and are they mapped (GIS)?

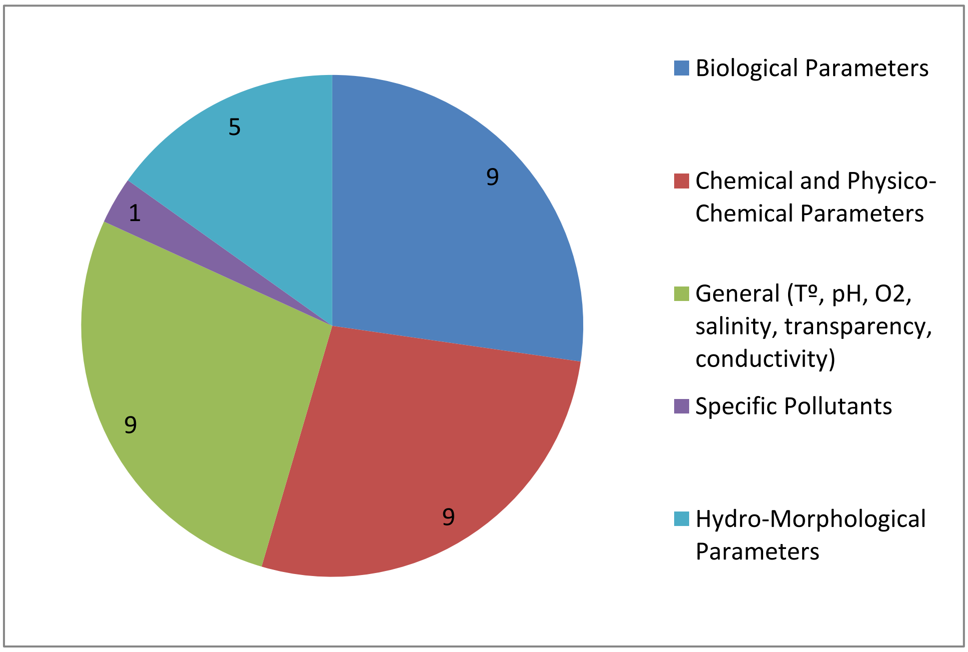
- **Algeria:** urban discharges, wastewater treatment plants and industries (partial mapping)
- **Cyprus:** farms, slaughter-houses (no GIS)
- **Egypt:** wastewater treatment plants and industrial discharges, urban discharges (no GIS).
- **Israel:** agriculture and others (GIS)
- **Jordan:** urban discharges (partial mapping).
- **Lebanon** : urban and industrial discharges
- **Morocco:** domestic, industrial, agricultural discharges (GIS being developed)
- **Palestine:** wastewater treatment plants' discharges (no GIS).
- **Syria:** urban, wastewater treatment plants and industrial discharges, (no information about mapping).
- **Tunisia:** industrial, wastewater plants and urban discharges (partial mapping).
- **Turkey**: wastewater plants and urban discharges (SIG).

- ***Q.2.5*** *Monitored Parameters*

	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestina	Syria	Tunisia	Turkey
Biological Parameters		√	√	√	√	√	√	√		√	√
Phytoplankton		√			√					√	
Other aquatic flora (e.g. phytobenthos & macrophytes)		√			√					√	
Benthic invertebrate fauna		√			√						
Fish fauna					√						
Bacteria (Coliform, faecal coliform, streptococcus, staphylococcus, enterococcus, escherichiacoccus, ligionella…)			√	√	√	√	√	√		√	√
Chemical and Physico-Chemical Parameters	√		√		√	√	√	√	√	√	√
DCO, DBO_5, COD, TSS,TDS	√		√		√		√		√	√	√
Ca	√				√		√	√			
Cl	√				√		√	√			
MOA, Phenols, MAP, OCP	√				√	√	√	√			√
Heavy metals	√				√	√	√	√	√	√	√
NKjeldahl, NO2, NO3,Nh3	√				√	√	√	√	√	√	√
Phosphates (PO4…)	√				√	√	√		√	√	√
Sulfates (SO4, SO2…)	√				√	√	√		√	√	√
General	√		√		√	√	√	√	√	√	√
Transparency/Turbidity					√	√	√	√	√	√	
Temperature			√		√		√		√	√	√
Oxygenation	√				√	√	√			√	√
Salinity					√	√	√			√	
PH	√		√		√	√	√	√		√	√
Conductivity	√					√	√			√	
Specific pollutants							solved hydrocarbures, anionic detergents, pesticides				
Hydro-morphological Parameters		√			√	√				√	√
Quantity and dynamics of water flows		√			√	√				√	√
Connection with groundwater body		√			√						
Residence time (lake)		√			√						
River continuity		√			√						
Depth variation		√			√					√	

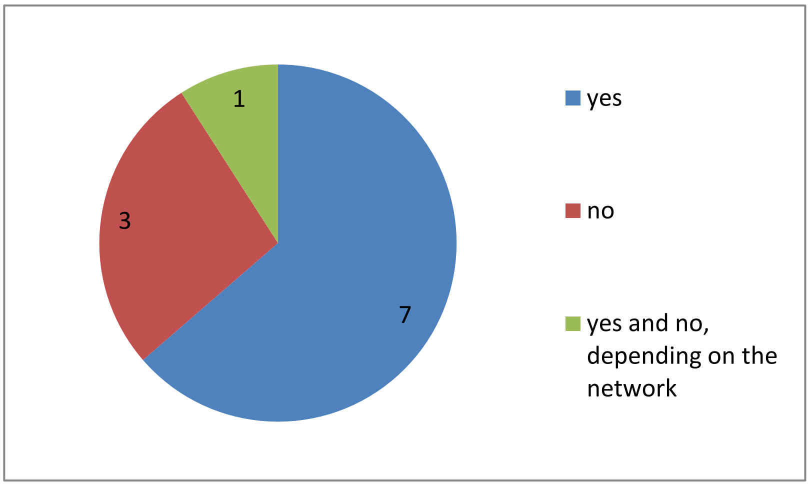
	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestina	Syria	Tunisia	Turkey
Width variation (rivers)		√			√					√	
Structure of substrate		√			√					√	
Quantity of substrate (lakes, transitional water)		√			√					√	
Tidal Regime		√									

Number of countries monitoring the different parameters:



3rd section: Data processing and dissemination

Q3.1 Is there a centralised collection and information system?



In **Lebanon** the situation differs according to the networks:
- yes: EEBML, EELN, EELS
- no: ONL

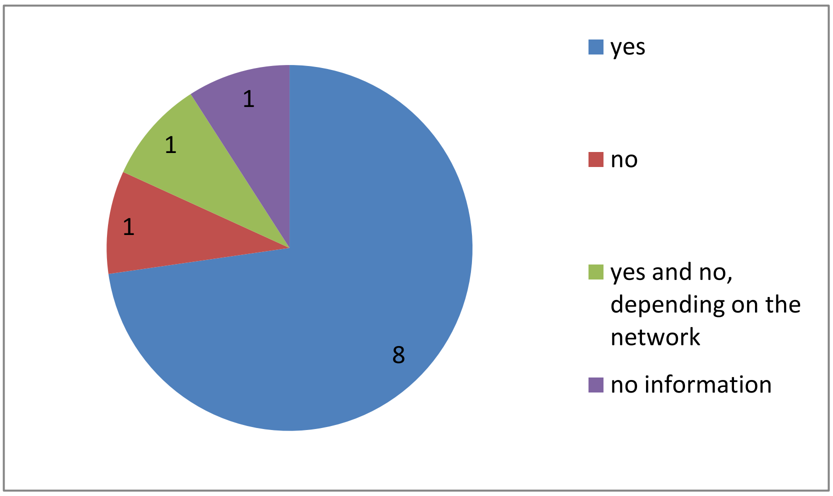
Specify how data are transferred: teletransmission from the stations, computer file, manual data entry, other?

Data entry is manual in almost all the countries (except **Morocco**, only computer files), but it is most often coupled with data-processing techniques (at least for certain networks). **Tunisia** alone specifies using only manual acquisition.
The data-processing techniques can be:
- teletransmission, telemetry
- transmission on computer media (CDROM, USB key)

Who manages this centralised system?

- **Algeria:** The *Ministry of Water Resources* at the national level.
  The *ABHs* at the regional level.
- **Cyprus**: *Water Development Department* and *Department of Fisheries and Marine Research*.
- **Egypt:** *Ministry of Water Resources and Irrigation, Ministry of Health and Population* and *Ministry of Environmental Affairs*.
- **Israel:** *Public Health Headquarters (Ministry of Health data).*
- **Jordan:** There are 2 systems one at the Water Information Department of the *Ministry of Water and Irrigation* and one at EMARCU/RSS.
- **Lebanon**: technical office (EEBML).
- **Morocco**: SEE/Water Department.
- **Palestine**: Data Bank department.
- **Syria:** *Ministry of state for Environment Affairs*, *Ministry of Housing and construction* and *Ministry of Irrigation.*
- **Tunisia**: COPEAU and MED POL/'ANPE
  SYGREAU : Currently being developed (Data processing system for surface and ground water resources management) – DGRE
  SYNEAU: Federating and advanced information system (National Water information System) – DGRE
- **Turkey:** *DSI Water Monitoring System, EIE Monitoring System, General Directorate of Protection and control network,* and *DGEM Monitoring System*.

Q3.2 Are collected data validated?



In **Lebanon** the situation differs according to the networks:

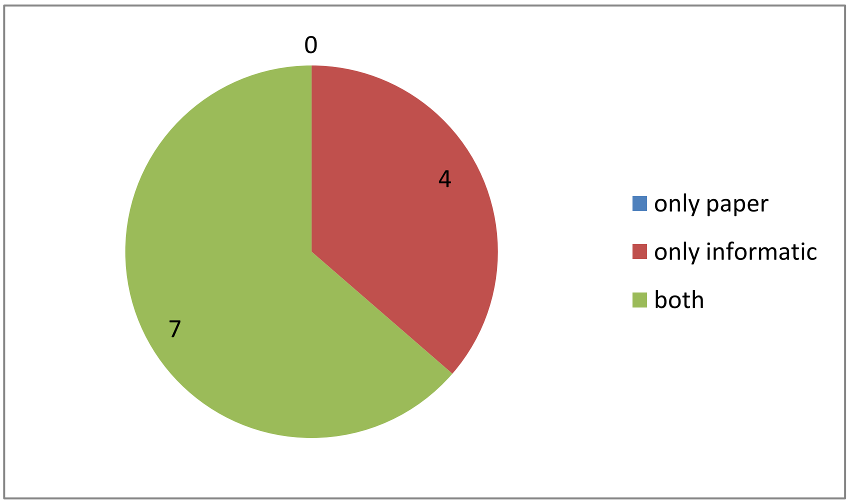
- yes: EEBML, EELN, EELS
- no: ONL

As for **Syria**, there is no information.

What are the methods used for validation?

- **Algeria:** comparison homogeneity test, validation at the source
- **Cyprus:** checking by qualified personnel to detect obvious errors, etc.
- **Egypt:** statistical methods.
- **Israel:** laboratory procedures and computer programmes
- **Jordan:** using functions included in the software and daily analysis of the data by water specialists
- **Lebanon:** manual and computerised methods - *The ISO methods*
- **Morocco:** chemical control tests (ionic balance, dry residues, etc.) - Statistical analyses (Identification of aberrant values, whisker package)
- **Tunisia**: computerised (quality, integrity)

Q3.3 Data storage/processing:
Under which (electronic, paper) format(s) are data stored?



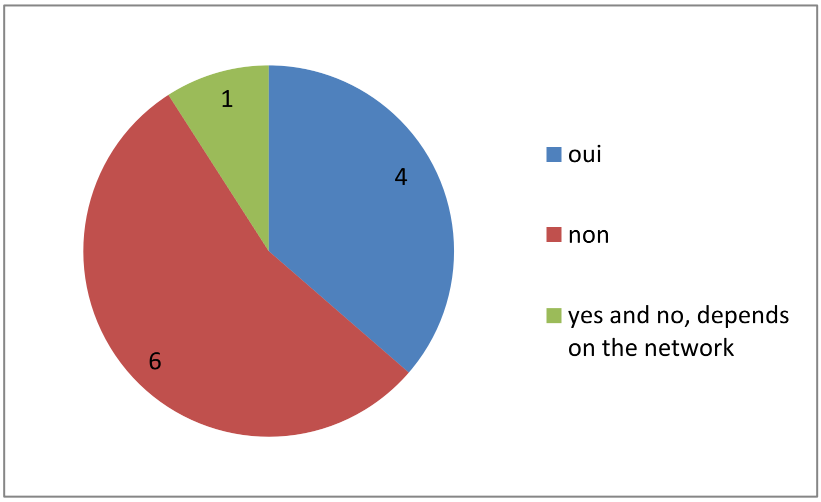
All the countries store their data on computer media.

If databases are computerised, what are the software programmes used?

There are several systems for each country (often different from one network to another).

- **Algeria, Jordan, Tunisia, Cyprus:** applications developed within the network
- **Algeria, Egypt, Lebanon, Morocco, Tunisia:** Microsoft Access
- **Algeria, Lebanon, Tunisia:** Excel
- **Lebanon, Tunisia:** Word
- **Algeria, Cyprus:** SQL Server 2000 (regional data base)
- **Lebanon:** Rv telemetry
- **Morocco, Turkey:** ORACLE

Are data integrated into a GIS?



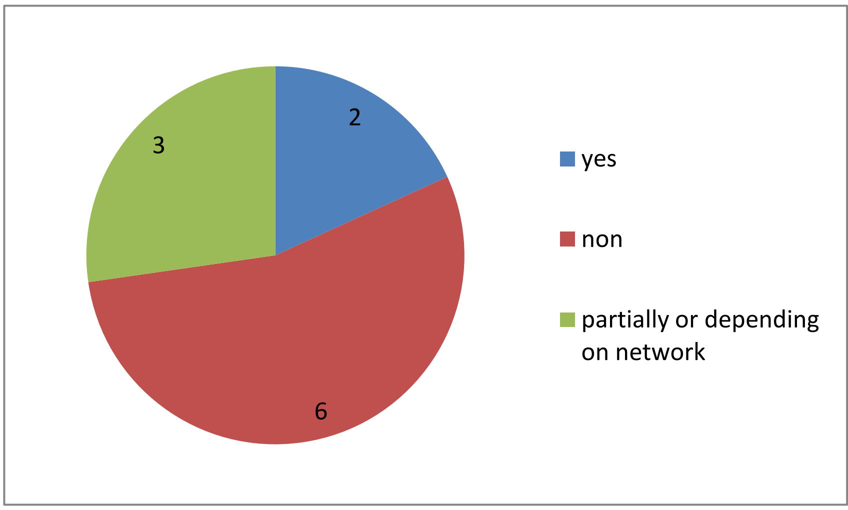
In **Lebanon** the situation again differs according to the networks:

- yes: EEBML
- no: ONL, EELN, EELS

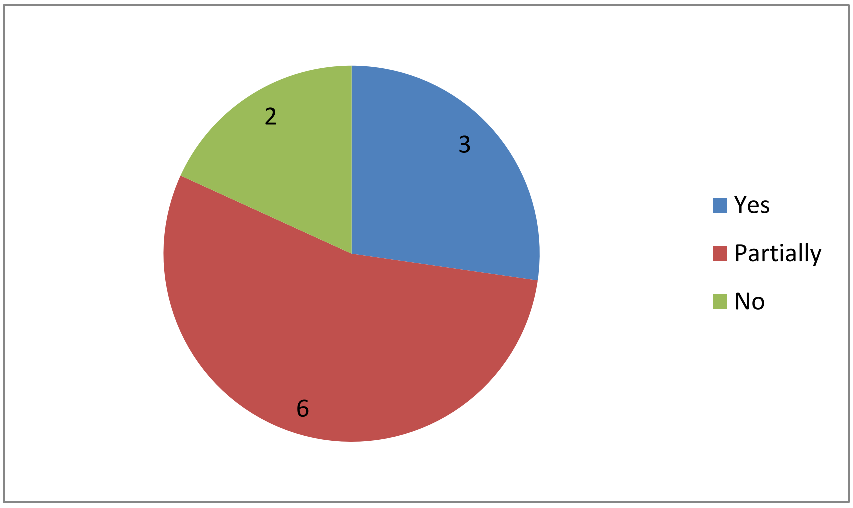
What are the formats used for data storage (please provide the data structure separately, whenever possible)?

- **Algeria**, **Cyprus**: ESRI ArcGIS shapefiles & geodatabase
- **Algeria**: Mapinfo
- **Jordan**: ORACLE data base
- **Lebanon**: Informatics and intranet (EEBML), CD-R and files and hard USB (EELS)
- **Morocco**: Access or SQL Server, ArcMap/ArcGIS, Visual Studio 2005

Are data accessible on the Internet?



Q3.4 *Data dissemination:*
Are data disseminated?



General public

Dissemination method used for the general public:

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Upon request	6	√	√		√	√	√		√			
Free	5	√			√				√	√	√	
Event (fairs…)	1							√				
Official publications	1										√	
No	2			√								√

How is the dissemination made to the general public?

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Website	6	√	√		√	√				√	√	
Publications	4	√			√		√				√	
The medias	2				√						√	
Computer file	5		√		√	√	√		√			

What is the frequency used for dissemination to the general public?

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Monthly	2	√					√					
Half-yearly	1										√	
Yearly	4	√			√					√	√	
Never	1											√
Other	6	Occasionally	Daily *storage of main reservoirs*		Biannual	No specific frequency	Upon request		Upon request			

Political World

Dissemination method used for the political world:

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Upon request	9	√	√	√	√	√		√	√	√	√	
Free	5	√			√			√	√		√	
Official publications	2			√							√	
No	2						√					√

How is the dissemination made to the political world?

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Website	3	√			√						√	
Publications	6	√		√	√	√		√			√	
The medias	2				√			√				
Computer file	5		√		√	√			√	√		

What is the frequency used for dissemination to the political world?

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Monthly	1	√										
Half-yearly	1										√	
Yearly	3			√				√			√	
Never	1											√
Other	4	Upon request				No specific frequency			Upon request		Upon request, Events	

Universities

Dissemination method used for the universities:

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Upon request	8	√	√			√	√	√	√	√	√	
Free	4	√						√	√		√	
Official publications	1										√	
No	2			√								√

How is the dissemination made to the universities?

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Website	3	√			√						√	
Publications	5	√			√		√	√			√	
The medias	1				√							
Computer file	7	√	√		√	√	√		√	√		

What is the frequency used for dissemination to the universities?

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Monthly	1	√										
Half-yearly	1										√	
Yearly	2							√			√	
Never	1											√
Other	3	Upon request				No specific frequency	Upon request					

Others

Dissemination method used for others:

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Specify		Partenaires		M. Environment		M. water, Environment, Health, Agriculture	M. Energy &Water		Researchers & students		Ministeries, Water Adm., Research Students	
Upon request	7	√	√	√	√		√		√		√	
Free	4				√	√	√		√			
Official publications	1										√	
No	3							√		√		√

How is the dissemination made to others?

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Website	3				√	√					√	
Publications	3				√		√				√	
The medias	1				√							
Computer file	6		√	√	√		√		√		√	

What is the frequency used for dissemination to others?

	Total	Algeria	Cyprus	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Syria	Tunisia	Turkey
Monthly	1						√					
Half-yearly	0											
Yearly	3			√	√						√	
Never	1											√
Other	3					No specific frequency			Upon request		Upon request	

Is data dissemination following a particular agreement protocol?

- **General public:** no for all the countries, except **Lebanon**, MED POL. (**Tunisia**), and **Cyprus**.
- **Political world:** no for all the countries, except **Lebanon** and **Morocco**.
- **Universities:** no for all the countries, except **Lebanon** and **Cyprus.**

Q.3.5 *Are data used for modelling or simulation?*

Yes for all the countries, except 2 networks (ONL and EELN) in **Lebanon**. **Israel** did not answer to this question.

What are the objectives?

- **Algeria:** implementation of general or regional studies on the various parameters.
- **Cyprus:** water quality (sea water intrusion), *water abstraction.*
- **Egypt**: data are used for modelling and simulation in a small scale and it will be expanded in the coming months also, data are disseminated based on request.
- **Israel**: no answer.
- **Jordan:** groundwater modelling, tool for the completion of the National Water Plan (MWI /WAJ/JVA). Applied research projects (EMARCU/RSS, universities).
- **Lebanon:** comparative study of previous years (rainy year) (EEBML). To be up to date, to meet our needs and to be faster in the controls, results and monitoring (EELS).
- **Morocco:** to take actions for pollution removal.
- **Palestine:** Special researches or studies *depending on the study objective.*
- **Syria:** decision-making.
- **Tunisia:** on-going study on the feasibility of modelling covering the whole Medjerda river basin (ANPE) **-** studies, forecasts, planning, management.
  To simulate pollution sources and hydrology, floods, high water flows (sources of influence) and status (quality) of the Medjerda river basin, to be used as a decision-making supporting tool.
- **Turkey**: no answer.

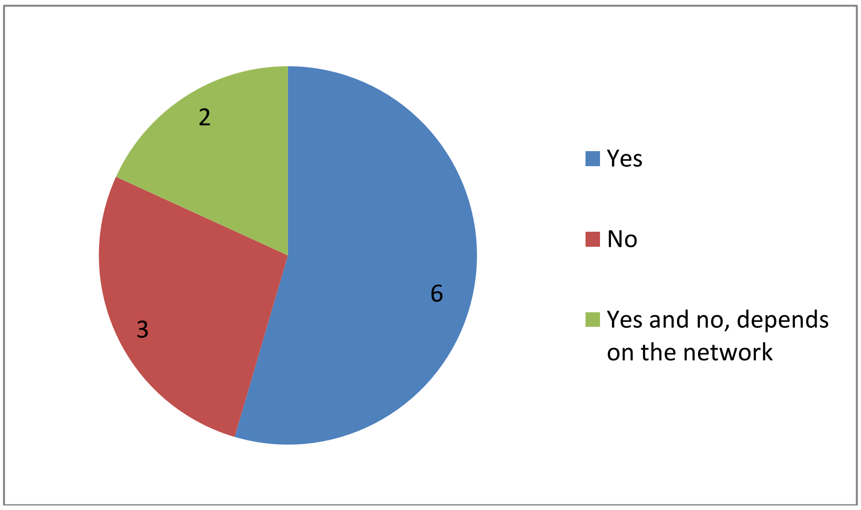
What are the software programmes used?

- **Algeria:** data processing software: SIQUEAU, SASS **-** specific software developed for the Master Plan for Water Resources Development (PDARE) called BILAN.
- **Cyprus**: Modflow, Feflow.
- **Egypt**: no answer..
- **Israel**: no answer.
- **Jordan**: no answer.
- **Lebanon:** telematics programme (EEBML) - Access or other according to the specific need (EELS).
- **Morocco**: Modflow.
- **Palestina**: Aquachem, Surfer for contour mapping, and Mt3D.
- **Syria:** the Arab Centre for Studies of Arid and Dry Zones: ACSAD.
- **Tunisia:** the model considered for the Medjerda modelling: PEGASE (ANPE.)
- **Turkey**: no answer.

What are the organisations in charge of this modelling?

- **Algeria**: the departments of the ANRH and ABHs.
- **Cyprus**: *Water Development Department.*
- **Egypt**: no answer.
- **Israel**: no answer.
- **Jordan:** Ministry of Water and Irrigation and two units which depend on it (WAJ, JVA) - EMARCU/RSS, universities.
- **Lebanon:** private organisations (contractual) (EEBML) - IT department: internal or subcontracting (EELS).
- **Morocco:** Water Department, River Basin Agencies, ONEP.
- **Palestina:** NGOS, PWA, Universities, research centers**.**
- **Syria:** Ministry of Agriculture and Agricultural Reform.
- **Tunisia:** Aquapôle (university of Liege) as well as other national institutions (ANPE, ONAS, DGRE, etc.).
- **Turkey**: no answer.

Q.3.6 *Are data used for reporting at the international level (conventions, agreements, etc.)?*



The level of awareness on international reporting obligations varies from one institution to the other e.g. in **Lebanon** only the EELS, in **Tunisia** only ANPE

Who takes care of this reporting?

- **Algeria and Palestine:** no reporting mentioned
- **Cyprus:** the department in charge (see question Q.1.1).
- **Egypt:** no reporting.
- **Israel:** the Ministry of Health (MoH).
- **Jordan and Morocco** no answer.
- **Lebanon:** the Head of Department of the laboratory.
- **Syria:** the State Ministry for Environmental Affairs and the Ministry of Irrigation.
- **Tunisia:** the ANPE submits annual reports on the quality of the marine environment to the co-ordination unit of the MED POL. Programme (UNEP-MAP).
- **Turkey:** the Organisation for Economic Cooperation and Development (OECD), European Environmental Agency (EEA).