

Horizon 2020 Mediterranean report

Toward shared environmental information systems

EEA-UNEP/MAP joint report

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European Environment Agency



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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark
Tel.: +45 33 36 71 00
Fax: +45 33 36 71 99
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

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- Annex 4: Morocco
- Annex 5: Palestine
- Annex 6: Tunisia

Foreword

Over the last eight years, since the Cairo Declaration, the Mediterranean Region has been facing emerging environmental challenges, whilst the environmental status of the Mediterranean Sea has remained a high priority on the political agenda. To meet the goal of the Horizon 2020 Initiative to de-pollute the Mediterranean Sea by 2020 would require enhanced efforts, among which further and better implementation of policies supported by reliable, targeted and, above all, shared environmental information.

The current report, which we are glad to hereby present, provides relevant evidence of such developments. This report is a joint effort by the European Environment Agency (EEA) and the United Nations Environmental Programme – Mediterranean Action Plan (UNEP/MAP), and builds on previous joint EEA and UNEP/MAP reports. The work undertaken by the review and monitoring subgroup of the Horizon 2020 Initiative was instrumental in its preparation, with financial support from the European Commission.

We are pleased to recognise that the Shared Environmental Information System (SEIS) principles served as a vehicle to implement the review process. Gradually extending SEIS across the whole region can contribute to better management and easier sharing of environmental data and information which would have a positive effect on achieving the de-pollution of the Mediterranean Sea.

We acknowledge the engagement and work carried out by national partners and authorities, which were instrumental in drawing the key finding and recommendations of the current report. At this time these represent an important tool which we hope will be used by all stakeholders in the region.

The present report is very timely! It informs about the status of the three H2020 priority issues in the region and takes stock of the advancements made at regional and national levels in de-polluting measures. The report confirms the importance of the three thematic priority areas (municipal waste, urban waste water and industrial pollution), and points out the relevance

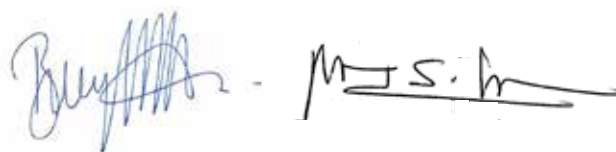
of addressing them together with other linked areas in a more integrated and systemic manner.

One of the findings of the report calls for the enhancement of the inter-institutional cooperation between relevant partners at national level to ensure the sustainability of a regular H2020 review and monitoring process. There is a huge potential for meeting the objectives through a stronger cooperation, coordination and involvement of different actors within national context and across the region.

The report demonstrates significant improvements in national monitoring and reporting tools. One of the recommendations points to the use of national good practices and promotes replication as a way of ensuring data sharing and the building up of a solid knowledge base that is readily up-to-date and accessible to support the decision-making process. The country contributions have proved to be an efficient capacity building approach and a useful tool to assess main environmental drivers and pressures at national level.

Taking into consideration all the efforts invested so far, we should continue working together to create strong leadership, provide further support to this process and ensure continuity in implementing the agreed commitment.

We encourage you to thoroughly read this report, openly discuss it with your colleagues and let us know of your ideas how to best respond to the ultimate goal of de-polluting the Mediterranean Sea by year 2020.



Hans Bruyninckx
Executive Director
European Environment
Agency

Maria Luisa Silva Mejias,
Executive Secretary and
Coordinator
UNEP/MAP
Barcelona Convention

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Authors and acknowledgements

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The chief editors were Cecile Roddier-Quefelec from EEA and Claudette Spiteri from ETC/ICM-Deltares. The main contributors in alphabetical order were: Susanna Casanovas (UNEP/MAP-MED POL expert), Jean-Pierre Giraud (UNEP/MAP-Plan Bleu), Tatjana Hema (UNEP/MAP-MED POL), Alex Lascaratos (UNEP/MAP-MED POL expert), Cecile Roddier-Quefelec (EEA), Claudette Spiteri (ETC/ICM-Deltares).

With additional contributions received from: Georges Akl (H2020 MeHSIP-PPIF); Françoise

Breton (Universitat Autònoma de Barcelona); Antonio Cruzado (UNEP/MAP-MED POL expert) François Guerber (UfM Secretariat), Dimitris Poursanidis (GIS Analyst).

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Executive summary

Over the last 40 years countries bordering the Mediterranean region have been cooperating to protect the fragile and vulnerable marine environment ecosystem of the Mediterranean Sea. Eight years ago in Cairo, the Euro-Mediterranean Ministerial Conference on the Environment endorsed the '**Horizon 2020 Initiative**' (H2020). This aimed to de-pollute the Mediterranean by 2020.

As part of the review and monitoring component of the Horizon 2020 Initiative (H2020) and the setting-up of a regular H2020 reporting mechanism, the European Environment Agency (EEA), in cooperation with United Nations Environment Programme (UNEP)/Mediterranean Action Plan (MAP) and together with the European Neighbourhood Policy (ENP) South partner countries, developed a first regional assessment report. This H2020 Mediterranean assessment Report, as called for by the H2020 Cairo road-map ⁽¹⁾, is the first of its kind based on data and information reported by the ENP-South partner countries ⁽²⁾. This process leading to this report was supported by the EU funded European Neighbourhood Policy Instrument (ENPI) Shared Environmental Information System ⁽³⁾ (SEIS) – known as the ENPI-SEIS project ⁽⁴⁾. SEIS operates on the basis of three pillars: content, infrastructure and governance. The SEIS pillars have guided the review process and have been useful in engaging stakeholders in this first H2020 reporting exercise.

The H2020 Mediterranean Report is a joint effort of the EEA and UNEP/MAP resulting from the creation of a regular review mechanism of environmental progress in the three H2020 policy priorities. These are municipal waste, urban waste water and industrial pollution. The report also serves as a contribution to the mid-term review of the H2020 initiative.

The H2020 Mediterranean Report is structured in three parts;

- The first part provides a synthesis of the process which created a regular review mechanism. It also lists key recommendations.
- The second part develops a regional analysis based on the key indicators agreed in the framework of the H2020 review and monitoring section. This part highlights the major drivers of environmental changes in the Mediterranean region and their implications on the protection of the marine environment. It also provides thematic assessments of the three H2020 priority areas (waste water and sanitation; solid municipal waste; and industrial emissions) developed on the basis of data and information reported by the countries themselves.
- The third part gathers analyses written by the countries on the three H2020 priority areas, addresses specific country situations, reviews national actions being taken and their associated problems and solutions.

Analysis of the three parts stresses the need for further mainstreaming and streamlining of information requirements as well as improved data collection and exchange between the countries. The report provides recommendations to cover some existing shortcomings. These are structured around the three SEIS pillars and are presented in the first part of the report.

The H2020 review process was instrumental for drawing up key messages from the selected H2020 indicators, shared data and information by countries and expressed expert's views. The following key insights (touching upon major trends; building the

⁽¹⁾ Cairo Declaration of the Euro-Mediterranean Ministerial Conference in the Environment, Cairo, 20 November 2006 http://ec.europa.eu/environment/enlarg/med/pdf/2020_timetable_phase1_en.pdf.

⁽²⁾ Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia.

⁽³⁾ <http://ec.europa.eu/environment/seis/>

⁽⁴⁾ The European Neighbourhood Policy Instrument (ENPI) Shared Environmental Information System (SEIS) (ENPI-SEIS) project is being implemented by the EEA together with the partner countries in the period 2010–2014.

knowledge base; and capacities and governance) are considered as an important contribution to the mid-term review discussions.

Major trends

Steady progress in access to improved sanitation services has been achieved since 2003 in all the ENP-South partner countries. In 2011, 92 % of the population in the ENP Southern region had access to improved sanitation as compared to 87.5 % in 2003, in large part made possible by investments from regional and international cooperation. It is estimated that 11.5 million out of the 17.6 million inhabitants without access to sanitation systems are concentrated in coastal areas. Therefore, access to sanitation systems still deserves attention in certain areas. The access to improved sanitation in ENP South partner countries is generally above the world average.

Due to the migration from rural to urban areas, the *emergence of urban poverty 'pockets' and inequities between urban and rural areas are still significant*. The gap between urban and rural coverage is striking: more than 5.5 million people living in urban areas and no less than 12 million rural dwellers were deprived of access to improved sanitation systems in 2011. Over the period 2003 to 2011 the number of urban dwellers without such access has significantly increased.

The progress in municipal wastewater management is more difficult to assess as the data available do not provide sound evidence or trends at the regional level. In general terms, an increase in the volume of wastewater collected and treated is observed in those countries for which data is available. This increase does not only cover the concurrent population growth but also contributes to the relative improvement of the wastewater management practices in the region. However, it is not possible to confirm whether these trends are the result of increased data coverage or the result of heavy investments in wastewater treatment contributing towards social and economic development or a combination of both. There is strong indication that inhabitants and environment in coastal watersheds draining into the marine environment are the most severely impacted by the lack of appropriate sanitation systems. Although local improvements have been observed, it is difficult to assess the progress at the regional scale. Nevertheless, the extent of reuse of both treated and untreated wastewater is limited to 1 % in the ENP-South partner countries.

Municipal solid waste generation (MSW) in the ENP-South partner countries continues to grow: (+15 % over the last 10 years) mostly due to population and economic growth. Twice as much municipal solid waste is currently generated in Europe as in ENP-South partner countries. Whilst the situation varies widely between countries and more particularly from one local area to the next, it appears that average municipal solid waste production stands at around 270 kg/per capita/year for the ENP-South partner countries compared to 520 kg/per capita/year in the EU-27. The organic waste represents the biggest share of the MSW. However, following changes in consumption patterns, largely as a result of the importation of manufactured goods, the proportion of biodegradable waste decreases as the share of plastics and other synthetic material has increased.

Despite important improvements in the last decade, **the collection and treatment of MSW is a significant issue in most ENP South partner countries. Few of them succeed in reaching full waste collection coverage, especially in rural areas** (national collection rate is around 76 %). Important efforts took place in the last decade to close unregulated dumps and open controlled landfills; nevertheless the management of MSW in most of the ENP-South partner countries relies almost exclusively on dumps. 58 % of the collected waste is disposed in open dumps and 31 % in sanitary landfills. The share of recycling and composting represents less than 10 % of the total collected amount. However, with the development of more integrated waste management policies, countries have reported increasing number of waste sorting initiatives promoting recycling and reuse.

Industrial emissions and nutrients have been assessed using data already reported by the countries to the marine pollution assessment and control component (the MEDPOL programme) of MAP. The **analysis confirmed that pressures from land-based sources remain high**, and that attention needs to be given to the following key sectors: the production of energy, manufacture of refined petroleum products, treatment of urban wastewater, food packing, manufacture of cement and metals. The existence of only two reporting years (2003 and 2008) does not allow for precise conclusions. This highlights the importance of yearly pollutant reporting. Yearly reporting of pollutants to MEDPOL and the establishment of a Pollutant Release and Transfer Register (PRTR) would be worthwhile investments. This would make a significant difference in establishing a sustainable dataflow for reporting purposes, for following up

the trends in pollution reduction and for measuring the effectiveness of measures taken. Most national laws and legislations support monitoring; however, there is a lack of systematic implementation of monitoring activities.

Building the knowledge base

Knowledge on water resource management is increasing in the region but *reporting and monitoring still needs to be improved, in particular for wastewater management*. Data on access to sanitation systems and wastewater management is generally available at the national level, but not at the coastal river basin level due to the lack of integrated water information systems. Wastewater that remains uncollected (and therefore untreated) is currently not accounted for. Reliable data on the type and efficiency of wastewater treatment at the regional scale is largely missing. This, combined with the important proportion of wastewater treatment plants which are not running effectively, hampered efforts to assess the efficiency of the infrastructure in place.

Knowledge of the complexity of the processes related to the waste management cycle has been strongly improved in the ENP South partner countries. *The production of reliable data and regular monitoring of waste streams is still necessary* to support informed decision-making. The adoption and use of international standards for the production of statistics still requires additional capacity building efforts and coordination among national institutions to ensure an effective improvement in the data production. For most of the countries there is a lack of access to data and information which is a constraint when producing indicators on waste generation and management.

All Mediterranean countries have put in place a marine pollution monitoring and reporting system from industrial sources in the framework of UNEP/MAP and other EU policy frameworks. A pollutant inventory takes place every two and five years to the UNEP/MAP Secretariat. Although the preparation of such inventories and reporting capabilities of the Mediterranean countries improved between 2003

and 2008, *establishing a coherent and sustainable system requires further efforts at regional and national levels, in particular for the eastern and southern part of the Mediterranean*.

Capacities and governance

Reporting capacities have greatly improved particularly on sanitation, possibly as a result of political support and processes that are already in place to improve and monitor access to sanitation (i.e. through the Millennium Development Goals (MDG) process). In most of the ENP-South partner countries, access to sanitation is now over 90 %, implying that the efforts needed to reach 100 % have to be more targeted. In recent decades, the ENP-South partner countries have responded to water scarcity by investing heavily in infrastructure and water resource management, and by engaging in public private partnerships (PPP). Targets and compliance objectives need to be defined throughout the wastewater management chain, which considers the link between sanitation, municipal wastewater collection, treatment and disposal in a holistic way. *The creation of more systemic approaches*, such as attempts to provide economic and environmental values on water (known as water accounting), could support the assessment of progress in the area of wastewater and sanitation.

All countries have put in place policies, programmes and/or strategies to support their wastewater and municipal solid waste management. However, effective monitoring of the enforcement of those strategies remains low. Further strengthening of the institutional set-up at national and regional levels to cope with the challenges of pollution control and prevention remains a high priority for the Mediterranean region. Enhancing the capacities of public authorities, in particular, their capacity to *monitor and enforce the implementation of environmental legislation is regarded as crucial*. The implementation of reliable environmental information systems is essential to identify main pollution sources to be addressed on a priority basis and the establishment and implementation of the appropriate measures or action plans.

PART 1 SYNTHESIS

I Background

I.1 Horizon 2020 Initiative – process

Despite measures taken to improve the marine environment and ecosystems in the Mediterranean region over the last five decades, there is little evidence of progress.

The need for cooperation and coordination amongst all the countries bordering the Mediterranean has long been recognised. This has resulted in close to 40 years of international efforts to protect this fragile and vulnerable ecosystem including the Mediterranean Action Plan (MAP); the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols, the Euro-Mediterranean Partnership (EUROMED) referred as the Barcelona Process and re-launched in 2008 as the Union for the Mediterranean (UfM) ⁽¹⁾.

In 2005 at the 10th anniversary summit of the Barcelona Process, the Euro-Mediterranean Partners committed themselves to substantially reduce pollution in the Mediterranean region by 2020. This became known as the 'Horizon 2020 Initiative' (H2020). H2020 was endorsed during the

3rd Environment Ministerial Conference in Cairo in November 2006 and is now one of the key initiatives endorsed by the Union for the Mediterranean (UfM) at its launch in Paris in 2008.

Horizon 2020 builds on the work carried out by institutions as well as existing attempts on the same topic, and aims to bring added value in the areas where gaps have been identified. It operates within the framework of existing and developing environmental policy instruments and supports the implementation of the pollution reduction commitments undertaken in the framework of MAP and its Barcelona Convention.

A number of concrete actions, as well as a feasible timetable on how to depollute the Mediterranean by 2020, were suggested during the 2006 ministerial conference. Following this a road map for the first phase of implementation (2007–2013) was adopted by ministers. This marked an important milestone for regional environmental cooperation and commitment. The road map focused on the:

- identification of projects to reduce the most significant sources of pollution;

The Cairo Declaration of the Euro-Mediterranean Ministerial Conference on the Environment, Cairo, 20 November 2006

*...the Euro-Mediterranean Ministers of Environment and other heads of delegation at the Cairo Ministerial Conference ...Endorse the timetable for the Horizon 2020 initiative for de-pollution of the Mediterranean Sea by 2020 attached to this declaration. ... **Undertake to...take steps to develop national integrated environmental information systems** to produce reliable, comparable and timely statistical data and information to support Horizon 2020 aims.'*

'Source: <http://ec.europa.eu/environment/enlarg/med>.

⁽¹⁾ Formerly known as the Barcelona Process, cooperation agreements with euro-Mediterranean partners countries were re-launched in 2008 as the Union for the Mediterranean (UfM). With the 28 EU member states, 15 southern Mediterranean, African and Middle Eastern countries are members of the UfM: Albania, Algeria, Bosnia and Herzegovina, Egypt, Israel, Jordan, Lebanon, Mauritania, Monaco, Montenegro, Morocco, Palestine, Syria (suspended), Tunisia and Turkey.

- identification of capacity building measures to help neighbouring countries to create national environmental administrations that are able to develop and police environmental laws;
- use of the European Union (EU) research budget to develop and share knowledge of environmental issues relevant to the Mediterranean;
- development of indicators to monitor the success of H2020.

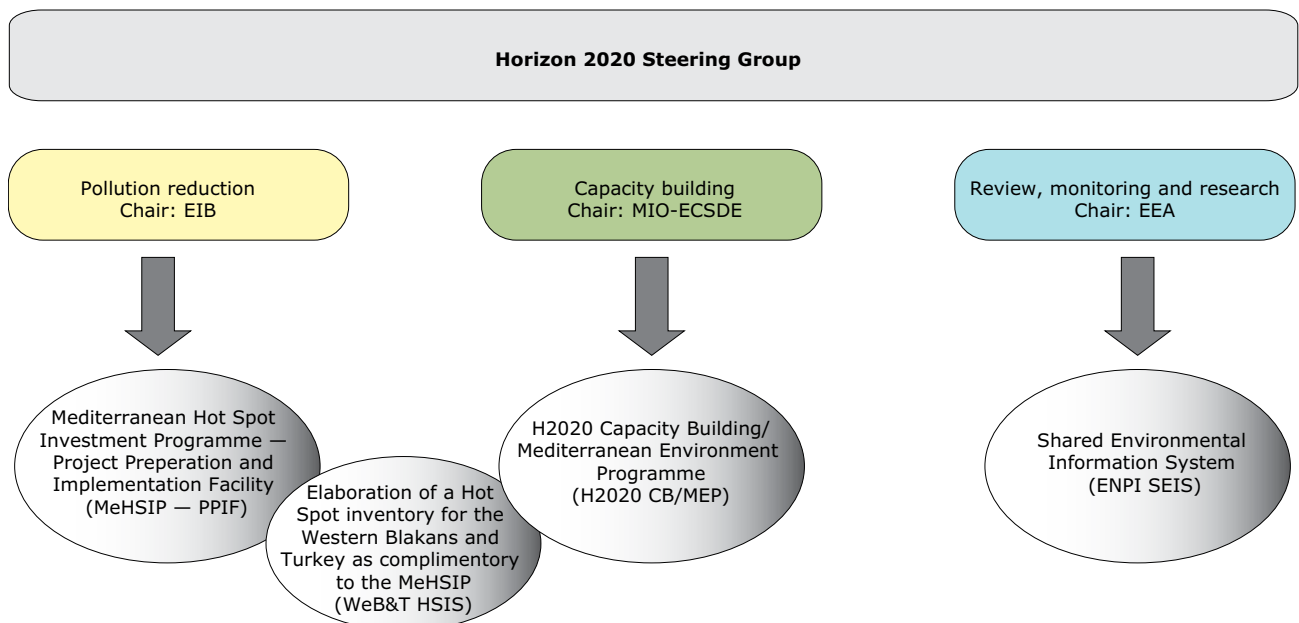
In the first phase of implementation (2007–2013), H2020 focused on three policy priority areas, namely municipal waste, urban waste water and industrial emissions. Collectively, these are recognised to be responsible for up to 80 % of pollution in the Mediterranean Sea. Other topics, including desertification, climate change, biodiversity and air quality are considered on a longer-term perspective. These issues are addressed either in full or in part through other processes such including the UNEP/MAP ecosystem approach, the Mediterranean Strategy on Sustainable Development, the Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership).

The implementation of the H2020 initiative is overseen by a Steering Group, the members of which participate on an equal footing and include focal points of European Neighbourhood Policy

(ENP) Mediterranean partner countries, focal points of EU member states, EU Institutions (the European Commission, the European Investment Bank (EIB), the European Environment Agency (EEA)) and other stakeholders, such as Inter-Governmental Organisations (IGOs), International Financial Institutions (IFIs), Non-Governmental Organisations (NGOs), local authorities, the private sector etc. The H2020 Steering Group is supported by three thematic subgroups, established to oversee its implementation:

1. **Pollution reduction (PR)**, with the objective to support the identification, prioritisation and implementation of the most significant pollution reduction projects tackling major priority sources of pollution (chaired by the EIB);
2. **Capacity building (CB)**, to support to the implementation of H2020 by identifying key gaps and promoting capacity building actions at the regional, national and local level (chaired by the Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO- ECSDE)), that represents a forum of more than 100 Mediterranean NGOs);
3. **Review, Monitoring and Research (RMR)**, to monitor the progress of the implementation of H2020, through the development of common indicators and shared information systems that support a mechanism for regular reporting on environmental issues (chaired by the EEA).

Figure I.1 H2020 components and corresponding projects



Each subgroup is supported by EU-funded projects which leads and support the process (Figure I.1):

- The project for the **PR** subgroup is entitled the 'Mediterranean Hot Spots Investment Programme- Project Preparation and Implementation Facility' (MeHSIP-PPIF);
- For the **CB** subgroup the project is the 'H2020 Capacity Building/Mediterranean Environment Programme' (H2020 CB/MEP); and
- Under the **RMR** subgroup the project is entitled European Neighbourhood Policy Instrument (ENPI) Shared Environmental Information System (SEIS), known as the ENPI-SEIS project ⁽²⁾. The H2020 Mediterranean report is one of the key outcomes of the ENPI-SEIS project.

The implementation of H2020 started in 2007 with the identification of priority projects for pollution reduction, as well as initial efforts on the priority capacity building measures in partner countries. Under ENPI-SEIS, the activities related to the review and monitoring process started in 2010. The three pillars of the Shared Environment Information System (SEIS) (content, infrastructure and governance) have been stepping stones for the review process and for engaging the stakeholders in data sharing.

I.2 Producing the H2020 Mediterranean report

The current H2020 Mediterranean report is a joint effort of the EEA and the UNEP/MAP. It summarises the work carried out in the RMR subgroup, and led by the ENPI-SEIS project, to set-up a regular review mechanism of the environmental progress in municipal waste, urban waste water and industrial. This was called for by the Ministers in the Cairo Conference in 2006. It is the first of its kind produced within the H2020 process, and builds on previous joint EEA and UNEP/MAP reports ⁽³⁾.

Based on the data and indicators reported by Mediterranean partner countries and country analyses, the objective of the H2020 Mediterranean report is twofold: first to inform on the pollution levels in the region; and, second to take stock of progress made at regional and national levels in monitoring and reporting on this progress.

The H2020 Mediterranean Report is structured in three parts:

- The first part provides a synthesis describing the process in setting-up a regular review mechanism and listing key recommendations.
- The second part develops a regional analysis based on the key indicators agreed in the framework of the H2020 Review and Monitoring subgroup. This part highlights the major drivers of environmental changes in the Mediterranean region and their implications on the protection of the marine environment and puts emphasis on thematic assessments of the three H2020 priority areas (waste water and sanitation; solid municipal waste; and industrial emissions) developed on the basis of the data and information reported by the South Mediterranean Partners countries.
- The third part gathers analyses written by the countries themselves on the three H2020 priority areas, addresses specific country situations, existing national actions being taken and their associated problems and solutions.

I.2.1 Review process

Inspired by the EEA/Eionet ⁽⁴⁾ experience in providing indicator-based assessments on the state of environment, the RMR subgroup puts in place a review process by developing pilots for each H2020 thematic area. The review process is based on the different level of aggregation and analysis of environmental information: monitoring, data, indicators, assessment and knowledge (MDIAK). This MDIAK reporting chain has been developed by the EEA to support the provision of observations,

⁽²⁾ The ENPI-SEIS project is being implemented by the European Environment Agency (EEA) together with the European Neighbourhood Policy (ENP) South partner countries (Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia) in the period 2010–2014.

⁽³⁾ State and pressure of the marine and coastal Mediterranean environment. Report No5/2000 European Environment Agency; Priority issues in the Mediterranean environment. Report No 5/2005 European Environment Agency, Copenhagen

⁽⁴⁾ Eionet is a partnership network of the EEA and its member and cooperating countries. It consists of the EEA itself, six European Topic Centres (ETCs) and a network of around 1 000 experts from 39 countries in over 350 national environment agencies and other bodies dealing with environmental information. These are the National Focal Points (NFPs) and the National Reference Centres (NRCs).

data processing and the production of indicators that underpin assessments that can later support policy-making, based on acquired knowledge and its use.

The pilots were initiated to provide assessments of the current situation, associated problems and solutions to be identified at country, regional or sub-regional levels, tackling one thematic area or all three in parallel. The aim of the pilots was to create a common understanding about the synergies between various actors at different levels, contributing with their knowledge, expertise and information at different parts of the review process. The review process steered by the RMR subgroup was built into three interlinked phases (Figure I.2):

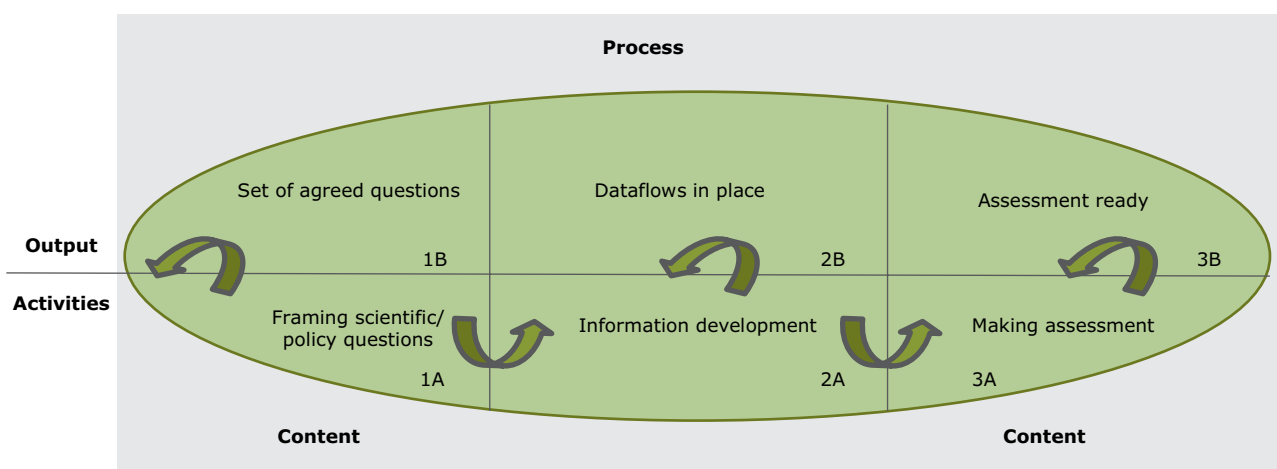
Since 2011 the concrete implementation of the proposed review process has been fully embedded into the activities of the ENPI-SEIS project ⁽⁵⁾, which aims at progressively developed the SEIS principles (6) in the European Neighbourhood Policy partner countries. The conceptual framework of SEIS, built on three pillars – **content**, **infrastructure** and **governance**, has been used to design and implement of a coherent indicator process for regular indicator-based analyses, fulfilling the mandate of the RMR subgroup. Within the Mediterranean context, among the seven SEIS principles, the principles 'managed information as close as possible to its source' or 'collect once and share with other for many purposes' are of particular relevance.

The work on the **content pillar** has been organised around the priority areas identified under H2020: municipal waste, urban waste water and industrial emissions. Following initial consultation with the ENP-South partner countries, the scope of the H2020 thematic areas has been enlarged for the water theme to also include fresh and marine water, both in terms of quality and quantity. Data on the priority areas is processed and aggregated based on common definitions, harmonised methods and standards, to produce regionally-coherent indicators and indicator-based assessments. The ultimate goal is to increase the knowledge on the environment, as a way to support the implementation of the right policies for its protection.

Under the **cooperation pillar**, focus has been given to set-up and maintain strong and long-term (human) networks between providers and users of data ensuring that the necessary data, information and knowledge are exchanged at every level; local, national and regional. This strong inter-institutional cooperation is essential for streamlining dataflows and network infrastructures.

Under the **infrastructure pillar**, efforts have focused on the application of modern web-based information and communication technologies to improve and facilitate the open and public access to information. Currently, the exchange of data between institutes is mainly through paper reports and information posted on websites. Such shared technical

Figure I.2 The activities and output involved in the step-wise implementation of a regular review mechanism of H2020



⁽⁵⁾ <http://enpi-seis.ew.eea.europa.eu/workplan/south>.

⁽⁶⁾ European Commission Communication entitled 'Towards a Shared Environmental Information System (SEIS)' <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0046:FIN:EN:PDF>.

infrastructures rely on the use of compatible and freely available exchange tools for the generation of policy-relevant and comparable content.

Throughout the implementation of the pilot of the review mechanism, a distinction is made between generating the 'Content' required to address progress on H2020 issues and setting up the 'Process' for regular reporting. The Process is based on the establishment and maintenance of the infrastructure and cooperation needed to allow for the exchange of data and information. The main steps involved in the setting-up of the review mechanism are best described by Figure I.2. Steps 1A and 1B are primarily steered by the objectives of H2020; steps 2A and (part of) 2B are mainly related to the establishment of the process through setting up the infrastructure (infrastructure, tools, common standards, data specifications, nomination of national data reporter) that allows for the exchange and access of data within and across countries following the principles of SEIS. The provision of the harmonised datasets is the core of the regional indicator-based assessment described in steps 3A and 3B and in Part 2 of this report.

I.2.2 *Developing information to generate H2020 content*

The design of a coherent regional indicator process is the basis of regular and indicator-based reviews on progress with H2020. This process is comprised of the following steps:

- selection of a set of priority indicators that best capture the state and trends of the issue to be monitored;
- development of detailed guidelines, specifying the methodological aspects, definitions, all capture is detailed in the Indicator Specification Factsheets (see footnote 10);
- establishment of the necessary dataflows and common infrastructure for the delivery of data;
- use of the underlying datasets to populate the selected indicators, aimed at providing a quantitative and comparable *measurement* in the evaluation and communication of the state as well as trends over time.

The selection of H2020 indicators is based on the indicator work of the main regional actors mainly the marine pollution assessment and control component of MAP (MED POL programme), the Plan Bleu Regional Activity Centre, the 2007 Mediterranean Environment Reporting Mechanism overview MERM-MED (?), the European Marine Strategy Framework Directive and former European Marine Monitoring and Assessment process (EMMA) (?), the EEA indicators, the work of the Center for Environment and Development for the Arab Region and Europe (CEDARE) and the Arab league as well as international initiatives, such as the Millennium Development Goals. A number of criteria guided the selection of the H2020 priority indicators:

- be simple, straight-forward, concise, easy to interpret;
- be issue-specific yet relevant to all countries;
- build on previous activities and initiatives in the region to ensure the full use of the existing information and data;
- provide a realistic and representative baseline of the current situation;
- give a comprehensive, yet non-exhaustive coverage of the priority areas;
- allow for the periodic review and update in line with future developments.

The indicator development process steered by the RMR subgroup has been undertaken with the ENPI-SEIS Working Group on Environmental Indicators (9), composed of two members nominated by the national focal points from each ENP-South partner country. The nominated officials, representing environmental and statistical organisations, respectively, led to the selection of six main H2020 indicators, each associated with a specific policy question.

The H2020 indicators selected for monitoring the progress are:

Waste:

1. Municipal waste generation
 - Additional information: Municipal waste composition

(?) http://coordination.h2020.net/rmr/documents/mer_med_01_06_2007.pdf.

(?) <http://circa.europa.eu/Public/irc/env/marine/library?l=/workingsgroups/europeansmarinesmonitori&vm=detailed&sb=Title>.

(?) <http://enpi-seis.ew.eea.europa.eu/data-and-indicators/working-group-environmental-indicators-south>.

2. Collected and treated municipal waste
 - Additional information: Number, type and location of landfills

Water:

3. Share of total, urban and rural population with access to an improved sanitation system
4. Volume of wastewater collected, of which volume of wastewater treated, including type of treatment.
5. Nutrient concentrations in transitional, coastal and marine waters

Industrial emissions:

6. Release of toxic substances and nutrients from industrial sectors

The second step of the indicator development process concerns the preparation of Indicator Specification Factsheets ⁽¹⁰⁾, in which the methodological aspects, such as definition, units, geographical and temporal coverage, methods for gap filling and uncertainties are clearly documented.

Lastly, the mapping and establishment of the national dataflows are required to deliver the data according the indicator specification factsheets. This

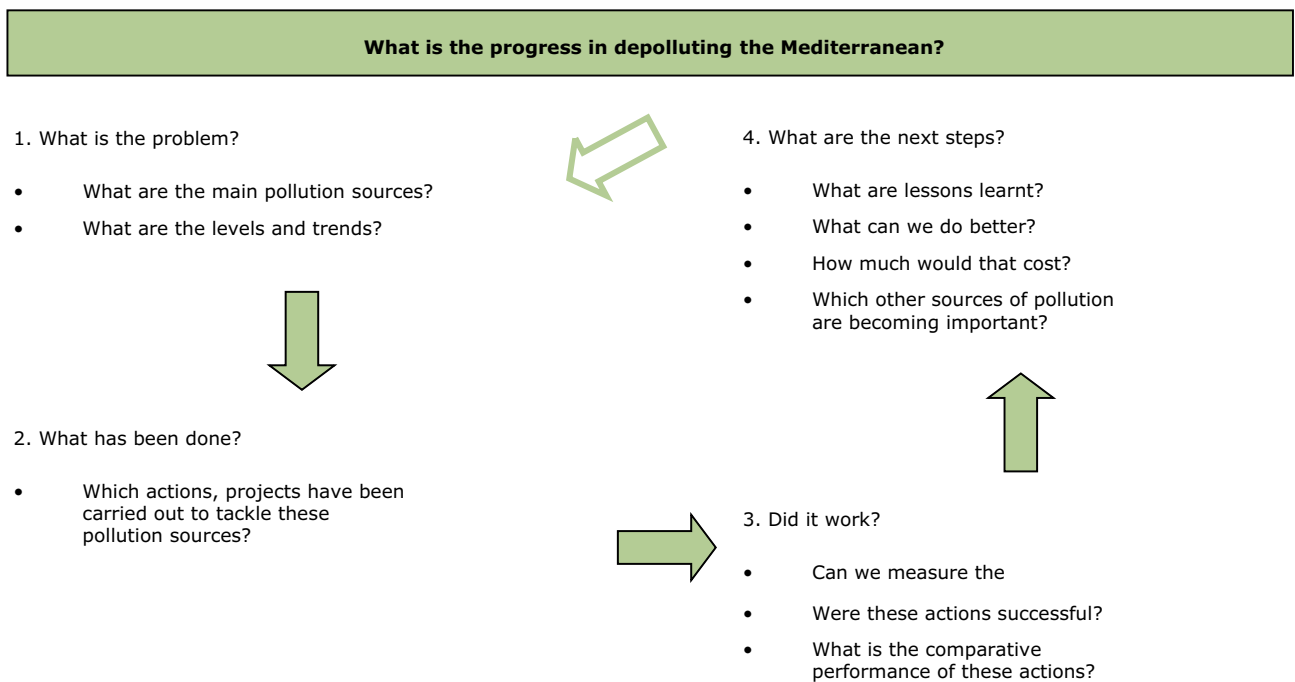
mapping exercise requires bringing together all national actors that are involved in the production of the agreed datasets and outlining the necessary steps for mobilising this data. Most of these steps include an agreement on common content, cooperation and common infrastructure.

I.2.3 Structuring questions

In order to monitor effectively the progress with H2020, a number of policy objectives and questions have been formulated. These structuring questions have been used as a guidance framework throughout the implementation of the ENPI-SEIS project and H2020 reporting process, including the identification of indicators.

The Cairo Ministerial declaration and H2020 timetable expound on the overarching objective to depollute the Mediterranean by 2020. Therefore, the primary question is: *What is the progress in depolluting the Mediterranean?* To evaluate the progress at the level of the three identified priority areas, the overall policy question is further broken down into the following problem-oriented questions illustrated in Figure I.3.

Figure I.3 Set of structuring questions



⁽¹⁰⁾ <http://enpi-seis.ew.eea.europa.eu/project-activities/data-and-indicators/factsheet-consultation>.

1.2.4 Geographical context of H2020 – regions and groups of countries

The 22 Mediterranean bordering countries and Jordan provide the geographical context to H2020. The assessment presented in Part 2 of this report focusses primarily on the eight ENP-South partner countries (Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine and Tunisia). However, in order to provide an overall Mediterranean perspective, reference to the nine European countries bordering the Mediterranean Sea (Cyprus, Spain, France, Greece, Croatia, Italia, Monaco, Malta and Slovenia) grouped as EU Med countries, is made whenever possible. A third group of countries with Albania, Bosnia-Herzegovina, Montenegro and Turkey referred to as West Balkans and Turkey is also considered (Figure I.4).

The cooperation with Syria is currently suspended. Syria did not take part in the reporting exercise.

When figures are provided for this country they come from international sources.

Geographical levels

Three major geographical levels are considered in the indicator-based assessment: national, coastal regions and coastal hydrological basins (Figure I.5). For each priority area, reference to different geographical levels is made as follows:

- national and coastal regions for municipal waste;
- national and coastal hydrological basins for water (sanitation and wastewater) and specific hotspots for nutrients;
- industrial Emissions – the geographical scope covers all emissions reaching directly and indirectly the Mediterranean Sea as specified in the MED POL Strategic Action Programme (SAP).

Figure I.4 Mediterranean countries covered by H2020



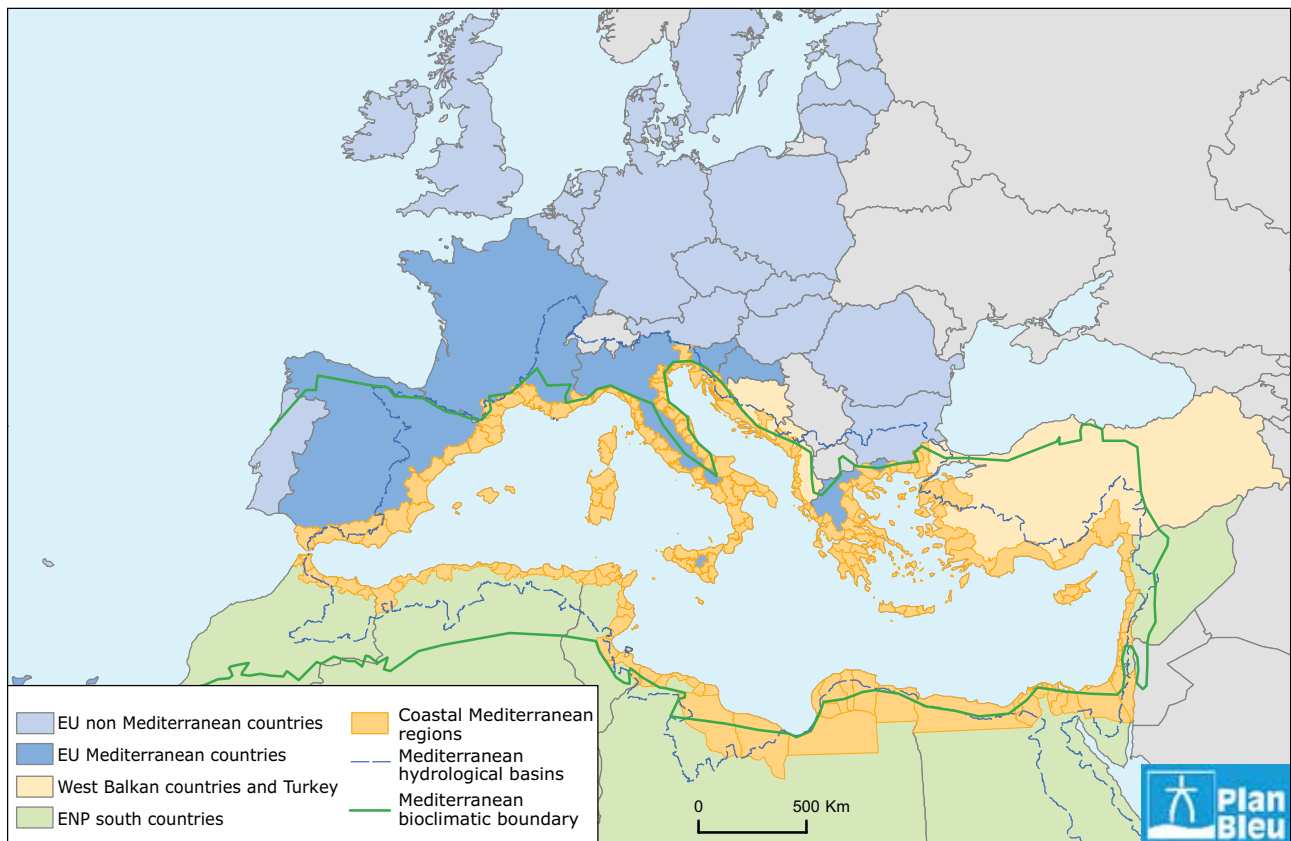
Note: EU Mediterranean: Croatia, Cyprus, France, Greece, Italy, Malta, Monaco, Slovenia and Spain.

ENP-South: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine and Tunisia.

West Balkans and Turkey: Albania, Bosnia-Herzegovina, Montenegro, Turkey

Source: Plan Bleu, 2014.

Figure I.5 Map of the Mediterranean regions delineating the coastal regions and coastal hydrological basins



Source: Plan Bleu, 2014.

Estimates of the share of the population in the Mediterranean coastal regions and hydrological basins in relation to the national population are given in Table I.1. Approximately one third of the Mediterranean population is concentrated along in its coastal regions, whereas more than half of the population resides in the coastal hydrological basins. Jordan is not included in this table, its coasts are bordering the Red Sea. Although Jordan has no Mediterranean coastal region and contains no part of the Mediterranean hydrological basin, it was decided with the national focal points to consider the whole territory of Jordan for the assessment regarding the H2020 issues.

Coastal regions and coastal cities

Among the 739 Mediterranean regions ⁽¹¹⁾ (except Jordan), 224 are considered as coastal. The population in these coastal regions is about 150 million, implying that one third of

the population of the countries resides in 15 % of the area. Moreover, about 1 600 cities with around 100 million inhabitants are located in the Mediterranean coastal regions (Figure I.6).

Coastal hydrological basins

Seventy five hydrological basins in the Mediterranean bordering countries are considered as coastal (Figure I.7). Their population consists of about 250 million of inhabitants (55 % of the total population). In the ENP-South region, 65 % of the population (i.e. around 120 million inhabitants) is concentrated in the Mediterranean coastal hydrological basins.

For some countries, such as, Israel, Lebanon and Palestine, it was decided to consider the national territories (i.e. not only the Mediterranean hydrological basins) as the coastal hydrological basins.

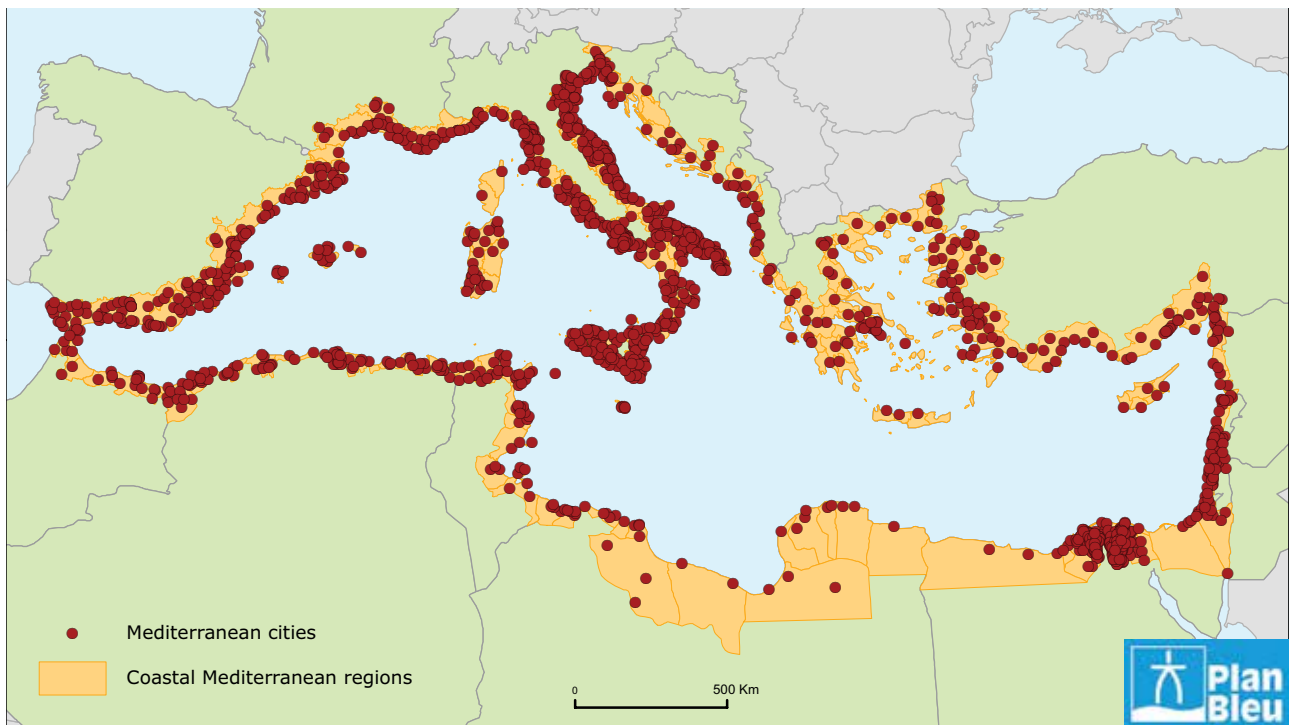
⁽¹¹⁾ These regions are statistical entities equivalent to the smallest level of the European Nomenclature of territorial units for statistics (NUTS 3); http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction.

Table I.1 Population of the countries and percentage of the population in the Mediterranean coastal regions and in the Mediterranean hydrological basins (period 2001–2008)

Countries	ISO2 code	National Population (1 000 inhabitants)	Population in the Mediterranean coastal regions (% of the national population)	Population in the Mediterranean hydrological basins (% of the national population)
Cyprus	CY	766	100	100
Spain	ES	40 847	39	45
France	FR	63 202	11	23
Greece	GR	10 786	59	88
Croatia	HR	4 437	50	15
Italy	IT	60 045	55	97
Monaco	MC	32	100	100
Malta	MT	404	100	100
Slovenia	SI	1 964	5	13
EU Med Countries		182 484	36	56
Albania	AL	3 170	68	100
Bosnia-Herzegovina	BA	3 799	6	18
Montenegro	ME	673	67	54
Turkey	TR	70 586	20	27
West Balkans and Turkey		78 228	22	30
Algeria	DZ	34 460	39	70
Egypt	EG	72 579	35	93
Israel	IL	6 991	84	80
Lebanon	LB	3 755	72	90
Libya	LY	5 324	83	85
Morocco	MA	29 892	11	12
Palestine	PS	3 762	68	38
Syria	SY	19 880	9	10
Tunisia	TN	10 126	69	84
ENP-South Countries		186 768	36	65
Total Mediterranean		447 480	33	55

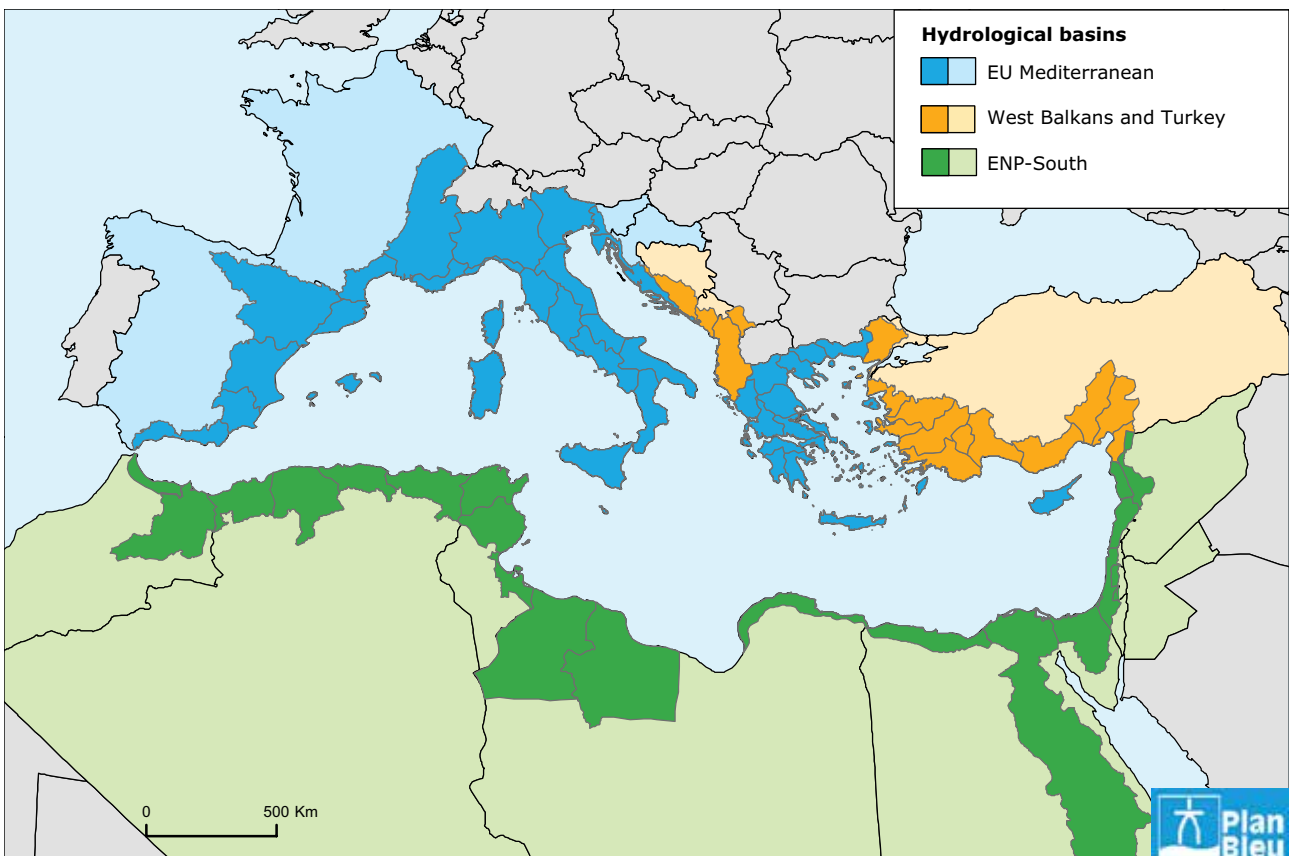
Source: UNEP/MAP RAC-Plan Bleu computation based on data from national statistical offices.

Figure I.6 Mediterranean coastal regions and main cities close to the coast



Source: Plan Bleu, 2013.

Figure I.7 Mediterranean coastal hydrological basins



Source: UNEP/MAP RAC-Plan Bleu, 2013.

II Dataflows and infrastructure development

Putting in place a review mechanism necessitates the establishment of regular dataflows and the setting-up of the appropriate supporting infrastructure (e.g. information system, report tools, etc.). The developments of this infrastructure are content driven. The support of dataflows for the H2020 indicators selected for monitoring progress is carried out by the ENPI-SEIS IT Working Group ⁽¹²⁾, composed of two IT experts representing the environmental and statistical organisations nominated by the NFPs from each ENP-South country. This builds upon the work done on indicators and data by the ENPI-SEIS Working Group on Environmental Indicators. For this first H2020 reporting exercise, it has been agreed by the IT working group to use EEA tools to deliver data for the selected H2020 indicators.

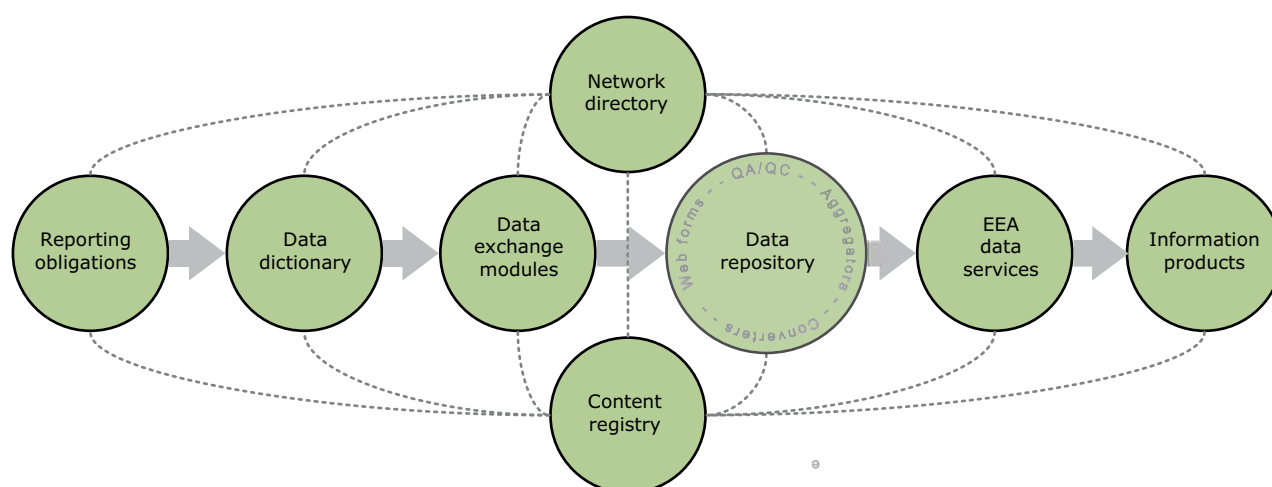
The EEA's own infrastructure and the related suite of web-based tools and applications for supporting and improving the environmental data and information flows was made available to the ENP-South partner countries. Referred to as

Reportnet, this system of tools assists countries to report data and information into a formal reporting process, to keep track of all obligations, including the quality assurance of delivered data (Figure I.8).

The reporting process is comprised of the following steps:

- setting up the Reporting Obligation Database (ROD) – the module of the reporting system that connects data to policy requirements;
- building a national network for reporting which comprises of identifying and nominating responsible persons in each country and of creating a directory in the system as well as setting up permissions;
- creating harmonised data specifications;
- creating the necessary folder structure in the Mediterranean Data Repository (MDR), thus preparing the system to receive deliveries;

Figure I.8 Reportnet tools for streamlining flows of environmental information in Europe



Source: Reportnet for Beginners, version 2.0 (July 2008) EEA, 2008.

⁽¹²⁾ <http://enpi-seis.ew.eea.europa.eu/seis-infrastructure/working-groups-information-technology/south>.

- retrieving data from national databases and delivering it in the harmonised structure
- checking and validating deliveries;
- building a database for the Mediterranean region.

Setting up the ROD

There are numerous reporting obligations, involving a great variety of national, regional and international institutions. The related reporting procedures are usually complex, making it difficult for both countries and institutions to know exactly what the obligations are, when the deadlines fall and in which formats the data and information should be submitted. The backbone of the reporting system is an up-to-date overview of the requirements and the deliveries. ROD is available for everyone and is now updated to include the obligation to deliver data in support of the H2020 process.

Nomination of data reporters

Data uploaded in the reporting system are official data provided by the country. This means it is important for the countries to nominate responsible persons who will upload or provide links to the required data in the required format and can ensure that the data provided are the official ones. The data reporters are also the key contact for any questions or clarifications related to the reported data. This nomination is an important step in the process to guarantee that data are shared and delivered in a transparent and coherent manner. Seven out of nine ENPI-South partner countries officially nominated data reporters. The ENPI-SEIS project team compiled the network directory of the data reporters and provided the necessary permissions in the system.

Harmonised data specifications

The Indicator Specification Factsheets (ISF) are used to clarify data needs and support the long process of data specification. The data specifications cover all aspects related to harmonised data such as:

- title, definition and size of fields;
- different code lists to be used (country codes, regional codes, codes for data collection methods etc);
- expected value of fields;
- expected data type;
- expected measurement units;

- methodology to be used for collecting the data.

These specifications help the countries to match the required elements in their national databases to the required fields in the regional harmonised structure and prepare data for delivery.

Setting up the Mediterranean Data Repository

The reporting system is equipped with a module that serves as a storage place for the data to be delivered, all Mediterranean countries are grouped under the Mediterranean Data Repository (MDR). The system enables simple automated quality checks to be made. The MDR module is also used to provide feedback on data delivered. The module contains envelopes for each requestor and folders for each obligation. The ENPI-SEIS team set up the necessary envelopes and folders to have the system ready for receiving data under H2020. Each country is responsible of the management of its own envelope to allow a management of the information as close as possible to its source.

Providing data from national databases

At national level data necessary for the regional indicators are stored in several databases which sit in different ministries or institutes. The national focal points ensure coordination at national level for these data to be collected and prepared according to the required format, then the data reporter makes the delivery. To ease this process and support effective coordination among the national institutions and partners involved, countries have set-up national teams or committees to oversee this, like in Palestine, Tunisia.

Validation and quality check

The system is enabled to make automated quality assessments and provide feedback, however it is not yet set up to do so for the first round of H2020 data deliveries. The validation and quality checking of data is currently carried out manually and if needed data reporters are contacted individually to clarify discrepancies.

Building the regional database

The selected H2020 regional indicators are built using several datasets. Each country provides each dataset in a different folder. This makes the system transparent and with a clear division of responsibilities, but makes the use of data for regional assessments difficult. To ease the process, the ENPI-SEIS team is compiling a regional database by merging the different deliveries into one large database, called the Mediterranean database.

III Developing country assessments

At discussions held during the 3rd RMR meeting (June 2012, Copenhagen) and the 2nd Working Group (WG) meeting on Environmental Indicators (October 2012, Copenhagen), the project team and working group members confirmed their interest in the development of country assessments as part of the H2020 reporting process.

The country level assessment section of the H2020 report is the opportunity to present national situations and responses. Such country analyses can simultaneously support national State of the Environment activities and other major regional assessments (e.g. UNEP/MAP State of the Marine and Coastal Environment, Mediterranean Strategy on Sustainable Development, African Environment Outlook, Arab Region Outlook), as well as global demands (e.g. UNEP-Live and the GEO process). These national narratives also provide information about the unique circumstances that influence national and local policy implementation.

The aim of the country level assessment (Part 3 of this report) is to provide a concerted view of the national environmental efforts in the ENP-South partner countries. This set of assessment complements the regional indicator-based assessment presented in Part 2 of this report, enabling countries to focus on the priority issues from a national perspective, contextualizing the diversity of country realities and highlighting country-specific issues. The country level assessments are also an opportunity to communicate issues of particular national concern.

The country level assessments have been prepared by the countries themselves, guided by the EEA and the project team. A guidance document and templates⁽¹³⁾ have been developed for this purpose. It is hoped that regular, rather than ad-hoc, development of country assessments will be produced.

Six assessments, from Egypt, Israel, Jordan, Morocco, Palestine and Tunisia, are included with Part 3. The other countries were not in a position to produce or deliver such an assessment for reasons such as lacking in technical and/or financial means or facing long national validation process of their assessment of H2020. Nevertheless, they have been all actively involved in the process.

The country level assessment has four objectives. The first is to analyse the environmental situation and prospects in countries with respect to the three H2020 priority areas.

The second is to provide better understanding of the diversity and complexity of the national situation. As no single country can be held responsible for the deterioration of the Mediterranean environment, no single country can protect it by acting alone. The analysis of existing country realities will contribute towards more coordinated actions that promote regional collaboration.

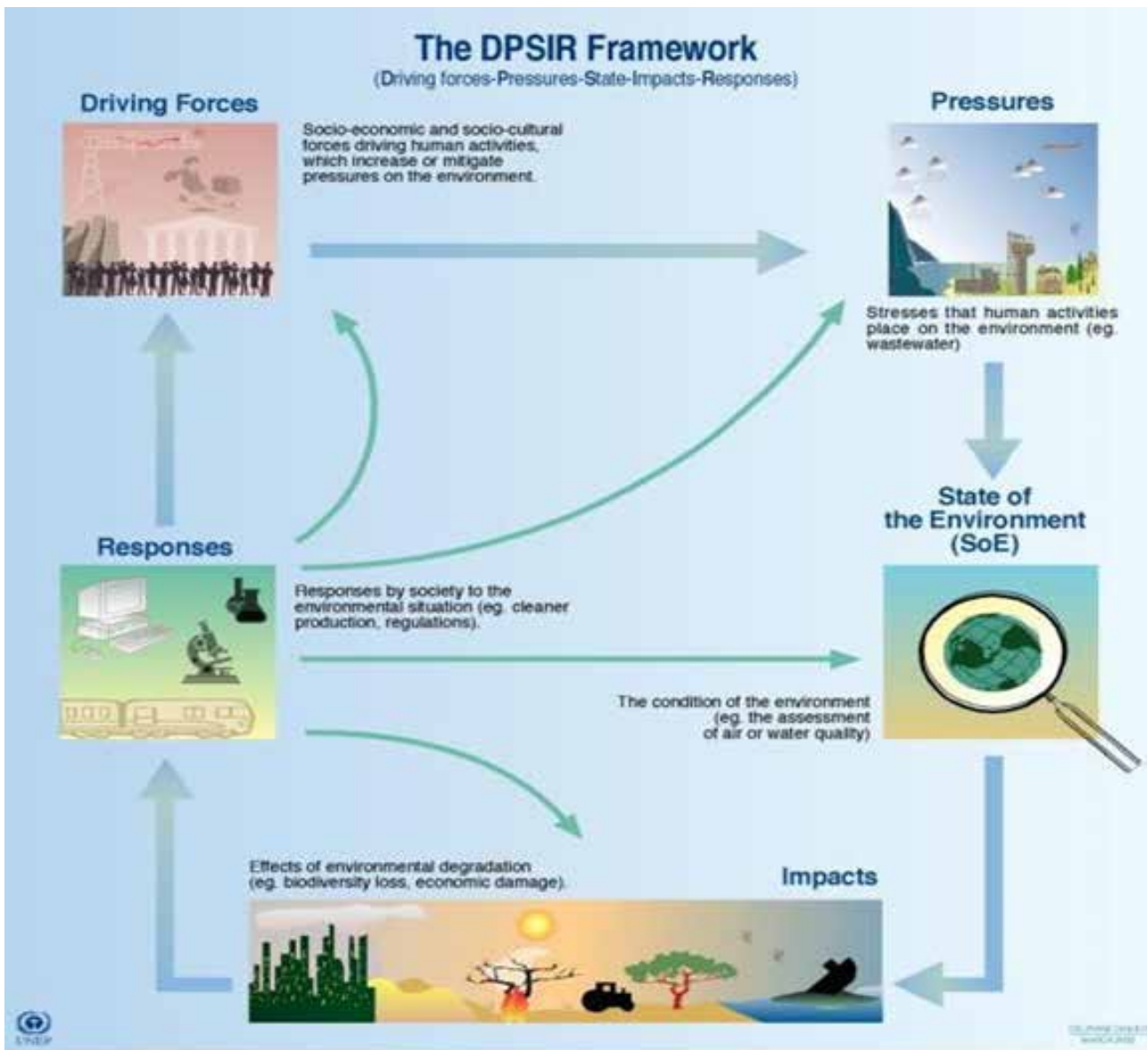
The third objective, therefore, is to provide the space within which countries can highlight additional issues of particular interest to themselves.

The final objective is to look beyond the specificities of the regional report and to consider how the review and monitoring process and the H2020 initiative can be seen as the 'single vehicle' for putting in place a streamlined approach to country analysis.

The country assessments are organised around a set of structured guiding questions for all three H2020 priority areas so that each national situation is assessed and described in a comparable way. For each priority area, the questions follow the DPSIR (Driving Forces-Pressures-State-Impacts-Responses) framework used to assess and manage environmental problems as depicted in the diagram below.

⁽¹³⁾ <http://enpi-seis.ew.eea.europa.eu>.

Figure I.9 Driving forces-Pressures-State-Impacts-Responses analytical framework



The current country assessments are available online at: <http://www.eea.europa.eu/publications/horizon-2020-mediterranean-report>.

IV Achievements and lessons learned

While supporting the RMR mandate, ENPI-SEIS provides guidance in setting up a process for a sustainable and continuous reporting mechanism of H2020. This mechanism allows for the improved sharing of environmental data, which will support content generation required to evaluate progress on H2020 issues. There have been a number of achievements and lessons learned both in terms of the process itself and the progressive implementation of SEIS than in terms of the production and development of the selected indicators.

IV.1 Inter-institutional cooperation at national and regional level

One key factor in the overall successful implementation is the establishment and maintenance of strong inter-institutional cooperation and coordination at the national level. This cooperation goes beyond the institutions that are directly involved in H202 and the ENPI-SEIS project. It includes all other stakeholders such as the data producers, data owners and data users of each indicator. The group of stakeholders varies from country to country but may include the Ministries of Interior, Industry, Water and Irrigation, as well as external holding companies. In some countries, inter-institutional cooperation remains very weak and is still based on ad hoc requests such as in Egypt, Lebanon and Palestine. In other countries, committees and national working groups representing different institutions have been established to work on the implementation of SEIS e.g. Coordination committees for each sectors in Jordan, National team for developing the Palestinian Environmental Information System; SEIS team in Tunisia. In some cases, such agreements have been formalised through Memoranda of Understanding on data exchange, case of Palestine. This is a major achievement in the implementation of SEIS.

In order to support the establishment of inter-institutional cooperation, a number of national workshops have been organised in all eight ENP-South partner countries during March–June 2013. The aims of these workshops were to bring

together the national stakeholders, map the national actors involved in populating the H2020 indicators, get insight into the extent of development of SEIS in each country and achieve a common understanding on the overall process. The national workshops proved to be an effective way to achieve these objectives.

To ensure proper coordination with UNEP/MAP activities and network, particularly on pollution reduction and indicators activities, the project itself, and development of the H2020 review mechanism, have been carried out in close cooperation between the EEA and UNEP/MAP.

Coordination with other appointed thematic contact points took place, in particular with Horizon 2020, MED POL focal points, and the Sustainable Water Integrated Management (SWIM) Regional Technical Assistance Programme and the Regional Solid Waste Exchange of Information and Expertise Network SWEEP-Net networks. This coordination has allowed for the streamlining of activities, in particular as regards capacity building.

IV.2 Establishment of thematic network

The establishment of a network of focal points on SEIS — bringing together one representative of statistics and one representative of environmental institutions, IT and national thematic experts from the ENP-South partner countries serves as a platform for sharing country experiences, successes or challenges and as a mechanism for national-regional exchange. In some Mediterranean countries these networking structures are already well in place (e.g. Eionet, MED POL); for others such networks are under consolidation, however they have contributed towards remarkable advances in countries where the stability and continuity of national focal points, and of the people working in the SEIS project team, could be ensured and sustained.

This continuity contributes towards strengthened national capacities, which forms the basis of successful regional initiatives.

IV.3 Choice of H2020 indicators

The selected six indicators capture some of the main trends concerning the priority themes. However they are not sufficient to provide a complete information base for future regular environmental reporting on the state of the environment. The same process established here should be extended to other indicators (see Recommendations).

As part of the establishment of the H2020 reporting mechanism, a number of steps related to indicator development were carried out. This included: the clear mapping of availability and accessibility of data; an assessment of the temporal and spatial coverage of the available data; and the development of Indicator Specification Factsheets with defined indicator specifications, documentation of uncertainties and limitations of the national datasets and identification of the relevant data providers/ data owners. They proved to be very useful in assessing the progress and limitations in setting up the reporting mechanism in each country for each priority area.

IV.4 Data availability

One of the indicator selection criteria was to build on previous activities and initiatives in the region, to ensure the full use of the existing information and data. Yet, in some cases, the datasets delivered were characterised by temporal and spatial gaps, as addressed in Part 2 for each priority area. This implies that even for already existing indicators, the data in the countries, when available, is not centralized but is distributed across different stakeholders, which, for the time being, limits access.

A distinction was made between the geographical levels of each priority area. The selection of geographical levels (coastal areas, coastal hydrological basin vs national) was intended to get a realistic estimate for the pollution loads reaching the Mediterranean Sea. As very limited data at the defined geographical levels was available, most of the assessments presented in Part 2 mainly focus on the national level.

Significant efforts were made to get comparable and reliable data, through a metadata questionnaire followed by the development of indicator factsheets in consultation with countries, harmonization of

definitions and production methods. Further efforts are required to address the targeted geographical levels and harmonize the regional datasets, in a way to facilitate the processing of data at the regional level and to put together a comprehensive regional database.

The progressive establishment of SEIS in the countries with a balanced development of its three pillars has been an effective way of identifying the needs of each country, including capacity building needs for instrumentation, measurement, guidelines link with the management of the pollution. Coordination has been developed with the H2020 Capacity Building component to enlarge attendance to trainings to the ENPI-SEIS/RMR network. However, the monitoring and data dimensions were never specifically addressed in H2020 Capacity Building activities. More support is needed in building national capacities on monitoring and data analysis (see Recommendations).

IV.5 Data delivery

Infrastructure was set up (data exchange tools and standards, data structure definition and design, including QA/QC, nomination of national reporters etc.) which allows for data delivery in an agreed and harmonized structure. This constituted a core part of the IT working group's mandate. As part of the reporting process, the IT working group provided technical support to the thematic experts, using the detailed guidance document explaining the steps required to deliver H2020 data using Reportnet prepared⁽¹⁴⁾ for Indicators 1–4 (water and waste indicators). This step in the reporting process required the involvement of both IT and indicators working groups to allow developing the necessary tools to support the content and underpinning dataflows. However, in some instances, the responsibilities of each working groups were not clearly defined and might have overlapped.

For Indicators 5 and 6 (nutrients and industrial emissions), the information system of UNEP/ MAP-MED POL was used to access the available monitoring data and develop the indicators. In line with the MED POL activities, support has been provided to the countries in the establishment of Pollutant Release and Transfer Register (PRTR), in order to make reporting of industrial emissions more sustainable.

⁽¹⁴⁾ http://enpi-seis.ew.eea.europa.eu/communication/seiscommunicationpaper/enpi_seis_communication_feb2013.pdf.

The choice of Reportnet ⁽¹⁵⁾ as the common data exchange tool (Indicators 1–4, data for Indicators 5 and 6 are directly reported to MED POL) was extensively discussed and suggestions for other tools and platforms were put forward but not developed at this stage.

Reportnet tools has been extensively used during the overall process, but only two countries used Reportnet as the data exchange tool for their data deliveries (Table I.2). The other countries delivered their data through email, in most cases following the agreed templates. The working groups identified the need for increased support for understanding the specifications, functionality and application at national level (see Recommendations).

IV.6 Data sharing

Countries replied to ENPI-SEIS project requests but did not fully make the link to their H2020 obligations. The short-term objectives of the ENPI-SEIS project were put in place to pilot the regular production of indicators and the corresponding organisation of dataflows. Consequently, a stronger understanding is needed about how the developments and results of the short-term project will lead to established and sustained processes, across also a broader domain of environmental indicators in the long-term.

The first steps towards the establishment of a common reporting mechanism are now laid down. However, more work and support is needed to achieve a situation where the shared information system is used for exchanging harmonized datasets on a regular basis.

The selected data exchange tool was not used to its maximum potential in supporting a data sharing trial exercise.

The current MED POL data policy (restricting access to data to MED POL) has been a constraint. A revision of this data policy in accordance with

the SEIS principles will ease access and use of the data reported.

IV.7 Geographical focus

The different geographical coverage of H2020 projects components as well as the geopolitical distribution of the region (EU, ENP, accession countries) caused some difficulties in carrying out the reporting process and have limited the integrated implementation of H2020 in the whole Mediterranean basin.

One major impediment is the mismatches between the data available compared with the needs of assessing the environmental issues at a correct scale. This is particularly the case for the river basins, where most of the data are only available within the administrative boundaries.

A second impediment is to do with the way data is organised and retained at different administrative levels (communes, provinces, regional, national) and within different institutions limiting their accessibility.

IV.8 Evaluation of progress

Achievements in content, infrastructure and cooperation were mainly gained through the feedback from the countries themselves and their participation in the regular working group meetings. However, a systematic metric that enables the evaluation of the overall progress in setting up sustainable reporting mechanisms is still to be elaborated.

Being able to measure and compare the successes and challenges which the different countries face, such as in the delivery of data and coordination, will help encourage and support this among other countries.

Using the three SEIS pillars to analyse progress helps to assess the activities needed to progress at the country level.

⁽¹⁵⁾ <http://www.eionet.europa.eu/reportnet>.

Table I.2 Status of data deliveries from ENP-South partner countries

Name of dataset	Name of table	Delivery %				Overall %					
		Palestine	Israel	Tunisia	Lebanon	Palestine	Israel	Tunisia	Lebanon		
Share of population with access to an improved sanitation system	Improved sanitation National	100	100	100	100	50	50	50	50		
	Improved sanitation in hydrological basin	0	0	0	0						
Name of dataset	Name of table	Delivery %				Overall %					
		Palestine	Israel	Tunisia	Lebanon	Palestine	Israel	Tunisia	Lebanon		
Wastewater collection and treatment	Collected and treated wastewater per country	45	100	54.54	72.72	22.5	50	27.27	36.36		
	Collected and treated wastewater per coastal hydrological basin	0	0	0	0						
Name of dataset	Name of table	Delivery %					Overall %				
		Palestine	Israel	Tunisia	Egypt	Lebanon	Palestine	Israel	Tunisia	Egypt	Lebanon
Municipal waste generation, collection and treatment	Collected municipal waste per country	100	100	61.5	84.62	92.3	83	83	19.5	55.32	107.9 ^b
	Collected municipal waste per coastal region	100	100	0	42.85	92.85					
	Collected municipal waste per coastal city	0 ^a	0 ^a	0 ^a	0 ^a	92.3					
	Treatment of municipal waste per country	100	100	55.5	77.77	100					
	Treatment of municipal waste per coastal region	100	100	0	60	70					
	Treatment of municipal waste per coastal city	0 ^a	0 ^a	0 ^a	0 ^a	100					
	Name and location of landfills	100	100	0	66.66	100					
	Name and location of open dumpsites	0	0	0	0	0					

Note: Official delivery using template: Palestine; Israel;
 Non official delivery using template: Tunisia; Lebanon;
 Non official delivery not using template: Morocco.

^a List of coastal cities not final.

^b Data for coastal cities provided.

V Main recommendations towards the establishment of a regular review and monitoring process

The results of the thematic analysis in Part 2 and of the progress made in the H2020 process itself stress the need for further mainstreaming and streamlining information requirements and data collection and exchange between the countries. The recommendations to cover some existing shortcomings are structured below around the three pillars of SEIS: content/knowledge base, infrastructure/dataflow and cooperation/governance. The recommendations are also built on the achievements and lessons learned of the previous section.

V.1 Geographical focus

The three thematic priority areas - municipal waste, urban waste water and industrial emissions remain valid and need to be developed further; countries need to continue their commitment in this direction.

In view of information needed for policy making, the regular reporting process needs to be developed towards other areas such as: hydrological basins, river basins, coastal areas and ecosystems.

In the next reporting phase, the other related main issues of concern in the Mediterranean (water scarcity, urbanisation, land erosion, marine transport, invasive species, ecological quality status and climate change) should be fully integrated and addressed in a systemic way.

A strong link with the research and research-funding streams needs to be sustained and strengthened to support the improvement of the Mediterranean knowledge base.

The country analyses (country level assessments) have proved to be an efficient capacity building approach and a useful tool to assess the main environmental drivers and pressures and to analyse their relevancy to other processes at national level. This can be built on and will allow further aggregation at regional level.

A systematic metric should be developed to evaluate the overall progress in setting up national and regional reporting mechanisms. Such a tool would not only be useful in providing a regular measure of the national and regional performance but would also help in the identification of areas where more support is needed.

V.2 Infrastructure/dataflow

The review exercise was a vehicle to improve national reporting and dissemination tools, as well as to provide support to national environmental information system to ensure data sharing and dataflows. To continue this progress, good practices at a national level should be used and replicated. The example of the Eionet priority dataflows is regarded as encouragement towards better performance through 'compétition amicale' concentrating on praise for achievements rather than blame for failures. Regular annual overviews of dataflows are used as argumentation to enable changes and progress at national level.

Regarding H2020 indicators, more efforts are needed to:

- better streamline with other regional and international reporting obligations, through the implementation of a common national information system that serves multiple reporting obligations;
- include other elements of the DPSIR analytical chain as part of the regular reporting cycle to allow for a full assessment of depollution that includes driving forces, impacts and responses, in synergy with other initiatives in the region, in cooperation with UNEP/MAP;
- sustain the established dataflows and encourage countries to use these dataflows in their regular national State of Environment reporting. Such a system would facilitate the compilation of an 'assessment of assessments' at the regional level.

V.3 Cooperation/governance

The chosen set-up for the governance and steering of the review processes seems to be appropriate. This should be strengthened to include other key environmental services as appropriate and in accordance with H2020 priorities. Main points include:

- The designation and commitment of national SEIS coordinators – their engagement requires recognition and further support at national level.
- The inter-institutional cooperation between relevant national level partners and synergies with established networks – this needs to be further institutionalised to ensure the sustainability of the process, in particular with:
 - Reporting under the LBS (Land Based Sources) Protocol of UNEP/MAP Barcelona Convention and its respective 7 Regional Plans;
 - Regional monitoring strategies and programmes currently being developed under the Ecosystem Approach (ECAP) implemented by UNEP/MAP;
 - Activities of UfM on the strengthening of the national water information systems and harmonization of data collection towards a Shared Water Information System;
 - Relevant research projects and regional development programmes.
- Engagement and commitment by all Mediterranean countries towards H2020 – this needs to be encouraged further. The strong engagement of all EU Mediterranean countries is required for effective transfer of knowledge and know-how, full regional implementation of H2020 and for offering a demonstration case of the benefits of SEIS implementation.
- Functioning of the RMR subgroup – based on the experience to date, this has worked as the appropriate institutional and coordinating body to steer the review process.
- The ENPI-SEIS project is regarded as a good vehicle to provide the necessary framework for long-term implementation and support of the review and monitoring of H2020.
- The links between RMR/ENPI-SEIS and the other H2020 components (Capacity Building and Pollution Reduction Investment) need to be strengthened and their activities planned to develop synergies. Examples:
 - Integrate capacity building trainings on monitoring strategies, use of equipment, guidelines and standards, data acquisition, data processing, indication production etc., based on the needs identified by the RMR and SEIS team.
 - Extend the indicator set and regular monitoring to include indicators on a macro scale that provide directions on where depollution investments should be made.
 - At the same time, assess the effectiveness of depollution investment projects using H2020 indicators, as appropriate.
- More focus should be put on strengthening national capacities, e.g. through concrete pilot implementation projects focused on the needs identified by the countries. This includes increased technical support on understanding data specifications, functionality of the data exchange tools and application identified by the IT working group.
- A regular reporting mechanism depends on well-established and implemented legal frameworks. The situation in Mediterranean countries varies a lot. The EU Member States have long-standing experience in data sharing and production of indicators due to the regular reporting obligations regulated by EU framework legislation. For the countries of the ENPI-SEIS region, data sharing is not periodic since they are not subject to the binding legal frameworks. Furthermore, the legal requirements of the Barcelona Convention do not entirely cover the thematic scope of H2020. The development, adoption and implementation of legal framework remain a prerequisite for building the knowledge base and ensuring a functioning infrastructure. Therefore, an endorsement for the process to establish a supporting legal framework for the H2020 reporting and review activities would ideally be required.

PART 2 REGIONAL THEMATIC ASSESSMENT

1 What makes the Mediterranean Sea and its basin unique?

The Mediterranean Sea is the largest of the semi-enclosed European seas: its basin area covers almost 2.6 million km², 0.82 % of the world's ocean surface. Surrounded by 22 countries that share a coastline of 46 000 km, the Mediterranean region is home to around 480 million people living across three continents: Africa, Asia and Europe.

Often called the 'cradle of world civilisation', the Mediterranean basin has a long history, and an extremely rich natural and cultural heritage. It provided an important ancient route for merchants and travellers, allowing for trade and cultural exchange between people in the region. It is still one of the world's busiest shipping routes: about one third of the world's total merchant shipping – or ~ 220 000 merchant vessels of more than 100 t – cross the sea each year.

1.1 Climate and climate change

Climatically, the Mediterranean is characterised by mild winters and hot and dry summers. The mean annual temperatures follow a distinct latitudinal gradient, with the lowest average temperatures being around – 5 °C in the higher altitudes of the Alps, and the annual average temperatures reaching > 20 °C in the southern part (see Map 1.1).

The total annual precipitation ranges from 1 500 mm to 2 000 mm in certain northern Mediterranean areas, such as the Alpine and Pyrenean regions, and reaches 100 mm in some southern Mediterranean countries (see Map 1.1). Precipitation is concentrated in autumn, winter and early spring, during which around 90 % of the annual precipitation falls (UNEP/MAP/MED POL, 2003). The distribution of annual precipitation varies greatly between the northern and the southern countries, with southern countries receiving only 10 % of the total precipitation. Although this general north-south gradient typifies the yearly precipitation patterns, precipitation can vary substantially intra-annually and inter-annually, with periods of severe drought followed by episodes of torrential rain. The strong

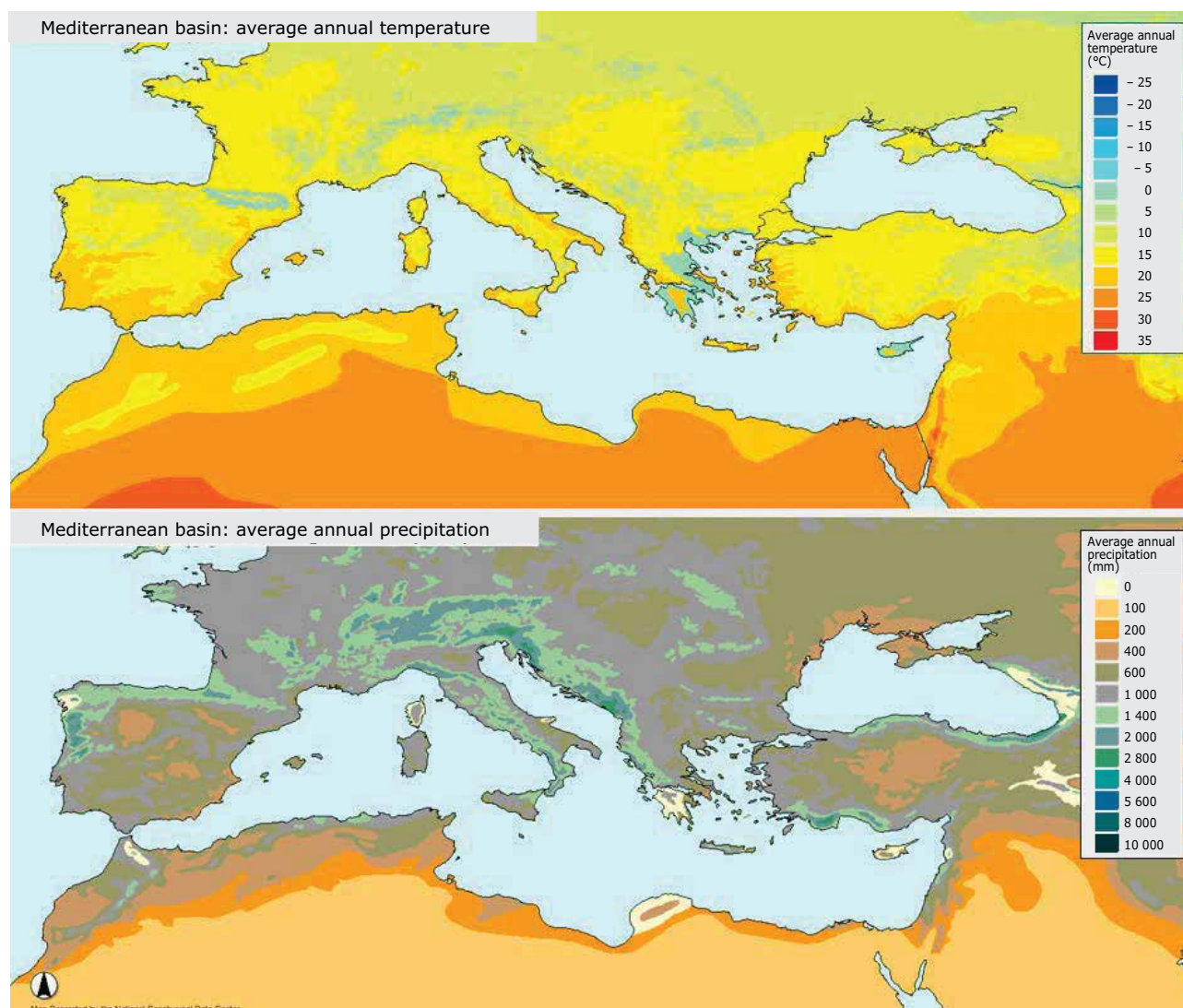
summer–winter rainfall contrast and the succession of dry and flash-flood periods are specific characteristics of the climate in the Mediterranean (UNEP/MAP, 2013).

Riverine discharges follow seasonal variations in precipitation and temperature; the lowest discharges during the summer months are due to strongly reduced or no precipitation and elevated temperatures (MerMex, 2011). Large variations in river discharges are also a major characteristic of Mediterranean rivers, with the most extreme variations exemplified by the non-permanent rivers ('oueds') in southern Mediterranean countries that occur after heavy rain events or flash floods. Such intense short-lasting rainfall events affecting small coastal catchments typically occur during spring and autumn, and are the main cause of coastal floods in arid and semi-arid parts of the Mediterranean area (UNEP/MAP, 2013).

The combination of low precipitation levels and high temperatures (evaporation rates) limits the available freshwater resources and results in water shortages. In general, all situations of shortage or scarcity result from an imbalance between water requirements (demand) and water supply, which could take the form of a high rate of water utilisation as compared to available supply (EMWIS, 2007). This problem is particularly prominent in the southern countries of the Mediterranean, where the available water resources per inhabitant reach conditions of water stress (< 1 000 m³/capita/year) and water shortage (< 500 m³/capita/year), year round (see Figure 1.1). As opposed to the seasonal shortages in northern Mediterranean countries that coincide with the dry months, the dry season in some southern countries may last longer than six months, leading to 'annual drought' conditions (EMWIS, 2007).

The Water Exploitation Index (WEI), defined as the mean annual total demand for fresh water, divided by the long-term average freshwater resources, refers to the following threshold values/ranges to indicate levels of water stress: (a) non-stressed countries: < 10 %; (b) low stress: 10 to < 20 %;

Map 1.1 Maps showing variations in annual average temperatures and precipitation between the northern and southern Mediterranean



Source: <http://www.grabovrat.com/mapsViews/mapsViews83.html>.

(c) stressed: 20 % to < 40 %; and (d) severe water stress: ≥ 40 %. These threshold values/ranges are averages, and it is expected that areas whose WEI is above 20 % will experience severe water stress during drought or low river-flow periods.

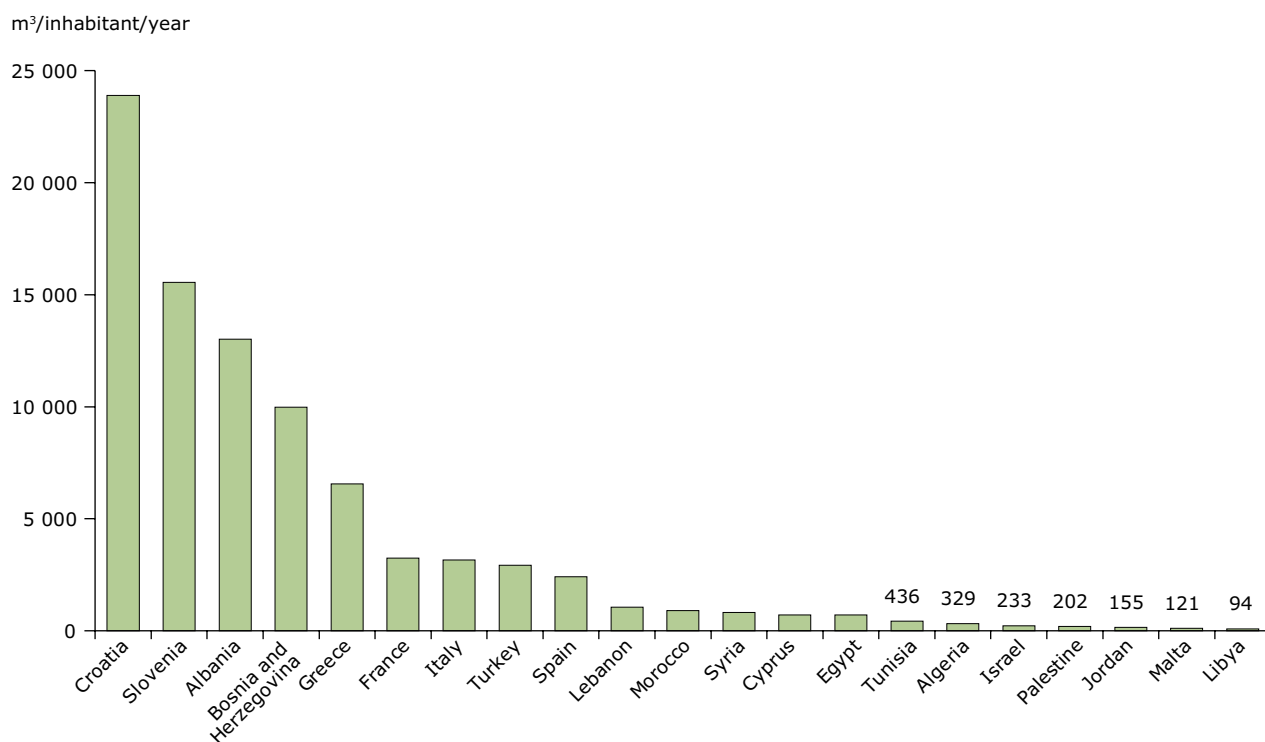
The WEI calculation (Figure 1.2) shows that European Neighbourhood Policy (ENP) South^(†) countries are amongst the Mediterranean countries with a WEI higher than 40 %, exceeding 80 % in Egypt, Israel, Syria and Libya. The WEI gives an indication of the pressure that the total water demand puts on water resources, with values higher than 40 % indicating a situation of severe

water stress. The volume of water resources per inhabitant is inversely correlated to the WEI, with ENP-South countries having the most limited water resources, and ranking highest in the WEI.

The Mediterranean region has been identified as one of the main climate change hotspots (Giorgi, 2006), i.e. one of the areas most responsive to climate change. As Mediterranean countries are already facing important issues of water stress and extreme climate events such as floods and droughts, climate change will most probably exacerbate these problems, resulting in significant human and economic losses.

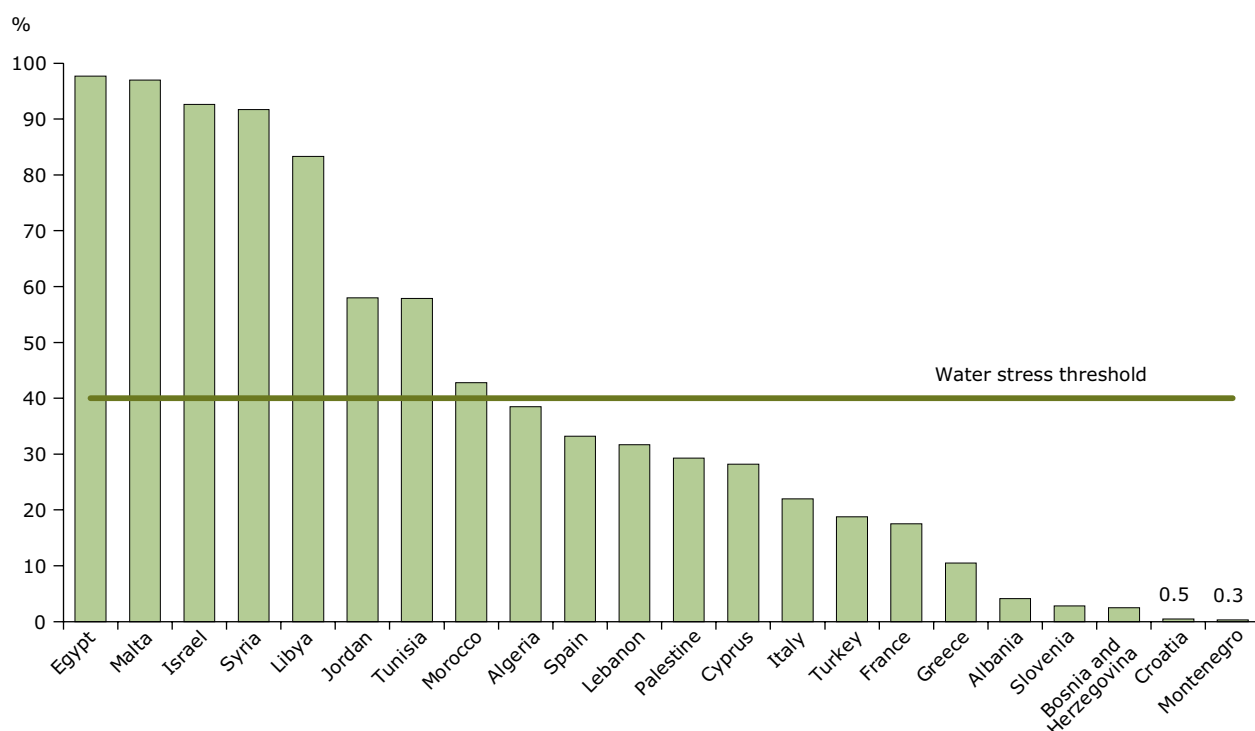
^(†) The 8 ENP-South countries are: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine and Tunisia.

Figure 1.1 Water resources per inhabitant in Mediterranean countries



Source: FAO- Plan Bleu, 2013.

Figure 1.2 WEI for natural renewable freshwater resources in Mediterranean countries (2005–2010)



Source: Plan Bleu, 2013.

Over the 20th century, and with a clear acceleration since 1970, an increase in temperature of almost 2 °C has been recorded in south-western Europe (the Iberian Peninsula and the south of France). The same increase has also been noted in northern Africa, although in this case, the lack of data makes it more difficult to estimate. The only exception is Greece, which until the early 2000s, saw its temperatures drop. The rise in temperature is more marked in winter than in summer, and for the minimum rather than the maximum figures. Thus, the range of the diurnal cycle is shrinking (EIB, Plan Bleu, 2008). As for rainfall, precipitation has increased to the north of the Alps, and diminished

in southern Europe, where a 20 % drop in rainfall has been recorded.

Based on new data sets at micro-spatial level, the FEMISE (Forum Euro-méditerranéen des Instituts de Sciences Economiques) project no 34-03 that was carried out by a north-south team ⁽²⁾ provided a statistical analysis of climate change for 808 geographical areas in the ENP-South region, from 1900 to 2008. Results show that ENP-South partner countries have already experienced dramatic climate change over the past century, both in terms of temperature increase (Table 1.1) and decrease in precipitation (Table 1.2).

Table 1.1 Changes in average temperatures in ENP-South countries

	Structural change	Average temperature (°C)		Change in temperature
	Year	Before	2000–2008	(°C)
Algeria	1971	23.1	24.0	+ 0.9
Egypt	1967	22.0	22.9	+ 0.9
Israel	1971	19.9	20.2	+ 0.3
Jordan	1982	19.3	19.7	+ 0.4
Lebanon	1972	17.3	17.9	+ 0.6
Libya	1978	22.3	23.3	+ 1.0
Morocco	1971	19.1	19.6	+ 0.5
Syria	1971	18.1	18.7	+ 0.6
Tunisia	1971	20.0	21.2	+ 1.2

Source: <http://www.grabovrat.com/mapsViews/mapsViews83.html>.

Table 1.2 Changes in annual rainfalls in ENP-South countries

	1900–1929	1930–1959	1960–1989	1990–2008	Change (%)
Algeria	109	94	87	89	- 17.90
Egypt	36	20	18	33	- 8.80
Israel	298	195	165	146	- 51.10
Jordan	239	150	125	108	- 54.70
Lebanon	1 035	727	654	568	- 45.10
Libya	86	41	39	43	- 49.60
Morocco	215	185	181	187	- 13.20
Syria	479	365	333	272	- 43.30
Tunisia	242	244	237	242	- 0.10

Source: <http://www.grabovrat.com/mapsViews/mapsViews83.html>.

⁽²⁾ Northern team: Nicolas Péridy and Marc Brunetto (Université du Sud Toulon-Var, France). Southern team: Ahmed Ghoneim (Cairo University, Faculty of Economics and Political Science, Egypt).

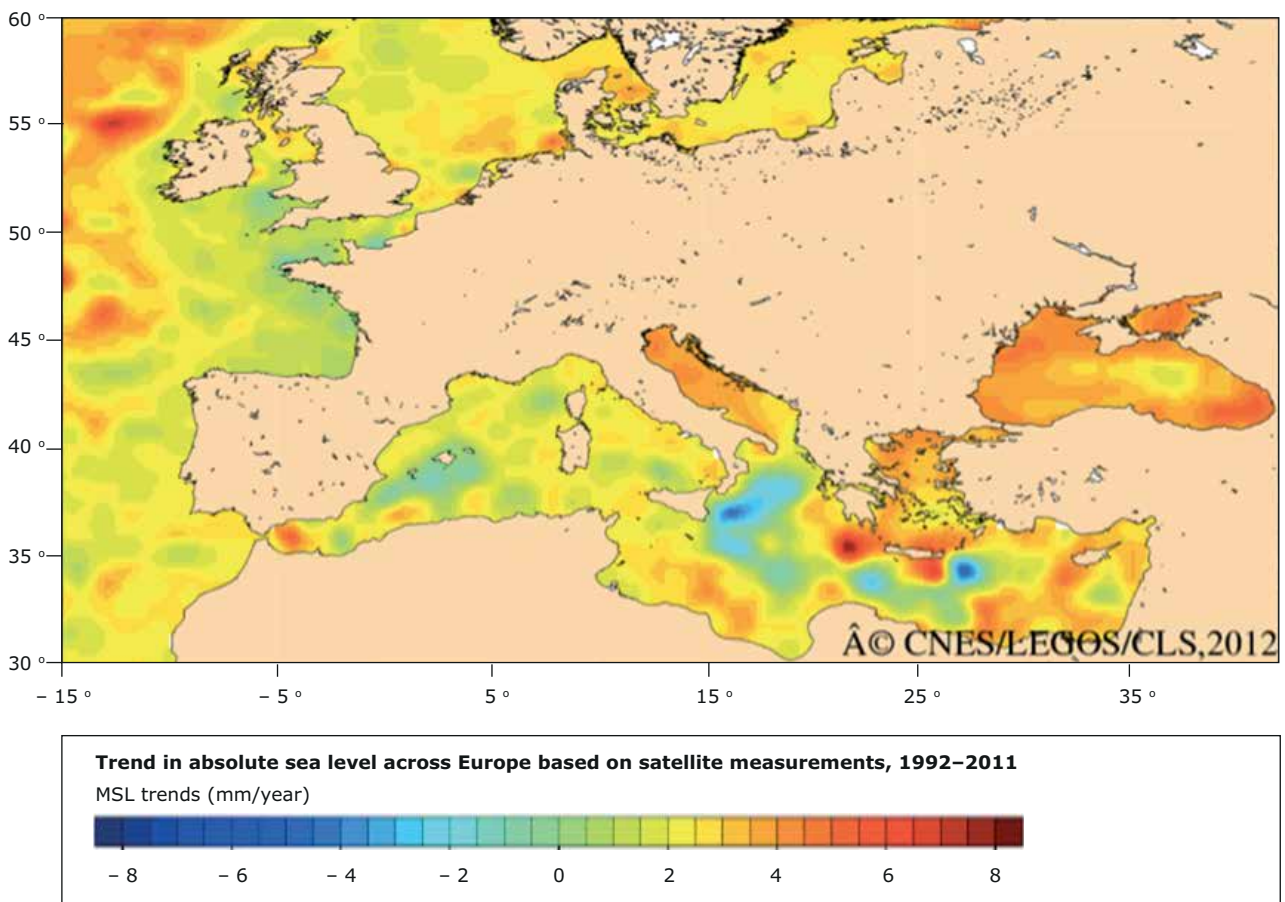
According to the International Panel on Climate Change (IPCC), a temperature rise of 2 °C to 3 °C is expected in the Mediterranean region by 2050, and of 3 °C to 5 °C by 2100. The 2007 IPCC projections for the ENP-South region predict an increase in temperature of up to 2 °C in the next 15 to 20 years and of 4 °C to 6.5 °C by the end of the 21st century. This increase in temperature is likely to be accompanied by a further decrease in the level of precipitation. In the IPCC scenario, summer rainfalls could decrease by the end of the century by 35 % on the southern rim, and by 25 % on the northern rim, (IPCC, 2013).

Other impacts of climate change include sea level rise (SLR). The trends in absolute SLR for Europe based on the EEA climate indicator (CLIM 012) ⁽³⁾ show that in the Mediterranean Sea there are regions with increases of more than 6 mm/year and with

decreases of more than 4 mm/year (see Map 1.2), as compared to a rate of global mean SLR of around 3 mm/year over the last 2 decades. Sea level is not rising uniformly at all locations: even within a particular sea basin, some locations are experiencing variations that are much greater (or lower) than average, driven by different physical processes. Despite local variations, a clear eastward increasing trend in SLR is observed in the Mediterranean basin.

Future projections of the spatial pattern of SLR remain highly uncertain. The IPCC predicts a SLR of 0.1 m to 0.3 m by 2050 and of 0.1 m to 0.9 m by 2100, with significant and possibly higher impacts on part of ENP-South region, due to the low-lying coastal areas in countries such as Egypt, Morocco, Algeria, Tunisia, and Libya. For example, Egypt is considered one of the top five countries in the world expected to be mostly impacted with a 1-metre SLR.

Map 1.2 Trend in absolute sea level across Europe based on satellite measurements, 1992–2011



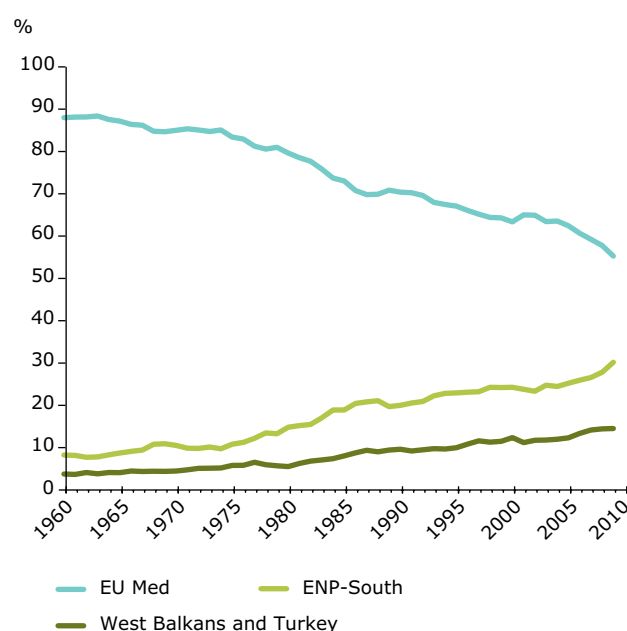
Source: EEA, 2012.

⁽³⁾ Global and European sea-level rise (CLIM 012) based on satellite measurements (1992–2011): <http://www.eea.europa.eu/data-and-maps/indicators/sea-level-rise-1/assessment>.

The Mediterranean region is highly susceptible to the risk of climate change impact due to water scarcity, concentration of economic activities in coastal areas and reliance on climate-sensitive agriculture. However, the region itself emits low levels of greenhouse gases (GHGs) as compared to other areas in the world. Carbon dioxide (CO₂) is known to be the most important, anthropogenic GHG: emissions data show that in 2009, the Mediterranean countries together emitted 6.7 % of world's emissions, equivalent to more than 2 billion tonnes of CO₂. This amount, however, has increased by a factor of 4 in the last 50 years. The ENP-South countries emitted 2 % of world's CO₂ emissions in 2009. Over the last 50 years, the contribution of the ENP-South countries to the Mediterranean emissions of CO₂ grew from 9 % to 30 %. Over the same period, the contribution of the EU Med countries decreased from 88 % to 54 % (Figure 1.3). The main sources of CO₂ are the burning of fossil fuels and the manufacture of cement, including CO₂ produced during consumption of solid, liquid, and gas fuels and gas-flaring.

In 2009, CO₂ emissions per capita varied from less than 1 tonne per capita in Palestine to between 9 t and 10 t in Israel and Libya (Map 1.3). In most ENP-South partner countries, CO₂ emissions per capita are less than 4 tonnes. Since 1990, most of the Mediterranean countries have reduced their CO₂ emissions per dollar of gross domestic product (GDP), except for Egypt and Morocco (Figure 1.4). CO₂ emissions in Libya, Jordan and Syria are around 650 g to 700 g per dollar. Other ENP-South countries emitted from 280 g to 450 g per dollar of GDP.

Figure 1.3 CO₂ emissions: contribution of each country group to CO₂ emissions of the Mediterranean countries (1960–2009) in percentage



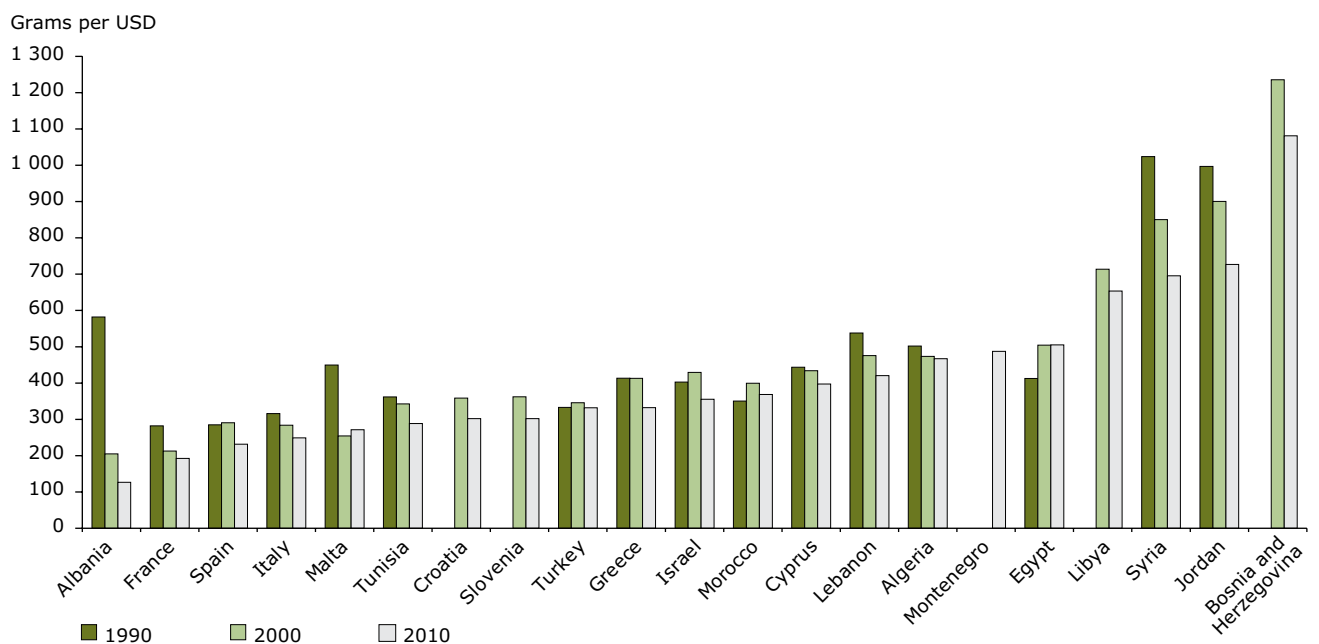
Source: Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States.

Map 1.3 CO₂ emissions per capita in the Mediterranean countries (2009), in kilograms per inhabitant



Source Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States, 2013.

Figure 1.4 CO₂ emissions/GDP in the Mediterranean countries (1990, 2000 and 2009), in grams per dollar



Source: Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States, 2013.

Box 1.1 Selected projects focused on climate change variability in the Mediterranean

- The Global Environment Facility (GEF) ClimVar project — Integration of Climate Variability and Change into National Strategies to implement the Integrated Coastal Zone Management Protocol in the Mediterranean — aims to integrate climate variability and change into national strategies for the implementation of the Integrated Coastal Zone Management (ICZM) Protocol in the Mediterranean (Plan Bleu participation).
- The European Neighbourhood and Partnership Instrument (ENPI) Clima South project – support for climate change mitigation and adaptation in the ENPI-South region — aims to enhance regional cooperation between the EU and its Mediterranean neighbours (EU-South) and among ENP-South partners themselves (South-South) on climate change mitigation and adaptation, mainly through capacity development and information-sharing.
- The European Climate Adaptation Platform (Climate-ADAPT) aims to support Europe in adapting to climate change.
- The Seventh Framework Programme (FP7) Climate Local Information in the Mediterranean region Responding to User Needs CLIM-RUN project (2011–2014) aims to develop a protocol for applying new methodologies and improved modelling and downscaling tools for providing adequate climate information at regional to local scale, that is relevant to and usable by different sectors of society (policymakers, industry, cities, etc.).

1.2 Water and nutrient dynamics

With a typical tidal range of less than 50 cm, the Mediterranean Sea is microtidal. This reduces the potential for dilution and dispersion of dissolved and particulate wastes. It is also one of the most oligotrophic (i.e. poor in nutrients) oceanic systems, and is characterised by an eastwards longitudinal gradient in this oligotrophy. The main source of nutrients in the Mediterranean lies in the inflowing Atlantic surface waters at the level of the Gibraltar Strait. These inflowing waters flow eastward along the African coasts in the western Mediterranean, then cross the Sicily Strait and continue their flow again along the northern African coasts. As the waters move eastwards from the Gibraltar Strait, they become depleted in nutrients. By the time they reach the Egyptian coasts, their nutrient signature has almost disappeared. Additionally, the Nile River nutrient signature has disappeared due to the 1960s Nile Dam construction. All this contributes towards making the Levantine Basin (at the eastern part of the Mediterranean Sea) one of the most oligotrophic areas in the world ocean.

Additional sources of nutrients exist in the Mediterranean, but these have localised and rather

small impacts. One is the outflow of Black Sea surface waters into the Aegean, which have an influence limited to the north Aegean; a second source is the Po River, emptying into the Adriatic on its western coast. The most eutrophic waters in the western basin are located on the north shore, at the mouth of the large rivers Rhone and Ebro. Riverine nutrient inputs are relatively low, as most river systems discharging in the Mediterranean Sea are small. High nutrient inputs to small rivers may be important in most North African oueds, as they collect rich effluents in large quantities (Djemai and Mesbah, 2008). In these rivers/oueds, metals, nitrates and organic carbon reach concentrations that could affect biological populations after heavy rains following dry periods (Nicolau et al., 2006).

The unique biogeochemical characteristics of the Mediterranean Sea determine the fate of physicochemical and biological cycles affecting all aspects of ecological processes. Primary production and phytoplankton biomass are reduced, due to the oligotrophic nature of the basin, giving rise to clear and transparent coastal and marine waters. Primary productivity at local scale is also controlled by factors other than limited nutrient input, including stratification of the water column, transparency and

surface currents. Eutrophication is very common in sheltered marine waterbodies, such as harbours and semi-enclosed bays along the Mediterranean coast, mainly in the vicinity of coastal towns subject to untreated or partly treated urban effluents containing significant loads of nutrients and suspended matter (degradable or inert).

1.3 Ecoregions with high biodiversity

The Mediterranean region is one of the global biodiversity hotspots, characterised as an area of exceptional biodiversity value, with a large number of endemic species (i.e. native only to the region) and critical levels of habitat loss. Globally, the Mediterranean region supports 10 % of known higher plant species and 7 % of marine species (UNEP/MAP-Plan Blue, 2008). The flora and fauna of the Mediterranean are differently distributed amongst its various basins and ecoregions: 87 % of the known forms of life are present in the western Mediterranean, 49 % in the Adriatic and 43 % in the eastern Mediterranean (including the Aegean and Levantine Sea), many of which are present in two or three basins. The climate plays a key role in determining the physical environment and the wide variety of landscapes, contributing to its rich biodiversity.

According to the global Marine Ecoregions of the World (MEOW) classification proposed by Spalding et al. (2007), the Mediterranean basin is subdivided into seven ecoregions: (a) Adriatic Sea, (b) Aegean Sea, (c) Levantine Sea, (d) Tunisian Plateau/Gulf of Sidra, (e) Ionian Sea, (f) western Mediterranean, and (g) Alboran Sea. The species composition of an ecoregion⁽⁴⁾ is likely to be determined by the predominance of a small number of ecosystems and/or a distinct set of oceanographic or topographic features such as isolation, upwelling, nutrient inputs, freshwater influx, temperature regimes, ice regimes, exposure, sediments, currents, and bathymetric or coastal complexity. It is estimated that no less than 10 000 to 12 000 marine species thrive in the Mediterranean Sea, comprising approximately 8 500 macroscopic fauna, over 1 300 plant species and 2 500 species from other taxonomic groups. Around 20 % to 30 % of these species are endemic (UNEP/MAP, 2013). This high biological diversity is thought to be related to the specific geomorphological and hydrographical features of the Mediterranean basin, its geological

history and its position as interface between temperate and tropical biomes (UNEP/MAP-Plan Bleu, 2009).

The wealth of natural resources of the Mediterranean basin makes it a unique, yet fragile ecosystem. Many of its species are threatened by a range of human activities. Pollution from land-based sources such as discharges of excess nutrients and hazardous substances, marine litter, overfishing and degradation of critical habitats are responsible for this biodiversity loss. The introduction of invasive alien species, sometimes referred to as biological pollution, also presents a threat to the biodiversity, structure, functioning and stability of the invaded ecosystem. The number of alien species has increased significantly during the 20th century (UNEP/MAP-Plan Bleu, 2009): it is currently around 1 000 (Zenetos et al., 2012).

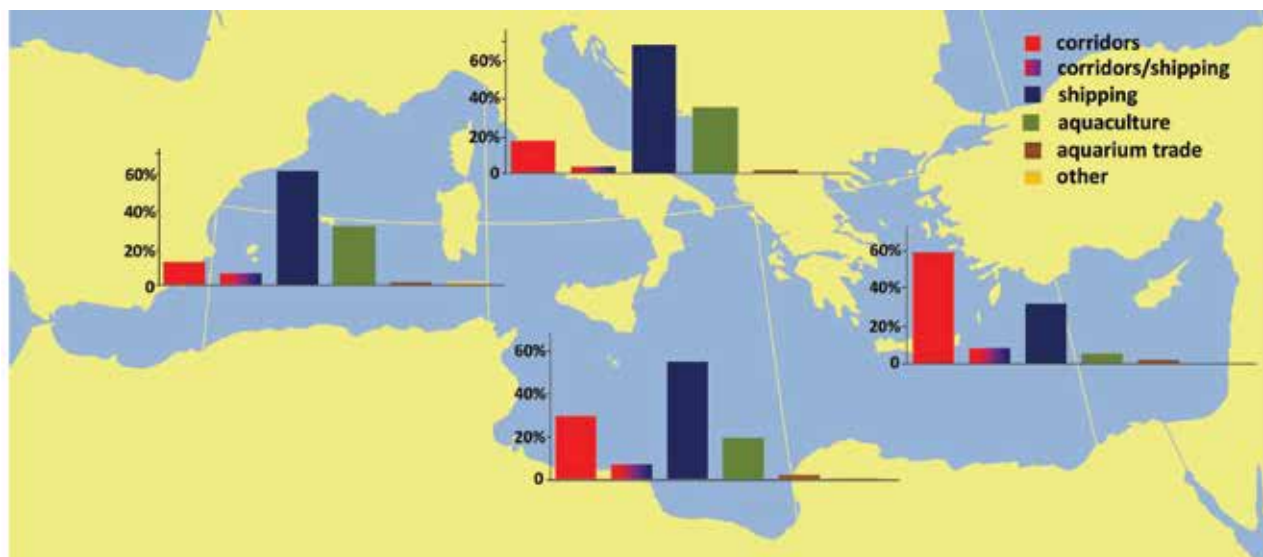
The distribution of the number of non-indigenous species varies across the Mediterranean basin, with the highest number of species (> 700) recorded in the eastern basin in the vicinity of the Suez Canal. In the western basin, most species are introduced via maritime transport and aquaculture (Zenetos et al., 2012) (see Map 1.4). Studies show that the vulnerability of an ecosystem to invasive species may also be related to its environmental status: polluted or physically degraded environments are more prone to invasions than pristine sites.

1.4 Civilisation and historical developments

The Mediterranean basin, with a recorded history of more than 5 000 years, is home to some of the world's oldest cultures. The Mediterranean region is a hub of a past civilisation whose heritage and cultural landscapes give added meaning to the sense of belonging in the Mediterranean. For thousands of years, strong bonds have existed between the people of the Mediterranean, due to the region's geography and history, which are linked together by a common sea. They share not only the sea itself, but also a natural environment that historian Fernand Braudel has described as 'far from fertile and often cruel, one that has imposed its own long-lasting limitations and obstacles'. Despite their diversity, the regional identity of the Mediterranean countries has been strengthened by centuries of commerce and communication (World Bank, IEB, 1990).

⁽⁴⁾ An ecoregion is an area of relatively homogeneous species composition, clearly distinct from adjacent systems.

Map 1.4 Percentages of marine non-indigenous species known or likely to be introduced by each of the main pathways by Marine Strategy Framework Directive (MSFD) subregion ⁽⁵⁾



Note: Percentages add up to more than 100 %, as some species are linked to more than one pathway.

Source: Zenetos et al., 2012.

⁽⁵⁾ The Mediterranean Sea is subdivided into 4 MSFD subregions: 1) Western Mediterranean Sea, Adriatic Sea, Ionian Sea and Central Mediterranean and Aegean-Levantine Sea.

2 What are the main socio-economic factors impacting the environment?

The Mediterranean region is undergoing intensive demographic, social, cultural, economic and environmental changes. Population growth combined with the growth of coastal (peri) urban hubs generates multiple environmental pressures stemming from increased demand for water and energy resources, generation of air and water pollution in relation to wastewater discharge or sewage overflows, waste generation, land consumption and degradation of habitats, landscapes and coastlines. These pressures are further amplified by the development of tourism, often concentrated in Mediterranean coastal areas.

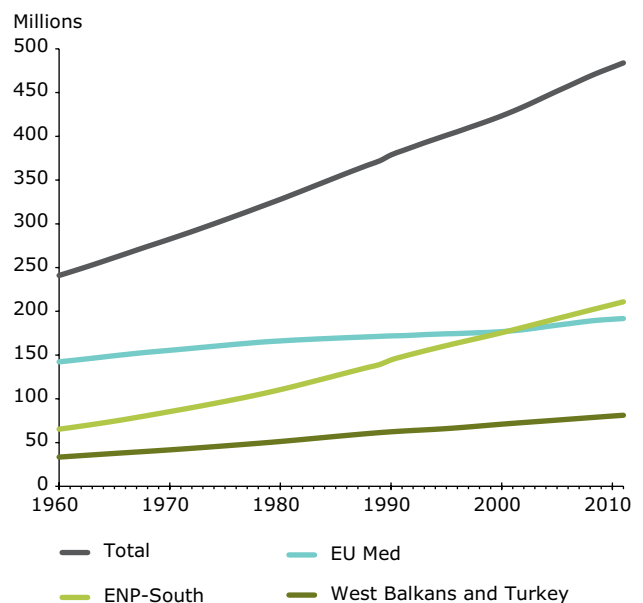
The change in consumption patterns as a result of increasing development implies a drastic increase in the quantity and distribution of waste generated and in the volume of water used and wastewater generated by the population, mainly in the south-eastern Mediterranean countries. Meanwhile, progress in waste management and wastewater treatment is inadequate for meeting growing needs.

2.1 Population growth

The population of Mediterranean countries (including Jordan) has been steadily increasing over the last 50 years (see Figure 2.1); it doubled from 240 million in 1960 to 480 million in 2010. The distribution of population between EU Med and ENP-South countries has changed dramatically: in 1960, EU Med countries represented 59 % of the total population, while today this figure has dropped to 40 %. The population of the 10 ENP-South countries (210 million in 2010) represented 44 % of the Mediterranean population in 2011, but a mere 27 % in 1960. Around the year 2000, the population of the ENP-South region exceeded that of the EU Med (see Figure 2.1). The share of the population in the West Balkans and Turkey (81 million) increased from 13.9 % to 16.8 % during the same period.

Of the ENP-South countries, Egypt, Algeria and Morocco are the most heavily populated: they have 151 million inhabitants, representing 71 % of the population in ENP-South countries. The population

Figure 2.1 Total population growth of Mediterranean countries (1960–2011), in million inhabitants



Source: United Nations and national sources, 2013.

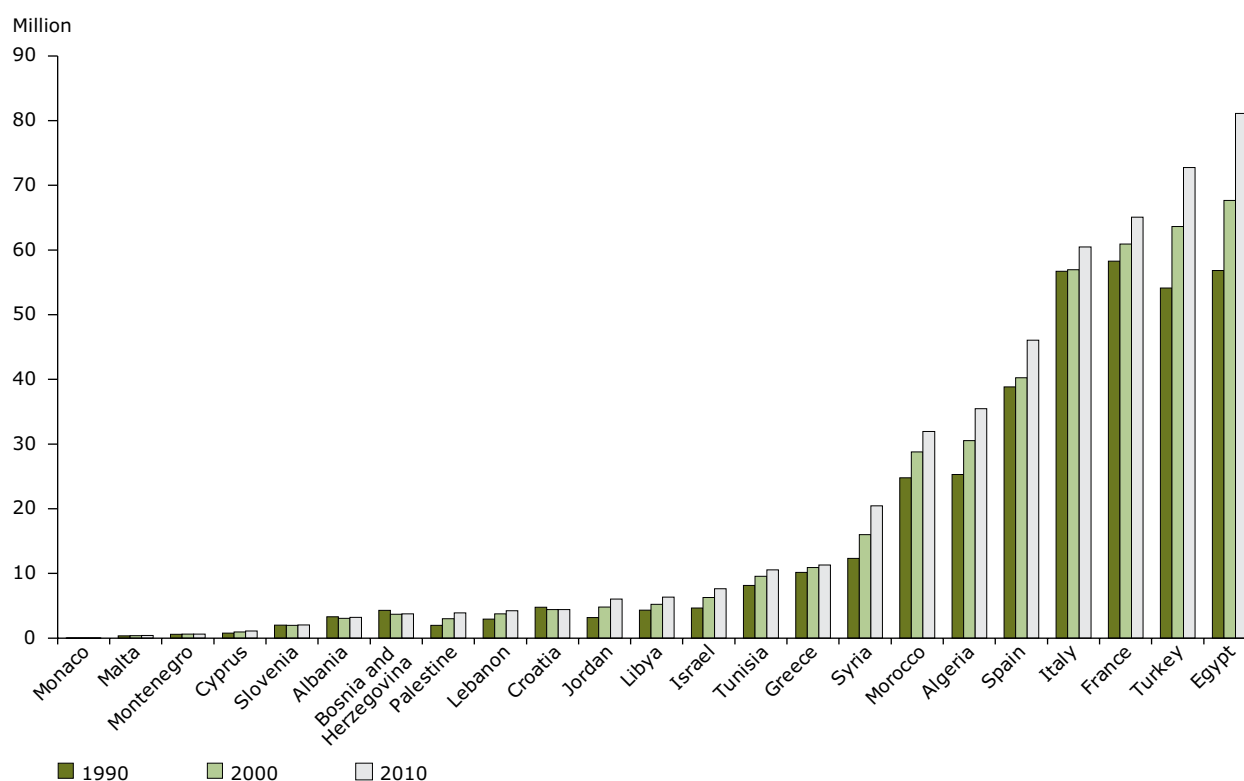
growth rate in these countries is still high; it reached 1.6 % per year during the 2000s (see Figure 2.2).

2.2 Urban population growth

Urbanisation trends differ significantly between northern and southern rims of the Mediterranean: During the last 50 years (1960–2010), the urban population in the Mediterranean region has increased significantly: in 1960, the urban population represented 48 % of the whole Mediterranean population, whereas in 2010, around 67 % of the population lived in urban areas. In particular in the ENP-South region, the urban population increased by around 100 hundred million inhabitants, reaching 123 million in 2011 (see Figure 2.3).

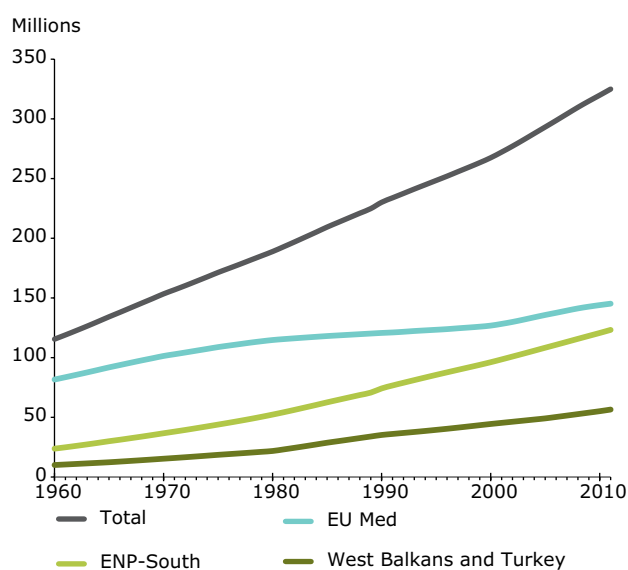
The urban population rate of EU Med countries was already high back in 1960 (57 %) — in 2011,

Figure 2.2 Total population growth in Mediterranean countries (1990, 2000 and 2010), in million inhabitants



Source: United Nations and national sources, 2013.

Figure 2.3 Urban population growth of Mediterranean countries (1960–2011), in million inhabitants

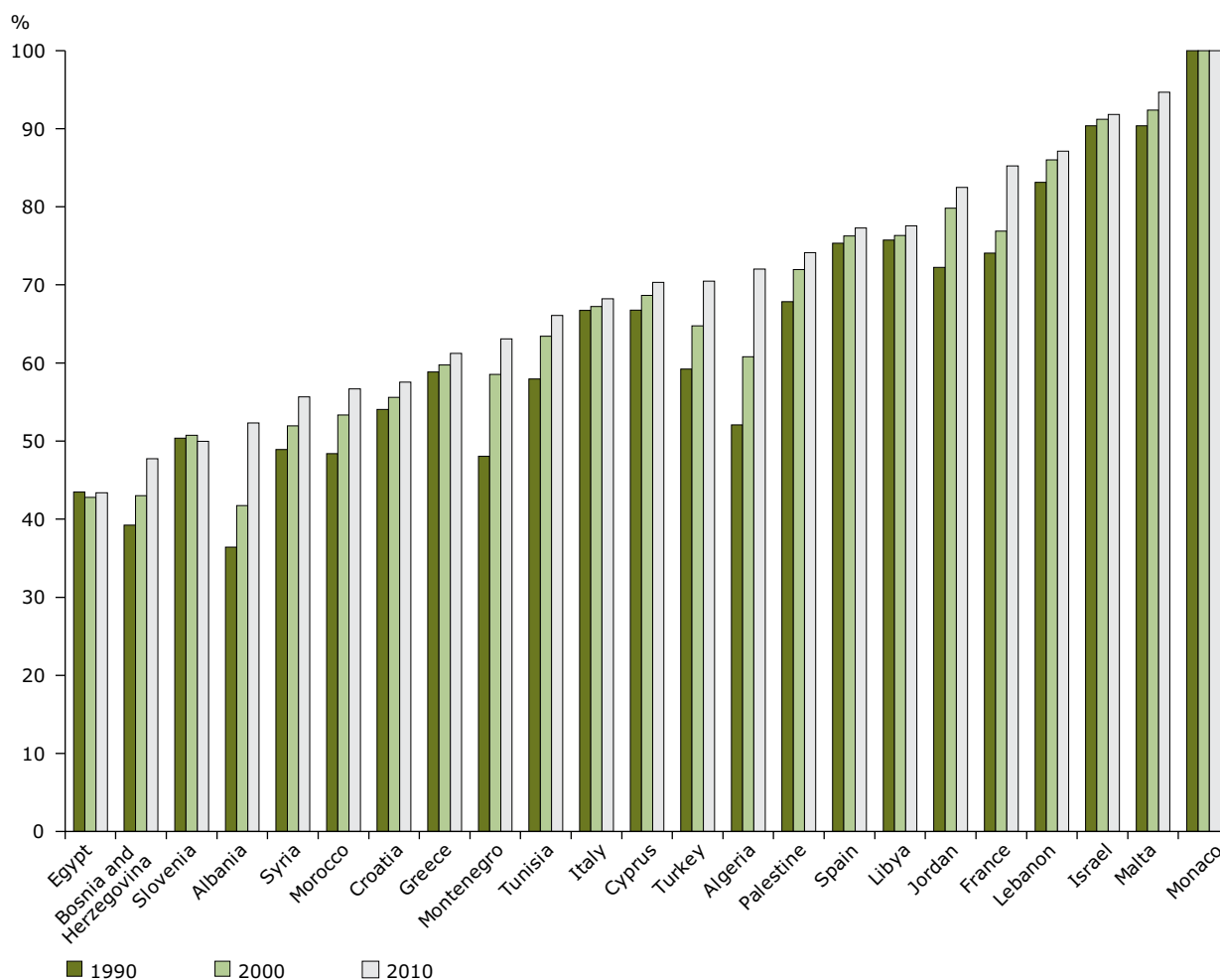


Source: World Bank Staff estimates based on United Nations, World Urbanization Prospects, 2013.

it stood at around 76 %. For the West Balkans and Turkey, and the ENP-South countries, the growth was much more significant: from 30 % to 70 % and from 36 % to 58 %, respectively.

Of the ENP-South countries, Israel, Lebanon and Jordan are the most urbanised (with an urban population rate higher than 80 %) (see Figure 2.4). Egypt, despite having 36 million urban inhabitants (10 million in 1960), still has the lowest urban population rate (44 %).

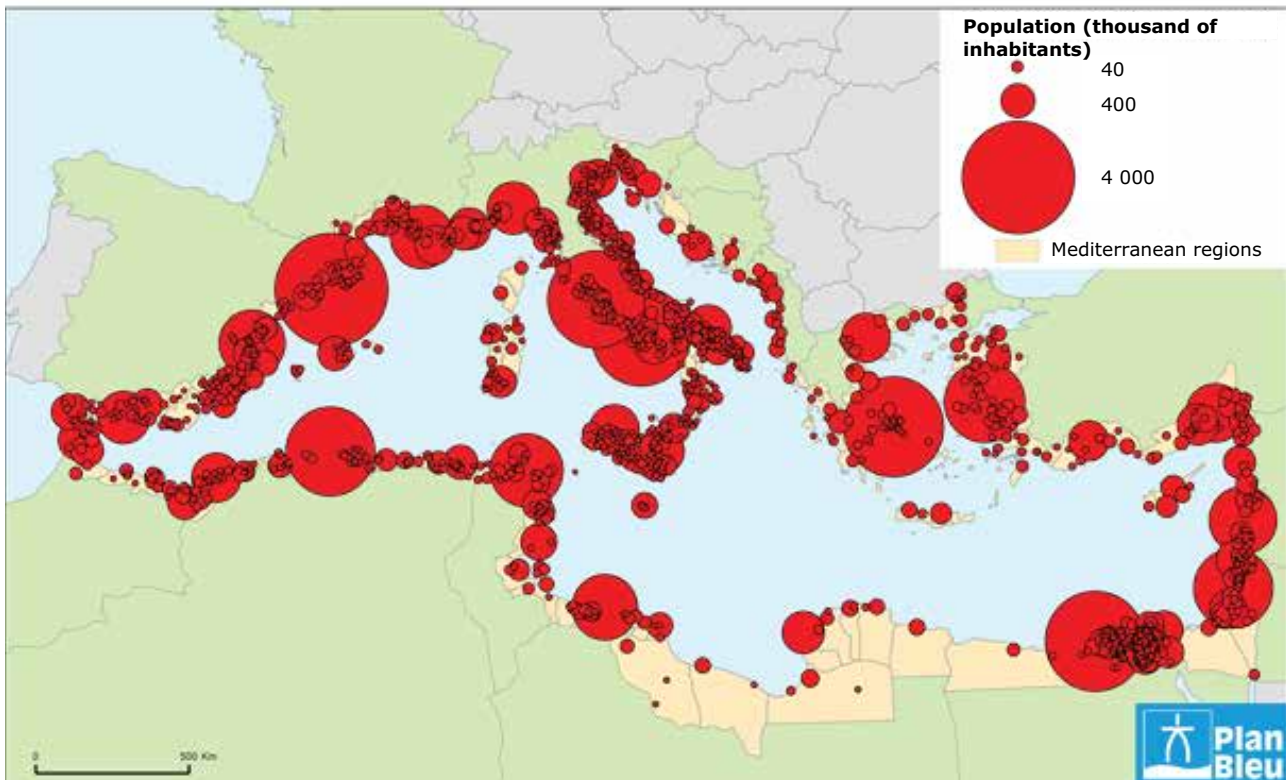
Most of this urbanisation takes place along the coastal zones (Map 2.1). The population in the EU Med coastal cities (Rome, Athens, Barcelona, Naples and Marseille) has increased less than twofold between 1950 and 2010. The growth in coastal cities in the ENP-South countries, however, has been much more dramatic. For instance, over the same time period, Shubra el Kheima (Egypt) grew 28-fold, Amman, Rabat and Istanbul grew 10-fold to 15-fold, Damascus, Beirut, Ankara, Casablanca, Tel-Aviv and Algiers grew 5-fold to 10-fold, and Cairo, Tunis and Alexandria grew 3-fold to 5-fold.

Figure 2.4 Urban population rate in Mediterranean countries (1990, 2000 and 2010), in percentage of the total population

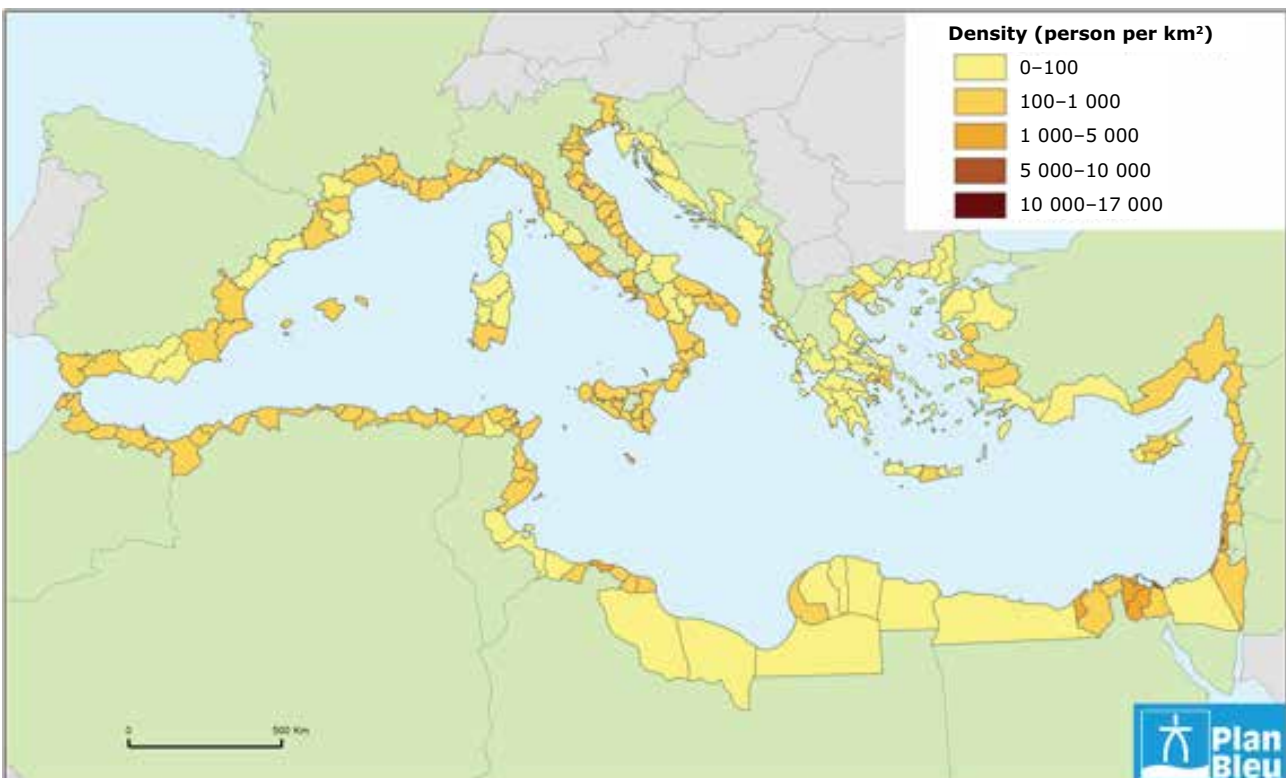
Source: World Bank Staff estimates based on United Nations, World Urbanization Prospects, 2013.

Population densities in coastal regions vary across the Mediterranean basin, ranging from between 0 and 100 persons per km² along parts of West Balkans and southern Turkey, Greece and coastal Libya, to > 5 000 persons per km² in certain locations in Palestine and Israel (see Map 2.2). In general, the highest concentrations are found in the western Mediterranean and the shores of the Levant region. With a population of around 250 to 500 persons per km², the Nile hydrological basin is one of the most populated in the region (Map 2.3).

Population density gives an indication of the exerted demographic pressure. A comparison of coastal densities (120 inhabitants/km²) to national population densities (58 inhabitants/km²) clearly highlights that the most of the Mediterranean population is concentrated in the coastal region. Coastal areas tend to be more populated than other areas owing to various economic activities such as tourism, leisure, fishing and ports.

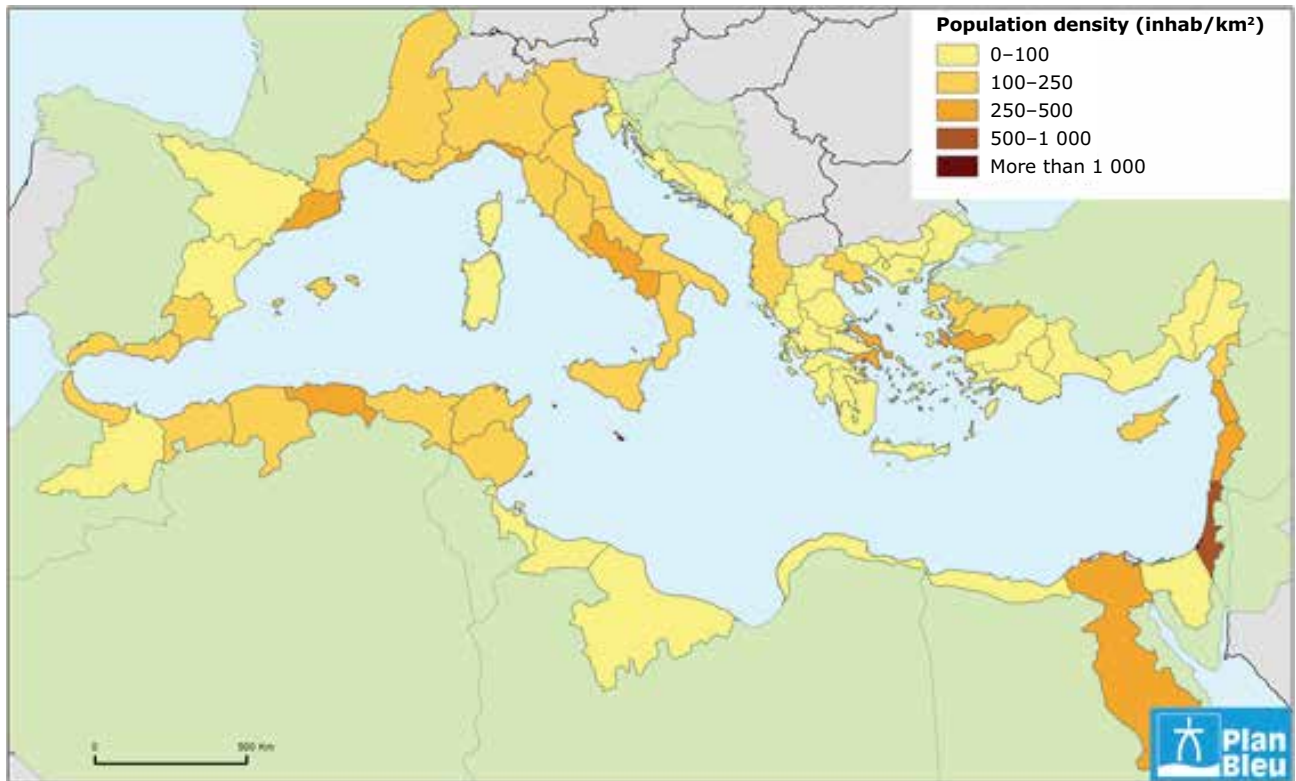
Map 2.1 Population of coastal Mediterranean cities (last year available)

Source: UNEP/MAP RAC-Plan Bleu, based on different sources, 2013.

Map 2.2 Population density of Mediterranean coastal regions (last year available)

Source: UNEP/MAP RAC-Plan Bleu computations based on national census, 2013.

Map 2.3 Population density of coastal Mediterranean hydrological basins (last year available, around 2008)



Source: UNEP/MAP RAC-Plan Bleu computations based on national census, 2013.

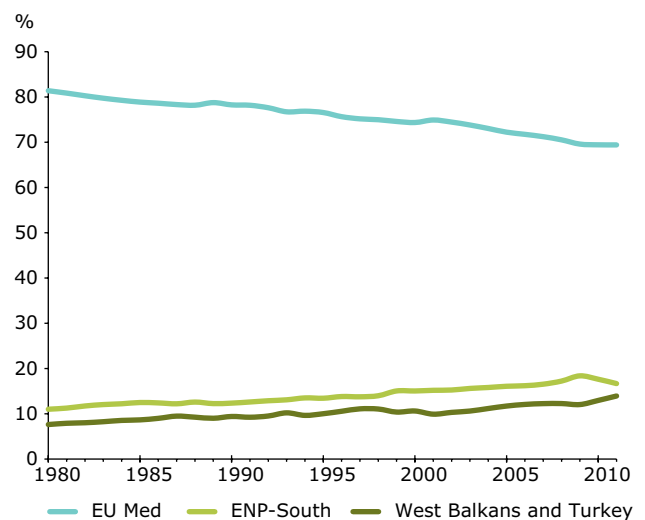
2.3 Growth and development

The Mediterranean GDP share of the world's GDP has slightly decreased during the last 20 years, from more than 13.5 % in 1990 to 11.5 % in 2010. Meanwhile, when compared to the world's population, the share of Mediterranean population has remained constant, at about 7 %.

In 2011, EU Med countries contributed to more than 69 % of the Mediterranean GDP, as compared to 82 % in 1980 (see Figure 2.5). The three biggest countries (Spain, France and Italy) represent 64 % of this total.

GDP growth rates in ENP-South countries are much higher than those of EU Med countries. This growth is, however, not so important when compared to the corresponding population growth rate. The gap between the EU Med countries and the ENP-South countries still remain high: in 2011, the average income per capita in ENP-South countries (about

Figure 2.5 GDP growth of Mediterranean countries (1980–2011) in percentage of Mediterranean GDP



Source: World Bank, International Comparison Program database, 2013.

6 000 dollars) was 4.6 times lower than the average income in EU Med countries. In 1980, this gap was five times as high. The GDP growth rates in the West Balkans and Turkey closely follow those recorded for the ENP-South region for the period from 1980 to 2011.

The gaps between the ENP-South countries are also important: in 2010, the average income per capita was around 5 000 dollars in Morocco, Syria, Jordan and Egypt, around 8 000 dollars in Algeria and Tunisia, and 25 000 dollars in Israel (see Figure 2.6).

2.4 Tourism

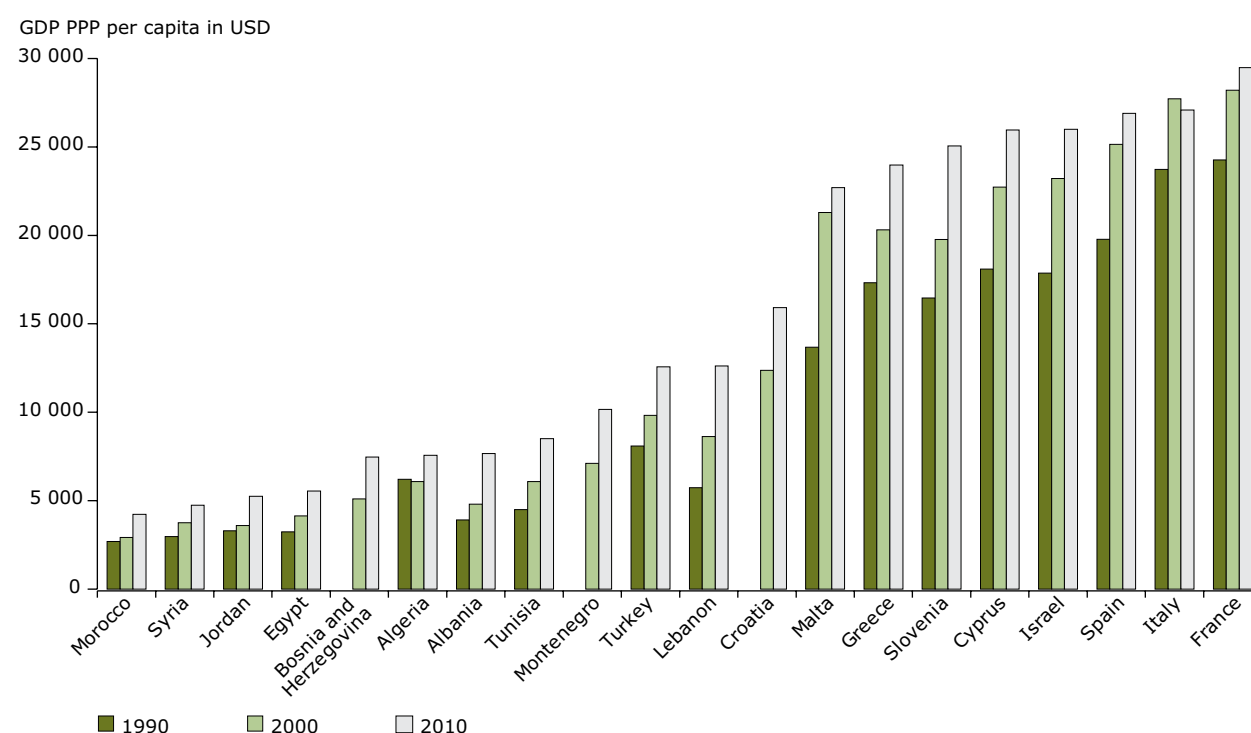
Attractive landscapes and rich biodiversity, cultural heritage and traditional lifestyles, coupled with favourable environmental conditions such as a mild climate, beaches and clear seawater have made the Mediterranean basin one of the most popular tourist destinations in the world. With a coastline of 46 000 km, the Mediterranean region is the world's leading tourist destination; in 2010, it accounted for 285 million tourist arrivals or 28 % of international tourism in the world (5 % in the ENP-South countries). Since 1995, tourism

in the Mediterranean has grown by almost 75 % (Figure 2.7). Projections show that the number of arrivals is expected to continue growing, and could reach 637 million by 2025 (Plan Bleu, 2012).

In terms of international tourist arrivals compared to the national population, the situation in the ENP-South countries also differs dramatically from that of the EU Med region. The number of international tourist arrivals in Algeria is ~ 50 per 1 000 inhabitants, whereas in Jordan and Tunisia, it reaches between 650 and 750 per 1 000 inhabitants, comparable to popular EU destinations such as Italy, France Spain and Greece (see Map 2.4).

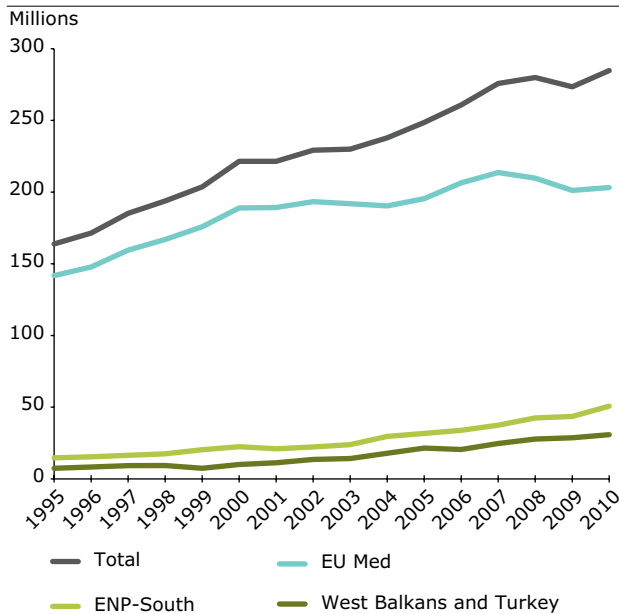
Tourism is one of the most important economic sectors in the Mediterranean, particularly for regions with limited industrial or agricultural development. International tourism generated USD 5.6 billion of revenue across the Mediterranean basin in 1970. In 2011, it generated USD 224 billion of revenue, a multiplication by a factor of 40 compared to 1970 (Plan Bleu, 2012). When expressed as a percentage of the total exports, international tourism receipts give an indication of the size of the sector within the overall economy.

Figure 2.6 GDP Purchasing Power Parity (PPPs) per capita in Mediterranean countries (1990, 2000, 2010) in USD (2005)



Source: World Bank, International Comparison Program database, 2013.

Figure 2.7 Growth of, international tourist arrivals in the Mediterranean countries (1995–2010), in millions

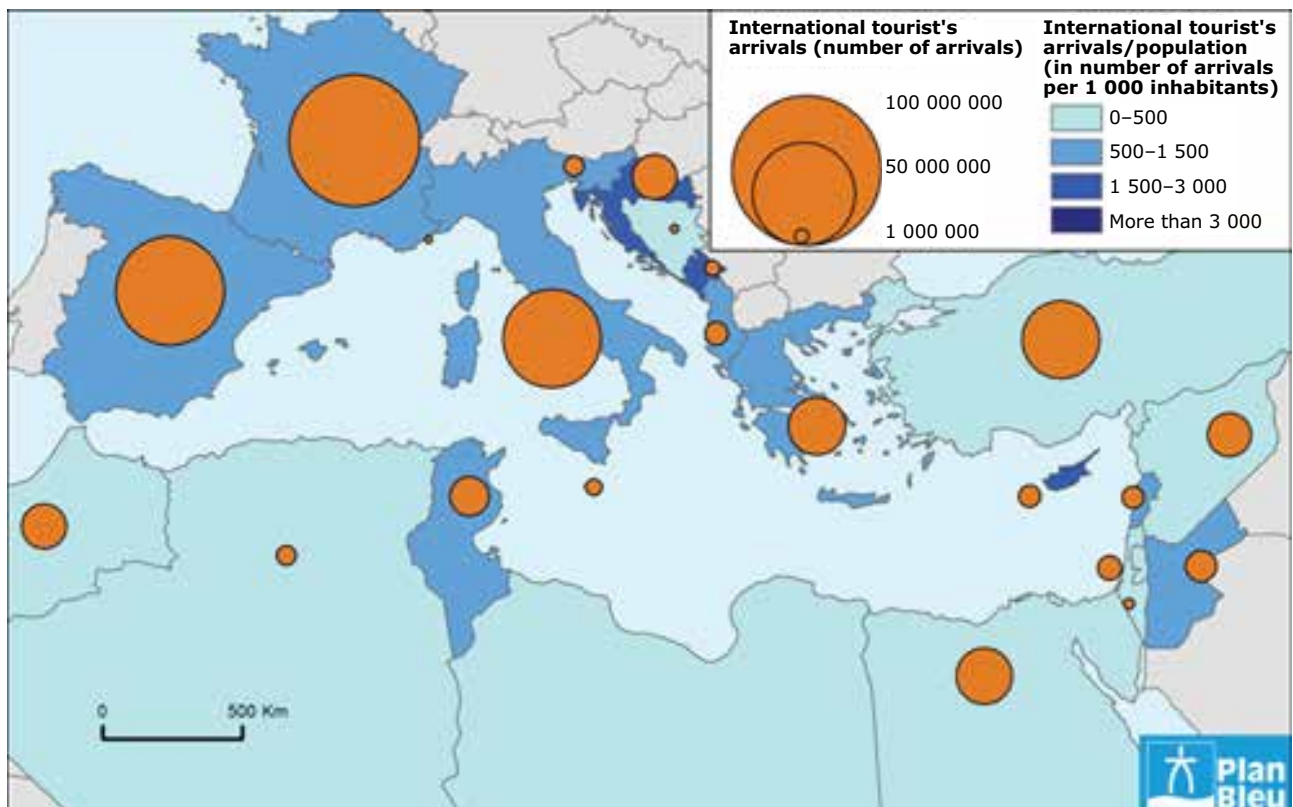


Source: World Tourism Organization, 2013.

In 2010, international tourism receipts from ENP-South countries accounted for more than 30 % in Lebanon, Palestine, Jordan and Syria. This percentage was around 27 % in Morocco and Egypt, and was very low in Algeria and Libya (Figure 2.8). In spite of remarkable figures in certain countries, the link between tourism revenue and regional development remains questionable. Also, sustainable development in this sector implies an equitable redistribution of the wealth it generates, as well as a minimisation of its environmental impacts.

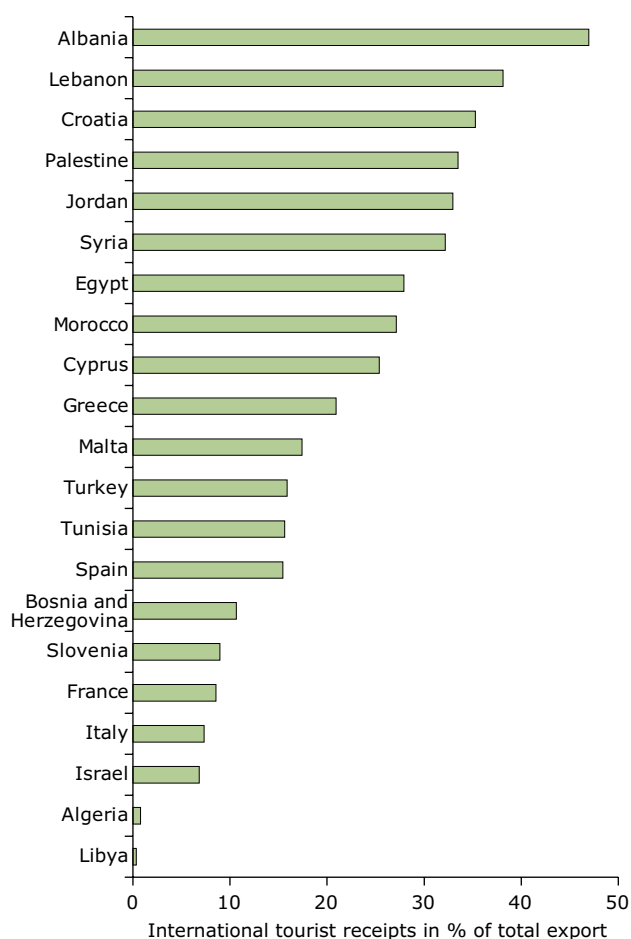
Tourism in the Mediterranean is predominantly concentrated along the coastal strip (40 % of which is built up), and peaks during the summer season. It is therefore highly spatially and seasonally variable. This concentration of tourism strongly amplifies the impacts on the environment due to increased waste production, increased discharges of untreated wastewater and pressures on natural resources. A high seasonal influx of visitors, in combination with the general trend of increasing population, particularly in urban hubs, intensifies the pressure on coastal environmental due to construction and water resources in periods of water stress, and

Map 2.4 International tourists arrivals (2010) in millions, and in number of tourists per 1 000 inhabitants



Source: World Tourism Organization, 2013.

Figure 2.8 International tourist receipts in 2010, as a percentage of total exports



Source: World Tourism Organization, IMF and World Bank exports estimates, 2013.

increases the generation of waste and wastewater discharges from domestic and industrial sources and the over-exploitation of natural resources (agriculture/water, energy/oil, fisheries/biodiversity, etc.). The effect of all these pressures leads to environmental degradation.

There is a two-way relationship between the impact of tourism on the environment and the impact of environmental quality on tourism development potential. For example, poor water quality resulting from increased sewage discharges during peak seasons may in turn lead to reduced tourism revenues due to algal blooms. Overdevelopment and environmental deterioration reduce the appeal of many tourist destinations, causing the decline of the tourism sector itself. If the appeal of the coastal area decreases, the main source of income for these areas is likely to decrease significantly. Such two-way relations are an important element of the concept of tourism-carrying capacity of a destination, based on the physical-ecological-environmental, socio-demographic and economic-political dimensions.

3 Why is municipal solid waste a priority issue in the Mediterranean region?

Since the mid 1970s, waste management has become a major concern for Mediterranean countries which have invested heavily in the collection, treatment, disposal and more recently prevention, control and recycling of waste (UNEP/MAP-Plan Bleu, 2009). Waste represents an enormous loss of resources in the form of both materials and energy. At the same time, if it is managed badly, it poses numerous direct and indirect risks to both humans and the environment, in the form of infectious diseases, contamination of soil, groundwater and surface waters from leachate, and air pollution due to GHG emissions, collection vehicles and waste disposal methods (estimated at 5 % of the total emissions). Due to the large share of the population and human activities located in coastal regions bordering the Mediterranean Sea, waste is a significant pressure on coastal and marine environments, causing visual pollution and contributing to beach and marine litter. Such threats to the coast and sea are especially significant in areas where coastal dumpsites are still used or are used without rehabilitation.

The amount of municipal solid waste generated in a country is closely related to its economic development, rate of urbanisation, its types and patterns of consumption of raw materials, and household revenue and lifestyles. In particular in the ENP-South region, the increasing trends in population, especially in urban areas, growing

tourism industries and standards of living are key drivers for waste issues. With the economies of these countries becoming increasingly open to international trade, growing consumption is generating changes in the production and composition of waste, including 'new' waste streams such as electronic and packaging waste.

Municipal solid waste management, i.e. its collection, treatment and disposal, is one of the most important services provided by local authorities and cities. It is still one of the first priorities for countries, the sector benefiting from significant investments, which, however, do not always yield optimal results. While municipal solid waste is only one part of total waste generated in each country, its management often reflects more than one third of the public sector's financial efforts to abate and control pollution (OECD Factbook, 2010). Because of its complex character and its distribution amongst many waste generators, environmentally sound management of municipal solid waste is complicated. Proper management is important from an environmental and social viewpoint, yet it can constitute an economic burden for industries, municipalities and households, particularly in developing countries.

In most countries, the government is either the major financier of municipal solid waste collection

Box 3.1 Municipal waste definition

Municipal waste is collected by or on behalf of a municipality. It includes waste originating from households and similar waste from commerce and trade, from private and public services, from institutions including schools and hospitals, and often from small craft or small industrial enterprises. This definition excludes waste from municipal sewage networks and treatment or municipal construction and demolition waste. However, these types of waste are often found mixed with municipal waste in most Mediterranean countries, posing a problem for composting (when there is glass, metal and plastic, mixed with organic waste). Source: H2020 factsheet at http://enpi-seis.ew.eea.europa.eu/data-and-indicators/resources/H2020_indicator_factsheets.

and disposal (in Lebanon and Tunisia, for instance), or it fills the gap between the costs and the revenues of municipal solid waste (as in Algeria, Egypt, Jordan and Palestine).

Cost recovery is only partially implemented in Algeria, Egypt, Jordan, Lebanon (Zahle only) and Palestine; Morocco and Tunisia, however, do not recover costs through the operation of services. Cost recovery arrangements are made through electricity bills, as in Egypt and Jordan.

Waste management is recognised as a priority area in the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities (LBS Protocol) of the Barcelona Convention, the Strategic Action Programme to Address Pollution from Land-Based Activities in the Mediterranean Region (SAP MED) and the National Action Plans (NAPs) developed and implemented by the Mediterranean countries. When setting priorities for the preparation of action plans, programmes and measures for the elimination of the pollution from land-based sources and activities, the following waste-related sectors of activity are primarily considered in the LBS Protocol:

- management of municipal solid waste;
- the waste management industry;
- incineration of waste and management of its residues.

The Mediterranean Strategy for Sustainable Development (MSSD) (2005) promotes environmentally sound production processes, products and services through the development of voluntary initiatives and the reduction of waste generation by adopting the '3R' approach (reducing, reusing and recycling). The renewed EU Sustainable Development Strategy sets the target of 'avoiding the generation of waste and enhancing efficient use of natural resources by applying the concept of life-cycle thinking and promoting reuse and recycling'.

3.1 What is the status of municipal solid waste generation and management in ENP-South countries?

The situation in municipal solid waste generation and management can be assessed through the following indicators: amount of municipal solid waste generated, collected and treated; and type of treatment. Ideally, within the context of the Horizon 2020 (H2020) programme, these indicators

are produced at coastal region level. However, in this assessment, the overall situation is presented at national level, mainly because it was not possible to synthesise the data and information provided by the national focal points and institutions and to provide a precise assessment for the coastal regions.

As an approximation, the share of the population of Mediterranean coastal regions in ENP-South Mediterranean countries and the municipal solid waste generation per capita are used to calculate municipal solid waste for coastal regions. The amount of municipal solid waste generated in the Mediterranean coastal regions is around 20 million tonnes, and it represents at least 41 % of the amount generated at national level. The amount generated per capita in Mediterranean coastal regions (294 kg per capita) is higher than the national average (272 kg per capita).

In ENP-South countries, 272 kg of municipal solid waste were generated per person around 2010, and 76 % of the 50 million t generated were collected (see Table 3.1). Of this amount, 58 % was disposed of in open dumps and 31 % in sanitary landfills. The recycled and the composted waste represent only 7 % and 4 % respectively. By comparison, 503 kg of municipal solid waste were generated per person in 2011 in the EU-27, while 486 kg of municipal solid waste were treated per person. This municipal solid waste was treated in different ways: 37 % was landfilled, 23 % incinerated, 25 % recycled and 15 % composted (Eurostat, 2012). While the situation varies widely from one country to another, and more particularly from one local area to the next, it is nonetheless fair to say that average municipal solid waste production in the EU-27 is twice as much as that currently generated in ENP-South countries.

3.2 What are the trends in municipal solid waste generation?

Although waste generation per capita in the ENP-South region is still very low compared to that in European countries, waste production per capita in ENP-South region has risen by 15 % over the last 10 years and is expected to continue growing in the coming years: it is estimated to reach almost 135 million by 2025. These trends can be attributed to population growth and growing economies in the countries around the Mediterranean. Based on the indicator data, Egypt has the highest waste generation rate (21.4 million tonnes per year), on account of having the highest national population (82.5 million), followed by Algeria (9.3 million tonnes per year) (see Table 3.2).

Table 3.1 Municipal solid waste in ENP-South countries (2010–2012): some key indicators

	Algeria	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Tunisia
Population (million)	36.0	82.5	7.8	6.2	4.3	32.3	4.0	10.7
Municipal solid waste generation (MT/year)	9.3	21.4	4.8	2.6	1.9	6.7	1.5	2.4
Municipal solid waste generation per capita (kg/year)	258	252	615	420	459	209	365	221
Municipal solid waste generation (g/USD)	34	47	23	87	36	49		27
Organic material (%)	62	55	40	50	53	65	59	68
Collection rate (%)	80	65	99	77	100	72	89	50–100
Openly dumped (%)	67	83.5	0	40	30	57	76	15
Sanitary landfilled (%)	26	5	87	50	51	33	22	70
Recycled (%)	7	2.5	13	10	8	10	2	10
Composted (%)	0	9	0	0	11	1	0	5

Source: National sources, supplemented by SWEEP-Net, UNSD and Medstat compendium 2006, 2013.

Table 3.2 Municipal solid waste generation (1 000 t)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Algeria				10 625								9 300	
Egypt	14 500			18 769				20 000	20 400	20 800	21 100	21 300	21 400
Israel				3 847	3 978	4 086	4 227	4 304	4 434	4 551	4 594	4 776	4 898
Jordan	1 801		2 892			3 063	2 999	2 867	2 742	2 496	2 687	2 630	
Lebanon								891			1 940		
Morocco	6 558							6 300			6 670		
Palestine	1 072	1 102	1 133	1 165	1 198	1 234	1 271	1 309	1 346	1 385	1 426	1 468	1 513
Tunisia					2 025			2 200				2 364	

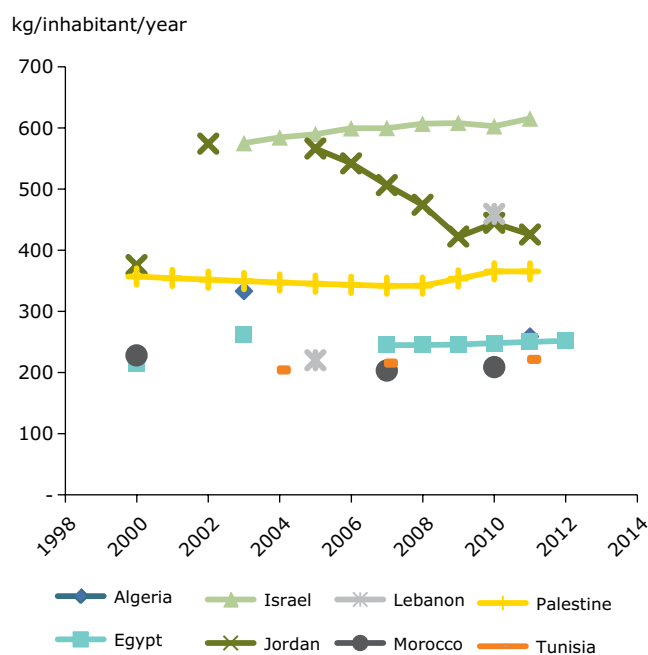
Source: National sources, supplemented by SWEEP-Net (Algeria and Tunisia in 2011), UNSD (Algeria in 2003) and Medstat compendium 2006 (Egypt in 2000, Lebanon in 2007, Morocco in 2000 and Tunisia in 2004), 2013.

When municipal solid waste generation is normalised by per capita, Israel and Lebanon rate top with 615 kg/inhabitant/year and 459 kg/inhabitant/year, respectively. This value decreased in Jordan from 574 kg/inhabitant/year in 2002 to 425 kg/inhabitant/year in 2011. In Palestine, the generation rate per capita remained constant from 2000 to 2011, at around 350 kg/inhabitant/year. The lowest value was Morocco's (209 kg/inhabitant/year) (see Figure 3.1).

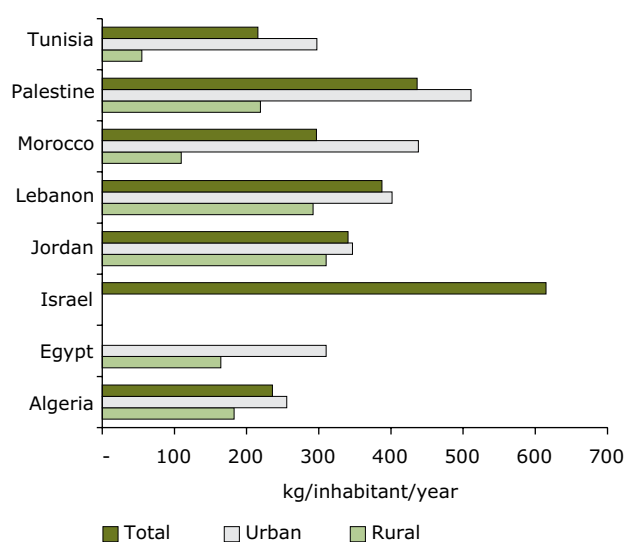
The quantity of municipal solid waste generation per capita is generally higher in urban areas (250 kg/capita/year to 550 kg/capita/year) than in rural

areas (55 kg/inhabitant/year to 310 kg/inhabitant/year). This difference can be up to a factor of five times higher, as in the case of Tunisia (see Figure 3.2). In Jordan, however, the rural rate (310 kg/inhabitant/year) is higher than the urban rate in Tunisia, Palestine, Morocco, Egypt and Algeria.

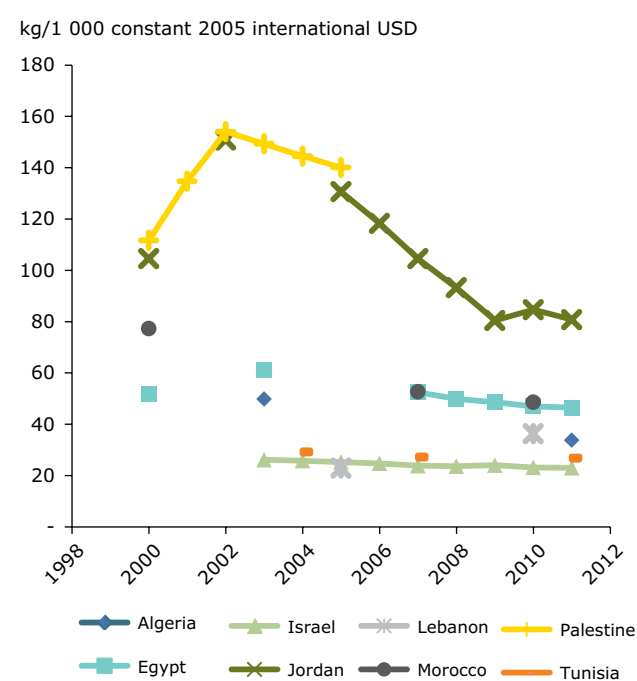
Calculating municipal solid waste generation per GDP is a means of viewing the extent of decoupling of waste generation from economic growth, i.e. the increase in waste generation with respect to economic growth. Decoupling the increase in waste generation and GDP growth form part of the 2015 waste management objectives set by the MSSD

Figure 3.1 Municipal waste generation per capita (kg/inhabitant/year)

Source: National sources supplemented by SWEEP-Net (Algeria and Tunisia in 2011), UNSD (Algeria in 2003) and Medstat compendium 2006 (Egypt in 2000, Lebanon in 2007, Morocco in 2000 and Tunisia in 2004), 2013.

Figure 3.2 Municipal solid waste generation per capita (kg/inhabitant/year) (last year available)

Source: Computation based on SWEEP-Net data (Waste generation), 2013.

Figure 3.3 Municipal solid waste generation per GDP (kg/1 000 constant 2005 international USD)

Source: National sources supplemented by SWEEP-Net (Algeria and Tunisia in 2011), UNSD (Algeria in 2003) and Medstat compendium 2006 (Egypt in 2000, Jordan in 2003, Lebanon in 2007, Morocco in 2000 and Tunisia in 2004), 2013.

(2005). The aim is to decrease the current growth rate in waste generation by around 50 %, as well as to double recycling rates, and transform at least half of unregulated waste dumps into sanitary landfills. Decoupling waste generation from economic growth is also one of the most important objectives of EU policy.

Around 2010, the quantity of municipal solid waste generated per GDP varied from 23 kg/1 000 constant 2005 international USD in Israel to 81 kg in Egypt (see Figure 3.3), as compared to the regional average of 40 kg/1 000 constant 2005 international USD for ENP-South countries. In general, the decoupling of municipal solid waste generation from economic growth was not so evident, except for a few countries. In Jordan, the decoupling of municipal solid waste generation from economic growth is important: the quantity decreased from 151 kg in 2002 to 81 kg in 2011. The decoupling of municipal solid waste generation from economic growth is also significant in Egypt. Between 2003 and 2012, the quantity decreased from 61 kg/1 000 constant 2005 international USD to 47 kg/1 000 constant 2005 international USD (Figure 3.3).

3.3 What is the composition of municipal solid waste?

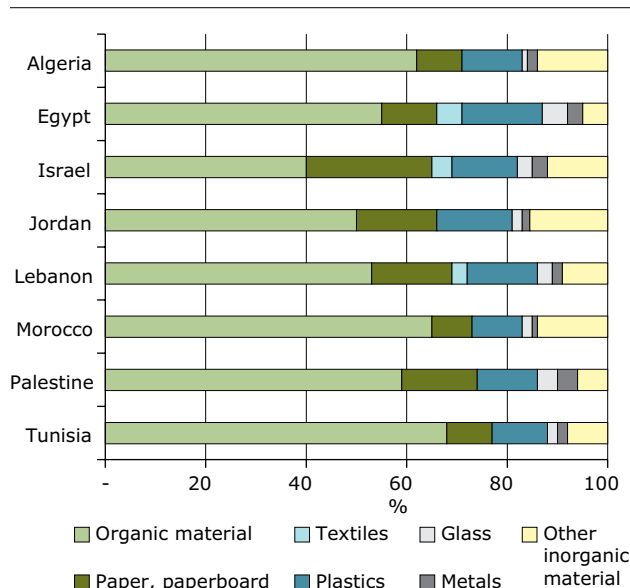
Changing consumption patterns, largely resulting from the importation of manufactured goods, are driving change in waste composition. Municipal solid waste in ENP-South countries currently contains twice as much organic waste and two times less cardboard waste than European dustbins. The discrepancy is changing, however, with some categories such as plastics showing an increase in Mediterranean countries. In most countries in the ENP-South region, the proportion of biodegradable waste is on a clear downward trend, while the share of plastics and other synthetic materials is on the increase. Some hazardous waste such as batteries, and electric and electronic equipment can be included in the composition of municipal solid waste; it is dumped without any sorting and/or treatment. (Plan Bleu, 2012). Organic waste is still the biggest share of municipal solid waste, ranging from 40 % in Israel to 68 % in Morocco (see Table 3.3), as compared with 20 % to 25 % in developed countries.

According to the national data for Israel, Lebanon and Palestine, supplemented by the SWEEP-Net data for the other countries, the composition of municipal solid waste is set out in Figure 3.4.

3.4 How much municipal solid waste is collected?

Municipal solid waste is collected from the point of generation (residential, industrial commercial, institutional) to the point of treatment or disposal in several ways (house-to-house, community bins, kerbside pick-up, self-delivered, etc.). Municipal

Figure 3.4 Municipal solid waste composition, last year available



Source: National sources and SWEEP-Net for Algeria, Morocco and Tunisia, 2013.

solid waste collection by or on behalf of local authorities calls for enormous financial and logistic means, which increases with the improvement of the waste collection rate. In ENP-South countries, most of the solid waste management budget is still allocated to waste collection.

Indicator data show that the amount of municipal solid waste collected in the ENP-South region is about 40 Mt/year. The municipal solid waste collection rate is around 76 %, varying between 50 % and 100 % (see Table 3.5) and reaching near-complete collection in Lebanon and Israel, as is the case for the European countries.

Table 3.3 Municipal waste composition (%)

	Year	Organic material	Paper, paperboard	Textiles	Plastics	Glass	Metals	Other inorganic material
Algeria	2011	62	9		12	1	2	14
Egypt	2012	55	11	5	16	5	3	5
Israel	2005	40	25	4	13	3	3	12
Jordan	2013	50	16		15	2	2	16
Lebanon	2010	53	16	3	14	3	2	9
Morocco	2011	65	8		10	2	1	14
Palestine	2012	59	15	0	12	4	4	6
Tunisia	2011	68	9		11	2	2	8

Source: National sources and SWEEP-Net for Algeria, Morocco and Tunisia, 2013.

Table 3.4 Municipal solid waste collection (1 000 t)

	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Algeria		8 500									
Egypt		12 200				13 700	14 000	13 500	13 700	13 800	14 000
Israel		3 819	3 951	4 058	4 198	4 266	4 395	4 510	4 552	4 733	4 841
Jordan	1 387			2 359	2 310	2 207	2 111	1 922	2 069	2 025	
Lebanon		1 445	1 440	1 474				1 720	1 930		
Morocco	6 500					2 772			4 802		
Palestine	931	934	1 066	1 119	1 147	1 165	1 181	1 225	1 269	1 351	1 392
Tunisia			1 316								

Source: National Sources and UNSTAT (Algeria in 2003, Lebanon from 2001 to 2009, Morocco in 2000 and Tunisia in 2004), 2013.

Table 3.5 Municipal solid waste collection rate (%)

	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Algeria		80									
Egypt		65				70	70	65	65	65	65
Israel		99.3	99.3	99.3	99.3	99.1	99.1	99.1	99.1	99.1	98.8
Jordan	77.0			77.0	77.0	77.0	77.0	77.0	77.0	77.0	
Lebanon									99.5		
Morocco						44			72		
Palestine	86.8	80.2	89.0	90.7	90.3	89.0	87.7	88.4	89.0	92.0	92.0
Tunisia											

Source: National Sources and UNSTAT (Algeria in 2003), 2013.

The extent of municipal solid waste collection varies across countries and also within each country. The coverage of municipal solid waste collection and the collection rates are in general higher in urban areas than in rural zones (see Table 3.6). For example, the collection rate in Cairo varies from 72 % to 85 %, as compared to the national average of 60 % (Plan Bleu, 2010).

Municipal solid waste collection coverage is a significant issue in most ENP-South countries, none of which succeeded in reaching full waste collection coverage, especially in rural areas. The uncollected waste is directly thrown away in the street or the fields. Better coverage would prevent wild tipping or landfilling in unmanaged dumpsites, burying, burning of waste, generation of (marine) litter, and the related impacts on health and environment. An important characteristic of the collection is the degree of separation at source, which has an impact on the amount of waste recycled and on the quality of the recycled material.

Table 3.6 Municipal solid waste collection rate (%) in urban and rural areas (last year available)

	Urban areas	Rural areas
Algeria	85 %	60 %
Egypt	40–75 %	30–50 %
Israel		
Jordan	90 %	70 %
Lebanon	100 %	99 %
Morocco ^a	85 %	
Palestine	100 %	80 %
Tunisia	80–100 %	50–100 %

Note: ^a In Morocco, the collection rate in urban areas provided by the national source is 80 % (85 % for SWEEP-Net).

Source: National sources for the national value and SWEEP-Net for the urban and rural rates, 2013.

Box 3.2 Marine litter: Mediterranean, the first regional sea adopting legally binding measures for marine litter management

The root cause of marine litter from 'shoreline and recreational activities' lies in the fact that solid waste management in most Mediterranean countries is still very poorly executed. Funding, awareness and individual good waste management practices are insufficient in this region. Current legal and illegal waste-handling practices contribute to the presence of marine litter. The inadvertent release of litter from coastal landfills and garbage from water transports, recreational beach and roadside litter and the illegal dumping of domestic and industrial garbage into coastal and marine waters are practices that contribute to the marine litter problem (UNEP, 2009). Waste also reaches the coasts either through streams, rivers and drains or via waves, currents and tides, and therefore should also be tackled as a land-based source requiring both the provision of solid waste management services and proper drainage infrastructure. During the summer season, seaside town inhabitants are sometimes twice the wintertime number. In some tourist areas, more than 75 % of annual waste production is generated during the summer season.

Marine litter has become a global issue, and is high up on the global environmental agenda. The only new target agreed at Rio+20 was on marine litter. The Honolulu Strategy, the Honolulu Commitment, and the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (UNEP/GPA) are global mechanisms that promote sound marine litter management in partnership among all stakeholders.

In Europe, the Berlin conference held in April 2013 drew together countries from across Europe, the four European regional seas, non-governmental organisations (NGOs), the private sector, the research field and politicians. Together, all highlighted the Berlin message: notwithstanding the need to expand the knowledge base on marine litter, there is enough knowledge at hand to take necessary action now.

In the Mediterranean, the problem of marine litter was identified a long time ago; UNEP/MAP started active work on this problem almost 30 years ago. The LBS Protocol, which explicitly recognised the importance of dealing with the problem of marine litter, was adopted as far back as 1980. The contracting parties to the Barcelona Convention adopted further protocols with direct or indirect implications for marine litter management. In addition, the Mediterranean was designated a Special Area for the purposes of Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78, which was recently revised.

The first common regional measures on marine litter date back to 1991: drawing up the necessary legislation and establishing proper law enforcement, setting up regular surveys and/or monitoring programmes (including beach-cleaning), designing and implementing educational programmes, encouraging the use of biodegradable synthetic materials and promoting research.

Two major comprehensive assessments on the status of coastal litter management in the Mediterranean were undertaken. The assessment results indicated that inadequate coastal solid waste management is responsible for the presence of litter on beaches, whether floating on water or on the seabed (benthic). In fact, the problem is related to enforcement of the policies, which is, in general, weak.

The 2008 assessment created a sound basis on which to prepare the 'Strategic Framework for the Management of Marine Litter in the Mediterranean 2012–2020' that was adopted at the 17th Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols (COP 17) in Paris, France (in 2012). The framework was inspired by the work of the UNEP Regional seas programme, and had substantive contributions from NGOs. The same decision mandated the UNEP/MAP Secretariat to prepare a Regional Plan on Marine Litter Management, under Article 15 of the LBS Protocol. In addition, COP17 adopted another important decision on the ecological objective related to marine litter, one of the 11 ecological objectives in the context of the MAP ecosystem approach to road-map implementation, in synergy with the EU MSFD.

Box 3.2 Marine litter: Mediterranean, the first regional sea adopting legally binding measures for marine litter management (cont.)

The Regional Plan on Marine Litter Management in the Mediterranean adopted by the 18th meeting of the contracting parties to the Barcelona Convention, from 3 to 6 December 2013, provides for ambitious and innovative legally binding measures on solid waste hierarchy management, prevention measures (reduction of marine litter generation at source) and up-to-date sustainable production and consumption (SCP) tools application. It aims at enhancing regional cooperation to take concrete actions and measures, with efforts to improve monitoring, research and assessment, to fill the knowledge gap and support measure implementation, enhance enforcement, and create partnerships with local authorities, the private sector, and civil society with a view to making a difference. The marine litter regional plan sets strict deadlines (2020 and 2025) for the implementation of measures.

To enhance public understanding of this issue, the EEA is launching an app called Marine Litter Watch, which uses modern technology to help tackle the problem of marine litter. Organised groups and members of the public can use the app to upload data on the litter they come across on their beaches. These data will be used to better understand the problem, and will hopefully help support a policy response as formulated in the European MSFD (see http://www.eea.europa.eu/highlights/new-mobile-phone-app-will?utm_campaign=newletter.2014-03-03.7097415447&utm_medium=email&utm_source=EEASubscriptions).

3.5 How much of municipal solid waste is treated?

After collection, municipal solid waste is generally transported to a location where collection vehicles are emptied. This location may be a material-processing facility, a transfer station, a sanitary landfill or an open dump site.

The municipal solid waste treatment rate allows for measuring the efficiency of the municipal solid waste management system. The total amount of municipal solid waste treated in ENP-South countries is not well known, with the exception of Israel, Jordan and Palestine (see Table 3.7). No data are available for Algeria, Morocco and Tunisia. In 2012, the treatment rate reached 100 % of the collected municipal solid waste in Israel. In Egypt,

Palestine, Jordan, and Lebanon, this rate is 19 %, 31 %, 50 %, and 70 %, respectively. Table 3.8 shows the amount of municipal solid waste treated by landfilling and recycling for those countries for which data are available. Recycling rates have remained relatively constant over a long period (since 2000).

The information gathered in the SWEEP-Net reports helped providing an overall picture of the distribution of waste treatment types for the last year available. More than half the collected waste is disposed of in open dumps, the main method of waste 'treatment' in most ENP-South countries (Figure 3.5). This fraction amounts to 83.5 % of MSW in Egypt, 76 % in Palestine, 67 % in Algeria and 62 % in Morocco. This value is low in Tunisia (13 %) and there is no open dump in Israel (0 %).

Box 3.3 Waste treatment methods

Landfill means the depositing of waste into or onto land, including specially engineered landfill and temporary storage of over one year.

Incineration means thermal treatment of waste in an incineration plant.

Recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances, whether for the original or other purposes, excepting for use as fuel.

Composting means the biological treatment (anaerobic or aerobic) of biodegradable matter, resulting in a recoverable product.

Table 3.7 Municipal solid waste treatment (1 000 t) and municipal solid waste treatment rate in %, 2012

	Amount of municipal solid waste treated, in 1 000 t											In %
	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2012
Algeria												
Egypt											2 600	19
Israel		3 847	3 978	4 086	4 227	4 304	4 434	4 551	4 594	4 776	4 898	100
Jordan	694			1 179	1 155	1 104	1 056	961	1 035	1 012		50
Lebanon											1 350	70
Morocco												
Palestine	289	290	331	347	356	361	366	380	393	419	431	31
Tunisia												

Source: National sources, 2013.

Table 3.8 Municipal solid waste treatment per type

		2000	2004	2005	2006	2007	2008	2009	2010	2011	2012
Israel	Landfilling (1 000 tonnes)		3 507.8	3 628.5	3 714.5	3 807.3	3 877.0	3 968.3	4 078.1	4 152.1	
	Recycling (1 000 tonnes)		470.5	457.4	512.0	496.7	556.9	582.5	515.6	624.0	
	Recycling rate (%)		11.8	11.2	12.1	11.5	12.6	12.8	11.2	13.1	
Lebanon	Landfilling (1 000 tonnes)										1 118
	Recycling (1 000 tonnes)										155
	Recycling rate (%)										12.2
Palestine	Landfilling (1 000 tonnes)	279.2	319.9	335.7	344.2	349.4	354.3	367.4	380.6	405.2	417.5
	Recycling (1 000 tonnes)	9.3	10.7	11.2	11.5	11.6	11.8	12.2	12.7	13.5	13.9
	Recycling rate (%)	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Tunisia	Landfilling (1 000 tonnes)							1 500	1 690	1 000	

Source: National sources, 2013.

The next most commonly used treatment method is (sanitary) landfilling; it accounts for 31 % of the collected waste: 87 % in Israel, 70 % in Tunisia, and ~ 50 % in Lebanon and Jordan. This ratio is very low in Egypt (5 %), where the percentage of municipal solid waste disposal in open dumps is the highest among ENP-South countries. In Greater Cairo, only 35 % of the population is served by a sanitary landfill (Plan Bleu 2010; National study and case study of urban waste management in Egypt, Rami EL-Sherbuny and Lise Debout). It should be noted that under EU policy, landfilling is considered the last resort, and should only be used when all other treatment options have been exhausted. Only material that cannot be reused,

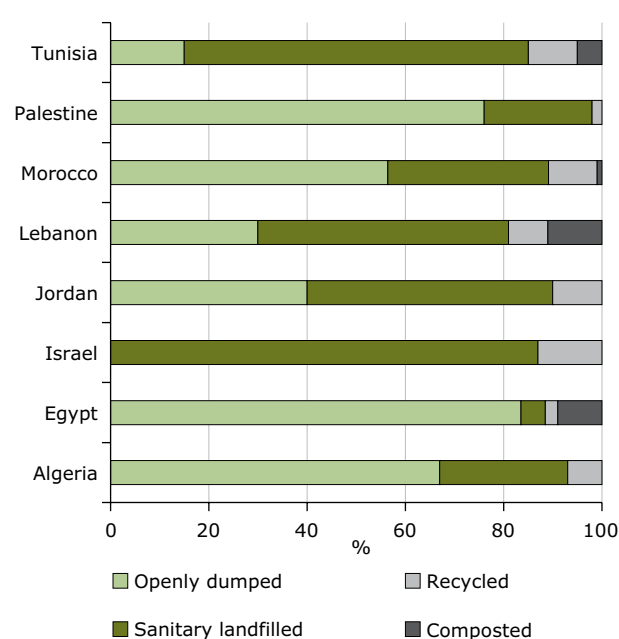
recycled or otherwise treated should be landfilled. Although it remains the first treatment means, landfilling has been steadily decreasing since 1995.

Both recycling and composting are generally low (< 13 % to 14 %) in all countries. In 2011, 40 % of treated municipal solid waste of EU-27 countries was recycled or composted, up from 27 % in 2001 (Eurostat). However, an increase in the proportion of recyclable materials is expected in the ENP-South region as a result of economic development; the monetisation of waste products recovered through recycling will present an important economic opportunity. Composting is highest in Egypt and Lebanon, reaching 9 % and

11 % of the MSW treated, respectively. Around 2.5 % of MSW is recycled in Egypt: 433 200 t are recycled by the formal sector, and 979 400 t are recycled by the informal sector (the *Zabbaleen*) (CWG and GIZ, 2011). Based on the data available for Egypt, there are currently 34 plants involved in recycling and composting, no operational incineration systems and 4 landfills for the 29.69 million tonnes of waste collected in 2009.

Many towns rely on unregulated open dumps (see Table 3.9). These dumps have existed for decades for the disposal of all types of waste, but their capacity is such that they cannot keep up with current production. These landfills are rarely regulated and controlled, and have no geomembranes to protect the soil. Consequently, leachate discharge may pollute the groundwater and immediate environment. A shift from dumpsites to well-managed sanitary landfills — including the rehabilitation of abandoned quarries — would have a considerable environmental and social/health impact. Sanitary landfills avert nuisance, odour, fires and smoke (often with dioxin emissions), run-off water impacts, soil contamination, and health risks (e.g. from avoided methane (CH₄) emissions to nearby dwellings). Although notable improvements are under way in many countries, considerable effort is still required, particularly in medium-sized towns and rural areas.

Figure 3.5 Municipal solid waste treatment per type (%) (last year available)



Source: SWEEP-Net and national sources, 2013.

Table 3.9 Number of landfills and open dumps in 2012

2012	Landfills	Open dumps
Egypt	8	140
Israel	14	0
Jordan	16	
Lebanon	4	670
Palestine (*)	1	160
Tunisia (*)	10	

Note: (*) These numbers have been constant since 2000 in Palestine, and since 2001 in Tunisia.

Source: National sources, 2013.

Some communities may have transfer centres, from which transport vehicles carry the collected waste to landfills, indiscriminately taking in household waste, hospital waste and some industrial waste. Despite the existence of some private sorting and collection systems for specific types of waste, very little waste is treated — and this is mainly the most easily recoverable waste types. These systems consist of small-scale private operators working on markets ensuring minimum returns, but volumes are limited. In most countries, sorting tends to be carried out by the informal sector.

During the last decade, most ENP-South countries have started a process of legislative and institutional changes in order to improve the integrated municipal solid waste management policy at national and local level (Report for RECO Baltic 21 tech, Fundació ENT!; 2012).

Strategies and master plans

The development and implementation of national strategies were carried out in most countries. Strategies and master plans were developed in Morocco, Algeria, Tunisia, Egypt and Palestine, and a draft solid waste management strategy/policy was prepared in Lebanon and Jordan.

Solid waste management was enacted in Morocco, Algeria and Tunisia, and a draft solid waste management law was prepared in Lebanon and Palestine. In Egypt, solid waste management law is under preparation to replace the Public Cleaning Law of 1999. In 2006, Israel set out a Sustainable Solid Waste Management Master Plan up to the year 2020, and in 2012, regional master plans were adopted for organic waste.

Box 3.4 Municipal solid waste indicators: methodological issues

In most countries, data on municipal solid waste management are obtained from specific surveys carried out at regular intervals and through statistical methods. Data reliability can be compromised by incomplete waste collection and disposal, and lack of weighting system at landfill sites. In countries where municipal solid waste is 100 % collected, the total of municipal solid waste generated is equal to the total of municipal solid waste collected by or on behalf of municipal authorities, and disposed of through the waste management system. In other countries where some areas are not covered or are only covered partially by a municipal solid waste collection scheme, the amount of waste generated has to be estimated using the amount of municipal solid waste collected and the percentage of the population served by municipal solid waste collection schemes.

The difference between 'municipal solid waste generation' and 'amount of collected municipal solid waste' gives an indication of the amount of municipal solid waste that is not collected, and which has implications on the amount of waste dispersed in the environment, especially as marine litter. When defining 'municipal solid waste collected by or on behalf of a municipality', it should be noted that it is linked to the collection responsibility, and not to the content or sources of waste generation! It is generally confusing.

The location of waste collection could be very different from the location of waste treatment, and it is essential to be aware of the country's municipal flow in order to optimise waste management and reduce the environmental impact. Supplementary data on leakage of contaminants from landfills to the sea (via groundwater and surface water) and the environmental quality of the landfill surroundings is also necessary.

There are a number of uncertainties associated with the key waste indicators, as explained below.

Methodological uncertainties

- Municipal solid waste includes household waste. In most European countries, households generate between 60 % and 90 % of the municipal solid waste, while the remainder may be attributed to commercial sources and administration.
- Although significant progress has been made in harmonising definitions, wide variations still prevail, something reflected in the data acquisition methods (declaration, surveys and estimates).
- It is assumed that imports and exports of municipal solid waste in countries/coastal areas are rather low, and are therefore not accounted for, unless evidence is available to show that this fraction is not insignificant. The main problems in terms of data comparability relate to the coverage of waste from commerce and trade, and separate waste collections carried out by private companies. The concept of municipal solid waste reflects different waste management practices in municipalities, especially regarding the degree to which waste from small businesses, offices and public institutions is included. This makes the interpretation of differences between countries more difficult.

Data sets uncertainties

Municipal solid waste generation at source is difficult to measure. It is highly dependent on the mode of collection by local authorities, and on whether the waste is actually disposed of in the official system.

The amount of municipal solid waste generation can be calculated, and is generally done so using:

- the population and the waste generation per capita (urban and rural);
- the collection rate and amount of collected municipal solid waste.

Box 3.4 Municipal solid waste indicators: methodological issues (cont.)

The term 'municipal solid waste' is less elusive when related to the role of municipalities as guarantor of public health at the origin of municipal services (of public utility), such as waste collection. What is collected, however, may vary considerably. It generally consists of waste from households and similar waste generated by high-street commerce, private and municipal services, schools and hospitals, workshops and enterprises and sometimes industry. It may also contain spoil earth from street cleaning, while industrial waste is generally collected by parallel collection channels. In the Mediterranean, such a framework typifies northern Mediterranean countries and Turkey. In Morocco and Tunisia, for instance, regulations distinguish between hazardous and non-hazardous waste; the waste generated by small crafts and industrial enterprises and that generated by markets are often mixed with household waste in most major cities (UNEP/MAP-RAC/Plan Bleu, 2009; Plan Bleu, 2010).

Regarding the similar waste definition, it is sometimes difficult to remove the industrial, agricultural, demolition waste collected by municipalities.

The definition of the term 'treatment' also varies between countries and regions. Also, more complex waste management systems (sorting, mechanical-biological treatment, etc.) lead to further uncertainties.

Investment projects on solid waste

In the Mediterranean region, solid waste management is tackled by 20 % of the 912 identified projects for protecting the Mediterranean Sea from pollution. These 182 solid waste projects relate to agglomerations of more than 200 000 inhabitants served. Solid waste management is referred to in Integrated Projects (117), and 82 % of solid waste projects are NAPs projects. Some 31 % of the projects are operational and around 29 % are in execution or under preparation. In addition, 38 % of the projects have secured funding. In ENP-South countries, 93 projects focused on solid waste, 22 % of the 421 projects identified (UfM, 2013).

Institutions in charge of policy and planning

The responsibilities of solid waste management policies and planning at national level are generally shared between the ministries and specific institutions:

- dedicated solid waste management agencies exist in Algeria and Tunisia;
- national committees exist in Morocco, Egypt, and Lebanon;
- the Ministry of Local Administration/Government is responsible in Palestine;

- the Ministry of the Environment is responsible in Jordan, and the regional and local offices of the Ministry of Environmental Protection are responsible for implementing waste management policy in Israel.

In most countries, local authorities are responsible for contracting and overseeing the collection and disposal of municipal solid waste.

Private sector involvement

The private sector is involved in both municipal solid waste collection and disposal in Morocco, Lebanon and in the main cities of Egypt. In Tunisia, the private sector is involved in the disposal of municipal solid waste and landfill gas (LFG) recovery systems. In Jordan, the private sector has initiated involvement in the LFG system established on the landfill in Amman.

Despite all these legislative and institutional efforts, in most ENP-South countries, municipal solid waste management is still challenged by a number of issues.

The following statements are issued from the conclusions of the ENPI-SEIS national workshops ⁽⁶⁾ and from other reports such as the Sweep-net reports and the Report for RECO BALTIC 21 TECH, Activity 5.6, MEDA cooperation:

- environmental and municipal solid waste legislation management is still weak;
- there are no waste reduction policies;
- separate collection is practically non-existent;
- there is a lack of knowledge of modern municipal solid waste management facilities;
- there are many informal activities in municipal solid waste management;
- there are strong regional disparities between urban and rural areas;
- there is lack of data, mainly on waste generation and composition.

Box 3.5 Options for improvement

- Applying or completing the regulatory framework for municipal solid waste in most SWEEP-Net Partners Countries (namely, Algeria, Egypt, Jordan, Lebanon, Mauritania Morocco, Syria, Tunisia, Palestine, and Yemen).
- Clarifying and strengthening the roles, responsibilities and competencies of individual solid waste management actors (state, governorates, municipalities, formal and informal sector and waste generators), towards financial sustainability through the application of full-cost accounting, the introduction of the 'polluter pays' principle in financing and cost recovery.
- Encouraging multi-stakeholder involvement at every stage of the solid waste management sector.
- Integrating the informal sector within any proposed solid waste management systems.
- Minimising waste through cleaner production and material light-weighting and waste reduction.
- Adding new waste utilisation technologies (e.g. biogas and waste for energy projects).
- Establishing national solid waste management networks to consolidate information on solid waste management from different institutions and practitioners.
- Providing training and capacity-building to local authorities in managing and monitoring solid waste management contracts, as well as in managing landfill sites.
- Developing a national communication strategy on municipal solid waste management.

Source: SWEEP-Net, 2012.

⁽⁶⁾ <http://enpi-seis.ew.eea.europa.eu/meetings/2013/egypt-indicators-national-workshop>.

4 Why is water a priority issue in the Mediterranean region?

Water resources are scarce in the ENP-South countries: limited and sporadic rainfall makes water a vulnerable yet highly valuable natural asset. Water shortages generally occur in areas with low rainfall and high population density, or in areas where agricultural or industrial activities are intense. The marked population growth in ENP-South countries (from 65 million in 1960 to 185 million in 2003 and 210 million in 2011) and increased water demand for agriculture and tourism have intensified the pressure on available water resources. Although water scarcity is a long-term and widespread problem, climate change is likely to aggravate this issue, in particular by increasing the frequency, length and severity of extreme event, such as droughts.

One way to 'buffer' the demand for fresh water is through groundwater abstraction. In regions where the extent of groundwater abstraction exceeds the rainfall-dependent recharge rates, over-abstraction of aquifers may occur, causing the over-exploitation of groundwater resources and the deterioration of its quality, through saltwater intrusion, for instance. Although ground water is an important freshwater resource in the Mediterranean region, it is not considered in the current assessment.

The pressures on water resources are further compounded by anthropogenic contamination that deteriorates the water quality, greatly limiting its use. One of the main sources of water pollution in the ENP-South region is the discharge of inadequately-treated municipal and industrial wastewater into the environment. In regions where a large proportion of the population is not served with adequate water supply and sanitation, wastewater flows directly into groundwater reservoirs, lakes, streams, rivers, coastal lagoons and oueds. Eventually, it reaches coastal and marine areas, creating pathological risks through the contamination of fish and seafood products and the deterioration of bathing water quality. For this reason, H2020 focuses its efforts on depolluting the Mediterranean from the discharge of insufficiently treated wastewater, to safeguard the valuable inland water resources as well as the

receiving coastal and marine Mediterranean waters. H2020 focuses on urban wastewater. However in the 'European Neighbourhood and Partnership Instrument — Shared Environmental Information System' (ENPI-SEIS) project, the scope is extended to include inland, wastewater and marine water, in order to assess the 'downstream' impact of water management practices and policies on the receiving coastal and marine waters.

Over the last few decades, the ENP-South countries have responded to water scarcity by investing heavily in infrastructure (see Table 4.1), including in projects on wastewater, which is now recognised as a very important resource. According to the European Investment Bank (EIB), between 2003 and 2008, EUR 692 million was provided in loans through the Facility for Euro-Mediterranean Investment and Partnership (FEMIP) to support access to water resources and to tackle the most significant pollution sources of the Mediterranean. The financial capacity of the public sector in most countries is limited and unable to provide the necessary resources for investing in water (UNEP, 2010). For this reason, countries like Jordan, Morocco and Algeria are increasingly engaging in public private partnerships (PPPs) for various water projects: upgrading and managing drinking water networks and sewage systems, and constructing wastewater treatment plants (WWTPs). These investments, however, have not always been accompanied by the necessary institutional and policy changes, and often do not generate optimal economic returns.

Water seems to be getting higher in the political agendas of most ENP-South countries (Water Governance in the Mena Region: Policies and Institutions, 2009) and many countries have implemented national water plans and carried out reforms of water policies. However, the lack of enforcement of laws and policies is a general problem, and remains a key bottleneck in the region. Also, the fragmentation of the water sector at national level hinders the achievement of good water governance and the successful implementation of integrated water resources management (IWRM).

Table 4.1 Total value of proposed water and wastewater projects in ENP-South countries (USD billion)

	Water projects	Wastewater projects
Algeria	10 471	775
Egypt	8 250	6 185
Israel	2 420	1 000
Jordan	1 989	675
Lebanon	475.3	737
Libya	7 200	3 000
Morocco	4 149	3 038
Palestine	192	173
Syria	1 800	525
Tunisia	480	630
Total	36 951	16 738

Source: <http://www.globalwaterintel.com/archive/6/1/market-insight/thirsting-for-investment.html>.

4.1 What is the progress in access to improved sanitation systems?

Improved sanitation concerns the management of human faeces at household level, and includes connection to a public sewer, connection to a septic system, a pour-flush latrine, and access to a pit latrine and a ventilated, improved pit latrine (WHO and Unicef). Only those facilities which are not shared or public, and which separate human excreta from human contact are considered improved. Sanitation solutions considered non-improved include public or shared latrines, open pit latrines and bucket latrines.

Inadequate sanitation poses health risks, from contaminated drinking water to life-threatening forms of diarrhoea to infants, particularly for poorer segments of the population who are most exposed to inadequate human waste disposal. Globally, almost 2 000 children die every day from preventable

diarrheal diseases, some 1 800 of which are linked to water, sanitation and hygiene (Unicef, 2013) (see http://www.unicef.org/media/media_68359.html). Among the eight Millennium Development Goals (MDGs) adopted at the Millennium Summit in September 2000 at the United Nations Headquarters in New York, Goal 7 focuses on ensuring environmental sustainability, partly through improved access to water and sanitation. The set global target is to halve the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015 (Target 10) (Table 4.2). This target was also adopted by the contacting parties to the Barcelona Convention in 2005 as part of the Mediterranean Strategy for Sustainable Development (MSSD).

The economic losses associated with poor sanitation and water supply amount to USD 260 billion annually in developing countries. However, it is estimated that the benefits from improved sanitation account for 90 % of the total annual economic benefits of meeting the MDG target (USD 54 billion of the USD 60 billion) (WHO, 2012). According to the most recent MDG report (2013), as many as 1.9 billion people worldwide have gained access to improved sanitation facilities since 1990. Despite this remarkable progress, further efforts and investments are needed to increase the relatively low coverage in rural areas, and to reach the set targets by 2015.

As part of the H2020 programme on assessing progress made in depolluting the Mediterranean, the indicator on access to improved sanitation systems has been selected as a way to monitor progress towards more adequate sanitation services, both in urban and rural areas. Sanitation services are the basis of the 'wastewater management chain', which considers the link between sanitation, municipal wastewater collection, treatment and disposal in a holistic way. Although sanitation services strongly determine the quantity and quality of municipal wastes that are produced, the availability of adequate sanitation facilities on its

Table 4.2 Share of total population (%) with access to improved sanitation systems in ENP-South countries in 2011, compared to targets set for 2015, based on values for 1990

	Algeria	Egypt	Israel	Jordan	Lebanon	Morocco	Palestine	Tunisia
1990	89.0	72.0	100.0	97.0		53.0		73.0
2011	95.1	95.0	100.0	98.1		69.7	94.3	89.8
Target 2015	94.5	86.0	100.0	98.5		76.5		86.5

Source: MDG database; UNSD.

own does not guarantee the 'downstream' protection of coastal and marine environment from discharge of untreated wastewater. In other words, in areas where adequate sanitation services are currently being provided, typically quantified by a high share of the population with access to improved sanitation systems, these should be coupled to adequate collection and treatment of wastewater, in order to safeguard the receiving waterbodies in line with the objectives of H2020 (see Section 3.3). Targets and compliance objectives need to be defined throughout the wastewater management chain, since even where reasonable treatment facilities exist, poor maintenance and operation often result in failure to meet design effluent levels and thus to protect the receiving environment.

In 2011, around 92 % of the population in the ENP-South region ^(?) had access to improved

sanitation. Most countries reached connection rates as high as 95 % of the total population (Figure 4.2), as compared to an overall coverage of 87.5 % in 2003. This implies that steady progress has been achieved since 2003 in all the ENP-South countries, in particular in Egypt and Tunisia, where coverage increased by more than 5 % of the total population over the time period from 2003 to 2011. Since 2003, more than 3 million people have gained access to improved sanitation in the region, in large part made possible by investments from regional and international cooperation.

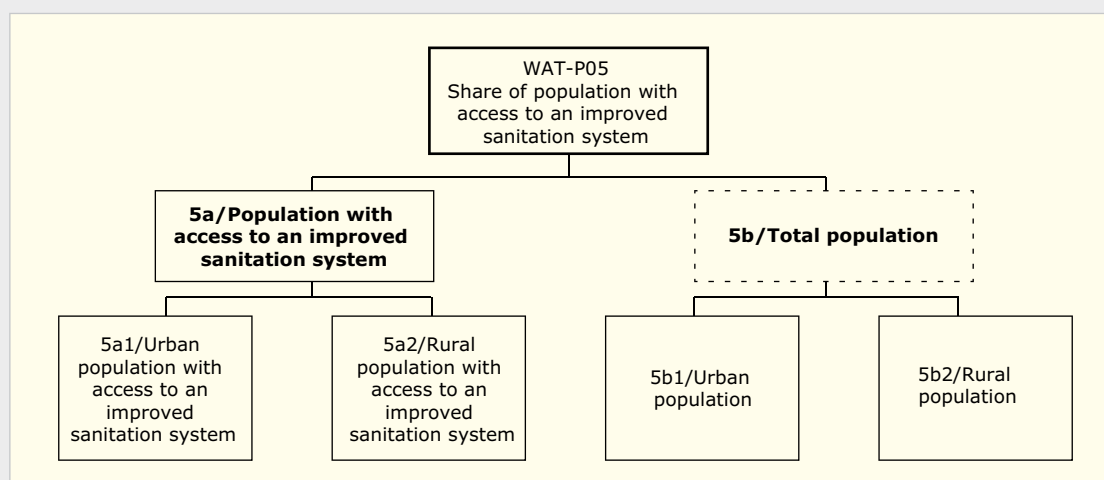
Although the indicator data show general progress in access to sanitation services, they do not fully take into account the current population growth and (especially the informal) urban sprawl, which are amongst the major drivers as well as pressures in the region. These figures should therefore be

Box 4.1 Access to improved sanitation systems: methodological issues

The calculation of 'Indicator 3: Share of total, urban and rural population with access to improved sanitation systems' relies on statistics for urban and rural populations. This presents a source of uncertainty, since the characteristics of urban and rural areas vary from country to country. Statistics on urban and rural populations come directly from population censuses, but the distinction between urban and rural populations is not amenable to a single definition applicable to all countries. Moreover, some countries distinguish between communal and non-communal areas, while others consider refugees a separate population group, and others still do not make a distinction between rural and urban at all.

Administrative records and household surveys are the two main sources for this indicator. The combination of different methodologies may result in discrepancies between different data sets.

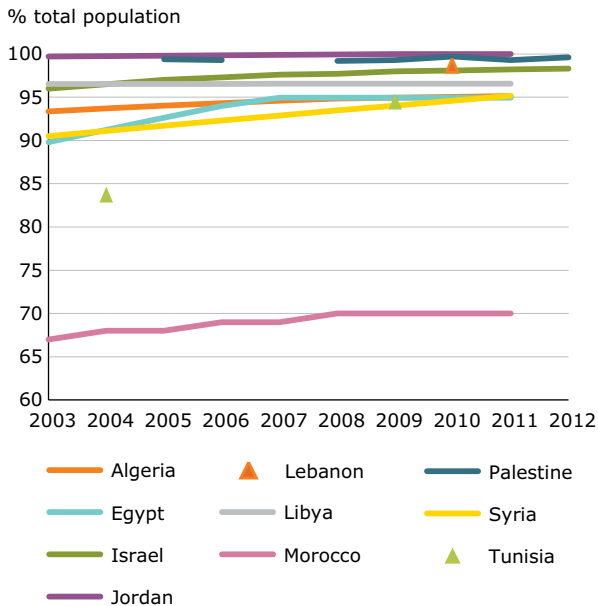
Figure 4.1 Example of analysis of data sets availability to complete H2020 indicator number 3



Source: EMWIS Mediterranean Water Information Mechanism, 2011 (<http://www.emwis.net/medwip/topics/WSS/donnees-chiffrees/analyse-de-la-disponibilite-des-donnees/wat-p05-part-de-la-population-ayant-acces-un>).

(?) Including Jordan, Libya and Syria.

Figure 4.2 Percentage of total population having access to improved sanitation systems in ENP-South countries, for the time period 2003–2011



Note: Data for Israel, Jordan, Palestine, Tunisia and (Lebanon) is provided by countries under the ENPI-SEIS South project. The source of data for Algeria, Egypt, Libya, Morocco and Syria is the UN database. Morocco did provide data for Indicator 3 in the context of the ENPI-SEIS South project. However, these data were at the level of the coastal hydrological basins, and could not be integrated with national data from other countries.

interpreted with caution, accounting for a possible bias that depicts a more favourable situation than exists in reality. Although most countries have already reached the target set for 2015 (Table 4.2), data for 2011 show that an estimated 17.6 million people continued to rely on unimproved sanitation solutions, calling for more localised efforts. It should be noted that the UN data presented in Table 4.2 vary slightly from those provided by the countries in the context of the ENPI-SEIS project (see Figure 4.2 and its notes). This is because the national data sources may not be the same and the methodologies used may differ (see Box 4.1).

As explained in Part 1, the geographical focus of H2020 for the Water priority theme is established as the coastal watershed draining into the

Mediterranean Sea. Indicator data on access to sanitation systems provided by ENP-South countries in the context of the ENPI-SEIS project, as well as supplementary data retrieved from international sources, namely the UN database, refer to the national level. With the exception of Morocco (see Box 4.2), reliable data at the desired geographical level are not readily available. Assuming that ~ 65 % of the population in the ENP-South countries reside in the coastal watershed⁽⁸⁾ (see Table I.1), it is estimated that 11.5 out of the 17.6 million inhabitants without access to sanitation systems are concentrated in this coastal watershed. Although this is a highly approximate calculation, it is a strong indication that the inhabitants and environment in coastal watersheds draining into the marine waters are the most severely impacted by inadequate sanitation systems.

According to the WHO and Unicef definition, 'improved sanitation systems' include connection to public sewage network, as well as to septic systems, pour-flush latrines, access to a pit latrine, a ventilated improved pit latrine and other not shared facilities that separate human excreta from human contact. In some countries, Palestine for instance, the fraction of households connected to a sewage network varied between 43.6 % in 2003 and 55 % in 2011. In 2010, ~ 39 % of Palestinian households, particularly those residing in the West Bank, still relied on other improved facilities such as porous cesspits. Cesspits or cesspools are also the most common disposal method for wastewater in rural areas in Jordan. These cesspits, which are purposely designed and constructed without a concrete lining to allow seepage into the ground, occasion a number of environmental concerns. With time, cesspits get filled with wastewater, which require periodical emptying by vacuum tankers. The collected wastewater in the tankers is often released into the oueds (dry riverbeds, which may at times form intermittent streams), contaminating the environment and creating a nuisance odour, particularly during the summer months. During times of heavy rain, the untreated wastewater turns into a 'sewage flood', causing the degradation of the environmental quality of the surrounding agricultural land, and putting public health at risk.

⁽⁸⁾ Does not include Jordan.

Box 4.2 Access to sanitation systems in the coastal hydrological basins of Morocco

Since the 1960s, Morocco has focused significantly on the development of the water sector, in particular on the implementation of hydraulic structures enabling safe access to drinking water. However, the upgrading of sanitation systems, including sewage networks and wastewater treatment, was a low priority, resulting in insufficient coverage and significant delays. Lack of adequate sanitation services led to the deterioration of the quality of water resources and natural environments, posing a threat to public health and to the social and economic development of the region. To counteract the situation, in 2005 the Moroccan government approved the National Sanitation Programme (Programme National d'Assainissement liquide et d'épuration des eaux usées (PNA)) which aims to achieve an 80 % connection rate to the sanitation network in urban areas and a 60 % wastewater treatment rate by 2020. By improving the sanitation connection network, this programme also contributes towards lowering the pollution load into receiving waters.

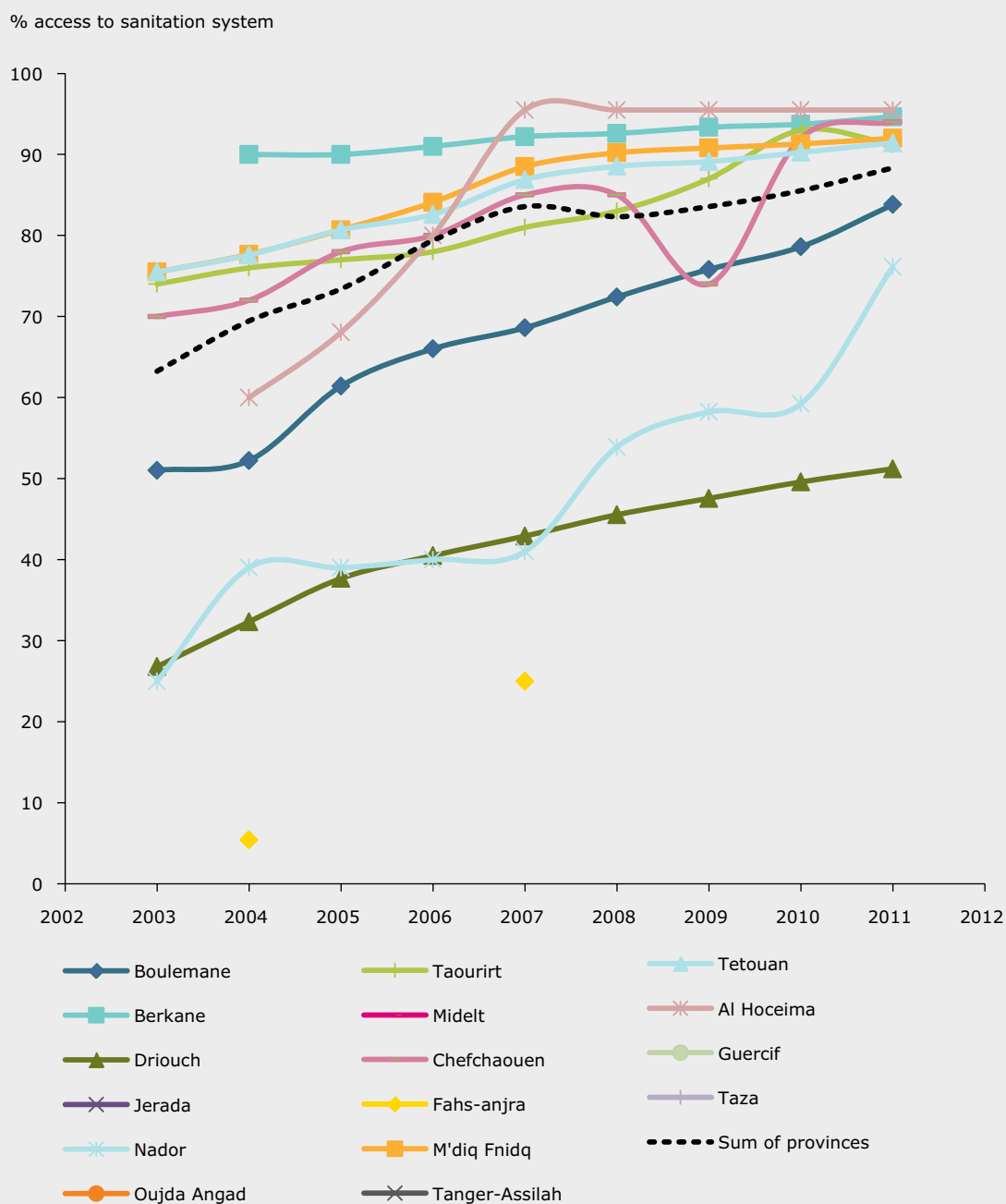
In the context of the ENPI-SEIS South project, Morocco lay down the geographical focus: the 16 provinces and prefectures in the coastal hydrological basins of Oued Moulouya and Tangier in the Mediterranean region. These two regions cover an area of 74 000 km² and 9 000 km², respectively, and have a total population of 2.5 million, ~ 8 % of the total population.

In general, a steady increase was observed during the time period from 2003 to 2011 in the 16 provinces (see Figure 4.3 below). Based on the available data, the rate of access to sanitation systems in 2011 has exceeded 90 % in the following 6 provinces: Berkane, Taourirt, Chefchaouen, M'Diq Fnidq, Tetouan and Al Hoceima. In the ENPI-SEIS focus area, coverage increased from ~ 63 % in 2003 to 88 % in 2011, denoting a significant progress in sanitation services. This estimation, however, does not include the provinces of Jerada, Ouja Augad, Midelt Tanjer-Assilah, Guercif, Taza, one commune in Berkane, one commune in Driouch, five communes in Nador and two communes in Taourirt, with a collective population of 1.9 million inhabitants in 2003 and 1.3 million inhabitants in 2011, for which no data are available. At national level, the rate of access to sanitation systems is around 70 % (see Table 4.2).

According to the WHO and Unicef definition, 'improved sanitation systems' include connection to public sewage network, as well as to septic systems, pour-flush latrines, access to a pit latrine, a ventilated improved pit latrine and other not shared facilities that separate human excreta from human contact. In some countries, Palestine for instance, the fraction of households connected to a sewage network varied between 43.6 % in 2003 and 55 % in 2011. In 2010, ~ 39 % of Palestinian households, particularly those residing in the West Bank, still relied on other improved facilities such as porous cesspits. Cesspits or cesspools are also the most common disposal method for wastewater in rural areas in Jordan. These cesspits, which are purposely designed and constructed without a concrete lining to allow seepage into the ground, occasion a number of environmental concerns. With time, cesspits get filled with wastewater, which require periodical emptying by vacuum tankers. The collected wastewater in the tankers is often released into the oueds (dry riverbeds, which may at times form intermittent streams), contaminating the environment and creating a nuisance odour, particularly during the summer months. During times of heavy rain, the untreated wastewater turns into a 'sewage flood', causing the degradation of the environmental quality of the surrounding agricultural land, and putting public health at risk.

Box 4.2 Access to sanitation systems in the coastal hydrological basins of Morocco (cont.)

Figure 4.3 Percentage access to sanitation systems in 16 Moroccan provinces based on available data



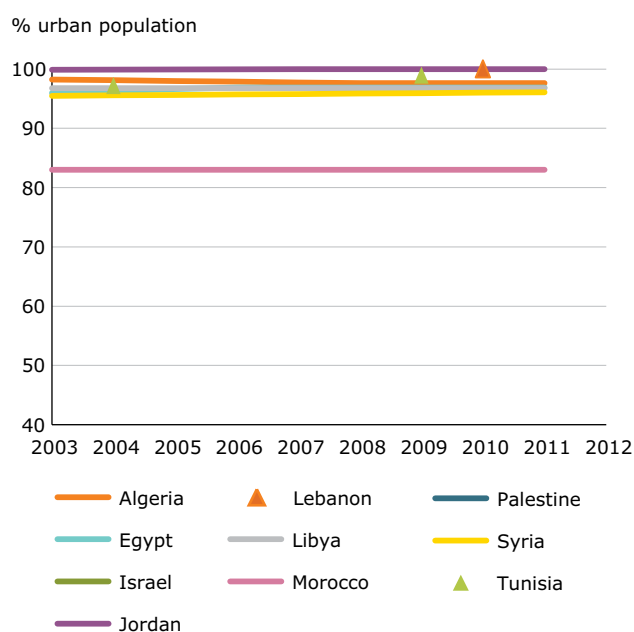
Note: The sum of provinces does not include Jerada, Oujda Angad, Midelt, Tanger-Assilah, Guercif, Taza, one commune in Berkane, one commune in Driouch, five communes in Nador and two communes in Taourirt, for which no data are available.

Source: Moroccan country-level assessment and indicator data delivered by Morocco under the ENPI-SEIS South project.

4.2 What is the difference between urban and rural areas?

Access to improved sanitation services in the Mediterranean region is generally above the world average (MDG report, 2013). Yet, due to the migration from rural to urban areas, the consequent increase in urban populations, the emergence of 'pockets' of urban poverty, and the inequities between urban and rural areas, the planning of sanitation services in the ENP-South countries remains challenging. Ensuring access to sanitation services in unregulated peripheral quarters and in medium and small-sized towns involves the whole cycle of services delivery: mobilisation of financial and human resources, planning and design, construction, operation and maintenance as well as policymaking.

Figure 4.4 Percentage of urban population having access to improved sanitation systems in ENP-South countries for the time period from 2003 to 2011

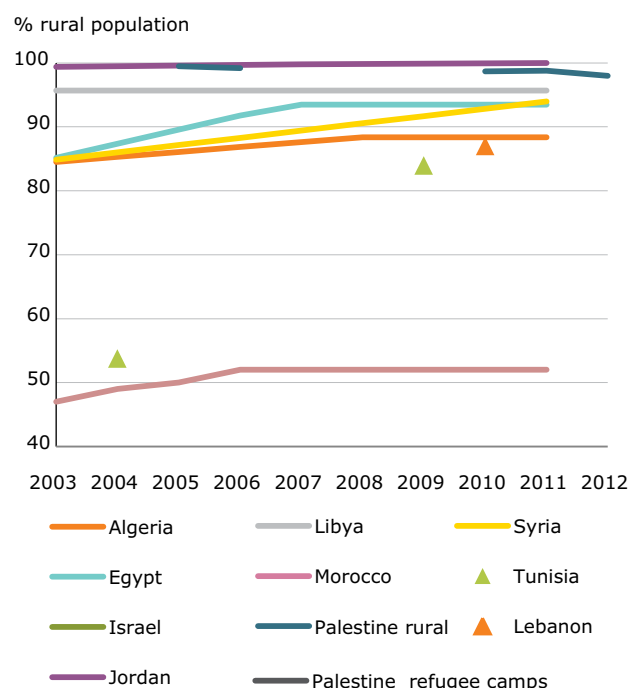


Note: Data for Tunisia refer to 'communal' areas. No data are provided by Israel for urban population fraction.

Sources: Data for Jordan, Palestine, Tunisia and (Lebanon) are provided by countries under the ENPI-SEIS South project. Data for Algeria, Egypt, Libya, Morocco and Syria are from the UN database.

The breakdown between the urban and rural population (see Figure 4.4 and Figure 4.5) shows that in most cases, access to improved sanitation in rural areas is lagging behind. More than 5.5 million people living in urban areas and no less than 12 million rural dwellers were deprived from access to improved sanitation systems in 2011, and had to revert to public or shared solutions and open defecation. The corresponding data from 2003 show that the number of people without access to improved sanitation systems was 5.5 million and 18 million in urban and rural areas, respectively. This implies that the gap between the urban and rural coverage has been gradually narrowing in most countries over the time period from 2003 to 2011.

Figure 4.5 Percentage of rural population having access to improved sanitation systems in ENP-South countries for the time period from 2003 to 2011



Note: In Palestine, refugee camps are considered a separate locality type. Data for Tunisia refer to 'non-communal' areas. No data are provided by Israel for rural population fraction.

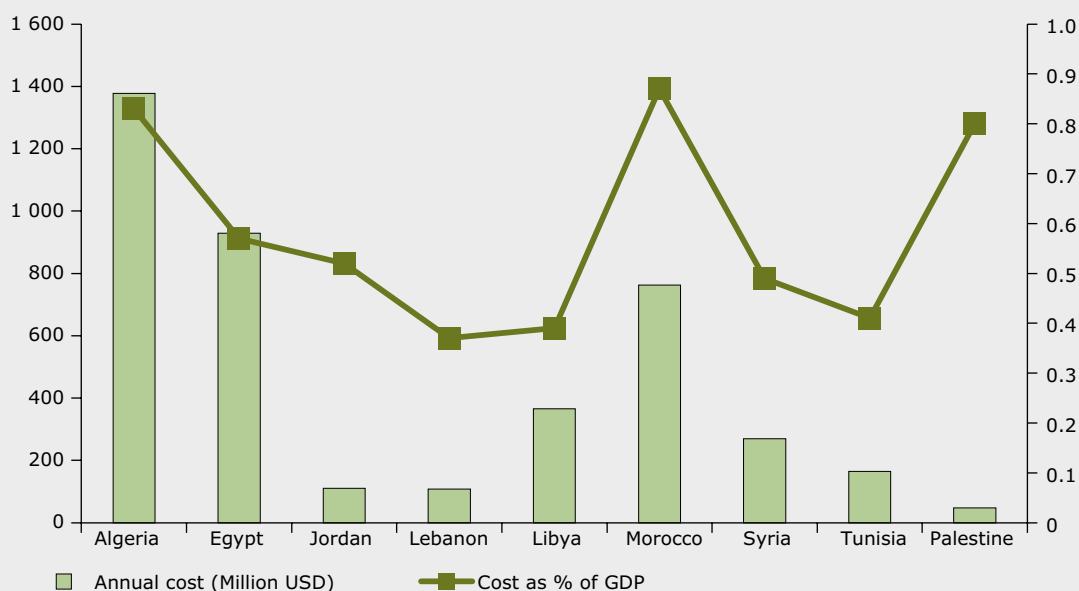
Source: Data for Jordan, Palestine, Tunisia and (Lebanon) are provided by countries in the context of the ENPI-SEIS South project. Data for Algeria, Egypt, Libya, Morocco and Syria are from the UN database.

Box 4.3 Social and economic benefits of improved sanitation systems

In a study by Larsen (2010), the cost of inadequate potable water, sanitation and hygiene in northern African and Middle Eastern countries ⁽⁹⁾ was assessed for the year 2007/08, as a follow-up to similar studies previously conducted by World Bank through its Mediterranean Environmental Technical Assistance Program (METAP). Estimates included further substantiated linkages between health and environmental quality, based on empirical direct and indirect health effects such as diarrheal infections and malnutrition.

The annual cost of health effects associated with water, sanitation and hygiene in 2008 was estimated at USD 4.1 billion in the ENP-South region, equivalent to between 0.4 % and 0.9 % of the countries' GDP. These included both the cost of mortality (instances of death) and morbidity (instances of disease), with the cost of morbidity being higher than that of mortality in most of the nine countries.

Figure 4.6 Annual costs of health effects associated with water, sanitation and hygiene in ENP-South countries in USD, as a percentage of GDP



Source: Larsen, 2010.

The benefits of enhanced environmental protection in the ENP-South region were further investigated in the recent project 'Environmental benefits' (Ten Brink et al., 2011). This study identified the health, environmental, economic and social benefits of an improved water and sanitation situation, to meet a set of targets for the year 2020. These targets included achieving 100 % population connection to a water supply and sewage network system (except in isolated rural areas), ensuring continuous, reliable and safe water provision to the population, serviced with a piped water supply, and providing improved sanitation to households in isolated rural areas that are currently without such facilities. The targets also considered improving hygiene practices to prevent the spread of contagious diseases. The assessment focused on the qualitative, quantitative and monetary benefits associated with reduced incidence of morbidity and mortality as a result of improved water, sanitation and hygienic conditions.

Based on the current population distribution connected to water supply and sanitation services in the ENP-South region, it was estimated that by achieving the targets, diarrheal disease and diarrheal mortality nationwide will decrease: by 15 % to 17 % in Israel, and by 33 % in Morocco. The assumption here is that the entire population already has good hygiene practices that are adequate for health protection.

⁽⁹⁾ The overall geographical coverage of this study included the 16 countries of the Arab League: Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, West Bank and Gaza, Syria and Tunisia as well as Comoros, Djibouti, Iraq, Mauritania, Somalia, Sudan and Yemen.

Box 4.3 Social and economic benefits of improved sanitation systems (cont.)

Assuming that the hygiene practices are also improved by 2020, the decrease in morbidity and mortality is estimated at 25 % to 27 %, to 65 %. This is equivalent to ~ 45 million and 100 million avoided annual cases of diarrhoea, and between 4 350 and 9 500 avoided deaths. Using the benefits methodology developed as part of the project, the annual monetised benefits from the avoided incidences would amount to between EUR 2 136 and EUR 4 710 million for morbidity, and between EUR 1 673 and EUR 3 700 million for mortality. In total, the annual benefits for the entire region would range from EUR 3 808 million to EUR 8 412 million, representing between 0.06 % and 0.99 % of the GDP of individual countries in 2020.

References:

Larsen, B., 2010, 'Cost assessment of environmental degradation in the Middle East and North Africa region – selected issues', Economic Research Forum, working paper 583 (http://www.erf.org.eg/CMS/uploads/pdf/1290798530_Envi_Nov_03.pdf) accessed 8 April 2014.

ten Brink, P. (IEEP), Bassi, S. (IEEP), Farmer, A. (IEEP), Hunt, A. (Metroeconomica), Lago, M. (Ecologic), Larsen, B., Spurgeon, J. (ERM), Tucker, G. (IEEP), Van Acoleyen, M. (Arcadis), Doumani, F. and Van Breusegem W. (Arcadis), 2011, *Analysis for European Neighbourhood Policy (ENP) Countries and the Russian Federation on Social and Economic Benefits of Enhanced Environmental Protection. Regional Report: ENPI South. A synthesis report on Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, occupied Palestinian territory, Syria and Tunisia* (http://ieep.org.uk/assets/942/ENPI_South_benefits_of_environmental_protection.pdf) accessed 8 April 2014.

4.3 What is the progress in municipal wastewater management?

Wastewater refers to water that has been adversely affected in quality through anthropogenic use. Municipal wastewater is wastewater collected by or on behalf of a municipality. In the Mediterranean, municipal wastewater consists of a mixture of domestic wastewater (residential settlements and services predominantly for human metabolism and household activities) and industrial wastewater.

The discharge of untreated municipal wastewater in coastal areas or rivers flowing into the Mediterranean Sea remains a major environmental issue in most ENP-South countries and therefore constitutes one of the challenges of H2020. Municipal wastewater carries high loads of nutrients (nitrogen and phosphorus), pathogens and microorganisms (including coliforms, faecal streptococci, and salmonellae) posing direct or indirect risks to human health and well-being. In cities with intense industrial activity, municipal wastewater discharged directly into public sewerage systems generally contains a variety of chemical wastes: total dissolved solids, ions (such as sodium, calcium and magnesium), organic compounds (such as phenols, pesticides

and chlorinated hydrocarbons) and metals (such as cadmium, zinc, nickel, and mercury). These substances of particular concern due to their toxicity and their resistance to conventional wastewater treatment methods.

The composition of wastewater depends on the standard of living, climatic conditions, water supply systems and the available water quantities. For the Mediterranean region, water consumption is of the order of 150 l/cap per day to 250 l/cap per day (UNEP/MAP, 2009). Typical consumption rates vary: 250 l/cap/day to 350 l/cap/day in the northern Mediterranean region (UNEP/MAP, Plan Bleu, 2009), and 120 l/cap/day to 70 l/cap/day in urban and rural areas of the drier southern Mediterranean region (Abu-Madi and Al-Sa'ed, 2009). Due to the limited water availability expressed in low daily consumption rates, municipal wastewater in the ENP-South countries tends to be characterised by higher concentrations of substances (UNEP/MAP, 2009).

In coastal communities and other touristic areas, seasonal variations can be particularly pronounced due to higher consumption related to tourist activity. Of the total quantity of water supplied to the communities, around 70 % to 80 % reaches the

sewerage system, while the rest is infiltrated into the ground, due to irrigation of gardens, for instance.

The provision of wastewater treatment varies across the region, but in many cases treatment plants are often absent or do not function optimally (Environmental Benefits Report, 2011). Recently, a number of inventories of municipal wastewater treatment facilities in Mediterranean countries have been published (MAP Technical Report Series No 157, 2004; UNEP/MAP, 2011; UNEP(DEPI)/MED WG.357/Inf.7). These studies provide information on the population served by WWTPs, the degree of the treatment provided, quantities of wastewater produced and disposal alternatives. A summary of the results is presented below.

The most recent inventory (UNEP/MAP/MED POL, 2011) (Table 4.3) also considers a number of cities with a population of > 2 000 inhabitants that discharge their municipal wastewater (treated or

untreated) into major rivers. Wastewater produced from the cities located in the catchment area of a river draining into the Mediterranean Sea will eventually end up in the sea, thus indirectly contributing to the pollution of the marine environment. In cases of wastewater discharges to rivers, when selecting the degree of treatment, the following should be considered: the specific characteristics of the recipient, in terms of both quantity (e.g. rivers with significant flow variations) and quality (e.g. nutrient concentrations), as well as the possible long-term impacts on the aquatic environment.

A comparison of the outcome of the 2004 and 2011 inventories shows an increase in the proportion of coastal cities served with wastewater treatment facilities (Table 4.4 and Figure 4.7). When focusing on the data provided by the ENP-South countries (Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Syria and Tunisia), only 51 % of the coastal cities

Table 4.3 Summary of the number of cities considered in the 2003 and 2010 MED POL inventories

Reference year	2003	2010	
Year of publication	2004	2011	
Number of countries	19	20	
	Coastal	Coastal	River
Number of cities	601	1 822	858
Of which cities with population of < 10 000 inhabitants (for which population was reported)	25 (*)	1 172	-
10 000–100 000 inhabitants (for which population was reported)	464	556	-
> 100 000 inhabitants (for which population was reported)	104	94	-

Note: (*) included due to seasonal population.

Source: MED POL, 2011.

Table 4.4 Summary of the number of coastal cities served/not served with WWTPs based on the 2003 and 2010 inventories

Reference year	2003	2010	
Year of publication	2004	2011	
Number of countries	19	20	
Coastal cities with population of 10 000–100 000 inhabitants			
Total	489	556	
Served with WWTPs	332 (68 %)	420 (75 %)	
Not served with WWTPs	157 (32 %)	136 (24 %)	
Coastal cities with population > 100 000 inhabitants			
Total	104	94	
Served with WWTPs	77 (74 %)	77 (82 %)	
Not served with WWTPs	27 (26 %)	17 (18 %)	

Source: MED POL, 2011.

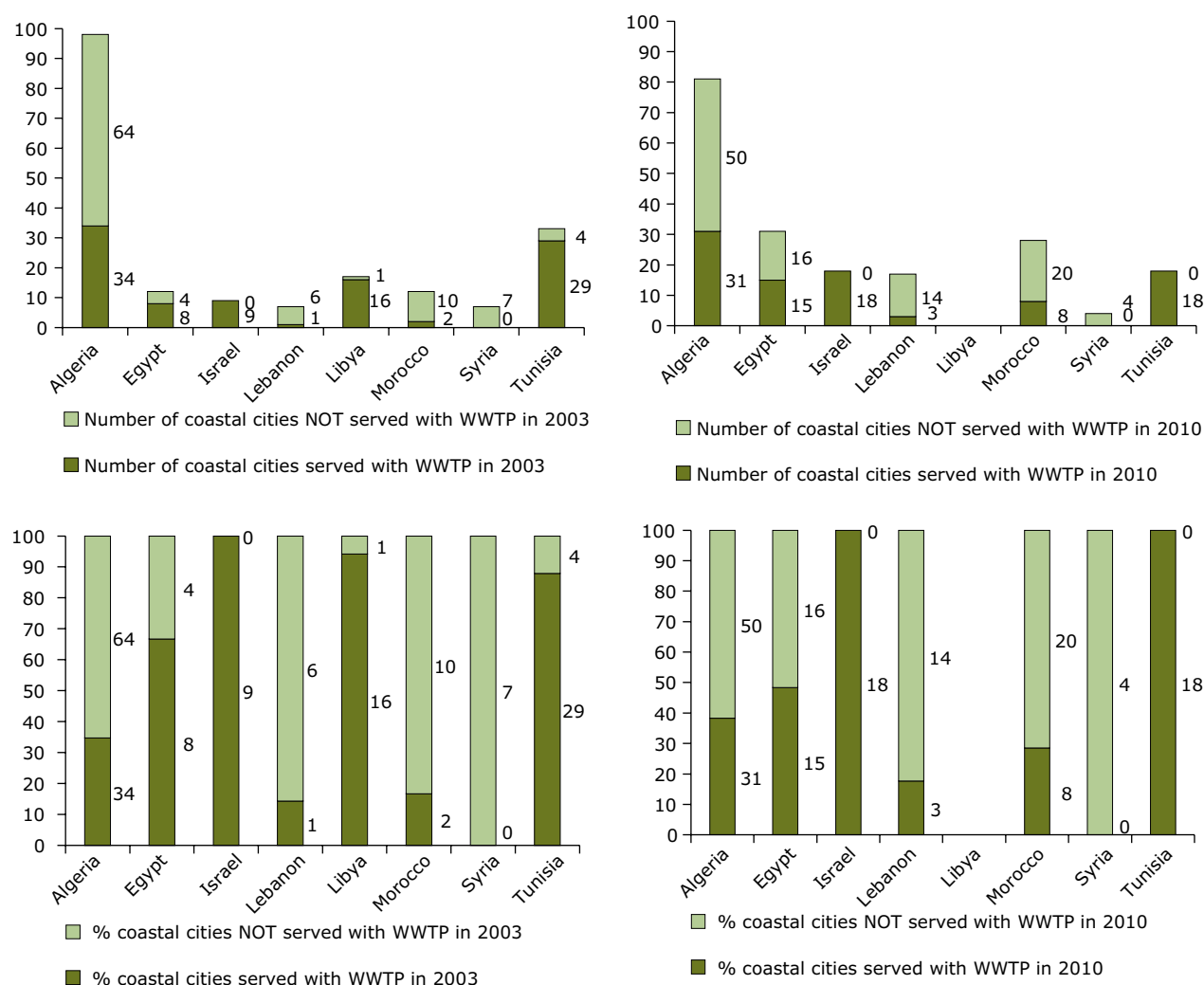
(99 out of 195) were served with wastewater treatment facilities in 2003. In 2010, the proportion of coastal cities served with WWTPs was found to be 47 % (93 of 197 cities), comprising 62 % of coastal cities with a population > 100 000 inhabitants, and 43 % of the cities with between 10 000 and 100 000 inhabitants. Based on these results, it is difficult to draw any conclusions on progress made in the installation of wastewater treatment facilities in coastal areas of the ENP-South countries, since the number of cities considered per country differs in the two studies.

Indicator 4 on wastewater management (Figure 4.8 and Table 4.5) shows a general increase in the

volume of wastewater collected and treated in Israel, Jordan, Palestine and Tunisia over the past 10 years. In some countries, such as Palestine and Jordan, the volume of wastewater collected in 2011 is nearly 50 % higher than it was in 2003. A similar increase in the volume of wastewater treated is observed, implying that most of the collected wastewater (~ 80–98.6 %) (see Figure 4.8) undergoes treatment.

Time-series data on volumes of wastewater collected and treated are not available for Algeria, Egypt and Lebanon. In Egypt, data on the volume of wastewater collected and treated are available at the Holding Company for Water and Wastewater⁽¹⁰⁾, in collaboration with its affiliated companies that run

Figure 4.7 Number of coastal cities in ENP-South countries with/without WWTPs, in 2003 and 2010



Source: MAP Technical Report Series No 157, 2004; UNEP/MAP, 2011; UNEP(DEPI)/MED WG.357/Inf.7.

⁽¹⁰⁾ <http://www.hcww.com.eg/En/Default.aspx>.

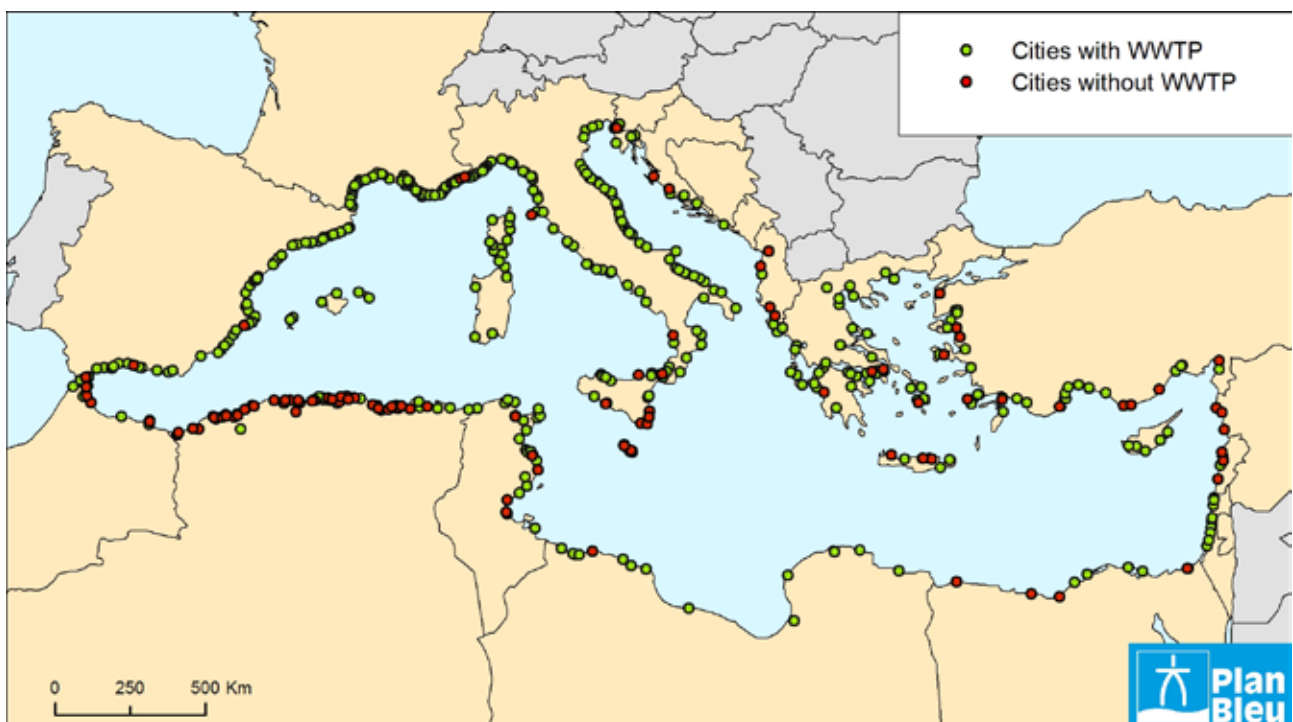
Box 4.4 Regional plan on biochemical oxygen demand (BOD) from wastewater treatment plants (WWTPs)

The establishment of WWTPs in all cities around the Mediterranean Sea with more than 100 000 inhabitants and appropriate outfalls and/or appropriate treatment plants for all cities with more than 10 000 inhabitants are amongst the targets of the Genoa Declaration (1985) approved by the contracting parties to the Barcelona Convention. In addition, in 2009 the contracting parties adopted Decision IG.19/7, the 'Regional Plan on the reduction of BOD₅ from urban waste water in the framework of the implementation of Article 15 of the Land-based Sources (LBS) Protocol'. This regional plan is to apply to the collection, treatment and discharge of urban wastewater with the objective of protecting the coastal and marine environment and health from the adverse effects of direct and indirect wastewater discharges, in particular the adverse effects on the oxygen content of the coastal and marine environment, and eutrophication phenomena. It obliges Mediterranean countries to ensure a sewage collection system is in place for cities with more than 20 000 population equivalent, and/or economic activities sufficiently concentrated for urban wastewater to be collected and conducted to an urban WWTP or to a final discharge point.

A number of measures have been defined:

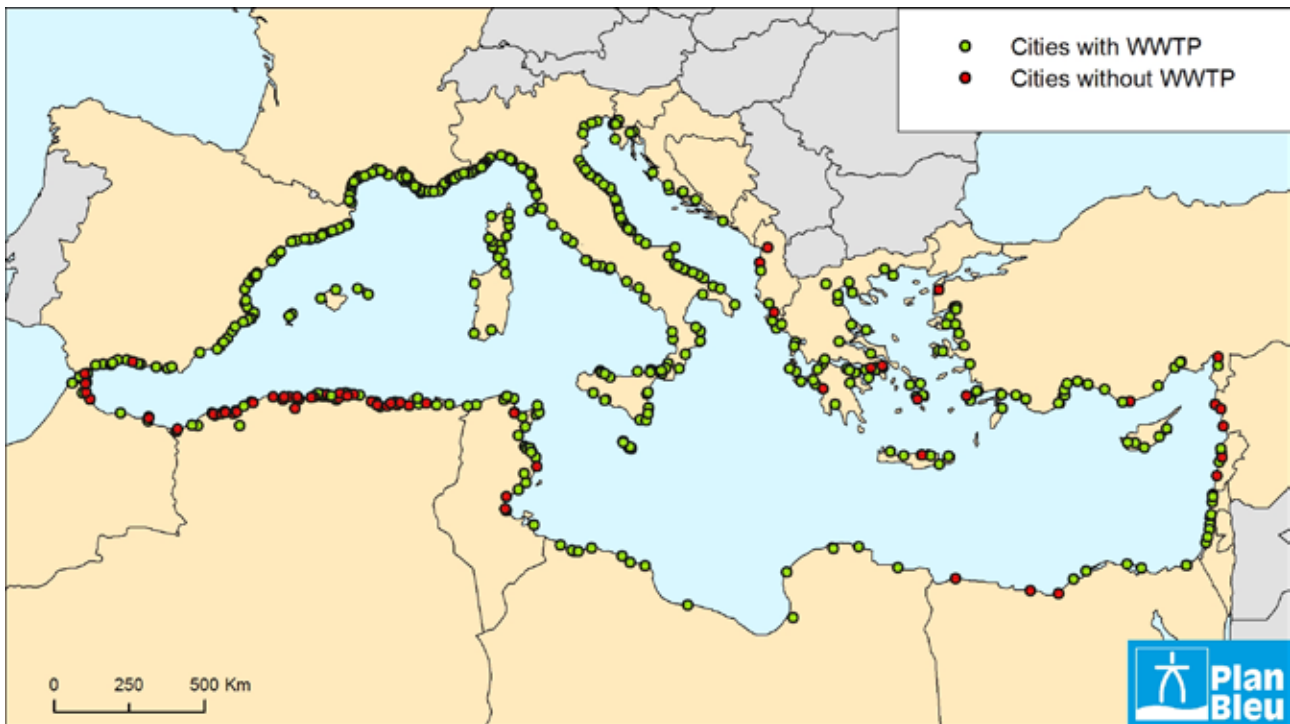
1. parties are to ensure that all agglomerations collect and treat their urban wastewater before discharging it into the environment, using collecting systems that satisfy defined requirements;
2. parties are to adopt national BOD₅ Emission Limit Values (ELVs) for urban wastewater after treatment (i.e. maximum allowable concentration of BOD₅ to be finally discharged from WWTPs to the receiving water environment);
3. parties are to ensure that the characteristics of collected and treated urban wastewater are, before discharge into the environment, be in accordance with provisions on prescribed ELVs.

Map 4.1a Overview of the major coastal cities with/without WWTPs in 2004



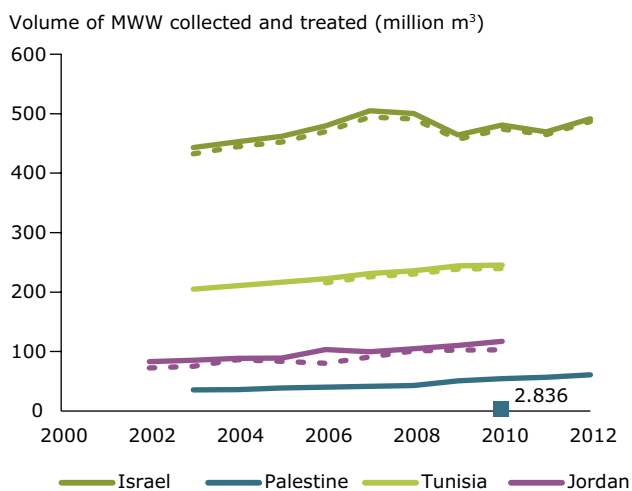
Source: Based on MAP Technical Report Series No 157, 2004; UNEP/MAP, 2011 UNEP(DEPI)/MED WG.357/Inf.7

Map 4.1b Overview of the major coastal cities with/without WWTPs in 2010



Source: Bbased on MAP Technical Report Series No 157, 2004; UNEP/MAP, 2011 UNEP(DEPI)/MED WG.357/Inf.7

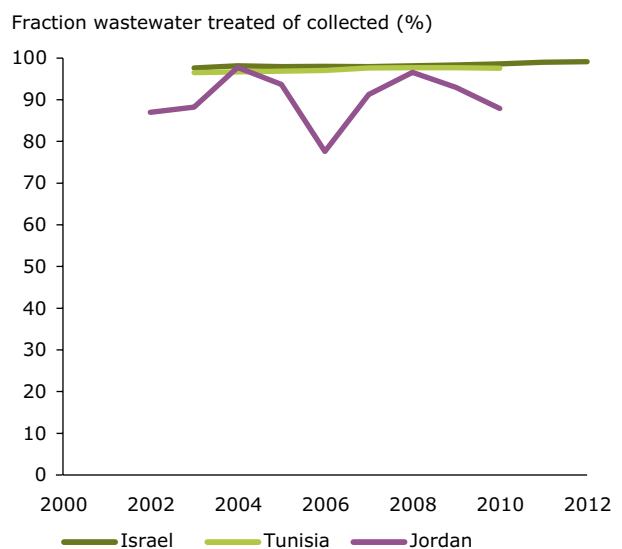
Figure 4.8 Volume of municipal wastewater collected and treated in the ENP-South region, per country



Note: Data for Tunisia refer to the entire country and to the volume of municipal wastewater collected by public sewage networks only. No time-series data are available for Lebanon, Algeria and Egypt.

Source: National sources, H2020 reporting, 2013.

Figure 4.9 Volume of municipal wastewater treated as a fraction of the volume of wastewater collected



Note: Data for Tunisia refer to the volume of municipal wastewater collected by public sewage networks only.

Source: National sources, H2020 reporting, 2013.

a number of water and sanitation projects. Annual data are available from 2007 onwards, covering 17 governorates in 2007 and 23 out of 27 governorates in 2012. A master plan for the years 2000 to 2037 has been developed that takes into account all projects, based on future population estimations. Primarily, the target is to achieve full coverage of wastewater collection; secondarily, it is to improve the level of wastewater treatment (primary and secondary treatment). Private-public partnerships between private bodies and stakeholders are highly encouraged, so as to achieve the set targets.

The indicator data delivered by the countries suggests that the volume of treated wastewater closely follows the volume of collected wastewater (Figure 4.8). This could be explained by the fact that the volume of wastewater collected is estimated based on the volume of wastewater entering the WWTPs, whereas the volume of wastewater treated is estimated on wastewater leaving the WWTPs. In those countries for which data are available, an increase in the fraction of volume collected and treated is observed over the period from 2003 to 2010 (Table 4.5). The normalisation of the volumetric data by population (Table 4.6) indicates that the reported increase in the volume of wastewater collected and treated not only covers the concurrent population growth,

but also contributes to the relative improvement of wastewater management practices in the region.

Particularly in Palestine, between 2003 and 2010, the volume of wastewater collected increased remarkably by 52.5 %; from 35.6 million m³ to 54.3 million m³ (Table 4.5). However, data on the volume of wastewater treated and type of treatment is very limited. Wastewater treatment facilities are restricted to a few localities in Palestine, and the lack of appropriate infrastructure for wastewater collection and treatment has been the limiting factor in development of the wastewater sector. In Egypt, the volume of treated wastewater also increased over the same time period, by a staggering 153 % (from 1 900 million m³ to 4 800 million m³). However, it is not possible to confirm whether the drastic increase and these trends are the result of increased data coverage, or of heavy investments in wastewater treatment, contributing towards social and economic development.

According to official data from Tunisia, more than 90 % of the wastewater collected by ONAS is treated, and more than 20 % of treated wastewater is reused. The Strategic Action Plan for urban wastewater in Tunisia set the following targets i) WWTPs for cities of over 100 000 inhabitants by 2010; and ii) treatment

Table 4.5 Volume of wastewater collected and treated in 2003 and 2010

	Volume collected (million m ³)		Volume treated (million m ³)		Percentage of treated wastewater as a fraction of volume collected (%)		Increase in volume collected (%)	Increase in volume treated (%)
	2003	2010	2003	2010	2003	2010	2003–2010	2003–2010
Algeria	-	150	-	150	-	100	-	-
Egypt	-	6 500 (2011)	1 900 (2002)	4 800 (2011)	-	73.8	-	152.6 (2002–11)
Israel	443	480.7	432.5	473.8	97.6	98.6	8.5	9.6
Jordan	85.46	117.2	75.4	103	88.2	87.9	37.1	36.6
Lebanon	69 (2001)	103 (2009)	-	-	-	-	49.3 (2001–09)	-
Morocco	-	-	-	124	-	-	-	-
Palestine	35.6	54.3	-	2.84 (*)	-	-	52.5	-
Tunisia	204.8 (**)	245.6	197.6 (**)	239.6	96.5	97.6	19.9	21.3

Note: Data for volume of wastewater collected and treated are delivered by countries, except for Algeria, Egypt and Lebanon. The source of the data for Algeria, Egypt and Lebanon is FAO Aquastat. Morocco provided indicator data for volume of wastewater collected and treated for the 16 coastal provinces. No data are available for Morocco in FAO Aquastat for the 2003-to-2010 period.

(*) Value for West Bank only.

(**) Value for 2003 estimated from data for 2006–10. Data refers to the population under the responsibility of Office National de l'Assainissement (ONAS) only, amounting to 6.5 million in 2012.

Source: National sources, H2020 reporting, 2013.

of all sewage from the entire coastal area by 2025. The former target has already been achieved, as is shown in the table below. However, due to the rapid growth of urban population, some treatment plants are not able to cope with the increasing effluent rates: consequently, in some large cities such as parts of Tunis, Mahdia, Sfax and Gabes, the current sewage treatment networks need to be extended.

In Egypt, the total number of WWTPs has been increased from 301 plants in the year 2008/2009

to 333 plants in 2010/11, reaching 370 plants in 2012/2013. This represents an increase of about 23 % across all Egypt. No information on the volume of wastewater treated and type of treatment is available.

Although the indicator data provided in the context of the ENPI-SEIS project show that the volume of treated wastewater closely follows the volume of wastewater collected, the fraction of collected wastewater does not always reflect the volume of wastewater that is generated. This implies that

Table 4.6 Volume of wastewater collected and treated per capita in 2003 and 2010

	Population (no of inhabitants)		Volume collected per capita (m ³)		Volume treated per capita (m ³)		Increase in volume collected per capita (%)	Increase in volume treated per capita (%)
	2003	2010	2003	2010	2003	2010	2003–2010	2003–2010
Algeria	31 913 462	35 468 208	-	4.2	-	4.2	-	-
Egypt	70 174 632 (2002)	82 536 770 (2011)	-	78.5 (2011)	27.1 (2002)	58.2 (2011)	-	114.8 (2002–11)
Israel	6 689 700	7 623 600	66.2	63.1	64.7	62.1	- 4.8	- 3.9
Jordan	5 164 000	6 047 000	16.5	19.4	14.6	17.0	17.6	16.4
Lebanon	3 802 903 (2011)	4 196 990 (2009)	18.1	24.5	-	-	35.3	-
Morocco	29 770 316	31 951 412	-	-	-	3.9	-	-
Palestine	3 334 512	3 905 364	10.7	13.9	-	-	29.9	-
Tunisia	9 839 800	10 549 100	20.8	23.3	20.1	22.7	12	12.9

Source: National sources, H2020 reporting, 2013.

Table 4.7 Overview of the number of WWTPs, and volume of wastewater collected and treated in the large cities of Tunisia

	Number of WWTPs	Volume of collected wastewater (million m ³)	Volume of treated wastewater (million m ³)	Fraction of treated wastewater (%)
Jendouba	5	2.7	2.6	96.3
Béja	4	3.3	3.2	97
Bizerte	2	8.8	8.5	96.6
Ariana	2	14.4	14	97.2
Tunis	2	33.2	32.1	96.7
Ben Arous	4	14.7	14.2	96.6
Nabeul	10	13.2	12.8	97
Sousse	5	15.4	14.8	96.1
Monastir	8	10.5	10.1	96.2
Mahdia	4	2.9	2.8	96.6
Sfax	3	11	10.6	96.4
Gabès	2	4.3	4.1	95.3
Medenine	8	5.5	5.3	96.4
Average/total	59	139.9	135.1	96.6

Source: Tunisian country-level assessment/ONAS, 2013.

Table 4.8 Number of WWTPs in 2012/13 per governorate in Egypt

Governorate	Number of stations
Cairo	11
Giza	7
El-Qallliopiah	11
Alexandria	17
Kafr El-Sheikh	22
El-Sharkeya	29
Damietta	27
Dakahlia	43
El-Beheira	22
El-Garbia	34
El- Menoufia	19
El-Minya	11
Bani Sueif	14
Aswan	14
El-Fayoum	25
Luxor	5
Qena	5
Sohage	6
Ismaila	7
Port Said	5
Suez	3
Assiut and New Valley	5/14
North and South Sinai	12
Red Sea	1
Matrouth	1
Total	370

Source: Egypt country-level assessment, EEAA, 2013.

the fraction of generated wastewater that remains uncollected (and therefore untreated) is not accounted for by this indicator.

Direct comparison of Table 4.5 and Table 4.9 shows that the proportion of wastewater treated is much lower when expressed as a function of wastewater generated rather than wastewater collected. For instance, in Algeria the % treated as a function of wastewater collected is as high as 100 % (Table 4.5). However, when considering the extent of treatment in relation to the generated volumes, only 20.5 % undergoes treatment (Table 4.9). This means that a significant volume of generated wastewater remains uncollected (~ 530 million m³ in 2010: the difference between 730 million m³ generated wastewater and 150 million m³ treated wastewater) and therefore also untreated. Estimates of the amount of untreated wastewater show that at least 5 000 million m³ of raw wastewater are discharged to the environment on an annual basis. This estimate does not include Israel, Lebanon, Libya and Syria.

Analysis of information collected for the UNEP/MAP (2011) inventory of WWTPs shows that a significant volume of wastewater (> 1 million m³ per day) remains untreated in the ENP-South countries, as compared to 2.8 million m³ per day for the whole region. However, it should be noted that the information provided on the volume of wastewater discharged untreated was limited, and therefore these figures are only indicative. An overview of the number and type of WWTPs shows that the proportion of WWTPs that were out of order was much higher in ENP-South countries (58 out of 393 WWTPs, i.e. 15 %) as compared to the overall region (72 out of 1 555 WWTPs, i.e. 5 %). In other words, 80 % (58 of 72) of all WWTPs reported to be out of order were located in ENP-South countries.

Box 4.5 Wastewater management indicators: methodological issues

The volume of municipal wastewater collected by public sewage networks, septic systems and cesspits is difficult to determine. The sources of data for this indicator are generally national water authorities and water supply utilities, river basin/catchment authorities, municipal authorities, industry and field project evaluation reports. It is based on the number of connections to the sewerage system and estimations on the capacity of the areas serviced by septic systems and cesspits.

Data on the volume and type of wastewater treatment are generally based on the performance of wastewater treatment facilities and information from wastewater laboratories. Wastewater treatment, the process of removing contaminants from wastewater, is subject to the standards for environmental protection established at the national level.

There are a number of uncertainties associated with indicators on wastewater, discussed below.

Methodological uncertainties

- Data based on WWTP nominal capacities may in reality be much higher than actual/real capacities.
- Data based on inflowing wastewater volumes to WWTPs may lead to erroneous values in cases of malfunctioning and overflowing WWTPs, where wastewater goes through the WWTPs without proper treatment. For this reason, information on compliance with effluent quality standards should also be considered.
- The definition of primary, secondary and tertiary treatment depends on the set national standards on effluent quality, and may hamper regional coherence and comparability.

Data set uncertainties*Composition of municipal wastewater*

There are many types of wastewater collection systems: separated collection systems, in which rainwater and wastewater are discharged in separate conducts; and mixed collection systems, which discharge rainwater and wastewater in one conduct. Also, municipal wastewater may contain a mixture of urban, commercial, industrial and domestic wastewater, and the composition may vary from country to country.

Table 4.9 Volume of wastewater generated and treated, including an estimation of the volume of wastewater discharged untreated

	Volume of wastewater generated (million m ³) ^a		Volume of wastewater treated (million m ³)		Volume of treated wastewater as a fraction of volume generated (%)		Volume of wastewater discharged untreated (million m ³)	
	2003	2010	2003	2010	2003	2010	2003	2010
Algeria	-	730	-	150	-	20.5	-	219 (2008) 530 ^e
Egypt	-	8 500 (2011)	1 900 (2002)	4800 (2011)	-	56.5	-	3 610 (2010) 3700 ^e
Israel		500 (2007)	432.5	473.8	-	90.6 ^d	-	-
Jordan	147.3	195.3	75.4	103	51.2	52.7	71.9 ^e	92.3 ^e
Lebanon	249 (2001)	310 (2011)	-	-	-	-	-	-
Morocco	650 (2002)	700	-	124	-	17.7	-	576 ^e
Palestine	81.7	99.8 44.8 ^b	-	2.84 ^b	-	6.3 ^b	-	42.0 ^b
Tunisia	240 (2000)	246	197.6 ^c	239.6	-	92.3	-	6.4 ^e

Note: (a) Data are from FAO Aquastat database, except for Jordan and Palestine, for which data are provided by the countries in the context of the project.

(b) Figure only includes West Bank.

(c) Value for 2003 estimated from data for 2006–2010. Data refer to the population under the responsibility of ONAS only, amounting to 6.5 million in 2012.

(d) Assumed average of volume of wastewater treated for 2003 and 2010.

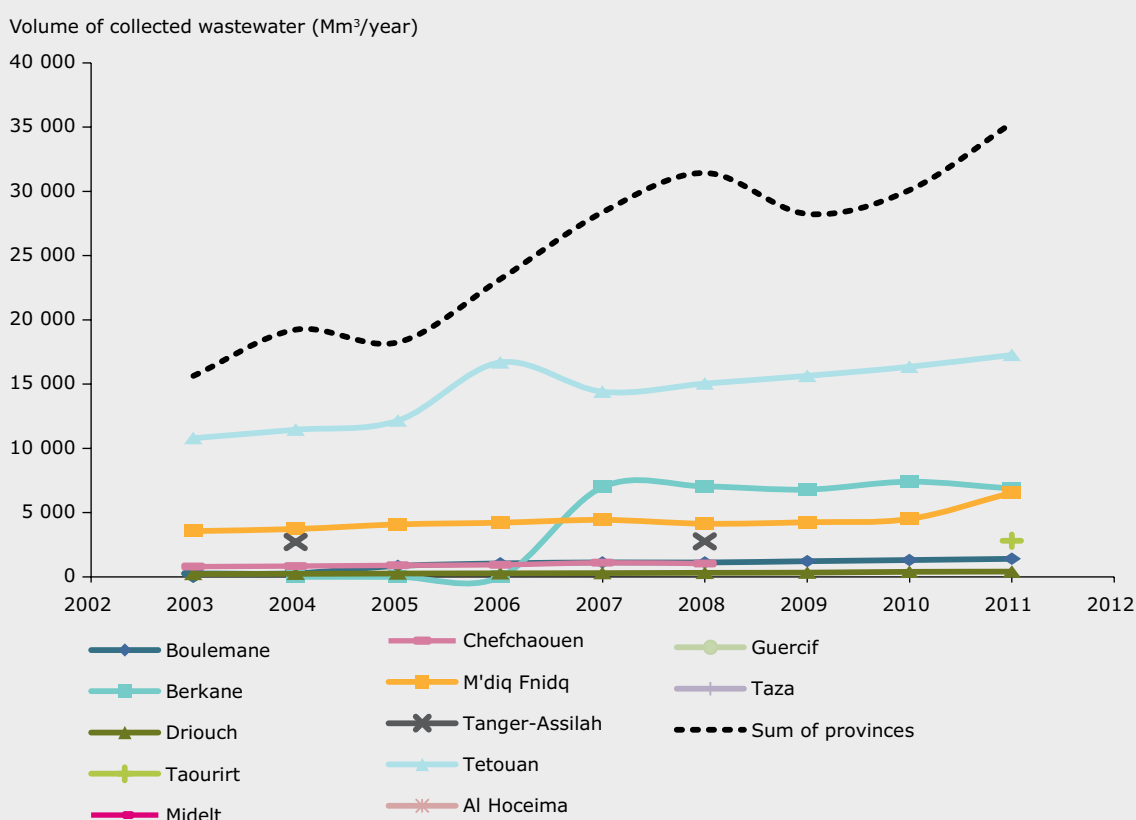
(e) Computed by difference between volume of wastewater generated and volume of wastewater treated.

Source: National sources, H2020 reporting, 2013.

Box 4.6 Wastewater collected and treated in the coastal hydrological basins of Morocco

Data for the communes and provinces in the coastal hydrological basins of Oued Moulouya and Tangier in Morocco show an overall general increase in the volume of wastewater collected in the 16 coastal provinces. The increase in collected wastewater (from ~ 15 000 Mm³/year in 2003 to 35 000 Mm³/year in 2011) not only compensates for the 17 % growth in population over the same time period, but also indicates improved wastewater collection practices and facilities. In fact, data available for selected communes show a gradual increase in the volume of wastewater collected per capita (Table 4.10).

Figure 4.10 Volume of collected wastewater (Mm³/year) in the 16 provinces located in the Mediterranean coastal hydrological basins of Morocco



Note: No data are available for the provinces of Jerada, Nador, Oujda Angad, Midelt, Al Hoceima, Guercif and Taza (total population in 2011: 1.3 million inhabitants). Only partial data are available for Taourirt, Fahs-Anjra and Tanger-Assilah.

Table 4.10 Volume of wastewater collected per capita in selected communes, for which data are available in 2003 and 2011

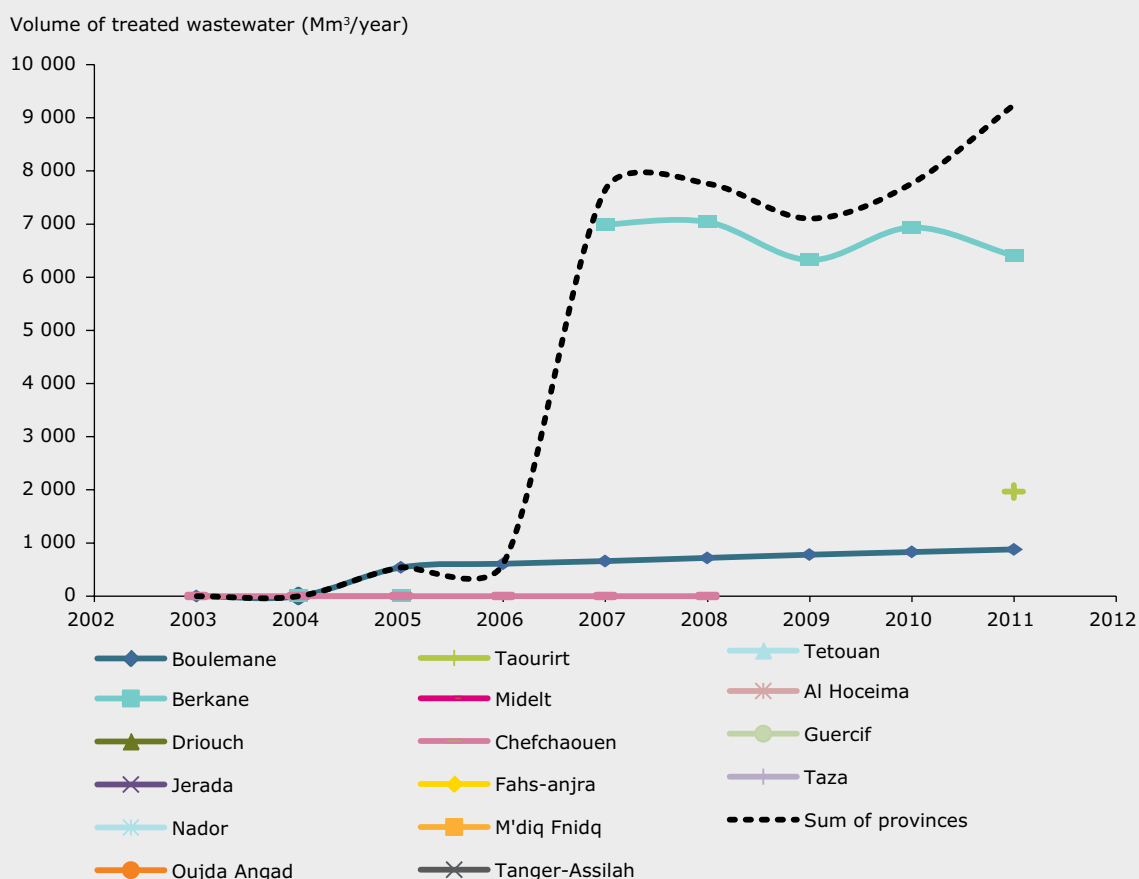
Province	Commune	Volume of wastewater collected per capita (m ³ /year/cap)	
		2003	2011
Boulemane	Missour	13 483	23 170
Driouch	Driouch	12 983	19 202
	Midar	5 486	9 935
	Martil	29 658	40 958
M'diq Fnidq	Fnidq	26 284	41 894
	Martil	29 658	40 958
	Mdiq	25 010	33 481
Tetouan	Tetouan	34 077	42 623

Box 4.6 Wastewater collected and treated in the coastal hydrological basins of Morocco (cont.)

Until the early 2000s, much of the volume of wastewater generated was discharged directly into the environment without treatment. According to available information, the first WWTPs were commissioned in 2004. Currently, there are in total 14 wastewater treatment stations in the area of focus: 2 for primary treatment, 7 for secondary treatment and 5 performing tertiary treatment. Data for the 16 provinces shows a 16-fold increase in the total volume of treated wastewater between 2006 and 2007, mainly attributed to the WWTP commissioned in the province of Berkane in 2007 (Figure 4.11). However, comprehensive data sets on the volume of wastewater treated are largely not available.

According to available information, the treated wastewater is currently not being reused. However, implementation of the Moroccan national water strategy that emphasises the importance of water conservation and the use of unconventional water is expected to promote projects focusing on the reuse of treated water, including the establishment of treatment plants with tertiary treatment.

Figure 4.11 Volume of treated wastewater (Mm³/year) in the 16 provinces located in the Mediterranean coastal hydrological basins of Morocco



Note: Only data for the provinces of Boulemane and Berkane, and partial data for Tourirt and Chefchaouen, are available.

One identified source of environmental pressure in Morocco in relation to the operation of the existing treatment plants is the management of the significant amounts of generated sludge. It is estimated that quantity of produced sludge in the study area was approximately 4 184 tonnes/year in 2010, representing almost 12 % of national production. This production is mainly related to the wastewater treatment in the cities of Nador and Al Hoceima.

Source: Moroccan country-level assessment and indicator data delivered by Morocco under the ENPI-SEIS South project.

4.4 Which are the main wastewater treatment types?

The most common type of treatment in the region is secondary treatment. In ENP-South countries, tertiary treatment is not so commonly operated and is registered in two countries only, namely Israel and Morocco. Primary treatment is surprisingly high in the whole Mediterranean region, mainly due to Italy's contribution: no less than 306 installations for primary treatment were recorded in 2010 (UNEP/MAP, 2011). The fraction 'treatment not determined' is relatively higher in ENP-South countries, reported for 8 % (or 31) of the number of installations, and for 5 % of the wastewater volume (641 151 m³/d).

Only a limited number of countries provided time-series data on the type of wastewater treatment (primary, secondary and tertiary) as part of H2020's Indicator 4. In Israel, a gradual shift from primary treatment to tertiary treatment is observed, with around 40 % of the wastewater undergoing tertiary treatment in 2012 (Figure 4.13). Around 50 % of wastewater is subject to secondary treatment, while 10 % of wastewater undergoes primary treatment. Jordan also experienced a drastic shift from primary to secondary wastewater treatment, with more than 90 % of the wastewater treatment being subject to secondary treatment in 2010 (Figure 4.14). The most significant change occurred between 2006 and 2007 when the WWTP Alkerbeh Al-Samra, which treats more than 50 %

Figure 4.12 Distribution of treatment method by WWTP and by wastewater quantity for Mediterranean countries and ENP-South countries



Source: UNEP/MAP/MED POL, 2011.

Box 4.7 Different types of wastewater treatment

Treatment can comprise a wide range of processes including simple screening, sedimentation, biological-chemical processes, or appropriately designed marine discharge. Depending upon the degree of treatment, the following processes are identified.

Primary treatment (mechanical) removes at least 50 % of suspended matter and reduces BOD₅ values by at least 20 % of initial concentrations.

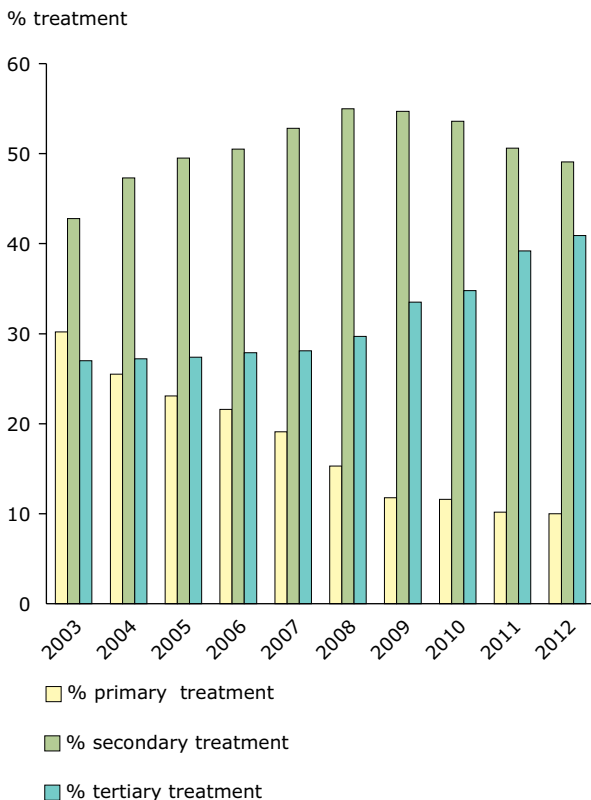
Secondary treatment (biological) uses aerobic or anaerobic microorganisms to decompose most of the organic matter and retain some of the nutrients (around 20 % to 30 %). It reduces the concentration of suspended matter and BOD₅ by 70 % to 90 %, and chemical oxygen demand (COD) concentrations by at least 75 %.

Tertiary treatment (advanced) removes organic matter even more efficiently. It generally includes phosphorus retention, and in some cases, nitrogen removal.

Primary treatment alone does not remove ammonium, whereas secondary (biological) treatment removes around 75 %. Pretreatment involves the application of operations with which bulky matter, sand and gravel, greases and oils are removed from wastewater.

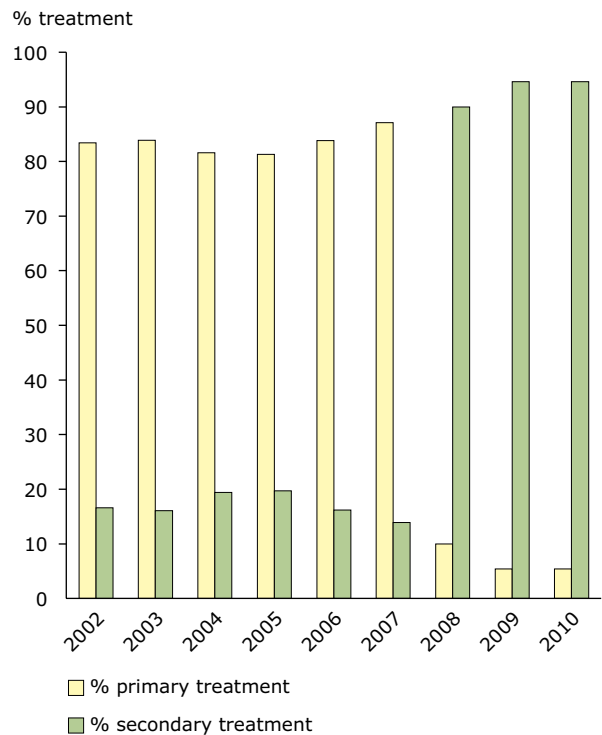
Source: Planning and designing of urban wastewater treatment projects in Mediterranean coastal cities (MAP/UNEP/PAP, 7/TC, 4/1, 1992).

Figure 4.13 Wastewater treatment type during the period 2003–2012 in Israel



Source: National sources, H2020 reporting, 2013.

Figure 4.14 Wastewater treatment type during the period 2003–2012 in Jordan



Source: National sources, H2020 reporting, 2013.

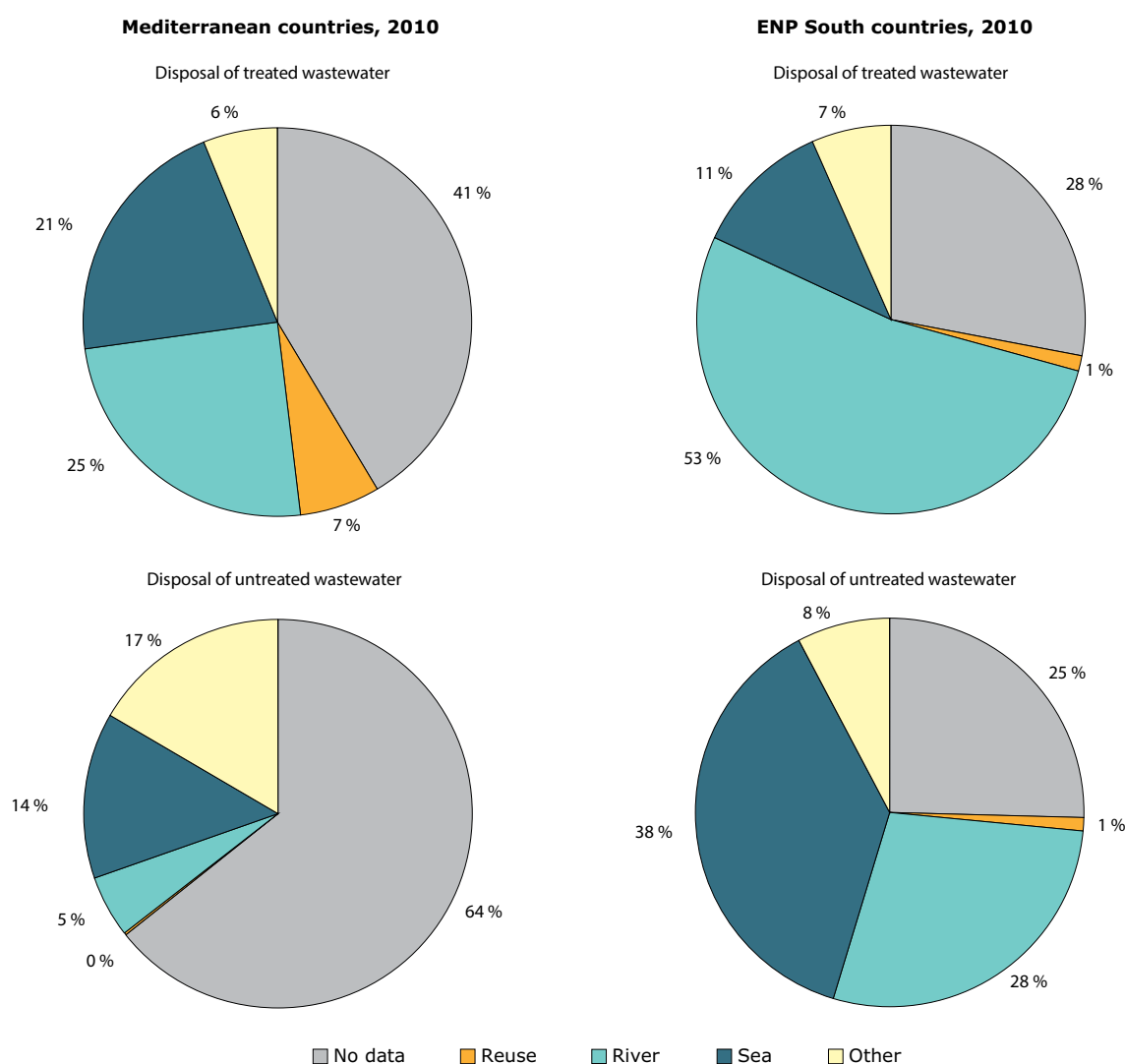
of wastewater, was upgraded to perform biological treatment in addition to mechanical treatment.

Tunisia reported that all WWTPs perform secondary treatment, while a few plants operate tertiary level of treatment. In Palestine, wastewater treatment facilities are restricted to a few localities only, due to the lack of adequate and appropriate infrastructure for wastewater collection and treatment. A very small fraction (~ 5 % to 6 %) of the generated wastewater in the West Bank is being treated in centralised and collective WWTPs. The rest is discharged untreated into the environment. No information on the actual volume of treated wastewater and level of treatment is reported by Lebanon. However, data provided indicate that

the nominal capacity of the operational WWTPs (97.46 million m³ or 267 000 m³/day) greatly exceeds the estimated annual volume of collected wastewater (~ 13.87 million m³).

The type of discharge/disposal determines the fate of treated and untreated wastewater. One of the most common ways of wastewater disposal in coastal areas is via the direct discharge, through outfalls into the sea. Further inland into the catchment area, wastewater is commonly discharged into the rivers, either directly through a discharge pipe or indirectly through streams. Alternatively, wastewater could be reused as a non-conventional source of water, such as for agriculture. Other types of discharge include disposal to the ground or to forests.

Figure 4.15 Disposal of treated and untreated wastewater in the Mediterranean and ENP-South countries



Source: UNEP/MAP/MED POL, 2011.

Based on the analysis carried out by UNEP/MAP/MED POL, (2011), information on the type of discharge of treated and, in particular, untreated wastewater in the Mediterranean region, is largely unavailable (Figure 4.15). In general, the most common ways of disposal of both treated and untreated wastewater is through its discharge, either directly into the sea or into rivers that drain into

the sea. The fraction of treated wastewater that is reused amounts to 7 % in the Mediterranean region. ENP-South country data show that more than half of the treated wastewater is disposed of through discharge into rivers, while the untreated fraction is more likely to be discharged directly into the sea. The extent of reuse of both treated and untreated wastewater is limited to ~ 1 % in ENP-South countries.

Box 4.8 Wastewater reuse

Conditions of water shortages and stress corroborated by high exploitation indices are an indication that water demands cannot be entirely covered by conventional resources. Other complementary non-conventional sources of water, such as wastewater reuse and desalination, are growing in importance. In the Mediterranean, the predominant use for wastewater is agricultural irrigation. Agriculture represents up to 60 % of the global water demand (MED EUWI, 2007a), ~ 65 % of the total water demand in the Mediterranean region and a substantial 80 % in ENPI-South countries (Global Water Partnership WP/Plan Bleu, 2012). Other uses include irrigation of golf courses and other green spaces and artificial recharge of aquifers, as in Jordan, where treated wastewater is also used for artificial recharge of aquifers with non-potable uses (MED EUWI, 2007b).

According to the World Bank (Scheierling et al., 2010), Egypt, Israel, Jordan, Syria and Tunisia are amongst the 20 countries in the world with the largest volume of wastewater used for irrigation (treated and untreated). Jordan is reusing up to 85 % of treated wastewater, while Tunisia is reusing around 20–30 %. Israel is another large user of treated wastewater (280 mm³ per year, around 83 % of total treated wastewater).

Despite the economic, social and environment benefits, wastewater reuse in the Mediterranean region remains rather limited. In ENPI-SEIS countries, only ~ 1 % of treated water is reused (UNEP/MAP 2011) as compared to a global average of 4 % (AFD, 2011). The main obstacles for treated wastewater reuse were identified in a recent Blue Plan paper (Conform et al., 2012).

These include the following.

- Legislative and regulatory framework. The necessary policy framework is non-existent or not adapted to the local context.
- Complexity of treated wastewater reuse, involving cross-sectorial issues.
- Institutional and organisational context. There is no common authority, and a lack of coordination and lack of strategy on reuse of treated wastewater.

Other issues include competition between treated wastewater and conventional water, difficulties in combining the planning of supply and demand over time and space, inadequate storage capacity and sanitation capacity, inadequate monitoring, controls and evaluation, and negative public perception and unacceptability.

A recent review on wastewater reuse in the Mediterranean countries by Kellis et al. (2013) provides an overview of the guidelines and applications governing each country, including a summary of the existing regulations on reuse.

Box 4.8 Wastewater reuse (cont.)**Table 4.11 Current regulations in selected Mediterranean countries**

Country	Regulation in place	Date regulation adopted
ENPI South		
Algeria	No	Reuse prohibited
Egypt	No	1984, 1989 WHO, Martial law prohibits reuse
Israel	Yes	1959
Lebanon	No	Reuse for human consumption prohibited, reuse for crops considered
Libya	No	
Morocco	Yes	1995, WHO
Palestine	Yes	2001
Syria	No	Considered
Tunisia	Yes	1980
EU Med		
Cyprus		2005
France		1999, 2003
Greece		2004, 2011
Italy		2003
Malta		1983, 2001
Spain		1985, 2007
West Balkan and Turkey		
Turkey		Considered

Source: Modified from Kellis et al., 2013.

As a way to improve the sustainable integrated management of non-conventional water resources in the ENP-South region, the Sustainable Water Integrated Management (SWIM) programme 'Sustain Water MED' has identified five demonstration projects for sustainable integrated wastewater treatment and reuse in four Mediterranean countries (Egypt, Jordan, Morocco and Tunisia). Each of the demonstration projects addresses a different aspect pertaining to wastewater treatment and reuse, such as wastewater quality, governance structure between water users and providers, and strategies for eco-sanitation. Another SWIM demonstration project, IMPROWARE⁽¹¹⁾, aims to prompt innovation and best practices on water protection in Mediterranean coastal areas through the reinjection of treated water into over-exploited aquifers. For this project, two pilot areas have been selected in Egypt and Tunisia. The Nobariya site in north Egypt is located in a desert area, where the groundwater is affected by saltwater intrusion. In this location, there is a great need for water availability for agricultural use. The second site, Korba in the north-east of Tunisia, is a region with a high demand for water due to economic activities related to agriculture, agro and textile industries and tourism.

The study concludes that the implementation of wastewater reuse practices is accelerated in countries with stronger economies, higher water needs, and favourable guidelines and regulations. In EU Med countries, a push for development is observed because of the financial incentives associated with EU guidelines established in Member States. In ENP-South countries, the stage of adoption is mainly linked to the state of economic development of the country, and to other considerations such as religious concerns.

⁽¹¹⁾ <http://www.improware.eu/about-improware/the-project>.

Box 4.8 Wastewater reuse (cont.)**References**

Agence Française de Développement, 2011, 'La réutilisation des eaux usées traitées. Perspectives opérationnelles et recommandations pour l'action', Study Report (<http://www.afd.fr>) accessed 8 April 2014.

MED EUWI, 2007a, 'Mediterranean water scarcity and drought report', Technical Report 009 – 2007.

MED EUWI, 2007b, 'Mediterranean wastewater reuse report'.

Condom, N., Lefebvre, M. and Vandome, L., 2012, 'Treated wastewater reuse in the Mediterranean: lessons learned and tools for project development', Plan Bleu, Valbonne (Blue Plan Papers 11) (http://planbleu.org/sites/default/files/publications/cahier11_reut_en.pdf) accessed 10 April 2014.

Global Water Partnership WP/Plan Bleu, 2012, 'Water demand management: the Mediterranean Experience', GWP Technical Focus Paper 1. ([http://www.gwp.org/Global/ToolBox/Publications/Technical%20Focus%20Papers/01%20Water%20Demand%20Management%20-%20The%20Mediterranean%20Experience%20\(2012\)%20English.pdf](http://www.gwp.org/Global/ToolBox/Publications/Technical%20Focus%20Papers/01%20Water%20Demand%20Management%20-%20The%20Mediterranean%20Experience%20(2012)%20English.pdf)) accessed 10 April 2014.

Kellis, M., Kalavrouziotis, I.K. and Gika, P., 2013, 'Review of wastewater reuse in the Mediterranean countries, focusing on regulations and policies for municipal and industrial applications', *Global NEST Journal*, (15) 333–350 (http://journal.gnest.org/sites/default/files/Journal%20Papers/333-350_15-3_936_Kalavrouziotis.pdf) accessed 10 April 2014.

Scheierling, S. M., Bartone, C., Mara, D. and Dreschel, P., 2010, 'Improving Waste Water Use in Agriculture, an Emerging Priority', Policy Research Working Paper # 5412, The World Bank.

See <http://swim-sustain-water.eu/> and <http://www.improware.eu>.

4.5 Coastal and marine waters: are elevated nutrient concentrations in coastal waters decreasing?

Enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, leads to increased primary production and growth of algal biomass, a phenomenon termed as eutrophication. Eutrophication can cause a chain of undesirable effects, including changes in species composition and functioning, reduced water transparency due to an increase in suspended algae, and oxygen depletion and noxious odor due to the decay of organic material. Since nitrogen and phosphorus may also be bound to sediment particles in organic and inorganic forms with the possibility of returning to the dissolved state, particulate and organic forms also have to be taken into account. Chlorophyll-a is a pigment directly related to the presence of such marine algae in coastal and marine waters and is often used as an indirect way of estimating nutrients in sea water.

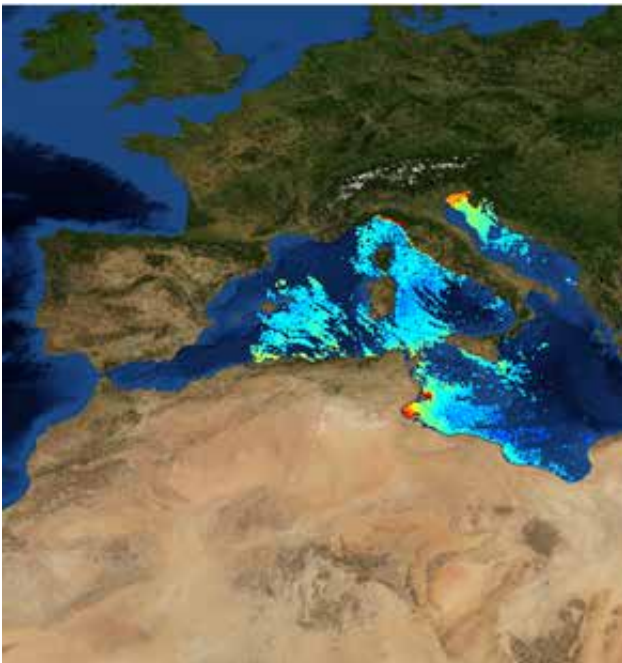
The status of eutrophication in the Mediterranean was assessed in 1996, 2007, and 2012 by UNEP/MAP. In addition, joint eutrophication assessments with the EEA were undertaken in 1999 and 2006. All assessments confirm that the main body of water of the Mediterranean Sea is characterised by very low nutrient concentrations. However some coastal hotspots receive excessive loads of nutrients from sewage effluents, river fluxes, aquaculture farms, fertilisers, and industrial facilities, resulting in intense eutrophic phenomena, with adverse effects for the marine ecosystem and humans. This explains why eutrophication in the Mediterranean is mostly limited to coastal areas, enclosed bays, river estuaries, coastal lagoons or embayments with restricted water exchange with the open sea. Although eutrophication has been more intense in the northern part of the basin, special attention must also be given to the southern part: here, the population is steadily growing, certain agricultural and industrial activities are rapidly developing, and sewage treatment facilities are still lacking.

Satellite images of the Mediterranean (Figure 4.16) reveal that the highest levels of autotrophic biomass correspond to the areas close to river deltas or those off large urban agglomerations. The northern coastline presents most eutrophication

hotspots, whereas open seawaters in the eastern Mediterranean are extremely oligotrophic (UNEP/MAP MTS, 2007). The joint EEA and UNEP/MAP 2006 report on 'Priority issues in the Mediterranean environment' reiterated that

Figure 4.16 Surface chlorophyll-a concentrations in the Mediterranean in January and July 2003 and 2010

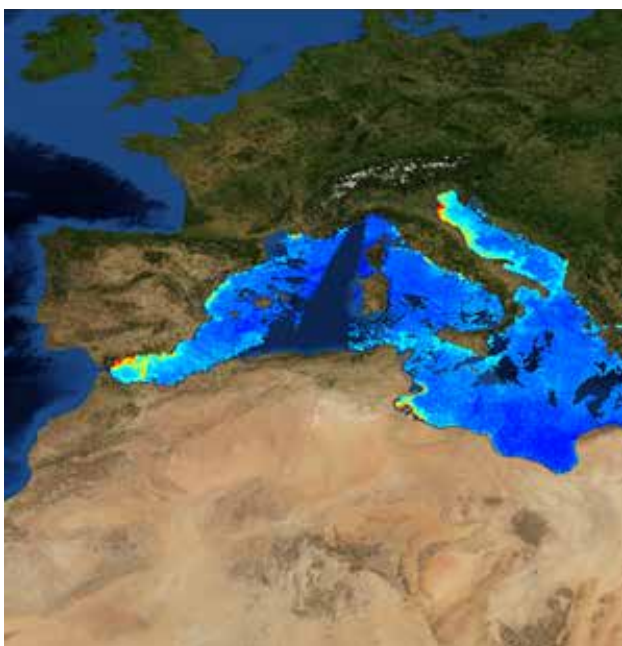
January 2003



January 2010



July 2003



July 2010



Source: MyOcean project 2009–2012 (<http://www.myocean.eu>).

Box 4.9 Nutrients in marine and coastal waters: methodological aspects

One of the H2020 indicator for the Water Priority Area concerns nutrient concentrations in transitional, coastal and marine waters. The main indicator (as defined in the Indicator 5 Fact Sheet) refers to the levels and trends in total nitrogen (TN) and total phosphorus concentration.

Total nitrogen comprises the ions nitrate (NO_3), nitrite (NO_2) and ammonium (NH_4) in the dissolved phase Dissolved Inorganic Nitrogen (DIN) and the organic forms of nitrogen (mostly proteins and other N-containing substances) existing in biota and other particulate materials (particulate organic nitrogen or PON) and in dissolved organic matter (dissolved organic nitrogen or DON).

Total phosphorus (TotP) comprises the dissolved ion phosphate and the organic forms of phosphorus existing in biota and other particulate materials (particulate organic phosphorus or POP) and in dissolved organic matter (dissolved organic phosphorus or DOP). As mentioned in the fact sheet, annual values of the main indicators are to be used. Alternatively and additionally, winter and summer values may be used where available. All indicator values are depth-integrated values. Sub-indicators nitrates (NO_3), nitrites (NO_2), ammonia (NH_4) and orthophosphates (o-PO_4) are to be used exceptionally, at this stage.

The MED POL programme receives and collects information on nutrients in hotspots, from various countries, although not on a regular basis. Most of the data collection stations are located near coastal wastewater effluents and treatment plants.

Difficulties arising from the choice of parameters and frequency of reporting

Data on nutrients in marine and coastal areas come from the analysis of water samples collected in various grid stations, selected and decided upon by countries, and monitored on a more or less regular basis. The parameters measured and analysed may be TotN and TotP, as well as NO_3 , NO_2 , NH_4 and o-PO_4 . In the context of the present study, total nitrogen and total phosphorus have been identified as main nutrient indicators, while the rest are considered sub-indicators. Reporting of nutrient data by countries to MED POL is on a voluntary basis. Not all countries have reported such data on a more or less regular basis. Whether data were not collected or were collected and not reported is unclear and remains to be clarified. Finally, not all countries have reported the same indicator data; some have reported main indicator data, while others reported sub-indicators, making comparison on a regional scale a difficult exercise. Countries should be encouraged to measure and report at least the main indicators on a regular basis, as far as possible.

Data sets uncertainties

The methodology for measuring nutrient data in a marine water sample is basically standardised, and presents no major difficulties. The difficulties and uncertainties are mostly related to the choice of the sampling stations per se and of the sampling depth. In very shallow waters which are vertically homogenised by wave and tidal mixing, the sampling depth plays no role. In deeper stations and especially when a more or less important thermocline is established in the water column, the sampling depth may play a crucial role in the results obtained, depending on whether it is located above, at, or below the thermocline.

As already mentioned above, a question to be posed for further discussion with countries is that of the possibility of streamlining the data each country sends, in order to make the regional assessments more meaningful.

eutrophication is still a major environmental problem in the coastal zone of Mediterranean. In fact, 15 coastal countries had reported on facing eutrophication problems, among which 11 countries characterised these problems as medium (Albania, Algeria, Greece, France, Israel, Morocco, Palestine,

Slovenia, Spain, Syria and Tunisia) and 4 countries as important (Croatia, Egypt, Italy, Turkey).

Most Mediterranean countries use nutrient concentrations (N, P) as eutrophication state parameters, and chlorophyll-a concentrations,

dissolved oxygen and in several cases, toxic phytoplankton occurrence, toxins in shellfish tissues, mortality of organisms, N/P or even faecal coliforms as impact parameters.

Monitoring eutrophication

From its inception, UNEP/MAP-MED POL program included the study of eutrophication as part of the seven pilot projects approved by the Contracting Parties at the Barcelona Meeting in 1975 (UNEP/MAP, 1990). The coordinating work of UNEP/MAP with regard to the eutrophication of Mediterranean coastal areas always responded to the importance of its impact on coastal resources (tourism, fisheries, ecosystem).

At the end of the Pilot Phase of MED POL, a Long-term Programme (MED POL Phase II) was launched (1981–1990), the implementation of which was also coordinated by UNEP/MAP, but under the direct responsibility of the Governments through their Focal Points and National Coordinators. Individual country Monitoring Programmes were negotiated in which the monitoring and research activities to be carried out by national institutions were defined eventually with the financial support of UNEP/MAP. Other eutrophication pilot projects were implemented in the framework of MED POL Phase III and IV and as a result several Mediterranean countries have monitored and reported on annual basis a number of parameters related to nutrient concentration in coastal waters and eutrophication.

National Monitoring Programmes

Morocco

The National Monitoring Programme of Morocco has made a number of campaigns of measurement of orthophosphate, total phosphorus, dissolved oxygen and temperature in the waters of the oueds and WWTPs but no measurement in the receiving body where the eutrophication may develop with the extra nutrients discharged. In this regard it is not possible to assess the level of eutrophication existing in the coastal zone although it is more than probable that a certain level of eutrophication develops in the lagoon of Nador or Mar Chica.

Algeria

The National Monitoring Programme of Algeria has made two sampling campaigns in 2011 and 2012 measuring total phosphorus, orthophosphate, dissolved oxygen and temperature at a number

of oueds and effluents but no measurement in the receiving coastal waters. However, the coastline being rather open, it is not very probable that any signs of eutrophication may develop in such areas, except in the near field of the ports and bays where the oueds discharge.

Tunisia

In the framework of the National Monitoring Programme of Tunisia the following stations were monitored systematically between 2003 and 2011: B1 (émissaire), B2 and B3 (Menzel Jemil) in the Bay of Bizerte, T2 (Canal), S3A (Éstuaire Méliene) and CHOU (Rejet Choutrana) in the area of Tunis, G1 in Akarit — Gabès, S2 in Barraka — Sfax and M1 in Oued Chouâba — Médenine (Map 4.3). Both total phosphorus and total nitrogen and chlorophyll were measured. The high values obtained indicate that the objective of study were the outfalls rather than the receiving bodies. It is thus difficult to make an assessment of the degree of eutrophication existing in places, such as the Bay of Bizerte or the Lake of Tunis.

Libya

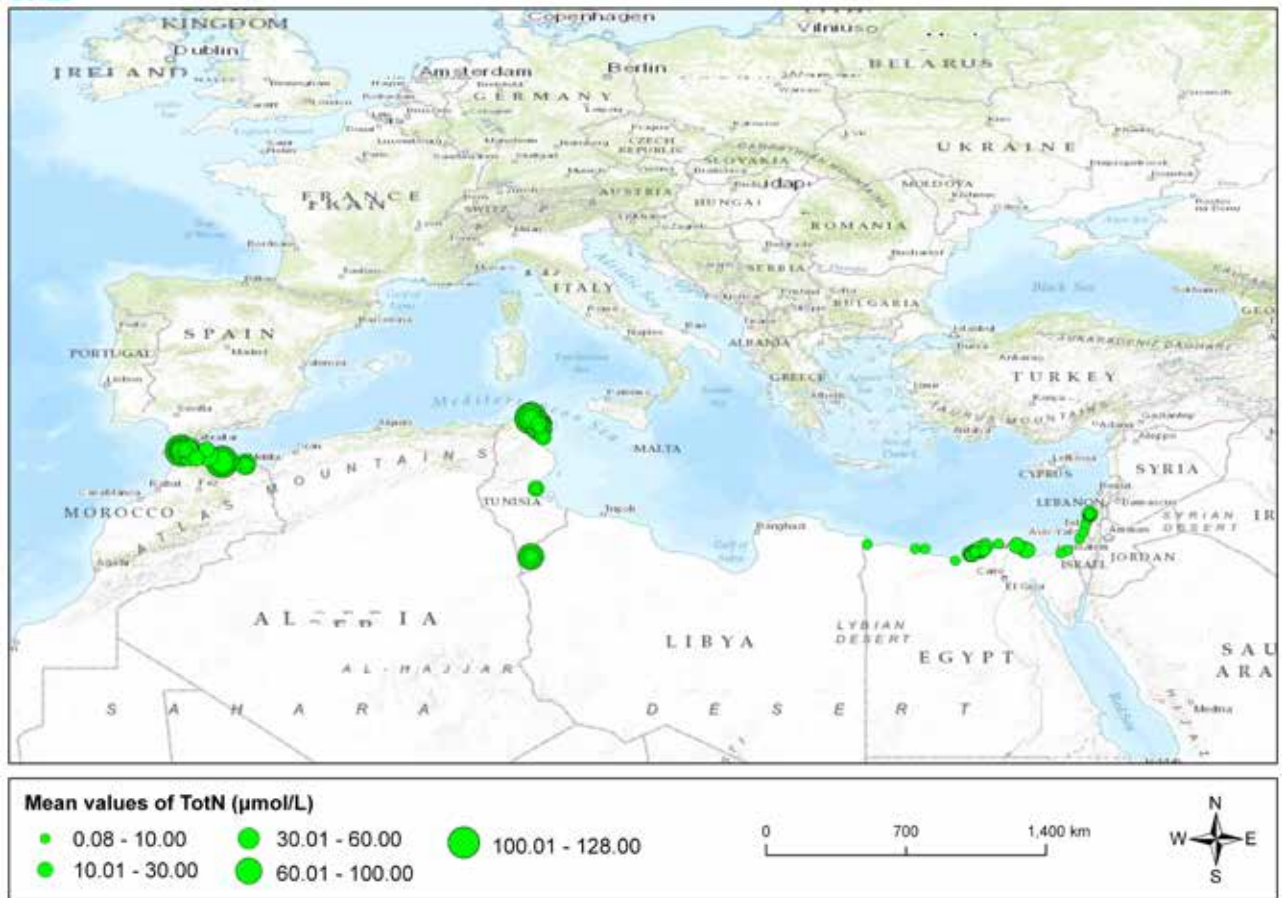
No data are available.

Egypt

The National Monitoring Programme of Egypt covers a number of coastal stations at *El Mex*, *Abu Qir East*, *Port Said*, *Abu Qir Bay*, *Alexandria eastern Harbour*, *Rashid* and *Damietta*. According to the data reported, the values of total phosphorus are negatively correlated with salinity, corresponding to the estuarine area around the Nile. The orthophosphate and nitrate values given are consistent with a generalised mildly eutrophic area around most of the coastline of Egypt. There is a general negative correlation of nutrients with salinity. However, coastal dynamics should be taken into consideration before assessing the general trends in the levels of eutrophication of the area.

Israel

The National Monitoring Programme of Israel covers a large number of stations from Ashkelon in the south to Akko in the north (Map 4.4). Many of the stations are located in the Bay of Haifa and one of them, visited weekly, outside Israel Oceanographic and Limnological Research (IOLR) institution, the laboratory carrying out the monitoring work. After some initial high values (in 2001), all the stations have experienced a significant lowering of the phosphate concentrations thus indicating the inexistence of eutrophication in the coast of Israel. Nevertheless, the station off IOLR shows anomalously high nutrient concentrations, possibly indicating the discharge of poorly treated sewage effluent.

Map 4.2 Location of total nitrogen sampling stations (with proportional symbols)

Source: UNEP/ MAP/MED POL Monitoring database, 2011.

Lebanon

No data are available.

As a conclusion, with the exception of some significant stretches of coastline (Libya, Palestine and Lebanon and Syria for which there are no data available), all the coastal areas from Gibraltar to the Iskenderun Bay area (south and east Mediterranean Sea) are being monitored in one way or another and the relevant data reported to UNEP/MAP. An in-depth analysis of relevant available monitoring data is presented below on country level and sub regional level.

Data for total nitrogen from Morocco and Egypt are too few to form a time series (2006, 2007, and 2009, 2010, respectively). Nevertheless the two values from each country show almost no variability with values around $35 \mu\text{mol/L}$ and $10 \mu\text{mol/L}$, respectively.

The time series from Tunisia shows a significant variability with values that increase from 2005 to

2008, to almost double, and then decrease back, close to their original values. This can be attributed to a variety of reasons, and definitely calls for further examination. All high Tunisia values in the period 2007–2010 are found in stations in the Gulf of Tunis and in Bizerte (see Figures 4.17 and 4.18).

Except for 2002, no winter values for Israel exist. Summer values form a time series with low variability after 2007, although a clear, almost linear increasing pattern of values is obvious (Figure 4.19). The trend from 2007 to 2011 is approximately $0.7 \mu\text{mol/L}$ per year.

Comparison between country values is not evident, for the following two main reasons.

- The geographical span of stations may differ substantially from one country to another; in other words, in one case, stations may all be concentrated next to an effluent, whereas in other cases, they may cover a larger area.

Map 4.3 Detailed map showing total nitrogen sampling stations in Tunisia



Source: UNEP/MAP/MED POL monitoring database, 2002–2011.

Map 4.4 Detailed map showing total nitrogen sampling stations in Israel



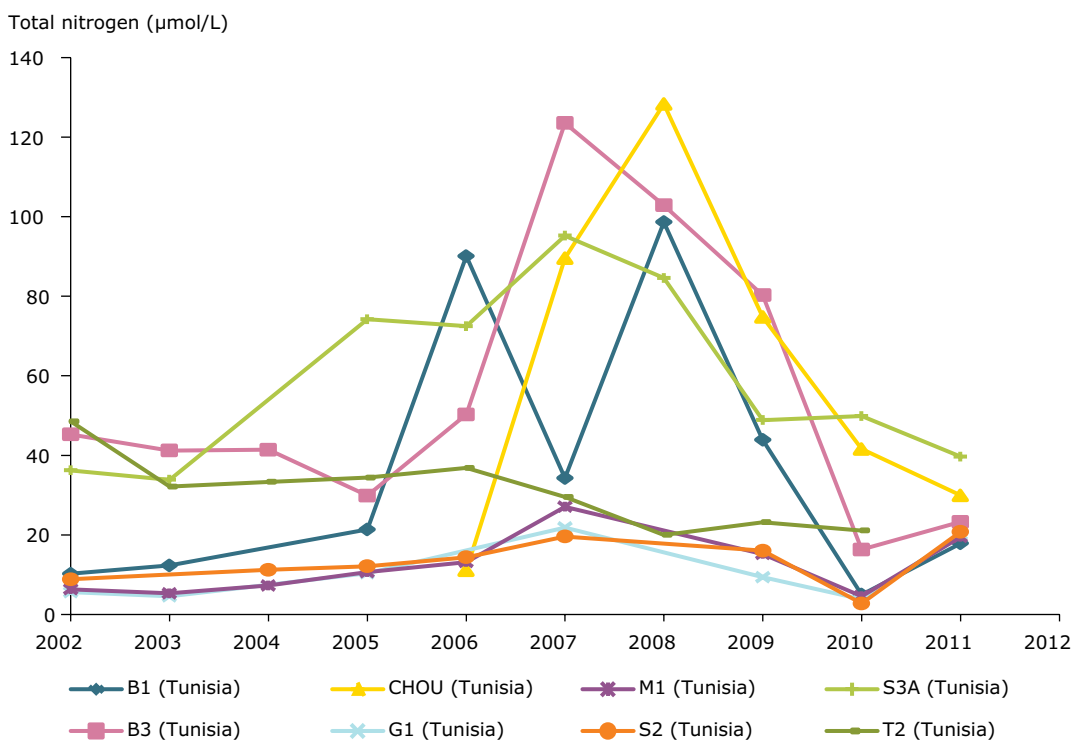
Source: UNEP/MAP/MED POL monitoring database, 2002–2011.

- Bathymetry may substantially differ from one case to another.

It is evident from Map 4.2 that higher total nitrogen values can be observed along the coasts of Morocco and Tunisia, compared to those off the coasts of Egypt and Israel. This fact should be interpreted with caution: by no means does it indicate a higher human activity-induced load along the Moroccan and Tunisian coasts. As shown by the satellite images, the

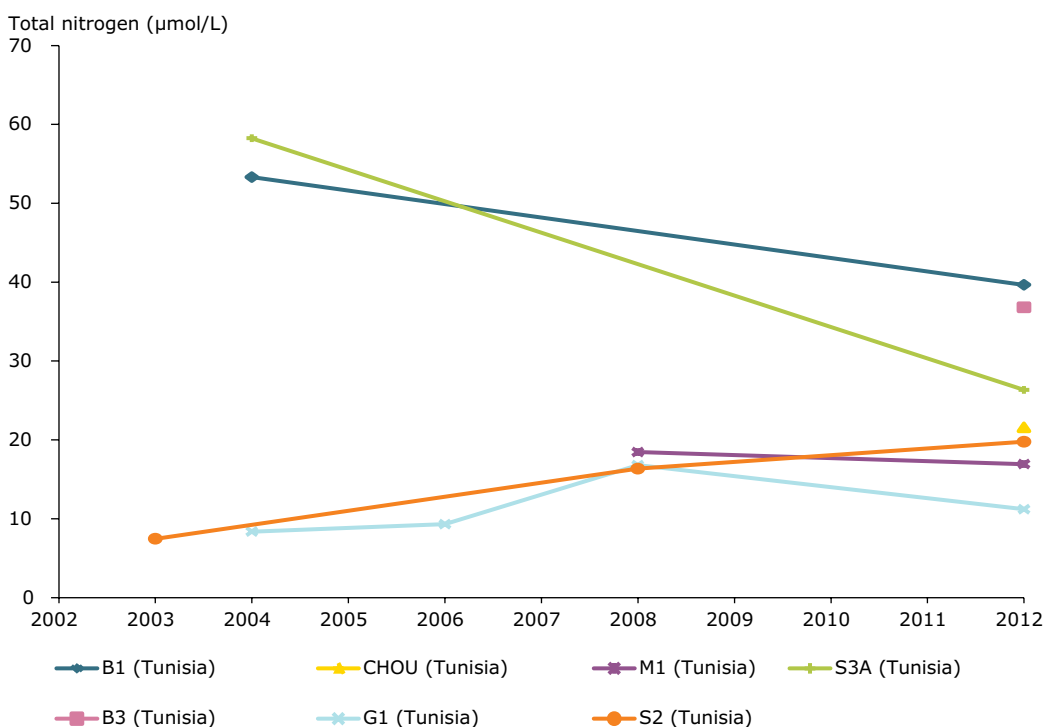
nutrient-rich Atlantic waters enter the Mediterranean Sea through the Strait of Gibraltar, and after being caught in the Alboran Sea gyres, they move eastward along the North African coasts. This is the main reason for the high nutrient 'background' values observed. This pattern varies in intensity from season to season, with an important interannual variability, of course. The pattern can be modulated or even reversed by human activity, but this seems not to be the case for total nitrogen.

Figure 4.17 Total nitrogen concentrations (mean summer) in Tunisian stations for the time period 2002–2011



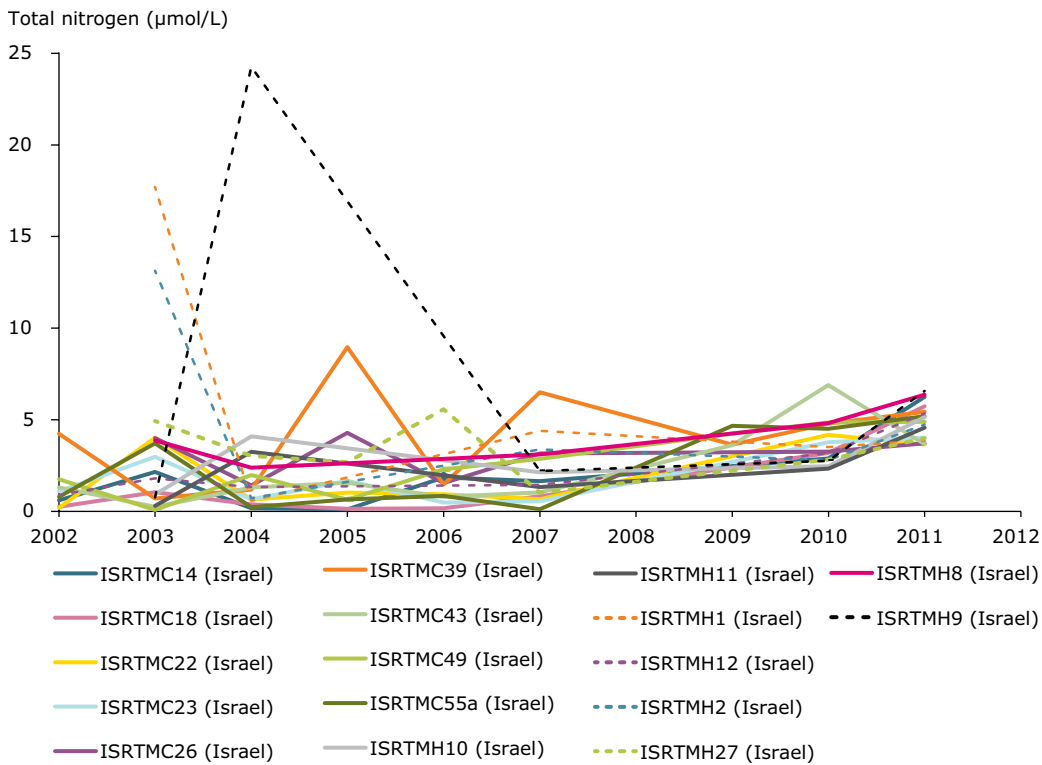
Source: UNEP/MAP/MED POL monitoring database, 2002–2011.

Figure 4.18 Total nitrogen concentrations (mean winter) in Tunisian stations for the time period 2002–2011



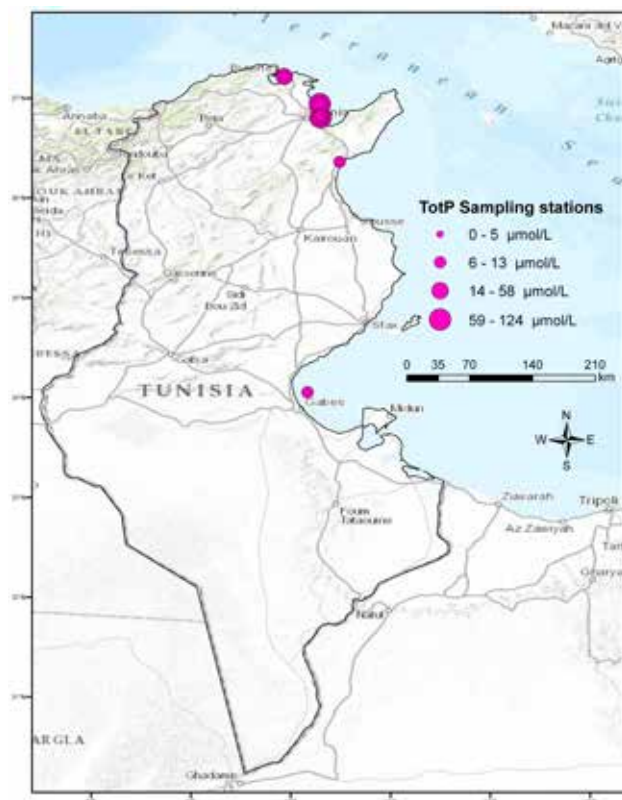
Source: UNEP/MAP/MED POL monitoring database, 2002–2011.

Figure 4.19 Total nitrogen concentrations (mean summer) in Israeli stations for the time period 2002–2011

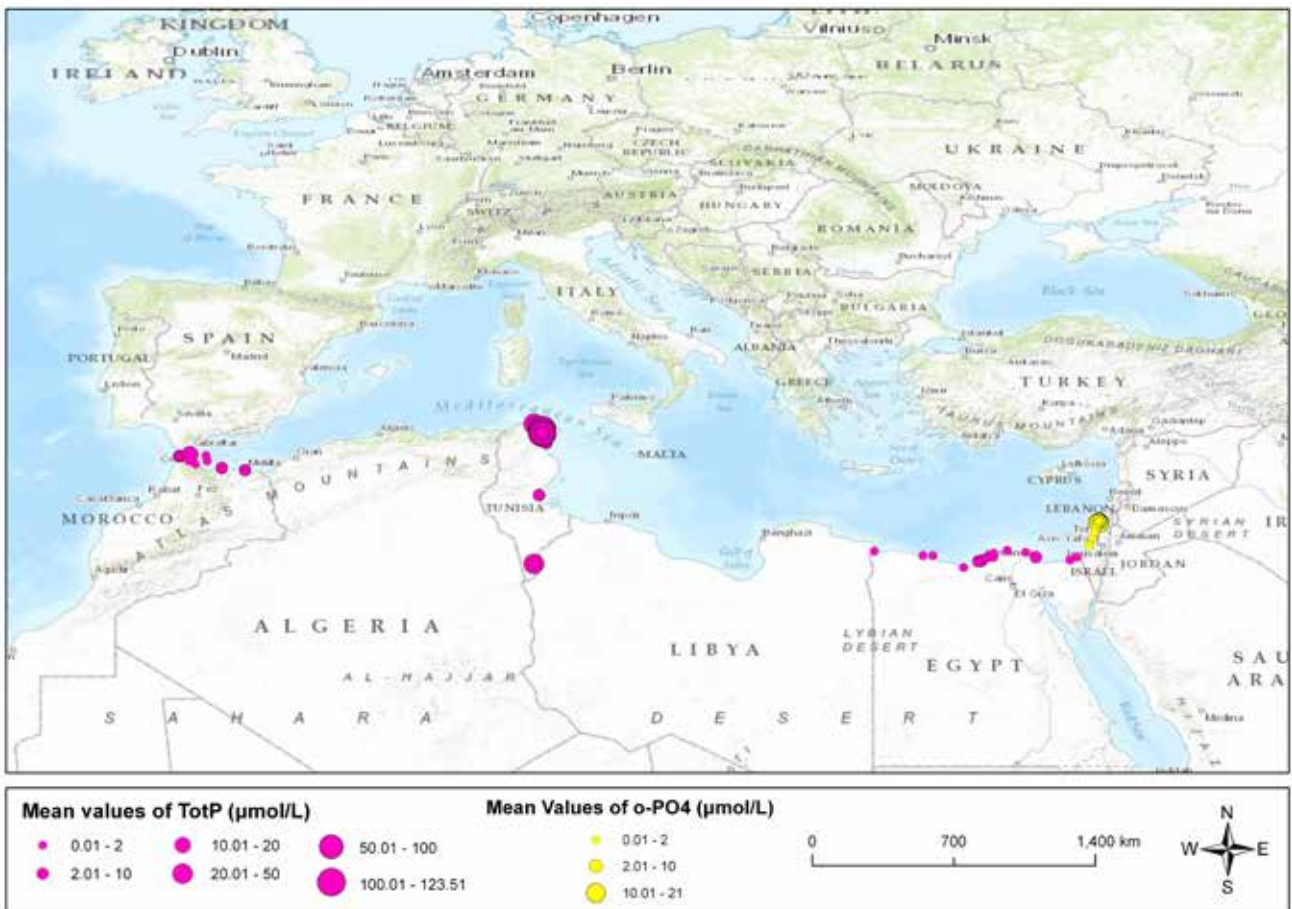


Source: UNEP/MAP/MED POL monitoring database, 2002–2011.

Map 4.5 Detailed map showing total phosphorus sampling stations in Tunisia

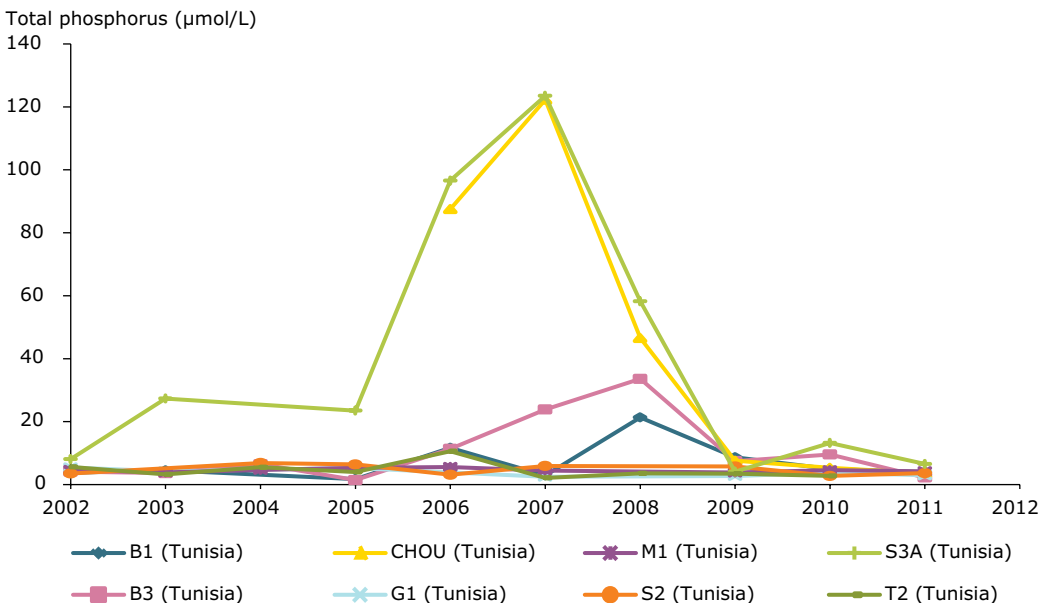


Map 4.6 Location of total phosphorus and orthophosphate sampling stations (with proportional symbols)



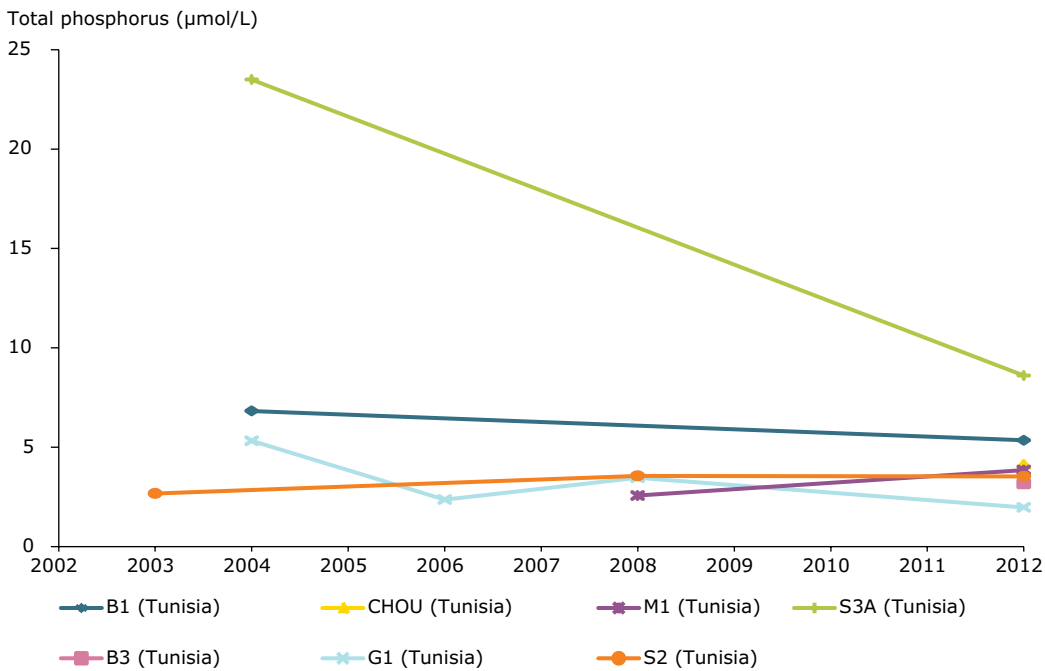
Source: UNEP/MAP/MED POL monitoring database, 2002-2011.

Figure 4.20 Total phosphorus concentrations (mean summer) in Tunisian stations for the time period 2002-2011



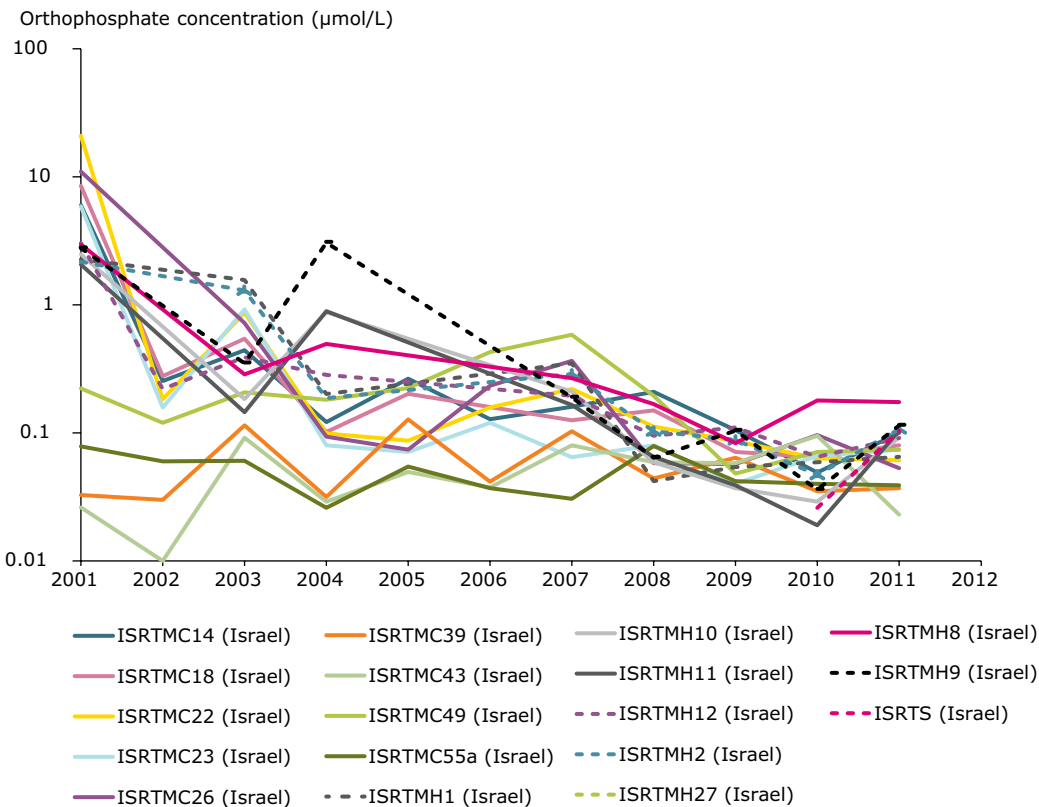
Source: UNEP/MAP/MED POL monitoring database, 2002-2011.

Figure 4.21 Total phosphorus concentrations (mean winter) in Tunisian stations for the time period 2003–2012



Source: UNEP/MAP/MED POL monitoring database, 2002–2011.

Figure 4.22 Orthophosphate concentrations (mean summer) in Israeli stations for the time period 2001–2012



Source: UNEP/MAP/MED POL monitoring database, 2002–2011.

Data for total phosphorus from Morocco and Egypt (not shown) are too few to form a time series (2006, 2007 and 2009, 2010, respectively). Values range from 1 to 9 and from 1 to 3 $\mu\text{mol/L}$ in Morocco and Egypt.

Summer values of total phosphorus in Tunisian stations CHOU, S3A and to a lesser degree B3 have substantially high values going up to 120 $\mu\text{mol/L}$ for the 3-year period from 2006 through 2008, as was the case for total nitrogen. For the rest of the stations values are more or less stable in each of them, with values ranging from 4 $\mu\text{mol/L}$ to 10 $\mu\text{mol/L}$, depending on the station (Figures 4.20 and 4.21).

Israel has not reported total phosphorus data; instead, it had provided orthophosphate (o-PO_4) data (Figure 4.22).

Data from Israel show a steady and continuous decrease in o-PO_4 values, going from 0.8 $\mu\text{mol/L}$ to 0.08 $\mu\text{mol/L}$ from 2004 to 2012 (a decreasing trend of 0.09 $\mu\text{mol/L}$ per year).

The location of total phosphorus (and o-PO_4 , for Israel) sampling stations (with proportional symbols) (see Map 4.4) indicate a reversal of the pattern observed for total nitrogen, namely the west–east decrease, compatible with the general circulation of the Atlantic waters. Here, an increase in total phosphorus is observed from Tunisia to Morocco, a clear indication that the higher values in Morocco are induced by human activities.

As explained above, the oceanographic conditions are far from being homogeneous although, apart from the area around the Straits of Gibraltar and the Alboran Sea, they indicate a rather dynamic (Algerian current) oligotrophic environment. The only exception is the area off the Nile river delta that shows a relatively mesotrophic coastal environment due to natural and man-made causes.

Yet it is not possible to make a comparison of the conditions prevailing in the various national sections, covered by national monitoring programmes of different characteristics: If the Israel and, to some extent, the Egyptian programmes focus on the open sea coastal waters, the Moroccan, Algerian and Tunisian programmes focus on the oueds and other effluents.

While the two first programmes (Israel and Egypt) reflect the eutrophic status of the marine coastal waters, the other three programmes do not permit a clear view of the eutrophic state of the coastal waters to be obtained (Tunisia, Algeria and Morocco). A reformulation of the programmes ought to be made if the goal is to obtain an assessment of the coastal eutrophication of the entire Mediterranean Sea or of parts thereof.

Like in Israel, eutrophic situations should not be expected in open coastal stretches. However, a special interest ought to be applied to the surveillance of enclosed bays and lagoons (Mar Chica, Bizerta Bay, Lac de Tunis, Djerbah) very much prone to eutrophication due to the restrictions in water dynamics and the heavy loads of urban, industrial and agricultural waste waters being discharged in them.

In view of the above there is a need for a remodeling of the national monitoring programmes in particular in those countries in which the present programmes focus on the effluents and land-based sources only. In the framework of Ecosystem approach implementation, UNEP/MAP is undertaking an adjustment of the monitoring programme to expand its geographical scope and enlarge the number of related parameters. It is also recommended that the H2020 indicator on nutrient concentration in coastal waters follows the same approach as UNEP/MAP. Chlorophyll-a and dissolved oxygen are two important parameters that ought to be included in all the programmes.

Box 4.10 Brief country assessment

The first MED POL assessment report on eutrophication was prepared by a group of experts on eutrophication and published as document UNEP(OCA)/MED WG.111/Inf.5 and as MTS 106 (UNEP/FAO/WHO, 1996). It describes the state of eutrophication in the Mediterranean Sea until the 1990s, and covers the main themes relating to this phenomenon, through an accurate analysis of the theoretical aspects as well as by describing the circumstances, effects and remedies to be applied.

Later, the EEA/UNEP (1999) report, 'State and pressures of the marine and coastal Mediterranean environment', pointed out that the problem of eutrophication appeared to be limited to the Mediterranean. The report reviewed, updated and summarised the recorded eutrophication incidents and related side-effects, though information was not always available, partly because of insufficient eutrophication monitoring throughout the basin.

In a more recent joint EEA and UNEP/MAP (2006) report, 'Priority issues in the Mediterranean environment', it is stated that eutrophication is still a major environmental problem in the coastal zone of Mediterranean. In fact, seven ENP-South countries had reported facing eutrophication problems, six of which characterised these problems as medium (Algeria, Israel, Morocco, Palestine, Syria and Tunisia) and one country as important (Egypt).

Two more recent documents on the subject were published, a UNEP/MAP (2007) document entitled 'Approaches to the assessment of eutrophication in Mediterranean coastal waters (first draft)', and a UNEP/MAP (2009) document entitled 'Eutrophication in the Mediterranean Sea: an assessment and road map for future action' (2009), prepared by A. Cruzado confirm the findings of the previous reports.

In **Algeria**, with regard to eutrophication, the following parameters were determined: total nitrogen, nitrates, total phosphorus, and orthophosphates together with other complementary data, such as BOD₅, COD, pH, temperature, dissolved oxygen and 'oil and grease'. Two sampling campaigns were carried out in 2012 covering a total of eight points along the 1 000 km long coastline of Algeria. It is not easy to assess the level of eutrophication with the data available. Nutrient pollution can be identified in most sites, but symptoms of eutrophication are detected in two locations characterised as 'hotspots' near Algier and Arzew ⁽¹²⁾.

In **Egypt**, four eutrophic sites were reported (El Mex, Abu Qir East, Port Said and Abu Qir Bay), and three sites were reported as being at risk of becoming eutrophic (Alexandria eastern harbour, Rashid and Damietta), in 1997.

Cases of acute eutrophication in Egyptian waters have been reported mainly from the ports and coastal waters off Alexandria, and from the lagoons in the Nile delta for several decades (UNEP/FAO/WHO, 1996). Overall, eutrophication and the worsening of water quality (abnormal water colours, anoxia in bottom waters and production of hydrogen sulphide) in Egyptian coastal and brackish waters are caused by the combination of several factors: (a) large inputs of fertilising substances from urban, agricultural and industrial sources; (b) the long water-residence times in the lagoons, partly due to physical barriers; (c) salinity stratification of the waters; and (d) generally high water temperatures.

El Mex

El Mex is situated at the western part of Alexandria Area. El Mex receives water from the heavily polluted Lake Maryut, into which many industries discharge their wastewater, and also domestic sewage from residential areas.

⁽¹²⁾ PROJET: MEL-2322-2B93-2664-2203 Surveillance de la qualite physico-chimique du milieu marin (eux-sediments-biotes), Final Report, 2013.

Box 4.10 Brief country assessment (cont.)**Abu Qir East**

This is an industrial area that also receives domestic sewage. Industry contributes markedly to marine pollution through the discharge of hazardous effluents.

Port Said

Port Said is situated at the mouth of the Suez Canal. There are resort areas with bathing beaches. The major source of marine pollution is sewage discharged into Lake Manzala, which is connected to the Mediterranean Sea west of Port Said. Polluted water from the lake may be transported along the beaches of Port Said by the prevailing east-going currents. There is also a shipyard and a number of plants discharging wastewater. The seabed off Port Said is sandy. Along the coast there is a high abundance of *Donax* mussels that are exploited by fishermen. The abundance of *Donax* mussels seems to increase in areas near sewage outlets (such as Alexandria, Rashid, Damietta and Port Said). *Donax* mussels seem to be a suitable monitoring organism for toxic substances.

Abu Qir Bay

The Abu Qir Bay is also heavily polluted and there is an outlet at the Tabia pumping station. This outlet receives water from agricultural drains and wastewater from textile mills.

Alexandria eastern harbour

Alexandria harbour is a fishing port and receives effluents from boats and domestic sewage. It also receives discharge from shipyards.

Rashid

Rashid is a popular tourist city, mainly visited by Egyptians. There are many brick factories in the area and they use bunker oil. The marine waters off the Rosetta branch receive Nile water contaminated with hazardous industrial waste, domestic sewage, fertilisers and pesticides from agricultural activities. The water also contains wastewater from a pesticide plant at Kafr el Zaiyât in the Delta.

Damietta

This is the second branch of the Nile River. The major sources of marine pollution in the area are water from the Damietta branch of the Nile contaminated with hazardous industrial waste, domestic sewage as well as fertilisers and pesticides from agricultural activities, domestic sewage from the residential area and the resort.

In **Lebanon**, the National Centre for Marine Sciences (one of four subsidiary branches of the Lebanese National Centre for Scientific Research) runs several seawater quality monitoring programmes covering physical, chemical (including nutrient concentrations), hydrological and microbiological parameters under the CANA project. Starting in May 2013, the University of Balamand (UOB) — Institute of Environment (IOE) will conduct seawater quality monitoring in the context of the PEGASO project.

In **Morocco**, seawater eutrophication problems and hotspots are not mentioned, but reference is made in the country report to wastewater, i.e. that some of this water might create eutrophication problems.

In **Tunisia**, the data analysis presented, as well as the country report of Tunisia for 2012 indicate a substantial improvement (decrease) of nutrients present in seawater, both in the hotspot stations (S3A, CHOU, B3) as well as in all reference stations, from 2009 (Figure 4.17 and Figure 4.20).

For most stations, values of chlorophyll-a remain basically unchanged since 2007, with values lower than 5 mg/m³. These results, combined with the nutrient values, indicate that eutrophication events are not likely to be observed.

5 Why are industrial emissions a H2020 priority issue?

Industrial pollution is generated on a wide scale along the Mediterranean coastline. Industrial pollution is one of the major environmental pressures addressed by the Land-Based Protocol (LBS) of the Barcelona Convention and its related policy and regulatory framework, at both regional and national levels, e.g. the Strategic Action Programme SAP MED and the National Action Plans (NAPs) to combat pollution from land-based sources and activities. Most of the countries are making significant efforts to control pollution from this source by developing specific strategies for dealing with wastewater treatment, solid waste management and abatement of air pollution, and are issuing, inter alia, legislation on Effluent Limit Values (ELVs) for specific industrial sectors and/or specific pollutants, as well as Environmental Quality Standards (EQSs) for the receiving waterbodies.

All countries have introduced legal measures for the protection from SAP pollutants generated in the urban environment or discharged from industrial facilities/activities. Most of the environmental legislation includes specific measures regarding the establishment of monitoring systems for SAP priority pollutants, regular reporting, authorisation and regulation of discharges of wastewater and air emissions from industrial and urban installations, and implementation of sanctions in cases of non-compliance. In this respect, legislation reflects the traditional pollution command and control tools, and it is relatively weak in promoting economic instruments to combat LBS pollution in a considerable number of countries.

In spite of measures taken, pressures from the industrial sector across a considerable part of the Mediterranean coastline are too high. In addition, the measures taken do not operate effectively everywhere, and additional measures are required, due to gaps in the legislation and/or lack of proper enforcement of permission and compliance. As a consequence, industrial pollution control and its monitoring still constitutes a big challenge for most Mediterranean countries (UNEP/MAP MED POL, 2006; UNEP/MAP MED POL, 2014).

According to NAP implementation evaluation report (UNEP/MAP MED POL, 2014), industrial pollution has been addressed at policy level by almost all the countries, in the context of developing strategies for:

- a) protecting the urban environment from municipal wastewater, solid waste, and air pollution;
- b) protecting human health and the marine environment from priority pollutants emitted from industrial activities such as persistent organic pollutants (POPs) and heavy metals;
- c) specifically dealing with wastewater treatment, solid waste management and abatement of air pollution, or incorporating these policies into framework strategies such as sustainable development, national environmental protection and ICZM;
- d) specifically dealing with the management of hazardous wastes, e.g. those containing polychlorinated biphenyls (PCBs), heavy metals and other POPs.

All Mediterranean countries have put in place a marine pollution monitoring and reporting system from industrial sources under UNEP/MAP and other policy frameworks, as appropriate. An inventory of pollutants through the national baseline budget (NBB) to the Mediterranean Sea is normally reported every 2 and 5 years to the UNEP/MAP Secretariat. Although the preparation of such inventories and the reporting capabilities of Mediterranean countries have improved over the years (2003 and 2008), establishing a coherent and sustainable system requires further efforts at regional and national levels, in particular for the eastern and southern parts of the Mediterranean.

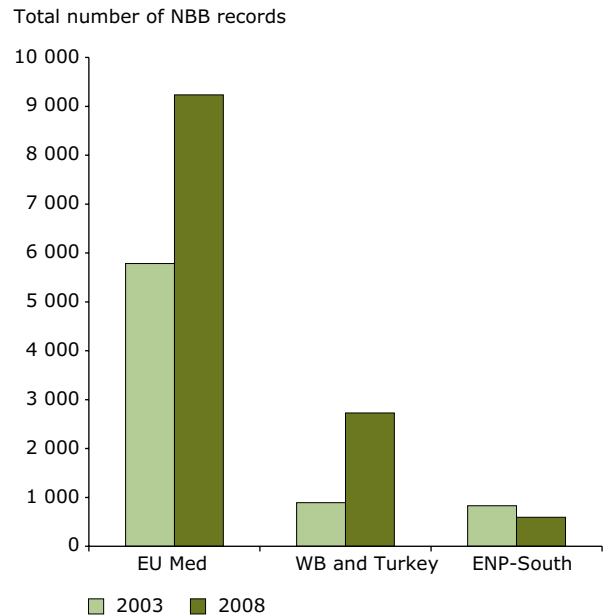
Further strengthening the institutional set-up, including better public involvement at both national and regional levels, in order to cope with the challenges of pollution control and prevention, and to enhance capacities, remains a

high priority for the region. A particular area of focus is their capacity to monitor and enforce the implementation of environmental legislation.

The implementation of reliable environmental information systems is essential for identifying the main pollution sources to be addressed on a priority basis, and for the establishment and implementation of the appropriate measures or action plans. In addition, environmental information systems facilitate compliance with reporting requirements (e.g. the NBB and the Pollutant Release and Transfer Register (PRTR)) to detect pollution reduction progress/trends resulting from the implementation of priority actions.

At Mediterranean level, the NBB 2003 database reported by 21 countries, included emissions for a total of 75 different pollutants and contains a total of 7 509 records (Figure 5.1 and Figure 5.2 left). The most abundant parameters are BOD₅ and NO_x, followed by other generic parameters such as VOC, CO₂, SO_x, or total nitrogen (Figure 5.3 left). By groups, atmospheric pollutants account for 31 % of total records, followed by nutrients/suspended solids/BOD₅/TOC (23 %), metals and compounds (22 %), and hydrocarbons (17 %). Organohalogen and other inorganic and organic compounds are much less represented. Metals are the most abundant subgroup (22 %), followed by other combustion gases (17 %) nutrients, and suspended solids (13 %), BOD₅/COD/TOC (11 %) and greenhouse gases (9 %).

Figure 5.1 Geographical distribution of NBB records in UNEP/MAP MED POL database; 2003 and 2008

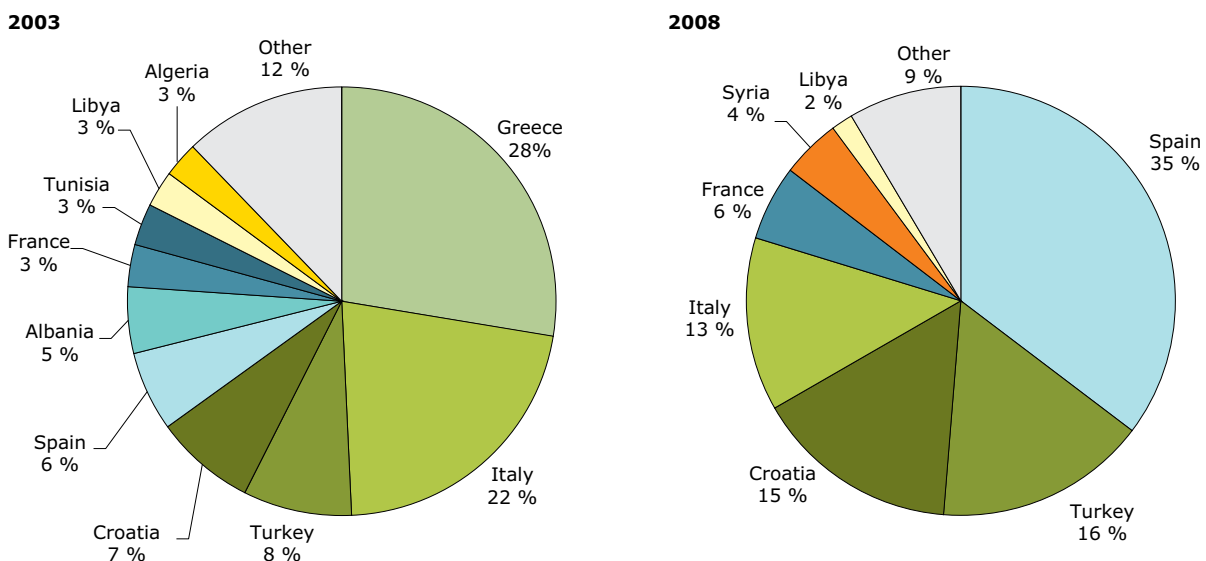


Note: EU MED: European Mediterranean countries; WB and Turkey: West Balkans and Turkey; ENP-South: European Neighbourhood Policy South countries

Source: UNEP/MAP MED POL, 2011.

The NBB 2008 database contains a total of 12 560 records for the year 2008 from 19 countries (Figure 5.1 and Figure 5.2 right). By group, nutrients, suspended solids and BOD₅/TOC account for

Figure 5.2 Contribution of the different countries to the total number of records in the NBB database in 2003 and 2008



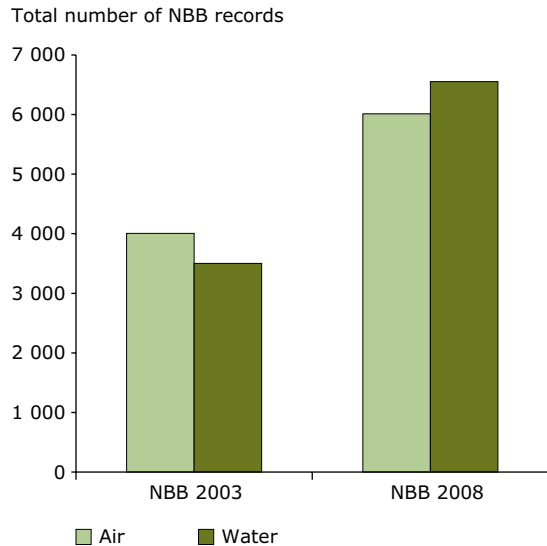
Source: UNEP/MAP MED POL, 2010.

29 % of total records in 2008, followed by metals and compounds (27 %), atmospheric pollutants (19 %) and hydrocarbons (16 %) (Figure 5.3 right). Organohalogen account for 6 % and other inorganic and organic compounds are much less represented. Metals are the most abundant subgroup (25 %), followed by BOD₅/COD/TOC (16 %), nutrients and suspended solids (13 %), and other combustion gases (10 %).

For both 2003 and 2008 NBB database, pollutants were not homogeneously reported by countries. Some substances were reported by very few countries, while others were reported by several countries, but very few records were provided. Figure 5.3 shows how pollutants with an important number of records in the database can have been reported by a representative number of countries (e.g. BOD₅, total nitrogen, total phosphorus,...) while others are just reported by very few countries (e.g. CO₂). About 52 % of records refer to water pollution, while air emissions account for 48 % of records (Figure 5.4).

By sectors (Figure 5.5), the food industry accounted for 15 % of total records, followed by the production of energy (11 %), the metal industry (10 %), cement production (7 %), and the inorganic chemical industry (5.5 %) in NBB 2003. A significant amount of records (7 %) were not allocated to any sector. As

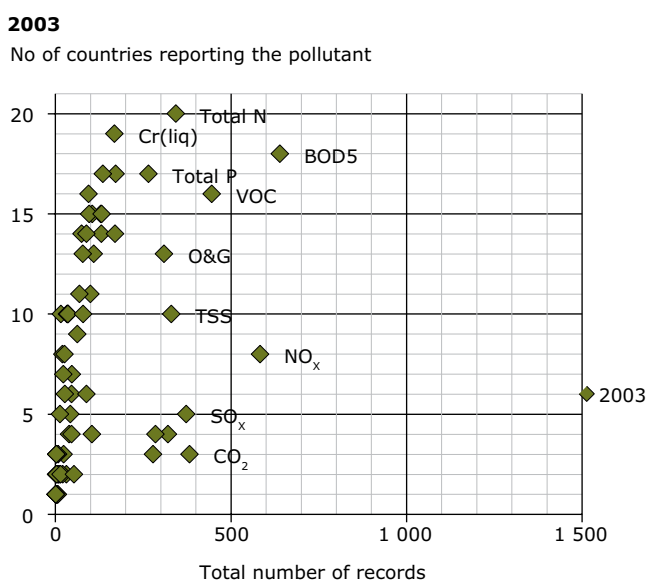
Figure 5.4 Total number of NBB records by receiving media or nature of emissions



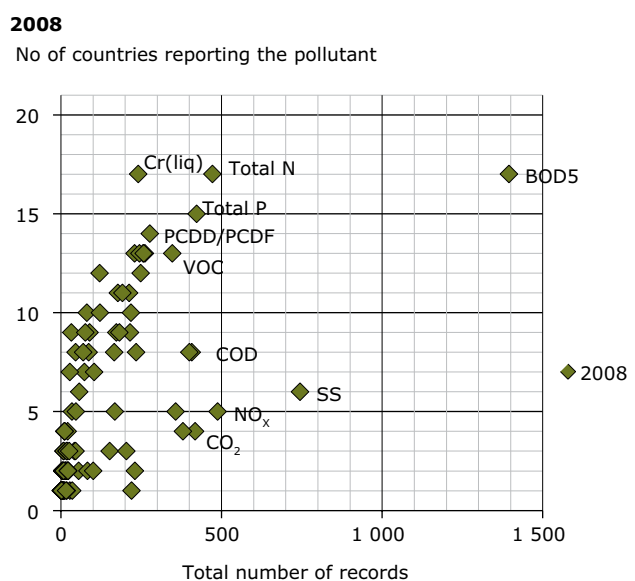
Source: UNEP/MAP MED POL, 2010.

for NBB 2008, the production of energy accounted for 20 % of total records, followed by the treatment of urban wastewater (16 %), manufacture of metals (14 %), food packing (13 %) and the organic and inorganic chemical industry, with 12 % and 11 % of total records, respectively.

Figure 5.3 Number of records by substance and number of countries reporting each pollutant in NBB 2003 and NBB 2008



Source: UNEP/MAP MEDPOL, NBB database 2003



Source: UNEP/MAP MEDPOL, NBB database 2008

Source: UNEP/MAP MED POL, 2010.

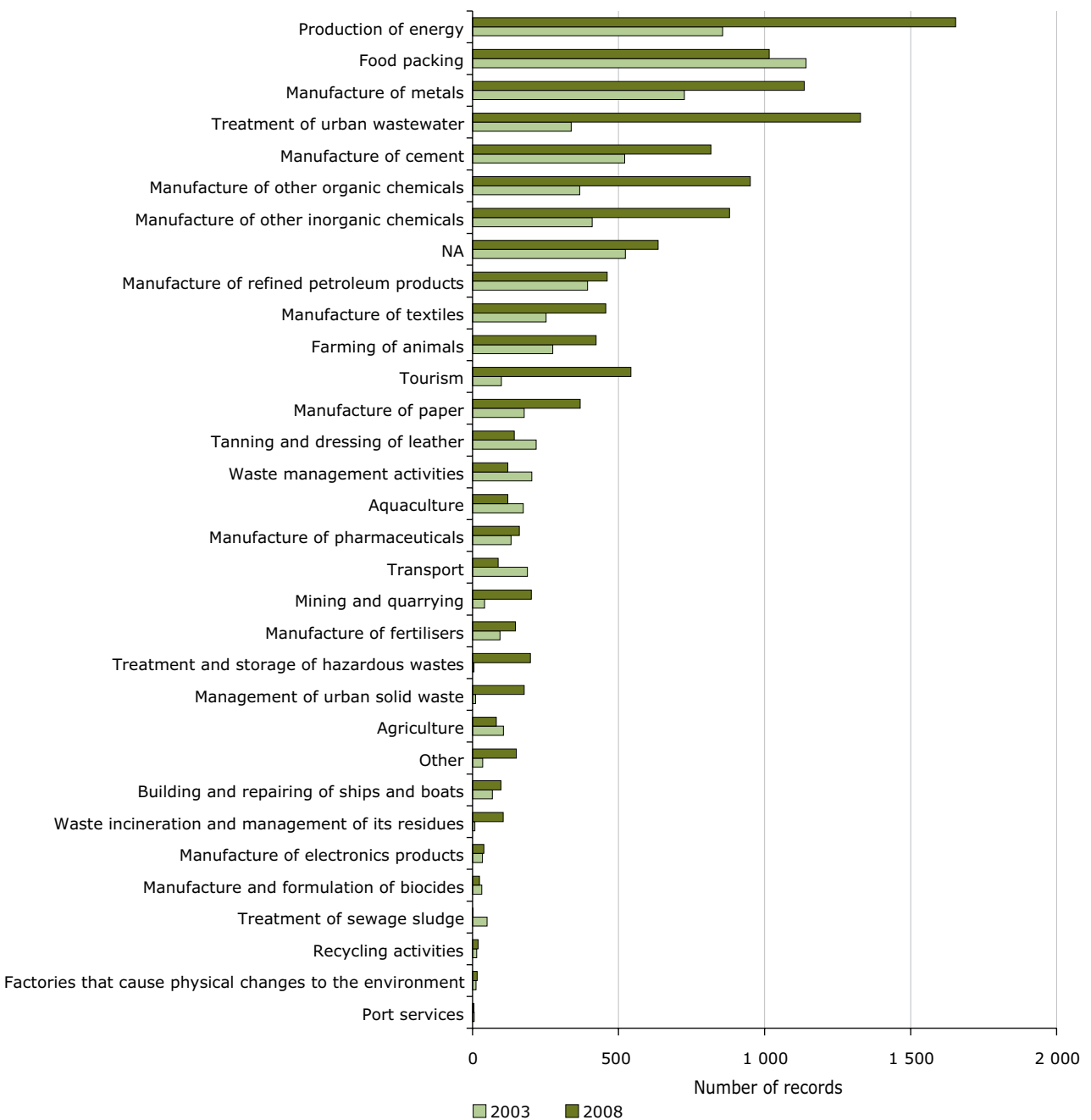
Several sectors accounted for less than 1 % of total records, such as manufacturing of electronic products, port services and those related with recycling and waste management activities.

The total number of records in the NBB database increased by 67 % between 2003 and 2008 (from 7 509 to 12 560 records). This can be considered a notable improvement of the Mediterranean countries pollution monitoring and reporting

capability in the total availability of data, taking into account that there are two countries that did not report to the NBB 2008. By receiving media or nature of emissions, the total number of records for water releases increased by 87 % between 2003 and 2008, while air emission records increased by 50 %.

By countries, some relevant increases include Croatia (from 570 to 1,932 records; 239 % increase), France (239 to 710; 197 %), Spain (453 to 4 437;

Figure 5.5 Number of records by sectors in NBB 2003 and NBB 2008



Source: UNEP/MAP MED POL, 2010.

879 %), Syria (102 to 560; 449 %) and Turkey (615 to 2 005; 226 %). On the other side, some countries have decreased the number of records, like Algeria (200 to 116; – 42 %) or Tunisia (236 to 104; – 56 %). All of these variations are assumed to be a result of changes and adjustments in the inventory process (in methodology or scope), rather than the closure or installation of new industrial facilities. Due to these changes, the relative contribution of each country to the total number of records in the database has notably changed between 2003 and 2008.

The substances included in the NBB have been increased from 75 different pollutants in 2003 to 103 in 2008. As a whole, out of the 70 pollutants

which are included in both NBB 2003 and 2008, 61 substances (87 %) have increased their total number of records, while only 9 substances (13 %) have reduced their total number of records.

Sectors that have notably increased the number of records in the database at Mediterranean level (in total and relative terms) are the management of urban solid waste, the inorganic and organic chemical industry, the mining industry, the production of energy or the treatment of urban wastewater. In contrast, other sectors have decreased the number of records, such as food packing, transport, tanning and waste management activities. As a whole, about 70 % of sectors have increased the number of records.

Box 5.1 Industrial emission indicators and methodological issues

This H2020 indicator refers to the emissions from industrial sources in the coastal area of the Mediterranean Sea from individual facilities. For the purpose of H2020 assessment, Indicator 6 on industrial emissions covers only BOD₅, cadmium (gas), chromium (gas), chromium (liq), lead (gas), lead (liq), mercury (gas), PAH (gas), total nitrogen and total phosphorus.

The selection of these pollutants was made based on the following criteria:

- legal/regulatory context (supported by relevant strong policy and legal framework: UNEP/MAP Barcelona Convention/LBS Protocol, SAP MED, regional plans, UfM&H2020, UNEP/GPA and global conventions);
- representativity (the most representative group of contaminants at regional level in terms of data availability, and reported by a considerable number of Mediterranean countries);
- availability of reporting tools and dataflow available (inventory system in place through national pollutant budget and PRTR tools that guarantee a further improvement of data generation and collection, and therefore, a sustainable reporting system);
- data availability (existing data series from 2003 and 2008 (7 000 and 13 000 records for 75 and 103 substances)) per source, per administrative region, at national level.

Table 5.1 Category of substances and specific pollutants

Categories	Substances
Nutrients and oxygen-depleting substances	biochemical oxygen demand (BOD ₅) total nitrogen (TotN) total phosphorus (TotP)
Halogenated hydrocarbons	polychlorinated biphenyls (PCB) polychlorinated dibenzodioxins/dibenzofurans (PCDDs/PCDFs)
Hydrocarbons	polycyclic aromatic hydrocarbons (PAHs) volatile organic compounds (VOCs)
Heavy metals	mercury (Hg) chromium (Cr) lead (Pb) cadmium (Cd) zinc (Zn)

Mercury and chromium values are collected and reported on a systematic basis, while lead, cadmium and zinc are reported on a voluntary basis.

Box 5.1 Industrial emission indicators and methodological issues (cont.)

There are three possible methodologies for calculating this indicator. These are the emission factors, field measurements and modelling. The most commonly used method is based on emission factors. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant.

Description of data

Each record consists of the following fields: Country, Region, Sector, Subsector, Process, Pollutant, Emission value and Nature of emission.

Geographical coverage

Administrative regions of the whole Mediterranean sea watershed. For the purpose of H2020 the focus is on ENP-South countries..

Temporal coverage

Two data series are available: 2003 and 2008, and another is ongoing.

Basis for aggregation

Due to the very complex nature of this indicator, the only possible aggregation is per substance (measured in the same phase) at the national level or at the coastal hydrological basin.

Trend analysis

Not yet fully available. It will become more relevant when another time series of data is made available in 2014.

5.1 Which are the main sources of industrial pollution in the ENP-South countries?

Table 5.2 presents the most representative pollutant reported in 2003 and 2008 on the basis of which H2020 indicator on industrial emission was identified and selected. The number of records per sector and substance in the ENP-South countries (2003 and 2008) is shown in Figure 5.6 and Figure 5.7, respectively.

From an in-depth reporting of pollutant loads from the industrial sector in the Mediterranean (Table 5.2), it results that the major pollutant sectors and subsectors are: Agriculture, Aquaculture, Farming of animals, Food packing, Manufacture of cement, Manufacture of fertilisers, Manufacture of metals, Manufacture of refined petroleum products, Manufacture of textiles, Production of energy, Tanning and dressing of leather, and Transport.

As observed in Figure 5.6, sectors that have notably increased (in total and relative terms) the number

of records in the database are the production of energy (102 records; 170 %), the farming of animals (48 records; 267 %) and the manufacture of textiles (38 records; 136 %), food packing (38 records; 32 %) and manufacture of refined petroleum products (22 records; 79 %). In contrast, other sectors have decreased the number of records, such as tanning (27 records; – 180 %), manufacture of cement (10 records; – 10 %), aquaculture (7 records; – 50 %) and manufacture of other inorganic chemicals (2 records; – 40 %).

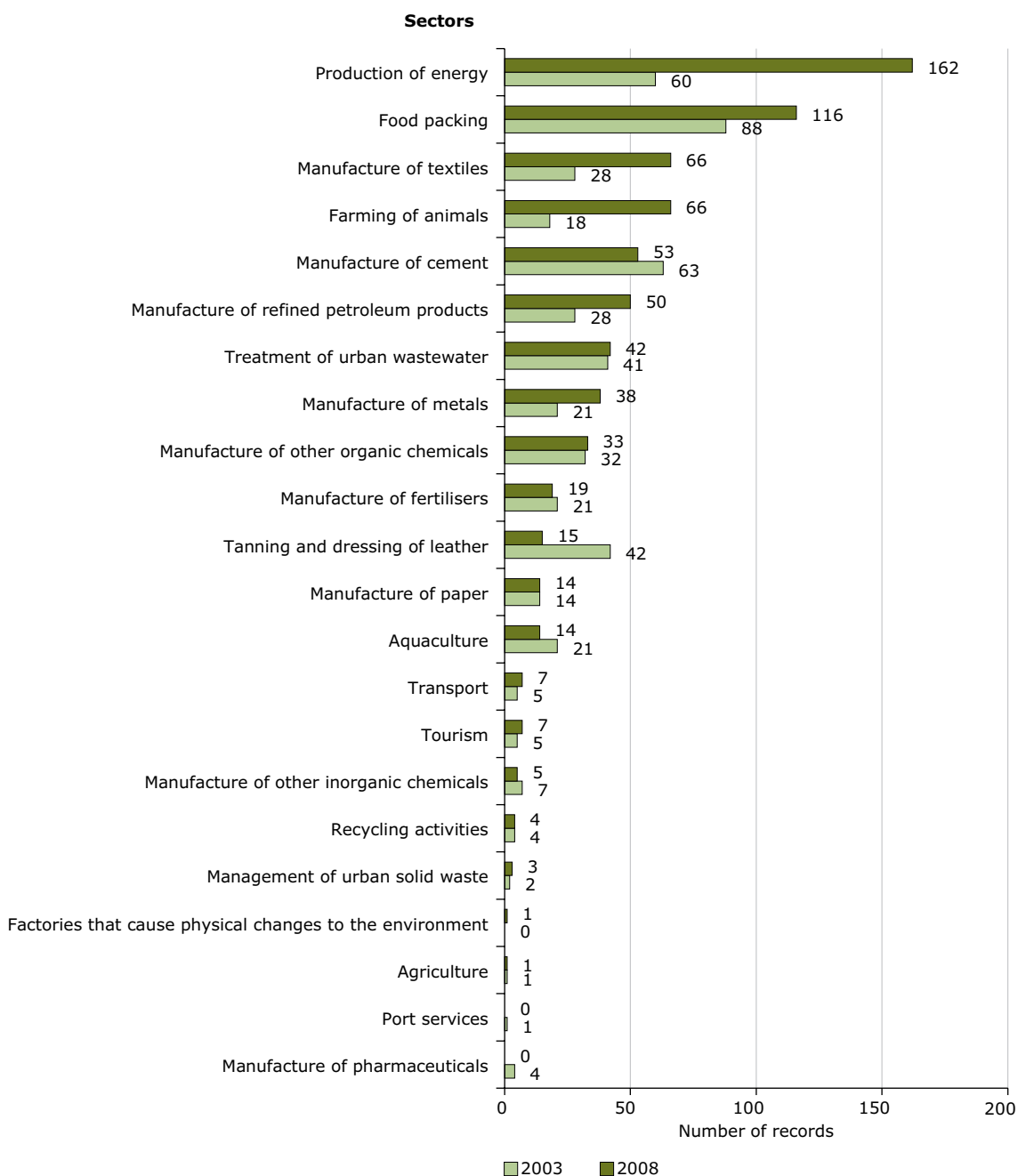
A range of variations can be observed in the total number of records for each individual pollutant (Figure 5.7). Relevant increases in the availability of data can be observed for BOD₅ (93 new records; 60 %), VOC (44 new records; 100 %). On the other side, notable reductions in the number of records are observed for total nitrogen (decrease in 34 records; – 47 %), total phosphorus (decrease in 20 records; – 62 %).

Table 5.2 Overview of substances emitted by sector (2003 and 2008)

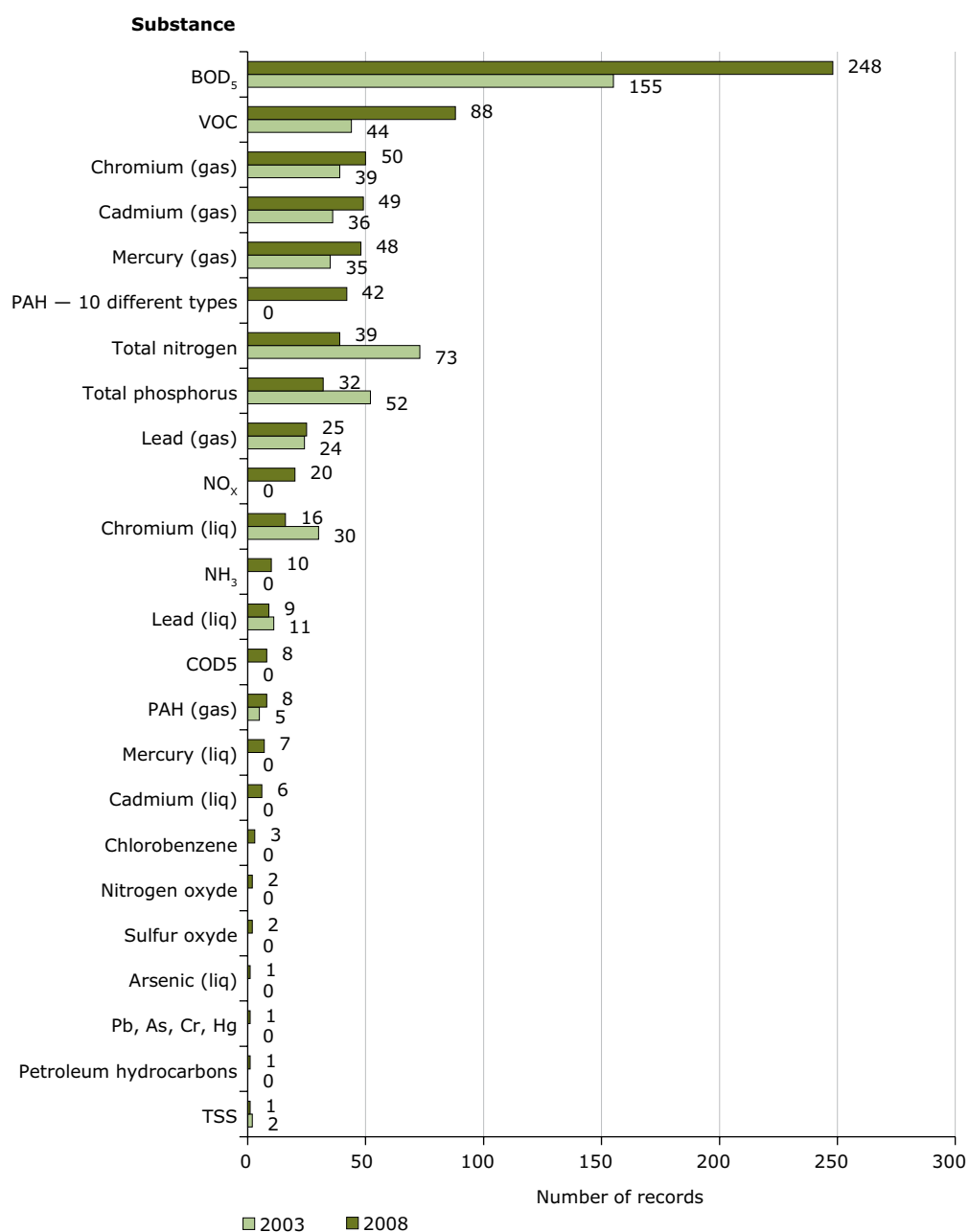
	BOD ₅	Cadmium (gas)	Chromium (gas)	Chromium (liq)	Lead (gas)	Lead (liq)	Mercury (gas)	PAH (gas)	Total nitrogen	Total phosphorus	Total suspended solids (TSS)	VOC
Agriculture	X											
Aquaculture	X X								XX	XX		
Farming of animals	X X								XX	XX		
Food packing	XX	X	X		X		X		XX	XX		XX
Manufacture of cement	X	X	XX		XX	X	XX		X	XX		
Manufacture of fertilisers	XX	X		XX		XX			XX	XX		X
Manufacture of metals	XX	XX	XX	X	XX	XX		XX	XX	XX		X
Manufacture of other inorganic chemical	XX								X	XX		X
Manufacture of other organic chemicals	XX					X			XX	XX	XX	XX
Manufacture of paper	XX								XX	XX		X
Manufacture of refined petroleum products	XX		XX	XX					X			XX
Manufacture of textiles	XX								XX	XX		XX
Production of energy		XX	X	X			XX		X			
Tanning and dressing of leather	XX			XX					XX	X	X	X
Tourism	XX								XX	XX		
Transport					X			XX				
Treatment of urban wastewater	XX	X				XX			XX	XX		

Note: X = 2003; X = 2008.

Figure 5.6 Number of records per sector in ENP-South countries (2003 and 2008)



Source: UNEP/MAP MED POL NBB database 2003 and 2008.

Figure 5.7 Number of records per substance in ENP-South countries (2003 and 2008)

Source: UNEP/MAP MED POL NBB database 2003 and 2008.

5.2 Which are the main substances in industrial emissions in the ENP-South countries?

In the context of UNEP/MAP MED POL, the contracting parties reported 73 and 103 substances respectively in 2003 and 2008.

Each activity and/or industrial sector may result in the emission of one or more pollutant, while each pollutant may originate from different industrial activities, not necessarily the same ones, depending on the country and the year. This makes the picture very complex and difficult to assess. The main pollutants from industrial emissions are nutrients and oxygen-depleting substances, VOCs, as well as some heavy metals.

Based on an in-depth analysis of sectors and their releases recorded in 2003 and 2008 (Table 5.3), it can be observed that most of the industrial sectors are reported in both years as releasing the same category of pollutants despite some changes. As expected, BOD₅ emissions are related to all activities. Most of the other emissions are related to specific activities. Additional time series of data for other years would lead in the future to a better understanding of trends of pollutants per sector and reasons behind those changes.

Table 5.3 The most representative pollutants reported in 2003 and 2008

2003	2008
BOD ₅	Arsenic (gas)
Cadmium (gas)	BOD ₅
Chromium (liq)	Cadmium (gas)
Hydrocarbons	Chromium (g)
Lead (liq)	Chromium (liq)
Oils and greases	Copper (gas)
PCDDs/PCDFs (gas)	Lead (gas)
Phenols	Lead (liq)
Total nitrogen	Mercury (gas)
Total phosphorus	PAHs (gas)
VOC	PCDDs/PCDFs (gas)
Zinc (liq)	Total nitrogen
	Total phosphorus
	VOCs
	Zinc (liq)

Source: UNEP/MAP MED POL, 2011.

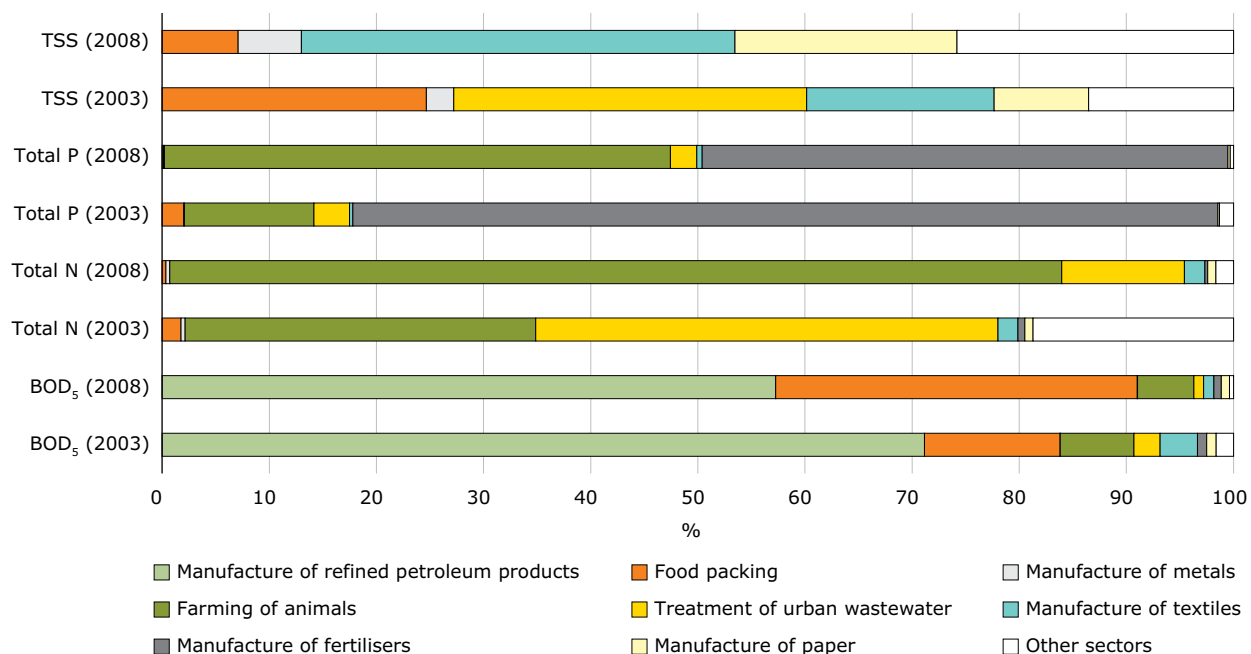
5.3 Which are the substances emitted by the most important sectors?

The main sectors contributing to the emissions of nutrients and oxygen-depleting substances (BOD₅, total nitrogen, total phosphorus, TSS) for ENP-South countries for the years 2003 and 2008 are presented in Figure 5.8. Increasing contributions from 2003 to 2008 are observed for nutrients from the farming of animals; TSS from the manufacture of textiles and the manufacture of paper, and BOD₅ from food packing. On the other hand, contributions which have decreased are: TSS from food packing, total phosphorus from the manufacture of fertilisers, total nitrogen from the treatment of urban wastewater and BOD₅ from food packing.

The main sectors contributing to the emissions of nutrients and oxygen-depleting substances (BOD₅, total nitrogen, total phosphorus, TSS) both for ENP-South countries and the whole Mediterranean region for the years 2003 and 2008 are presented in Figure 5.9 and Figure 5.10.

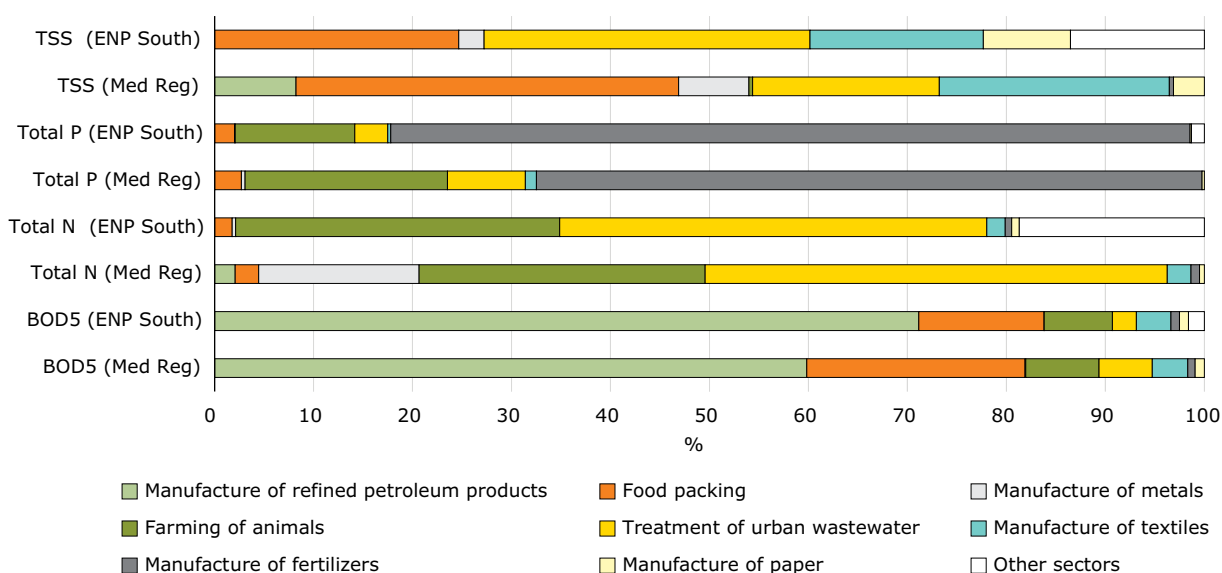
For BOD₅, the distribution per sector for ENP-South countries and the whole Mediterranean region are roughly similar; the main contributing activities are related to manufacture of refined petroleum products and food packing for both 2003 and 2008. A significant increase of BOD₅ from food packing is observed from 2003 to 2008 both for ENP-South countries and the Mediterranean region, causing a lower percentage contribution from other sectors. The contribution of the manufacture of refined petroleum products remains the same for both 2003 and 2008; however, it must be noted that ENP-South countries are responsible for almost the total value of BOD₅ emitted by this sector for the whole Mediterranean.

For total nitrogen, the major contributing sectors at both ENP-South and Mediterranean level are farming of animals and treatment of urban wastewater. However, trends are different; while in the whole Mediterranean the contribution from the treatment of urban wastewater has increased from 2003 to 2008, in ENP-South countries this contribution has dropped. In addition, the contribution from food packing in ENP-South has also decreased in 2008 due to the apparent elimination of such emissions from Tunisia. On the other hand, a significant increase in total nitrogen from the farming of animals reported by ENP-South countries has been observed from 2003 to 2008. Contributions to total nitrogen from other sectors are generally bigger in the whole Mediterranean than in southern countries.

Figure 5.8 Loads of emissions (%) for nutrients and oxygen-depleting substances per sector

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, Tunisia.

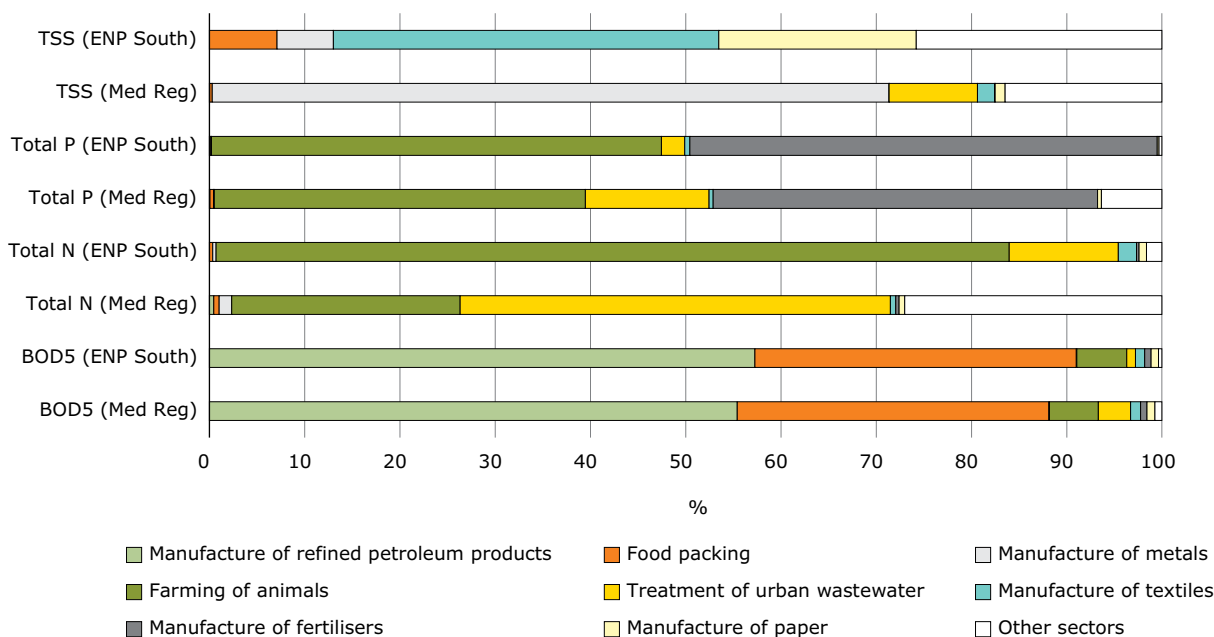
Source: UNEP/MAP MED POL NBB database 2003 and 2008.

Figure 5.9 Loads of emissions (%) for nutrients and oxygen-depleting substances per sector

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, Tunisia.

Med Reg: Whole Mediterranean region.

Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.10 Loads of emissions (%) for nutrients and oxygen-depleting substances per sector

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, Tunisia.

Med Reg: Whole Mediterranean region.

Source: UNEP/MAP MED POL NBB database 2008.

For total phosphorus, the major contributing sectors are manufacture of fertilisers and farming of animals. ENP-South countries are the major contributors of total phosphorus emissions from both manufacture of fertilisers and farming of animals for the whole Mediterranean. From 2003 to 2008 a significant decrease of total phosphorus from the manufacture of fertilisers has been observed in ENP-South countries, causing also a decrease in the whole Mediterranean. On the contrary, the contribution of farming of animals has increased from 2003 to 2008.

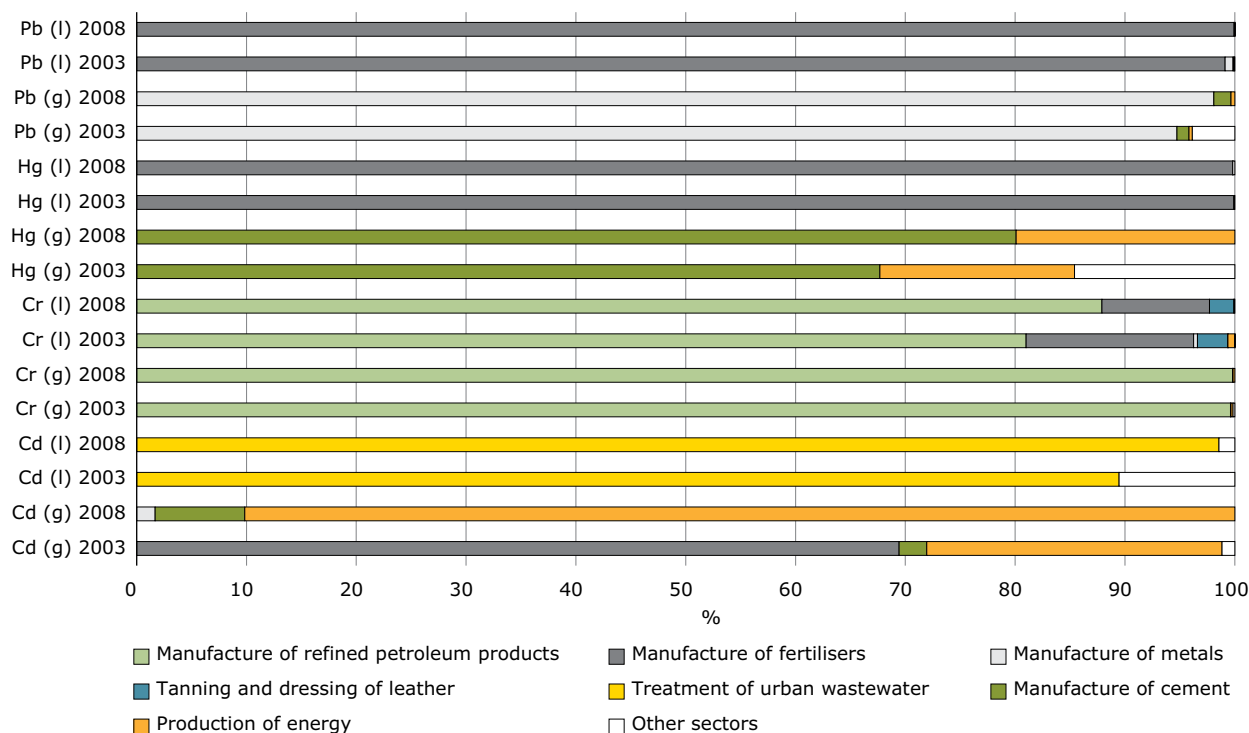
For TSS, trends are difficult to identify as there are some discrepancies, e.g. no data for the treatment of urban wastewater in ENP-South countries in 2008 and a very high value from the manufacture of metals at THE Mediterranean level in 2008. However, a decrease from food packing in the ENP-South countries can be observed from 2003 to 2008.

The main sectors contributing to the emissions of heavy metals (Pb, Hg, Cd and Pb) for ENP-South countries and the Mediterranean region for the years 2003 and 2008 are presented in Figure 5.11, Figure 5.12 and Figure 5.13. As it can be observed, the picture varies for each pollutant. However the

most contributing sectors in 2003 and 2008 are the manufacture of refined petroleum products, manufacture of fertilisers and manufacture of metals. The Southern countries are the major contributors for the manufacture of refined petroleum products and the manufacture of fertilizers in the Mediterranean region. It has to be noted that there are sectors for which heavy metal releases are reported only for one year that may be explained with data reporting discrepancy.

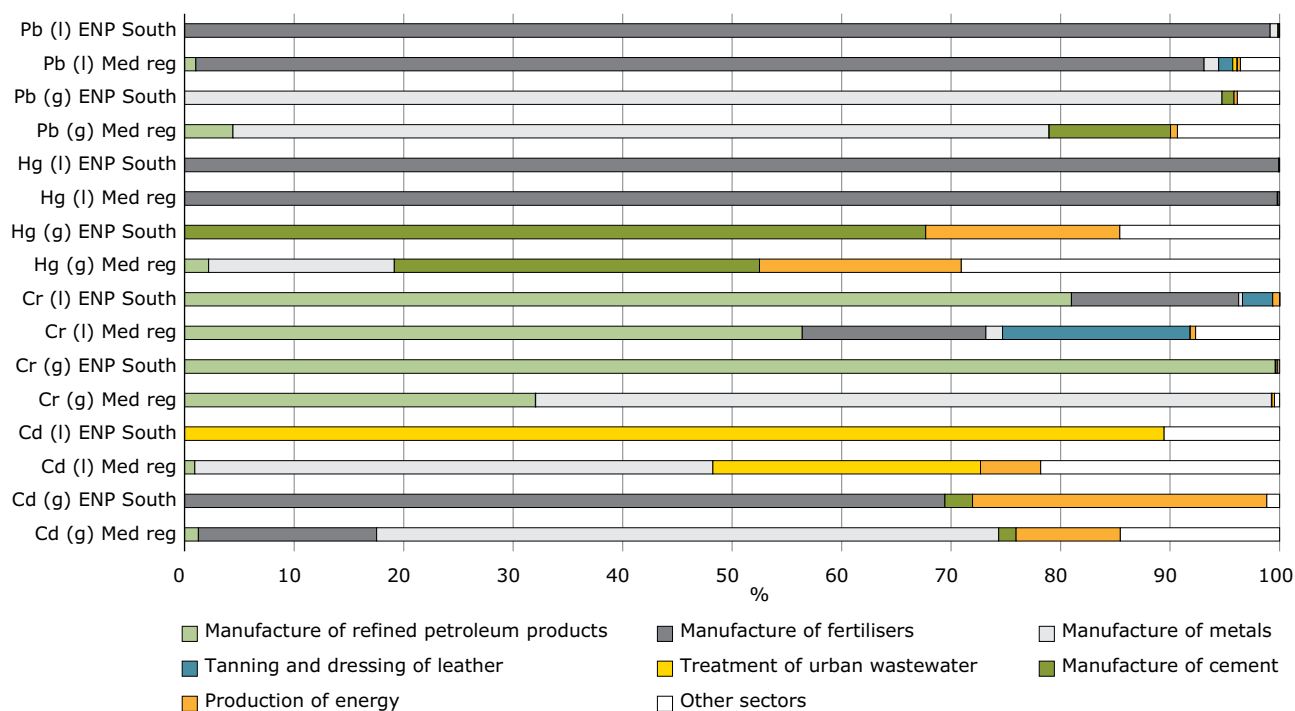
Main particular trends observed are :

- Cd (g) emissions from the manufacture of fertilisers in southern countries have been drastically reduced from 2003 to 2008.
- Cd (g) emissions from the production of energy have increased at the Mediterranean level while they have remained the same in the ENP-South countries.
- Pb (liq) and Hg (liq) emission values have dropped from 2003 to 2008 in the southern countries. However they are the major contributors to Hg (liq) and Pb (liq) emissions at Mediterranean level from the manufacture of fertilisers.

Figure 5.11 Loads of emissions (%) for heavy metals per sector in the ENP-South countries

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, Tunisia.

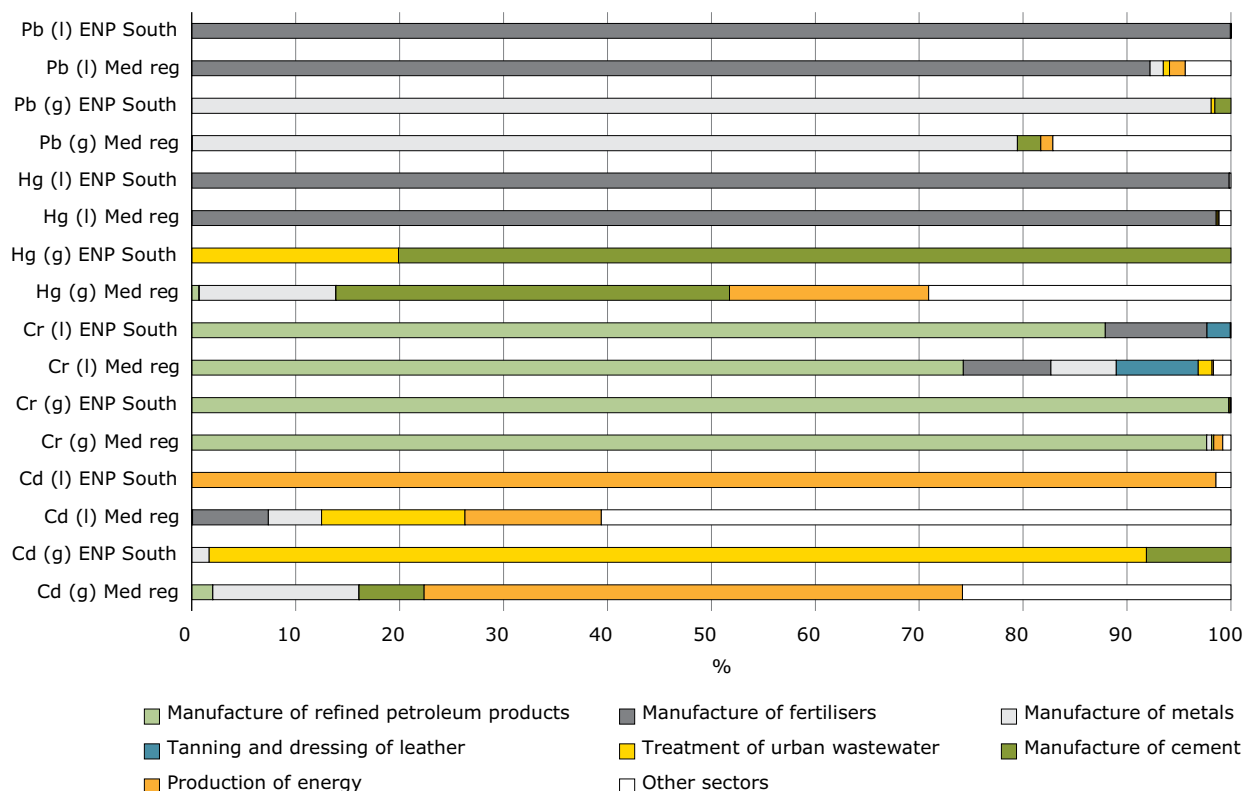
Source: UNEP/MAP MED POL NBB database 2003 and 2008.

Figure 5.12 Loads of emissions (%) for heavy metals per sector

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, Tunisia.

Med Reg: Whole Mediterranean region.

Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.13 Loads of emissions (%) for heavy metals per sector

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, Tunisia.

Med Reg: Whole Mediterranean region.

Source: UNEP/MAP MED POL NBB database 2008.

- No significant trends are observed with regards to Pb (g) emissions from the manufacture of metals. Southern countries are also the major contributors of such emissions at the Mediterranean level.
- No significant trends are observed with regards to Cr (liq) and Cr (g) emissions from the manufacture of refined petroleum products. Southern countries are the major contributors of such emissions at Mediterranean level.

Figures 5.14 to 5.29 present the contribution of the main sectors in the emission of relevant pollutants (BOD₅, total nitrogen, total phosphorus, cadmium, chromium and mercury) per country per year. The following conclusions can be observed for each pollutant for the period 2003–2008:

- BOD₅: main sectors contributing to BOD₅ emissions in the ENP-South countries are the manufacture of refined petroleum products, food packing and farming of animals. Total

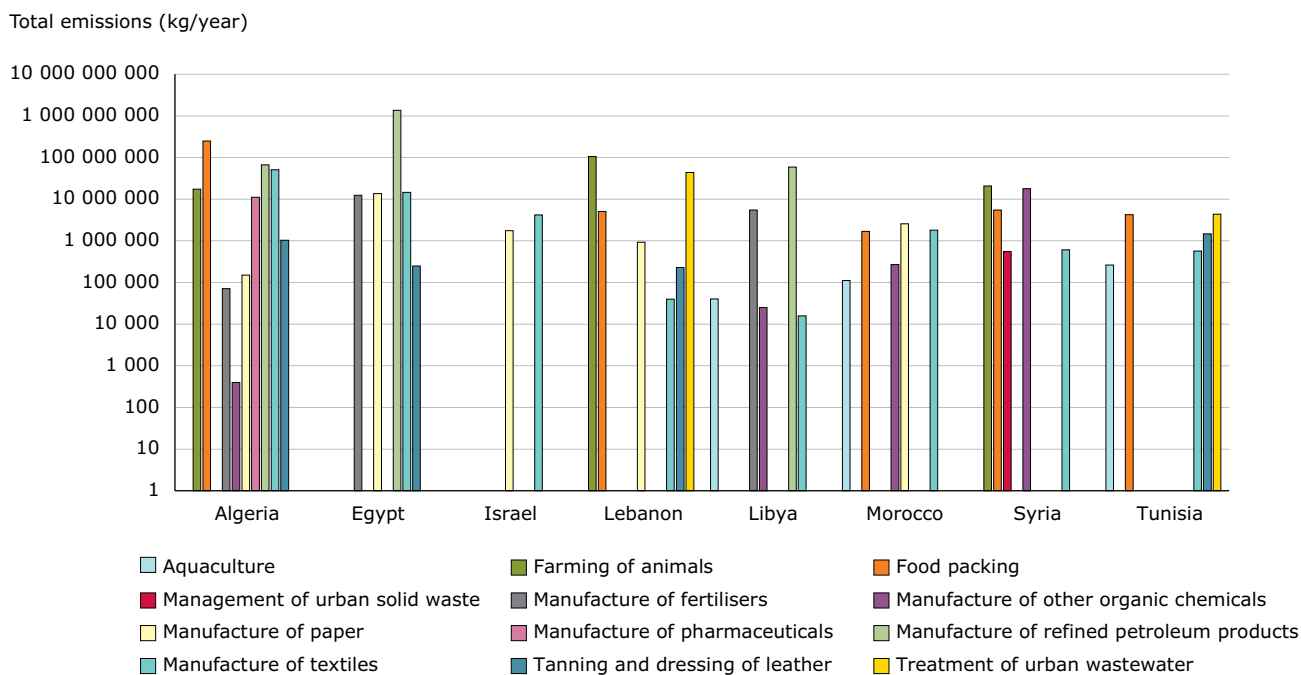
emission values have slightly increased from 2003 and 2008, in particular emissions from food packing in Algeria and Lebanon. On the other hand, significant emissions from some countries reported in 2003 have not been reported in 2008, e.g. manufacture of refined petroleum products, manufacture of textiles and manufacture of pharmaceuticals in Algeria and manufacture of other organic chemicals in Syria.

- Total nitrogen: main sectors contributing to total nitrogen emissions in the ENP-South countries are the farming of animals and the treatment of urban wastewater. Total emission values have increased notably from 2003 to 2008 as some sectors' emissions were reported for the first time in 2008 (e.g. farming of animals in Lebanon and treatment of urban wastewater in Syria) or increased (e.g. manufacture of textiles in Morocco). On the other hand, significant emission values from some countries reported in 2003 have not been reported in 2008, e.g. farming of animals and tanning and dressing of

leather in Algeria; manufacture of other organic chemicals in Syria and food packing in Tunisia.

- Total phosphorus: main sectors contributing to TP emissions in the ENP-South countries are the manufacture of fertilisers and the farming of animals. Total emission values for ENP-South countries have dropped from 2003 to 2008 due to significant reductions in some loads of emission (e.g. farming of animals in Syria and manufacture of fertilisers in Tunisia). Also, some emissions reported on 2003 have not been reported in 2008 e.g. farming of animals and manufacture of fertilisers in Algeria and food packing in Tunisia. On the other hand, some sectors' emissions have notably increased in 2008, particularly farming of animals and manufacture of fertilisers in Lebanon.
- Cadmium (gas): an overall reduction is observed from 2003 to 2008 due to the emissions from the manufacture of fertilisers reported by Lebanon in 2003 which have not been reported in 2008. The main sectors contributing to emissions in ENP-South countries are the production of energy and the manufacture of cement.
- Chromium (gas): an overall increase is observed from 2003 to 2008 although no data were reported by Algeria in 2008. The sector most contributing to emissions in ENP-South countries is the manufacture of refined petroleum products which has been only reported by Algeria (2003) and Egypt (2003, 2008), followed by the production of energy and manufacture of cement.
- Chromium (liquid): total emissions for ENP-South countries have decreased from 2003 to 2008. The sector most contributing to emissions in ENP-South countries is the manufacture of refined petroleum products followed by the manufacture of fertilisers, which is responsible for the reduction trend.
- Mercury (gas): total emissions for ENP-South countries have slightly decreased from 2003 to 2008. The sector most contributing to emissions in ENP-South countries is the manufacture of cement followed by the production of energy.
- Mercury (liquid): total emissions have halved from 2003 to 2008. The sector most contributing to emissions in ENP-South countries is the manufacture of fertilisers. A reduction of such emissions in Tunisia is observed, while Algeria only reported mercury (liquid) emissions in 2003 and Lebanon only in 2008.

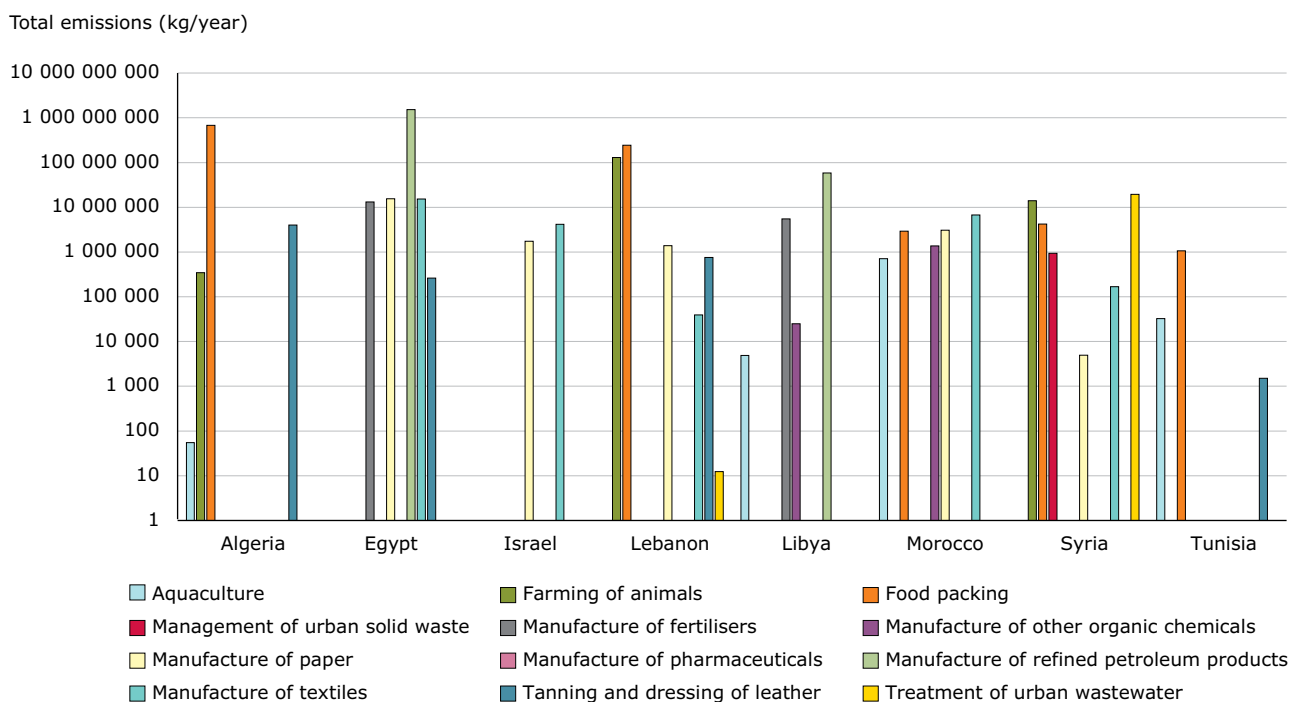
Figure 5.14 Loads of emissions for BOD₅ per country and per sector, 2003



Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

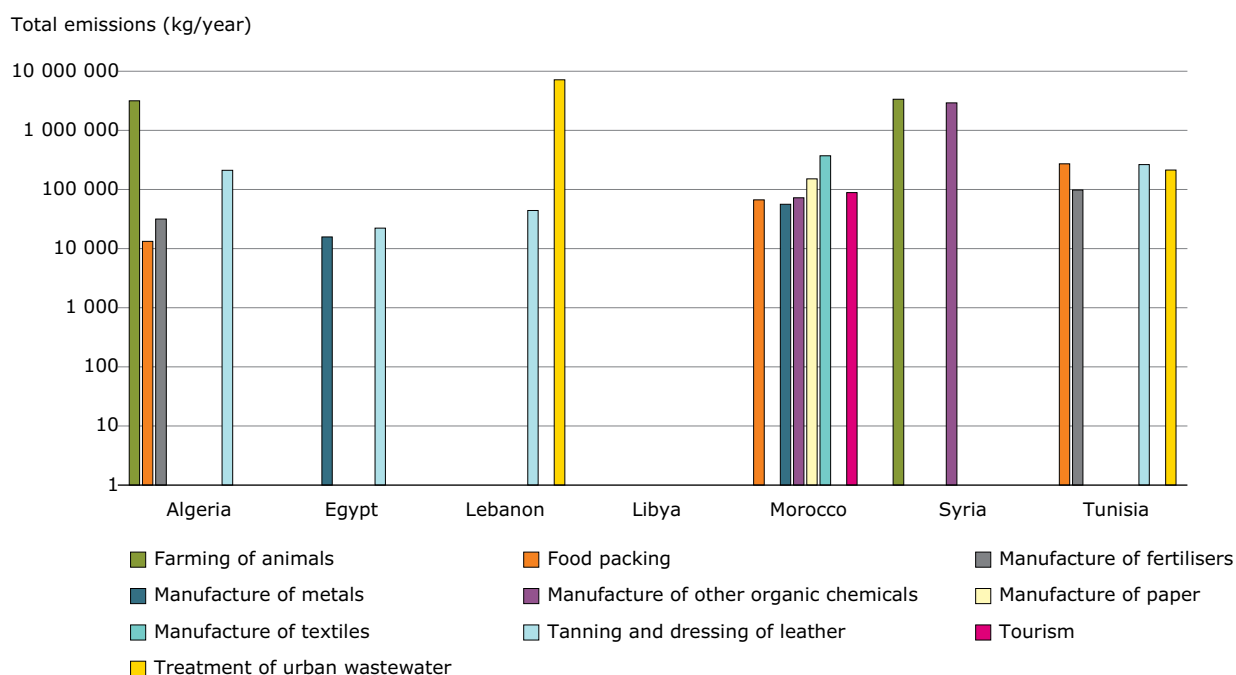
Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.15 Loads of emissions for BOD₅ per country and per sector, 2008



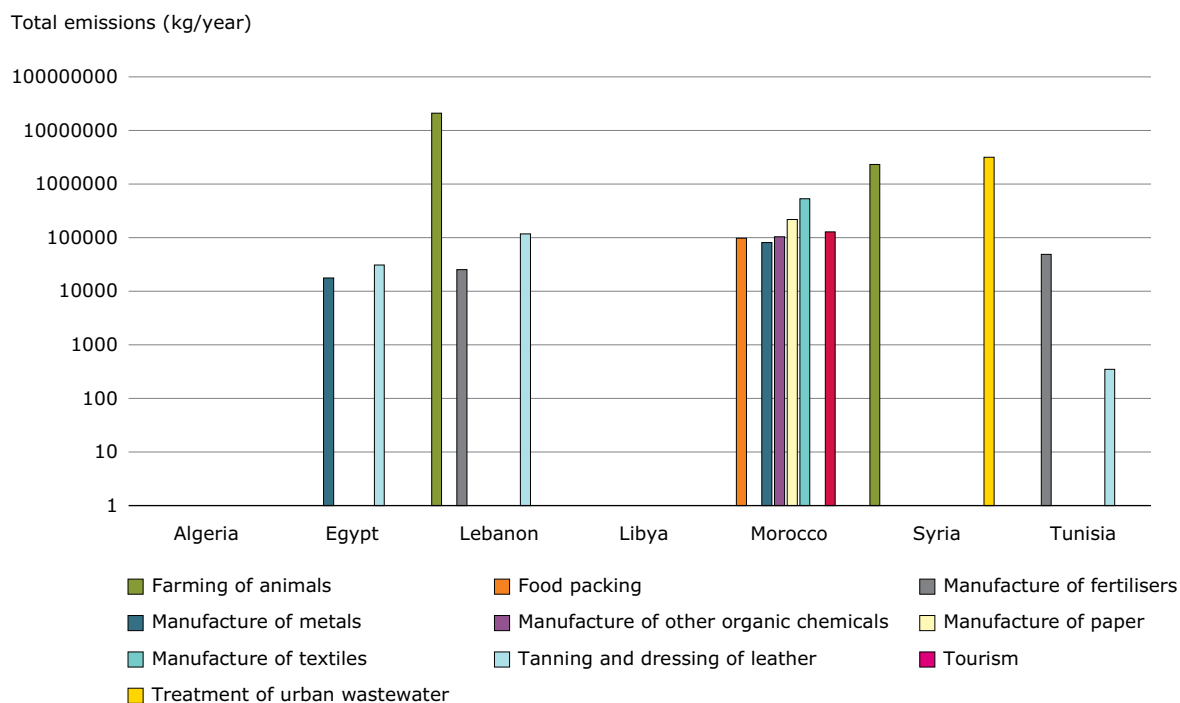
Note: According to 'State of the Environment in Israel, Indicators, Data and Trends, 2010', the BOD₅ emission value in 2008 from all sectors except Shafdan was 3 386 000 kg/year, which is lower than the value reported by NBB 2008 (5 943 750 kg/year) regarding manufacture of paper and manufacture of textiles' sectors.

Source: UNEP/MAP MED POL NBB database 2008

Figure 5.16 Loads of emissions for total nitrogen per country and per sector, 2003

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

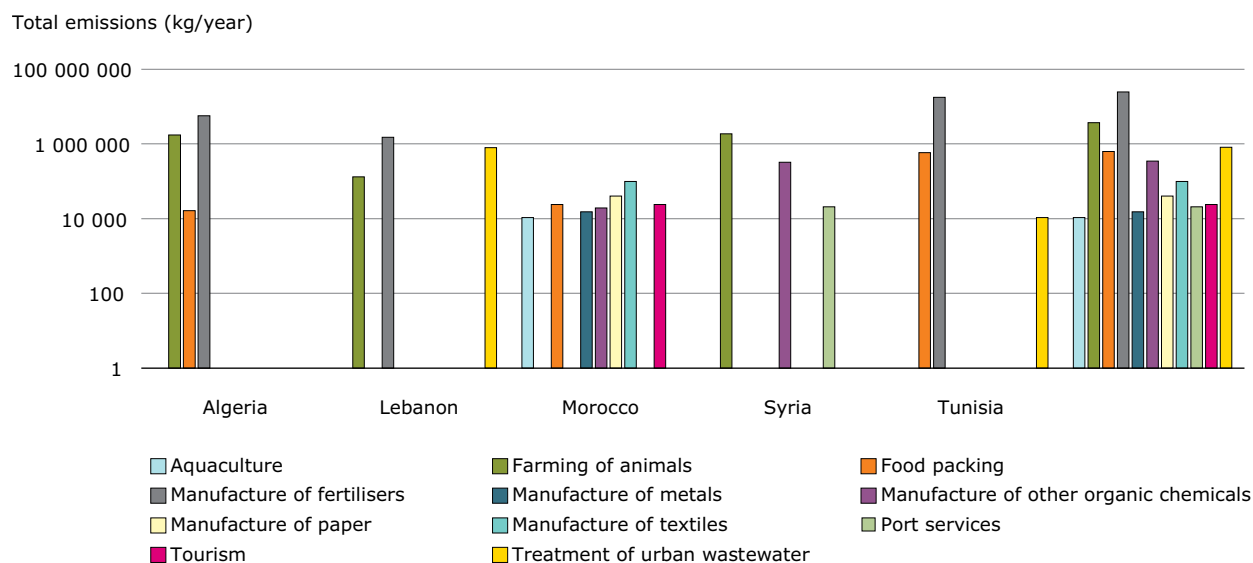
Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.17 Loads of emissions for total nitrogen per country and per sector, 2008

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

Source: UNEP/MAP MED POL NBB database 2008.

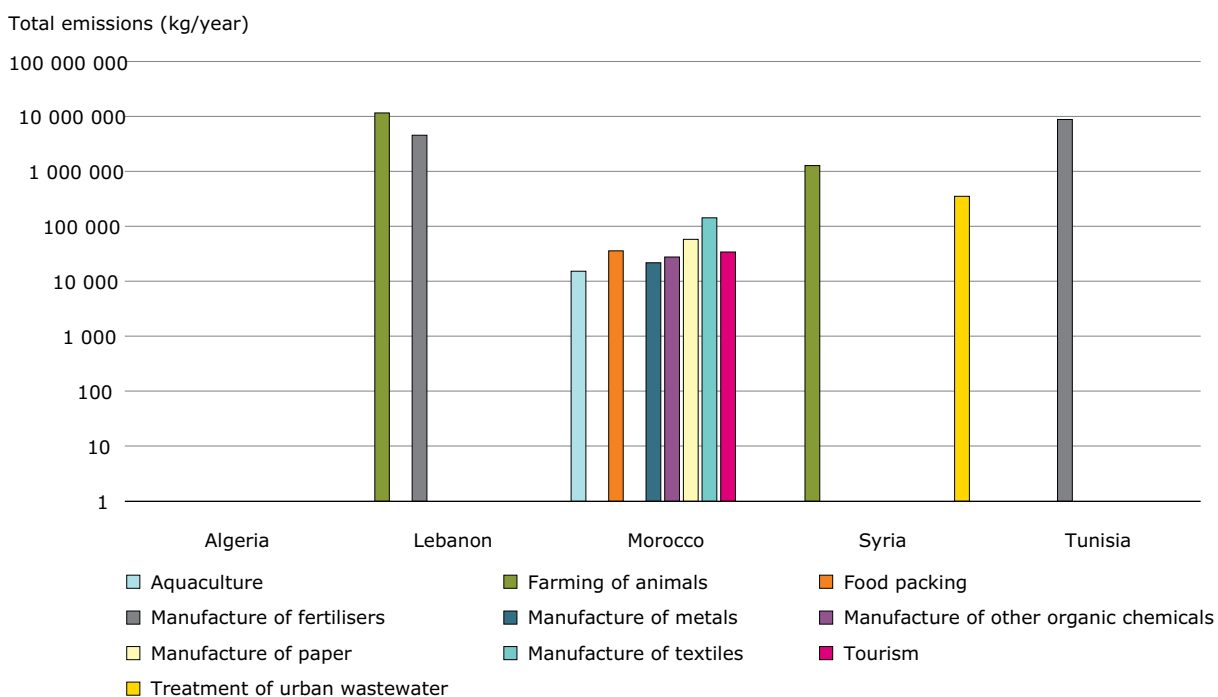
Figure 5.18 Loads of emissions for total phosphorus per country and per sector, 2003



Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

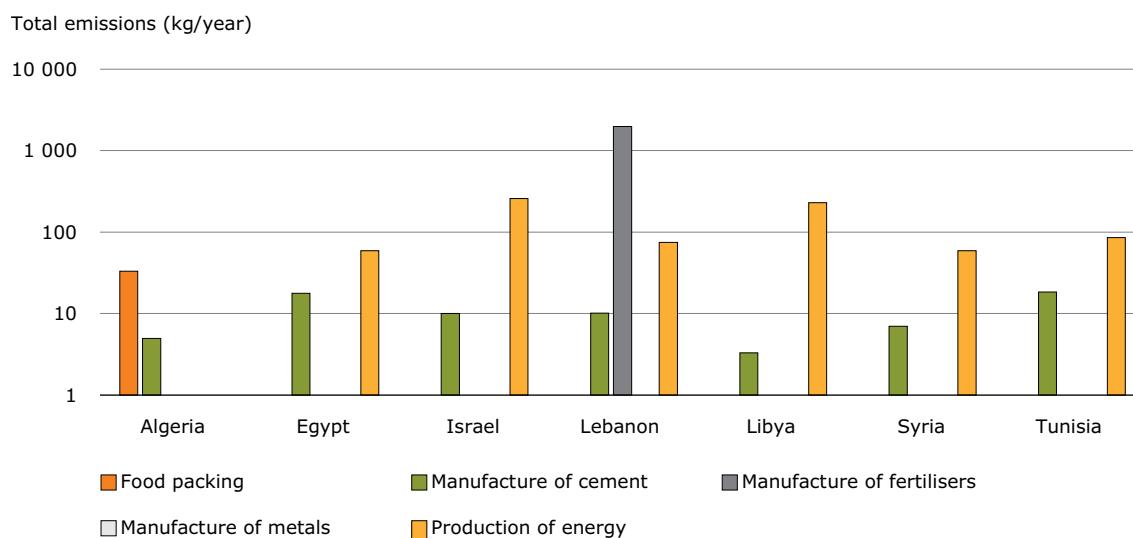
Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.19 Loads of emissions for total phosphorus per country and per sector, 2008



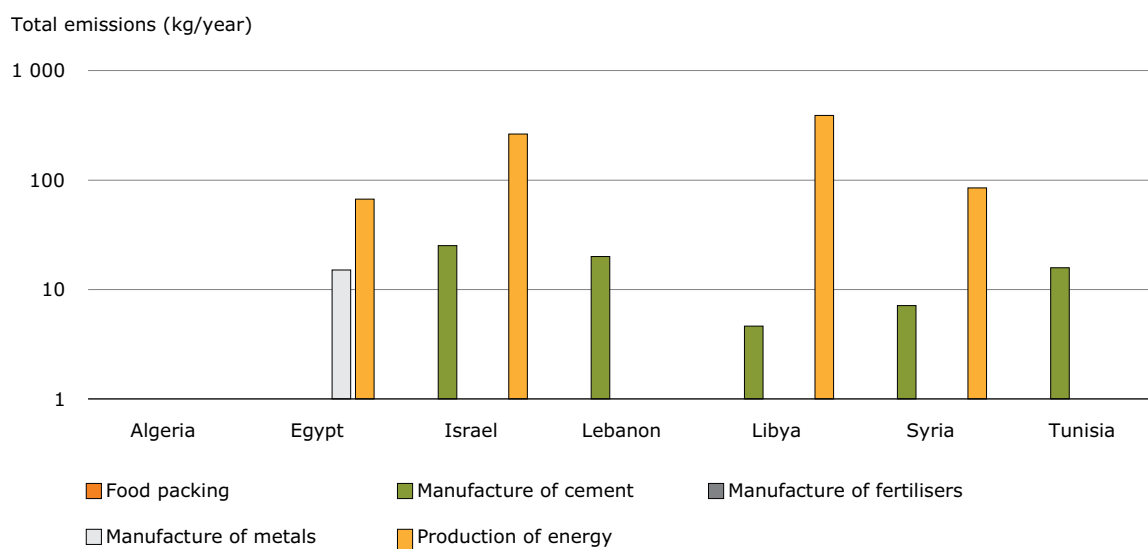
Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

Source: UNEP/MAP MED POL NBB database 2008.

Figure 5.20 Loads of emissions for Cadmium (gas) per country and per sector, 2003

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

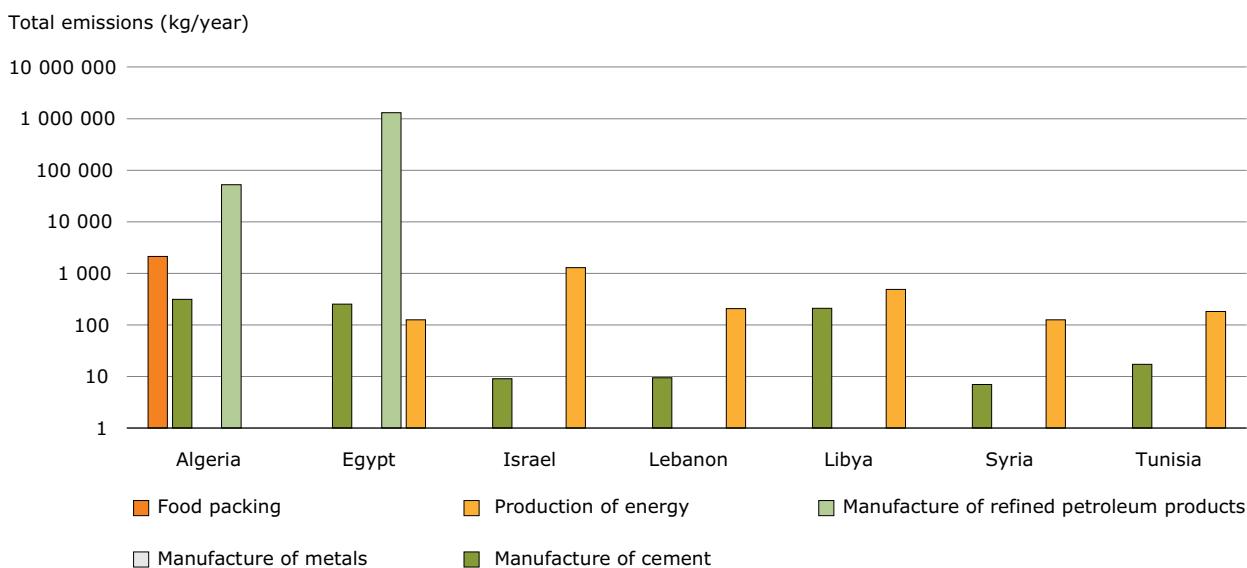
Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.21 Loads of emissions for Cadmium (gas) per country and per sector, 2008

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

Source: UNEP/MAP MED POL NBB database 2008.

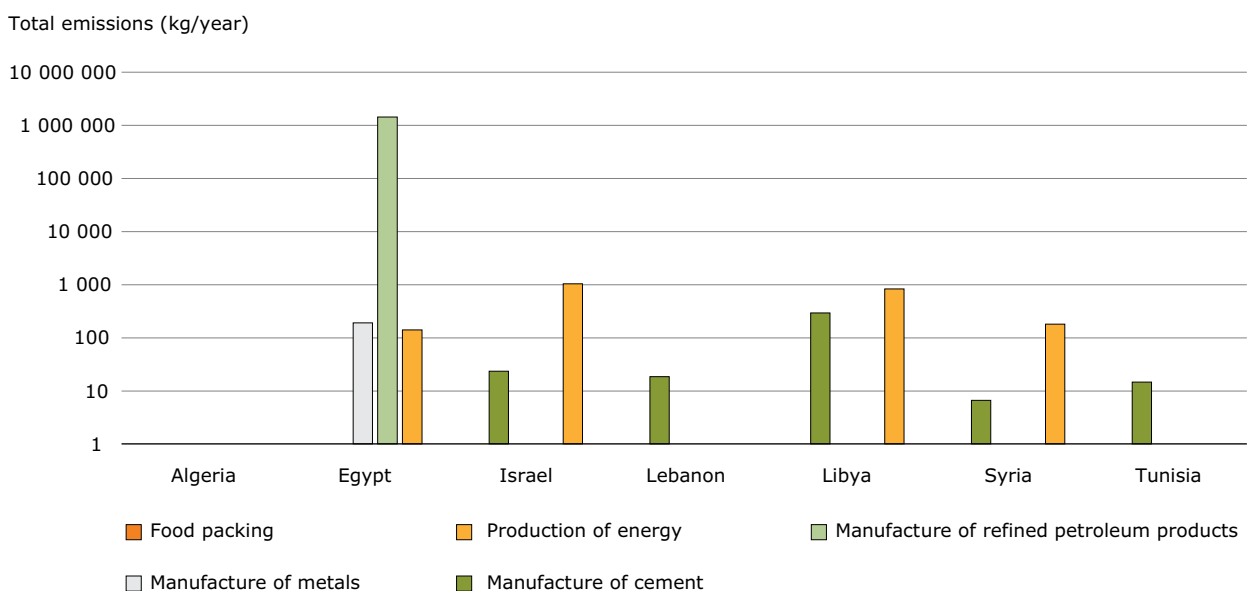
Figure 5.22 Loads of emissions for Chromium (gas) per country and per sector, 2003



Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria and Tunisia.

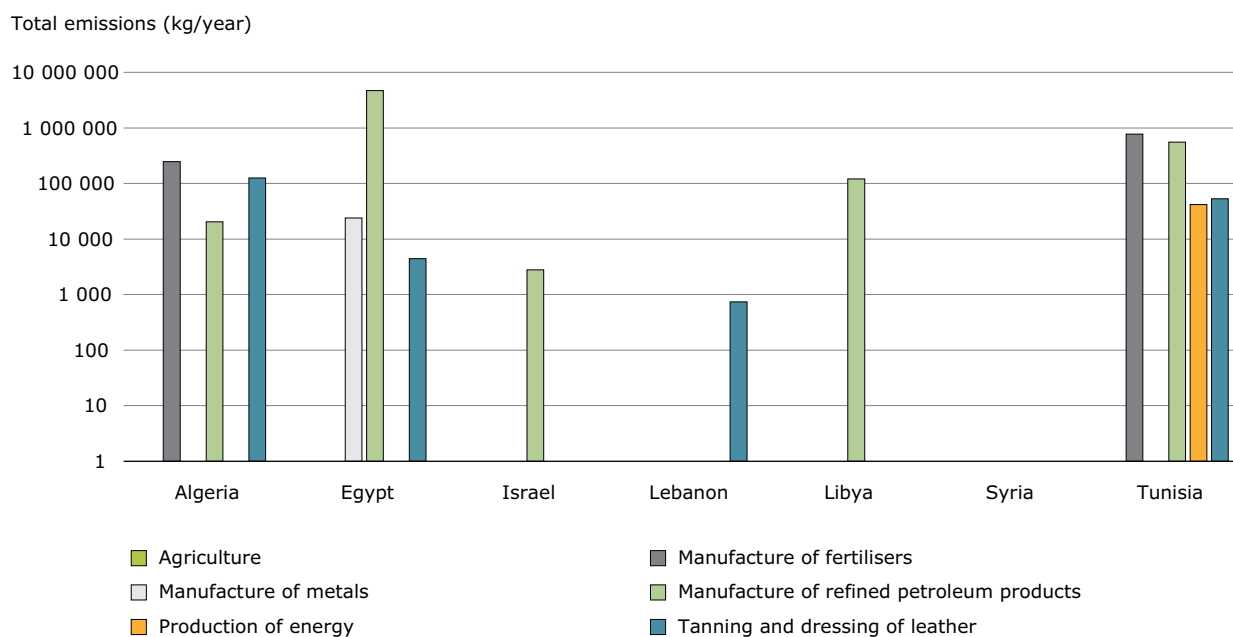
Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.23 Loads of emissions for Chromium (gas) per country and per sector, 2008



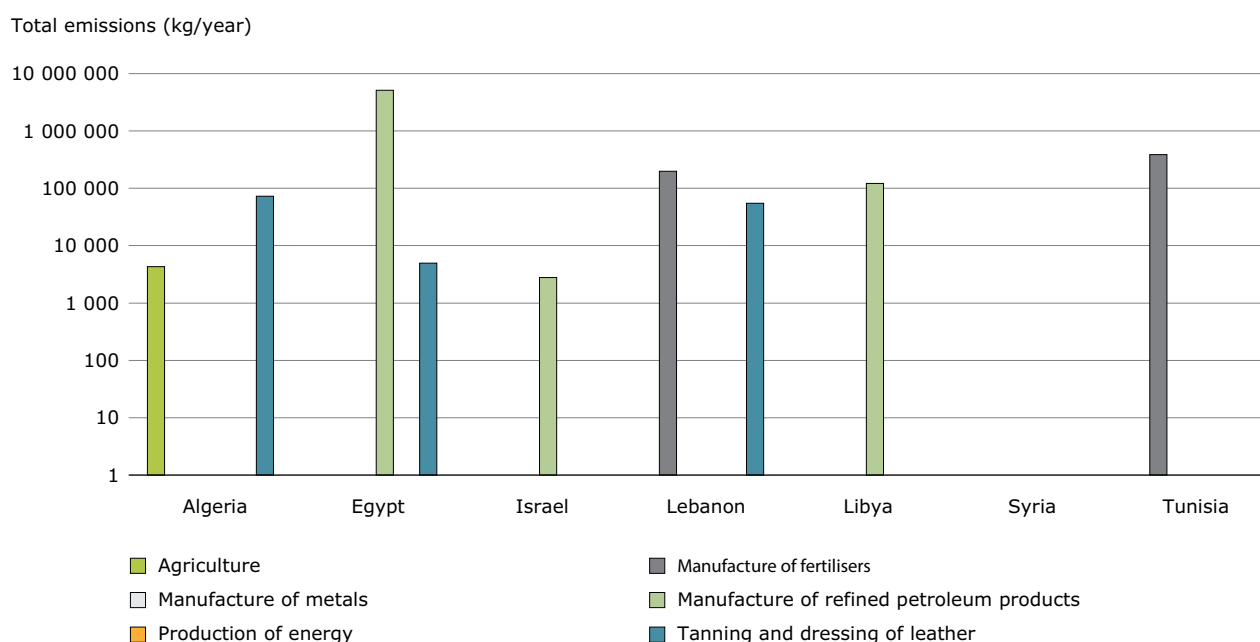
Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

Source: UNEP/MAP MED POL NBB database 2008.

Figure 5.24 Loads of emissions for Chromium (liquid) per country and per sector, 2003

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria and Tunisia.

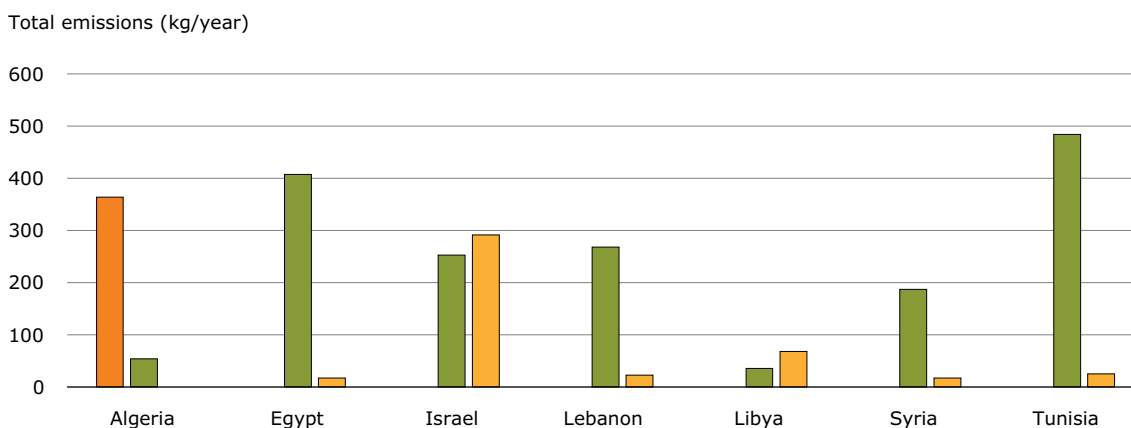
Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.25 Loads of emissions for Chromium (liquid) per country and per sector, 2008

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

Source: UNEP/MAP MED POL NBB database 2008.

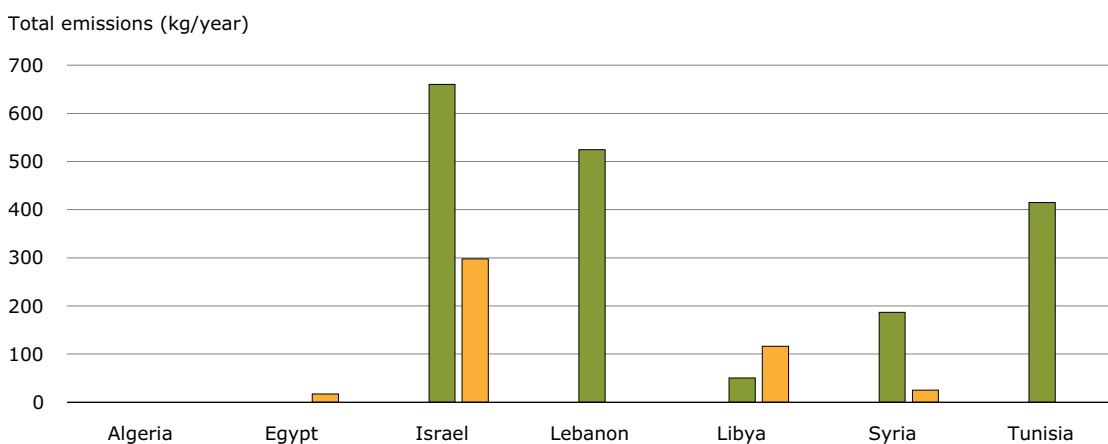
Figure 5.26 Loads of emissions for mercury (gas) per country and per sector, 2003



Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

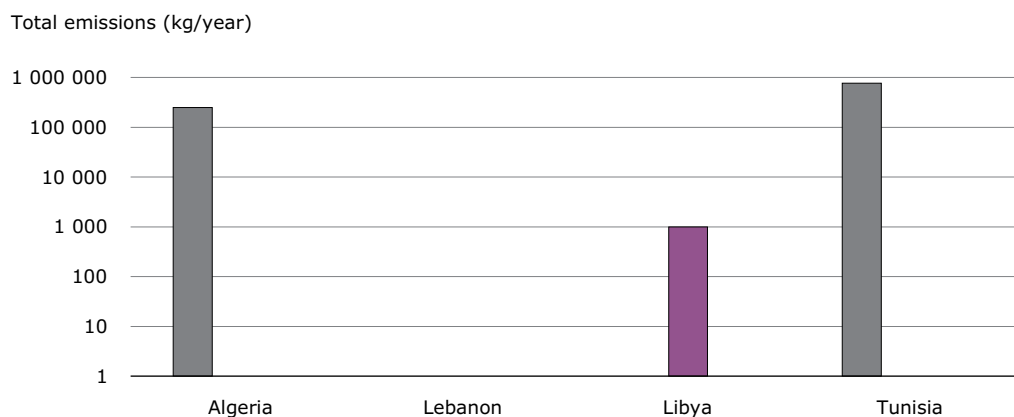
Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.27 Loads of emissions for mercury (gas) per country and per sector, 2008



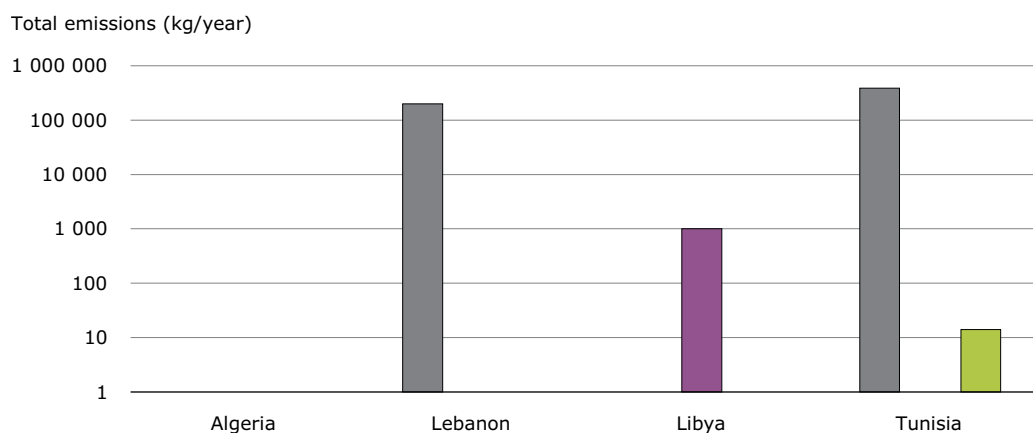
Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

Source: UNEP/MAP MED POL NBB database 2008.

Figure 5.28 Loads of emissions for mercury (liquid) per country and per sector, 2003

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

Source: UNEP/MAP MED POL NBB database 2003.

Figure 5.29 Loads of emissions for mercury (liquid) per country and per sector, 2008

Note: ENP-South: Algeria, Egypt, Israel, Lebanon, Libya, Morocco, Palestine, Syria, and Tunisia.

Source: UNEP/MAP MED POL NBB database 2008.

5.4 What are the main changes and trends in industrial emissions?

This question is of great importance, especially in designing future policy initiatives and measures. Based on existing data, the existence of only two years of data (2003 and 2008, and in a number of cases, data of a single year alone) does not allow for any conclusions to be drawn. In order to establish trends, it is important to ensure yearly reporting of pollutant loads. Reporting national budgets of pollutants every year and the establishment of PRTR by the countries is a step in the right direction — not only establishing a sustainable dataflow for reporting purposes, but also for following up the trends in pollution reduction and measuring the effectiveness of measures taken.

To this end, the environmental information systems (the NBB and the PRTR) need to be reliable, consistent and homogeneous, if they are to be the source for periodic reporting requirements to track pollution reduction progress, both at national and regional level.

The implementation of an environmental information system and the availability of reliable data also allow for improved enforcement of laws and regulations on industrial pollution, and for a more effective approach towards addressing environmental problems on a priority basis.

Among the several initiatives being developed at the national level by the Mediterranean countries, the interesting experiences of Egypt and Jordan are described in Box 5.2 and Box 5.3.

Box 5.2 Egypt's experience of combating pollution from industrial sources

In the last decade, industry has developed rapidly in Egypt, and it is expected to keep growing at a rate of about 7 % per year. However, continuous growth of industrial production has led to both human health and environmental stresses. In this context, the Ministry of State for Environmental Affairs (MSEA) and its Executive Agency (EEAA) have established and supervised, respectively, an integrated national network for monitoring the main air pollutants from 87 stations.

Key drivers and pressures at national level

(a) Waste sector GHG emissions

The major gas produced in this sector is CH₄, contributing with more than 99 % of the total emissions, with solid waste disposal on land being the most significant source category (67 % of the total GHG emissions from the sector).

(b) Industrial GHG emissions by sources

About 60 % of all CO₂ emissions, and 40 % of SO₂ emissions, originate from industry. The main source categories for CO₂ emissions are cement, and the iron and steel production sectors. Their emissions are 17.25 million tonnes/year and 1.576 million tonnes/year, respectively. Together with the fertiliser industry, urea production and aluminium production, they contribute to 99.66 % of the total emissions of Egypt's industrial sector.

Responses put in place or planned at national level

(a) The Egyptian Pollution Abatement Project (EPAP) has been launched, with the overall objective of decreasing the pollution loads generated by Egyptian industries by at least 50 %.

(b) Several plans and programmes have been launched to improve the management of waste reduction, reuse, recycling and/or proper disposal, leading to a reduction in emissions from the waste sector.

(c) Mitigation measures are currently being implemented in the waste sector (2009–2025).

Box 5.2 Egypt's experience of combating pollution from industrial sources (cont.)**Solid waste treatment:**

- composting and recycling facilities;
- refuse-derived fuel with electricity generation/substitution in cement kilns, composting and recycling facilities;
- anaerobic digestion with recycling (flaring biogas or electricity generation).

Wastewater treatment: aerobic treatment of wastewater, and treatment/composting/combustion of sludge.

(d) Egypt's Industrial Development Strategy, issued in 2006, aimed to upgrade the Egyptian industrial sector: a move from being technologically excluded to becoming a technological adopter in the medium term. Some of these industrial processes, e.g. cement production, have already partly acquired technologies through the Clean Development Mechanism (CDM) under the Kyoto Protocol.

(e) As a result of the implementation of the Support for National Action Plan (SNAP), the GEF building capacity and the GHG-emission reduction projects, more than 20 projects emerged during the last decade, all of which promoted GHGs mitigation actions.

After the first implementation of a PRTR pilot project in 2001, the implementation of a full-size PRTR project in the Mediterranean coastal regions of Egypt was initiated in 2013. Currently, pollution loads are being estimated for pollutants/chemicals generated and released to the environment.

The expected outputs of the project are:

- PRTR for industrial sources established in pilot areas; list of chemicals to report the annual pollution load discharged to the sea agreed with industry;
- a national structure to deal with PRTR, set up in a sustainable manner.

Policies and policy actions to be strengthened

- enforcement of compliance: environmental impact assessments (EIAs) and licensing of industrial facilities, online monitoring of industrial emissions, improved inspection, load-based emission standards and time limits for the validity of permits;
- an updated database on industrial pollution;
- cleaner production for the reduction of GHG emissions, e.g. energy efficiency and cleaner fuels;
- economic incentives;
- public disclosure;
- management of industrial hotspots and guidance of industrial development;
- continuous review and updating of emission standards, monitoring and compliance procedures, e.g. the new Law 9/2009 and its' executive regulations.

Source: Country-level assessment Egypt, 2013.

Box 5.3 Jordan's experience of combating pollution from industrial sources

The Ministry of Environment of Jordan has established an ambient air quality monitoring network at different residential areas that are close to industrial activities. In addition, several monitoring programs are implemented to monitor the levels of concentration of gaseous air pollutants (SO₂, H₂S, NH₃, NO, NO₂, NO_x, CO and CO₂) and suspended fine dust in industrial sites. An example of the available data for SO₂ concentrations is given below for Sahab and Irbid.

Table 5.4 Monthly and yearly averages, and max. hourly and daily averages of SO₂ concentrations and percentages of hourly and daily exceedances of monitoring sites during July 2009–September 2010 and November 2010–November 2011

Site name	Study period (year)	Month											
		July	August	September	October	November	December	January	February	March	April	May	June
Sahab	2010/2011					0.010	0.002	0.003	0.005	0.007	0.004	0.003	0.003
	2009/2010	0.004	0.001	0.005	0.002	0.006							
		0.014	0.014	0.016	0.01	0.007	0.007	0.01	0.017	0.005	0.005	0.003	0.004
Irbid	2010/2011					0.000	0.001	0.001	0.003	0.003	0.002	0.002	0.000
	2009/2010	0.002	0.004	0.008	0.001	0.000							
		0.005	0.005	0.003	0.002	0.002	0.002	0.002	0.003	0.005	0.000	0.000	0.000

Site name	Study period (year)	Max. (ppm)		Exceedance of JSTD		Yearly average (ppm)
		Hourly average	Daily average	Hourly average (%)	Daily average (%)	
Sahab	2010/2011	0.167	0.032	0.00	0.00	0.008
	2009/2010	0.403	0.101	0.06	0.00	0.008
Irbid	2010/2011	0.249	0.104	0.00	0.00	0.002
	2009/2010	0.05	0.018	0.00	0.00	0.002

These data, as well as all the others included in the report, are data from air quality measurements/ monitoring and as such cannot be used to fill in H2020 indicator 6 (release of toxic substances and nutrients from industrial sectors). Emission factors and activity data with regards the industrial sources are required to obtain loads of emissions (expressed as kg of contaminant per year).

Source: Country-level assessment Jordan, 2014.

6 Response: actions to combat environmental degradation

What has been done to combat environmental degradation?

How effective have the environment policies to combat and prevent pollution in the Mediterranean been?

6.1 Mediterranean pollution reduction regulatory framework

The Mediterranean Action Plan (MAP), established in 1975 under the auspices of UNEP, represents a solid and long-standing institutional and legal framework in which to coordinate the collective and action-oriented efforts of the Mediterranean countries and the EU, for the protection of the marine and coastal environment and their sustainable development. Originally, MAP focused its action on integrated planning as well as on the major pollution drivers affecting the marine and coastal environment, including marine pollution assessment and monitoring.

In 1976, the Mediterranean countries and the EU strengthened their commitment to MAP by adopting the Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention). This was followed by the adoption of seven associated protocols that address (in greater detail) the additional operational legal and technical obligations regarding specific aspects of Mediterranean environmental protection and sustainable development.

- Dumping Protocol (from ships and aircraft), 1975; amended in 1995. Amendments not yet in force.
- Prevention and Emergency Protocol (pollution from ships and emergency situations), 2002.
- Land-based Sources and Activities (LBS) Protocol, 1980; amended in 1996. Amendments in force since 2008.
- Specially Protected Areas and Biological Diversity Protocol, 1982; amended in 1995. Amendments in force since 1999.

- Offshore Protocol (pollution from exploration and exploitation), 1994. In force since 2011.
- Hazardous Wastes (HW) Protocol, 1996. In force since 2011.
- ICZM Protocol, 2008. In force since 2011.

MAP is equipped with a network of regional programmes and/or centres of excellence (Programmes and Regional Activity Centres) and respective national focal points to foster technical cooperation among the contracting parties and enhance the implementation of its work programme. MAP is an evolving cooperation framework and has been subject to adjustments in order to remain relevant to the region, respond effectively to the needs of the contracting parties and ensure the necessary coherence and synergies are in place with global and other regional commitments. In this context, MAP expanded its geographical scope of application to also cover the land part of the coastal zone, as well as the whole Mediterranean hydrological basin, where appropriate. From a substantive point of view, MAP strengthened its policies and actions to streamline sustainable development principles, enhance biodiversity conservation and sustainable management of marine and coastal resources, apply ICZM and ensure a better interaction of environment and development integration. This culminated with the revision of MAP and the Barcelona Convention in 1995 to streamline the Rio principles and outcomes, as well as with the establishment of Mediterranean Commission for Sustainable Development in 1996, followed by the adoption of the Mediterranean Strategy on Sustainable Development (MSSD, 2005). The MSSD highlighted the protection of marine and coastal environment and sustainable development of coastal regions among its priorities.

Since 2008, MAP committed to applying the ecosystem approach as an overarching principle of its policies and actions, with the view to achieve good environmental status according to an ambitious implementation road map and cyclic-based timetable, the first of which extends

till 2019/20. In this respect the Contracting Parties at their 15th meeting held in Almeria agreed on the following ecological vision for the Mediterranean and strategic goals:

- (a) 'A healthy Mediterranean with marine and coastal ecosystems that are productive and biologically diverse for the benefit of present and future generations';
- (b) To protect, allow recovery and, where practicable, restore the structure and function of marine and coastal ecosystems thus also protecting biodiversity, in order to achieve and maintain good ecological status and allow for their sustainable use.
- (c) To reduce pollution in the marine and coastal environment so as to minimize impacts on and risks to human and/or ecosystem health and/or uses of the sea and the coasts.
- (d) To prevent, reduce and manage the vulnerability of the sea and the coasts to risks induced by human activities and natural events;

The ecosystem approach road map (Decision UNEP/MAP IG 17/6), comprising the following steps:

1. establishing the vision for an ecosystem approach throughout the Mediterranean;
2. setting up three strategic goals to achieve this vision;
3. undertaking an initial assessment to determine priority issues and information availability as well as gaps that need to be filled;
4. deciding on ecological objectives;
5. determining operational objectives and associated indicators, and identifying targets or thresholds for those indicators;
6. developing a monitoring strategy;
7. drawing up specific management plans and actions that will ensure that ecological objectives and strategic goals are met.

To date, steps 1 to 5 of ECAP road-map implementation have been completed; work on the thresholds is ongoing. In implementing the ECAP, the UNEP/MAP Barcelona Convention is ensuring necessary synergies with the EU MSFD common

implementation strategy. It should be noted that H2020 Indicators 5 and 6 respectively on nutrient concentration in coastal waters and on industrial emissions are consistent with ECAP indicators agreed under the ecological objectives related to eutrophication (Ecological objective number 5 — EO 5) and contaminants (EO 9). Work has started on preparing an integrated monitoring programme for the region, with a view to its consideration by the contracting parties in 2015. Preparatory work will be carried out during 2014–2015 based on the last COP Decision, 2013, Istanbul, Turkey. This decision aims to review any existing measures at regional and national levels that contribute to Good Environmental Status (GES), target achievements as well as to identify potential additional measures as appropriate for consideration by the contracting parties.

6.2 Mediterranean Marine Pollution Assessment and Control Programme (MED POL) and Cleaner Production/ Sustainable Consumption and Production Regional Activity Centre (SCP/RAC)

As a high priority and challenge for the region, pollution reduction and elimination continues to be central to the MAP agenda. This is translated through the establishment in 1975 of the MED POL programme as the first operational programme of MAP. Over the years, the MED POL programme mandate evolved with a view to assisting the contracting parties to set their common regional policies on pollution elimination/reduction in the region, and meet their obligations and commitments under the Barcelona Convention, including the protocols related to land-based sources and activities, dumping and hazardous waste. Therefore, MED POL's programme mandate shifted from pollution monitoring and assessment to also measures at regional and national levels, so as to ensure that pollution reduction and control is supported and guided by assessments of marine pollution levels and sources and their respective trends.

In addition, a Regional Activity Centre on Cleaner Production was established in 1996 in Barcelona, Spain to support the contracting parties in applying best available techniques (BAT) and best environmental practice (BEP) for combating pollution from land-based sources. The mandate of this centre evolved over the years, and its scope extended to promotion of sustainable production and consumption, with a view to preventing

pollution generation at source and ensuring efficient use of resources.

Strategic Action Programme to combat pollution from land-based sources (SAP MED) and legally binding measures and timeframes (Regional Plans) adopted under Article 15 of the LBS Protocol.

In 1997, the contracting parties to the Barcelona Convention adopted the Strategic Action Programme to Address Pollution from Land-based Activities (SAP MED). SAP MED describes the main regional land-based pollution problems (sources, levels, and where appropriate, impacts), identifies possible control measures, with an estimate of their cost, and sets targets and deadlines for their achievement.

The implicit long-term objective of the SAP MED is to facilitate implementation by the contracting parties of the provisions of the 1996 LBS Protocol through:

- formulation of principles, approaches, measures, timetables and priorities for action;
- preparation of a Priority Investment Portfolio;
- analysis of baseline and additional actions related to transboundary problems;
- identification of the elements of and the preparation of guidelines for the formulation of NAPs;
- identification of the role and involvement of non-governmental organisations and stakeholders in its implementation.

Legally binding measures and programmes adopted under Article 15 of the LBS Protocol of the Barcelona Convention

The contracting parties have adopted several legally binding measures (regional plans) in the context of implementing Articles 5 and 15 of the LBS Protocol. The origin of these measures can be traced back to the year 2008, when MED POL focal points agreed to establish a list of priority substances⁽¹³⁾.

In principle, it was agreed that in order to propose measures:

- (a) the substance should be covered by regional and/or international instruments regulating its use, release or phasing out;
- (b) the substance should have an Emission Limit Value, or its ELV should be under development either at national or at regional levels;
- (c) the substance's high input could represent a risk to the marine environment or human health;
- (d) the parties may propose additional substances at the contracting parties' meeting.

Regional plans addressing the following concerns were adopted in 2009, 2012 and 2013:

- elimination of aldrin, chlordane, dieldrin, endrin, heptachlor, mirex and toxaphene;
- phasing out of dichlorodiphenyltrichloroethane (DDT) (adopted in 2009);
- reduction of BOD₅ from urban wastewater (adopted in 2009);
- reduction of inputs of mercury (adopted in 2012);
- reduction of BOD₅ in the food sector (adopted in 2012);
- phasing out of hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether (adopted in 2012);
- phasing out of lindane and endosulfan (adopted in 2012);
- phasing out of perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride (adopted in 2012);
- elimination of alpha hexachlorocyclohexane, beta hexachlorocyclohexane, chlordecone, hexabromobiphenyl and pentachlorobenzene (adopted in 2012);
- management of marine litter in the Mediterranean (adopted in 2013).

⁽¹³⁾ The 'action' priority substances consist of nutrients, metals, organic metallic compounds, polychlorinated biphenyls (PCBs), polychlorinated dibenzodioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), total suspended particulates, total volatile organic compounds, nitrogen oxides, ammonia, sulphur oxide, and persistent organic pollutants.

The pollutants agreed under H2020 Indicator 6 on industrial emissions were selected from the list of priority substances. Most of them are related to the regional plans: nutrients and oxygen-depleting substances, heavy metals, and persistent organic pollutants (POPs). Furthermore, Indicators 1 to 4 on municipal solid waste and urban wastewater are very much linked to both UNEP/MAP regional plans on BOD and the Regional Plan on Marine Litter Management.

Most of the regional plans call on the contracting parties to adopt national emission-level values for the relevant pollutants within agreed timetables, as well as BAT, BEP and Sustainable Production and Consumption (SCP) applications. Deadlines are set for meeting the target emission-level values (where applicable). The regional plans provide for monitoring discharges, implementation of the necessary enforcement measures and reporting.

The contracting parties have adopted with support from MED POL programme and SCP/RAC a number of other policies and regional plans that do not have a strict legally binding nature, in order to address high priority sectors.

These include:

- plan on reduction of input of BOD by 50 % by 2010 from industrial sources for the Mediterranean region (COP 13, Catania, Italy, 2003);
- plan for the reduction by 20 % by 2010 of the generation of hazardous wastes from industrial installations for the Mediterranean region (COP 13, Catania, Italy, 2003);
- plan for the management of hazardous waste, including inventory of hazardous waste in the Mediterranean region (COP 13, Catania, Italy, 2003);
- plan for the management of PCBs waste and nine pesticides for the Mediterranean Region (COP 13, Catania, Italy, 2003);
- strategic framework on marine litter management (COP 17, Paris, France, 2012).

Reporting systems to track pollution reduction

UNEP/MAP has established a 2-year reporting cycle for implementation of the Barcelona Convention and its protocols. The most important obligations for

the contracting parties are related to the inventory of pollutants entering the Mediterranean Sea directly and indirectly, as well as marine pollution monitoring data. In this context, several reporting tools covering both content and infrastructure, and dataflow aspects are operational or under development to support the contracting parties in meeting their reporting obligations.

Under the MED POL programme, the contracting parties report their national budget of pollutants that represent the pollutant loads of substances emitted per sector/subsector at regional and national levels, as provided for in the LBS Protocol. In addition, SAP MED also encourages the contracting parties to develop PRTR as an innovative tool that would allow them to cooperate with private and public industrial sectors while tracking pollution reduction in a transparent and accurate manner, and acknowledge progress achieved and take necessary measures to implement national legislation. PRTR pilots were implemented in Egypt, Morocco, Tunisia and Syria. Under the H2020 SEIS project, PRTR-related activities were given high priority and several countries are being supported so as to enhance their capacities to establish PRTR for the industrial sectors, in particular for substances covered by H2020 Indicator 6 on industrial emissions.

6.3 Implementing National Action Plans (NAPs) to combat pollution from land-based sources

The long-term operational output of SAP MED is country implementation of NAPs to combat pollution from land-based activities. Under Articles 5 and 15 of the LBS Protocol of the Barcelona Convention, 21 contracting parties prepared and adopted NAPs that were endorsed in 2005 by the 14th contracting parties' meeting. The measures provided in the NAPs include legal, institutional and technical targets and investments to be accomplished by 2010 and 2015. The categories of targeted substances cover activities carried out within the urban environment or as part of activities related to industrial development. It was demonstrated that if NAPs are fully implemented, the midterm targets of the SAP will be achieved.

The adopted NAPs presented a very significant investment portfolio for the Mediterranean countries in six sectors (i) municipal sewage, (ii) urban solid waste, (iii) air pollution from mobile sources, (iv) reduction and control of pollution by heavy metals, mercury, cadmium and lead, (v) reduction

and control of pollution by organohalogen compounds, and (vi) sound management of wastewater and solid waste from industrial installations. There were clear investment needs for the period up to 2010 and in some cases to 2015, and with general indications for 2025.

The respective investment portfolio of the NAPs were largely used by initiatives such as Horizon 2020 and the GEF MedPartnership investment component (SustainableMed) and funding agencies (EIB, WB, etc.), for guiding their work in developing project pipelines of priority environmental investment projects, and in this way, supporting the respective countries in reducing pollution. In this context, NAPs' priority interventions have been reviewed for developing priority investment projects by MeSHIP/EIB under H2020; World Bank Sustainable Med project, and other International Financial Institutions according to their respective environmental and/or other criteria.

In 2008, under UNEP/MAP leadership, the Medpartnership project was launched funded by GEF, the Mediterranean Trust Fond (MTF) and other major donors, as a collective effort with contribution from a considerable number of competent international and regional organisations to undertake policy reforms at regional and national levels and actions on the ground. One of the major components in this respect is to promote the financial sustainability of NAP implementation.

The contracting parties have also recognised the list of Mediterranean pollution hotspots as the areas where the main pollution sources are located and where pollution reduction projects are to be implemented as a priority, in order to protect the sea in a coherent way. Hotspots were listed in the NAPs as priority investment interventions.

The central issue of NAP implementation funding is closely related to the mobilisation of external financing. Different types and sources of financing may be appropriate, depending on the type, size and risks of environmental investment being considered and the administrative, legal, political and social context in which the investment will be utilised. Long-term sustainable financing is also dependent on adequate accounting for decision-making, and valuation of marine and coastal ecosystem services. There is, therefore, the need to bring strategic financial planning and management into the NAP

project cycle, reduce the 'financing gap' and overcome the present financing difficulties of implementation, with the aim of securing sustainable flow of financing for the purpose of pollution reduction.

Before agreeing on the NAP update, a midterm evaluation of implementation of NAPs was requested at the 17th contracting parties' meeting, in Paris, France, in 2012.

The main objectives of this evaluation were to:

- (a) enhance the sustainability of the SAP MED/NAP implementation, based on a forward-looking assessment of the status of implementation of SAP/NAP and the achievement of their targets;
- (b) provide specific recommendations on ways and means to integrate ecosystem approach in the SAP/NAP process as well as to extend the scope of NAP implementation to include the legally binding measures and obligations taken by the contracting parties under the Regional plans adopted in 2009, 2012 and 2013 to achieve good environmental status in line with commitment taken under ECAP

The final results of SAP/NAP implementation midterm evaluation are subject to validation by each contracting party and are expected to be finalised by end of 2014 and discussed by the contracting parties in 2015.

6.4 National responses

At national level, a number of responses are in place to tackle pollution reduction and elimination, including legislative measures, strategies and policy tools, financial instruments, investment projects and monitoring activities. In their country-level assessments ⁽¹⁴⁾, the countries highlighted responses that either are already in place or are currently being implemented for each priority area. A selection of responses per type is given below.

Laws and legislation

In most of the countries, a number of environmental legal policies are in place, aimed at regulating pollution from different sources. However, much of this legislation may be outdated and require

⁽¹⁴⁾ See http://enpi-seis.ew.eea.europa.eu/login_html?came_from=http%3A//enpi-seis.ew.eea.europa.eu/assessment/ENP-south-h2020-country-level-assessment/index_html&retry=&disable_cookie_login__=1.

periodic revisions. Upstream policy formulation is often complicated given the coordination required with the many different public bodies concerned. Insufficient monitoring, inspection mechanisms and enforcement often result in rather weak legislative frameworks. In addition, the unstable political situation in many of the ENP-South countries results in frequent cabinet reshuffling, which further delays and jeopardises policymaking, as new governments and ministers tend to overlook previous policies or policies still in the making, and engage with new studies.

National programmes and strategies

Environmental challenges are often addressed in national programmes and strategies which set objectives, determine priorities and draw roadmaps for the implementation of depollution activities. Countries have outlined the status of a number of national management and policy strategies to tackle priority areas.

For example, in 2003, the Algerian Ministry of Planning and Environment initiated a national management programme for municipal waste, known as PROGDEM⁽¹⁵⁾. This programme presents an integrated and phased approach to the management of waste, and aims at eradicating illegal dumping practices and achieving more organised collection, transportation and disposal of municipal waste. The improved management and control of municipal waste will not only affect the cleanliness of cities but will also improve the quality of life of citizens, safeguard public health and create green jobs.

National programmes and strategies addressing pollution issues are increasingly becoming cross-sectorial, involving environmental, socio-economical, institutional and legal aspects. Palestine recently issued a National Strategy for Solid Waste Management (NSSWM), in accordance with the Palestinian Ministerial Cabinet Decision No 53 (2008). This new strategy aims at setting the development path for Palestinian solid waste management until 2014, and is considered the first cross-sectorial strategy for solid waste management in Palestine. It constitutes the reference point and strategic framework for all decisions, programmes,

activities and medium-term investment plans. Egypt is currently engaged in the revision of its ICZM framework in order to update it and align it to new management challenges that involve multiple sectors and international obligations. The amended framework will evolve into a full 'National ICZM Strategy for Egypt', developed in line with Egypt's commitment to the Barcelona Convention Protocol on ICZM (adopted in 2008). In line with Article 7 of the protocol, the strategy focuses on enhancing coordination in interinstitutional strategic planning.

Financial instruments

The successful implementation of national programmes and strategies relies heavily on the availability of financial instruments. Some countries have national funds in place to support the private sector in investing in pollution control. For example, in 1998, the Department of Environment in Morocco, with financial support via German cooperation, launched the Industrial Pollution Control Fund (FODEP⁽¹⁶⁾) to encourage industrial and commercial enterprises to use clean technologies so as to reduce industrial emissions and make savings in raw materials.

In the region of Tangier Tetouan, six projects on the treatment of liquid waste have benefited from FODEP funds of up to MAD 14 million (equivalent to ~ EUR 1.2 million). To ensure continuity in the abatement of industrial pollution, Morocco has implemented a new Incentive Mechanism in Waterborne Industrial Pollution (MVDIH)⁽¹⁷⁾. This mechanism provides water agencies with financial resources to subsidise up to 20 % to 40 % of remediation projects, such as the establishment of treatment stations for liquid discharges from industrial units. This mechanism had a budget of MAD 100 million (~ EUR 9 million) between 2011 and 2013.

Similar depollution funds are also available in Tunisia. FODEP, created by ANPE⁽¹⁸⁾ in 1992, aims at achieving a balance between boosting development and protecting the environment. This financial mechanism helps manufacturers implement their projects on reducing water and air pollution. It also provides support to companies specialising in the collection and recycling of waste,

⁽¹⁵⁾ PROGramme national de GEstion intégrée des déchets Municipaux.

⁽¹⁶⁾ Fonds de Dépollution Industrielle.

⁽¹⁷⁾ Mécanisme d'Incitation à la Dépollution Industrielle Hydrique.

⁽¹⁸⁾ Agence Nationale de Protection de l'Environnement.

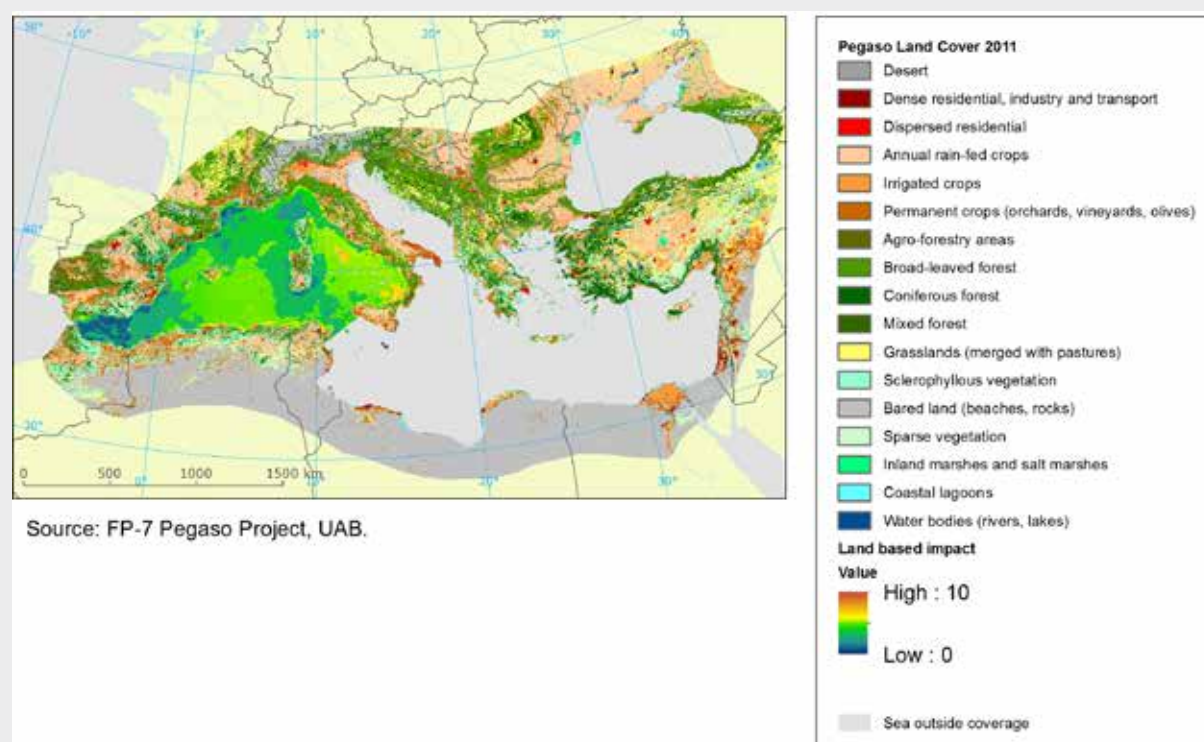
Box 6.1 Available tools from the scientific community to support integrated policies for coastal, marine and maritime realms of the Mediterranean Sea: the example of PEGASO ⁽¹⁹⁾ (People for Ecosystem Based Governance in Assessing Sustainable Development of Ocean and Coast) tools

States and changes in natural capital are related to pressures and impacts derived from human activities. An innovative approach applied by PEGASO is to map the cumulative impact of human activities on marine ecosystems. Cumulative impact map is created by overlaying individual threat maps and using vulnerability scores to estimate ecological impact. Individual threat maps are maps of individual human activities that impact marine ecosystems by estimating the ecological consequences of these activities and by quantifying the vulnerability of different ecosystems to these activities. They are based on a methodology designed by Halpern (2009). The resulting cumulative impact map provides critical information for evaluating where certain activities can continue with little effect on the oceans, where other activities might need to be stopped or moved to less sensitive areas, and where to focus efforts on protecting remaining pristine areas.

In PEGASO the approach is used to evaluate in a systematic way the potential impact of anthropogenic pressures, hereafter called 'stressors', on different marine ecosystems. Uses and land based pollution data are considered as proxies for stressors and the cumulative impact they have on ecosystem components is based on expert judgment. An estimate of cumulative impact was provided at the square kilometer scale. Cumulative pressure and cumulative impact indexes were calculated over the Western Mediterranean (Map 6.2).

The land based impact map (Map 6.1) for the Western Mediterranean has been inserted into the PEGASO Land Cover 2011, which is the first land cover map produced for the whole Mediterranean and Black Sea basins. Land cover represents an evaluation of the land resources that exist at certain place and time.

Map 6.1 Land based impact on the Western Mediterranean Sea



⁽¹⁹⁾ PEGASO is a collaborative Project — Large Scale integrating project from the Seventh framework programme of the European Community for research and technological development that runs over the period 2010–2014.

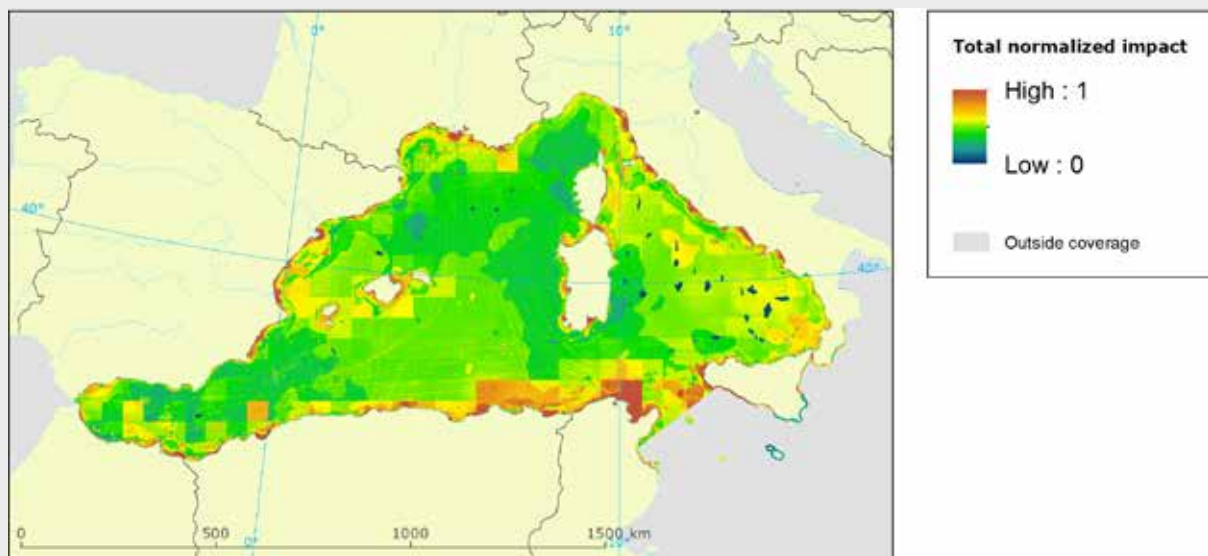
Box 6.1 Available tools from the scientific community to support integrated policies for coastal, marine and maritime realms of the Mediterranean Sea: the example of PEGASO ⁽⁸⁾ (People for Ecosystem Based Governance in Assessing Sustainable Development of Ocean and Coast) tools (cont.)

The evaluation is expressed in a scale of values, described and mapped as discrete classes or land cover categories, structured in a land cover nomenclature. The PEGASO land cover product is created from MODIS multispectral data following a simplified CORINE classification scheme.

The maps have been done using the PEGASO Spatial Data Infrastructure (SDI), where all PEGASO products are embedded. Maps represent the land-based impacts on the Western Mediterranean sea ecosystems. They show that main impacts on sea ecosystems take place near the coast, coinciding mostly with urban growth on land and river catchments. It can be also appreciated that in areas where water are renewed through strong currents (area near to the Gibraltar strait for example), impacts are lower.

During the PEGASO process, databases and maps has been done in a collaborative work with the PEGASO ICZM governance platform that includes the PEGASO consortium, the Collaboratives Application Sites (CASES) and a number of 24 end users from regions, economic sectors, NGOs, and countries. Since September 2011 all the National Focal Points of the ICZM Protocol have been also part of the ICZM Governance platform of PEGASO. It is in this context that the tools have been identified (user needs) and constructed with a timely validation of all end users. Finally the resulting statistics and maps have been used in the participatory methods to discuss possible ways of management today and the vision of the stakeholders in the long term, to co-construct together the best plausible future and decide on priority management actions and at what scales they should be done (national, cross boundary, sub regional, etc.). This is extremely useful for developing ICZM national strategies, marine strategies and marine spatial planning.

Map 6.2 Total cumulative impact on the Western Mediterranean Sea



Source: FP-7 Pegaso Project, UAB.

These maps showing final products have been done by UAB(1) and UPO(2) (Authors: Cesar Martinez(1), Gonzalo Malvarez(2), Emilia Guisado(2), and Françoise Breton(1)), as PEGASO final products.

as well as industrial projects that propose the use of clean technologies. By the end of 2013, 510 projects concerned with the clearance, collection and recycling of waste and clean technology were funded, with a total allocation of grants of around MAD 33.230 million (~ EUR 15 million or 20 % of investment).

6.5 H2020 components and related initiatives

PR/MeHSIP/PPIF, CB/MEP, Research

The Mediterranean Hot Spots Investment Programme — Project Preparation and Implementation Facility (MeHSIP/PPIF) supports the Pollution Reduction (PR) subgroup of H2020. Through continuous updating, the 'Horizon 2020 Project List' today contains 88 projects across the south Mediterranean partner countries with an estimated total investment value of around EUR 7 billion. MeHSIP/PPIF is also responsible for updating the 'Horizon 2020 Pipeline', which includes projects that still need to secure funding in the target sectors (Figure 6.1). The Horizon 2020 Pipeline currently contains 35 investment projects with an estimated value of EUR 2,53 billion, implying that a significant demand for additional funding is required for the implementation of these projects. A key component of the development of the Horizon 2020 Pipeline and of the implementation of the investment projects is close coordination with the European Union (EU) Delegations and other international financing institutions' (IFIs) country and sector programmes. This is done at a regional level and by on-going and regular coordination with country representatives.

Four projects have been undertaken by MeHSIP/PPIF from idea to maturity for financing (Table 6.1).

MeHSIP-PPIF undertook a validation exercise to determine the state of progress of H2020 projects with secured financing, that is those projects that have already undergone some project preparatory activities, for example through the form of a feasibility study leading to closing of financing agreements with: (i) IFIs in the case of loans; (ii) grant agreement in the case of grants; and/or (iii) budget allocation in the case of Government investment/contribution. The effectiveness of this validation process was maximised through

constructive cooperation and collaboration with other ongoing initiatives by UfM, UNEP/MAP and EEA (ENPI-SEIS). In addition to partners working under the H2020 umbrella this exercise was also supported through a partnership established between SWIM-SM⁽²⁰⁾ (EU-funded technical assistance) and MEHSIP-PPIF to mobilise experts to carry out three (3) field verification visits to the selected sites that were found to be operational. In total, 47 projects with 'secured' financing were part of this validation exercise, although only 42 projects were retained subject to the available information (Figure 6.2).

In summary, the main analyses extracted from the findings of the validation exercise covering the three main phases of the investment project cycle (Preparation, Implementation and Operation phase) are as follows:

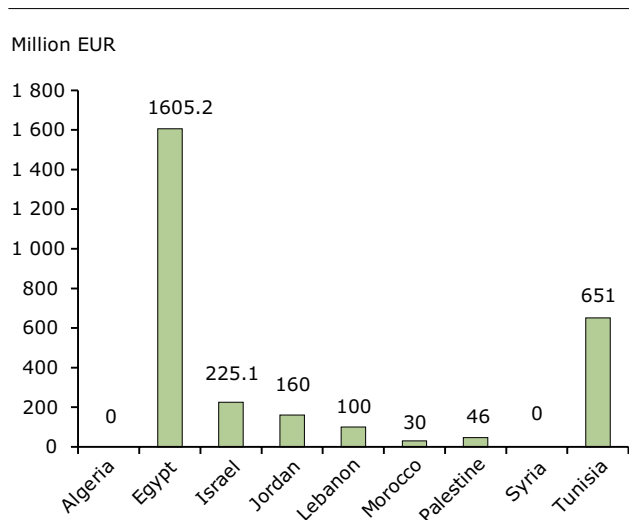
Preparation: The Preparation phase is when the promoter initiates the needed studies to be undertaken to make the project a bankable project. Despite the fact that this phase usually takes place prior to securing financing, the validation exercise gave more insight in the dynamics of this phase as it has the major impact on the implementation phase. It is well established that the main preparatory exercise for a successful investment project is a high-quality feasibility study that clarifies important aspects of the investment projects. According to the validation exercise, the average time required to complete all preparation studies was not less than three years. The preparation phase is considered to be the best time to establish a good consultation process with stakeholders and beneficiaries that should also continue throughout the project cycle phases.

Implementation: Five discreet stages were defined under the implementation phase, defining the status of the project in question. These are:

- Complementary/Updating of Feasibility Study;
- Detailed design;
- Procurement;
- Under construction;
- Post commissioning and Operation

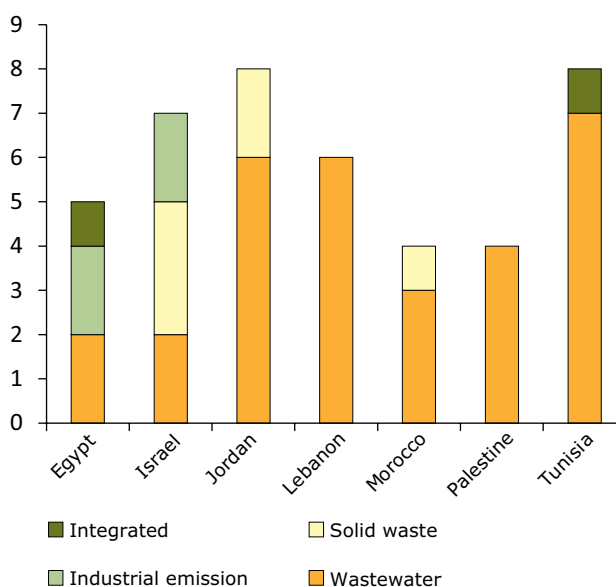
⁽²⁰⁾ Sustainable Water Integrated Management — Support Mechanism.

Figure 6.1 Horizon 2020 Project List – projects with financing not secured (million EUR)



Source: MeHSIP/PPIF, 2013.

Figure 6.2 Distribution of projects with secured funding



Source: MeHSIP/PPIF, 2013.

Table 6.1 Overview of MeHSIP-PPIF Projects

Country	Sector	Project Title	Estimated project cost (million euros)
Egypt	Wastewater	Wastewater Expansion for Kafr El Sheikh Governorate (part of Integrated Pollution Reduction Programme for Lake Burullus)	142
Jordan	Solid waste	Integrated SWM Project (Al-Ekaider)	39
Lebanon	Wastewater	Extension of WWTP (Al Ghadir)	100–150 (*)
Tunisia	Integrated	Integrated intervention program for de-pollution of (Lake Bizerte)	70

Note: (*) The estimated amount mentioned includes networks and an extended preliminary treatment plant with long sea outfall. If the project is considered for secondary treatment the project cost would increase to 390 M Euro.

Source: MeHSIP/PPIF, 2013.

Only 40 of the 42 projects were considered to be in the implementation phase. Of the 40 projects more than 60 % have been identified to be in the last stages of the implementation phase; 40 % 'under construction' and 25 % 'completed'. This means that 16 projects are under construction amounting to a total value of EUR 1 699.50 million. The validation also identified the main challenges facing implementation, of which 'change in scope', related to lack of good preparation and bad consultation with stakeholders and beneficiaries was among the top causes in delaying a project during its implementation phase.

Operation: This is the final phase of the project cycle when implementation has been completed, projects are commissioned and start performing according

to the project design criteria. The verification of operation is one of the most critical assessments as it includes a confirmation that all standards have been respected, installation of equipment have been done properly, including the achievement of the intended pollution reduction at the hot spot locations identified under H2020 as a key parameter. Ten projects were reported as completed and operational, amounting to a total investment of EUR 418.7 million.

The establishment of such a reporting and validation mechanism provides an update of the responses and progress achieved on committed investments for pollution reduction. It allows for identifying the gaps that still need to be addressed in terms of country commitments and needed infrastructure

financing. MeHSIP-PPIF has today established close relationships with key ministries in most of its partner countries. Such relationships take time to establish and have to be constantly nurtured over the period of project development. If one considers the impressive increase of the H2020 Pipeline (from EUR 1.6 billion in 2009 to EUR 2.8 billion today), which sets out the current investment needs, it is evident that MeHSIP-PPIF can provide valuable services and support in developing national priority projects.

Update of investment project portfolio by UfM

The Union for the Mediterranean (UfM) Secretariat was recently set in place in order to provide a regional platform for political dialogue and acceleration of projects towards cooperation, security and sustainable development in the Mediterranean region. In the field of Environment and Water, the Mediterranean Sea has always been seen as a shared natural resource and common good for the bordering countries, and one of the first mandates given to the UfM is to protect the Sea from pollution. In order to develop its specific role in this field, the UfM Secretariat has benefited from previous knowledge, planning and protocols developed by MED POL in the framework of the UNEP/MAP, and also from feasibility studies, indicators and capacity building activities set in place in the framework of H2020. Regarding the delivery of projects, the efforts were based on previous or on-going actions identified by MED POL within the 21 depollution National Action Plans (NAPs) drafted in 2005 (see Section 6.3). For this reason, in 2013 the UfM updated the knowledge on the lists of projects, which gave rise in the following results: managing a Steering Committee with partners (EC, UNEP/MAP, EIB and EEA) involved in pollution reduction.

Gathering information: The Strategic Action Plan (SAP) (see Section 6.2) of 2000 sets targets for 2025, in particular through 120 pollution 'Hot Spots' to be tackled as a priority, regional plans of 2009 and 2012 provide target for certain types of pollutants. During its first phase, H2020 PR investment component has based its actions on these documents for ENP-South countries and three priority sectors (waste water, solid waste and industrial emissions), updating the information on projects in 5 countries and selecting 80 projects ready to be constructed or financed in 2007–2009 (see Section 6.5).

In 2013, the UfM — with the help of a consortium of consultants and professionals, LDK & IME — identified all the projects necessary to meet the MED POL targets in 2025 for the three H2020 sectors.

This inventory included those project that were mentioned in 2005 but also new projects in the same areas, i.e. areas likely to contribute to pollution Hot Spots or new investment needs whenever a gap between depollution current achievements and depollution future needs is detected. This means that the UfM inventory does not include investment in the areas that were already equipped with depollution facilities in 2005 or in other sectors, such as agriculture although it is recognized as a source of nitrate and phosphorus at the origin of eutrophication of fresh and marine waters. Some NAPs were focussed on pollution sources located on the coast. This was a priority for the first phase but should be extended in the future to upstream sources or activities resulting in downstream marine pollution through rivers.

The main output delivered by the UfM is an updated list of investment depollution projects, called the investment portfolio. This inventory contains the following information for each project: title/location and link with a Hot Spot or with the NAP/characteristics of size/reduction of pollutants' loads/status of implementation/cost or investment need/donors.

Achievements 2006–2013. The achievements can be evaluated both through projects and through impacts:

- The projects already implemented or under construction give an idea of what has been achieved so far. To simplify, projects implemented are supposed to provide their environmental impacts by now, whilst projects under construction are supposed to provide their environmental impacts in 2015. A simple comparison between what was planned in the NAPs and what has been listed by the UfM is the basis for the following analysis per sector:
 - Waste water projects: 68 % of these projects were not in the NAPs; 50 % are operational but more than half need extension or upgrade; 22 % are under construction and 30 % are under preparation or planned; 77 % have secured funding. Information on waste water project is most exhaustive and allows for extending the analysis to the population served or not served by facilities in the area, to the pollutants loads' reduction or release and to investment costs.
 - Solid Waste projects: 32 % were not in the NAPs; 31 % are operational whilst 10 % are under construction; 33 % are under preparation or planned; 38 % have secured funding.

- Industrial Emissions: although some industrial pollution are taken into account through public waste water or solid waste facilities, the list is far from complete and information attached to projects is insufficient for most countries.
- In terms of impact, the pollutants loads reduction in 2015–2025 is already an indication, but it is available only for waste water projects. In addition, these loads are estimated for areas where projects have been listed in the UfM inventory, whilst previous or recent loads estimations from UNEP/MAP or EEA are only available for the whole country or the whole Mediterranean watershed area. Therefore these cannot be directly compared. Waste water projects identified by the UfM have already reduced BOD loads by 567.000 tonnes per year for the whole region, which is significant compared to the total BOD loads generated in the same areas, i.e. 1.587.000 tonnes per year. The contribution from EU countries was the most important up to now, although in the (near) future the contribution from non EU countries is expected to be more significant.
- Another way of evaluating the impact of projects is to make the link with pollution Hot Spots, defined by UNEP/MAP as polluted areas or sources of regional importance. A detailed assessment of the situation of each Hot Spot would require detailed site-specific information, such as pollution sources and types of pollutants at the origin of the Hot Spot, projects needed to tackle all these sources, assessment and measurements of discharges before and after the implementation of the project and confirmation of the quality of the sea. This information is not readily available and therefore this assessment has been postponed to the next biennium within the UNEP/MAP process. Nevertheless, the UfM study has already started looking into the available information. Based on this work, it is not possible to draw conclusions for more than 40 % of the Hot Spots. However, 25 % of the Hot Spots (half of them in the EU) should have been already tackled by now whereas by 2020, 60 % of the Hot Spots are likely to be tackled. Following this way of reasoning, the projects identified and achieved since 2005 may have already removed 33 Hot Spots whilst projects under construction might raise this number up to 44 in 2015.

Prospective 2014–2025: When extrapolating the results already achieved to the future, the obtained average trend is more or less consistent with the

objective of depollution in 2025. However, this is not homogeneous between the sectors and between the countries. Up-to-date information is dramatically lacking about industrial emissions and most probably, this sector will not be in line with the 2025 deadline in many countries either for air pollution, hazardous substances or waste waters. Some countries, such as in the EU, have already met or will soon meet the MED POL targets, as is the case for Israel. In contrast, other countries show insufficient depollution efforts because they have accelerated their programs only recently, such as Albania, or have a slow rhythm of investment, such as Egypt. Another disturbing finding is that the population and activities in the region are not stable but are instead evolving based on demographic and economic growth. Many infrastructures designed for the needs of 2015 will not be fully relevant to the depollution needs of 2025. The UfM has estimated the so-called 'Depollution Gap' based on the difference between the pollution that will be produced in 2025 and the pollution that will be treated by the facilities which are already in place or planned with secured funding. Such an analysis shows the needs of the remaining efforts.

The Mediterranean Sea will be protected against pollution from land-based source and activities only when the MED POL targets will be met everywhere since the sea is a common recipient of all pollutants. Following the UfM findings, including the estimation of Depollution Gaps, depollution will not be achieved in all bordering countries within the targeted deadlines if efforts continue to be focused only on infrastructures and extensions to tackle additional pollution sources coming from population and economic growth. The current scenario of 'end-of-pipe' solutions must be completed by other policies dedicated to pollution reduction at source or recycling (Sustainable Consumption and Production measures) which are particularly relevant for solid waste or industrial emissions and are already being developed within EU countries. In parallel, extension of services for urban liquid or solid waste, particularly connection to and extension of sewage networks, will constitute the major part of the investment needs in the future, which has to be planned and funded with the same degree of care as treatment facilities. Last but not least, maintenance and operational costs will rise significantly following recent investments and countries will have to set in place adequate economic instruments to deal with operating costs separately from investment costs. The primary economic instrument is the tariff of public depollution services but pollution fees are also necessary, especially for private activities.

H2020 Capacity Building/Mediterranean Environment Programme

The ENPI Horizon 2020 Capacity Building/Mediterranean Environment Programme (H2020 CB/MEP) aims to support the implementation of the Horizon 2020 Initiative Road Map and Work Plan through capacity building and awareness raising activities, and to promote integration/mainstreaming of environment issues into other sector policies. It is also responsible for the coordination of the H2020 Steering Group and the overall enhanced visibility of Horizon 2020.

Environmental mainstreaming, being one of the objectives of the H2020, CB/MEP acts as an umbrella under which the three H2020 priorities (municipal solid waste, urban wastewater and industrial emissions) are developed horizontally, penetrating all capacity building activities as a cross-cutting issue to facilitate and create the enabling environment for the proper implementation, of all the components of the entire Horizon 2020 Initiative.

The priorities and needs identified in the region have been an outcome of a variety of sources, covering environmental desk studies of the partner countries, mapping of the major capacity building activities undertaken or in the pipeline in the period 2005–2015, expert advice, major inputs from missions to all partner countries, and a series of comparisons and considerations of capacity needs and available resources. Findings and priority needs expressed by the governments and other stakeholders in the countries have been recorded and systematised. The effort to satisfy as much as possible the expressed needs is obvious. The

concrete impacts of the CB/MEP activities are visible in institutional strengthening in countries. Overall, around 130 CB activities organised by the end of the project (October 2014) with over 3000 experts trained in different aspects of environmental domains.

Capitalising on these positive elements and synergies with relevant processes (such as the SEIS implementation, pollution reduction investments, UNEP/MAP, UfM) as well as the results achieved in shaping the way forward in the period 2014–2020 is needed to support reaching the goals of the H2020 Initiative.

H2020 Research component

While the review and monitoring elements have been geared towards setting-up of a reporting mechanism in preparation of the current regional report and establishing a more regular sustainable process in future, the research component has been a bit stand-alone in these discussions and has been addressed by various research projects as part of the Euro-Mediterranean Research and Innovation platform (e.g. FATE, MELIA/MIRA, etc.). In April 2012 there was a proposal made by the H2020 Steering Group to establish a separate core group on research, which however has not been followed up since. The Directorate-General for Research and Innovation's remains in charge of the EU-funded research in the field of environment in the Mediterranean, linking to various ongoing activities in the region. Recommendations on the way forward on the research aspect linking to the other H2020 components is to be expected at the upcoming H2020 Steering Group meetings/events.

References

Part 1 References

UNEP, 2006, *African Environment Outlook 2: Our environment, Our wealth*, UNEP Job No. DEW/0801/NA, UNEP, Nairobi, Kenya.

UNEP, 2010, *Environment Outlook for the Arab Region. Environment for Development and Human Well-being*.

UNEP/MAP, 2013, *State of the Mediterranean Marine and Coastal Environment*, UNEP/MAP - Barcelona Convention, Athens, 2013.

Part 2 References

Ten Brink, P. (IEEP), Bassi, S. (IEEP), Farmer, A. (IEEP), Hunt, A. (Metroeconomica), Lago, M. (Ecologic), Larsen, B. (consultant), Spurgeon, J. (ERM), Tucker, G. (IEEP), Van Acoleyen, M. (Arcadis), Doumani, F. (consultant) and Van Breusegem, W. (Arcadis), 2011, *Analysis for European Neighbourhood Policy (ENP) Countries and the Russian Federation on Social and Economic Benefits of Enhanced Environmental Protection. Regional Report: ENPI South. A synthesis report on Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, occupied Palestinian territory, Syria and Tunisia*.

BRL Ingénierie, 2011, *La réutilisation des eaux usées traitées. Perspectives opérationnelles et recommandations pour l'action*, ADF.

Condom, N., Lefebvre, M. and Vandome, L., 2012, *Treated Wastewater Reuse in the Mediterranean: Lessons Learned and Tools for Project Development*, No. 11, Plan Bleu, Valbonne.

CWG/GIZ, 2011, *The Economics of the Informal Sector in Solid Waste Management. Based on information from: Scheinberg, A., M. Simpson, Y. Gupta et al. (2010): Economic Aspects of the Informal Sector in Solid Waste Management. GTZ and CWG, Eschborn, Germany, No 5*.

Djemai, M. and Mesbah, M., 2008, 'Physicochemical and bacteriological water characterization of the

OuedAissi drainage basin (Great Kabylia, Algeria)', *Bulletin du Service Géologique National* 19(1), pp. 51–70.

Durrieu de Madron, X., Guieu, C., Sempéré, R., Conan, P., Cossa, D., D'Ortenzio, F., Estournel, C., Gazeau, F., Rabouille, C., Stemann, L., Bonnet, S., Diaz, F., Koubbi, P., Radakovitch, O., Babin, M., Baklouti, M., Bancon-Montigny, C., Belviso, S., Bensoussan, N. et al., 2011, 'Marine ecosystems' responses to climatic and anthropogenic forcings in the Mediterranean', *Progress in Oceanography* 91(2), pp. 97–166.

EEA/UNEP, 1999, 'State and pressure of the marine and coastal Mediterranean environment', (<http://www.eea.europa.eu/publications/ENVSERIES05>) accessed 15 April 2014.

EEA/UNEP/MAP, 2006, 'Priority issues in the Mediterranean environment', (http://www.eea.europa.eu/publications/eea_report_2006_4) accessed 15 April 2014.

EIB - Plan Bleu, 2008, *FEMIP Study on Climate Change and Energy in the Mediterranean*, EIB — Plan Bleu.

EUWI MED, 2007b, *Mediterranean Wastewater Reuse Report*, MEDiterranean WasteWater Reuse Working Group (MED WWR WG),

EUWI MED, 2007a, *Mediterranean Water Scarcity and Drought Report*, Technical report on water scarcity and drought management in the Mediterranean and the Water Framework Directive,

FAO — Plan Bleu, 2013, *State of Mediterranean Forests*, FAO, Plan Bleu.

Giorgi, F., 2006, 'Climate change hot-spots', *Geophysical Research Letters* 33(8), pp. L08707.

Global Water Partnership/Plan Bleu, 2012, *Water Demand Management: The Mediterranean Experience*, Technical Focus Paper, No. 1,

Halpern, B. S., Walbridge, S., Selkoe, K.A., Kappel, C.V., Micheli, F., D'Agrosa, C., Bruno, J.F., Casey,

- K.S., Ebert, C., Fox, H.E., Fujita, R., Heinemann, D., Lenihan, H.S., Madin, E.M.P., Perry, M.T., Selig, E.R., Spalding, M., Steneck, R. and Watson, R., 2008, 'A Global Map of Human Impact on Marine Ecosystems', *Science* 319(5865), pp. 948–952.
- IPCC, 2013, *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley, Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Kellis, M., Kalavrouziotis, I. K. and Gika, P., 2013, 'Review of wastewater reuse in the Mediterranean countries, focusing on regulations and policies for municipal and industrial applications', *Global NEST Journal* 15, pp. 333–350.
- Larsen, B., 2010, *Cost assessment of environmental degradation in the Middle East and North Africa region – selected issues*, Economic Research Forum, Cairo, Egypt.
- Abu-Madi, M. and Al-Sa'ed, R.M.Y., 2009, *Towards Sustainable Wastewater Reuse in the MENA Region*, SSRN Scholarly Paper, ID 1676709, Social Science Research Network, Rochester, NY.
- Nicolau, R., Galera-Cunha, A. and Lucas, Y., 2006, 'Transfer of nutrients and labile metals from the continent to the sea by a small Mediterranean river', *Chemosphere* 63(3), pp. 469–476.
- OECD, 2010, *OECD Factbook 2010*, Organisation for Economic Co-operation and Development, Paris.
- Plan Bleu, 2012, *Tourism: Economic Activities and Sustainable Development*, Plan Bleu Notes, No. 24.
- RECO Baltic 21 Tech, 2012, *RECO Baltic 21 Tech Activity 5.6*, MEDA Cooperation Fundació ENT, Vilanova i la Geltrú.
- Scheierling, S.M., Bartone, C., Mara, D. and Dreschel, P., 2012, *Improving Waste Water Use in Agriculture, an Emerging Priority*, No. 5412, The World Bank.
- Spalding, M.D., Fox, H.E., Allen, G.R., Davidson, N., Ferdaña, Z.A., Finlayson, M., Halpern, B.S., Jorge, M.A., Lombana, A., Lourie, S.A., Martin, K.D., Mcmanus, E., Molnar, J., Recchia, C.A. and Robertson, J., 2007, 'Marine Ecoregions of the World: A Bioregionalization of Coastal and Shelf Areas', *BioScience* 57(7), pp. 573.
- UN, 2013, *The Millennium Development Goals Report*, New York.
- UNEP, 2009, *Marine Litter: A Global Challenge*, Nairobi.
- UNEP, 2010, *Environment Outlook for the Arab Region. Environment for Development and Human Well-being*.
- UNEP/FAO/WHO, 1996, *Assessment of the state of eutrophication in the Mediterranean sea*, MAP Technical Reports Series No. 106, UNEP, Athens.
- UNEP/MAP, 2005, *Mediterranean Strategy for Sustainable Development*, Athens.
- UNEP/MAP, 2007, *Approaches to the assessment of eutrophication in Mediterranean coastal waters (first draft)*, UNEP/MAP.
- UNEP/MAP, 2009, *Eutrophication in the Mediterranean Sea: An assessment and road map for future action*.
- UNEP/MAP, 2013, *State of the Mediterranean Marine and Coastal Environment*, UNEP/MAP - Barcelona Convention, Athens, 2013.
- UNEP/MAP/MED POL, 2003, *Riverine transport of water, sediments and pollutants to the Mediterranean Sea*, MAP Technical Reports Series No. 141, UNEP/MAP, Athens, 2003.
- UNEP/MAP/MED POL, 2006, *Regional review of NAPs by sector of activity/substance*, UNEP(DEPI)/MED WG.289/Inf.4, Durres, Albania.
- UNEP/MAP/MED POL, 2009, *Review of the MED POL marine monitoring activities. Assessment of the state of the environment and pollution trends*. UNEP/DEPI(MED) WG 343.3, Athens.
- UNEP/MAP/MED POL, 2011, *Releases, emissions and sources of pollutants in the Mediterranean region. An assessment of 2003–2008 trends*, UNEP/MAP/MED POL, Athens.
- UNEP/MAP/MED POL, 2014, *Mid-term evaluation of SAP/NAP implementation*, UNEP(DEPI)/MED WG.393/Inf.3, UNEP/MAP/MED POL, Athens.
- UNEP/MAP/MED POL/WHO, 2004, *Municipal wastewater treatment plants in Mediterranean coastal cities (II)*, MAP Technical Report Series No. 157, UNEP/MAP, Athens.

UNEP/MAP/MED POL/WHO, 2011, *Inventory of municipal wastewater treatment plants of coastal Mediterranean cities with more than 2,000 inhabitants (2010)*, UNEP(DEPI)/MED WG.357/Inf.7, Athens.

UNEP/MAP/MEDPOL, 2009, *Discharge from municipal wastewater treatment plants into rivers flowing into the Mediterranean Sea*, UNEP(DEPI)/MED WG. 334/Inf.4, Athens.

UNEP/MAP/MEDPOL/WHO, 2008, *Municipal wastewater treatment plants in Mediterranean coastal cities inventory of treatment plants in cities of between 2,000 and 10,000 inhabitants*, MAP Technical Reports Series No. 169, UNEP/MAP, Athens.

UNEP/MAP-Plan Bleu, 2008, *The Blue Plan's sustainable development outlook for the Mediterranean*, UNEP/MAP.

UNEP/MAP-Plan Bleu, 2009, *State of the Environment and Development in the Mediterranean*, Report, UNEP/MAP-Plan Bleu, Athens.

UNICEF, 2013, 'Children dying daily because of unsafe water supplies and poor sanitation and hygiene', *UNICEF* (http://www.unicef.org/media/media_68359.html) accessed 14 April 2014.

Union for Mediterranean, 2013, *Update Priority Investment Projects for Protecting the Mediterranean Sea from Pollution*,

WHO, 2012, 'Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage', *WHO* (http://www.who.int/water_sanitation_health/publications/2012/global_costs/en/) accessed 14 April 2014.

World Bank — EIB, 1990, *The environmental program for the Mediterranean : preserving a shared heritage and managing a common resource*, 8504, The World Bank.

Zenetos, $\alpha.$, Gofas, S., Morri, C., Rosso, A., Violanti, D., Garcia Raso, J.E., Cinar, M.E., Almogi-Labin, A., Ates, A. S., Azzurro, E., Ballesteros, E., Bianchi, C.N., Bilecenoglu, M., Gambi, M.C., Giangrande, A., Gravili, C., Hyams-Kaphzan, O., Karachle, P.K., Katsanevakis, S. et al., 2012, 'Alien species in the Mediterranean Sea by 2012. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part 2. Introduction trends and pathways', *Mediterranean Marine Science* 13(2) (<http://www.medit-mar-sc.net/index.php/marine/article/view/327>) accessed April 14, 2014.

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Tel.: +45 33 36 71 00
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