Technical assessment of progress towards a cleaner Mediterranean

Monitoring and reporting results for Horizon 2020 regional initiative

Joint EEA-UNEP/MAP Report

ISSN 1977-8449

UN environment programme

Mediterranean Action Plan Barcelona Convention

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Layout: Rosendahls a/s

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Luxembourg: Publications Office of the European Union, 2021

ISBN 978-92-9480-254-5
ISSN 1977-8449
doi: 10.2800/898759

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REG.NO. DK-000244

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Contents

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Additional support and guidance were received from Ronan Uhel (EEA) and Tatiana Hema (UNEP/MAP), the Union for the Mediterranean Secretariat and the European Commission. Additional inputs were received from EEA experts: Michael Assouline, Ioannis Bakas, Irene Del Barrio Almut Reichel, Peter Kristensen, Monika Peterlin, Kees Schotten, Caroline Whalley, Bastian Zeiger; the EEA's European Topic Centre on Inland, Coastal and Marine Waters (ETC/ICM): Sophie Vergouwen, Lorinc Meszaros, Sonja Wanke; Umweltbundesamt GmbH: Sabah Nait; UNEP/MAP-MED POL: Christina Bodouroglou, Erol Cavus, Christos Ioakeimidis, Mohamad Kayyal, Dimitris Tsotsos; UNEP/MAP Plan Bleu: Elen Lemaitre-Curri, Jean-Pierre Giraud, Lina Tode, Emanuele Bigagli, Menouer Boughedaoui, Olgac Guven, Borhan Kreitem; UNEP/MAP Info-RAC: Carlo Cipolloni, Alessandro Lotti, Céline Ndong; and UNEP/MAP SCP/RAC: Magali Outters.

This second Horizon 2020 indicator-based technical report is the core of the the joint work of the European Environment Agency (EEA) and the United Nations Environment Programme/Mediterranean Action Plan (UNEP/MAP) in monitoring and reporting results for Horizon 2020 regional initiative. The assessment is based on the information reported by European Neighbourhood Instrument (ENI) South partner countries within the framework of the ENI SEIS II South Support Mechanism and H2020 reporting exercise, information and data reported by EU Member States and available at the EEA as well as a raft of other information sources, e.g. UN data, ODYSSEA.

In addition, the report includes information from EEA thematic reports and Europe's Environment State and Outlook report SOER 2020, UNEP/MAP Plan Bleu State of the Environment and Development Report 2020, UNEP/MAP Quality Status Report 2017 and assessment activities by other international organisations.

The EEA, UNEP/MAP and the authors are indebted to the Horizon 2020 Core Group, country Focal Points, national teams and organisations implementing and reporting on the monitoring and assessment of the Mediterranean environment. This second Horizon 2020 indicator-based technical report would not have been possible without their sustained and dedicated work. Likewise, we would like to thank those individuals who provided valuable feedback during the consultation on the final draft of this report.

The report was edited by European Service Network SA and Cécile Roddier-Quefelec, and produced by Carsten Iversen (EEA), Bilbomática S.A. and Umweltbundesamt GmbH.

This publication was produced with the financial support of the European Union. Its contents are the sole responsibility of the EEA and UNEP/MAP and do not necessarily reflect the views of the EU. The maps are informative and are used exclusively for the needs of this publication.

1 Section A: The H2020 Assessment Framework

1.1 H2020 initiative for a Cleaner Mediterranean

The Horizon 2020 initiative (H2020) for a Cleaner Mediterranean was launched in 2006 at the 3rd Euro-Mediterranean Ministerial Conference on Environment. It aims at concerting efforts to achieve a cleaner Mediterranean by 2020. At its core, H2020 addresses the main land-based sources of pollution: **municipal waste, wastewater** and **industrial pollution** affecting the environmental status of the Mediterranean.

The first phase of the H2020 initiative (2007-2014) culminated in the publication of the first regional assessment 'Horizon 2020 Mediterranean report — Toward shared environmental information systems' (EEA and UNEP/MAP, 2014) and its presentation at the Union for the Mediterranean (UfM) Ministerial Meeting on Environment and Climate Change, held on 13 May 2014 in Athens, Greece (EU, 2014b). It provided a solid baseline for further cooperation with the European Neighbourhood Instrument (ENI) South countries ([1]) in terms of developing and sustaining the regular production and sharing of quality assessed environmental data, indicators and information. This key achievement was made possible through the EU-funded regional project 'Towards a Shared Environmental Information System (SEIS) in the European neighbourhood' (ENPI-SEIS), implemented by the European Environment Agency (EEA) between 2010 and 2015, in partnership with the United Nations Environment Programme/Mediterranean Action Plan (UNEP/MAP).

In 2014, the above-mentioned UfM meeting in 2014 gave a new impetus to this cooperation, calling for greater collaboration on reducing marine pollution, which led to the launch of the second phase of the Horizon 2020 initiative (2015-2020). The complementary actions of the UfM actively supporting effective pollution-prevention projects and the commitment of the Contracting Parties to the Barcelona Convention to protect the fragile ecosystems of the Mediterranean from the increasing pressures from human activities shape the operative context of this ambitious initiative.

The H2020 supports and complements the implementation of other commitments under the Barcelona Convention (Barcelona Convention, 1995), for example in targeting pollution 'hot spots' that have been identified by countries in their national action plans (NAPs). It enables synergies with the ecosystem approach (EcAp), which aims to achieve *a good environmental status* (GES) for the Mediterranean Sea and coast (UNEP/MAP, 2008), and with its regional Integrated Monitoring and Assessment Programme (IMAP) (UNEP/MAP, 2016a). Such alignment ensures the optimisation and use of data and information to serve different purposes, the organisation of information in a systematic and harmonised manner, and promoting a holistic and integrated assessment of the progress related to the priority themes, in line with the SEIS principles (see Box 1.1). The EU-funded implementation project European Neighbourhood Instrument (ENI) Shared Environmental Information System (SEIS) — ENI SEIS II South Support Mechanism (2016-2020) supports improved availability and access to relevant environmental information to the benefit of effective and knowledge-based policymaking in the European Neighbourhood South region. It is building on the achievements of the previous ENPI-SEIS project while putting into effect the review and monitoring (RM) component ([2]) of the H2020 initiative.

1.2 The 'source-to-sea' paradigm to assess progress towards a cleaner Mediterranean

Since 2008, the H2020 assessment framework takes into account the concept of the EcAp as the

([1]) Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, Syria*, Tunisia.
*Cooperation with Syria is currently suspended. However, when data is available, it is included in the analysis.

([2]) The H2020 RM subgroup is one of the three H2020 initiative components. The other two subgroups are: Investments for Pollution Reduction and Prevention (PRPI) and Capacity Building (CB).

Box 1.1 The seven principles underpinning a shared environmental information system (SEIS)

1) Information should be managed as close as possible to its source;

2) Information should be collected once, and shared with others for many purposes;

3) Information should be readily available to public authorities and enable them to easily fulfil their legal reporting obligations;

4) Information should be readily accessible to end-users, primarily public authorities at all levels, to enable them to assess in a timely fashion the state of the environment and the effectiveness of their policies, and to design new policy;

5) Information should also be accessible to enable end-users, both public authorities and citizens, to make comparisons at the appropriate geographical scale (e.g. countries, cities, catchments areas) and to participate meaningfully in the development and implementation of environmental policy;

6) Information should be fully available to the general public, after due consideration of the appropriate level of aggregation and subject to appropriate confidentiality constraints, and at the national level in the relevant national language(s);

7) Information sharing and processing should be supported through common, free open source software tools.

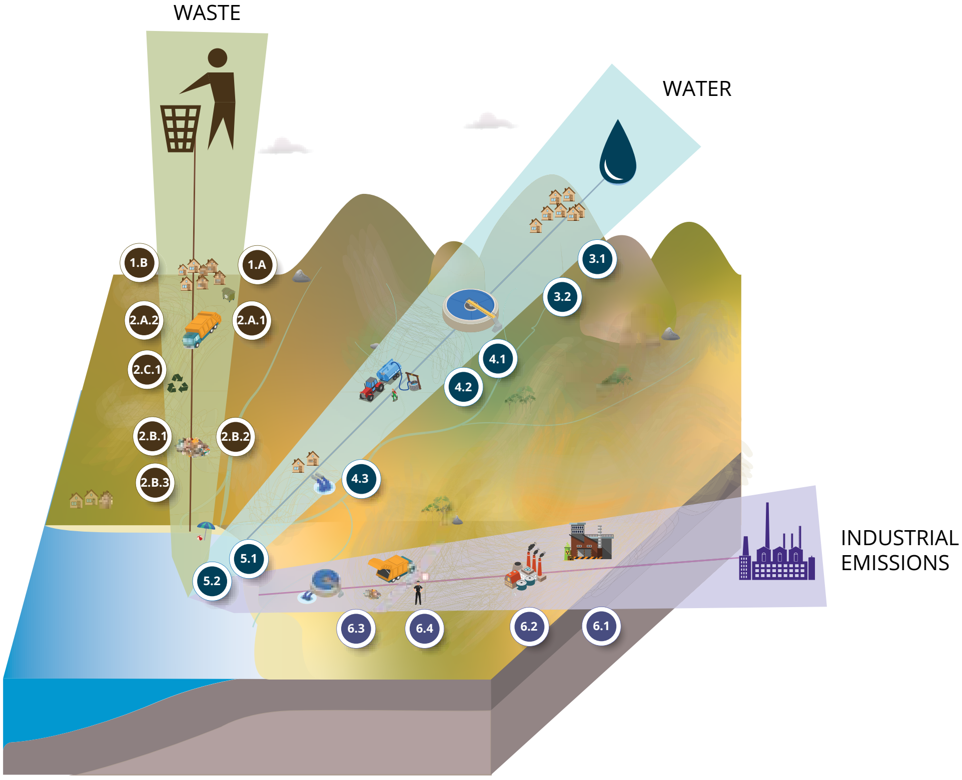
guiding principle for the MAP Programme of Work with Decision IG.17/6 (UNEP/MAP, 2008). Although it is often strongly linked to the achievement of GES through the implementation of IMAP, EcAp has been mainstreamed in all workstreams of the UNEP/MAP Barcelona Convention, including work related to the management of human activities, their pressures and impacts. The EBM approach is also the backbone of European Directives, such as the Marine Strategy Framework Directive (MSFD, EC, 2008) and the Water Framework Directive (WFD, EC, 2000). It goes beyond examining single issues, species, or ecosystem functions in isolation. Instead, it recognises: (1) marine ecosystems as rich mixes of interacting elements with marine biodiversity at the core, supplying ecosystem services; (2) the interaction with human activities and pressures; and (3) socio-economic systems and support for human well-being. Under the realm of the EcAp, the management of human activities and their pressures requires a shift to a more systemic, integrated and holistic approach.

The source-to-sea approach (Berggren and Liss Lymer, 2016; Matthews and Stretz, 2019) is the principal assessment framework used to structure the assessment of the three H2020 thematic areas (see Section C). It provides the most appropriate framework for assessing the land-based sources along the source-to-sea continuum (Figure 1.1). By using this framework, the link between marine litter and poor prevention and management practices for municipal solid waste is very clear. The deterioration in coastal water quality can be related to point source discharges of untreated wastewater within the coastal hydrological basin, in line with UNEP/MAP guidance on the Integrative Methodological Framework (IMF) ([3]) for the sustainable management of the ecological continuum constituted by the coastal zone, river basin and coastal aquifer. Furthermore, contaminated hot spots can be traced to hazardous waste and emissions from industries. By considering that flows from land to sea are linked to one common system and actively focusing on the sources of pollution, the *pressures*, rather than downstream fixes, a more holistic approach to pollution management can be achieved. In the current assessment, this paradigm proved particularly valuable in the conceptual framework. However, due to the data gaps along the continuum, the quantitative assessment of issues from source-to-sea remains a challenge.

In its geographical scope, the source-to-sea paradigm incorporates the marine and land parts of coastal zones as defined in the Integrated Coastal Zone Management (ICZM) Protocol, the ultimate objective of which is to establish a common framework for the integrated management of coastal zones. It also includes the pressures from marine and maritime activities, encompassing the environmental dimension of the blue economy. While these sectors create pressures on the seas, most of them rely on healthy and productive seas as a prerequisite for their sustainable operation

([3]) http://pap-thecoastcentre.org/pdfs/IMF%20Guidelines.pdf; https://iwlearn.net/documents/30017

Figure 1.1 Source-to-sea schematic with H2020 indicators for each thematic area



Waste

- 1.A Municipal waste generation & composition
- 1.B Plastic waste generation per capita
- 2.A.1 Waste collection coverage
- 2.A.2 Waste captured by formal waste sector
- 2.B.1 % of waste to uncontrolled dump sites
- 2.B.2 Uncontrolled dump sites in coastal areas
- 2.B.3 Waste going to dump sites in coastal areas
- 2.C.1 % of plastic waste generated that is recycled

Water

- 3.1 Share of population with access to safely managed sanitation systems
- 3.2 Share of population with access to improved sanitation systems
- 4.1 Volume of municipal wastewater collected and treated
- 4.2 Volume of treated wastewater reused
- 4.3 Release of nutrients from municipal effluent
- 5.1 Nutrient concentrations in coastal waters
- 5.2 Bathing water quality

Industrial emissions

- 6.1 Release of nutrients from industrial sectors
- 6.2 Release of toxic substances from industrial sectors
- 6.3 Industrial hazardous waste disposed in environmentally sound manner
- 6.4 Compliance measures aimed at reduction of pollutants generated by industrial sector

Source: ETC/ICM-Deltares.

and use of their resources. Pressures from these activities will result in cumulative impacts in the system, in addition to the pressures the Mediterranean is already under (see Box 1.2). Thus, a transition to a sustainable green and blue economy is an objective for the region under the Mediterranean Strategy for Sustainable Development 2015-2025 (UNEP/MAP, 2016b) which will ensure environmentally sustainable development of the marine and coastal area. This was further recognised during the UfM Ministerial Conference on Blue Economy (EU, 2015b), after which the Working Group on Blue Economy was set up to implement the Ministerial Declaration on Blue Economy (EU, 2015b). Development of a blue economy and the subsequent increase in the competition for maritime resources requires adequate spatial management of Mediterranean waters through marine spatial planning (Directive 2014/89/EU; EU, 2014). Finally, sustainable use of the seas and reduced pressure from human activities, both in the marine space and catchment area, are prerequisites for achieving GES under the MSFD (2008/56/EC; EC, 2008).

Box 1.2 The Mediterranean, an ecosystem under cumulative pressures

Among the four European seas, the Mediterranean ecosystem is particularly rich in biodiversity compared to other regional seas and hosts a variety of ecosystem services upon which society depends (Culhane et al., 2020). While pollution is one of the main pressures impacting the Mediterranean ecosystem, several others are causing cumulative impacts (ETC/ICM, 2019; EEA, 2014, and the Marine Messages II, 2019).

Many of the pressures on the Mediterranean ecosystem go beyond pollution and many are the result of human activities along coastal areas and in marine waters. For example, a major threat specific to the Mediterranean (and the Black Sea) concerns fishery-related activities, with 88 % of stocks being overfished. The impacts of fisheries go beyond stocks; they affect the seafloor habitats, including benthic fauna damage, and contribute to marine litter and microplastic generation. This continued pressure is on already largely degraded fishing stocks in the Mediterranean, compared to the EU Atlantic and Baltic Sea, where fishing pressures have been reduced. Habitat loss due to coastal developments put an additional pressure on the system, in particular in fast-developing coastal tourism sites along the Mediterranean. Other pressures come from maritime activities, such as marine oil and gas extraction, which are prevalent in the Mediterranean Sea (EEA, 2019e).

Furthermore, alien species invading the Mediterranean can severely impact native communities, significantly impacting aquatic ecosystems through processes which are further enhanced by the rise in seawater temperature as a consequence of climate change. In relation to other regional seas, the Mediterranean has the highest number of invasive species (EEA, 2019e). Finally, the impact of climate change, sea-level rise and heatwave shocks put additional pressure on an already heavily impacted ecosystem. The need for a holistic approach and ecosystem-based management addressing these pressures and impacts is becoming more urgent, due to our dependency on a well-functioning marine and coastal ecosystem for its natural capital and the development of a sustainable blue economy.

The source-to-sea assessment framework was combined with the commonly used Driver-Pressure-State-Impact-Response (DPSIR) analytical framework (EEA, 1999). This framework was adopted by the EEA as an extension of the Pressure-State-Responses model developed by the Organisation for Economic Co-operation and Development (OECD). Although it is commonly used to structure thematic and other integrated assessments, describing the entire causal chain from driving forces to impacts and responses is a complex task. Often, the focus lies in the assessment of subcomponents, for example, the pressure-state relationship. In the current H2020 assessment, the *drivers of change*, including the driving forces (key socio-economic trends, economic growth, geopolitical issues, climate change, etc.) and responses (policies, investments, monitoring, etc.) collectively, are put at the forefront (see Section 2). Being the second H2020 regional assessment, it is important to first assess those key aspects that *drive change* and which provide the necessary context for better understanding the observed trends in pressures and the progress achieved (see Section 3).

1.3 Framing the policy boundaries

Being geographically located at the crossroads between Europe, Northern Africa and the Middle East, the management of the Mediterranean Sea is subject to a complex and heterogenous policy landscape. Several instruments stemming from different policy processes are in place to help make human activities more sustainable and protect the sea from land-based pollution sources.

The Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean was adopted in 1995 to replace the Mediterranean Action Plan of 1975. This was the first-ever Regional Seas Programme under the UNEP umbrella. It has been adopted by 22 Contracting Parties ([4]) and provides the main regional legal and institutional framework to protect the Mediterranean marine and coastal environment while boosting regional and national plans to achieve sustainable development. On the northern shores, a set of environmentally related European Directives have been transposed and implemented by the EU Member States, of which Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia and Spain are also Contracting Parties of the Barcelona Convention. Mediterranean countries are committed to global agendas, such as the 2030 Agenda for Sustainable Development, and are signatories to international conventions, such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal

([4]) Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, European Community, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syria, Tunisia and Turkey.

and the Rotterdam Convention on promoting shared responsibilities in relation to the importation of hazardous chemicals. The ensemble of policies, strategies, protocols, regional plans, initiatives and associated targets, ranging from global, to EU regions and then to the Mediterranean region, are presented in Table 1.1 below.

The H2020 initiative has direct synergies with the Strategic Action Programme to address pollution from land-based activities (SAP-MED) which sets out 33 regional pollution-reduction targets to be achieved by 2025. It is complemented by the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities (LBS Protocol). This provides for the Contracting Parties to take all appropriate measures to prevent, abate, combat and eliminate, to the fullest possible extent, pollution of the Mediterranean Sea. In this context, the Contracting Parties have negotiated and adopted 10 regional plans since 2009, including the regional plan on the reduction of biochemical oxygen demand (BOD5) from urban wastewater and marine litter management, both with direct links to the H2020 initiative priority areas. Recently, a mid-term evaluation of the implementation of existing regional plans has been undertaken, and the main elements for the six new pollution reduction regional plans are currently being developed. The latter will address municipal wastewater treatment, sewage sludge management, agriculture nutrients management, aquaculture nutrients management, urban storm water management and an update of the marine litter regional plan.

In view of implementing the LBS Protocol and its respective SAP-MED, countries drafted and adopted their first NAPs in 2004-2005 and updated them in 2015. The NAPs 2016-2025 comprise legally binding programmes of measures and timetables set out by the countries to achieve GES. They refer to a set of proposed indicators to assess the progress and effectiveness of the implementation of the LBS Protocol at the national level, complementing the H2020 core set of indicators developed at the regional level.

Under the EcAp umbrella, the development of an IMAP was that adopted at COP 19 in 2016 (Decision IG.22/7; UNEP/MAP, 2016a). IMAP lays down the principles, standard guidelines and approaches for the integrated monitoring of biodiversity, non-indigenous species, pollution and marine litter, coast and hydrography, through its 27 common indicators as its framework. It has direct synergies with H2020 particularly through the ecological objectives of eutrophication (EO5), contaminants (EO9) and marine litter (EO10) and their respective common indicators.

The Mediterranean Strategy for Sustainable Development (MSSD 2016-2025) was adopted by the Barcelona Convention Contracting Parties in 2016 with the aim of translating the 2030 Agenda for Sustainable Development at the regional, subregional and national levels (UNEP/MAP, 2016b). By addressing the interactions between socio-economic and environmental goals, the MSSD is the key regional integrative policy framework focusing on aspects related to drivers.

The overview in Table 1.1 clearly shows that the key Horizon 2020 thematic areas are covered by a broad range of instruments, with ambitious visions and objectives. However, the Horizon 2020 initiative itself did not define targets against which progress can be measured. The Mediterranean region is the only region with legally binding instruments providing for integrated coastal management and with an ambitious framework strategy for sustainable development. While these instruments are aiming for an integrated approach, the implementation of such approaches remains a challenge. There is tension between how these visions and goals are interpreted and how the objectives can be achieved through effective implementation measures. Closing this implementation gap is critical for the region not only to fully embrace a source-to-sea approach but also to achieve a clean Mediterranean. To help to close this gap, institutions across different policies must act in a truly coordinated way, with targets measuring progress towards these objectives clearly defined (within a realistic time frame which allows management measures to deliver) and regularly monitored (reliable measurements and high-quality data on environmental trends and progress to provide for and lay down the foundations for effective policymaking — a lack of progress would trigger further measures). This does not require new policies/legislation, but rather empowering public institutions to adequately address politically agreed commitments.

1.4 The second H2020 Mediterranean assessment

The second H2020 Mediterranean Assessment comprises three products (Figure 1.2): a synthesis report, an H2020 Mediterranean indicator-based technical report (this document) and national indicator factsheets. It provides a technical indicator-based appraisal of the progress observed towards the goal of a cleaner Mediterranean.

The synthesis report describes the policy boundaries, main regional drivers and key achievements and draws a set of key messages. The current H2020 Mediterranean indicator-based technical report

Table 1.1 Policy overview linking existing policies on three geographical scales (Mediterranean, European and global) to the H2020 thematic areas

	Policy	H2020 thematic areas		
		Waste	**Water**	**Industrial emissions**
MED region	**The Land-Based Sources and Activities (LBS) Protocol of the Barcelona Convention, 2008** (United Nations, 1980; UNEP/MAP, 1996)	Applies across H2020 thematic areas, in particular Article 5 (Action plans, programmes and measures to eliminate pollution), Article 6 (Inspection), Article 8 (Monitoring programmes), Article 15 (Adoption of regional action plans and programmes) and the Annex.		
	Strategic Action Programme (SAP-MED) (UNEP/MAP, 2015c)	By 2025 at the latest, to base urban solid-waste management on reduction at source, separate collection, recycling, composting and environmentally sound disposal.	By 2025, to dispose of all municipal wastewater (sewage) in conformity with the provisions of the LBS Protocol.	Several targets by 2025 apply to point sources: conformity with Protocol and international provisions; phase out inputs of polycyclic aromatic hydrocarbons (PAHs), discharges, emissions and losses of heavy metals; dispose, in conformity with the LBS Protocol and international provisions, all wastewater from industrial installations, all hazardous wastes and all used batteries in a safe and environmentally sound manner. And to diffuse sources: reduce nutrient inputs from agriculture and aquaculture practices into areas where such inputs are likely to cause pollution.
	Regional action plans on BOD5 reduction (COP Decisions IG.19.7 and 20/8.2 UNEP/MAP, 2009, 2012)		Emission limit values (ELVs), compliance monitoring of discharges from municipal wastewater treatment plants, measures for enforcement.	Target by 2025 is for disposal of wastewater from industrial installations in conformity with the LBS Protocol. Monitor food-sector installation discharges.
	Regional action plan on mercury (COP Decision IG. 20/8.1 UNEP/MAP, 2012)			By 2020, cease releases of mercury from chlor-alkali activity. Prohibit installation of new chlor-alkali plants. Adopt national ELVs by 2015 and 2019 for mercury emissions. Monitor releases of mercury into water, air and soil.

Table 1.1 Policy overview linking existing policies on three geographical scales (Mediterranean, European and global) to the H2020 thematic areas (cont.)

	Policy	H2020 thematic areas		
		Waste	**Water**	**Industrial emissions**
MED region	**Regional action plans on POPs (COP IG Decisions 19/8, 19/9, 20/8.3.1-4)**	Prohibit and/or take legal and administrative measures necessary to eliminate the production and use, import and export of persistent organic pollutants (POPs) and their waste.		Prohibit and/or take legal and administrative measures necessary to eliminate the production and use, import and export of POPs and their waste. Application of best available techniques (BATs) and best environmental practices (BEPs) for environmentally sound management of POPs. Take appropriate measures to handle, collect, transport, store and dispose of POPs waste, including products and articles when they become waste, in an environmentally sound manner.
MED region	**Regional Plan on Marine Litter (Decision IG.21/7** (UNEP/MAP, 2013)	Reduction of fraction of plastic packaging waste that goes to landfill or incineration (Article 9; timetable 2019). Adopt preventive measures to minimise inputs of plastic in the marine environment (Article 9; timetable 2017). Close as many existing illegal solid waste dump sites as possible (Article 9; timetable 2020).	Ensure adequate urban sewer systems, wastewater treatment plants and waste management systems to prevent run-off and riverine inputs of marine litter (Article 9; timetable 2020). Urban solid waste management is based on reduction at source with the following waste hierarchy: prevention, reuse, recycling, recovery and environmentally sound disposal (Article 9; timetable 2025).	
MED region	**Regional Action Plan on Sustainable Consumption and Production in the Mediterranean (COP Decision IG. 22/5)** (UNEP/MAP, 2017b)	**Goods manufacturing:** adoption of measures to implement the waste management hierarchy, develop extended produced responsibility schemes, and encourage the circular economy. **Tourism:** adoption of measures to promote tourism eco-labels and facilitate their award by tourist facilities.		**Food, fisheries and agriculture:** adoption and implementation of good agricultural practices and sustainable fishing practices in line with EcAp ecological objectives and ICZM guidelines. **Goods manufacturing:** develop policy instruments to support the private sector in the sustainable design, production and use of manufactured goods.

Table 1.1 Policy overview linking existing policies on three geographical scales (Mediterranean, European and global) to the H2020 thematic areas (cont.)

<table>
<tr><th rowspan="2"></th><th rowspan="2">Policy</th><th colspan="3">H2020 thematic areas</th></tr>
<tr><th>Waste</th><th>Water</th><th>Industrial emissions</th></tr>
<tr><td rowspan="4">MED region</td><td rowspan="2">Ecosystem approach (Decision IG.17/6 (UNEP/MAP, 2008)</td><td colspan="3">3 out of the 11 ecological objectives (EO) adopted within the framework of the MAP/ Barcelona Convention address marine pollution and litter, the definition of GES and targets:
EO 5. Human-induced eutrophication is prevented.
EO 9. Contaminants cause no significant impact on coastal ad marine ecosystems and human health.
EO 10. Marine and coastal litter does not adversely affect coastal and marine ecosystems.
The 3 EOs are used as an overarching goal and are embedded in common operational targets under the NAPs endorsed by COP 18 of the Barcelona Convention, 2016.</td></tr>
<tr><td>Common operational targets in the NAPs under (EcAp) EO10:
provide for the collection of XX % ([5]) of solid waste;
construct XX % municipal solid waste landfills;
adopt good practices in solid waste management including waste reduction, sorting, recycling, recovery, and reuse;
regulate/reduce usage/ discharge of XX % of fraction of plastics;
close/remediate XX% of illegal solid waste dump sites.</td><td>Common operational targets in the NAPs under (EcAp) EO5:
provide XX % of agglomerations of over 2 000 inhabitants with wastewater collection and treatment;
reduce by XX % the BOD discharged to water bodies.</td><td>Common operational targets in the NAPs under (EcAp) EO9:
reduce discharge of hazardous substances from industrial plants (apply BAT/BEP) by XX % or dispose of them in a safe manner.</td></tr>
<tr><td>UNEP/MAP Criteria and Standards for Microbial Water Quality (Decision IG.20/9 UNEP/MAP, 2012)</td><td></td><td>Adopt revised criteria and standards for microbial water-quality monitoring, assessment and classification of bathing water quality. In addition to monitoring, the preparation of beach profiles or bathing water profiles is also required.</td><td></td></tr>
<tr><td>Mediterranean Strategy for Sustainable Development (MSSD) (UNEP/MAP, 2016b)</td><td>MSSD/UNEP/MAP Mid-Term Strategy (Decision IG.22/1): marine and coastal litter does not adversely affect coastal and marine environments.
By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.
By 2025, 90 % of wastewater treated by country.
All agglomerations collect and treat their urban wastewater before discharging it into the environment.</td><td>By 2015, halve the number of inhabitants without access to sanitation (MSSD 2005).
By 2030, enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.</td><td></td></tr>
</table>

([5]) XX % designate a specific percentage to be specified and applied by the countries. It varies from one country to another according to the state of the sector and related infrastructure.

Table 1.1 Policy overview linking existing policies on three geographical scales (Mediterranean, European and global) to the H2020 thematic areas (cont.)

	Policy	H2020 thematic areas		
		Waste	Water	Industrial emissions
MED region	**Mediterranean Strategy for Education on Sustainable Development** (MSESD) (UfM, 2014)			
EU region	**Water Framework Directive** (2008/105/EC; EC, 2008) & (2000/60/ EU; EU, 2000) & 2008/56/EC; EU, 2008); EU Urban Waste Water Treatment Directive (UWWTD) (91/271/EEC; EU, 1991); New Bathing Water Directive (2006/7/EC; EU, 2006)			
	EU Waste Framework Directive; (2008/98/EC; EC, 2008) & (2018 B, EU, 2018); **EU Plastic Strategy Directive** (EC, 2018a); **Single-Use Plastic Directive** (Directive 2019/904; EU, 2019); **Packaging Waste Directive** (94/62/ EC and 2018/852; EC, 1994; EU, 2018); **Landfilling Directive (1999/31/EC and 2018/850; EC, 1999; EU, 2018); EU Directive (2015/720; EU, 2015) on reducing the consumption of lightweight plastic carrier bags**	EU recycling targets for municipal waste: 55 % by 2025; 60 % by 2030. Recycling targets for plastic packaging waste: 50 % by 2025; 55 % by 2025.		
	Marine Strategy Framework Directive; (2008/56/EC; EU, 2008)			
EU region	**Industrial Emissions Directive** (2010/75/ EU; EU, 2010); **European Pollutant Release and Transfer Register (E-PRTR) Regulation** (EU, 2006c)			

Table 1.1 Policy overview linking existing policies on three geographical scales (Mediterranean, European and global) to the H2020 thematic areas (cont.)

	Policy	H2020 thematic areas		
		Waste	Water	Industrial emissions
Global	**Basel and Stockholm Conventions** (UN, 1989, 2004)			
Global	**MARPOL** (IMO, 1978)			
Global	**Aarhus Convention** (UNECE, 1998)			
Global	**2030 Agenda — Sustainable Development Goals** (SDGs) (UN, 2015)	SDG target 12.1, 12.3, 12.5, 12.6, 12.7, 12.8, 12.9, 14.1.	SDG target 6.2, 6.3; link to 6.4.	SDG target 14.1, 12.4.

provides a detailed description of the methodological approach and a technical assessment of three thematic areas (waste, water and industrial emissions). The indicator factsheets delivered by the MED South countries have served as input to the Mediterranean indicator-based technical report.

This assessment is not the product of a desk study but the result of a multifaceted collaborative process to set up a regular review and reporting mechanism in the region. Such a mechanism required the development of regional data infrastructure and the setting up of appropriate governance systems, fully guided by the three SEIS pillars: content, infrastructure and governance (see Box 1.1). This is in line with the UfM Athens Ministerial Declaration (EU, 2014b) which emphasised the need for all countries 'to address data needs by applying the principles of Shared Environment Information Systems (SEIS) in line with the commitments in the EcAp Decisions of the Barcelona Convention, also contributing to its regional integrated monitoring'.

Multiple *content-process* iterations were required to ensure full stakeholder engagement in data collection and sharing. Support on the technical aspects related to the thematic areas and on developing the relevant data infrastructure was provided through dedicated technical assistance (TA) missions and continuous interactions with the countries. Guidance was provided to help countries to develop their national factsheets aimed at measuring and documenting progress in the three thematic areas, as a way to build national capacities on the state-of-environment reporting.

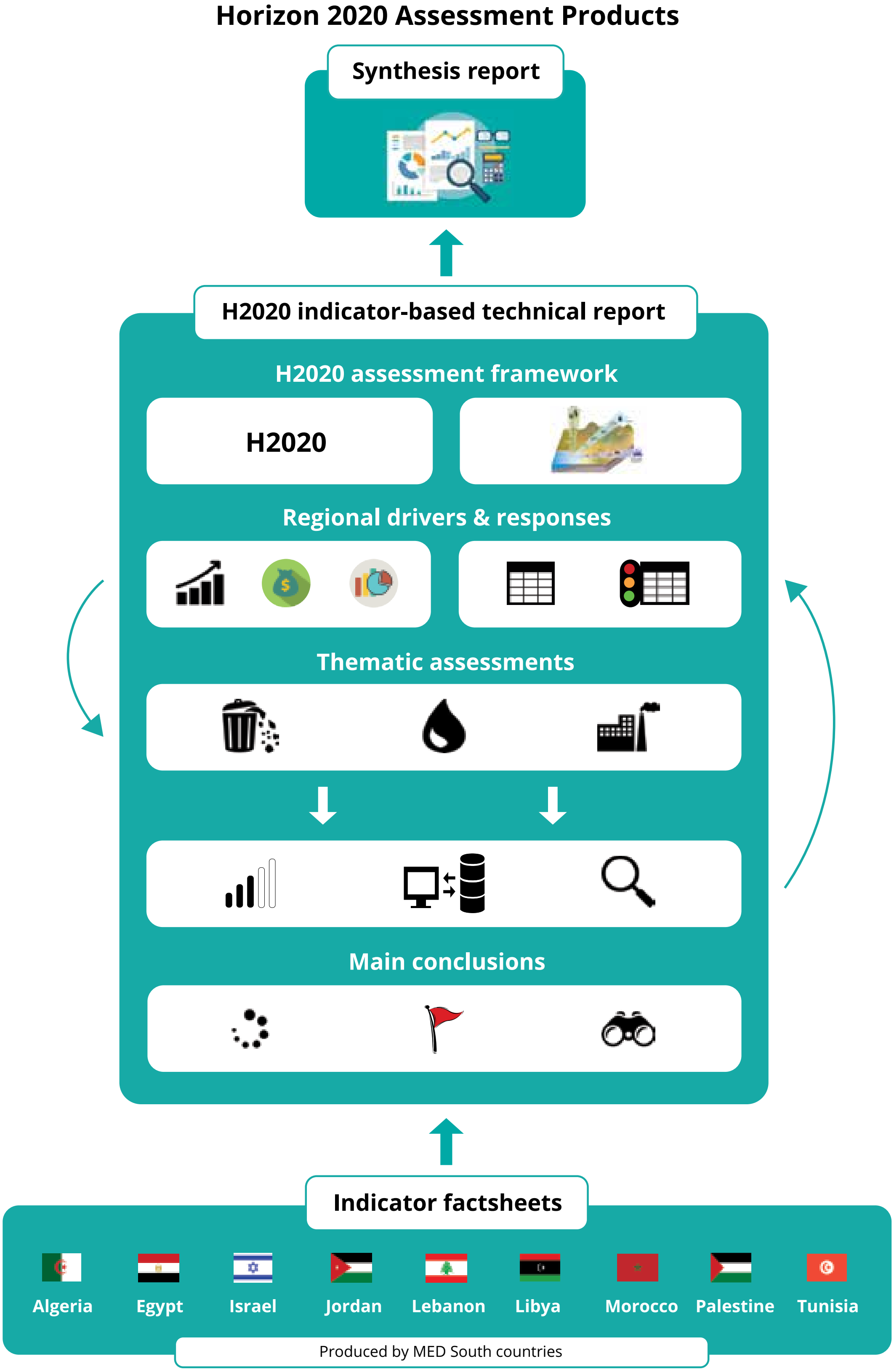
1.4.1 Scope, scale and boundaries

Acknowledging the outcomes of the mid-term review of the H2020 initiative (EC, 2014), and the work programme for its second phase (2015-2020) (EC, 2015), the geographical scope of the indicator-based appraisal has been enlarged to cover the whole Mediterranean area. For analytical purposes, the region is subdivided into three subregions: (1) Southern Mediterranean countries ([6]) (MED South); (2) Mediterranean countries which are EU Member States ([7]) (MED EU); and (3) Albania, Bosnia and Herzegovina, Montenegro and Turkey (MED Balkans and Turkey), reflecting the organisation of cooperation in the region. Note that the aggregated illustration at the subregional level (graphs, charts, etc.) may sometimes be impacted by the performance of an individual country. This is due to the heterogenous status of the countries clustered in these subregions based on comparatively different socio-economic parameters, such as size, economy and demographic performances, etc.

In the context of H2020, 'pollution' refers primarily to the land-based sources of pollution related to municipal waste, wastewater and industrial emissions. However, in line with the broadened scope of the H2020 work programme in the second phase, this second assessment also considers emerging issues, such as hazardous waste and marine litter, as well as efforts towards pollution prevention. By looking at cross-thematic interactions, the assessment provides a more holistic and realistic picture of an integrated approach to the management of pollution.

([6]) Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, Syria* and Tunisia.
*Cooperation with Syria is currently suspended. However, when data is available, it is included in the analysis.
([7]) Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia and Spain.

Figure 1.2 **Products from the second H2020 Mediterranean assessment**



Source: ETC/ICM-Deltares.

In line with the source-to-sea approach, the most appropriate assessment scale is the coastal hydrological basin in order to include only those relevant flows that are connected to the Mediterranean Sea. However, data is often only available on the national scale and there can be limited consensus on the definition of the hydrological basin. Despite efforts to focus on the coastal region draining into the Mediterranean Sea, data collection on a subnational scale proved to be challenging. Exceptions to this included data related to industrial emissions, which mainly cover the coastal administrative regions, and data delivered by Morocco for the two coastal administrative regions (Tanger-Tétouan-Al Hoceima and l'Oriental) and by Bosnia and Herzegovina for the Adriatic Sea coastal hydrological basin. The rest of the data are mainly available at the national level.

At its core, the assessment is based on the production and reporting of the H2020 indicators. The set of indicators was revised and extended in the second phase and now includes a total of 17 covering the three thematic areas (Figure 1.1). The revised H2020 indicator set is the result of an extensive participatory process which kicked off with the first Indicators Workshop held in Copenhagen in May 2017. Following subsequent consultations with countries, the final list of indicators and their methodological specifications was agreed during the second Indicators Workshop held in Athens in April 2018. A mapping exercise of the H2020 indicators against the different policies and their reporting requirements was performed, detailing how the selected indicators are related to other regional (e.g. IMAP, MSSD) and global (e.g. Sustainable Development Goals — SDGs) processes (Annex A). Ensuring the alignment of H2020 indicators with other ongoing processes was paramount, not only to support an integrated assessment but also to reduce the countries' reporting burden and optimise the use of data for different purposes. The H2020 indicators are among those selected to monitor the implementation of the NAPs and are thus referred to as H2020/NAP indicators.

Substantial efforts have been made to set up the H2020 reporting process from both the national and regional side. However, the regional H2020 database is still being compiled. For this reason, the data and information base for the assessment was supplemented by publicly available data collected from open databases (e.g. World Bank, UNSTATS/SDG, Eurostat, ESCWA, etc.) and recent national, regional and global assessments, expert judgement and documentation of examples and other evidence of progress such as case studies, based to some extent on information/data produced by non-governmental organisations (NGOs) and academia. Where possible, data reported by MED EU countries under relevant EU Directives was analysed to achieve full geographical coverage.

1.4.2 Complementarities with UNEP/MAP assessment studies

The second H2020 assessment complements other Mediterranean assessments, notably the 2017 Mediterranean Quality Status Report (UNEP/MAP, 2017; and forthcoming 2023) and the State of Environment and Development (SoED 2020) in the Mediterranean report (UNEP/MAP-Plan Bleu, 2020). Other assessments, such as the State of the Environment Report 2020 (EEA, 2019e) and the Global Environment Outlook (GEO) — regional assessment for West Asia (UNEP, 2016) are also referenced.

The 2017 Mediterranean Quality Status Report (UNEP/MAP, 2017) provided an in-depth assessment of the status of the Mediterranean ecosystem based on implementation of EcAp. Building on the structure, objectives and data collected under IMAP, progress towards achieving GES was evaluated. The further development of IMAP will form the main information and knowledge base for the forthcoming 2023 MED QSR.

The report on the State of the Environment and Development in the Mediterranean (UNEP/MAP-Plan Bleu, 2020) provides a comprehensive and updated assessment of the interactions between environment and development, the main driving forces (e.g. socio-economic) and their impacts on the Mediterranean through an integrated and systemic approach. It serves as an up-to-date basis for improved decision-making at all levels, while enhancing the implementation of the 2030 Agenda 2030 Sustainable Development Goals (SDGs; (UN, 2015a) and the MSSD).

The Mediterranean Sustainability Dashboard, developed by Plan Bleu in relation to the SDGs and the MSSD, provides regular information and factsheets on critical sustainable development indicators. A strategic foresight to 2050, MED 2050, to be developed by 2021, will explore scenarios and transition pathways towards a sustainable and inclusive future in the Mediterranean, using expert knowledge and participatory methods.

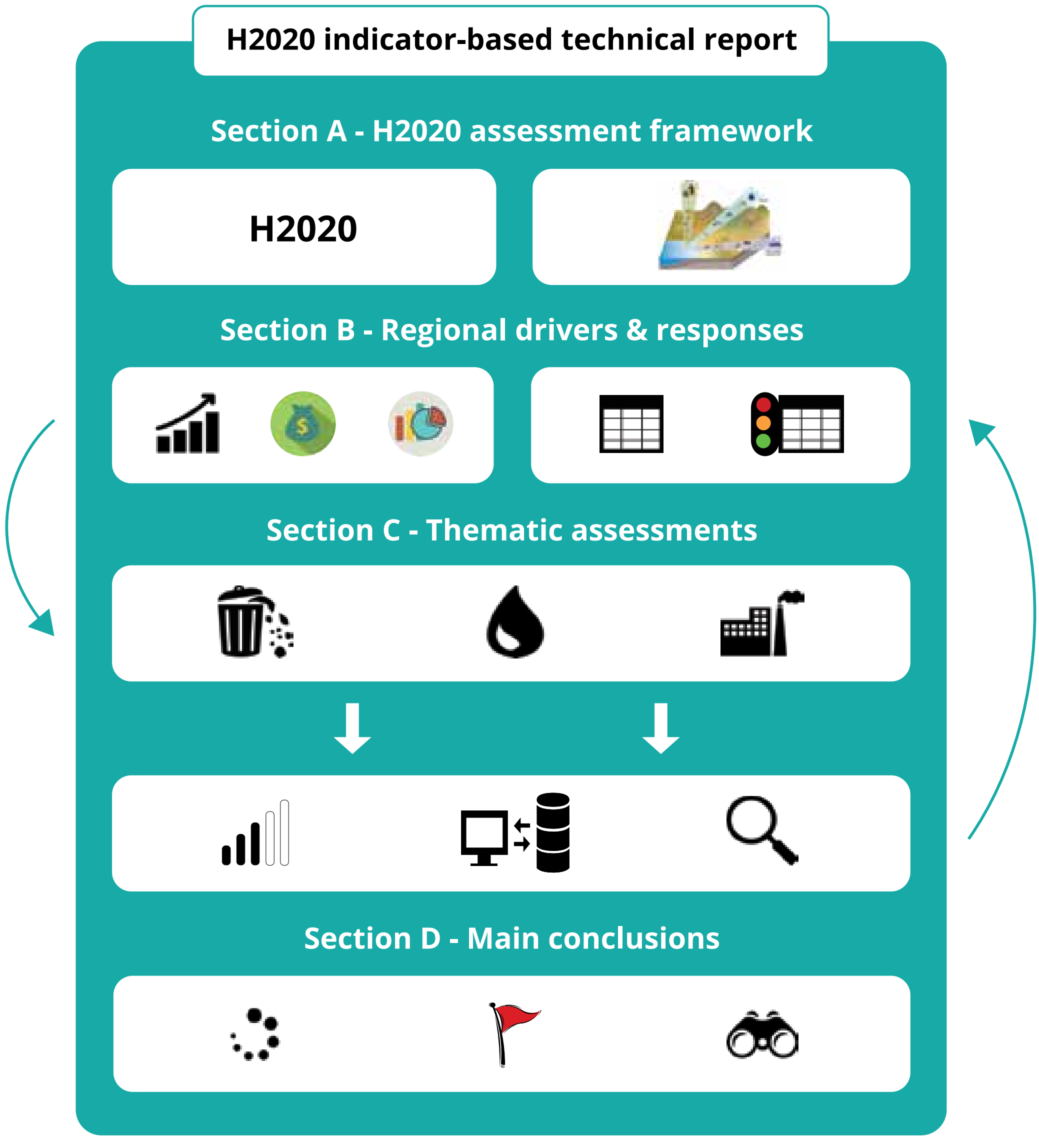
The first Mediterranean Assessment Report on the current state of play and risks of climate and environmental change in the Mediterranean, to be published in 2020, gathers scientific knowledge through the network of Mediterranean Experts on Climate and Environmental Change (MedECC, www.medecc.org) from voluntary scientists across the basin.

1.4.3 Structure of the H2020 Mediterranean indicator-based technical report

This report is structured into four key sections (Figure 1.3):

- **Section A** introduces the H2020 assessment framework and the policy boundaries within which this assessment is embedded.
- **Section B** describes the regional *drivers of change* — both in terms of changes in socio-economic drivers but also the responses put in place. It provides the factual input required to contextualise progress in the three thematic areas.
- **Section C** is subdivided into three parallel subsections, dealing with the three thematic areas: (1) waste and marine litter; (2) water; and (3) industrial emissions. This is the core of the technical analysis, providing an evidence-based assessment of the key trends in pressures. The cross-cutting interactions between the three thematic areas are also included in this section.
- **Section D** presents the main conclusions and overarching key messages.

Figure 1.3 Schematic overview showing the structure of the H2020 Mediterranean indicator-based technical report



Source: ETC/ICM-Deltares.

2 Section B: What drives change?

In many ways, the Mediterranean region is unique in the world and has witnessed dramatic changes in recent years. These changes reflect the dynamics and interaction of several socio-economic factors as well as the type, extent and effectiveness of societal responses. This section analyses those driving forces that most directly affect and pose particular challenges to the three areas of pollution, as these must be assessed within a broader context that goes well beyond their sectorial boundaries.

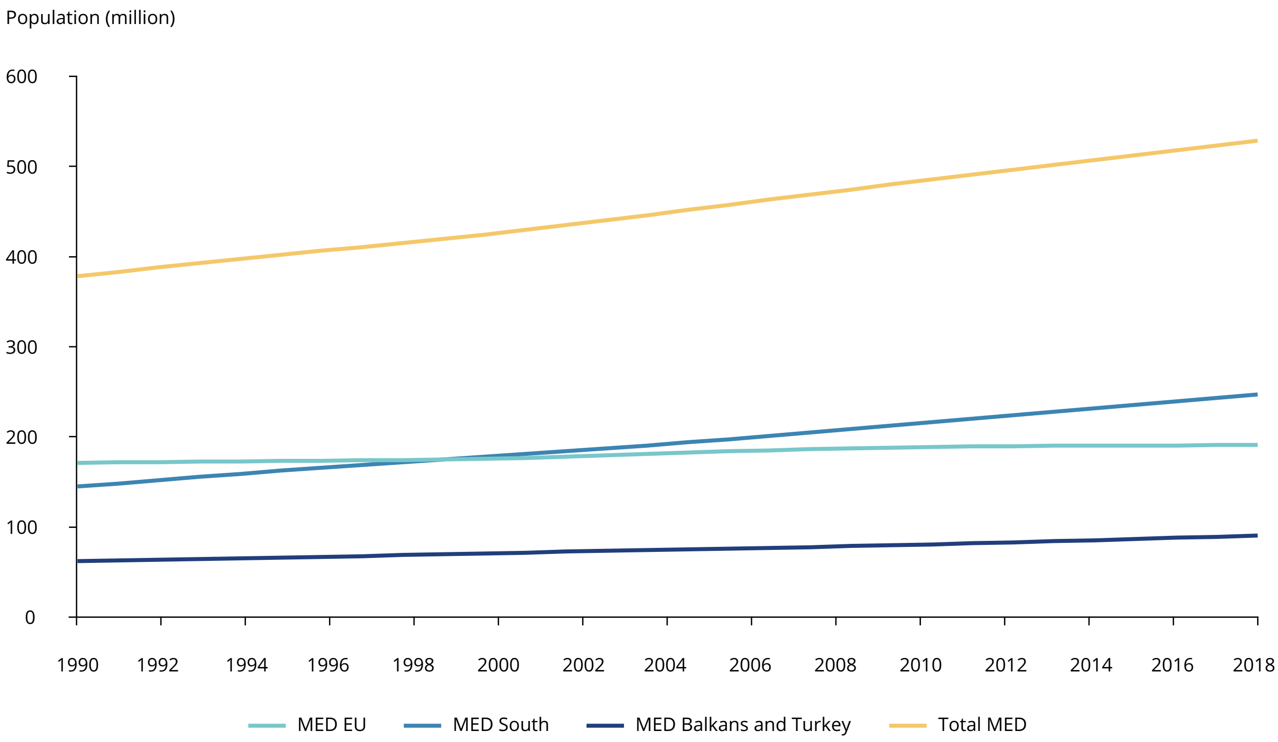
2.1 Key trends in socio-economic drivers

As covered extensively in the State of the Environment and Development report (UNEP/MAP-Plan Bleu, 2020), the nature of the key drivers of change affecting the Mediterranean basin has not changed significantly in the last few decades. In fact, they persist over time, often in an intensified or even accelerated way which, alongside their cumulative effect, currently drives change and makes the region very heterogeneous. Moreover, the spatial distribution of human processes is of particular relevance to the Mediterranean Sea is often the final recipient of discharges of wastewater, industrial contaminants and possibly mismanaged waste, given the proximity of coastal urban areas and industries or through riverine inputs from more inland communities.

2.1.1 Persistent drivers

One of the main **persistent** drivers in the Mediterranean is the increasing trend in its demography, the population having surpassed half a billion people in 2014 (Figure 2.1) and currently standing at 528 million (data for 2019;

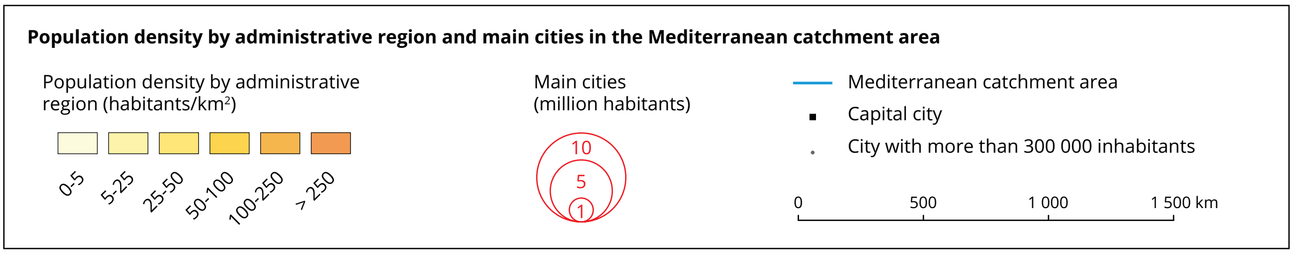
Figure 2.1 Total population in the Mediterranean countries between 1990-2019



Source: UN DESA, 2019.

Map 2.1 Population density by administrative region and main cities in the Mediterranean catchment area

Reference data: ©ESRI. Map adapted from Plan Bleu. Sources: Eurostat, 2018; National Statistics Departments, 2011-2018; World Urbanization Prospects: The 2018 Revision; GeoNames



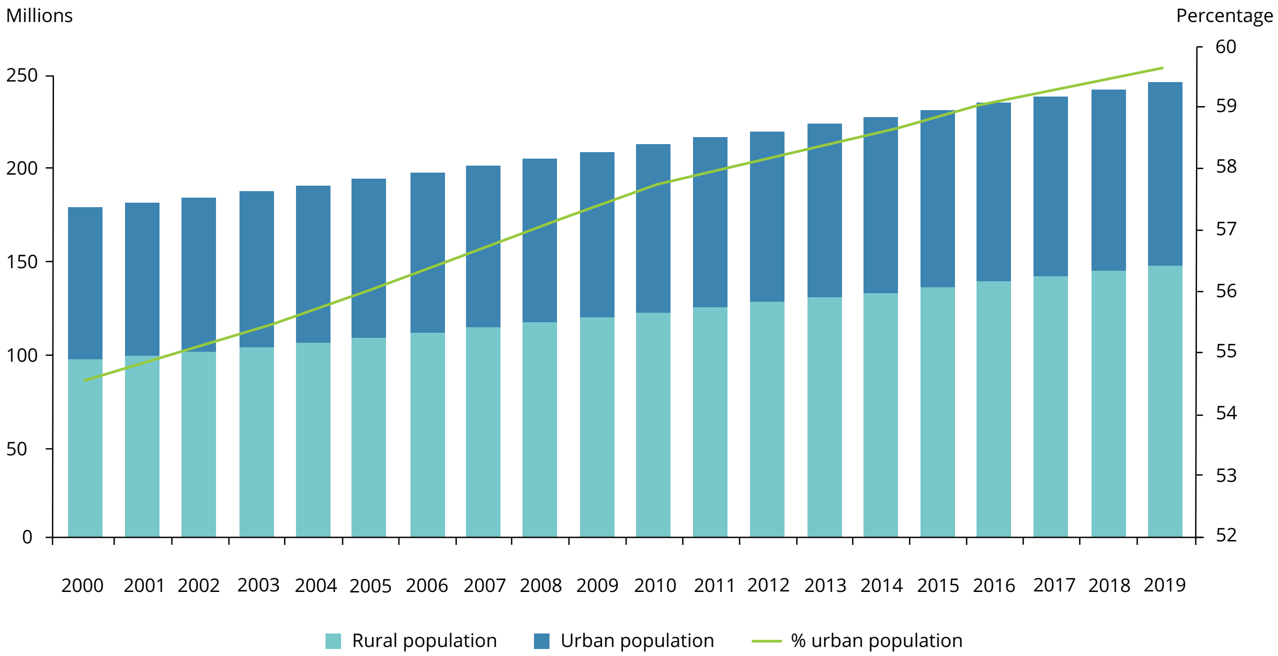
Sources: EUROSTAT, 2018; national statistics departments, 2011-2018; World Urbanization Prospects: The 2018 Revision (original figure: UNEP/MAP-Plan Bleu, 2020).

UN DESA, 2019). However, Mediterranean subregions present different demographic dynamics: the MED EU countries have seen their populations stabilise since the 1980s, whereas the eastern (MED Balkans and Turkey) and southern populations (MED South) have more than doubled, from roughly 162 million people in 1980 to 336 million in 2019 (UN DESA, 2019). This unprecedent population growth has led to an intensification in urbanisation, especially in coastal areas (Map 2.1). In fact, one third of the Mediterranean population lives in coastal administrative regions, which represent less than 12 % of the surface area of all Mediterranean countries, and more than half of the population resides within the coastal hydrological basins (UNEP/MAP, 2017a). Overall, only 30 % of the Mediterranean population live in rural areas, and in MED South countries the urban population has increased significantly over the last two decades (Figure 2.2), particularly in Algeria, Morocco and Tunisia.

2.1.2 Intensified pressures

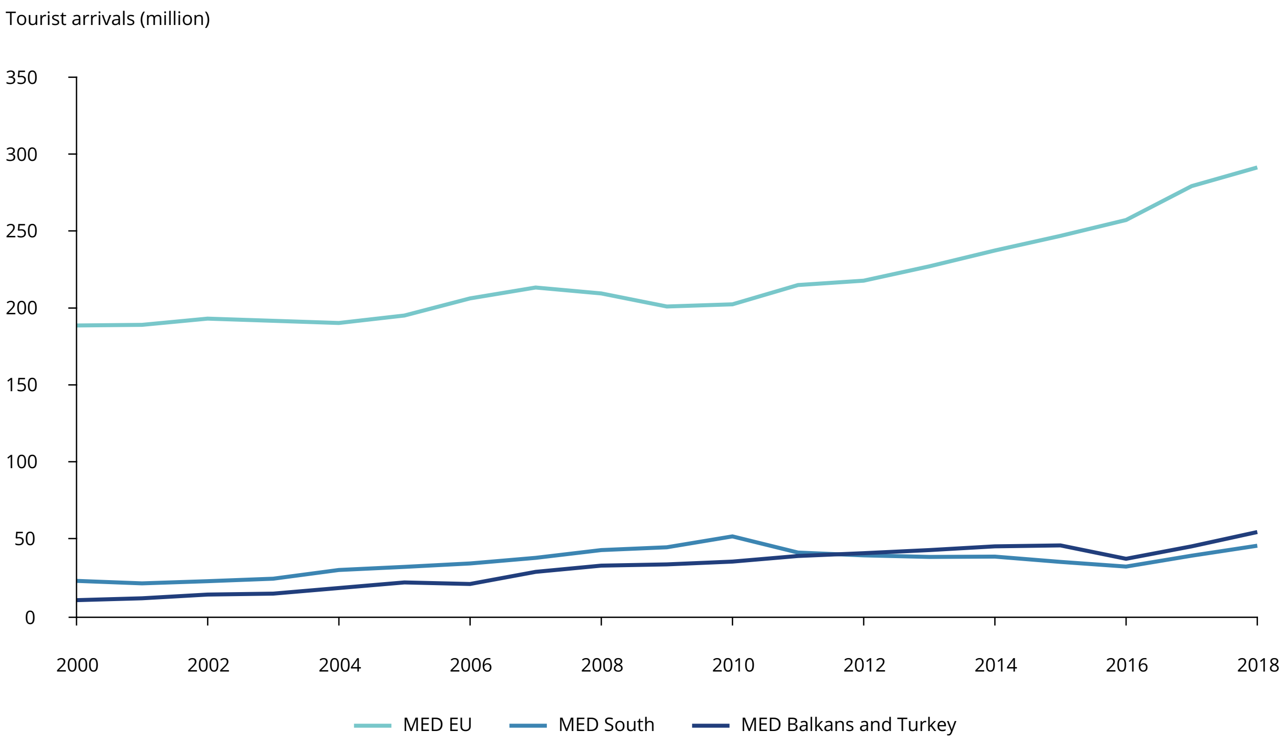
The **intensification** of urbanisation in coastal areas is further exacerbated by the growing number of tourists visiting the Mediterranean (Figure 2.3), which remains the largest global tourism destination to date (UNEP/MAP-Plan Bleu, 2020). In 2018 alone, over 390 million international tourists visited the Mediterranean countries, especially the MED EU and MED Balkans and Turkey (88 % of visits, according

Figure 2.2 Evolution of total urban and rural populations in MED South between 2000 and 2019



Source: UN DESA, 2018.

Figure 2.3 International tourist arrivals in Mediterranean countries between 2000 and 2018



Source: World Bank, 2020.

to the World Bank ([8]). Although less than in the MED EU countries, tourism is also an important source of revenue in the MED South countries and an important driver for socio-economic development. Political instability around the basin and the unrest resulting, for example, from the Arab Spring, lead to a contraction in international tourism and receipts, amplifying its negative impacts on economic growth (Diwan et al., 2017; Plan Blue, 2017).

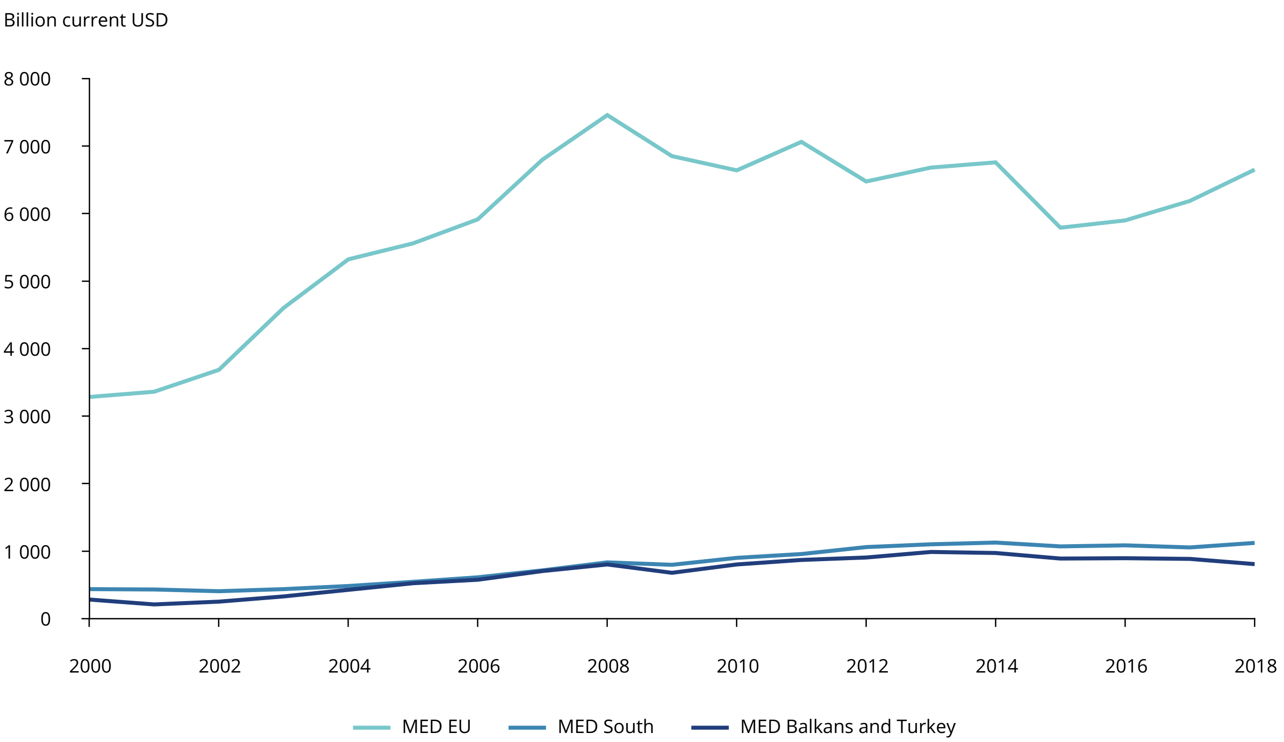
On the other hand, tourism is also recognised as resource-intensive, demanding high energy and water resources. The high spatial and temporal variations of tourism, which is predominantly concentrated along the coastal strip and peaks during the summer season, boosts the amount of potentially mismanaged waste, as well as in discharges of inadequately treated urban wastewater (Chaabane et al., 2019). Resulting environmental degradation, such as poor bathing water quality or littered beaches may, in turn, have consequences for tourism development, reducing the appeal of tourist coastal destinations and negatively impacting the economy.

2.1.3 Accelerating pressures

In particular over the last decade, Mediterranean societies have undergone social, political and economic transformations, to varying degrees, resulting from serious conflicts or driven by ambitions of reform. Acute transitions, as in the Arab Spring in Tunisia and later in Egypt, or more gradual political opening up, as seen in Morocco and Jordan, have led to transitions in government and constitutions (Diwan et al., 2017).

With urbanisation and political shifts in Mediterranean developing nations, improvements in the quality of living are rooted in economic models shared by more developed countries, which are still largely based on linear extraction of finite resources rather than systemic circular models of reuse and recycling, where waste products are a resource. As a result, the region is facing an overall **acceleration** of linear production and consumption patterns and the *take-make-waste* paradigm. On the other hand, a significant gap persists between MED EU and MED South and MED Balkans and Turkey countries in terms of economical performances (Figure 2.4) with the three subregions

Figure 2.4 Gross domestic product in Mediterranean subregions for the period 2000-2018 (current USD)



Note: Data for Syria only available for the period 2000-2007.

Source: World Bank, 2020.

([8]) World Bank Development Indicators.

being affected differently by global and local changes. MED EU countries are gradually recovering from the 2008 global and subsequent euro sovereign debt crisis. MED Balkans and Turkey were only partially affected by repercussions from weakened neighbouring EU countries, while MED South countries have been particularly resilient to the 2008 global crisis although their economies deteriorated as the result of geopolitical turmoil (UNEP/MAP-Plan Bleu, 2020).

Another transition relates to the overall decrease in the agriculture and industrial sectors' share of gross domestic product (GDP) in favour of services. Nevertheless, industrial installations continue to contribute significantly to national economies, despite varying widely among countries (between approximately 12 and 39 % for Cyprus and Algeria, respectively — data for 2018; World Bank, 2020). However, the overall shift in industries does not necessarily result in less resources being consumed or less pollution, as discussed in the SoED (UNEP/MAP-Plan Bleu, 2020) and as evidence gathered in this report indicates (see Section C — Industrial emissions).

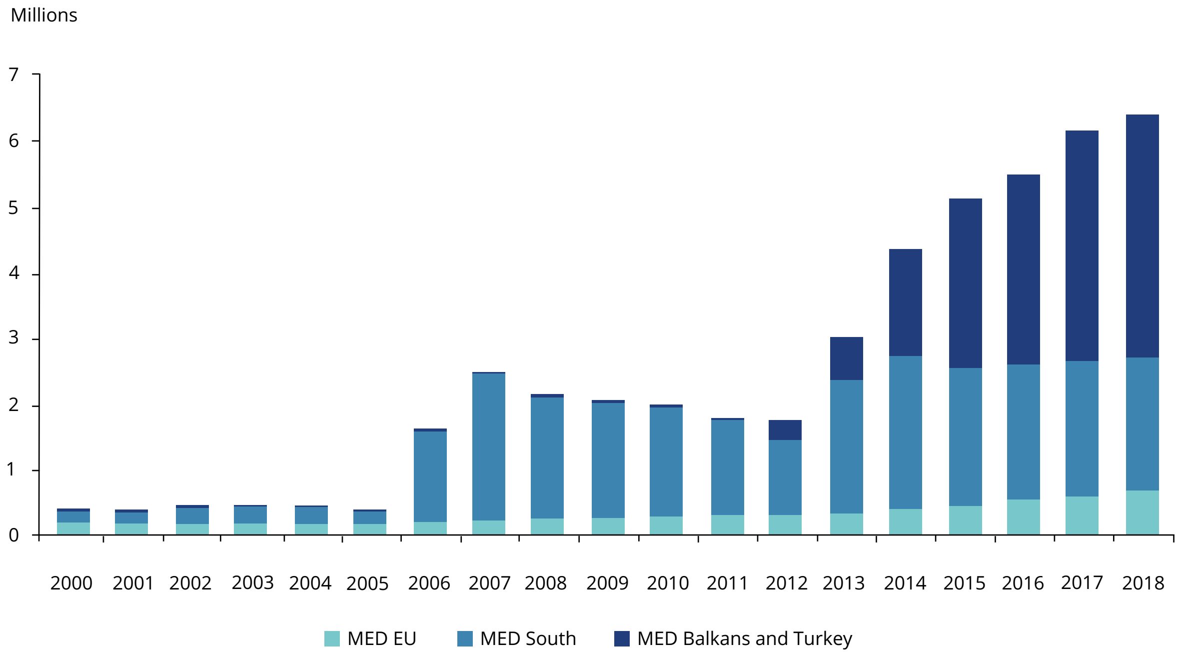
As the region continues to be dominated by tension and geopolitical conflicts, some countries are facing the disruption of institutions or even collapsing infrastructures and industries, as well as the displacement of populations, both within and across borders. In such an unstable and critical situation, pollution prevention and environmental policies no longer take priority on national agendas and budgets.

The conflicts are not always localised, and their negative impacts have spilled over to other countries in the region, including European Member States. As illustrated in Figure 2.5, the number of refugees received by Mediterranean countries has escalated in recent years following regional conflicts, in particular in Syria. MED South countries, mainly Lebanon and Jordan, received over 2 million refugees in 2018. Turkey alone took in 3.6 million refugees in 2018, more than half of the total hosted by the entire Mediterranean region and number one in the world for receiving the highest number of refugees. Access to water, food and sanitary services, as well as waste management, are of specific concern in the management of refugee camps.

2.1.4 Exacerbating pressures

Displacement of people can also be driven by climate and environmental shifts. The effects of climate change are accelerating in the Mediterranean and **exacerbating** the impact of other drivers, such as demand for resources resulting from growing populations and industries, in the context of linear economies. The region seems to be warming 20 %

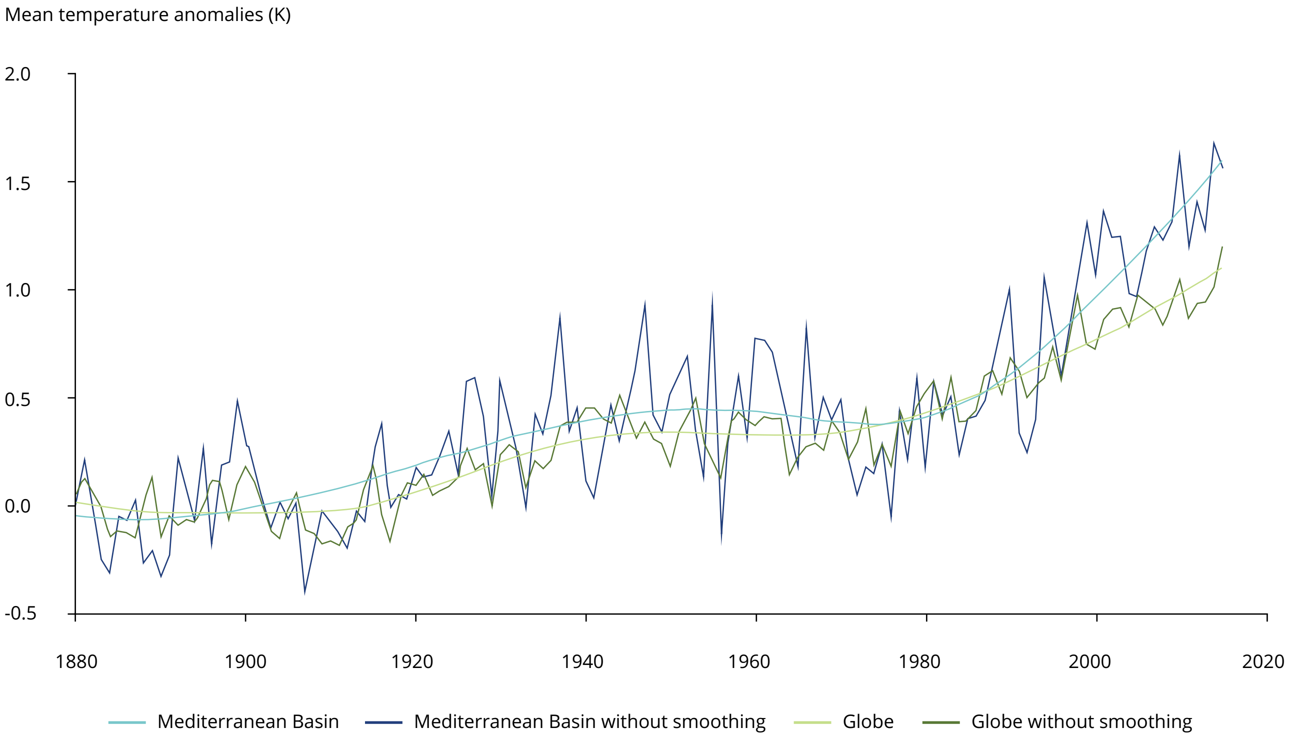
Figure 2.5 Number of refugees (including refugee-like situations) hosted in Mediterranean sub-regions between 2000 and 2018



Note: Data for Palestine not available and for Montenegro only for the period 2006-2018.

Source: UNHCR, 2020.

Figure 2.6 Warming of the atmosphere in the Mediterranean Basin



Notes: Warming of the atmosphere in the Mediterranean Basin (annual mean temperature anomalies with the period 1880-1899) (blue lines, with and without smoothing) and for the globe (green line).

Sources: Taken from MedECC, 2019; original source: Cramer et al., 2018.

faster than the global average, showing an increase in the average temperature of 1.5 °C (Figure 2.6), while, in the last few years, droughts have increased in frequency and intensity (Vicente-Serrano et al., 2014).

Water scarcity due to climate change and greater demand for water from increasing demographics is expected to lead to an increase from 180 million to 250 million people in the Mediterranean being classified as 'water-poor' (i.e. those having access to less than 100 m^3 per capita per year) in the next 20 years (MedECC, 2019). The consequences of other cumulative and disruptive impacts of climate change on already fragile but interdependent societies and economies may prove difficult to predict.

2.2 Responses as drivers of change

Besides the typical external drivers (changes in demography, economy, climate change, etc.), responses in the form of policies, investments, awareness raising and capacity building are also factors conducive to change. In general, *Responses* refers to measures taken by societies to remove, minimise or accommodate changes in the system. In this specific context, *Responses* refers to the type of actions that address pollution pressures, ranging from tools for data and information management, investments in infrastructure projects, developing capacities to respond to existing and new challenges, introducing new policies and legislations and integrating existing ones. In discussing the key responses, specific examples are provided mainly from MED South countries, on account of the dedicated cooperation with this subregion and the dialogue established through the H2020 RM group.

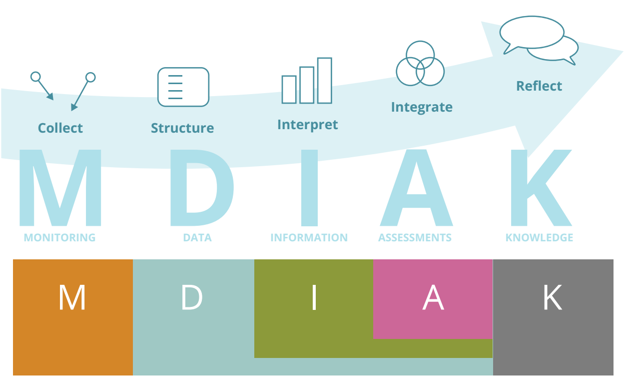
2.2.1 Development of new tools and platforms for data and information management

At the regional level, it was necessary to develop new tools and platforms to facilitate data and information management. A key milestone has been achieved over the last two years with the development of the InfoMAP platform by the UNEP/MAP Information and Communication Regional Activity Centre Info/RAC. The InfoMAP platform is the Mediterranean knowledge platform created to provide and share data, information services and knowledge for the benefit of the Mediterranean Action Plan components and Contracting Parties. It represents a unique access point for all the Barcelona Convention mandatory reporting, including industrial emissions, the IMAP pilot platform as well as H2020. It comes with multiple functionalities: harmonising data structure and models, creating a common catalogue of resources, integrating data with interoperability layers, creating a common platform to view, query and analyse data, and producing tools to support the dissemination of data and information. Supplementary information on the structure and functioning of the InfoMAP regional infrastructure can be found in Annex F.

This platform was used to support the H2020 reporting and assessment process, guided by two approaches: the Monitoring — Data — Indicators — Assessment — Knowledge (MDIAK) chain (Figure 2.7) and the SEIS framework. The MDIAK reporting chain, developed by the EEA, conceptualises the underlying provision of data and its processing, and the production of indicators that underpin assessments. The SEIS conceptual framework, which is based on three pillars — content, infrastructure and governance — supports the design and implementation of a regular reporting process and indicator-based environmental assessments. Both approaches were necessary to establish the governance structure, networks, coordination and synergies required for setting up a regional reporting and assessment process. This process was at the heart of the ENI SEIS II South project with the overall aim of developing an SEIS in support of the regular production and sharing of quality-assessed environmental data and indicators.

Although the technology is in place, the challenge of sustaining the system while maintaining a flexible environment for adapting to changing policy relevance remains. The value of sharing and reporting data is still not fully recognised and needs to be strengthened.

Figure 2.7 Schematic illustration of the MDIAK chain



Source: https://eni-seis.eionet.europa.eu/south/communication/news/further-development-towards-a-renewed-set-of-horizon-2020-indicators

The preparation of a UNEP/MAP Data Management Policy (Decision IG.24/2; UNEP/MAP, 2019) will ensure that data are managed transparently and are properly disseminated and recognised, following similar principles and rules across countries and stakeholders.

At the national level, significant efforts were made to further develop information systems based on SEIS principles. More specifically, Israel and Jordan developed web-based platforms dedicated to a real-time information system for waste, while Israel, Jordan and Palestine established water information systems. Morocco set up an environmental information system and Tunisia designed a dedicated information system for hazardous waste alongside a process to monitor health and environment indicators. However, in general, legally binding reporting obligations (law, by-law/legally binding Instruction) with clear guidance on the data and information to be reported are lacking.

In the second phase of H2020, the national interinstitutional cooperation, coordination and governance set-up were strengthened by formalising the engagements and liaison with stakeholders and entities, such as SDG national committees, MED POL Focal Points, ministries of interior, industry, water and irrigation, health and local authorities, as called for in the UfM Athens Ministerial Declaration (EU, 2014b) and specified in the H2020 work programme 2015-2020 (EC, 2015). In a process driven mainly by the designated authorities representing environmental and statistical organisations, efforts were made to increase ownership of both the process and the outcomes. These national committees acted as coordination platforms enhancing synergies between H2020 issues and other processes, for example, SDGs. Some countries, such as Jordan, Palestine and Tunisia, took advantage of the momentum created by the ENI SEIS I and II projects to establish national inter-institutional committees and national working groups that also bring together representatives of several relevant authorities. In some cases, these agreements have been formalised through Memoranda of Understanding on data exchange, such as in Palestine (see Box 2.1), compared to early 2011, when interinstitutional cooperation was typically based on ad-hoc requests or gentlemen's agreements.

This enhanced interinstitutional cooperation is a major achievement since the mid-term review of the initiative in 2014 (EC, 2014). However, despite more interinstitutional dialogue, in some cases, the cooperation among governmental institutions remains very limited resulting in a lack of cohesiveness and hampering the efforts for greater policy integration. An overview of the progress in activities related to data, indicators and information systems in MED South countries for each thematic area is provided in Table 2.1.

Box 2.1 Synergies with SDG indicators — the case of Palestine

The mandate for implementation of SDGs in Palestine was reiterated in the Palestinian cabinet decree, nominating the Palestinian Central Bureau of Statistics (PCBS) to lead efforts to modernise the SDG indicators, in cooperation with all stakeholders, for monitoring and evaluation. Hence, as the leading agency in the Palestinian National Statistical System, PCBS has worked with national political authorities to identify national SDG priorities and to plan for the collection, compilation, quality control and dissemination of data. In response, in order to achieve the monitoring of SDGs, the Palestinian prime minster issued a decree on forming a national team to coordinate the implementation of the action plans for sustainable development. The national team includes all ministries, NGOs and private sectors. The team will work to prepare reports for the Advisory Council, comprising representatives from the governmental, non-governmental and private sectors as well as academia. In the long term, the national efforts to implement the SDGs will have a positive effect on data production and availability.

Source: https://eni-seis.eionet.europa.eu/south/countries/palestine/key-docs/key-documents/country-visit-summary-report

2.2.2 Direct actions

In addition to effective governance and environmental policies, different sources of funding and investment are necessary to improve the situation through direct actions 'on the ground'. Although resources have been mobilised to prevent, reduce and remediate pollution, no aggregated data is available to produce a clear overview of the investments made in the last few years. The list of investment depollution projects compiled by the UfM in 2014 in the so-called investment portfolio, provided information on the location, characteristics of size/reduction of pollutants loads, status of implementation, cost or investment needed. This inventory has not been updated since. In the absence of such information, insights into the types of investments and measures planned by countries to target these types of pollution were retrieved from their updated NAPs and are presented below.

The range of measures put forward by countries in the updated NAPs which directly target the three types of pollution follow the prevention hierarchy, in which prevention at source prevails over reduction of pressures and remediation interventions. This is particularly valid for measures related to solid waste and urban wastewater, while for industrial emissions the focus is predominantly on end-of-the-pipe investments — reduction of pressure (Figure 2.8).

The investment component of the H2020 initiative was implemented through the Mediterranean Hot Spot Investment Programme (MeHSIP I and II projects) led by the European Investment Bank (EIB). Despite this programme's achievements (see Box 2.2), beneficiary countries highlighted a number of shortcomings in terms of investment capacities. Investment projects are inherently challenging: they take time to realise and face many obstacles along the way. Although subject to continuity as a precondition, in reality, priorities change and adaptations are constantly required. High-level political support is also necessary for investments to advance. Access to available funds is a particular limitation, together with the lack of investment capacities, including capacities to identify bankable projects, preparedness for project preparation and implementation, and support to conclude loan agreements with international financial institutions. In addition to support from such institutions for projects addressing pollution, some countries have dedicated funds to tackle different sources of pollution, for example, to fund the closing and rehabilitation of dump sites and the construction of new waste-treatment plants in Algeria and Morocco. However, data on the resources contributed by governments for such projects is not available.

Access to funding for green entrepreneurs in the MED South subregion also has its challenges and limitations (UfM and SCP/RAC, 2018). These activities promote the principles of sustainable consumption and production — taking profit into account alongside social and environmental sustainability, they have the potential to bring about change in societies. Yet, evidence shows that innovative ideas from green start-ups are not readily funded. Financing working capital, purchasing the necessary equipment, etc. are among the main issues facing green entrepreneurs, as a result of gaps in the supply of finance and the misalignment between their needs and just what the financial system is willing to provide for them (UfM and SCP/RAC, 2018).

The application of economic instruments, such as the polluter-pays principle, extended producer responsibility (EPR), is also conducive to changes in practice or behaviour. Although a comprehensive overview of these economic instruments and their effectiveness in supporting the overall H2020 goal is not readily available, specific examples are provided below to illustrate their application.

Table 2.1 Progress in activities related to data, indicators and information systems in MED South countries for each thematic area

Activity	Algeria	Egypt	Israel	Jordan	Lebanon	Libya	Morocco	Palestine	Tunisia
1.Data monitoring, production, collection * normalisation (in case one indicator is not produced by any country)	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions –	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions –
2. Data reported to InfoMAP	Waste Water Industrial emissions –	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↘	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗
3. Data accessibility/ external dissemination	Waste Water –	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water Industrial emissions –	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water Industrial emissions –	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗
4. Information systems	Waste Water Industrial emissions –	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions –	Waste Water Industrial emissions –
5. Use of H2020/ NAP indicators for national assessments, state of environment, etc.	Waste Water Industrial emissions –	Waste Water Industrial emissions –	Waste Water Industrial emissions –	↗	Waste Water Industrial emissions ↘	↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions –	↗
6. H2020/NAP indicators adopted as part of national indicator set	Waste Water Industrial emissions –	Waste Water Industrial emissions –	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water –	Waste Water Industrial emissions –	Waste Water Industrial emissions –
7. Data-sharing agreements/ regular data sharing	Waste Water Industrial emissions –	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water Industrial emissions ↗	Waste Water Industrial emissions –	Waste Water Industrial emissions ↗	Waste Water –	Waste Water Industrial emissions –	Waste Water Industrial emissions –
8. Interinstitutional coordination/ national team/ committee, thematic cooperation and data sharing	↗	–	↗	↗	–	↗	↗	↗	↗

Key: red — not acceptable/poor progress

orange — reasonable progress but not sufficient

green — satisfactory/good progress

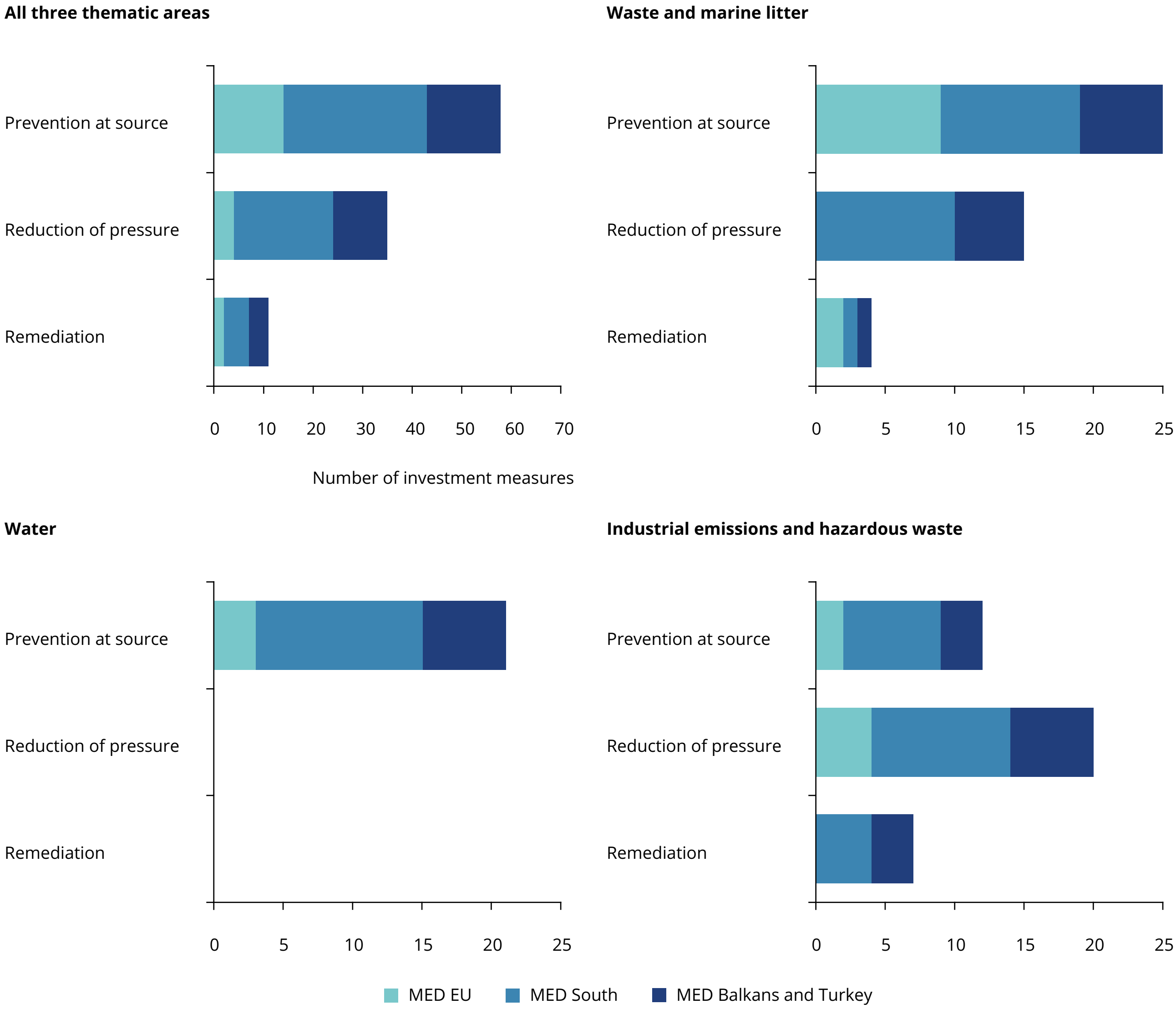
↘↗ — deteriorating/improving

'–' not possible to assess

Note: This classification should be regarded as 'perceived progress' based on the yearly monitoring of progress made by the H2020 RM group and expert judgement. It covers progress monitored over the last four years and provides a snapshot of when this report was being prepared.

Source : Elaborated by the authors.

Figure 2.8 Overview of investment measures proposed in the NAPs, collectively and per thematic area



Source: Synopsis of updated NAPs 2015: hot spots, sensitive areas, targets, measures, indicators and investment portfolios.

As is the case in the EU, the polluter-pays principle is beginning to be applied more in the region, for example, since 2007, a tax on industrial air pollution has been charged in Algeria on emissions exceeding the limit values set by law and on industrial wastewater loads exceeding limit values. In some countries, the polluter-pays principle is applied as a way of promoting more integrated management practices, for example, Lebanon adopted an integrated solid waste management law stipulating that the polluters bear the costs of managing the solid waste generated; and a landfill levy is paid by municipalities in Israel for the waste produced and sent to landfills. In turn, the funds collected are invested in improving waste management, increasing recycling and preventing pollution.
In Tunisia, apart from receiving penalties for infringing environmental laws, polluters must take action to reduce pollution. Environmental tax from industries — 'les établissements classes' — is collected on a yearly basis by the ministry of finance, part of which goes towards financing the Tunisian environmental agency (ANPE).

EPR, which entails making manufacturers responsible for the entire life cycle of products and packaging, is also progressively being introduced. It is currently in place in Israel and will soon be implemented in Jordan where a legal basis is being prepared. Other economic instruments include incentives, an example of which is the deposit law on beverage containers in Israel. The law and its regulations set up a refund, bottle collection, and recycling system that enables

Box 2.2 Investments in pollution reduction and prevention

The Mediterranean Hot Spot Investment Programme (MeHSIP), led by the EIB in cooperation with other European financial institutions, contributed to the overall objective of Horizon 2020 and its PRPI component, jointly chaired by the EIB and UfM. MeHSIP comprised two phases: MeHSIP-I (2009-2013) and MeHSIP-II (2015-2018). Its overall objective was to promote adequate and sound management of water, wastewater, solid waste and industrial emissions in the Southern Mediterranean region in order to reduce health risks and improve the quality of life, as well as contributing to achieving the H2020 goals. Its specific objectives were to increase the number of viable projects in priority sectors capable of being readily financed by donors and implemented by promoters, to ensure their efficient and sustainable operation in the long term, and to strengthen the project preparation capacity of public-sector institutions and the private sector. The thematic and geographical scope of MeHSIP-II was extended to include: (1) water resources management, water supply; (2) climate action (adaptation and mitigation); and (3) support for sustainable growth and job creation; and also to reduce pollution in areas that do not drain into the Mediterranean. MeHSIP-II achieved these objectives by providing TA for the preparation of investment projects in the above-mentioned relevant sectors. This assistance was based on two stages: the first consisted of building a project pipeline in each of the target areas, while the second phase covered project preparation starting from project screening up to the early stages of implementation. The H2020 pipeline was anchored in the NAPs for depollution of the Mediterranean under the LBS Protocol of the Barcelona Convention.

As of May 2020, MeHSIP-II mobilised a total of EUR 3.7 million in TA funds from the Climate Action in the Middle East and North Africa (CAMENA) envelope, EUR 0.7 million from the Public-Private Partnership Project Preparation in the Southern and Eastern Mediterranean (MED 5P) facility, and EUR 0.1 million from the Global Environment Facility (GEF). MeHSIP experts also provided technical support to several other projects.

Projects with a total investment exceeding EUR 1.4 billion have been prepared with the support of MeHSIP-II and approved for co-financing by the EIB (note that the EIB is only funding a part of the investment). Overall, projects supported by the programme have a total potential investment volume of EUR 2.8 billion. In total, MeHSIP-II has helped in the preparation of 24 projects (see below).

	Country	Project	Sector	TA budget (EUR million)	TA funding source	Estimated investment (EUR million)	Status
1	Egypt	Alexandria West wastewater treatment plants (WWTPs) upgrade and extension	WW	0.4	CAMENA	185	Approved by EIB Board
2	Egypt	Depollution of Bahr al-Baqar agricultural drain	MS	0.2	SSF Cairo	550	TA completed No further interest in the project from the Egyptian authorities
3	Egypt	Rehabilitation and extension for several water and WWTPs in different governorates	MS	0.2	SSF Cairo	250	TA completed Interest in the project withdrawn by the Egyptian authorities
4	Egypt	Kitchener drain investment project	MS	0.2	SSF Cairo	441	Approved by EIB Board
5	Egypt	Fayoum WW expansion project	WW	0.8	EBRD IPPF	395	Approved by EIB Board
6	Jordan	Deir Alla and Al-Karameh water supply and sanitation project	MS	0.5	CAMENA	97	Approved by EIB Board
7	Jordan	Bani Kenanah water supply and sanitation project	MS	0.5	CAMENA	40	TA completed Water supply component only to be taken forward

Box 2.2 Investments in pollution reduction and prevention

	Country	Project	Sector	TA budget (EUR million)	TA funding source	Estimated investment (EUR million)	Status
8	Jordan	Zarqa industrial WWTP	IE	0.7	MED5P	30	TA completed
9	Lebanon	Saida WW treatment and reuse	WW	0.3	CAMENA	60	TA completed
10	Lebanon	Rehabilitation and expansion of Tripoli WW networks	WW	-	MeHSIP	107	Approved by EIB Board
11	Lebanon	Al Ghadir WW	WW	-	MeHSIP	145	Approved by EIB Board
12	Morocco	Dépollution de l'Oued Martil/ COELMA	IE	-	MeHSIP	15	TA completed
13	Morocco	BMCE Ligne Bleue	MS	1.0	CAMENA	20	Approved by EIB Board
14	Morocco	BMCE Ligne Verte	SW	-	MeHSIP	40	Approved by EIB Board
15	Morocco	Integrated SW management	SW	-	MeHSIP	tbd	TA completed
16	Morocco	Fond d´Equipement Communal (FEC)	MS	-	MeHSIP	tbd	TA suspended
17	Palestine	North-east Ramallah villages WW collection and treatment system	WW	0.5	CAMENA	tbd	TA ongoing
18	Tunisia	Sustainable management of the phosphate mining basin in Gafsa	IE	0.5	CAMENA	25	TA completed
19	Tunisia	Valorisaton des déchets solides — PPP Djerba	SW	-	MeHSIP	60	TA completed
20	Tunisia	Aménagement et Valorisation de Sebkhat Sijoumi	MS	-	MeHSIP	100	TA completed
21	Tunisia	Depollution of the mercury contaminated site in the region of Kasserine (SNCPA)	IE	-	MeHSIP/ GEF	40	TA suspended
22	Tunisia	Programme Gestion Integréé déchets solides — 10 Governorates	SW	-	MeHSIP	100	TA completed
23	Tunisia	Hazardous waste treatment facility (Bizerte)	SW	-	MeHSIP	25	TA completed
24	Tunisia	Programme de mise à niveau de 10 STEP de l'intérieur	WW	-	MeHSIP/ GEF	80	TA completed
Total TA grants mobilised by MeHSIP*				4.5			
Total TA grants with MeHSIP support				5.9			
Volume of investments already financed by EIB						1.430	
Total potential investment volume						2.805	

* The figure includes EUR 0.1 million from the GEF used to support various projects. Support and inputs from MeHSIP experts have not been assigned monetary values.

IE = industrial emissions; WW = wastewater; SW = solid waste; MS= multiple support (cover the 3 components)

EBRD IPPF = European Bank for Reconstruction and Development Infrastructure Project Preparation Facility; SSF Cairo = Single Support Framework

MeHSIP-II worked in partnership with the SWIM-H2020 Support Mechanism project (2016-2019) and the UfM Secretariat to promote and facilitate sustainable investments in the water and sanitation services. MeHSIP-II also supported capacity building among local promoters and counterparts in several ways, including on-the-job training, dedicated workshops, conferences and trainings.

Source: MeHSIP-II, 2019; updated with the latest information from the EIB (May, 2020).

the public to return glass, metal and plastic containers and beverage cans that are between 100 millilitres and 1.5 litres in volume. The main objectives are to reduce littering, reduce landfill mass, and encourage recycling and reuse of beverage containers. Other relevant legislation includes the packaging law, electrical and electric equipment and batteries law, tyre disposal and the recycling law.

In addition to investments and economic instruments, capacity development plays a key role in acquiring the necessary technical skills, adopting best practices and updating existing policies or introducing new legislation to abate pollution. In recent years, capacities have been enhanced by regional cooperation actions, including SWIM-H2020 SM (see Box 2.3), TA under the ENI SEIS II South support mechanism on aspects related to monitoring, data and indicators, and TA under MeHSIP (see Box 2.2). Further support through different instruments (e.g. Twinning, TAIEX and TA) has proved essential for sustaining institutional capacities in MED South countries and ensuring up-to-date knowledge exchange on, for instance, integrated pollution prevention and control, waste management and integrated water resources management. Due to a higher demand for data, statistics and knowledge driven by the adoption of the 2030 Agenda and SDGs, efforts to enhance the statistical capacities of national statistical offices have been stepped up in response to SDG 17.18 ([9]): *Enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data in all countries by 2020.*

These capacity development activities did not only serve to enhance technical skills and competences, improve own practices and share best practices, but have been instrumental in establishing an extended regional network of professionals from across various institutions, disciplines and scientific areas. This network activates the cooperation and supports the synergies required for the adoption and extension of the notion of integration in policymaking and in managing pollution.

Alongside developing the capacities of institutions and technical staff comes awareness raising among civil society and the public. During the last five years, the region and the world in general have witnessed greater awareness of sustainable development and environmental issues as a result of the impetus given by the 2030 Agenda. The SDGs provide the global forum for engagement and a common reference framework at various levels — local, national, regional and global. The MSSD (2016-2025; UNEP/MAP, 2016b), a strategic guiding document for all stakeholders and partners to translate the 2030 Agenda for Sustainable Development at the regional, subregional and national levels, acts as a leverage for creating awareness around the potential of the green economy transition and sustainable lifestyles, sustainable tourism, urban resilience, climate change, etc. Several civil society organisations contributed to the overall H2020 efforts ([10]). Overall, there seems to be more awareness on the need for sustainable development among the public and society, while environmental issues are moving up the priority ladder in policy agendas.

2.2.3 Shift towards more integrated policies and management approaches

The holistic concepts and principles of sustainable development and the ecosystem-based approach are now firmly embedded in international policies and widely referenced in the strategies and plans prepared by Mediterranean countries. The debate on transition to systemic approaches, which considers the interlinkages between environmental, economic and social components in a holistic way, is beginning to resonate in the region. With the introduction of the ecosystem-based approach, the region is aiming to move away from addressing single pressures or sectors to multiple uses/sectors/activities and their combined effects on marine ecosystems and their services.

Such a shift is also noticeable at the national level. In the waste sector, recent policies are clearly shifting to the more integrated management of municipal solid waste and are mainly aligned with the EU *acquis*. Israel has the most-developed legislation in the MED South subregion (e.g. law for reducing the use of plastic bags, recycling and packaging law). Both Jordan and Israel have recently adopted national waste-management strategies based on the 'hierarchy of integrated solid waste-management practices' — prevention, preparing for reuse, recycling — with clear targets for reducing landfilling and increasing recycling and energy recovery (in the case of Israel). In Jordan, a waste framework law has recently been adopted (2020) serving as an umbrella for integrated waste management, covering both municipal solid waste and hazardous waste. Other countries, such as Lebanon and Egypt, are currently

([9]) https://sdg-tracker.org/global-partnerships#17.18
([10]) https://www.h2020.net/component/jdownloads/category/340-10th-horizon-2020-steering-group-meeting-25-september-2019-athens-greece?Itemid=411

Box 2.3 Sustainable Water Integrated Management and Horizon 2020 Support Mechanism (SWIM-H2020 SM)

The capacity-building component of the H2020 Initiative was realised mainly through the EU-funded SWIM-H2020 Support Mechanism (2016-2019) which focused on the reduction of industrial emissions, municipal waste and urban wastewater into the Mediterranean Sea and ensuring the sustainable use of water resources. The SM offered a range of tailored and targeted interventions for enhancing skills and competences of authorities and other stakeholders primarily in the MED South subregion. These included a demand-driven expert facility, peer-to-peer experience sharing and dialogue, training activities and webinars. These activities contributed not only to enhancing capacities but also to raising education and awareness, engaging stakeholders and facilitating communication on sustainable investments. In particular, the SWIM-H2020 project was instrumental in the development and outreach of the Mediterranean Strategy on Education on Sustainable Development (MSESD). It also disseminated innovative approaches tested within EU-funded demonstration projects and organised exchanges of good practices between the countries across the region.

A key aim of the project focused on strengthening regional coherence and cooperation in approaches to marine pollution prevention and control, and sustainable water management. In this way, it ensured that national needs matched the regional activities and challenges while, at the same time, countries were asked to propose national solutions to implement regional decisions. Country representatives expressed a high level of satisfaction with these tailor-made activities addressing national needs and priorities. Critical issues such as waste management, e.g. construction and demolition waste; the reduction of industrial emissions, such as heavy metals emissions from iron and steel mills*; the green economy; the efficient use of water; and education on sustainable development were tackled in a holistic manner. Within the H2020 framework, extensive work was carried on detailed calculation of loads of heavy metals from iron and mill industries, and the revision of ELVs in conjunction with BATs and BREFs.

In total, 1 408 trainees benefited from regional and national trainings provided by no less than 121 international and local non-key experts in interventions and characterised by a strong participatory, interactive and hands-on set-up. This enabled the sharing of best practices among countries, e.g. between northern and southern Mediterranean countries, as well as between MED South countries with similar problems and experiences. In addition, the project supported the creation of the necessary institutional and operational frameworks and strategies to help the authorities to reach consensus with various stakeholders on critical issues.

Countries in the MED South subregion are currently benefitting from capacity-building programmes provided by the Water and Environment Support project (WES; 2019-2023), as a follow-up to SWIM-H2020 SM.

Project websites: https://www.swim-h2020.eu/; https://www.wes-med.eu/

* https://www.h2020.net/component/jdownloads/send/291-lectures-presentations/2855-pollution-loads-from-iron-steel-industries-prof-michael-scoullos

developing their national waste strategies. In addition, countries are shifting towards the circular economy, based on sustainable consumption and production practices and nature-based solutions (see Box 2.4). Countries have developed Sustainable Consumption and Production (SCP) Action Plans as part of the implementation of the SCP Regional Action Plan, defining clear actions to move to more sustainable practices.

When it comes to water, there is a clear move away from addressing water quality issues per se to integrated water resources management (IWRM) which promotes coordinated and inclusive approaches for the development and management of resources. In the EU, IWRM is implemented through the WFD and daughter directives. Through bilateral EU support, Algeria and Morocco have already introduced some of these principles and concepts and have initial experience in developing management plans. This transfer of know-how has provided the Moroccan institutions in charge of planning with the organisational tools and techniques related to IWRM implementation. Another example is the piloted integration of IWRM and integrated coastal management (ICM) that was tested as part of the MedProgramme of UNEP/MAP ([11]) to support the implementation of policy measures related to the sustainable use of resources. Despite having

([11]) https://pap-thecoastcentre.org/pdfs/Plan%20Buna%20Bojana.pdf

Box 2.4 Nature-based solutions to wastewater management

In 2018, the assessment by UN Water (WWAP/UN-Water, 2018) sheds light on nature-based solutions (NBS) to water management, including wastewater. As the term implies, NBS are inspired and supported by nature by using or mimicking natural processes. In recent years, such solutions have received greater attention and investments worldwide. They support concepts such as the circular and green economy which aims to generate social, economic and environmental co-benefits. Several NBS are intended for managing water quality, including the management of non-point-source pollution from agriculture, through e.g. buffer strips, vegetative waterways, etc., and urban green infrastructure to reduce pollution from urban run-off. Other NBS, such as natural and constructed wetlands, are used for wastewater treatment because of their capacity to degrade or immobilise a range of pollutants, including emerging pollutants. Like most treatment systems, they function by reducing organic matter and pathogens to a minimum. However, their efficiency for nitrogen and phosphorus reduction is variable. Constructed wetlands for wastewater treatment can be a cost-effective NBS that provides effluent of adequate quality for several non-potable uses, including irrigation, as well as offering additional benefits, including energy production. When it comes to industrial wastewater treatment, the feasibility of NBS depends on the pollutant type and its loading. In the case of polluted water sources, grey infrastructure solutions may continue to be needed.

Constructed wetlands have been used in particular in many Mediterranean countries, including Egypt (pilot project in Bilbeis, 55 km north of Cairo), Lebanon (Litani river basin), Italy (reed beds in central Italy), Syria (Haran Al-Awamied), France (roughly 3 500 in small communities), Turkey (Balchik and Orucoglu), Croatia, Greece and Israel (Ayaz et al., 2016; Morvannou et al., 2015; Masi and Martinuzzi, 2007). Constructed wetlands of the lagoon type are commonly used in several Mediterranean cities in Morocco, including Berkane, Saïdia, Ben Taïeb, Midar, Al Aaroui, Kariat Arekmane and Ras El Ma (H2020 National Report for Morocco, 2020). Constructed wetlands are an efficient wastewater treatment method in terms of the removal of organic content in secondary treatment plants. Specifically, the Mediterranean climate makes the process more efficient because of the warmer temperatures, compared to Northern Europe (Masi and Martinuzzi, 2007), making it an interesting way of treating wastewater in the region.

a primary focus on water resources, the pilot also considered the interface of inland and marine waters as well as transboundary basin management.

The progressive use of pollutant release and transfer register (E-PRTR) systems in the whole region could be an important tool for supporting integrated environmental management and policies. The recently launched EU Green Deal ([12]) also offers promising development across the region.

The move towards integrated policies and sustainability transitions must be guided by the most up-to-date knowledge. In Europe, knowledge of systemic challenges and responses is growing and is increasingly reflected in EU policy frameworks (EEA, 2019e). Due to the complex interaction of cumulative pressures and their impacts, this knowledge for action should be both anticipatory and transdisciplinary (EEA, 2019e). The need to invest in a stronger knowledge base that enhances the capacity to react quickly in crisis situations while responding to sustainability for more long-term issues still remains across the whole Mediterranean region. Despite shifts on the policy front, achieving goals and targets set in the national strategies will not only require reinforcing the knowledge base but also more financing and capacity building, the engagement of businesses and citizens' awareness, and better coordination among all actors at the national level. For this reason, when it comes to the implementation on the ground, most approaches remain mainly sectorial.

([12]) https://ec.europa.eu/info/files/communication-european-green-deal_en

3 Section C: Thematic Assessment

3.1 Municipal waste and marine litter

3.1.1 Municipal waste and marine litter assessment — key messages

- **Coastal population and tourism, associated with take-make-waste economic models, are the main drivers of plastic waste generation and marine litter in the Mediterranean.** Marine litter in the Mediterranean originates predominantly from land-based sources but the lack of data means trends cannot be defined. Nevertheless, there is evidence that efforts to adequately prevent, collect and process such waste are far from sufficient to reduce leakages into the sea.

- **Municipal solid waste (MSW) generation has been increasing across the whole region** since 2014 and is expected to continue to do so in the coming decade. Although MSW generation is higher in more-developed countries, such as the MED EU countries and Israel, other nations are following similar trends, with no evidence of decoupling between economic growth and population increase. In the MED South alone, projections expect the trend to continue to rise (+29 % in 2030 and +50 % in 2050), although with significant differences between rural and urban areas.

- The composition of MSW across the Mediterranean continues to be dominated by organic waste, especially in the MED South countries, with relatively more glass, paper and plastic in other subregions. **Plastic fraction is expected to increase in the future**, largely driven by consumption changes and lifestyles, although it currently varies widely within the region (between 3 % and 23 % of MSW). Since 2007, there has been an overall increase in plastic packaging generation in the MED EU countries, although not in terms of generation per capita.

- Despite important improvements, the collection of MSW is still a **significant issue in most MED South countries, where only a few countries are succeeding in reaching full waste collection coverage**, which remains particularly difficult in rural areas, where waste is usually illegally dumped or burned. The picture is particularly negative in suburbs and slums, where a sizeable share of the population lives and where waste-collection services are either limited or non-existent. The **role of the informal sector** is particularly important for waste collection in some MED South countries, and

Table 3.1 Overview of progress on the H2020 waste indicators per subregion

Waste	MED EU				MED South				MED Balkans and Turkey			
	Years		Outlook		Years		Outlook		Years		Outlook	
	2003	2014	2020	2030	2003	2014	2020	2030	2003	2014	2020	2030
Waste generation		↘	↘	↘		↘	↘	↘		↘	↘	↘
Plastic waste generation per capita		↘	↘	↗		↘	↘	?		↗	↘	↗
Waste collection coverage		↗	↗	↗		↗	↗	↗		?	?	↗
Wasted collected by formal system		↗	↗	↗		↗	↗	↗		?	?	↗
Waste treatment		↗	↗	↗		↗	↗	↗		↗	↗	↗
Waste that goes to uncontrolled dumpsites		?	?	↗		?	?	?		?	?	?
Plastic waste recycling		↗	↗	↗		?	?	↗		?	?	↗

Note: MED South rating is attributed according to the situation in most countries in the subregion.

their inclusion in waste management represents a significant opportunity to improve the coverage and the efficiency of waste collection, with positive social and economic impacts.

- In the period 2014-2017, the disposal of waste in landfills and sanitary landfills declined in MED EU countries, remained stable in MED Balkans and Turkey, and increased in MED South countries. In the latter countries, **waste is normally discharged into open dumps**, creating considerable negative impacts on the environment and human health. In these countries, there have been improvements in capacity and infrastructure and such efforts should be further encouraged and expanded to meet the expected increase in waste generation in the future.

- Overall, **recycling is increasing in the Mediterranean region at different rates**, which are higher in the MED EU countries. The average recycling rate in the MED EU countries is still lower than the EU average and formal recycling remains very limited in most MED South countries. In this subregion, data coverage and reliability are limited and should be improved; they are also due to the role of the informal sector in the collection of recyclables. As shown by successful experiences at the national level, there is an opportunity to improve waste management in MED South countries by exploiting the high share of organic waste, putting in place composting treatment plants that could have positive impacts on the environment (in terms of reducing greenhouse gas emissions) and on the economy, creating jobs, and promoting a circular economy approach.

- The Mediterranean countries are active parts of major international conventions on the regulation of waste and marine litter. Accordingly, waste management legislation has been in place for several decades in the MED EU countries, while the recent EU Circular Economy Action Plan requires significant progress towards better waste management. Most countries in the MED South and MED Balkans and Turkey have waste policies, plans or strategies for waste management at both the national and subnational level. However, waste-management systems in these countries are constrained by a weak legal framework and a low level of enforcement, poor public awareness and citizens' improper waste-disposal behaviour, political instability and conflicts, and budgets. The capacities of the public authorities in MED South countries must be enhanced, in particular their **capacity to monitor and enforce the implementation of waste legislation** and to combat littering and illegal dumping activities.

- The production of **reliable data and regular monitoring of waste streams is still necessary** to support informed decision-making, in the MED EU countries, too. As in 2014, waste data collection in MED South counties is limited and the picture has not improved, mainly due to low investment and human resources in data production. This is also true for marine litter, where data are limited, inconsistent and fragmented. In this respect, it is necessary to ensure continuous support to Mediterranean-scale and national monitoring programmes, which have been designed and are in operation, to ensure a consistent dataflow and the generation of high-quality datasets. Moreover, it is fundamental to support capacity-building efforts and coordination among national institutions, to improve data harmonisation at the Mediterranean scale, to facilitate the creation of a comprehensive Mediterranean-level database and to support effective cross-border decision-making.

3.1.2 Why is waste a priority issue in the Mediterranean?

Waste generation and management entails a considerable loss of material and energy resources and may pose serious risks for the environment and human health. These include, for example, contamination of soil, groundwater, and surface waters from leachate; air pollution associated with open burning of waste; emissions from collection vehicles and waste disposal methods; and by facilitating the spreading of infectious diseases (UNEP, 2018).

The open burning of waste generates emissions of dioxins, polycyclic aromatic hydrocarbons, and black carbon, which are highly toxic, carcinogenic, and powerful short-lived climate pollutants (Wilson et al., 2015), and may contribute to global climate change. In parallel, landfills may generate high amounts of methane, up to 12 % of total global methane emissions (Wilson et al., 2015). Preventing waste generation and improving its management can avoid greenhouse gas (GHG) emissions from disposal, especially through the reduction of landfills. The increase in recycling can prevent GHG emissions associated to production of virgin materials.

Improper waste disposal and leakages from land and sea-based activities can lead to mismanaged waste reaching and accumulating in the sea, where it can have serious environmental and socio-economic impacts (UNEP, 2018; Wilson et al., 2015). In particular, the plastic fraction can impact marine fauna, mainly through ingestion and entanglement; moreover, it can be colonised by micro-organisms, and used by non-native and invasive species as a vector of transport across large distances. To this respect, a meta-analysis performed in the context of the EU-funded project PANACeA, reviewed and mapped existing data published in scientific literature, providing a spatial assessment of the interactions between marine litter and biodiversity in the Mediterranean, shown in Map 3.1 .

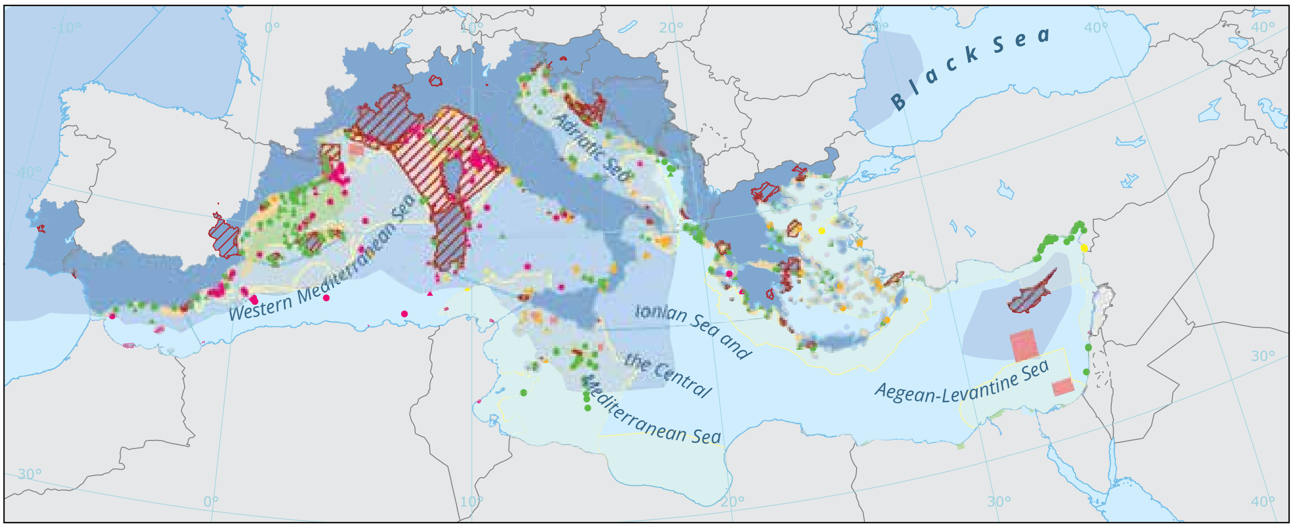
In the Mediterranean, coastal population and coastal tourism are the main drivers associated with waste generation and management and marine litter (see Section B). Especially coastal tourism generates additional quantities of waste, in particular drink and food packaging, which can entail further stress to waste management infrastructures, and lead to serious negative environmental impacts. Due to the large share of population and human activities located in the coastal regions of the Mediterranean, waste represents a significant pressure on coastal and marine environments, contributing to the generation of beach and marine litter and, on the other hand, causing visual pollution and loss of aesthetic value of beaches.

These threats are especially serious in areas where coastal dumpsites are still used, or are used without rehabilitation (UNEP/MAP, 2017a).

As in other regional seas, marine litter in the Mediterranean originates predominantly from land-based sources and is mostly composed of plastic (UNEP/MAP, 2017a). This section focuses mainly on municipal solid waste (MSW) and gives special emphasis to the plastic fraction, as these are potential precursors of marine litter.

The management of MSW is normally in the hands of local authorities and cities, which are responsible for its collection, treatment, and disposal. Because of its complex character and its distribution amongst many waste generators, environmentally sound management of MSW is complicated (Metaxas and Sfakianaki, 2011). Moreover, although MSW represents only a part of all the waste generated, its management often requires more than one third of the public

Map 3.1 Interactions between marine litter and biodiversity in the Mediterranean (2018)



Reference data: ©ESRI, © MedBioLitter

Interactions between marine litter and biodiversity in the Mediterranean

Marine Protected Area (MPAs)
- National MPAs
- Natura 2000 sites
- Fishery Restricted Areas
- SPAMIs
- EBSAs
- Pelagos Sanctuary

0 500 1 000 1 500 km

- EU waters
- Interreg MED area
- Biodiversity Protection Community pilot sites

Litter interaction
- Ingestion
- Colonisation
- Entanglement
- Other

Ecosystem
- Pelagic
- Benthic

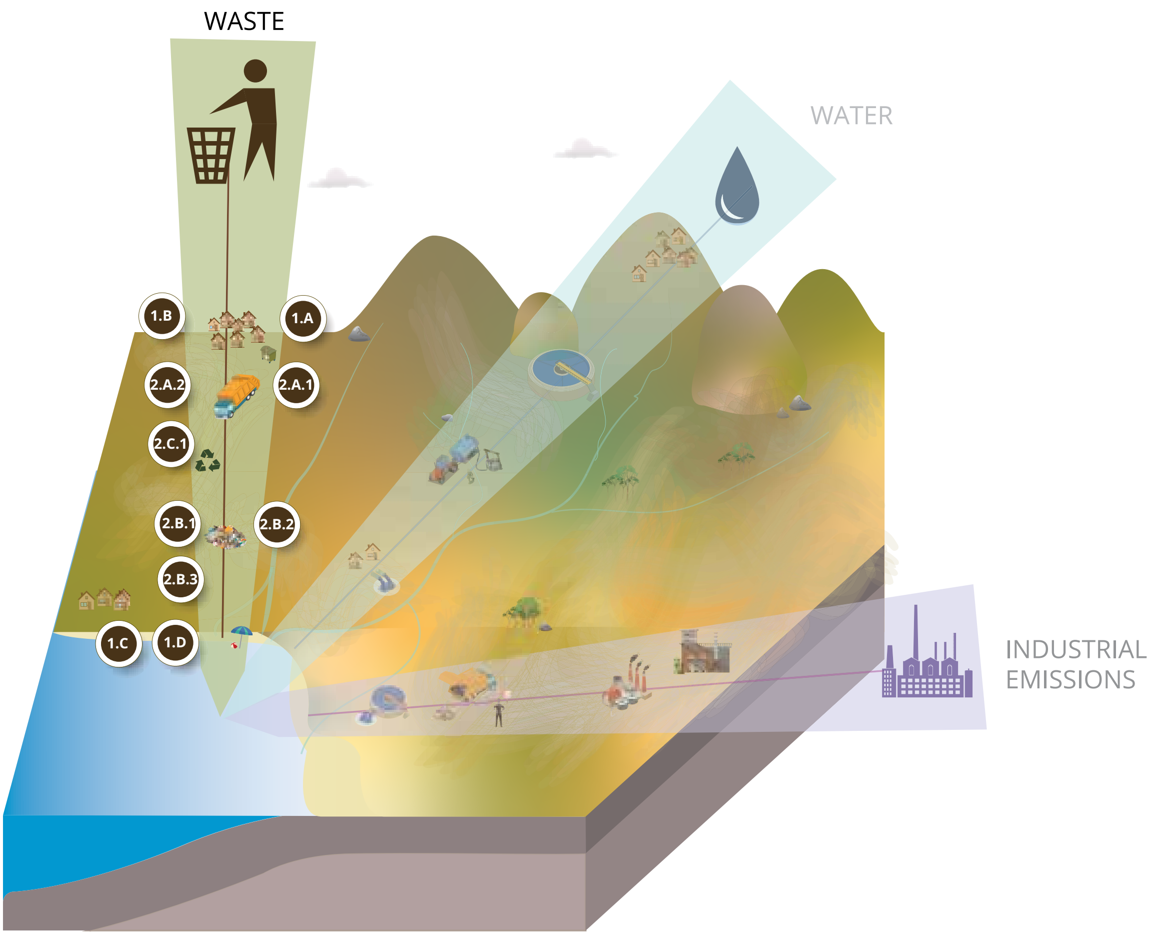
Source: PANACeA.

sector's financial efforts to abate and control pollution (OECD, 2011), representing an economic burden for industries, municipalities, and households, particularly in developing countries. To face this issue, in most countries the government is either the major financier of MSW collection and disposal (e.g. in Lebanon and Tunisia), or fills the gap between the costs and the revenues of MSW (as in Algeria, Egypt, Jordan, and Palestine). Cost recovery is only partially implemented in Algeria, Egypt, Jordan, Lebanon, and Palestine, while Morocco and Tunisia do not recover costs through the operation of services. Cost recovery arrangements are made through electricity bills in Egypt and Jordan.

3.1.3 A 'source-to-sea' approach to the waste thematic area

The adopted source-to-sea approach to waste and marine litter (Figure 3.1) allows the interactions between human and natural systems to be assessed through the adoption of the DPSIR framework. The selected H2020 indicators for waste and marine litter are proxies to assess the amount of waste that is transferred into the sea. They are intended to inform progress in the waste thematic area in relation to drivers of waste generation, their pressures on the environment, the state of marine litter and its impacts

Figure 3.1 H2020 indicators for waste and marine litter, used to inform progress across the source-to-sea continuum



1.A Municipal waste generation & composition
1.B Plastic waste generation per capita
1.C % of population living in coastal areas
1.D % of tourists in coastal areas
2.A.1 Waste collection coverage
2.A.2 Waste captured by formal waste sector
2.B.1 % of waste to uncontrolled dump sites
2.B.2 Uncontrolled dump sites in coastal areas
2.B.3 Waste going to dump sites in coastal areas
2.C.1 % of plastic waste generated that is recycled

Source: ETC/ICM-Deltares.

on marine fauna and flora, and the responses in terms of waste management (collection, treatment, disposal, recycling, and incineration and energy recovery).

3.1.4 Key waste and marine litter trends

Updated H2020 waste indicators

- IND 1.A municipal waste generation & composition
- IND 1.B plastic waste generation per capita
- IND 1.C % population living in coastal areas
- IND 1.D % tourists in coastal areas

Municipal solid waste generation

The quantity of MSW generated in a country is closely related to its economic development, rate of urbanisation, its types and patterns of product consumption, household revenue, and lifestyles (Spiteri et al., 2016). In particular in the MED South countries, population increase, especially in urban areas, improvements in the standard of living, and the growth of tourism represent the key drivers of waste generation, especially in coastal areas. In fact, consumption growth is generating changes in the production and composition of waste, including 'new' waste streams such as electronic and packaging waste.

The situation in the Mediterranean is varied not only in terms of data availability and quality but also in relation to the main trends. MSW generation data for MED EU countries and MED Balkans and Turkey are generally available through Eurostat, while for MED South countries there are fewer data and, in general, they are of a relatively lower quality.

Data for waste generation in MED South countries are not available on a regular basis in all countries and, in many cases, only data on waste generated by households were obtained (Figure 3.2). Solid waste generated in the southern and eastern shores of the Mediterranean is approximately half that of the EU, and relatively modest compared to global trends, primarily due to lower population and income levels (Table 3.2). Egypt generates the largest quantity of MSW by far, producing 21 000 thousand tonnes in 2012 and 22 000 thousand tonnes in 2016 (H2020 National Report for Egypt, 2020), while Palestine recorded the lowest quantity of MSW generated (1 629 thousand tonnes in 2016, adjusted value ([13])). Israel recorded the largest quantity of MSW generated per capita, equal to 753 kg per capita/year in 2016. In 2018, a total of 2 686 thousand tonnes of MSW were generated in Tunisia, representing 219 kg per capita/year (H2020 Country Report for Tunisia, 2020). The most recent estimates for Palestine, by GIZ-SWEEPNET (SWEEPNET, 2014), indicate MSW generation of 1 387 thousand tonnes in 2012, equal to 343 kg per capita/year. Based on this calculation, the total MSW generation was 1 687 thousand tonnes in 2017 and 1 755 thousand tonnes in 2018 (H2020 National Report for Palestine, 2020). The MoLG-JICA Data book (JICA, 2019) estimated MSW generation of 1 581 thousand tonnes in 2019 (957 thousand tonnes in the West Bank and 485 thousand tonnes in the Gaza Strip), representing 369 kg/year per capita. Finally, a total of 920 thousand tonnes of MSW were generated in the Mediterranean part of Morocco in 2018, mainly in densely populated areas such as the cities of Tanger, Tétouan, Nador, and Berkane, representing 12 % of the total MSW generated at the national level (H2020 National Report for Morocco, 2020). The available data show an increase in MSW generation since 2004 in all MED South countries (see Annex B). This trend is expected to continue in the future as population growth and income lifestyles evolve. The latest projections to 2030 and 2050 from the World Bank (World Bank, 2018) — calculated considering both GDP and population growth — indicate a steady increase in MSW generation in all MED South countries, within a range of +7 % for Lebanon to +70 % for Palestine (2030), and from +35 % for Morocco to +245 % for Palestine (2050). Similarly, MSW generation in the Mediterranean part of Morocco will reach 1 167 thousand tonnes in 2030, corresponding to 1.27 times the value for 2018 (H2020 National Report for Morocco, 2020).

MSW generation in MED EU and MED Balkans and Turkey is illustrated in Figures 3.3 and 3.4 , which show MSW generation in absolute terms and per capita. Overall, the MED EU countries generated 498 kg per capita/year in 2017, compared to 423 kg per capita/year in the Balkans. The highest values were recorded in Cyprus (637 kg per capita/year) and Malta (631 kg per capita/year), and the lowest in Bosnia and Herzegovina (352 kg per capita/year) and Croatia (416 kg per capita/year).

([13]) These data were adjusted by the Word Bank (2018) from a variety of origin years to specific years (i.e. 2016, 2030, and 2050), using a regression model that took into account GDP growth and population growth as drivers of MSW generation.

Table 3.2 Municipal solid waste generation in MED South countries

Country	2010-2012 ([a])		Original year reported ([b])		Year	2016 ([b])		2030 projection ([b])		2050 projection ([b])		Increase 2016-2030 (%)	Increase 2016-2050 (%)
	Absolute values (1 000 t)	Per capita (kg/y)	Absolute values (1 000 t)	Per capita (kg/y)		Absolute values (1 000 t)	Per capita (kg/y)	Absolute values (1 000 t)	Per capita (kg/y)	Absolute values (1 000 t)	Per capita (kg/y)		
Algeria	9 300	258	12 379	305	2016	12 379	305	16 320	334	21 172	369	+32	+71
Egypt	21 400	259	21 000	239	2012	22 000 ([c])	284 ([c])	34 214	286	55 163	360	+56	+151
Israel	4 800	615	6351d	750	2015	6531 ([d])	757([d])	7 109	712	10 039	798	+9	+54
Jordan	2 600	419	2 530	301	2013	3 496 ([e]) (2018)	339 ([e]) (2018)	3 825	344	6 352	448	+9	+82
Lebanon	1 900	442	2 040	364	2014	2 149	358	2 303	430	2 862	529	+7	+33
Libya			2 148	347	2011	2 420	385	3 632	495	4 617	568	+50	+236
Morocco	6 700	207	6 852	199	2014	7 126	202	10 160	249	15 158	332	+43	+113
Palestine	1 500	375	1 387 ([f])	343 ([f])	2012	1 629	340	2 768	411	5 619	579	+70	+245
Tunisia	2 400	224	2 700	242	2014	2 686 ([g]) (2018)	219 ([g]) (2018)	3 882	302	5 399	389	+44	+101

Sources: ([a]) H2020 Report (2014);

([b]) World Bank (2018);

([c]) H2020 National Report for Egypt (2020);

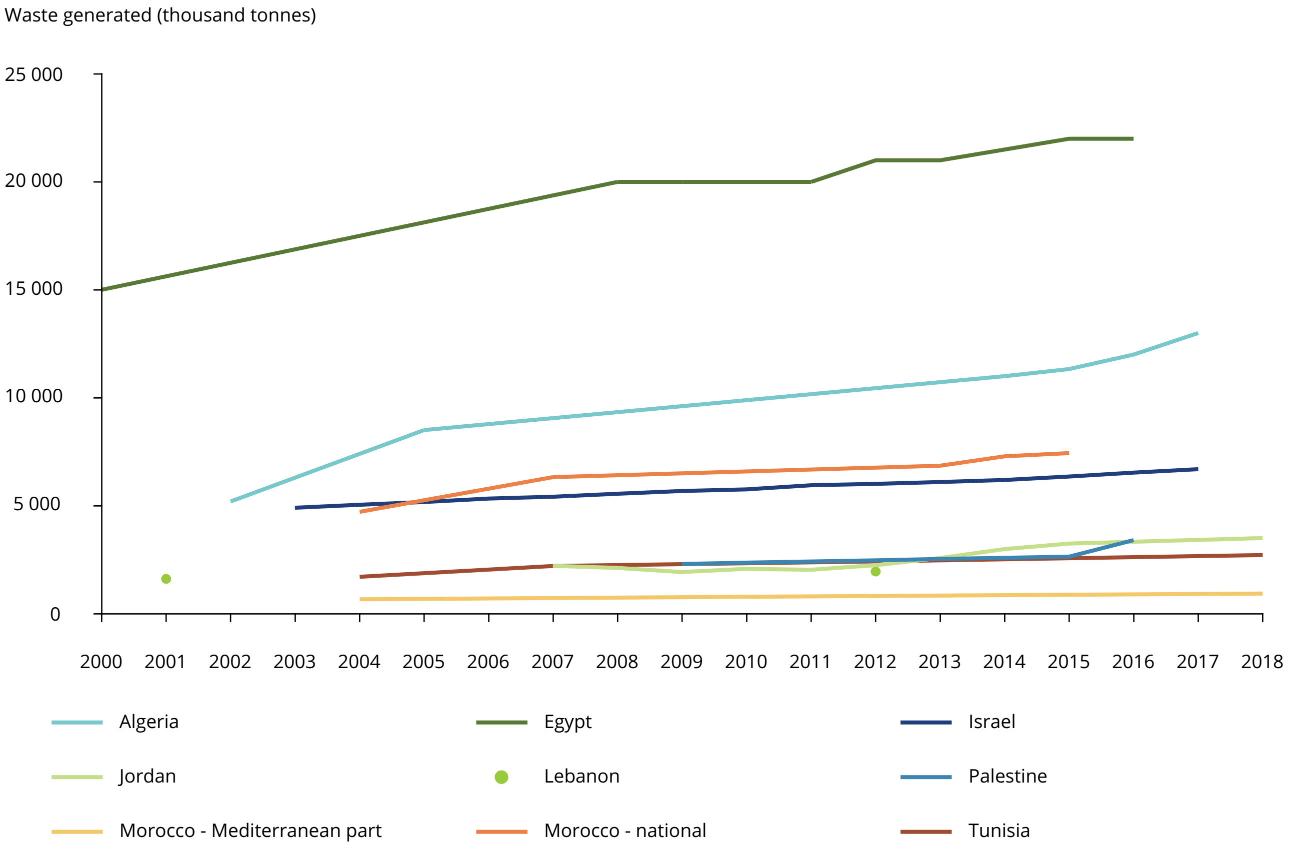
([d]) H2020 National Report for Israel (2020);

([e]) Data for 2018 from the H2020 National Report for Jordan (2020);

([f]) H2020 National Report for Palestine (2020);

([g]) H2020 National Report for Tunisia (2020).

Figure 3.2 Waste generation in MED South countries (thousand tonnes)



Note: Data for Jordan, Morocco and Tunisia has been retrieved from a combination of sources.

Source: UNSD except Egypt: H2020 National Report for Egypt (2020); Israel: H2020 National Report for Israel (2020); Morocco (2007): H2020 National Report for Morocco (2020); Jordan (2014-2018) H2020 National Report for Jordan (2020); Palestine: H2020 National Report for Palestine (2020); Tunisia (2018): H2020 National Report for Tunisia (2020).

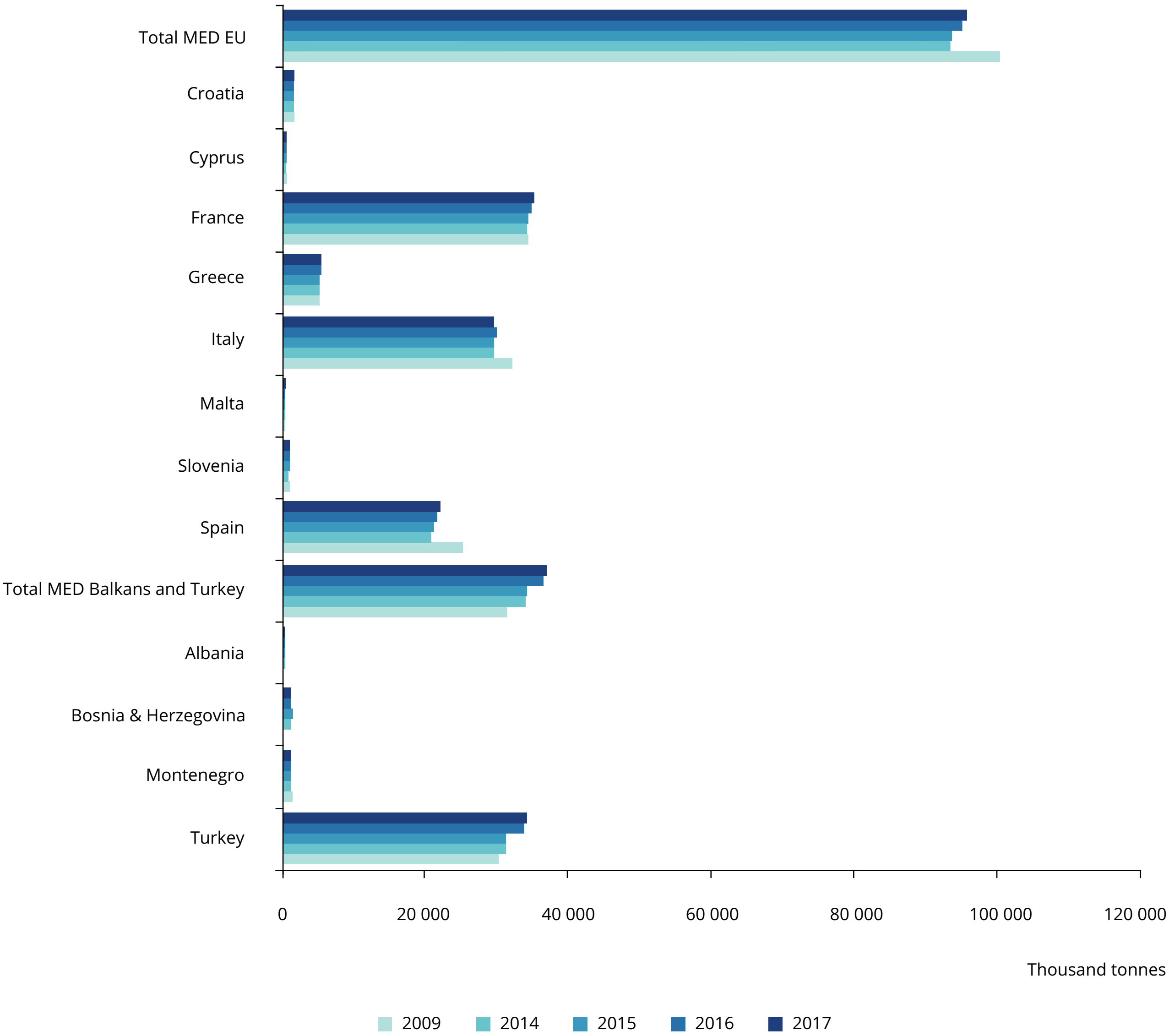
Looking at trends over the period 2009-2017, a decrease was recorded in MSW generation in the MED EU countries (-5 %), while the opposite trend was recorded in MED Balkans and Turkey (+17.2 %), although the picture is incomplete due to missing data from Albania and Montenegro. Similarly, per capita levels of MSW generation showed a general decrease in the MED EU countries (especially in Cyprus, Italy, Malta, Slovenia and Spain) over the same period, with the exception of Greece and Croatia, which recorded an increase of 9 % and 3 %, respectively. It is worth noting there was a slight increase in MSW generation in almost all MED EU countries from 2014 onwards (+2 % on average) which was particularly evident in Malta (+9.8 %) and Slovenia (+9.2 %). In MED Balkans and Turkey, MSW generation per capita followed an initially decreasing trend, with a minimum recorded in 2015, after which it started to increase again, reaching 423 kg per capita/year in 2017 (+2 % over the 2009 levels, and +5 % over 2014 levels), although with marked differences between Turkey (+9.4 %) and Montenegro (-7.5 %).

Municipal solid waste composition

MSW composition has direct implications on waste collection and disposal methods, as well as on the quantity and type of waste that reaches the sea. Figure 3.5 presents the available data on waste composition across the Mediterranean (World Bank, 2018). Organic and green waste is the predominant type of waste, especially in the MED South countries (with an average of 56 %), but also in the MED Balkans and Turkey (average of 37.9 %) and the MED EU (average of 40.8 %). Available data show that MED EU countries, together with Israel, generate proportionally more glass, paper and cardboard, plastic, and metal waste than the other Mediterranean countries, while wood waste proportion is higher in the MED Balkans and Turkey.

The composition of MSW varies across cities, depending on consumer behaviour and consumption patterns, income level, and culture, among other things. Generally speaking, low- and middle-income cities generate a larger proportion of organic waste, while high-income

Figure 3.3 Municipal solid waste generation in MED EU countries, MED Balkans and Turkey from 2009 to 2017 (thousand tonnes)



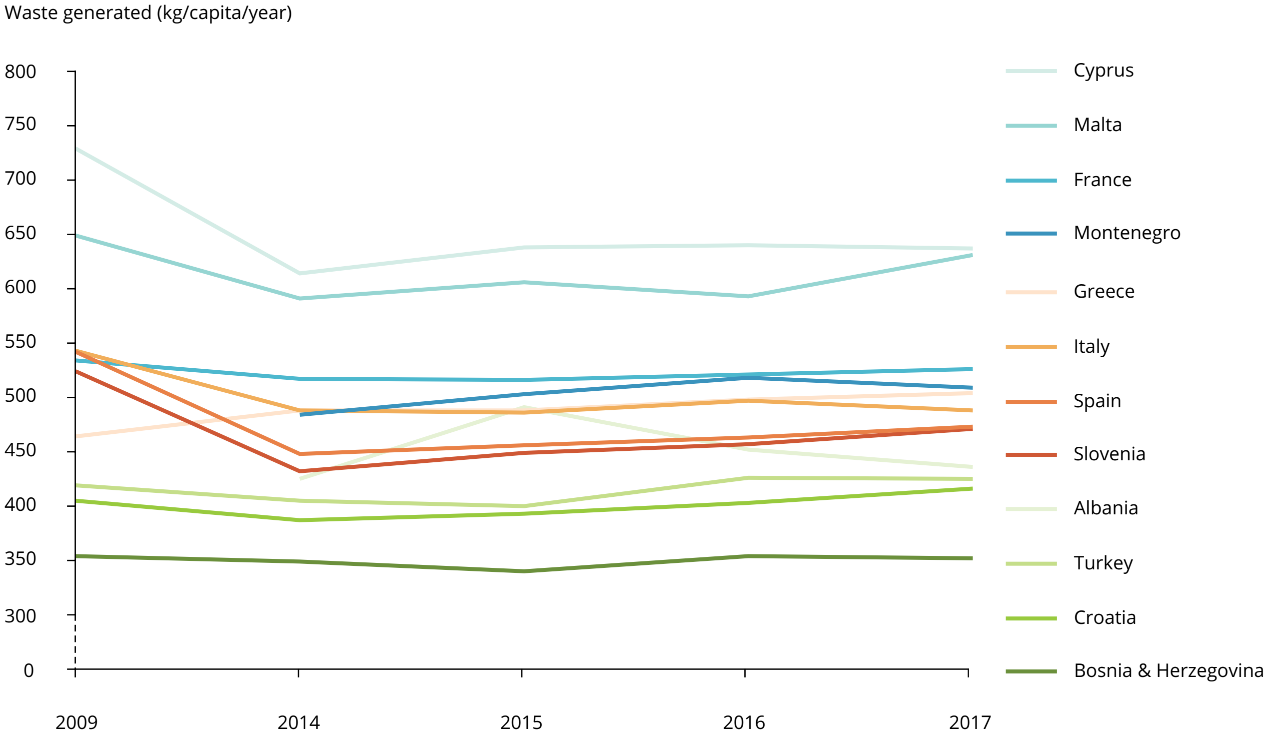
Note: Albania, Bosnia and Herzegovina, total MED Balkans and Turkey: incomplete data series.

Source: Eurostat (2020).

cities generate relatively more paper and packaging, including plastics (Hoornweg and Bhada-Tata, 2012). A high percentage of organic waste entails a high moisture content, which requires appropriate treatment technologies and whose disposal entails specific environmental impacts (UNEP, 2018).

Changing consumption patterns, largely resulting from the import of manufactured goods, are driving change in waste composition (see Annex B). In the majority of MED South countries, the proportion of biodegradable waste is on a downward trend, while the share of plastics and other synthetic materials has been increasing. This dataset also shows the limited and sometimes conflicting data on MSW generation in MED South countries, depending on the sources considered. Box 3.1 illustrates the case of MSW composition in Egypt, which highlights the high prevalence of organic waste in total MSW, and the need to design and implement tailored MSW management measures.

Figure 3.4 Municipal solid waste generation per capita in MED EU countries, MED Balkans and Turkey from 2009 to 2017 (kg per capita per year)



Note: Albania, Montenegro: incomplete data series.

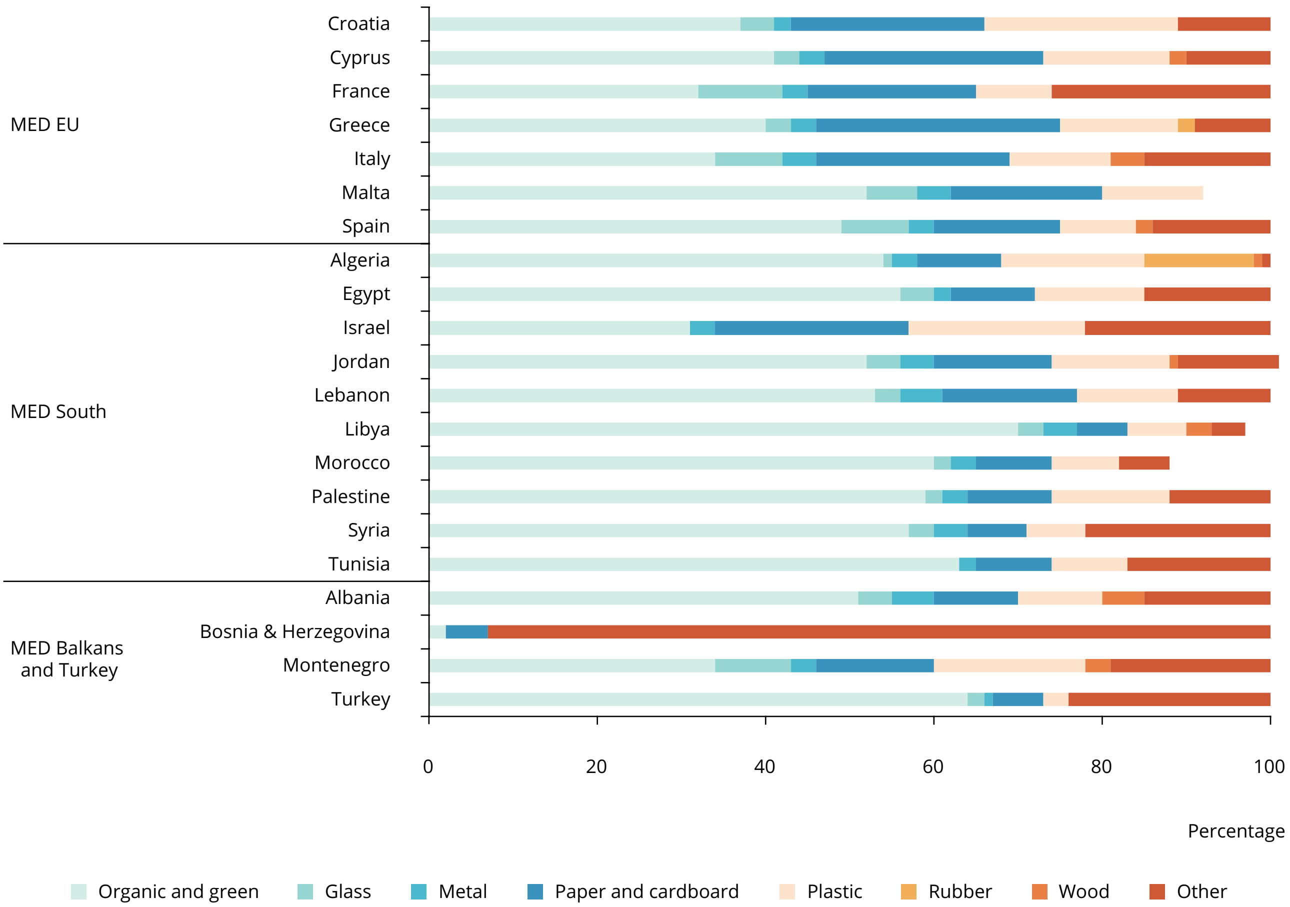
Source: Eurostat (2020).

Plastic waste generation

Data on plastic packaging waste generation are only available for MED EU countries from the Eurostat database, while they are generally lacking for MED Balkans and Turkey and MED South countries. In 2018, a total of 48.49 kg per capita/year of plastic waste were generated in Jordan (H2020 National Report for Jordan, 2020), and 22 kg per capita/year in Tunisia (H2020 National Report for Tunisia, 2020). Finally, the most recent estimates indicate a generation of 28.1 kg per capita/year of plastic waste in urban areas, and 16.1 kg per capita/year in rural areas of the Mediterranean part of Morocco for 2014 (H2020 National Report for Morocco, 2020), and 29.56 kg per capita/year in Egypt in 2016 (H2020 National Report for Egypt, 2020).

An overall increase in plastic packaging generation in MED EU countries is evident from the available data, equal to 6 % over the period 2009-2016 and 4 % over the period 2014-2016. This increase was higher in some countries, such as Croatia and Malta, and less evident in countries such as Cyprus and Greece, where an initial decrease was recorded for the period 2009-2016/2017, followed by an increase on the basis of 2014, and possibly explained by the effects of the economic crisis that hit these two countries particularly hard over the last decade. Data for Israel (H2020 National Report for Israel, 2020) indicate a steady growth in plastic waste generation, from 139 kg per capita/year in 2014 to 156 kg per capita/year in 2017. In 2018, a total of 48.49 kg per capita/year of plastic waste was generated in Jordan (H2020 National Report for Jordan, 2020), and 22 kg per capita/year in Tunisia (H2020 National Report for Tunisia, 2020). Finally, the most recent estimates indicate the generation of 28.1 kg per capita/year of plastic waste in urban areas, 16.1 kg per capita/year in rural areas of the Mediterranean part of Morocco for 2014 (H2020 National Report for Morocco, 2020), and 29.56 kg per capita/year in Egypt in 2016 (H2020 National Report for Egypt, 2020).

Figure 3.5 Waste composition in the Mediterranean countries, latest year available (%)



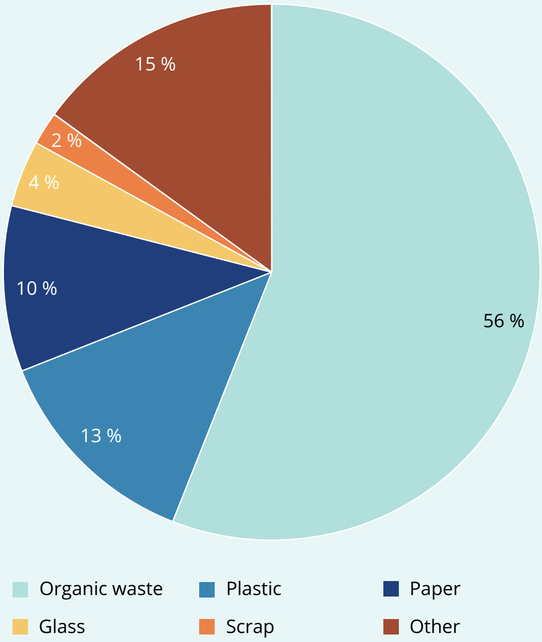
Note: Totals for Malta, Libya, and Morocco are not 100 % in the original source; data for Slovenia are missing. All data is from 2018, except for Israel (2017 — estimated) and Jordan (2015).

Source: World Bank, 2018 except Israel: H2020 National Report for Israel (2020); Jordan (2015) H2020 National Report for Jordan (2020); Tunisia: H2020 National Report for Tunisia (2020).

Box 3.1 Municipal solid waste composition in Egypt

Waste composition is one of the main indicators produced by Egypt's Ministry of Environment on a yearly basis as part of the national State of the Environment Report. In Egypt, MSW constitutes about 25 % of solid waste. The quantities of MSW generated are calculated on a daily basis by the municipalities of each governorate. Based on the data collected, the annual quantity of waste generated is calculated for each governorate and for the country as a whole.

Figure 3.6 Municipal solid waste composition in Egypt, 2016

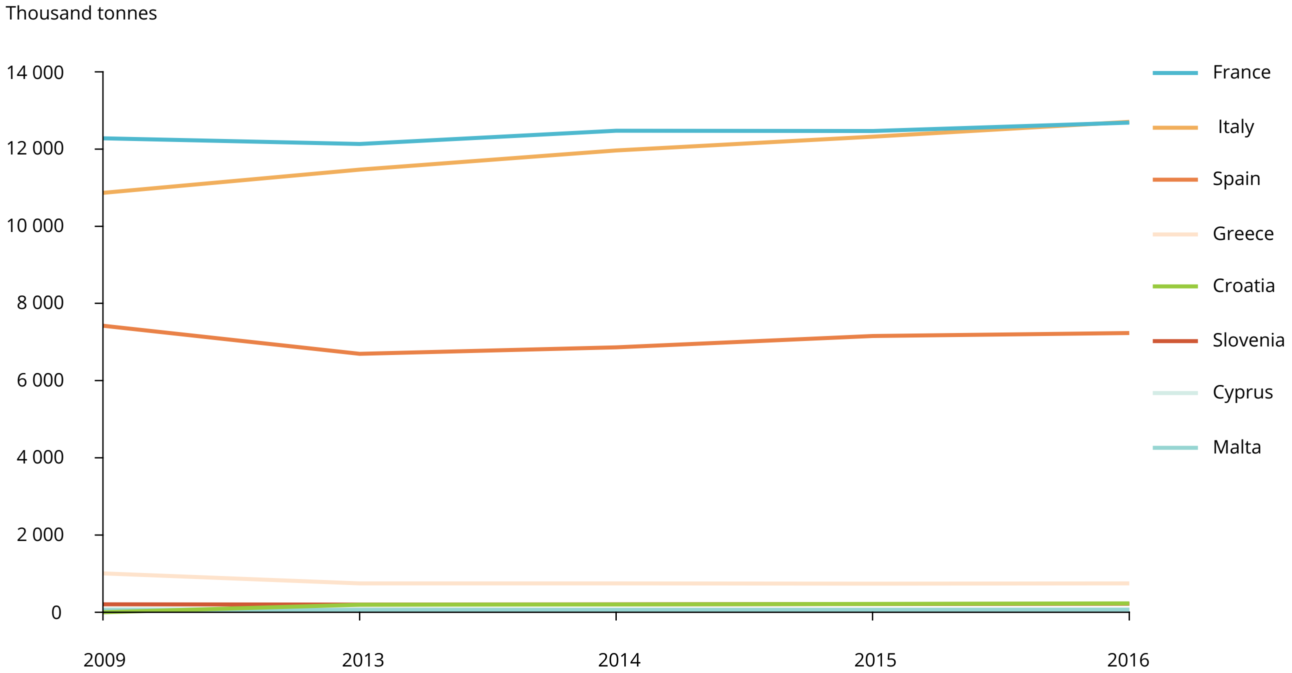


Waste density is influenced by waste composition, so it is important to define the number and capacity of waste storage and collection facilities required. Based on waste density and the capacity of the trucks, the amount of waste collected can be measured in tonnes (weight). In Egypt, the average density of waste is about 300 kg/m^3, which is comparable to that in other developing countries. The relatively high density measured in Egypt reduces the effectiveness of compaction vehicles for waste transportation.

The average MSW composition at the national scale in the relevant fractions is also calculated, based on the information coming from the municipalities. Organic waste is the major component of MSW, followed by plastic waste. To improve the exploitation of organic waste, the Ministry of Environment, along with various governorates, has established local units to use organic waste for the production of compost.

Source: Egypt State of the Environment Report (2016).

Figure 3.7 **Packaging waste generation in the MED EU countries between 2009 and 2016 (thousand tonnes)**



Source: Eurostat, 2020.

Municipal solid waste collection

Updated H2020 waste indicators

- IND 2.A Waste collection coverage
- IND 2.B Waste captured by the formal waste sector

As shown in Tables 3.3 and 3.5, waste collection coverage is relatively comprehensive in the MED South countries, with an average of 82 % of total population covered. Coverage is highest in urban areas, with an average of 90 % of waste being collected, especially in city centres, although there is a high variation across cities (see Annex B). It should be noted that data on waste collection coverage might be skewed by the fact that remotes parts are not considered in several countries as they do not qualify for waste collection.

Table 3.3 Municipal solid waste collection in MED South countries between 2000 and 2017 (thousand tonnes)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Algeria															4 816	5 182	5779	6000	
Egypt									29 306	35 635	29 209		94 868 *						
Israel a				4 880	5 026	5 148	5 303	5 395	5 539	5 670	5 744	5 927	5 986	6 084	6 169	6 336	6 514	6 670	
Jordan						2 358	2 309		3 863		2 069	2 024	2 242	2 566	2 629 (b)	2 854 (b)	2 926 (b)	3 000 (b)	3 078 (b)
Lebanon		1 438			1 580					1 720			1 940						
Morocco	6 500														5 667	5 817			
Palestine		1 102	1 133	1165	1 198	1 234	1 271	1 309	1 346	1 385	1 426	1 468	1 513	1 557	1 603	1 650	1 699		
Tunisia	1 170	1 180	1 195	1 205	1 316														

Note: * value for Egypt in 2012 is considered as an outlier.

Source: UNSTATS, 2018: a H2020 National Report for Israel (2020); b H2020 National Report for Jordan (2020).

Box 3.2 Waste collection in Morocco's coastal hydrological basins

According to the Moroccan Ministry of Interior (MEME/DE, Ministère de l'Intérieur) and the High Commission for Planning (Haut Commissariat au Plan, HCP), the collection rate of MSW at the level of the Mediterranean coastal regions of Tanger-Tétouan — Al Hoceima and l'Oriental in 2018 fell within the range 12 % to 96 %, as illustrated in Table 3.4. At the national level, the MSW collection rate increased from 44 % in 2008 to 79 % in 2012, thanks to the implementation of the PNDM (Plan National de Géstion des Déchets Ménagers et assimilés, National Waste Management Plan). Subsequently, the MSW collection rate in urban centres further increased to reach 81 % in 2013 and 2014, and 85.2 % in 2016 and 2018. The objective set by the National Waste Management Plan (Plan National de Géstion des Déchets Ménagers et assimilés, PNDM) is to reach 90 % collection by 2022 and 100 % by 2030.

Table 3.4 Munixipal solid waste collection rates in the Mediterranean regions of Morocco (%)

Region of Tanger-Tétouan — Al Hoceima	2004	2010	2014	2018
Al Hoceima	75	80	91	95
Chefchaouen	10	15	18	22
Fahs-Anjra	5	6	8	12
M'diq-Fnideq	70	75	93	96
Tanger-Assilah	70	75	93	96
Tétouan	65	70	78	85
Region of l'Oriental				
Berkane	60	65	77	85
Driouch	18	24	29	36
Nador	58	62	66	75

Source: H2020 National Report for Morocco (2020).

Table 3.5 Share of population served and municipal solid waste collected per capita served, latest year available

	Latest year available	Share of population served by regular MSW collection of the total country population (%)	MSW collected per capita served (kg)
Algeria	2015	85	153
Egypt			
Israel	2017 ([a])	99 ([a])	
Jordan	2018 ([b])	88 ([b])	
Lebanon			
Morocco	2016 ([c])	85 ([c])	
Palestine	2015 ([d])	95 ([d])	375
Tunisia	2004	65	202

Source: UNSTATS, 2018:

([a]) H2020 National Report for Israel (2020);

([b]) H2020 National Report for Jordan (2020);

([c]) H2020 National Report for Morocco (2020);

([d]) H2020 National Report for Palestine (2020).

Good waste collection and transport services are often only found in city centres (Table 3.6; see Boxes 3.3 and 3.4 for Israel and Egypt), while services in suburbs are usually poor. In urban centres, door-to-door waste collection by trucks is the most common practice, while source separation is not common. The picture is drastically different in slums, which house a sizeable share of the urban population (e.g. in Egypt; UNEP, 2018). Here, waste-collection services are either limited or non-existent, partly due to poor road access and a lack of waste infrastructure. The roads in slum areas are usually narrow, unpaved and sloping, and are also slippery during rainy seasons, which means modern waste-collection systems are not easy to implement under such conditions. Social and technological innovation is required to ensure that all urban residents have access to waste-collection services.

Table 3.6 Municipal solid waste collection rates in 2018 in selected cities in MED South countries (%)

City	Proportion of MSW collected (%)
Tangier, Morocco	96
Tunis, Tunisia	61
Cairo, Egypt	77
Sousse, Tunisia	99
Algiers, Algeria	100
Amman, Jordan	100
Beirut, Lebanon	100
Saida, Lebanon	100
Tripoli, Libya	100

Note: Maximum chosen as reported for households, geographical area, or waste.

Source: World Bank, 2018, except for Tangier, H2020 National Report for Morocco, 2020.

Box 3.3 Automated waste collection in Israel

Israel's, first pneumatic waste-collection system (the automated vacuum collection (AVAC) system), was built in 2012 in the green neighbourhood of Neot Rabin in the city of Yavne. Residents dispose of waste in two garbage chutes: dry waste in one and wet waste in the other. Residents place the rubbish in chutes and it is collected automatically in an underground storage unit, from which it is pumped through a network of underground pipes to a centralised garbage storage unit. Waste is then sorted, compacted and transferred by truck to the final disposal sites. In 2014, Yavne started to expand the network across other districts, so that in 2015, about 30 pneumatic waste-collection points were established in public areas, soon followed by two other municipalities (Ra'anana and Bat Yam).

Although the system seems to be rather inflexible towards more than two fractions of waste (i.e. dry and wet), the AVAC ensured the elimination of odour associated with waste and reduced traffic congestion. However, it requires a high initial investment and maintenance, including a trained workforce, and needs citizens to engage in the separate disposal of waste.

Source: World Bank, 2018.

Box 3.4 Assessment of waste collection coverage in Egypt

In Egypt, the collection and transportation of MSW constitute the largest financial burden on the available budget and has the biggest impact on the quality of life. The picture is further complicated by the fact that the limited funds are often used to acquire inferior and often inappropriate collection equipment, or to maintain an insufficient collection fleet.

Information about the efficiency of waste collection and transportation is not very consistent in Egypt, as shown below by the technical performance summary on municipal waste coverage in both rural and urban areas, including recycling, composting and open dumped waste.

Table 3.7 Technical performance summary for municipal waste, Egypt

MSW collection coverage:	**%**
Rural areas	0-30
Urban areas	50-65
MSW final destination	
Composted	7
Recycled	10-15
Openly dumped	80-88
Number of dump sites	-
Number of controlled landfills	-
Number of sanitary landfills:	-
Planned	22
Under construction	2
Constructed	-
Operational	7

Source: GIZ (2014)
H2020 Country Report for Egypt, 2019

Although a sizeable share of population lives in rural areas in many of the MED South countries, especially in Egypt ([14]) (57 % in 2018), in some cases, waste-management services are either limited or non-existent in such areas. It is true that rural coverage is relatively high for most MED South countries, with an average of 74 % of waste being collected. However, there is a significant variation across countries: in Tunisia and Egypt, 5 % and 15 % of rural waste is collected, respectively. As a result, rural waste that is not reused or recycled is often illegally dumped or openly burned on-site. This has become particularly problematic with the increasing consumption of plastic, health-care materials, and disposable nappies. However, there is a scarcity of data and information on rural waste generation, including the quantity, composition, sources and management of waste. Normally, rural areas are assumed to have lower consumption levels and to generate less waste per capita, with a high organic content. As such, there is potential in MED South countries to apply composting and biogas technologies (UNEP, 2018).

Traditionally, waste-collection services are provided by municipalities or private contractors. However, the role of the informal sector and community-based organisations in waste collection is equally important in many MED South countries (see Box 3.5). For example, an estimated 96 000 informal waste pickers are active in Cairo and account for 10 % of the waste collected in the city (World Bank, 2018). Several thousand *barbachas* ('waste pickers' in the local language) are estimated to operate in Tunisia, without any type of social coverage and often in a precarious situation (H2020 National Report for Tunisia, 2020). As such, in these countries there is a significant opportunity to improve waste management by including informal actors, which may ensure a higher and more efficient coverage of the city and have positive effects in terms of economic revenues and social inclusion (UNEP, 2018).

([14]) https://tradingeconomics.com/egypt/rural-population-percent-of-total-population-wb-data.html

Box 3.5 Informal recycling in Egypt

The informal processing of recyclable waste, especially organic waste, plays an important role in Cairo's waste management. Street scavengers search through both public and private waste containers, picking out virtually any material that can be sold. In many parts of Cairo, as well as in some other governorates, the so-called 'Zabbaleen' (informal garbage collectors) have long-standing door-service collection arrangements. Material collected on these routes is brought to the Zabbaleen's sorting and processing facilities where it is cleaned and possibly reprocessed before being sold, either locally or internationally.

Until 2009, the Zabbaleen were mainly using organic waste collected from houses to feed 200 000 to 300 000 pigs reared in the district where they live. During the 2009 swine flu epidemic, however, the Egyptian government decided to sacrifice all herds of pigs as a safety measure. This action resulted in the Zabbaleen losing interest in organic waste. As a result, they started to perform segregation at source, leaving behind all the organic waste accumulating in the streets. This change in the dynamics of the collection and transfer process resulted in a significant reduction in income for the Zabbaleen community. It also forced the Cairo governorate to explore other options for handling the disposal of food waste, which makes up roughly 50 % of Cairo's waste stream.

Municipal solid waste treatment and disposal

Updated H2020 waste indicators

- IND 2.B.1 % Waste going to uncontrolled dump sites
- IND 2.B.2 Uncontrolled dump sites in coastal areas
- IND 2.B.3 Waste going to dump sites in coastal areas
- IND 2.C % Plastic waste generated that is recycled

There are significant gaps in MSW treatment data in MED South countries, as shown in Tables 3.8 and 3.9. In 2012, the treatment rate reached 100 % of the MSW collected in Israel, while in Egypt, Palestine, Jordan, and Lebanon, this rate was 19 %, 31 %, 50 %, and 70 %, respectively (EEA and UNEP/MAP, 2014).

Table 3.8 shows the share of waste treatment in MED South countries (World Bank, 2018). More than half of the waste collected in MED South countries is

Table 3.8 Share of waste treated and disposed of in MED South countries, latest year available (% of total MSW)

Country	Open dump	Landfill unspecified	Controlled landfill	Sanitary landfill	Recycling	Composting	Year(s)
Algeria			2	89	8.0	1	2016, 2013
Egypt ([a])	81	7			12.0		2013
Israel		75			24 ([b])		2017
Jordan	45	48			7.0		2014
Lebanon	29		48		8.0	15.0	2014
Libya							
Morocco	52			37	8.0	1.0	2014
Palestine ([c])	32		65		3.0		2013
Syria	80	20			2.5	1.5	
Tunisia	21	70			4.0	5.0	2014
AVERAGE	**54**	**44**	**28**	**63**	**10.0**	**6.0**	

Source: World Bank, (2018):

([a]) Egypt State of Environment Report (2016), as cited by H2020 National Report for Egypt (2019);

([b]) H2020 National Report for Israel (2020);

([c]) H2020 National Report for Palestine (2020).

Table 3.9 Municipal solid waste treatment per type in selected MED South countries, latest year available

	Year	MSW collected (1 000 t)	MSW landfilled (%)	MSW incinerated (%)	MSW recycled (%)	MSW composted (%)	MSW managed with other treatment or disposal (%)
Algeria	2015	5 182	82.0		10	1.0	
Egypt	2012	94 868*	20.0		2		
Israel	2017	6 668 ([a])	76.0		24		
Jordan	2015	3 458	99.0	0.6		0.0	
Lebanon	2012	1 940	81.0	0.0	8	11.0	0
Morocco	2015	5 817	90.0		10		
Palestine	2015	1 651	30.0	69.0	1	0.0	0
Tunisia	2004	1 316	99.9			0.1	

Note: * value for Egypt in 2012 is considered as an outlier.

Source: UNSD Country Reports (2018),

([a]) H2020 National Report for Israel (2020).

disposed of in open dumps (54 %), mainly because it is considered to be a cheap way of getting rid of solid waste (UNEP, 2018). In fact, dump sites are frequently found around communities such as refugee camps, and in or near countries experiencing conflict. Furthermore, in high-income countries, most landfills are not engineered landfills and effectively operate as dumps. In 2013, this fraction was highest in Egypt (84 %), and lowest in Tunisia (21 %; see Box 3.6 for a description of waste treatment in Tunisia). The next most commonly used method of treatment is landfilling which accounts for more than 99 % of waste collected in Tunisia and Jordan, and 90 % in Morocco. This ratio is very low in Egypt (5 %), where the percentage of MSW disposal in open dumps is highest among MED South countries. In Greater Cairo, only 35 % of the population is served by a sanitary landfill. There are about 940 dumps in Lebanon for MSW, as well as for construction and demolition waste. A regional study (SWEEPNET, 2014) counted 75 uncontrolled dump sites in the Mediterranean coastal areas of Egypt, although other unofficial estimates put this number at over 400 (H2020 National Report for Egypt, 2019). In Palestine, recent estimates highlighted the presence of 83 uncontrolled dump sites in the West Bank (JICA, 2019), and 3 in the Gaza Strip (H2020 National Report for Palestine, 2020). In the Mediterranean part of Morocco, a total of 24 uncontrolled dump sites have been recorded, where about 19 % of all MSW generated was discharged in the period 2014-2018, from up to 93 % in the period 2006-2010 (H2020 National Report for Morocco, 2020). Finally, Israel reported that the last uncontrolled dump site officially close in 2013 (H2020 National Report for Israel, 2020).

MED South countries are slowly upgrading their end-of-life disposal infrastructure, from open dumping to controlled dumping, controlled landfilling, and sanitary engineered landfilling. In Morocco, the share of waste that has been treated increased from 19 % in the period 2006-2010 to 31 % in 2010-2014, and 92 % in 2014-2018, while, in parallel, the share of waste discharged in open dump sites fell from 93 % to 31 % and 19 %, respectively (H2020 National Report for Morocco, 2020). Although landfilling has been steadily decreasing since 1995 (EEA and UNEP/MAP, 2014), it shows some signs of an upsurge, at least in some countries such as Israel and Palestine. World Bank (2018) reports an increase in MSW disposal in sanitary landfills in Morocco from 10 % in 2008 to 32 % in 2012 and 53 % in 2016, with an expected maximum share of 80 % (World Bank, 2018). However, experience shows that, once established, engineered landfills are often not operated in accordance with design specifications or legislation, owing to various operational challenges. This, in addition to poor monitoring of waste flows, leads to the poor generation of knowledge to support treatment schemes, especially in relation to waste recycling.

Municipal solid waste recycling

Recycling means any recovery operation by which waste materials are reprocessed into products, materials or substances, whether for the original or other purposes, except for use as fuel. Following the EU waste hierarchy, any waste whose generation cannot be prevented, or that cannot be prepared for reuse, should be recycled as a preferable option over energy recovery and disposal.

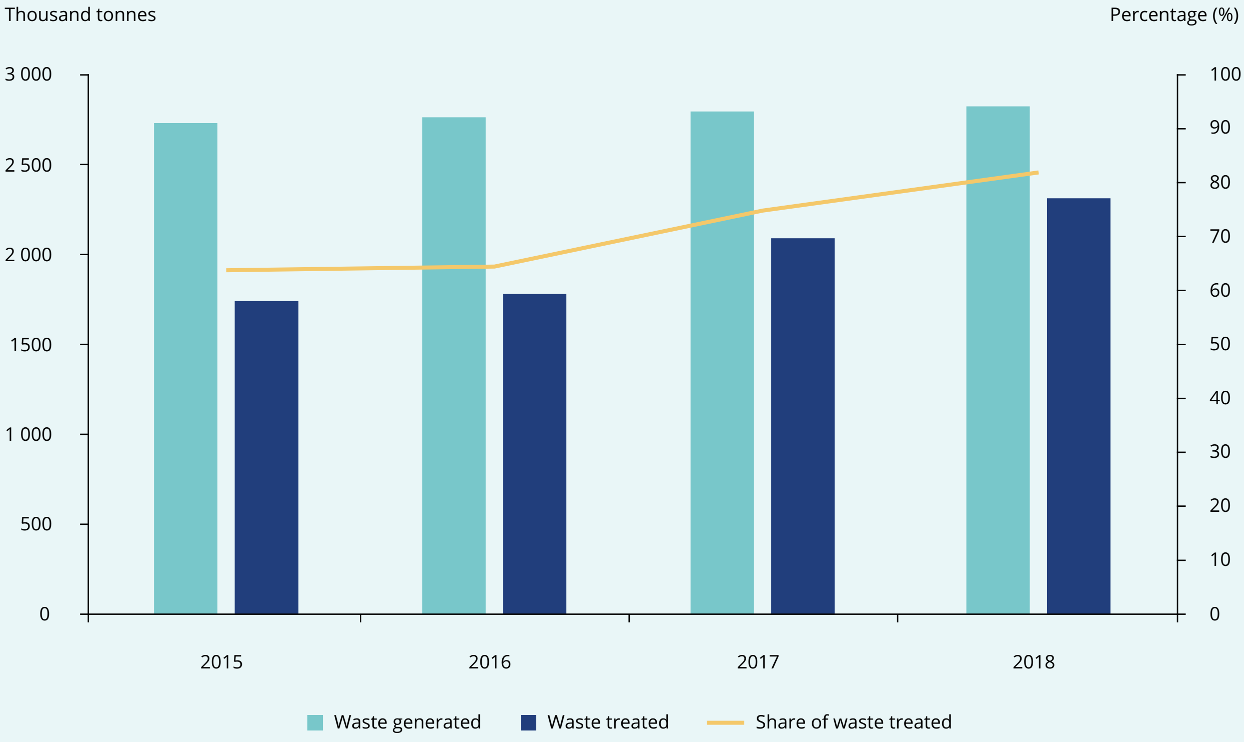
Box 3.6 Waste generation and treatment in Tunisia

After the promulgation of the new constitution in 2014, Tunisia decided to engage in an effective decentralisation of waste management. MSW is managed by municipalities which are in charge of waste collection, transport and disposal, and the National Agency of Waste Management (ANGED) which, through private enterprises, manages the controlled discharge of waste.

In 2018, MSW generation was estimated at about 2 686 420 tonnes, of which almost 75 % came from the 10 governorates in the north-east and east of the country. Daily waste generation per capita has been estimated at about 0.6 kg/day, with important differences between cities (>1 kg per capita/day) and rural areas (0.15 kg per capita/day).

As for waste treatment, the figure shows that an increase trend was recorded in waste treatment in controlled discharge sites from 2015 to 2018 in the country.

Figure 3.8 Evolution of MSW treatment in controlled discharge sites in Tunisia between 2015 and 2018 (thousand tonnes)



Source: H2020 National Report for Tunisia based on ANGED 2018.

Recycling is still limited in MED South countries (see Table 3.10, and Box 3.7 for the description of waste recycling in Tunisia). The average MSW recycling rate in MED South countries is only 4 % (UNEP, Africa, 2018), with a minimum in Palestine (1 % in 2015). In Israel, 24 % of MSW was recycled in 2017. In Morocco, a share of 25 % of all plastics generated was recycled in 2015, while the estimated volume of all MSW recycled in the Mediterranean part of Morocco was 92 000 tonnes, representing about 10 % of the total MSW generated (H2020 National Report for Morocco, 2020). There are only a few on-site material recovery facilities (MRFs) which, however, are often badly equipped (UNEP, 2018). The informal sector plays an active role in collecting recyclable material to supply both local and international end-use markets (UNEP, 2018). In Tunisia and Morocco, this is strongly supported by the municipality and, occasionally, by the producers (UNEP, 2018). In particular in Morocco, a recent study estimated the number of informal collectors at 7 100, with a total annual turnover of about EUR 16 million (PSIE II, 2011). Around 2.5 % of MSW was recycled in Egypt in 2012; 433 200 tonnes were recycled by the formal sector, and 979 400 tonnes were recycled by the informal sector, especially by the

Table 3.10 Share of Municipal solid waste recycled in MED South countries between 2000 and 2015 (% of total MSW)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Algeria															10	10		
Egypt										6	7		2					
Israel ([a])				11	11	12	12	14	15	14	16	18	19	20	20	21	22	24
Lebanon		3			7					8			8					
Morocco	2														10	10		
Palestine		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Tunisia		0																

Source: UNSD Country Files (2018):

([a]) H2020 National Report for Israel (2020).

Box 3.7 Tunisia's Eco-Lef recycling system

The Eco-Lef programme, launched in 1997 by the Ministry of Environment and administered by ANGED, developed a national system for the recovery and recycling of post-consumer packaging, primarily focused on plastic waste. A 5 % tax on the net added value of certain locally manufactured or imported plastic polymers provides the necessary funding to the programme.

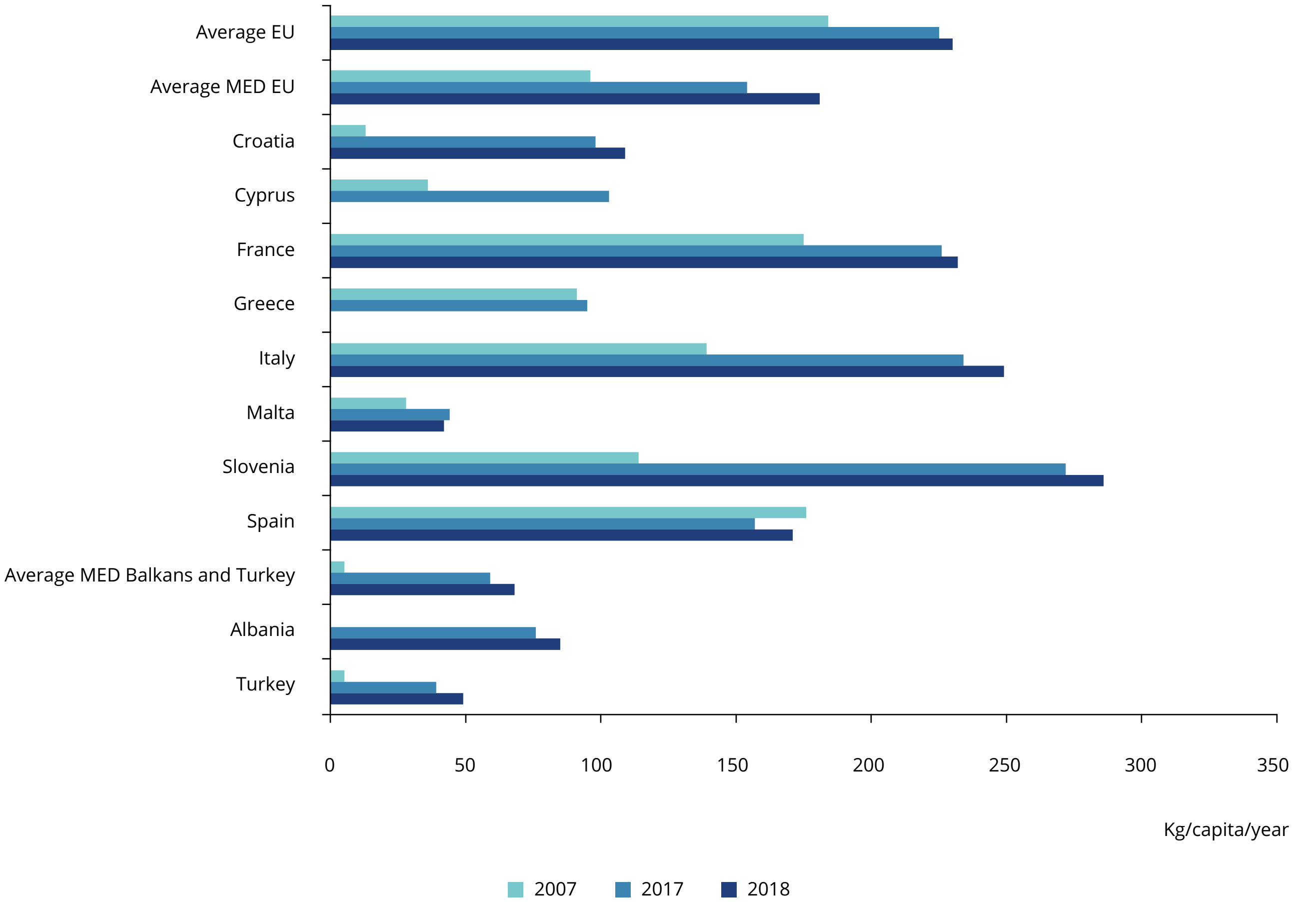
The 221 Eco-Lef collection centres receive plastic and metal packaging from both individuals and informal collectors in exchange for a remuneration that is usually higher than local market prices. A total of 14 centres are managed by ANGED, while the others are managed by the private sector. Since its launch in 2001, more than 150 000 tonnes of plastic packaging waste have been collected, 70-90 % of which has been recycled, and about 18 000 jobs have been created. In 2018, 3 500 tonnes of packaging were collected, while 148 units recycle 97 % of the volume collected. The success of the Eco-Lef programme shows the importance of government support to develop a recycling value chain, the private sector's role in ensuring financial sustainability and operational efficiency, and the integration of informal waste pickers.

Figure 3.9 Evolution of plastic and metal packaging recovered by ECO-Lef between 2001 and 2018 (tonnes)

Source: ANGED, rapport d'activité 2018

World Bank, 2018

Figure 3.10 Quantity of municipal solid waste recycled per capita in MED EU countries and MED Balkans and Turkey (kg per capita/year)



Note: Recycling comprises recycling material, composting and digestion. Data for Montenegro and Bosnia and Herzegovina are not available.

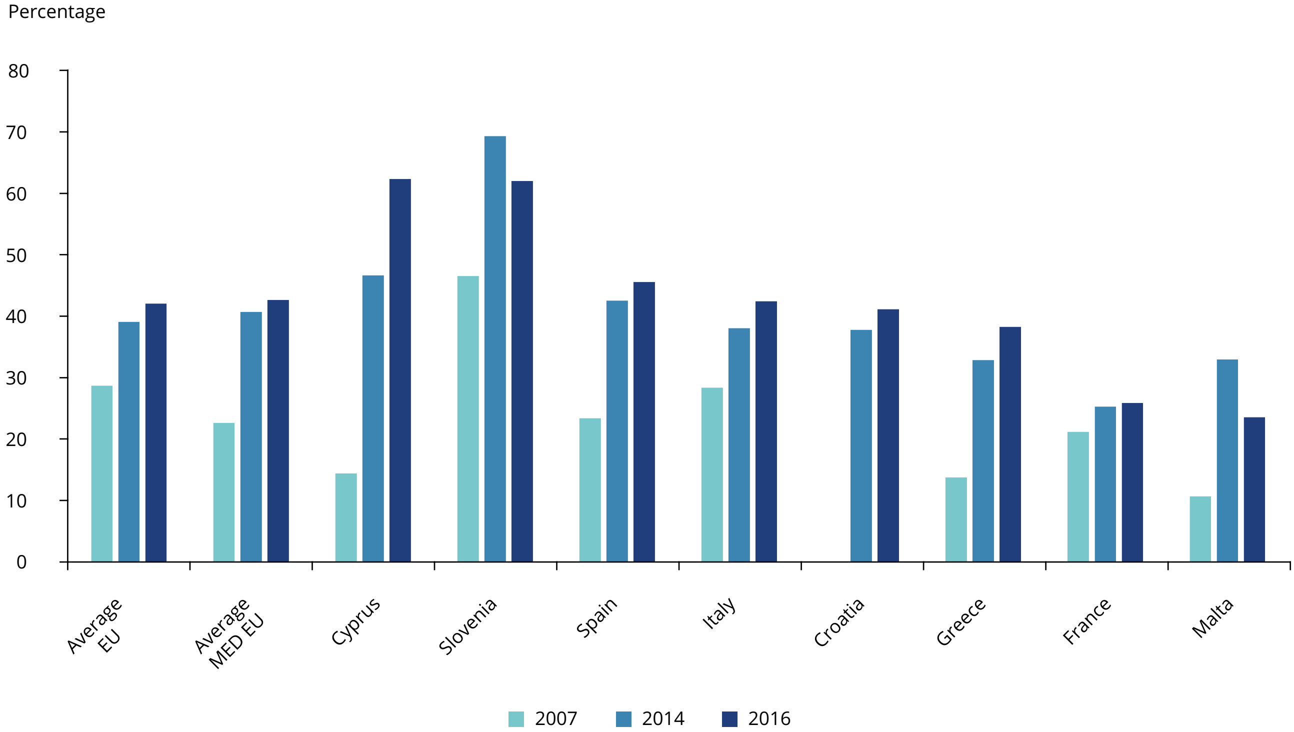
Source: Eurostat, 2020

community of Zabbaleen. Based on the available data for Egypt for 2014, a total of 34 plants were involved in recycling and composting.

In 2018, on average, MED EU inhabitants recycled 181 kg per capita of waste (as against a value of 234 kg per capita for the EU) (Figure 3.10), either through material recycling or by composting and digestion. The limited availability of data does not allow clear conclusions to be reached for MED Balkans and Turkey.

The performance of MED EU countries on plastic packaging recycling (Figure 3.11) ranges from as low as 23.5 % in Malta to as high as 62.3 % in Cyprus. Overall, there has been a slight increase in the period 2007-2016, when the average recycling of plastic packaging waste almost doubled, aligning it with, and sometimes topping, the overall EU average performance.

Figure 3.11 Share of plastic packaging waste recycled in MED EU countries (%)



Source: Eurostat, 2020.

Table 3.11 Waste incineration and energy recovery in MED EU, MED Balkans and Turkey

	Incineration + energy recovery (1 000 t)			Share of incineration and recovery on total MSW generated (%)			Temporal change in the share of incinerated and recovered waste on total MSW generated (%)
	2007	**2017**	**2018**	**2007**	**2017**	**2018**	**2007-2017**
Average MED EU	38	49	49	7	10.0	10	3
Croatia	0	0	0	0	0.0	0	0
Cyprus	0	2	0	0	0.3		0
France	181	184	184	33	35.0	35	2
Greece	0	5	0	0	1.0		1
Italy	68	93	95	12	19.0	19	7
Malta	0	0	0	0	0.0	0	0
Slovenia	0	54	50	0	11.0	10	11
Spain	58	56	62	10	12.0	13	2
Average MED Balkans and Turkey	0	4	5	0	1.0	1	1
Albania	0	15	22		3.0	5	3
Bosnia & Herzegovina	0	0	0		0.0		0
Montenegro	0	0	0		0.0	0	0
Turkey	0	0	0	0	0.0	0	0

Source: Eurostat, 2020b.

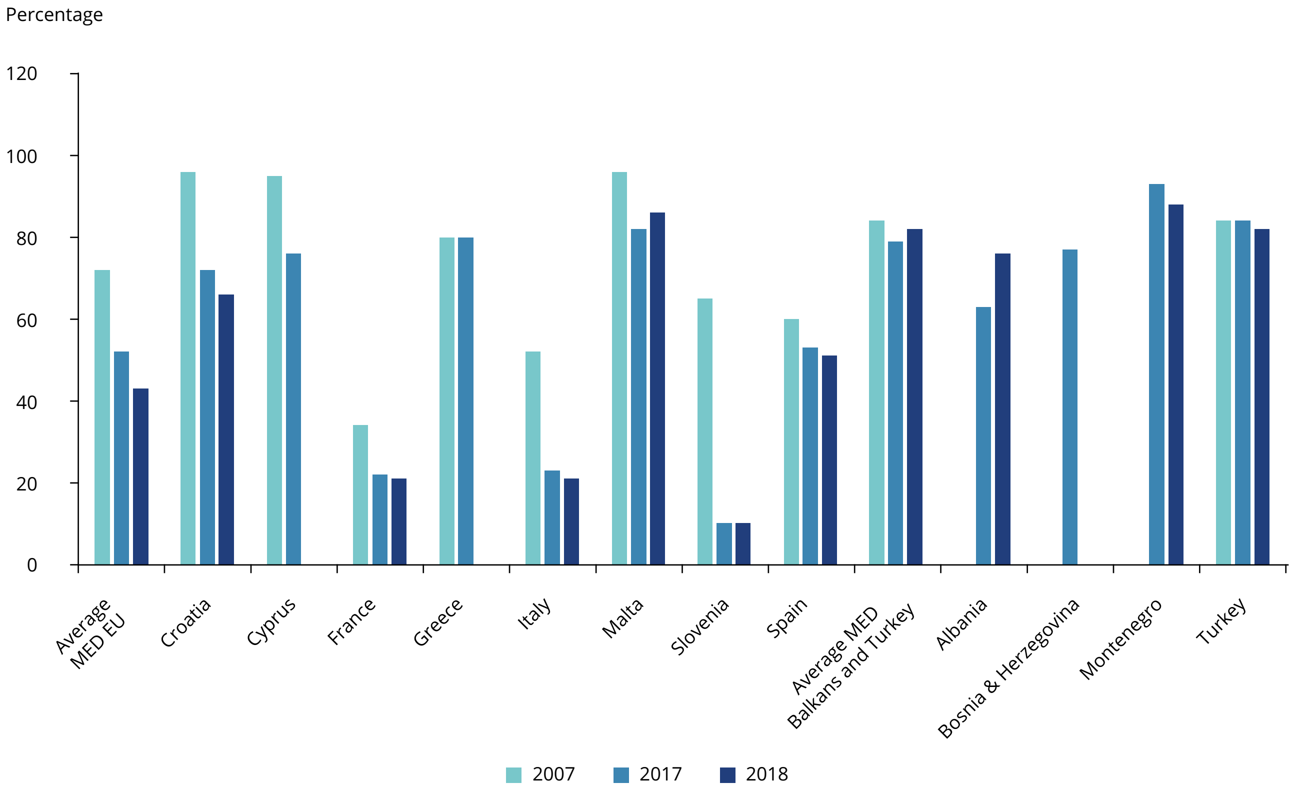
Municipal solid waste incineration

Waste incineration and energy recovery practices are mainly developed in MED EU countries and, to a lesser extent, in MED Balkans and Turkey, while it is almost non-existent in MED South countries, as reflected in Table 24. In 2018, 10 % of total MSW generated per capita in MED EU in 2018 were incinerated or recovered for energy production, ranging from 0 % (in Croatia and Malta) to 35 % (France; see Table 3.11). Although new EU recycling targets aim not to extend waste incineration, and notwithstanding the limited data availability, it is possible to observe that in the period 2007-2017, waste incineration and energy recovery had a slow increase trend in the MED EU (from 7 % of total MSW generated in 2007 to 10 % in 2017), while in Albania it increased from 3 % in 2017 to 5 % in 2018. In parallel, waste recovery is not common in MED South countries, because of the high costs if compared to uncontrolled dumping

Municipal solid waste landfilling

MSW landfilled in the MED EU countries reached an average of 224 kg per capita/year in 2018, corresponding to 43 % of all MSW generated, and ranging from 47 kg per capita/y in Slovenia (10% of all MSW generated) to 550 kg per capita/y in Malta (86 %; see Figure 3.12 Share of waste disposed in landfills (and other) of total municipal solid waste generated in MED EU and MED Balkans and Turkey (%)). Among the countries in MED Balkans and Turkey, the limited data available show that an average of 79 % of waste was landfilled in 2017, from a low of 63 % in Albania, to a high of 93 % in Montenegro. Disposal of waste in landfills per capita had a steady decrease trend in MED EU countries, from 72 % to 52 % of total MSW generated. This trend was especially strong in Slovenia (from 65 % in 2007 to 10 % in 2017), Italy (from 52 % to 23 %), and Croatia (from 96 % to 72 %), while Greece recorded a stable and high landfill rate (80 %) in the same period. The available data for MED Balkan countries show an increase of waste landfilled per capita in Albania (from 63 % in 2017 to 76 % in 2018), and a slight decrease in Montenegro (from 93 % to 88 %) and Turkey (from 84 % to 82 %).

Figure 3.12 Share of waste disposed in landfills (and other) of total municipal solid waste generated in MED EU, MED Balkans and Turkey (%)



Source: Eurostat, 2020b.

Marine litter sources: from land to sea

According to the 2017 Mediterranean QSR (UNEP/MAP, 2017a), 'shoreline activities (including poor waste management practices, tourism and recreation), along with sea/waterway activities, smoking-related activities, and the dumping and improper disposal of medical/personal hygiene items are among the main beach marine litter sources' in the Mediterranean. Tourism plays an important role in marine-litter generation. Marine litter can double during the summer season (UNEP/MAP, 2017a), while in some tourist areas over 75 % of annual waste production is generated during the summer season (Wilson et al., 2015). Other land-based sources of marine litter include fly tipping, industry (especially the food-processing industry on the southern and eastern shores), and the energy and chemical industries (on the northern shore), inadvertent release of litter from coastal landfills and garbage from water transport, and unprotected waste disposal sites (Wilson et al., 2015). Rivers, drains, sewage outlets and storm-water outflows, road run-off, and wind are the main routes through which marine litter ends up in Mediterranean coasts and waters (Wilson et al., 2015). An important role in the Mediterranean basin is played by intermittent rivers which are completely or almost dry during some seasons, or only carry water for very short periods (González et al., 2016). This can make a significant contribution to the peak transport of marine litter, dumped on the riverbed during the dry or rainy season.

Sea-based sources of marine litter include shipping, recreational boating, the fishing industry, and offshore oil and gas platforms, with litter entering the sea through both accidental and deliberate discharges of items ranging from galley waste to cargo containers (Seas at Risk, 2017). In the Mediterranean, recent estimates indicate that sea-based sources account for 5 % of marine litter, possibly due to the role played by port-reception facilities, and by the obligation of vessels above 400 tonnes, or carrying more than 15 people, to implement garbage management plans in accordance with international maritime law (Wilson et al., 2015).

Litter washed ashore on coasts and in the water column

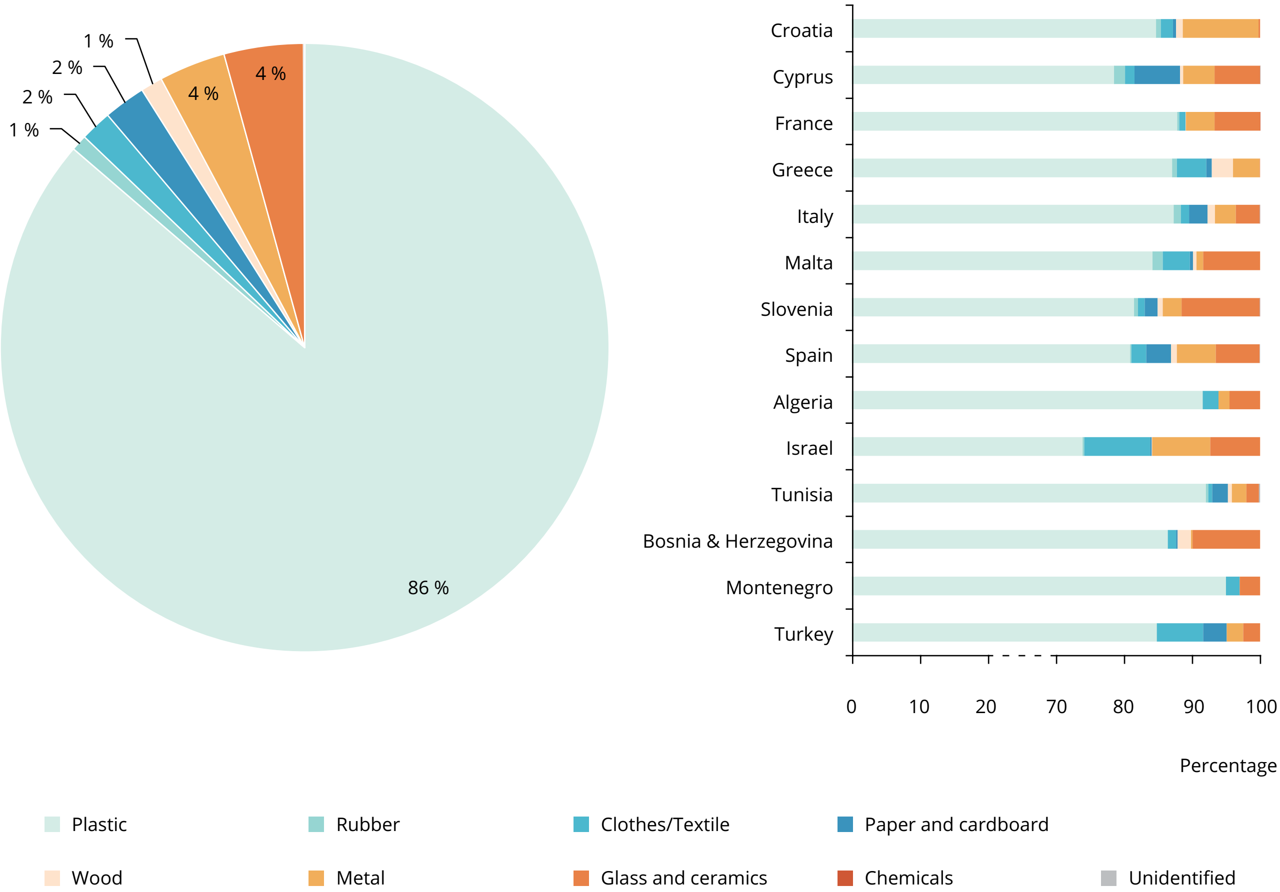
Several monitoring initiatives have collected data on the presence of litter washed ashore along coastlines and in the water column across the Mediterranean. The Marine Litter Watch initiative aims to empower citizen communities to provide relevant data through a mobile app, while creating more awareness of marine litter at the local level. All data collected are published on a web portal and a public database.

Figure 3.13 summarises the results of citizen-led marine-litter data collection activities on Mediterranean beaches, including the number of surveys performed and the temporal range. The results show that plastic pieces represent 74 % to 95 % of all marine litter found in Mediterranean beaches, with an average of 86 %, followed by glass (4 % on average) and metal (3.5 %). These figures are in line with a compilation of available studies and publications listing the main marine litter items found on European beaches (Addamo et al., 2017), developed by the European Commission's Joint Research Centre (JRC) within the Marine Strategy Framework Directive (MSFD; 2008/56/EC) Technical Group on Marine Litter. The results of this report show that synthetic polymer materials represented 84 % of all marine litter items found on European beaches in 2016. Approximately 50 % of marine beach litter items are single-use plastics (SUPs), including bottles, bags, caps/lids, strings and cords, cigarette butts, crisp packets and sweet wrappers, while plastic fragments (size range: 0-2.5 cm and 2.5-50 cm) represent about 25 % of marine litter. A recent study classified the litter found at the Hammamet beach in Tunisia (Fondation Heinrich Böll, 2019): 68 % of the litter washed ashore comprised plastic items, followed by paper (10 %), metals (7 %), textile (7 %) and cigarette butts (3 %). In parallel, in a study by UNEP in Egypt on the beaches of three Mediterranean coastal cities (Matroh, Alexandria and Port Said), synthetic polymer materials comprised 94 % of the total litter washed ashore (H2020 National Report for Egypt, 2019).

Marine litter from smoking-related activities is a particularly serious problem in the Mediterranean, where it accounts for almost 40 % of total marine litter items and 53.5 % of the top 10 items counted in 2013, a figure considerably higher than the global average (UNEP/MAP, 2017a). Finally, the contribution of fishery-related litter could be estimated at between about 3 % and 15 % of marine litter (Addamo et al., 2017).

The overall picture on marine litter in the Mediterranean is fragmented and geographically restricted to the northern part of the basin. Recent estimates by Jambeck et al., (2015), adapted from UNEP/MAP (2015), calculate the quantity of mismanaged plastic waste and plastic waste entering the Mediterranean (see Table 3.12). It emerges that the amounts of plastic waste littered across the Mediterranean vary significantly, with an average of about 1 kg per capita/year, ranging from a minimum

Figure 3.13 Composition of beach marine litter in Mediterranean countries (%)



Note: Chemicals category: 0.004 %; unidentified: 0.05 % (not shown).

Source: Marine Litter Watch database; accessed February 2020.

of 0.15 kg per capita/year in Morocco to 2.16 kg per capita/year in Israel.

The Mediterranean Sea is heavily impacted by floating marine litter, with concentrations comparable to those found in the five subtropical gyres (UNEP/MAP, 2017a). A floating litter abundance of 0 to 600 items per km^2 has been recorded (UNEP/MAP, 2017a). Recent research shows that floating marine-litter items are mainly made up of artificial polymer materials, such as plastic bags, wrappings, bottles, tableware and polystyrene boxes used by fishermen (Bigagli et al., 2019). Significant marine litter hot spots have been identified in areas close to land, and have recorded an increase in floating marine litter during spring and summer (Arcangeli et al., 2018; Campana et al., 2018). The Mediterranean seafloor also seems to be highly impacted by marine litter, with approximately 0.5 billion litter items (Wilson et al., 2015) and densities ranging between 0 and more than 7 700 items per km^2, especially in deep-sea canyons (UNEP/MAP, 2017a).

In summary, the limited spatial and temporal availability of data and information on marine litter in the Mediterranean — with most data found for the northern shores and limited temporal ranges — together with the lack of consistency and comparability (Bigagli et al., 2019) hinder the possibility to generate conclusions at basin scale on the quantity and distribution of marine litter in the Mediterranean, as well on accumulation and loading rates and the corresponding fluxes (UNEP/MAP, 2017a).

3.1.4 Policies on waste prevention and municipal solid waste management in the Mediterranean

The picture of existing legal and policy frameworks for the management of MSW is quite distinct across the shores of the Mediterranean. While all Mediterranean countries participate, although to differing extents, to the majority of existing international agreements on waste management, MED EU countries have an

Table 3.12 Estimated plastic mismanaged and littered at sea from Mediterranean countries (kg per capita/year)

Country	Coastal population	Mismanaged plastic waste [kg/person/year]	Plastic waste littered [kg/person/year]
Albania	2 530 533	11.74	0.50
Algeria	16 556 580	31.44	1.05
Bosnia and Herzegovina	585 582	22.12	1.05
Croati	1 602 782	10.27	1.83
Cyprus	840 556	2.17	1.81
Egypt	21 750 943	44.46	1.29
France	17 287 280	1.39	1.39
Greece	9 794 702	1.45	1.45
Israel	6 677 810	2.85	2.16
Italy	33 822 532	0.97	0.97
Jordan	55 392	31.36	1.05
Lebanon	3 890 871	12.29	0.68
Libya	4 050 128	13.03	1.05
Malta	404 707	6.47	1.55
Montenegro	260 336	16.96	1.05
Morocco	17 303 431	17.92	0.53
Palestine	3 045 258	1.84	0.46
Slovenia	336 594	1.65	1.06
Spain	22 771 488	2.01	2.01
Syria	3 621 997	43.60	1.30
Tunisia	7 274 973	32.21	1.05
Turkey	34 042 862	14.27	1.54

Note: * inputs from Egypt, France, Morocco, Spain and Turkey were estimated for the Mediterranean coast only (adapted from Jambeck et al., 2015).

Source: UNEP/MAP, 2015.

additional legal and policy layer, represented by the provisions of EU waste management legislation.

Several policies have been adopted in the EU to regulate all aspects of waste management, foster waste prevention, reduction/reuse/recycle, and to regulate waste discharge and disposal activities. They include provisions to avoid the generation of waste or to establish structures and mechanisms to recycle waste, as well as to avoid waste disposal into the environment. The main legislation is the Waste Framework Directive (2008/98/EC; EU, 2008b) which introduces the waste hierarchy, in which waste prevention has the highest priority, followed by preparing for reuse, recycling and other recovery and, finally, disposal as the least desirable option (EU, 2008b, 2018b). Moreover, it includes measures for preventing and reducing adverse effects from the generation and management of waste to reduce the overall impacts of resource use and improve resource efficiency. It includes targets for the reuse and recycling of waste up to 2035 and requires Member States to develop waste-management plans and waste-prevention programmes.

In line with the waste hierarchy, more than 30 binding targets have been set for the management of waste for the period 2015-2035 in the EU (EEA, 2019e), through specific legislation, including:

- the Packaging and Packaging Waste Directive (94/62/EC; EC, 1994) which aims to harmonise national measures concerning the management of packaging and packaging waste to prevent or reduce its impact on the environment;

- the Port Reception Facilities Directive (2019/883/EU; EU, 2019a) which aims to reduce discharges, especially illegal discharges, of ship-generated waste and cargo residues into the sea by improving the availability and use of port-reception facilities in EU Member State ports;
- the Landfill Directive (1999/31/EC; EC, 1999) defines technical requirements for landfill design and operation, and includes targets regarding the amount of waste that can be landfilled, eventually ensuring that landfilled waste would not exceed 10 % of total MSW generated by 2035;
- the Plastic Bags Directive (2015/720; EU, 2015a) to limit the annual per-capita consumption of lightweight plastic bags to 90 by 31 December 2019 and 40 by 31 December 2025, and/or requesting that lightweight carrier bags are not provided free of charge at the point of sales of goods or products by 31 December 2018;
- the Single-Use Plastics (SUP) Directive (2019/904; EU, 2019b) addresses the 10 single-use plastic products most often found on Europe's beaches and seas by banning some SUP products, requiring a significant reduction in the consumption of selected plastic items, and requiring labelling and/or EPR schemes for certain plastic items; and
- Other acts targeting specific waste streams, such as waste from electric and electronic equipment (2012/19/EU; EU, 2012), batteries and waste batteries (2006/66/EC; EC, 2006), end-of-life vehicles (2000/53/EC; EC, 2000), urban waste water treatment (91/271/EEC; EU, 1991), specific chemicals in recycled plastics (through REACH Regulation no. 1907/2006), and the emissions of solid particles, such as plastic pellets, from industrial operations (Industrial Emissions Directive 2010/75/EU; EU, 2010).

A key policy for tackling marine litter in the Mediterranean is the EU Marine Strategy Framework Directive (2008/56/EC; EC, 2008) which is the major binding legal instrument to protect the EU's marine environment. Under the MSFD, Member States are required to assess, monitor, and set environmental targets and measures to achieve a GES for European oceans and seas by 2020. The GES is articulated along 11 qualitative descriptors, among which descriptor 10 focuses on marine litter, requiring Member States to ensure that 'properties and quantities of marine litter do not cause harm to the coastal and marine environment'.

The EU Circular Economy Package confirmed the target for reducing marine litter by 30 % by 2020 for the 10 most common types of litter found on beaches, as well as for fishing gear found at sea. To this end, in 2018, the Commission adopted the EU Plastics Strategy with the aim of 'transforming the way plastic products are designed, used, produced and recycled in the EU', protecting the environment from plastic pollution while at the same time fostering growth and innovation.

Table 3.13 shows the laws and policies in place for waste management in MED South countries and MED Balkans and Turkey. Overall, the legal framework for waste management in the MED South countries is often fragmented and the provisions dealing with MSW are weak (UNEP, 2018). This was found in Egypt, for example, where there is no clear distinction between roles and responsibilities of the governorates, municipalities, service providers and waste generators.

The responsibilities of solid waste management policies and planning at the national level are generally shared between ministries and specific institutions, such as dedicated solid waste management agencies (Algeria and Tunisia); national committees (Morocco, Egypt and Lebanon); the Ministry of Local Administration/Government (Palestine); the Ministry of the Environment (Jordan); and the regional and local offices of the Ministry of Environmental Protection (Israel). As highlighted by the EEA and UNEP/MAP (2014), laws, strategies or master plans have already been developed in all MED South countries. However, the progress of these policies is being hindered by the lack of appropriate infrastructure developments and the necessary resources, as well as of clearly defined roles and responsibilities, or links to strategic objectives (UNEP, 2016). Local authorities are generally responsible for MSW management, with the growing involvement of the private sector in treatment and disposal (Morocco, Lebanon, and in the main cities of Egypt — see Box 3.8), landfill has landfill gas recovery (Jordan), or both (Tunisia; EEA and UNEP/MAP, 2014). Some countries have invested in improving waste management, such as Morocco, which launched an MSW National Programme worth USD 4.1 billion (Ministry of Energy, Mining and Environment, 2020), and Jordan, which has implemented waste tariffs to finance MSW management. However, the effectiveness of these measures is limited by the low willingness and ability of citizens to pay, and by competition in the informal sector that is threatening the commercial viability of public-private partnership contracts such as in Lebanon (UNEP, 2016).

Table 3.13 Waste management laws and policies in MED South countries, MED Balkans and Turkey

		Algeria	Egypt	Israel	Jordan	Lebanon	Libya	Morocco	Palestine	Tunisia	Albania	Bosnia and Herzegovina	Montenegro	Turkey
Marine Litter and Waste Management Framework	National assessment for marine litter and its impacts		YES	NO	YES			NO	NO	NO		NO	NO	
	National plan or strategy for marine litter		YES	YES	NO			NO	NO	NO		NO	NO	
	National plan or strategy for waste management		YES	YES	YES			YES	YES	YES		NO	YES	
	National law on waste		YES	YES	YES			YES	YES	YES		YES	YES	
	National plan or target to close dump sites before 2030		YES	NO	YES			YES	YES	NO		NO	YES	
	National information system for waste management in place			YES	YES			YES	NO	NO		NO	NO	
Resource recovery	National plan or strategy for waste prevention			NO	YES			YES	NO	YES		NO	NO	
	Mandatory targets for recycling — recovery of packaging waste			YES	NO			YES	NO	NO		NO	YES	
	EPR or deposit-refund schemes for packaging waste			YES	YES			YES	NO	YES		NO	NO	
	National policies to eliminate or reduce single-use plastics			NO	YES			YES	NO	YES		NO	NO	
	Financial incentives for reuse — resource-recovery activities			YES	YES			YES	NO	YES		NO	NO	
Sustainable consumption and production	Sustainable consumption and production plans or strategies			YES	YES			YES		YES		NO	NO	
	Green procurement rules for the public sector in place			YES	NO			YES		NO		NO	NO	
	Policies to support sustainable tourism			YES	YES			YES		YES		NO	YES	
	Policies to support eco-labelling and eco-design			YES	NO			NO		YES		YES	YES	

Source: H2020 National Reports (2020).

Box 3.8 Waste legislation and management in Egypt

Legal and institutional framework. The waste system is governed by several laws, including;

- Law No. 38 of 1967 on Public Hygiene
- Decision of the Minister of Housing and Utilities No. 134 of 1968 issuing the executive regulations of Law No. 38 currently in force
- Law No. 10 of 2005 on the collection of cleaning fees
- Law No. 4 of 1994 on the protection of the environment, as amended by Law No. 9 of 2009, and amended
- by Law No. 105 of 2015, which included many articles regulating the management of solid waste and related [word missing?] and affecting it.
- The Egyptian Penal Code promulgated by Law No. 58 of 1937
- Law No. 159 of 1953 concerning the cleanliness of squares, roads and streets and regulating the collection and transport of garbage
- Law No. 140 of 1956 concerning the occupancy of public roads
- Law No. 93 of 1962 concerning the discharge of liquid waste and its executive regulations
- Law No. 48 of 1982 on the protection of the River Nile and waterways from pollution
- Decree of the Minister of Irrigation No. 8 of 1983 promulgating the Executive Regulation of Law No. 48.

Waste management at the level of governorates. In Egypt, some governorates, including Cairo, have a special department for waste management that runs all relevant stages of waste management. In other governorates, representing the vast majority, the local administration department is in charge of waste-management processes alongside other administrative duties.

Waste management at the national level. Established in 2015, the Waste Management Regulatory Authority (WMRA, https://www.wmra.gov.eg/en-us/Pages/default.aspx) aims to improve the management of waste at the national level. Its main objectives include: (1) provide technical support to public awareness and societal commitment programmes; (2) conduct technical studies and propose mechanisms to determine tariffs on integrated waste management services; (3) develop key performance indicators for monitoring, follow-up and evaluating waste management activities; (4) regulate and determine the roles and responsibilities of all stakeholders in waste management systems; (5) regulate, follow and oversee all waste management processes at both the central and local level in a way that improves environmentally safe management; (6) strengthen the relationship between Egypt and other states and international organisations in the area of waste; (7) recommend the legal actions necessary to be taken for accession to the international and Mediterranean conventions on waste; and (8) attract and promote investment in the collection, transport, treatment and safe disposal of waste.

In parallel, in 2012, the Ministry of Environment launched the National Solid Waste Management Programme (NSWMP, https://nswmp.net) which aims to restructure the waste sector at the national, regional and local level, setting up an independent central entity to regulate the management of the MSW system, and establishing waste management units in four governorates (Kafr El Sheikh, Gharbia, Quena and Assiut), with a view to extending the coverage to all other governorates.

Current challenges of waste management in Egypt:

- Multiple laws regulating waste management;
- Failure to define the responsibilities of different stakeholders in the framework of existing laws;
- Inability of current laws to enforce and legalise payment of the service cost;
- Dispersal of sector's assets and lands;
- Weak and irregular financing of the sector (investment cost or operating cost);
- Insufficient government subsidies and fees for the integrated solid waste management sector;
- No independent budget allocated for the system, leading to inconsistent system provision;
- Fees collected through electricity bills are subject to the clearance of electricity dues on the governorate.

Source: Egypt SEIS national team.

Table 3.14 Examples of national legislation adopted in Mediterranean countries to tackle marine litter comprising critical plastic items

Country	Type of waste addressed	Brief description
Albania	Plastic containers	The Law on the Tax System No. 8977/2002 introduced a tax on plastic containers for liquids, such as bottles and cans, for both locally produced and imported products. This fee is levied at the container production stage. The rates are: • 1 lek (EUR 0.07) per container up to and including 1.5 litres; • 2 leks (EUR 0.14) for larger containers. Also, according to this Law, importers and manufacturers of plastic packaging are obliged to pay the national tax on plastic packaging. This tax applies to all plastic products when they are imported separately, and when plastic material is at least 51 % of the volume of overall packaging. The Law distinguishes two rates: • 100 leks/kg for imported products (collected by the General Directorate of Customs at the moment of import); • 50 leks/kg for the domestic recycling industry. For plastic packaging produced inside the country, the tax is paid when the product is sold with a tax receipt. Every month, a producer who uses plastic packaging should declare its stock of goods that falls under this regulation to the tax administration; otherwise, the tax should be paid on all items sold by the producer in the month concerned regardless of the quantity of goods which would actually have been subject to this tax.
Egypt	Plastic bags	Ban on the use of plastic bags in Hurghada. Distribution of 50 000 free cloth bags by the Hurghada Environmental Protection and Conservation Association, together with letters explaining the health and environmental reasons behind the campaign (Zohny, 2009).
Morocco	Plastic bags	2009: ban on the production, importation, sale and distribution of black plastic bags. Impact: although only considered partially successful, the law is seen as an important step forward (Ellis, 2016). 2016: ban on the production, importation, sale and distribution of plastic bags. The law does not apply to isotherm, garbage and industrial- or agrarian-use bags. Impact: 421 tonnes of plastic bags were seized in one year. Citizens have switched to fabric bags. The Moroccan government declared that plastic bags are virtually no longer used in the country (Morocco seizes bags, 2017).
	Plastic products	Plastic Ecotax: in 2014 a new tax came into effect, introduced by the Finances Law 2013, which taxed all plastic products (source materials and final products equally) with 1.5 % of the total value to encourage plastic recycling.
Tunisia	Plastic bags	2017: ban on the production, importation and distribution of single-use plastic bags in major supermarkets and a levy on consumers for the use of thicker ones (>50 μ).
		Single-use plastic bags and plastic bags of unknown origin have been forbidden since 1 March 2020 in commercial spaces and pharmacies, and from 1 January 2021, they will be prohibited for producers and suppliers.
Israel	Plastic bags	2017: ban on bags <20 μ and levy on thicker ones in supermarkets (around NIS 0.03) (Udasin, 2016). Impact: a survey revealed that, four months after the law came into effect, 42 % of shoppers had not bought any plastic bags from supermarkets (Raz-Chaimovich, 2017).
Turkey	Plastic bags	2019: charge for plastic bags, with the aim of reducing their use to 90 bags per person per year by 31 December 2019, and to 40 bags per person per year by 2025.

Source: Elaborated by the authors.

Box 3.9 Reducing plastic bag consumption in Egypt

A partnership between the Ministry of Environment, the United Nations Environment Programme, and the Centre for Environment and Development for the Arab Regions and Europe (CEDARE) was launched in June 2017 within the framework of the SwitchMed Regional Programme, funded by the European Commission. This initiative aims to encourage Egyptians to reduce their consumption of plastic bags and to shift towards more environment-friendly alternatives, in cooperation with large fast-moving consumer goods chains, hypermarkets, pharmacies, and other key players, via influential awareness campaigns and diverse activities. Policy options and measures are recommended to reduce the consumption of single-use non-biodegradable plastic bags and promote alternatives in Egypt.

The target is the reduction of the consumption of single-use, high-density polyethylene (HDPE) plastic bags which are lightweight and are less than 15-50 microns thick, normally used to carry goods and provided free of charge to consumers. They are single-use in the sense that they are usually used for one shopping trip, although they are often reused in the household for other purposes.

A series of consultation workshops took place between May and August 2017 to incorporate the perspectives of key stakeholders — mainly retailers, plastic-bag manufacturers, importers of raw materials, representatives from government, civil society organisations, and the media. Further actions to improve legislation on plastics are expected in the near future.

Source: Bayo et al., 2018.

Although almost all the MED South countries have policies that dictate how waste should be managed, there are several factors that constrain the waste management system, such as missing or weak legislation and enforcement; low public awareness and negative attitudes; and political instability and conflicts. These may create a favourable environment for organised crime engaging in illegal transboundary movements of waste, competition with the informal sector, and financial constraints (UNEP, 2016).

Several countries in the MED South and MED Balkans and Turkey are beginning to put in place policies to prevent plastic waste and marine litter, as shown in Table 3.14 and in Box 3.9. Discussions are being held between governments and industry on possible further bans on other single-use plastic products, such as polyethylene terephthalate beverage bottles, and food-service industry products such as plastic cups, containers, utensils and straws. In Turkey, the 'Zero Waste Regulation', introduced in 2009 by the Environmental Law no. 2872, aims to establish and develop a 'zero waste management system' to protect the environment and human health through a 'zero waste management system' and 'zero waste certifications'. This includes waste prevention and reduction measures, dedicated training, and data collection via a 'zero waste information system' created by the Ministry of Environment and Urbanization. In parallel, comprehensive action plans to tackle marine litter are being prepared in all of Turkey's 28 coastal provinces.

3.1.5 Regional policies and international conventions

At the Mediterranean level, waste management is recognised as a priority area in the LBS Protocol of the Barcelona Convention, the SAP-MED, and the NAPs developed and implemented by the Mediterranean countries. When setting priorities for the preparation of action plans, programmes, and measures for eliminating pollution from land-based sources and activities, the following waste-related sectors of activity are primarily considered in the LBS Protocol: (1) management of MSW; (2) the waste management industry; and (3) incineration of waste and management of its residues. In addition, the Regional Action Plan on Sustainable Consumption and Production in the Mediterranean, adopted in 2016, aims to engage Mediterranean countries in a shift towards sustainable consumption and production patterns and to establish a circular approach to the economy, including the promotion of new paradigms on the use of resources.

Finally, international efforts to address marine litter at the Mediterranean level are built around the Barcelona Convention and its Regional Plan on Marine Litter Management (RPMLM). The adoption of the RPMLM in 2013 made the Mediterranean the first regional sea committed to legally binding measures, programmes and related implementation timetables on marine litter management at the Mediterranean and national level, thereby contributing to the Honolulu Commitment and the Rio+20 marine litter targets. The major objectives of the RPMLM are to achieve GES in the

Mediterranean through the prevention and reduction of marine litter and by limiting its environmental, health and socio-economic impacts to a minimum. Most of the measures envisaged in the plan aim to improve solid waste management, implement innovative tools related to sustainable production and consumption, use economic incentives, and remove existing marine litter and eliminate hot spots. In this respect, the UNEP/MAP MED POL programme is mandated to undertake the assessment of marine litter every six years at the Mediterranean level, as well as to coordinate the formulation and implementation of a marine-litter monitoring programme based on an ecosystem approach used by all Mediterranean countries.

In this respect, the Regional Cooperation Platform on Marine Litter in the Mediterranean was established in September 2016 with the aim of providing coordinated support and guidance to implementation of the RPMLM. In addition, the platform acts as a forum for consultation, exchange of good practice, and seeking solutions.

Table 3.15 Participation of Mediterranean countries in international waste-related conventions

Country	Basel Convention (15)	Stockholm Convention (16)	Rotterdam Convention (17)	Minamata Convention (18)	Bamako Convention (19)	London Convention (1972) (20)	London Protocol (1996) (21)	MARPOL 73/78 Annex V (22)
Albania	A	R	A	S	–			A
Algeria	A	R						A
Bosnia and Herzegovina	A	R	A		–			
Croatia	A	R	A	R	–	R		R
Cyprus	R	A	R	R	–	R		R
Egypt	A	R				R	R	R
France	AA	AA	AA	R	–	R	R	R
Greece	R	R	R	S	–	R		R
Israel	R	S	R	S				R
Italy	R	S	R	S	–	R	R	R
Jordan	AA	R	A	R	–	R		R
Lebanon	R	R	A	A	–			R
Libya	A	A	A	S	R	R		R
Malta	A	R	A	R	–	R		R
Montenegro	A	R	A	R	–	R		R
Morocco	A	R	A	S		R	R	R
Slovenia	A	R	R	R	–	R	R	R
Spain	R	R	R	S	–	R	R	R
Syria	R	R	R	R	–	R		R
Tunisia	A	R	R	S	R	R		R
Turkey	R	R	R	S	–			R

Note: Status as per 1 March 2020; abbreviations: S (signature), R (ratification), A (accession), AA (approval), — (not applicable).

Source: Elaborated by the authors.

(15) Basel Convention (1989) on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
(16) Stockholm Convention (2001) for the protection of human health and the environment from persistent organic pollutants (POPs).
(17) Rotterdam Convention (1998) to promote shared responsibilities in relation to the import of hazardous chemicals.
(18) Minamata Convention (2013) to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.
(19) Bamako Convention (1991) prohibiting the import of any hazardous (including radioactive) waste in Africa.
(20) London Convention (1972) on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, as modified by the London Protocol (1996).
(21) London Protocol (1996) to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972.
(22) Annex V of the International Convention for the Prevention of Pollution from Ships of 1973, as modified by the Protocol of 1978 (MARPOL 73/78) on the Prevention of Pollution by Garbage from Ships.

In general, Mediterranean countries participate in international efforts to prevent and manage waste. This is testified by their high level of involvement in the international conventions in place, which target specific aspects of waste management. Table 3.15 summarises the status of Mediterranean countries' accession to these conventions.

3.1.6 Critical assessment of existing data and knowledge

Municipal solid waste data

According to the work programme for the second phase of the Horizon 2020 Initiative for a Cleaner Mediterranean (2015-2020), 'the main challenge for the second phase (period 2014-2020) is to ensure the systemic production and sharing of quality assessed data, indicators and information relevant to Horizon 2020, providing consistency between the effectiveness of measures implemented under the Barcelona Convention with what is effectively available to build up a full assessment on the state of the Mediterranean Sea'. It adds that 'the second challenge is to enhance the country ownership of the H2020 Monitoring and Review process (not only from RM representatives but from all partners), ensuring sustainability of the governance structure and an integrated coordination'.

These challenges were experienced during the preparation of the section on waste management in the MED South countries. As data were not available for several countries, the regional assessment activities for waste in the MED South region could not effectively use the sparse responses to H2020 waste indicators. This is reflected in this report, which relied on already published information produced during the first phase of the project (2007-2013) and on other documents published by the UNEP, the World Bank, and other international bodies. This problem was acknowledged by UNEP in the GEO6 (UNEP, 2016) which highlighted how waste management data for Western Asia countries are poor and often not up to date, and the infrastructure is limited, thereby hindering effective waste management and control.

In Egypt, indicators have been one of the main vehicles used to portray environmental conditions, progress made, and support decision-makers and other stakeholders with information and analysis. The Environment Law (Law No. 4, 1994) clearly identifies the role of indicators in supporting environmental regulations, and the need to abide by such indicators to maintain a safe and sound environment (Article 5, Environment Law, 1994). In addition, the recently published State of Environment Report (2017) clearly indicates the role of Law No. 4 in drawing the general policy and guidelines that maintain Egypt's environmental integrity and the role of indicators in this domain. Accordingly, the report produced by the Egyptian Ministry of Environment, jointly with the National Solid Waste Management Program (NSWMP) in 2013 ([23]), identifies the lack of sound indicators for waste management, especially those related to recycling, as one of the main hurdles to proper solid waste management in Egypt. However, the indicators used in Egypt by the Ministry of Environment, and that found in the literature, are limited in number and differ from those suggested by the H2020 framework. This has created a gap between the regular set of indicators used in Egyptian literature and the newly introduced set. This is the case, for example, for plastic-waste generation per capita (indicator 1.B) which is not included in the set of indicators in Egypt, possibly because of national authorities' recent interest in the problem of marine litter.

Another example relates to information needed for the H2020 requirements, which is hard to validate, such as in the case of the number of uncontrolled dump sites for which it is difficult to obtain reliable figures. Other information is available but not accessible, such as data for the number of tourists in coastal areas (indicator 1.D). Very often, although information regarding the population and other issues is available in some departments, it is not easily accessible. Finally, although the Ministry of Environment is responsible for presenting the indicator sets, most of them — or the information needed to produce them — originate from other public authorities. The outcome is that several indicators for the H2020 framework are unavailable (Annex F) (UNEP/MAP, 2019e).

To resolve the situation, the accessibility of the data in the hands of the Central Authority for Public Mobilization and Statistics should be improved by removing the existing logistic hurdles. Moreover, the skills of the personnel working in the field of marine litter must be improved (H2020 Report for Egypt, 2020).

In Jordan ([24]), data are generally available, although in some cases there is no quality assurance and control. The following data gaps have been identified: lack

([23]) https://www.eeaa.gov.eg/portals/0/eeaaReports/NSWMP/1_P0122721_NSWMP_Main%20Report_December2011.pdf
([24]) Extracts from a presentation by Jordan at 10th meeting of the Horizon 2020 Review and Monitoring Group, 23-24 September 2019 in Athens, Greece.

of standard definitions and classifications for some waste; measurements taken at disposal sites, waste composition figures changed due to formal and informal recycling practices; lack of measurements and standard methodologies for measurement; lack of standard reporting systems; inaccurate reporting of waste collected by the Greater Amman Area, Joint Service Council, and municipalities; role of illegally and randomly burned quantities of waste; and the fact that the recycling markets are not well structured and the relevant data is not systematically aggregated and reported on at the national level (H2020 National Report for Jordan, 2020). A new strategy for MSW management for the period 2017-2030 has been launched, with the support of the EU. The real-time monitoring of waste quantity is currently in place, through Wellbridge from landfills to the national monitoring information system at the Ministry of Environment. As a result, 40 indicators have been set up covering all SEIS indicators for waste.

Marine litter data

The issue of marine litter and the related information on the amounts and types in the Mediterranean is complex as, in most countries, it is addressed principally by scientific institutions and subregional and local authorities, and by competent NGOs, which provide valuable information on the volume and types of litter in the Mediterranean (Wilson et al., 2015).

In order to assess the impact of waste on the marine litter issue in the Mediterranean and Mediterranean countries' responses to the issue, several previous studies were evaluated to fill the data gap on marine litter. However, with the exception of data on total population and number of tourists arriving, available in the 'World Bank Development Indicators' dataset, most of the available data are either prior to 2014 or are not of the required quality. Although the Mediterranean countries demonstrated a high willingness to monitor and manage marine litter, regular monitoring activities are lacking in the region. Most of the available data on marine litter originated from available scientific studies with limited coverage. Consequently, the available knowledge on marine litter remains limited, inconsistent and fragmented. Under these circumstances, it has not been possible to analyse progress since 2014 in terms of the state of the indicators for marine litter. As a result, preparations for the current report have relied mainly on published information, produced during the first phase of the ENI-SEIS project (2007-2013) and on several available scientific and technical reports, activity reports and projects.

3.2 Water

3.2.1 Water assessment — key messages

- **Access to safely managed sanitation systems (SMSS) has increased in the region but efforts in the MED South subregion are not sufficient to keep up with population growth.** More than 158 million inhabitants in the MED South region do not have access to SMSS. However, the absolute population *without* access to SMSS has been on the rise since 2003, in line with the significant increase in the overall population. The gap in access to SMSS between urban and rural populations continues to close but still requires attention. In MED EU countries and MED Balkans and Turkey, a decline can be seen in the absolute population *without* access to SMSS.

- **Collection and treatment of municipal wastewater is generally on the rise,** as is wastewater generated as a result of the steady increase in population in the region. The MED EU is responsible for the largest volume of wastewater

Table 3.16 Overview of progress on the H2020 water indicators per subregion

Water	MED EU				MED South				MED Balkans and Turkey			
	Years		Outlook		Years		Outlook		Years		Outlook	
	2003	2014	2020	2030	2003	2014	2020	2030	2003	2014	2020	2030
Access to sanitation						↗	↗	↗		↗	↗	↗
Urban wastewater treatment		↗	?	↗		↗	↗	↗		↗	?	↗
Reuse of wastewater		?	?			↗	↗	↗		?	?	
Release of nutrients from urban wastewater		?	?			?	?			?	?	
Nutrients enrichment		?	?			?	?			?	?	
Bathing water quality		↗		↗		?	?	↗		?	↗	↗

Note: Rating of MED South is attributed considering the situation in most countries in the subregion.

generated in the region, although it also treats nearly all of its municipal wastewater (96 %). The MED Balkans and Turkey and MED South treat around 83 % and 63 % of their municipal wastewater, respectively, and have increased their proportion of treatment relative to that generated, reflecting investments in this sector since before 2012. **However, in some MED South countries, most of the wastewater generated is discharged untreated into the Mediterranean.** The current political crisis and instability in Lebanon, Libya and Syria have either resulted in the shutting down of wastewater treatment plants or the suspension of constructing new ones. The volume of wastewater discharged untreated into the environment, streams, wadis or directly into the sea (estimated to be around 5 km^3/yr) still requires attention.

- **The level of treatment has improved significantly, in particular in the MED EU, but tertiary treatment is lagging behind in three subregions.** Wastewater treatment is also an issue in some MED EU countries where full compliance with the UWWTD Directive remains a challenge.

- **Water reuse is on the rise, with a few countries making significant advances driven by a higher demand for water and lower water availability.** In Israel, Jordan and Tunisia > 96 % of wastewater collected is treated. These countries promote wastewater treatment and reuse as an integral part of their water management strategy. Within the broader scope of the regional plan for municipal wastewater, quality standards for effluents, wastewater reuse and nature-based solutions to wastewater management will be addressed. This will provide the right legislative framework for water reuse and its more holistic assessment in the future.

- **The contribution of urban wastewater treatment plants (UWWTPs) to nitrogen discharges is as high as 90 %, with the remaining 10 % attributed to industrial discharges.** Although the Mediterranean Sea is generally oligotrophic and eutrophication is not an issue at the basin scale, nutrient enrichment may occur in sheltered coastal waterbodies, such as harbours and semi-enclosed areas subject to nutrient inputs from, for example, urban effluents and industrial discharges. In situ data availability should be improved in order to conduct a trend analysis of the key nutrient concentrations at eutrophication hot spots, which are well documented. Although the use of the Copernicus Marine Environment Monitoring Service (CMEMS) satellite and modelled data products for the purpose of policy-relevant assessments is promising, it comes with a series of challenges.

- **Bathing water quality is improving in the region with the MED EU countries exceeding the EU average, and monitoring in some MED South countries showing clear progress.** However, MED EU countries are among those with the best and worst bathing water quality in Europe. Despite a general improvement, with most sites being classified as sufficient/good or excellent, and upward trends in countries that have reported under H2020, sites of poor bathing water quality, due to pollution from domestic and industrial effluents, still require attention.

- **Significant gaps in data, for example, on wastewater, especially in large MED South countries (Algeria, Egypt, Libya) are hampering a full regional assessment.**

3.2.2. Why does water continue to be a priority issue in the Mediterranean region?

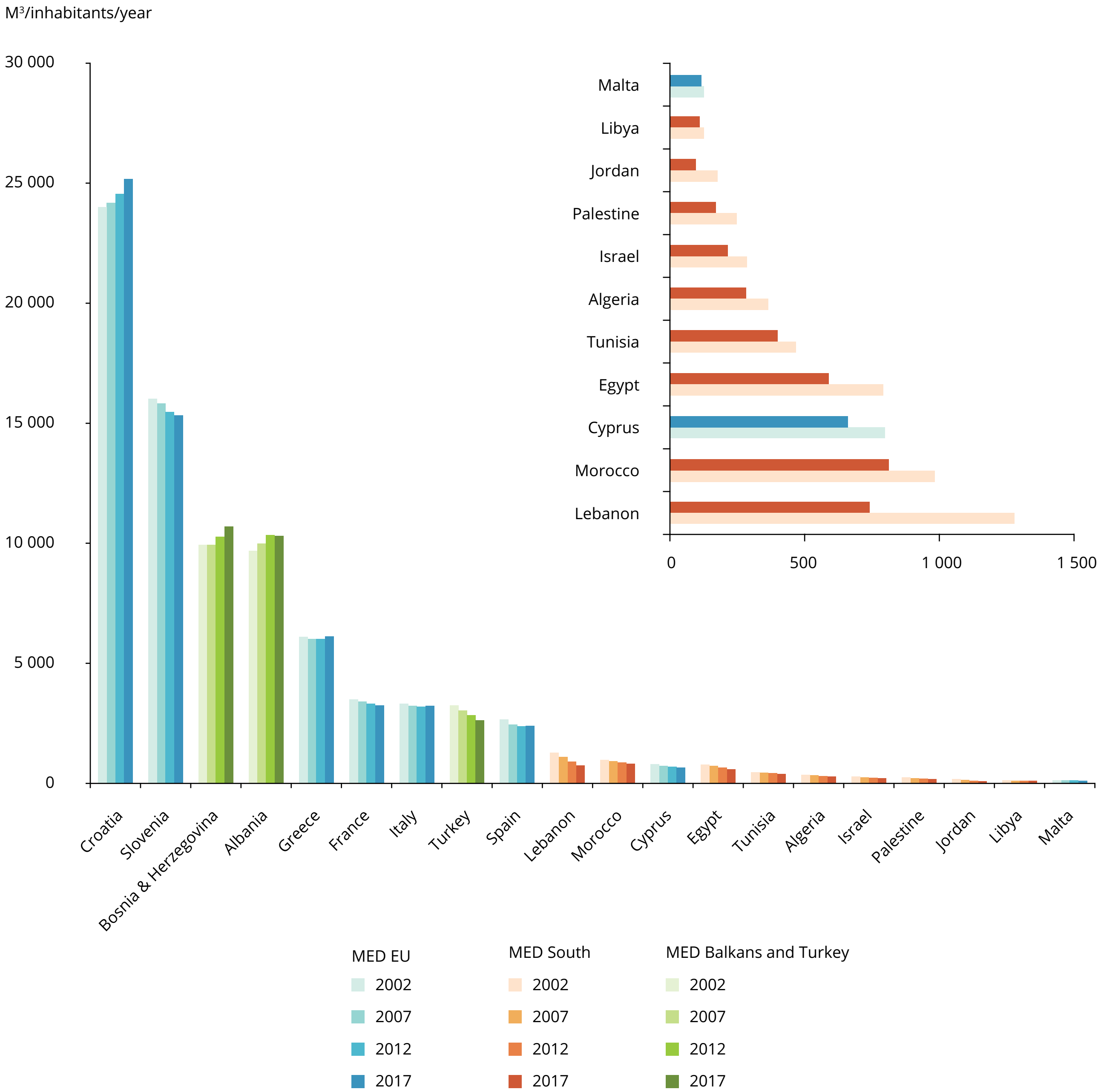
In the second phase of the Horizon 2020 programme (2015-2020), it was agreed to broaden the water area to inland, coastal and marine water. The aim was to achieve a more holistic assessment of the water issue in the region characterised by two challenging facets — limited water quantity (water scarcity ([25])) and the degradation of water quality. Although traditionally water quantity and quality have been considered as separate issues, the strong interactions between the two are now better recognised through the concept of the water quantity-quality nexus (Gunda et al., 2019). In some arid areas, water scarcity is seen as the root cause of many other water challenges, including access to safe drinking water, as well as water quality issues ([26]). These challenges are predicted to intensify with the changing climate, increasing water demands, and a growing concern over the degradation of water quality and related aquatic ecosystems. A case in point that illustrates the strong link between water quality and quantity is wastewater treatment and reuse in response to water scarcity. Although a full assessment of water quantity in the Mediterranean falls outside the scope of the H2020 Initiative, characterisation of the available water resources across the Mediterranean region is required to put the issue of water pollution into perspective. More detailed information on water

([25]) Water scarcity can be defined as <1000 m^3/inhabitants/year and absolute water scarcity as < 500 m^3/inhabitants/year.
([26]) https://blogs.ei.columbia.edu/2010/10/28/can-we-have-our-water-and-drink-it-too-exploring-the-water-quality-quantity-nexus/

availability and on the effect of climate change on water resources in the region can be found is available (MedECC, 2019; UNEP/MAP-Plan Bleu, 2020).

The Mediterranean region is characterised by an extremely unbalanced distribution of water resources, ranging from 25 000 m³/inhabitant/yr in Croatia to as little as 120 m³/inhabitant/yr in Malta (Figure 3.14). All MED South countries face water scarcity as the result of limited and sporadic precipitation, among which Algeria, Israel, Jordan, Libya, Palestine and Tunisia face absolute water scarcity. Nearly all Mediterranean countries have experienced a drop in the total renewable water resources per capita over the past 15 years (2002-2017), the most significant being in the MED South countries, notably Jordan (45.5 %) and Lebanon (42.1 %). A positive trend is observed in Albania, Bosnia and Herzegovina, Croatia and Greece (FAO, 2016).

Figure 3.14 Total renewable water resources per capita in Mediterranean countries (m³/inhab/yr)



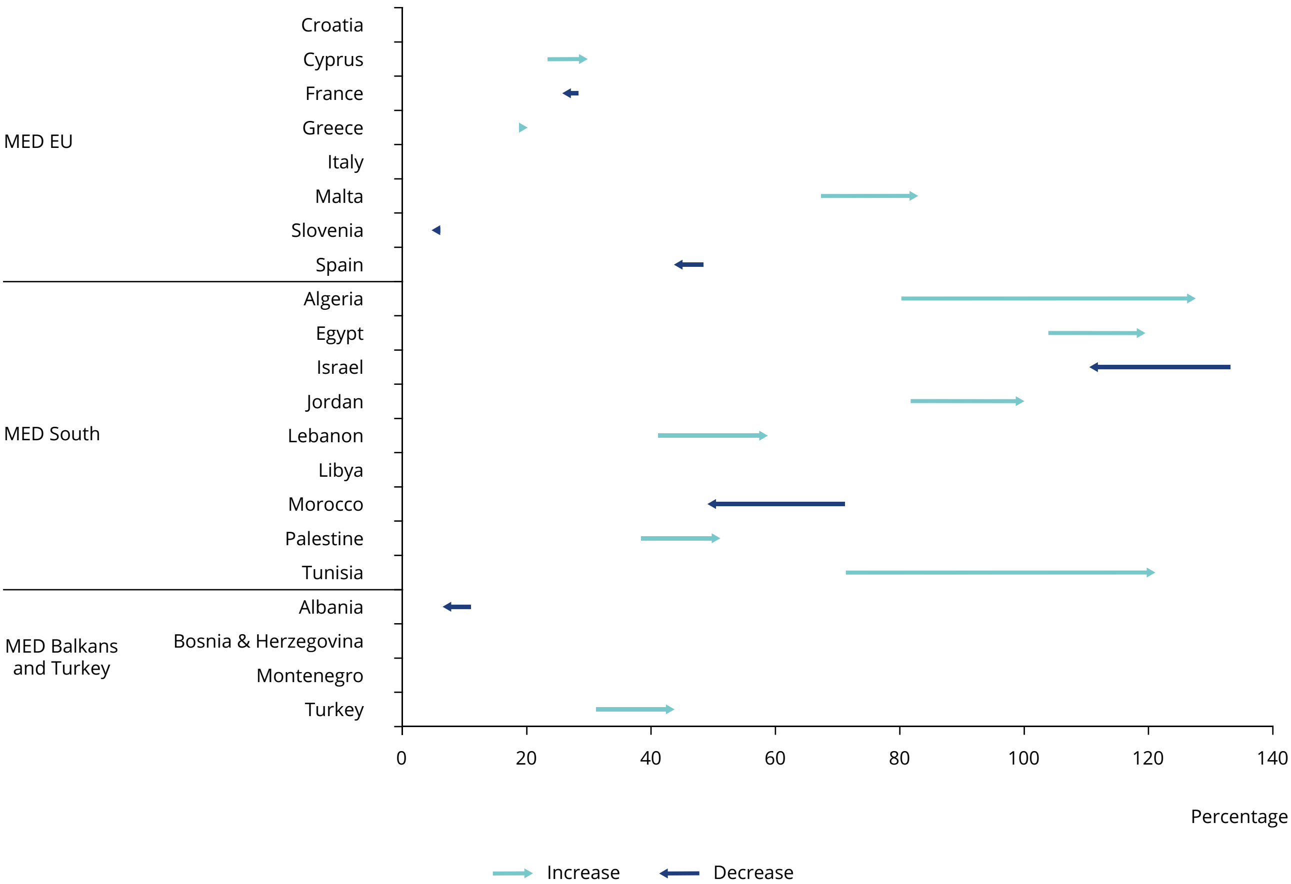
Note: Up to Tunisia — absolute water scarce; Up to Lebanon — water scarce. Inset shows the decline in total renewable water resources per capita in the (absolute) water scarce countries from 2002 to 2017. No data for Montenegro.

Source: AQUASTAT database (FAO, 2016).

Compounded with a decline in water resources due to the impacts of climate change (see Section B), population growth and the development of economic activities such as tourism, food and textile production have increased the pressure on water demand. With the MED South countries positioned among the most water scarce in the world, water continues to be a key priority for the development of the Mediterranean region.

When countries consume more water than they can sustain, the result is water stress. Progress towards SDG 6.4 *'to ensure sustainable withdrawals and supply of freshwater to address water scarcity'* is captured by SDG indicator 6.4.2: *'Level of water stress: freshwater withdrawal as a proportion of available freshwater resources'*. This indicator tracks the volume of freshwater withdrawn by all economic activities, compared to the total renewable freshwater resources available (UN Water, 2020a). Most Mediterranean countries experience water stress higher than the sustainable threshold of 25 %, with many, in particular MED South countries, exceeding 70 %. Figure 3.15 gives an overview of SDG indicator 6.4.2, showing the increase (orange arrow to the right) or decrease (blue arrow to the left) in the percentage of water stress on renewable water resources. For MED South, the water stress levels in Algeria, Egypt, Jordan, Tunisia and Libya have been increasing for the past 15 years (Figure 3.15, shown by orange arrows), some of which now exceed 100 %, implying that more than 100 % of available renewable freshwater resources are being withdrawn. This deficit in the extraction of sufficient renewable water sources is compensated by non-renewable sources, putting additional pressure on aquatic ecosystems. Water scarcity and water stress will be exacerbated as climate change and rapidly growing urbanisation place significant pressures on water resources, amplifying the already complex relationship between socio-economic development and water demand.

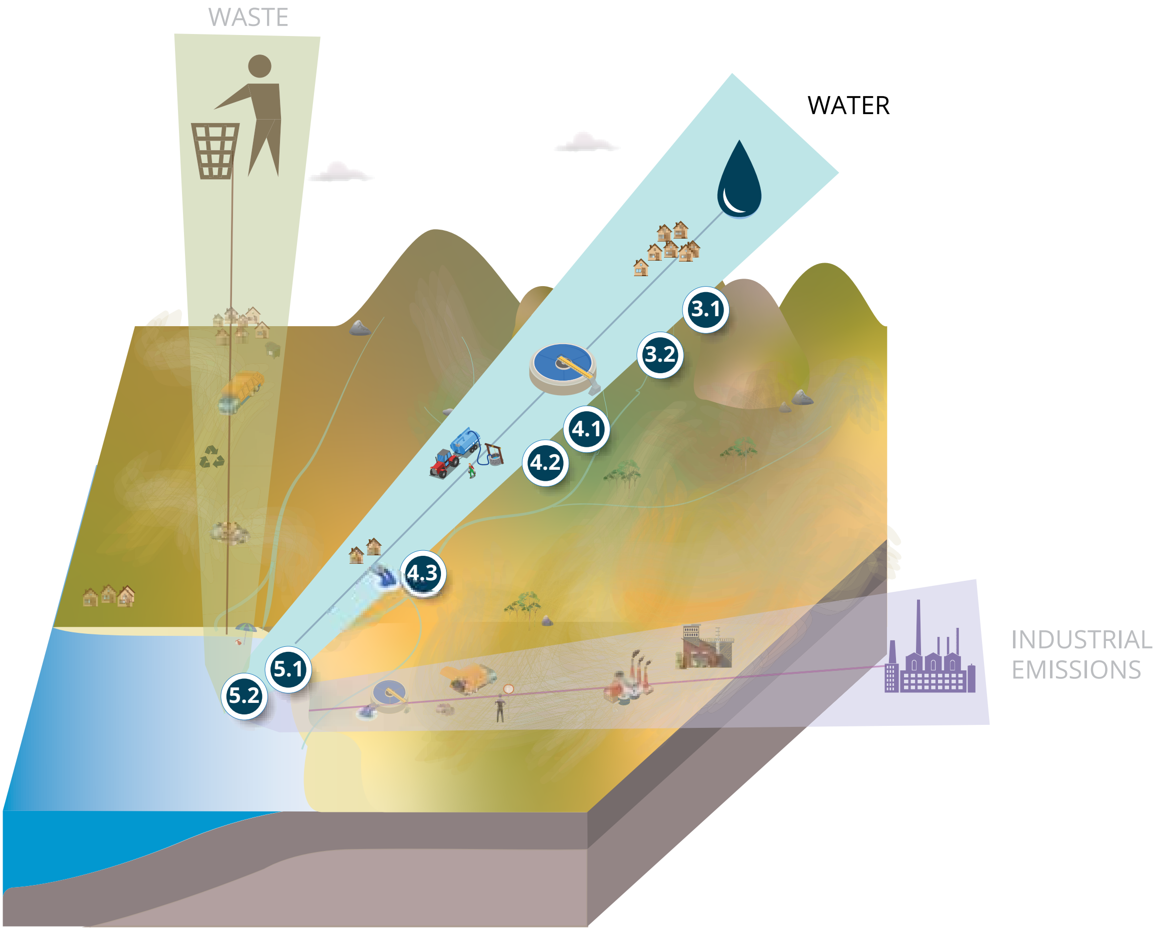
Figure 3.15 Change in SDG Indicator 6.4.2: 'Water stress — freshwater withdrawal as a proportion of available freshwater resources' between 2000-2002 and 2013-2017 (%)



Note: Value of water stress after considering the water needed for sustaining the natural environment. No data for Montenegro, Bosnia and Herzegovina (2000-2002) and Croatia (2000-2002). Water stress for Libya — 615.4 % in 2000-2002 (FAO, 2016) and 1 072.4 % in 2014 (UNSTATS, 2020) — is not included due to scale differences.

Sources: FAO, 2016 and UNSTATS, 2020 for Albania, Greece, Israel, Libya and Morocco (2014).

Figure 3.16 H2020 water indicators used to inform progress across the source-to-sea continuum



- **3.1** Share of population with access to safely managed sanitation systems
- **3.2** Share of population with access to improved sanitation systems
- **4.1** Volume of municipal wastewater collected and treated
- **4.2** Volume of treated wastewater reused
- **4.3** Release of nutrients from municipal effluents
- **5.1** Nutrient concentrations in coastal waters
- **5.2** Bathing water quality

Source: ETC/ICM-Deltares.

Two of the MED South countries have not experienced an increase in water stress, namely Israel and Morocco. Even though both Israel and Morocco have experienced a decline in renewable water resources per capita (Figure 3.14), a decrease in the percentage of water stress from the period 2000-2002 to 2013-2017 can be seen (Figure 3.15). In Israel, this can be explained by the installation of desalination plants since 1997, accounting for roughly 30 % of their total water consumption. In addition, the country has taken several measures to reduce freshwater withdrawal, such as the regulation of water extraction from the Sea of Galilee and aquifers, promoting the reuse of water for irrigation and the introduction of drip irrigation in agriculture (Legislative Council Commission, 2017). In response to the decline in freshwater resources, Morocco has made several efforts to enhance water security, such as centralising wastewater treatment in 2009 and constructing 43 additional wastewater treatment plants, investing in desalination in coastal areas, and subsidising drip irrigation for agriculture (Kurtze et al., 2015).

3.2.3 A 'source-to-sea' approach to the water thematic area

The adopted source-to-sea approach provides an integrated way to evaluate the progress in this thematic area across the land-sea continuum, starting from the upstream pressures related to access to sanitation, wastewater management and downstream state/impacts in terms of coastal and marine water quality. As shown in Figure 3.16, the selected H2020 water indicators are intended to assess the progress in the water thematic area along the source-to-sea continuum, covering most components of the DPSIR framework. The achievement of sustainable development should balance the needs and demands along the source-to-sea continuum, from satisfying the upstream equitable uses of water to safeguarding the downstream water quality and ecosystems (Berggren and Liss Lymer, 2016). For the water area, the source-to-sea approach presents a paradigm that recognises the need to address marine pollution from land-based sources and to manage freshwater and coastal pollution issues in a holistic way, in line with the ecosystem approach. It goes beyond the more established IWRM concept that brings together water stakeholders dealing with various aspects, such as drinking water, energy production, agriculture, and other industries, by extending the scope to coastal and marine areas. To this effect, in the second phase of the Horizon 2020 programme (2015-2020), the water area was extended to cover inland, coastal and marine waters in line with the IMF which links IWRM with ICZM, EcAp and DPSIR.

3.2.4 Key water trends

Updated H2020 water indicators

- IND 3.1 Share of total, urban and rural population with access to an improved sanitation system (ISS)
- IND 3.2 Proportion of population using safely managed sanitation services (SMSS)

Access to safely managed sanitation systems

Management of safe water sources and proper sanitation are crucial for sustainable development, and particularly important to the water-scarce Mediterranean region. Lack of 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.

Moving from the MDG to the SDG sanitation indicator

The H2020 indicator on sanitation (IND 3.2) was revised to align it with the corresponding indicator SDG 6.2.1: *Proportion of population using safely managed sanitation services (SMSS), including a hand-washing facility with soap and water*. As compared to the sanitation indicator under the Millennium Development Goals (MDG Indicator 7.9: *Population using improved sanitation systems* — ISS, equivalent to IND 3.1), SDG 6.2.1 goes further by addressing public health beyond the household level, including containment and treatment of fecal waste (Table 3.17). SMSS is the highest level defined according to the sanitation ladder, with the addition of: (1) facilities not being shared by households; (2) excreta are either safely disposed in situ; or (3) excreta are treated off-site (GEMI, 2016). The higher standard of the SDG sanitation indicator relative to the MDG indicator (Table 3.17) implies that values for access to SMSS (SDG 6.2.1) are generally lower than ISS (MDG 7.9) which was used in the first H2020 Mediterranean assessment (EEA and UNEP/MAP, 2014).

Regional trends in access to sanitation

A positive trend in populations with access to SMSS (top-right, dark-green fraction in Table 3.17) has been observed in all three Mediterranean subregions over the last 20 years (Figure 3.17). The total population with access to SMSS increased from 278 million in 2003 to 343 million in 2017. However, at the regional level, the population *without* access to

Table 3.17 Comparison of the MDG and SDG sanitation ladders and definitions of different types of sanitation

MDG sanitation ladder		SDG sanitation ladder	
Definition	**Service level**	**Service level**	**Definition**
Improved (ISS)	Use of improved facilities* that are likely to ensure hygienic separation of human excreta from human contact.	**Safely managed (SMSS)**	Use of improved facilities that are not shared with other households and **where excreta are safely disposed of in situ or transported and treated off-site.**
		Basic	Use of improved facilities that are not shared with other households.
Shared	Use of facilities of an otherwise acceptable type shared between two or more households. Only facilities that are not shared and not public are considered improved.	Limited	Use of improved facilities that are shared between two or more other households.
Unimproved	Use of facilities that do not ensure hygienic separation of human excreta from human contact, including use of pit latrines without a slab or platform, hanging latrines or bucket latrines.	Unimproved	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines.
No sanitation services	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces, or with solid waste.	Open defecation	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces, or with solid waste.

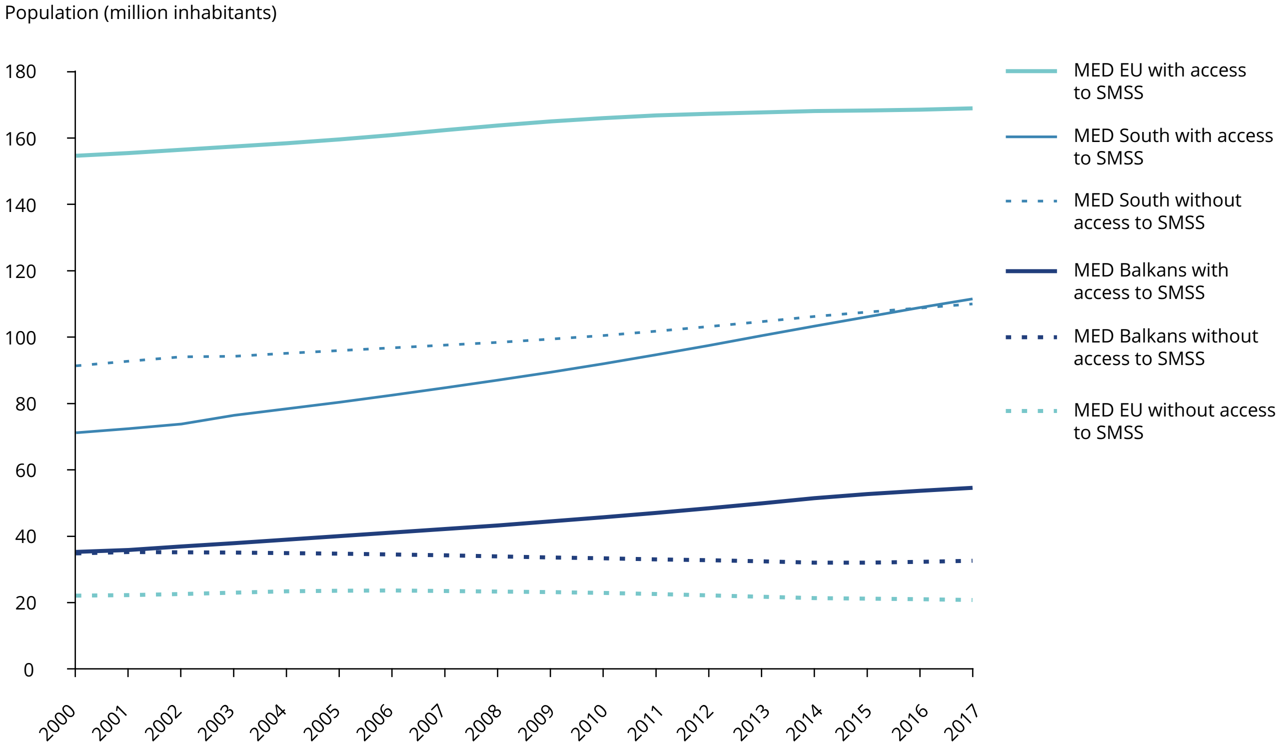
Notes: *Improved facilities include: flush/pour-flushed to piped sewer system, septic tanks or pit latrines, ventilated improved pit latrines, pit latrines with a slab, and composting toilets.

Source: GEMI (2016).

SMSS ([27]) is also increasing — from 146 million in 2003 to 158 million in 2017. In 2017, 158 million people in the Mediterranean region still had no access to SMSS, 111 million of whom lived in the MED South (excluding Syria), 33 million in MED Balkans and Turkey, and 15 million in the MED EU subregion. In the MED Balkans and Turkey, the population without access to SMSS has been on the decline since 2003, despite population growth. The equivalent population in the MED EU has remained constant at around 15 million inhabitants (Figure 3.17). In the MED South countries, however, the population without access to SMSS has been increasing steadily since 2003 (Figure 3.17). This can be partly explained by the concurrent population growth (Figure 3.18). If access to basic sanitation (light-green fraction in Table 3.17) is also considered as an acceptable sanitation service level, the population in the MED South sub-region without access to at least basic sanitation ([28]) (basic and SMSS) and relying on limited, unimproved and open defecation declined from 22.8 million in 2003 to 18.5 million in 2011 and 16.5 million in 2017 (excluding Syria).

([27]) https://blogs.ei.columbia.edu/2010/10/28/can-we-have-our-water-and-drink-it-too-exploring-the-water-quality-quantity-nexus/
([28]) 'At least basic' refers to Basic (light green) and Safely Managed Sanitation Systems (top right dark green) in Table 3.17.

Figure 3.17 Population with/without access to SMSS in the three subregions from 2000 to 2017 (million inhabitants)



Note: 'Without access to SMSS' is the sum of basic, limited, unimproved and open defecation. There are no data for Syria for SDG 6.2.1 in the database; for Montenegro, only values for urban sanitation (2006-2017) are available and included here. For the MED South subregion, data reported under H2020 was considered for Israel (2003-2017). Although Bosnia and Herzegovina, Jordan, Palestine and Tunisia reported data for Ind 3.2 under H2020, they did not provide a full-time series (Bosnia and Herzegovina reported for 2018; Jordan for 2004 and 2015; Palestine for 2014 and 2017; and Tunisia for 2004, 2009, 2014). For this reason, data from global databases were considered here which, albeit different from national reporting, does not alter the sub-regional picture.

Source: SDG 6.2.1 (%) (UNSTATS, 2020); Population data from (UN DESA, 2019).

Figure 3.18 Total population in MED EU, MED South, and MED Balkans and Turkey with access to types of sanitation services for 2003, 2011 and 2017 (million inhabitants)

Note: Basic includes data specified as 'at least basic'. The difference between total population of the MED EU and the population with different sanitation levels in 2003 is due to a lack of data for Italy. Data for Syria are available in the JMP WASH database and are included here.

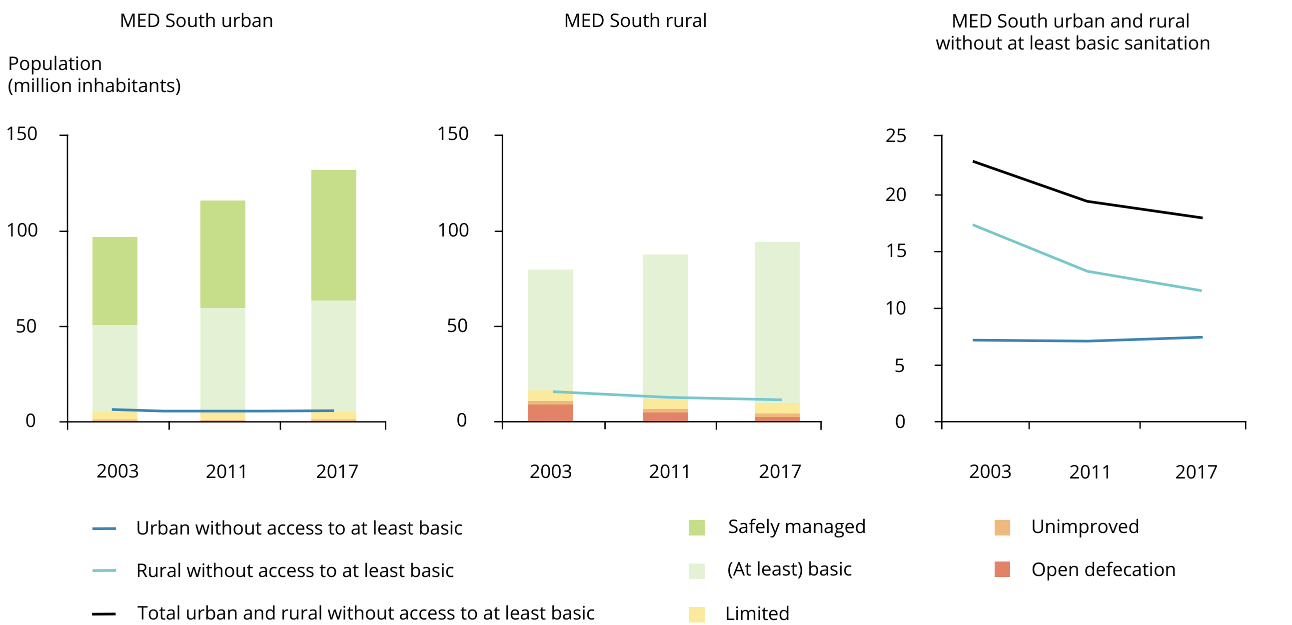
Source: WHO/UNICEF, 2020.

Focus on MED South

The actual population in MED South countries *without* access to SMSS (all fractions of the SDG sanitation ladder except the dark green in Table 3.17) is still rising as a result of the steadily increasing overall population. This rise is caused by an increase in the population using basic sanitation; the population using limited sanitation, unimproved sanitation and open defecation is declining. Since 2003, the proportion of the overall population with access to SMSS has increased for the MED South subregion by 6 %. However, in 2017, only half of the MED South population had access to SMSS. Some countries are exceptions, such as Israel where access to SMSS has been reported at 100 % in urban areas and steadily rising in rural areas since 1970. These findings imply that with some country-based exceptions, the level of responses showing access to SMSS in the MED South subregion is not yet able to keep up with the concurrent increase in population. Despite the relative increase in the proportion of the population with access to SMSS and a decline in the least-safe sanitation types, there is still a need for continuous investment to supply SMSS to the growing population. A more detailed analysis of the sanitation services in the MED South shows that differences between urban and rural sanitation service levels remain prominent, with access to SMSS in rural areas lagging behind. More than 5.7 million people living in urban areas and no less than 10.6 million rural dwellers were deprived of access to at least basic sanitation in 2017, and had to revert to limited, unimproved and open defecation. The comparison with corresponding data for previous years shows that there has been a much stronger decline in the number of people *without* access to at least basic sanitation in rural areas (16.4 million to 11.4 million in 2003 and 2017, respectively) than in urban areas (~ 6.6 million in both 2003 and 2017). This implies that the gap between urban and rural coverage has been gradually narrowing over the period from 2003 to 2017 (Figure 3.19).

Although there is progress in some countries, comprehensive information in responses referring to investment in improving sanitation services for the MED South subregion is difficult to find. Some countries provide information through different policy channels. For instance, according to the Egyptian Voluntary National Report, 80 sanitation projects have been completed over four years, covering 414 villages and costing EGP 9 billion (EUR 0.5 billion). The target is to achieve full provision of sanitation services in all villages by 2030 through the implementation of a sanitation projects plan in the remaining underserviced villages (2 800 villages, or 58 % of the total) for an estimated total cost of EGP 200 billion (EUR 11.24 billion).

Figure 3.19 Urban and rural populations in the MED South subregion with access to different types of sanitation service (million inhabitants)

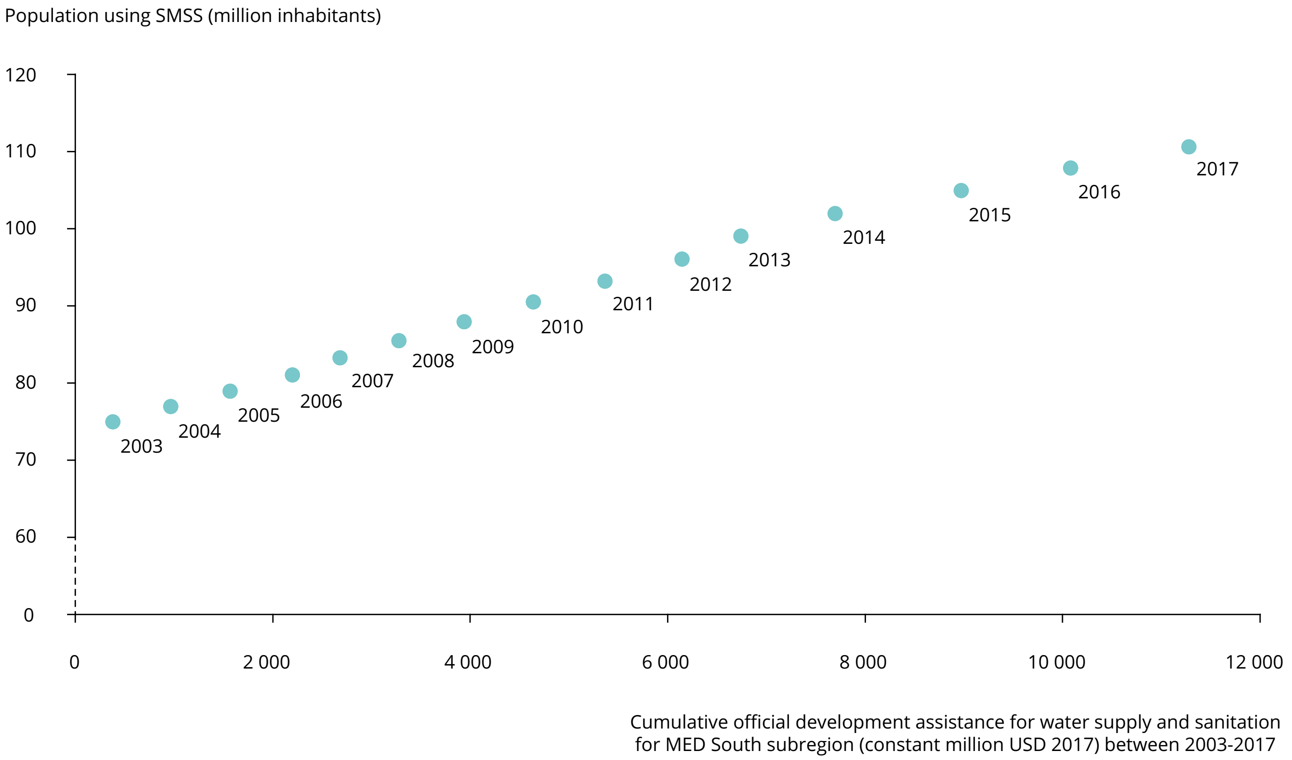


Note: 'Without access to at least basic sanitation' is the sum of limited, unimproved and open defecation. Data specified as (at least) basic includes basic and potentially SMSS. No data are available for Libya and Lebanon. Data for Syria are available in the JMP WASH database and are included here.

Source: WHO/UNICEF, 2020.

SDG indicator 6.a.1 defined, as the *'Amount of water- and sanitation-related official development assistance (ODA) that is part of a government-coordinated spending plan'* gives an indication of the official financial investments as part of capacity building in water and sanitation in a country (UN Water, 2020c). The analysis for the total official development assistance for water supply and sanitation (SDG 6.a.1) data and total population using SMSS (SDG 6.2.1) in the MED South countries gives rise to an interesting relatively linear correlation until 2012, before 'slowing down' in recent years (2014-2017) despite relatively large investments (Figure 3.20).

Figure 3.20 Correlation analysis of SDG 6.a.1 and SDG 6.2.1 between 2003 and 2017



Note: SDG 6.a.1: Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan; SDG 6.2.1: Population using SMSS, including a hand-washing facility with soap and water. In some years, total investments were lower (e.g. 2013) or higher (e.g. 2015) due to individual events, such as less official development assistance (ODA) to Egypt and Morocco in 2013 than in previous years and relatively higher ODA to Egypt and Morocco in 2015. Data on the x axis refer to cumulative investments.

Source: UNSTATS (2020).

Box 3.10 Case study on Tunisia: progress in access to sanitation and development of the policy support system (PSS) for SDG 6

Tunisia has made significant progress in providing access to sanitation, resulting in over 4 million people having access to improved sanitation between 1990-2015. Sanitation services fall under the Office National d'Assainissement (ONAS) which is responsible for both municipalities and rural areas with over 4 000 inhabitants. Rural areas (30 % of the population, most of whom are in coastal areas) fall under the responsibility of rural councils which often lack the resources for improving sanitation services. There have been several ad hoc initiatives and programmes targeting sanitation in rural areas, such as the PNAQP programme (1989-2019, funded by the French Development Agency) which aimed to improve sanitation of rural areas in 1 234 districts and included a sanitation pilot project in 15 rural communities (Tunisia NAP). Rural sanitation still requires prioritisation in terms of investments, laws and implementation (World Bank, 2018).

To make further progress towards achieving SDG 6, Tunisia has worked together with the Republic of Korea, Ghana, Tunisia, Pakistan and Costa Rica (2016-2018) in the project 'Water in the World We Want' to develop the SDG 6 Policy Support System (SDG-PSS). This tool provides a 'fit-for-policy' evidence framework for collaborative planning to develop and implement water-related policies for strengthening the enabling environment for achieving SDG 6. In Tunisia, the SDG-PSS was officially adopted for reporting on the SDG 6 and dissemination of the system at the regional and local level for the improved quality and reliability of data.

A workshop on using SDG-PSS to support countries in Africa and the Middle East on water-related sustainable development was held in Tunisia in 2019. From the MED South countries, Egypt, Jordan and Morocco were present as participating countries in the region. The project partners moved to the second phase of the project in 2019 with the aim of extending the use of SDG-PSS to other UN member states in different regions of the world. Due to its active role in promoting the engagement of more countries in the region, Tunisia is acting as the regional hub during the second phase.

Source: https://sustainabledevelopment.un.org/partnership/?p=30176

Wastewater as a valuable resource

Updated H2020 water indicators

- IND 4.1 Municipal wastewater collected and wastewater treated
- IND 4.2 Direct use of treated municipal wastewater
- IND 4.3 Release of nutrients from municipal wastewater

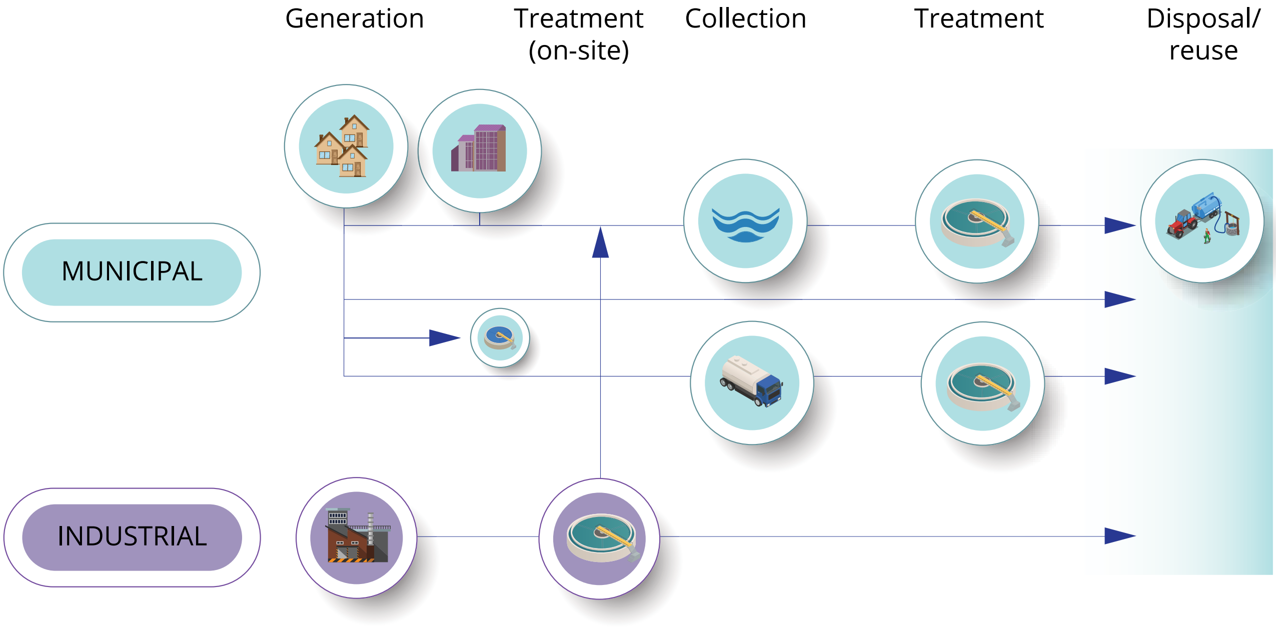
Untreated wastewater discharged into fresh and marine water bodies is a major source of pollution and health concern. The polluting effect of wastewater discharge is variable and largely dependent on the initial composition, quantity, level of treatment of the collected wastewater, composition of the effluent, and the capacity of the receiving water bodies. Appropriate collection and treatment of municipal wastewater not only prevents human health issues and pollution of aquatic environments but also has a large potential and benefits in the overall management of water resources. In a context of climate change and increased pressure on water availability, treated wastewater is an asset as it helps to close the gap between supply and increasing demand and is one of the most sustainable alternatives to cope with water scarcity. In this assessment, only point sources and their related infrastructure, including WWTPs and outfalls, are considered. Issues linked to diffuse effluents from agriculture are not addressed.

The wastewater management chain

For an analytical assessment of progress in wastewater management in the Mediterranean, the following stages have been identified in the wastewater management chain: wastewater generation, collection, treatment, and reuse (Figure 3.21). The wastewater management chain starts with the generation of wastewater either by municipalities or industries. Not all wastewater generated is collected — some may be disposed of directly without treatment. Municipal wastewater collected on behalf of a municipality is generally treated in municipal WWTPs. In the Mediterranean, the most prevalent type of wastewater reaching the treatment plants comprises a mixture of municipal wastewater (residential settlements and services predominantly for human metabolism and household activities), storm water and industrial wastewater.

Wastewater is subject to different levels of treatment, ranging from the lower standard levels (primary

Figure 3.21 Stages of the wastewater management chain, from generation to disposal/reuse



Source: Adapted from WHO and UN-Habitat, 2018.

treatment) to higher standard levels (tertiary treatment). In some cases, collected wastewater is not treated according to standards due to the non-optimal functioning of the WWTPs. Treated wastewater is either disposed of in the environment or reused. Volumes of wastewater collection and treatment, including per type of treatment and direct reuse, are covered in the H2020 indicator list (Figure 3.16). Where available, data on municipal wastewater generation are also considered to complete the wastewater management chain.

Wastewater generation, collection and treatment

Regional status and trends

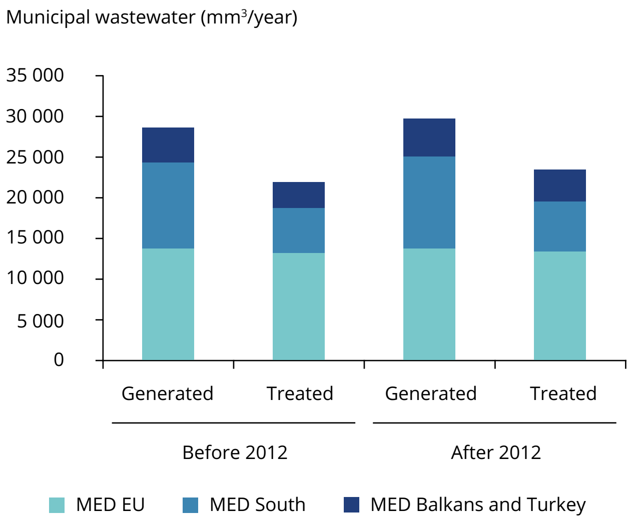
Figure 3.22 shows a comparison between wastewater generated and treated before and after 2012 based on available data for each subregion. The AQUASTAT database provides data on wastewater generated and treated for nearly all countries with near-complete coverage for before 2012 (FAO, 2016). Data from this database were used to complement the data delivered by countries under H2020, in order to get a full overview of the region when data were missing. While wastewater collected is usually a fraction of the wastewater generated, in the absence of a complete regional dataset on wastewater collection, the wastewater generated is shown.

The MED EU is responsible for the largest volume of wastewater generated in the region, followed by MED South, even though the population of MED South countries has exceeded that of the MED EU subregion since 2000 (see Section B). Based on data before 2012, the MED EU also treats the largest percentage of its municipal wastewater (96 % before 2012), followed by MED Balkans and Turkey (78 % and 83 % before and after 2012, respectively) and MED South (59 % and 63 % before and after 2012, respectively). While data for the MED EU was insufficient to complete the overview after 2012, the subregion is not expected to have experienced a decline in the proportion of treatment. MED Balkans and Turkey and MED South subregions registered an increase in the relative treatment of generated wastewater of 6 %, yet treatment in these subregions is still lagging behind the MED EU.

SDG indicator 6.3.1a ([29]) monitors the *proportion of domestic wastewater flow safely treated (%)*. It measures the flow of safely treated wastewater (sewage treated at treatment plants, and wastewater from on-site

([29]) SDG indicator 6.3.1 is composed of 2 sub-indicators:
6.3.1a: Percentage of safely treated domestic wastewater flows
6.3.1b: Percentage of safely treated industrial wastewater flows

Figure 3.22 Volume of wastewater generated and treated for the three subregions before and after 2012 (Mm³/yr)

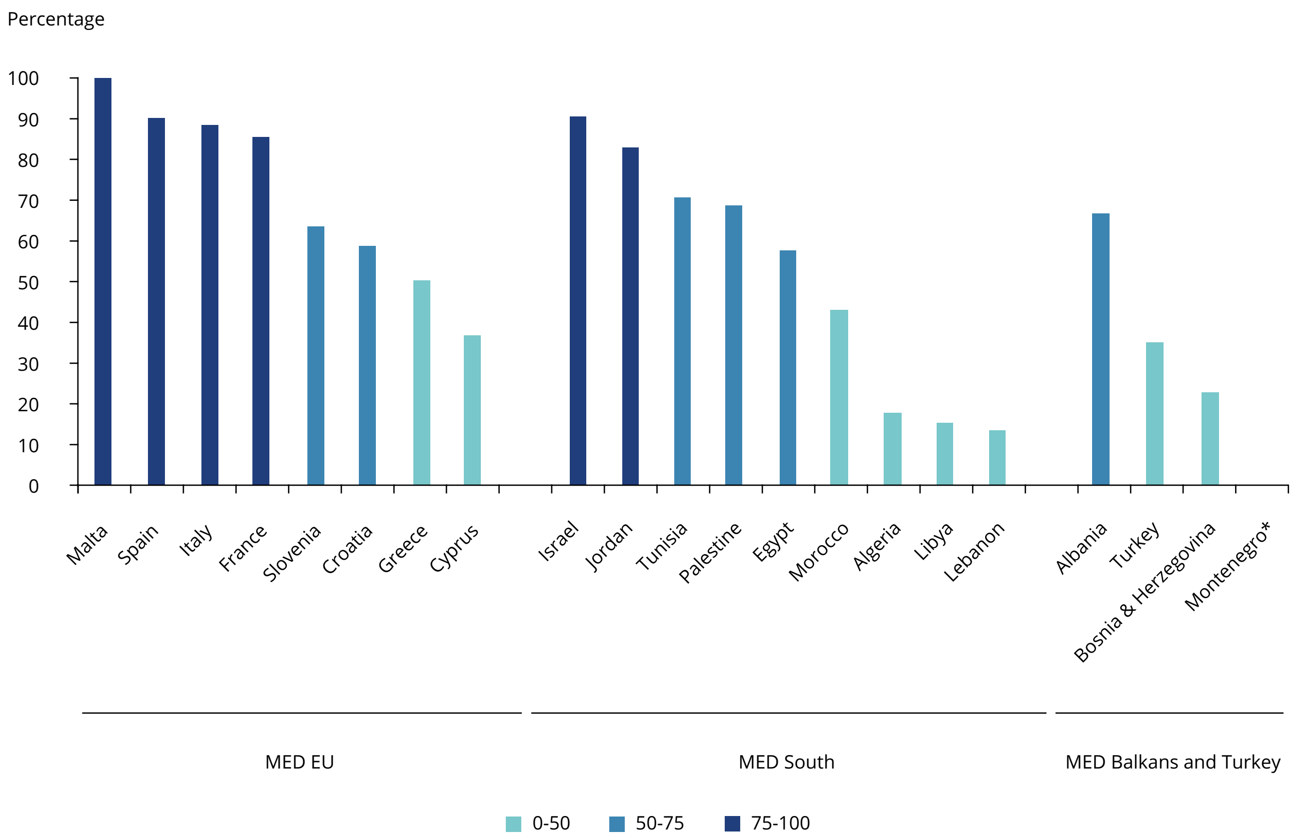


Source: See Annex C for data overview per country.

facility treated on-site or emptied, transported and treated off-site) as a proportion of all domestic wastewater generated based on household per capita water-use data. While the definition of this indicator differs from the H2020 water indicators, it provides an indication of the progress on wastewater management in the region.

The level of treatment varies between the three subregions and from country to country (Figure 3.23). Based on SDG 6.3.1, the safely treated proportion in MED South countries ranges from as low as 10-15 % in Lebanon and Libya, to as high as 80-90 % in Jordan and Israel. This is generally in line with the estimations presented in IPEMED (2018) showing relatively high treatment rates in Israel and Jordan (97 % ([30])); satisfying treatment levels in Egypt (79 %), with other countries like Syria (40 %), Libya (7 %) and Lebanon (2 %) lagging behind. In the MED EU, most countries safely treat more that 75 % of the collected wastewater, with the exception of Croatia and Slovenia, where

Figure 3.23 SDG 6.3.1 — proportion of wastewater safely treated in Mediterranean countries in 2018 (%)



Source: UNSTATS, 2020.

([30]) Data delivered under H2020 reporting.

50-75 % is treated safely; and Greece and Cyprus, where the proportion of safely treated wastewater is below 50 %. In MED Balkans and Turkey, the proportion safely treated varies between 0-50 % (Turkey) and 50-75 % (Albania, Bosnia and Herzegovina).

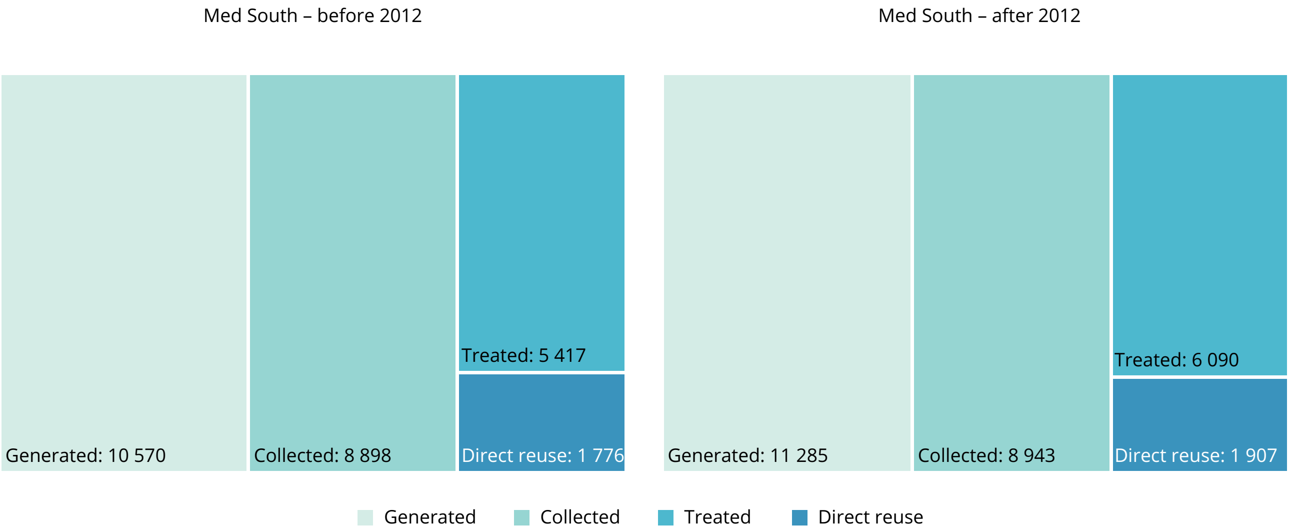
Focus on the MED South

The more comprehensive data overview for the MED South subregion allows for a more detailed analysis of the wastewater management chain (see Annex C). This subregional dataset brings together data from the H2020 Mediterranean assessment (2014), data reported by countries under H2020 in 2019/2020, and the AQUASTAT database (FAO, 2016). The data overview for 'before 2012' is almost complete; the dataset for 'after 2012' is missing more recent data for volumes of wastewater collected in Algeria and Egypt and overall updated data for Lebanon (Figure 3.24). The analysis of the wastewater management chain at the subregional level is mainly dominated by values for Egypt.

Based on the available data for before and after 2012, the volume of wastewater generated has increased as a result of population growth (Figure 3.24). The volume of wastewater collected has also increased (despite missing updated data for Algeria, Egypt and Lebanon) but, in relative terms, the proportion of wastewater collected declines after 2012. While investments strive to keep up with the increase in population, wastewater collection has improved significantly since 2012 at the subregion level. The proportion of wastewater treated as a percentage of the wastewater collected shows a slight increase (from 61 % to 68 %), pointing towards progress in treatment efficiency and quality. In absolute terms, the volume of wastewater directly reused has increased.

Time-series data delivered by countries (Israel, Jordan, Morocco, Palestine and Tunisia) under the H2020 reporting mechanism (Figure 3.25) provide a better understanding of the progress in wastewater management in MED South countries. Data show a steady increase in both volumes of wastewater collected and treated, reflecting the investments in new or rehabilitated wastewater infrastructure and the increase in the number of WWTPs (not shown). In some countries, such as Israel, Jordan and Tunisia, up to >96 % of wastewater collected is treated. These countries promote wastewater treatment and reuse as an integral part of their water-management strategy. For Israel, Jordan and Tunisia, the volume of wastewater collected and treated per capita remains roughly stable over time indicating that the increase in coverage is in line with the increase in population. Palestine still lacks the necessary infrastructure for the effective and efficient treatment of collected wastewater. Of the wastewater generated by municipalities in Palestine, most is not collected due to the lack of connections between households

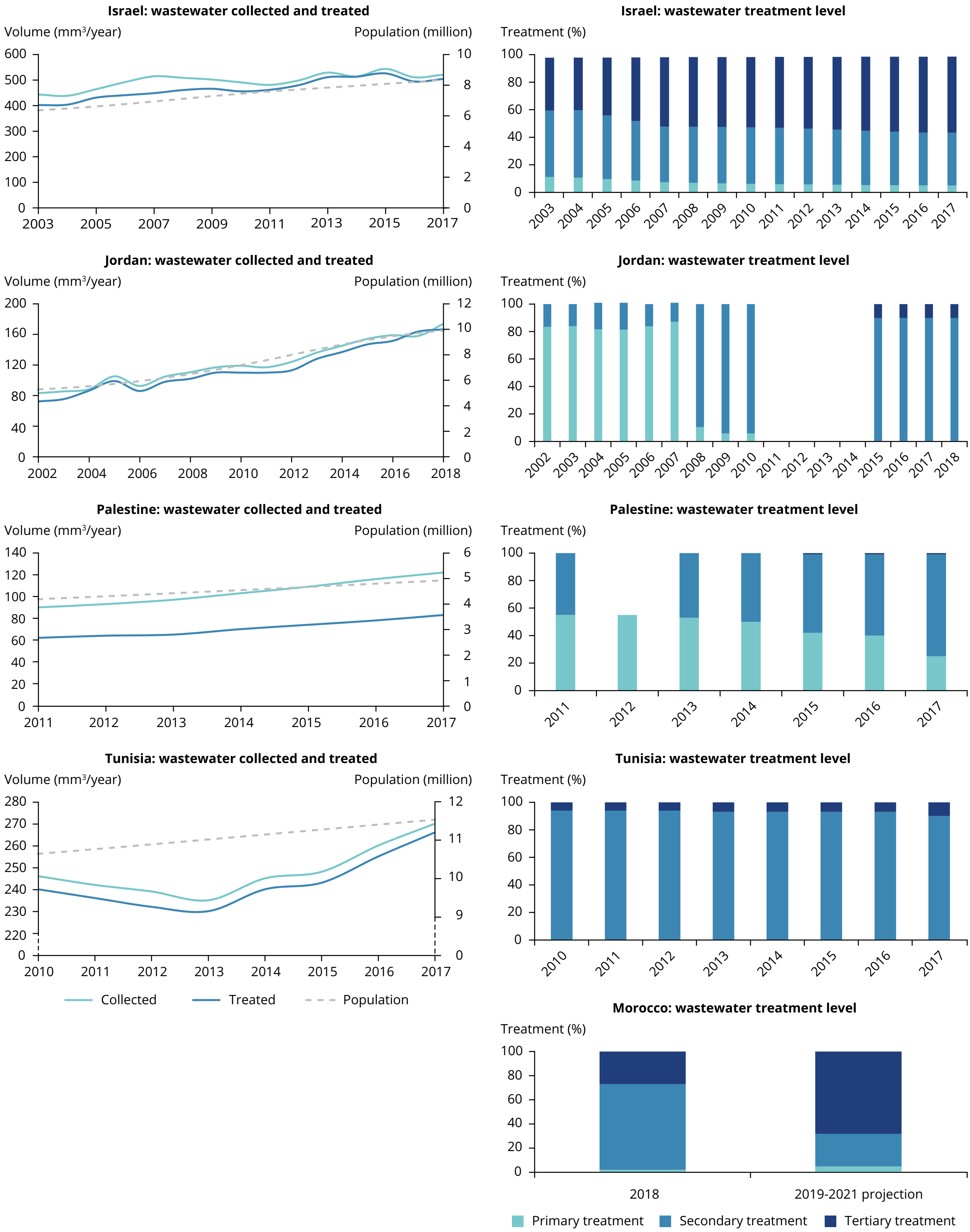
Figure 3.24 Amount of municipal wastewater generated, collected, treated and reused directly in the MED South subregion before and after 2012 (Mm³/yr)



Note: The 'before 2012' data overview is almost complete except for direct reuse data for Jordan and Lebanon. 'After 2012' data for Egypt and Algeria (volume of wastewater collected) are assumed to be the same as 'before 2012'. 'After 2012' data for Libya (volume of directly reused wastewater) are missing. 'After 2012' data for Lebanon (volume of wastewater generated, collected, treated and directly reused) are missing. Syria is not included.

Source: See Table 3.18 and Annex C for data used in this graph.

Figure 3.25 Wastewater data delivered by countries under H2020 reporting



Note: On the left, the volume of wastewater collected and treated is shown relative to the population growth. On the right, % treatment levels are given of the wastewater collected. Since not all wastewater is collected, the % treated of the overall volume of wastewater generated would be lower.

Source: H2020 reporting.

and the sewage network (H2020 National Report for Palestine, 2020). Only 68 % of the wastewater collected is treated in centralised or decentralised wastewater treatment plants. Since most wastewater generated is not collected, the fraction of wastewater treated amounts to a mere 25 % of that generated. However, the volume of wastewater collected (and to some extent treated) is increasing faster than the concurrent population increase (Figure 3.25), indicating an absolute improvement in wastewater management and a larger fraction of the population being served by wastewater infrastructure.

Wastewater, and specifically the prevention of environmental and marine pollution, has been a priority in Morocco since 2006 when the Wastewater Treatment and Purification Program (PNA) was launched. Under this support programme, several WWTPs have been developed over the years. Of the 111.36 Mm^3 of wastewater collected in the coastal hydrological basins of Morocco draining into the Mediterranean, 103.11 Mm^3 is treated in WWTPs, representing 93 %. Morocco has a relatively large marine outfall of wastewater in the Mediterranean (73.17 Mm^3/year), which is released pretreated (Morocco SEIS, 2020). Currently, Morocco is planning to install an additional eight municipal WWTPs and to extend two existing WWTPs in the period of 2019-2021 (Morocco SEIS, 2020). With this development, the country will make a shift towards more tertiary treatment of wastewater (Figure 3.25) in addition to increasing the total yearly treatment capacity by 16 000 m^3/year.

When it comes to treatment type, a shift towards tertiary treatment is observed over time for all reporting countries. In Israel, the tertiary treatment fraction has increased over the years reaching 55 % in 2017 (Figure 3.25). In recent years, Jordan and Tunisia have moved towards more advanced levels of treatment, and now only have secondary and tertiary treatment levels. However, the progression towards further tertiary treatment is developing slowly. Palestine has introduced tertiary treatment over the last five years which, however, still accounts for a very small fraction (1 %) of the treatment type (Figure 3.25).

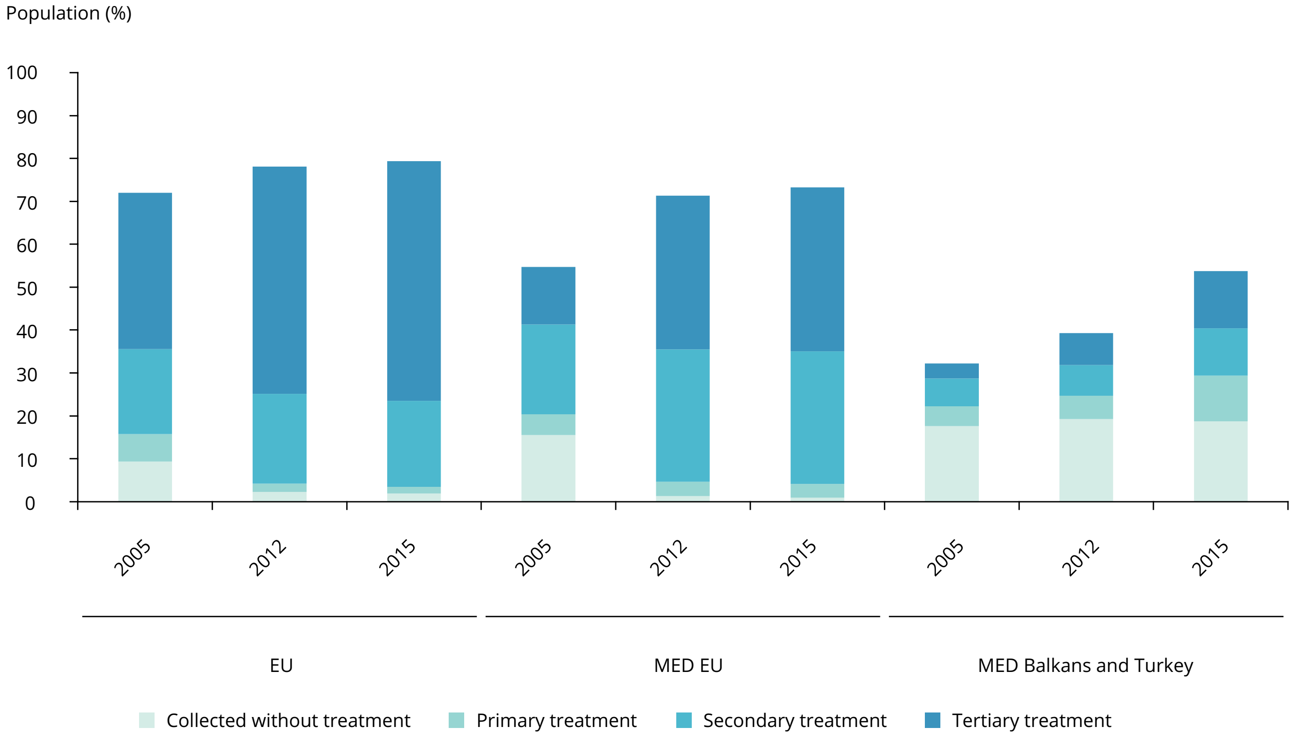
Focus on the MED EU and MED Balkans and Turkey

The EEA indicator on urban wastewater treatment (CSI 024) measures the percentage of the population connected to sewage collection systems, as well as the prevalence of primary, secondary and tertiary UWWTPs (EEA, 2017). The amount of urban wastewater treated is expressed as population equivalents (p.e.). This indicator, available for the MED EU and MED Balkans and Turkey, shows a marked improvement in urban wastewater treatment in all parts of Europe (EU plus the UK) over recent decades as the direct result of the implementation of the UWWTD (91/271/EEC; EU, 1991) in Europe.

The average treatment level in the MED EU and MED Balkans and Turkey has improved over the last 10 years (2005-2015) (Figure 3.26). Despite an overall improvement of roughly 15 % in connections between 2005 and 2015, the proportion of the population connected to urban wastewater treatment in the MED EU (around 70 %) and MED Balkans and Turkey (53 %) is generally lower than the whole EU average (80 %) (Figure 3.26). A marked decrease in collection without treatment can be observed in the MED EU between 2005 and 2012 with a concurrent increase in tertiary treatment, which nevertheless still requires attention.

Improved wastewater management generates social, environmental and economic benefits for moving towards the 2030 Agenda for Sustainable Development (UN, 2015). Several challenges are hampering progress on wastewater management around the Mediterranean. In the MED South subregion, the financial and institutional capacities to operate and maintain infrastructure that can adequately serve the growing population remain a challenge. The MED EU subregion faces other challenges, such as improving resource and energy efficiency, ensuring the effective removal of emerging pollutants, and achieving full compliance with European legislation (EEA, 2019b).

Figure 3.26 **Average percentage of population connected to public wastewater collection and treatment systems in MED EU and MED Balkans andTurkey in comparison to EU (2005, 2012, 2015)**



Note: MED EU includes Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia and Spain; MED Balkans and Turkey includes Albania, Bosnia and Herzegovina and Turkey; EU includes EU-27 plus the UK.

The initial stage for the treatment of wastewater is connection to sewage-collection systems. Wastewater can then be subjected to primary treatment, such as settling, followed by secondary treatment to reduce the amount of dissolved and suspended organic material. Secondary treatments include those using biological methods. More stringent 'tertiary' treatment can then be applied to remove mainly nutrients.

Source: EEA (2017) based on Eurostat 2017.

Wastewater disposal and reuse

The final stage of the wastewater management chain concerns the disposal of wastewater (treated or untreated), or reuse.

Discharge of untreated wastewater

Discharge of untreated wastewater into the environment still occurs around the Mediterranean, in particular in certain countries in the MED South and MED Balkans and Turkey. The efficiency of wastewater treatment in the Mediterranean region is highly variable. In some areas where wastewater treatment plants do not have the capacity to accommodate the large volumes of wastewater resulting from growing urban populations, retention times for wastewater treatment have become too short to be effective (Qadir et al., 2010). Consequently, untreated or insufficiently treated wastewater is discharged into open wadis, valleys, rivers, streams or directly into the sea. This presents risks for both human health and the environment.

Based on the data collected (Annex C), the volume of untreated wastewater discharged into environment ([31]) by MED South countries was estimated to be ~5 km^3/yr, ranging between 5.15 and 5.20 km^3/yr before and after 2012 and roughly equivalent to half of the amount of wastewater generated. Despite continuous efforts and investment in the region to improve wastewater management, the political, financial and institutional crisis faced by certain countries, notably Lebanon, Libya and Syria, has hit the wastewater sector hard. In these countries, several WWTPs are out of operation and the construction of new WWTPs has been discontinued.

([31]) Assumed as the difference between wastewater generated and treated.

In Lebanon, only 16 out of 50 WWTPs are classified as operational, serving just 308 000 residents out of a population of ~6 million. This implies that 99.95 % of the population still discharges its wastewater without treatment (Lebanon NBB, 2019). Beside the institutional and financial challenges facing the operation and maintenance of existing wastewater networks and treatment plants, the lack of wastewater management has been further exacerbated by the impact of displaced Syrians (Lebanon, 2018). In Syria, all preliminary domestic WWTPs are down and out of operation as a result of the current political crisis, which is also preventing the completion of a number of other plants (e.g. Jableh, Ras al Basit, Banias, and Al Hamidieh). Other infrastructure projects — for example, two sewage treatment plants designed to perform secondary treatment with mechanical sludge treatment in the coastal regions of Latakia and Tartus — have been temporarily suspended due to the difficulty of importing the necessary equipment (Syria NBB, 2019). Wastewater is either discharged directly/indirectly into the sea or passed through wastewater collection ponds considered as primitive and preliminary WWTPs. These ponds do not function properly and need improvements to make them operational until full WWTPs have been completed (Syria NBB, 2019). A similar situation can be seen in Libya, where around 99 % of the wastewater generated (~487 Mm^3/yr in 2017) is discharged untreated into the sea every year (Libya NBB, 2019). In Palestine, especially in the Gaza Strip, the discharge of untreated wastewater into open wadis or directly into the sea is common practice (H2020 National Report for Palestine, 2020). Industrial wastewater generated from local industries is also discharged through the sewer network or open wadis and, in most cases, is mixed with the municipal wastewater. Besides implications for the aquatic ecosystems, the discharge of raw wastewater into the environment poses a serious human health hazard due to the contamination of drinking-water sources and the greater risk of contact with pathogens. For instance, about 26 % of all diseases in the Gaza Strip are mainly connected to contaminated drinking water and 75 % of all Gaza beaches, the main destination for internal tourism, are not fit for bathing due to the deterioration in coastal and marine water quality (National Water Assessment, 2019). The construction of more WWTPs is in the pipeline, while others are at the design stage but lack the necessary funding.

Wastewater reuse: from waste to resource

In response to higher demands for water and lower water availability, the region is gradually moving towards non-conventional water resources to help offset the water deficit, including the expansion of desalination and the reuse of treated wastewater. When it comes to wastewater reuse, a distinction is made between direct and indirect reuse. Direct reuse refers to treated wastewater that is directly reused, for example, in agriculture. Indirect reuse concerns treated wastewater that is first diluted by releasing it into natural waters (disposal of treated wastewater) and later used as a water source. Since most treated wastewater ends up in natural water bodies, reuse usually refers to direct reuse. Treated wastewater can be reused for various purposes, including the creation of green belts, energy generation, fodder production for livestock, and irrigation for fruit trees or other cash crops. Proper treatment of wastewater prior to use is crucial for public safety, to prevent the spread of waterborne diseases. In the past, unauthorised reuse of untreated wastewater for irrigation has been the main source of cholera outbreaks in Mediterranean countries (Choukr-Allah et al., 2012).

To prevent improper reuse, quality requirements have been established in many countries. The recently proposed regional plan on municipal wastewater treatment (Decision IG.24/10) as an update/extension of the current regional plan of BOD5 from urban wastewater will also address aspects of the reuse of treated municipal wastewater in agriculture, including nutrient reclamation, the reuse/recycle of treated wastewater, for example, through aquifer recharge, in response to regional water scarcity and setting the appropriate quality standards for different water (re) uses. Progress is also being made towards establishing a legal instrument on water reuse in Europe. Following the work on establishing a common approach regarding quality standards for water reuse, specifically for agriculture and aquifer recharge (Alcade-Sanz and Gawlik, 2017), a proposal on 'minimum requirements for water reuse' has been published (EC, 2018b) and a Water Reuse Regulation was adopted in May 2020 ([32]). The aim is to support the transition to a more circular economy by increasing the efficiency of reuse of water resources and safeguarding Europe's water resources (EC, 2012).

Regional status and trends

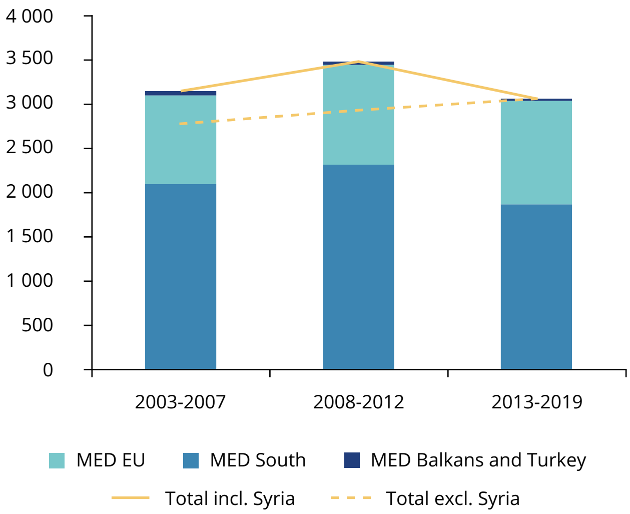
Based on the available data, an increasing trend overall in the direct reuse of wastewater over time in the Mediterranean region as a whole (excluding Syria) can be seen (Figure 3.27). There is significant uncertainty concerning the reliability of data on wastewater reuse, and contradictory country data were found in different sources. Methodological changes and revisions of

([32]) https://www.europarl.europa.eu/news/en/press-room/20200512IPR78921/parliament-approves-increased-water-reuse data series make it impossible to make a reliable comparison with the previous H2020 assessment. In terms of absolute volumes, wastewater reuse in the MED South subregion is significantly higher than in the other subregions. Syria had a particularly large volume of direct reuse of wastewater prior to 2013-2019, contributing strongly to the reused fraction in the MED South. This explains the observed drop in the volume of direct reuse of wastewater in the MED South in 2013-2019, for which data for Syria is not available. Data for the MED Balkans and Turkey subregion is unavailable, except for Turkey. Bosnia and Herzegovina reported the volume of direct reuse as 0.

Focus on the MED South

With the exception of a few countries, such as Israel, Jordan and Tunisia which rely heavily on wastewater reuse as a non-conventional source of water, the uptake of wastewater reuse in the MED South subregion has been slow and uneven despite the MED South being among the most arid and water-scarce regions in the world. In general, an increase in the proportion of directly reused wastewater since 2012 is observed in most countries (Table 3.18).

Figure 3.27 Volume of direct wastewater reuse (Mm^3/year)



Note: This overview is based on data delivered by MED South countries under H2020 reporting, supplemented by the AQUASTAT database (FAO, 2016) (see Annex C). Data for all three periods missing for: Albania, Bosnia and Herzegovina, Croatia, Lebanon, Libya, Montenegro and Slovenia. Data for Jordan 2013-2019 only; Morocco data refer to Mediterranean coastal hydrological basin (2003-2007 not available; 2008-2012 value is 0); Palestine 2003-2007 not available, and Syria 2013-2019 not available.

Source: Computed from H2020 reporting and (FAO, 2016).

Time-series data delivered by countries under the H2020 reporting mechanism clearly show the progress in direct reuse of wastewater (Figure 3.28). In particular, in Israel, direct reuse as a percentage of the treated volume increased from 72 % in 2003 to 86 % in 2019. This increase is specifically in tertiary treated wastewater. Over 90 % of reuse is for agriculture irrigation. In Jordan, the reuse of reclaimed wastewater, particularly domestic wastewater, is of great importance. The proportion of direct reuse is around 17-18 %. The national water strategy for Jordan has been updated to control and manage the use of all water resources according to environmental and public health regulations. The emphasis is on encouraging the (direct and indirect) reuse of treated wastewater, particularly in the Jordan Valley, as a major resource for agriculture. This is the largest consumer in Jordan, where around of 51 % of the total water budget is allocated for irrigation. In Tunisia, ~17 % of treated wastewater was reused in 2017, indicating an increase of 6 % since 2012. The largest volumes of reuse are indirect and are intended for aquifer recharge. Tunisia introduced a national reuse programme in the 1980s. The focus has been on valorisation of treated wastewater reuse as a strategic choice in response to the impacts of climate change. Despite government support, most farmers prefer groundwater irrigation over reused wastewater due to higher social acceptance. Time-series data for Palestine show that direct reuse was stepped up from less than 1 % in 2011 to a staggering 14 % in 2017. In Jordan, Palestine and Tunisia, most reused wastewater undergoes secondary treatment.

Morocco has also experienced an increase in water reuse, with reuse targeted mainly at agriculture and watering green spaces, and to a lesser extent industry. The estimated direct reuse fraction in the two coastal hydrological basins draining into the Mediterranean Sea increased from 0 % in 2010 to 48.1 % in 2019, compared to 12.9 % at the national level (Table 3.18). Water reuse in Morocco has been encouraged by several initiatives, including the adoption of a Water Law which incorporates specific provisions for the reuse of wastewater; publication of quality standards for water intended for irrigation; and a master plan for the reuse of treated wastewater in irrigation, targeting an increase in reuse (direct or indirect) at 325 Mm^3/year by 2030 (Morocco SEIS, 2020).

In Algeria, direct reuse increased by 7 % from 2011 to 2017, and is expected to continue increasing (Algeria NAP, 2016). Fourteen WWTPs in Algeria focus on the reuse of wastewater for agriculture. Limited data are available to assess the extent and progress of water reuse in Egypt. The 2030 Strategic Vision for the reuse of wastewater in Egypt projects an increase in reuse

Table 3.18 Overview of volume of direct wastewater reuse in the MED South countries before and after 2012

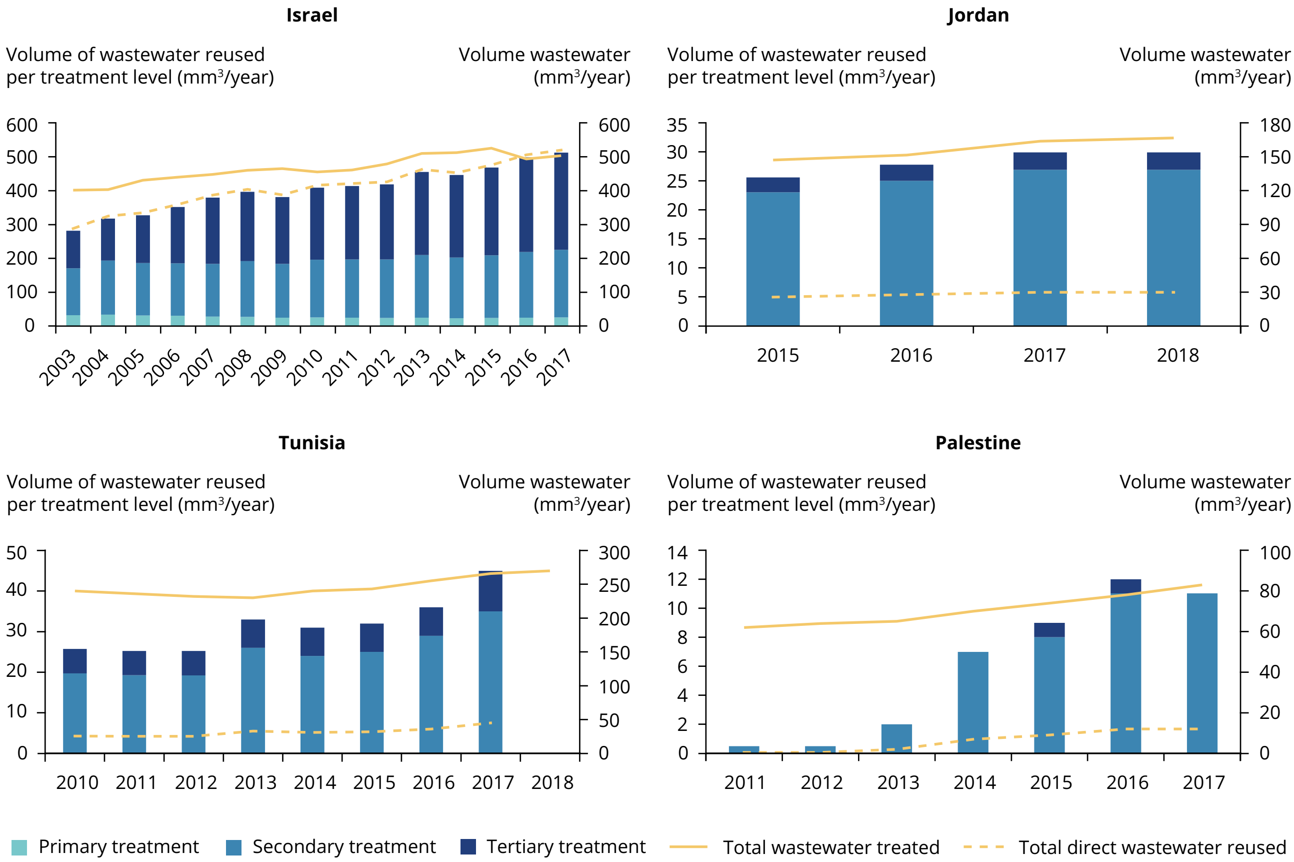
	Before 2012					After 2012					
	Year (2010-2012)	Volume of wastewater treated (Mm^3/yr)	Year	Volume of direct wastewater reuse (Mm^3/yr)	Estimated fraction of direct wastewater reuse (%)	Year (2017-2019)	Volume of wastewater treated (Mm^3/yr)	Year (2016-2019)	Volume of direct wastewater reuse (Mm^3/yr)	Estimated fraction of direct wastewater reuse (%)	Difference (%)
Algeria	2012	324.0	2011	17.0	5.2	2018	400.0	2017	50.0	12.5	7.3
Egypt	2012	4 013.0	2010	1300	32.4	2017	4 282.0	2016	1 200.0	28.0	-4.4
Israel	2010	455.0	2010	416.0	91.4	2017	503.3	2017	520.0	103.3	11.9
Jordan	2010	103.0				2018	166.6	2017	29.9	17.9	
Lebanon	2012	24.8									
Libya	2010	53.2				2017	6.7	2017			
Morocco	2010	18.3 (149.6*)	2010	0 (17.4*)	0 (11.6*)	2019	29.9 (382.0*)	2019	14.4 (49.5*)	48.1 (12.9*)	1.3
Syria	2012	550.0	2012	550.0	100.0						
Palestine	2011	62.0	2011	0.5	0.8	2017	83.0	2017	12.0	14.5	13.7
Tunisia	2012	232.0	2012	25.2	10.9	2017	266.0	2017	46.0	17.3	6.4
Total		**5 966.6****		**2 326.1****			**6 089.6**		**1 907.4**		

Note: * Morocco reported data for coastal hydrological basin and national data (indicated in brackets)

**Difference from Figure 3.24 due to Syria. Totals include national values for Morocco.

Source: see Annex C.

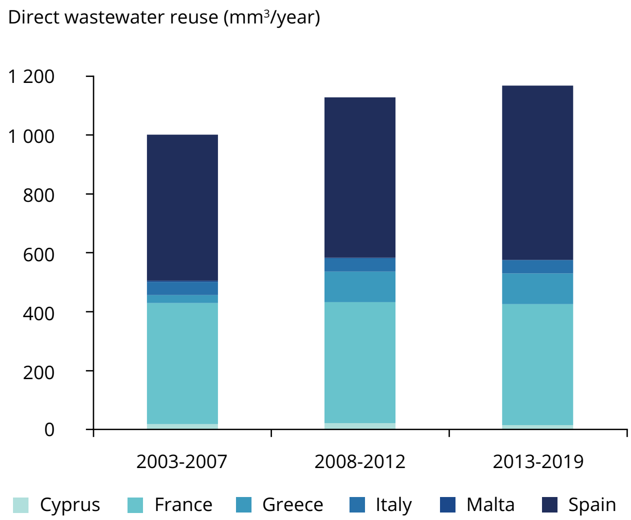
Figure 3.28 Volume of direct wastewater reuse per treatment level in selected MED South countries



Note: Total direct reuse for Israel include the fraction that goes back to nature

Source: H2020 reporting.

Figure 3.29 Volume of direct wastewater reuse in the MED EU subregion (Mm³/year)



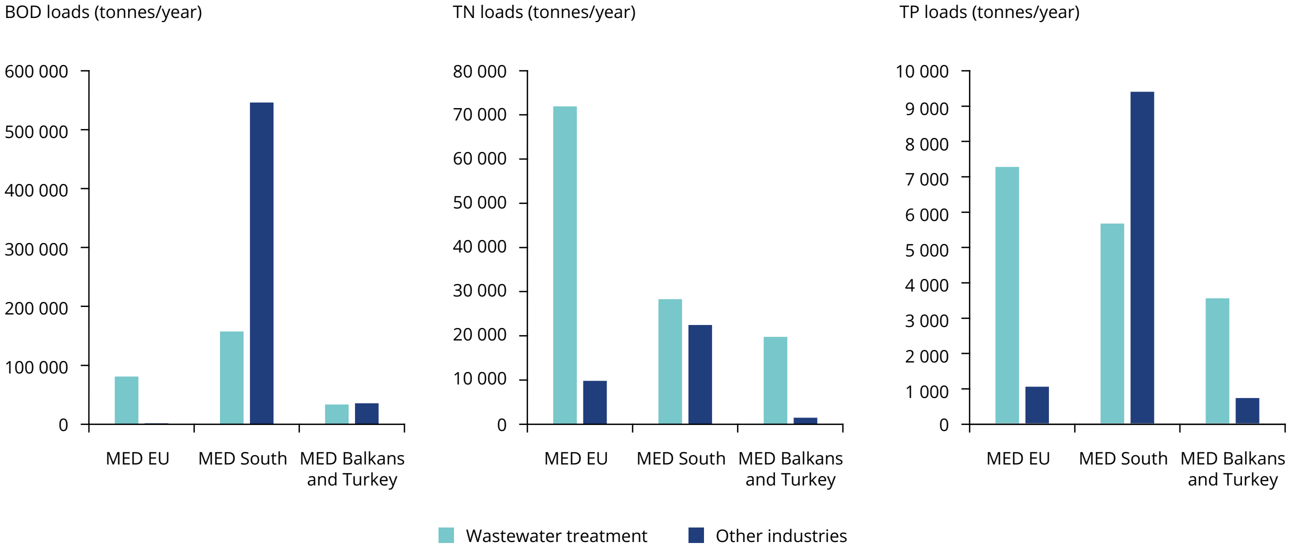
Source: Computation based on FAO-AQUASTAT (2016).

of secondary treated wastewater to 5820 Mm³/year to satisfy the annual demand from agriculture by 2030. It also proposes upgrading all primary treatment plants to secondary treatment by 2030 (AbuZeid and Elrawady, 2014).

Focus on the MED EU

The MED EU subregion shows a steady increase in the direct reuse of wastewater based on the available data. In absolute terms, France and Spain are the main contributors (Figure 3.29). Water reuse in Spain has been included in legal systems since the 1985 water law, enabling an increase in safe wastewater reuse over time, specifically in agriculture (45 %) and irrigation of parks and recreational areas (36 %) (Jodar-Abellan et al., 2019). In terms of percentage, Cyprus and Malta are the most advanced in reuse, with 90 % and 60 % of their treated wastewater reused, respectively. This is much higher than the European average of 2.4 % reported by Mudgal et al. (2015). Some countries are projected to have a large potential for wastewater reuse based on the capacity of their WWTPs (e.g. France, Greece,

Figure 3.30 Loads of BOD, TN and TP from WWTPs and other industries in coastal areas of Mediterranean countries (tonnes/year)



Note: Data for the MED South and MED Balkans and Turkey are from NBB 2018 reporting; data for the MED EU are from 2017 E-PRTR V17, following extraction of data for Mediterranean coastal river basin districts (RBDs). E-PRTR data only consider UWWTPs of over 100 000 p.e. which means smaller discharges are not included and hence actual loads are higher. Note that BOD loads in MED EU countries are estimated from TOC loads in E-PRTR using the conversion ratio BOD/TOC = 1.68 +/- 0.375, after Dubber and Gray (2010).

Source: See Annex C.

Italy and Spain). However, according to national experts from France, Greece and Italy, no large increase in reuse should be expected due to the high administrative burden and complexity associated with the application of standards (Mudgal et al., 2015).

Release of nutrients from municipal wastewater

The disposal of treated or untreated wastewater can be an important source of nutrients and organic substances in aquatic bodies, directly impacting water quality. High nutrient loads entering the Mediterranean from point sources, such as municipal treatment plants or sewage outfalls, can lead to eutrophication events in an otherwise nutrient-poor sea (see Section Coastal and marine quality). Industrial activities, such as power-generation plants, food and beverages, textile manufacturing, and the production of pulp and paper are another important source of nutrients depending on whether or not the releases are transferred to the collection system (see Section Industrial emissions). Although most point sources are land-based, others can be sea-based, such as aquaculture. Loads of nutrients from diffuse sources, such as agriculture, atmospheric deposition and mobile sources like shipping, are not included in the current assessment although their contribution is commensurate with point sources (e.g. Malagó et al., 2019).

The main substances to indicate nutrient enrichment are often BOD, total nitrogen (TN) and total phosphorous (TP), linking the release of nutrients from municipal wastewater to the concentrations in coastal and marine areas. A comparison of BOD, TN and TP from UWWTPs and other industries in Mediterranean coastal hydrological basins is provided in Figure 3.30. This overview is compiled from national baseline budget (NBB) reporting as part of the LBS Protocol by countries in the MED South and MED Balkans and Turkey, and E-PRTR reporting by MED EU countries (for more information, see section on Industrial emissions). The complete dataset used can be found in Annex C.

Nutrient (TN and TP) loads from wastewater treatment plants are generally higher than from other industries, in particular in the MED EU subregion where TN and TP loads from wastewater treatment plants amount to 90 % of total loads. This is in line with the conclusions drawn from the country industrial profiles discussed under the thematic assessment on industrial emissions (see section on Industrial emissions for more detail). However, in the MED South subregion, TP loads from other industries are higher, probably related to phosphate-mining activities in certain countries.

From the regional perspective, discharges of nutrient loads from WWTPs are regulated by a set of measures (legal, institutional and technical) stemming from the LBS Protocol, including Decision IG.19/7 'Regional Plan on the reduction of BOD5 from urban wastewater', adopted by the Contracting Parties to the Barcelona Convention in 2009. A mid-term evaluation of the existing regional plan (WG.473/14; UNEP/MAP, 2019) was carried out in 2019, which included a review of the status of implementation of measures and an analysis of the trends of discharges/releases. The evaluation indicated that the measures have yet to be fully implemented by all the Contracting Parties. Although most countries have met the deadlines for setting the ELVs for urban wastewater, around half have yet to consolidate formal authorisation, monitoring and reporting systems. Monitoring and reporting of discharges from municipal WWTPs are implemented in most MED EU countries, as well as Turkey, prompted by the enforcement of the UWWTD adopted in 1991. Although consolidation of the monitoring and reporting plans in Albania, Bosnia and Herzegovina, Egypt and Montenegro in currently under way, in other countries, for example, Algeria, Lebanon, Morocco and Tunisia, there is no evidence of the presence of sound monitoring systems. The status of wastewater treatment is primarily related to a country's economic situation, with advanced programmes found in the MED EU region compared to the MED South region. Analysis of reported data on releases from WWTPs as part of the mid-term evaluation (UNEP/MED WG.473/14; UNEP/MAP, 2019) did not lead to conclusive trends.

Apart from the new regional plan on municipal wastewater treatment, five new/updated pollution reduction regional plans are currently being developed, mandated by the COP20 (Tirana, Albania, December 2017) and adopted by COP21 (Naples, Italy, December 2019). These include regional plans for the management of sewage sludge and urban storm-water management; nutrient management from agriculture and aquaculture; and updating the regional plan on marine litter. The main elements of the proposed regional plan on municipal wastewater treatment include, among others, ELVs for BOD, chemical oxygen demand (COD), total organic carbon (TOC), TN, TP and other priority substances/emerging contaminants, based on sensitivity of the recipient environment, the application of BATs and BEPs, including energy saving or renewable/alternative energy sources for operating WWTPs and the promotion of solutions adapted to small agglomerations, such as NBS (e.g. constructed wetlands) (see Box 2.4). Other aspects related to wastewater management will be covered by the regional plan on sewage sludge from municipal WWTPs (Decision IG.24/10; UNEP/MAP, 2019).

The recent evaluation of the European UWWTD (EC, 2019c), with the aim of assessing whether the Directive is still fit for purpose 30 years after its adoption, showed that it has been highly effective in reducing loads of BOD, TN and TP from urban point sources (domestic/urban wastewater and similar industrial pollution). Modelling results show that, between 1990 (around the year when the Directive was adopted) and 2014, across the EU, BOD, nitrogen (N) and phosphorus (P) loads in treated wastewater fell by 61 %, 32 % and 44 %, respectively, clearly contributing to the improved quality of EU water bodies and ensuring the safety of EU bathing-water sites. Further reductions can be expected once the Directive has been fully implemented.

Coastal and marine water quality

Updated H2020 water indicators

- IND 5.1 Nutrient concentrations in transitional, coastal and marine waters
- IND 5.2 Bathing water quality

Water quality in transitional and coastal regions can be adversely affected by anthropogenic activities, such as the discharge of urban and industrial untreated wastewater, and diffuse sources such as agricultural and animal waste run-off, and the atmospheric deposition of airborne emissions from shipping and combustion processes. Although diffuse sources are not part of this assessment, understanding their trends could greatly boost progress in achieving GES in the Mediterranean Sea. The status of coastal and marine waters provides insight into the downstream part of the source-to-sea continuum affected by nutrient pollution pressures both in the coastal hydrological basin and on the coast. Water quality is thus not only important from an environmental perspective but also from a socio-economic one, considering that coastal tourism is a key economic activity in the Mediterranean region.

Nutrient concentrations

Higher nutrient concentrations (TN and TP) can lead to eutrophication and increased phytoplankton production. Nutrient enrichment and eutrophication have negative ecological impacts, such as potentially harmful algal blooms and oxygen depletion, affecting benthic communities and fish. The clear and transparent Mediterranean waters are the result of the oligotrophic nature of the basin which is characterised by low nutrient concentrations and low primary production and phytoplankton biomass. Although eutrophication is not an issue at the basin scale, it may commonly occur in sheltered marine water bodies, such as harbours and semi-enclosed areas subject to nutrient inputs from, for example, urban effluents, industrial discharges, and aquaculture activities as well as transboundary components, such as agricultural run-offs, riverine outflows, and airborne nutrient deposition. The Mediterranean's main coastal areas, historically known to be influenced by natural and/or anthropogenic inputs of nutrients, are the Alboran Sea, the Gulf of Lion, the Gulf of Gabès, the Adriatic, Northern Aegean and the SE Mediterranean (Nile-Levantine) (UNEP/MAP, 2017a). According to the 2017 Mediterranean Quality Status Report, nutrient concentrations in areas with available data were in line with characteristic values for coastal regions (UNEP/MAP, 2017a). In a recent assessment of nutrient enrichment and eutrophication in European seas (EEA, 2019b) through the application of the HEAT+ ([33]) tool, several coastal areas near the Mediterranean's largest cities were classified as eutrophication problem areas. However, both studies concluded that a full assessment of nutrient enrichment at the scale of the Mediterranean Basin was not possible due to the availability of insufficient data — both spatial and temporal — and a lack of science-based threshold values (EEA, 2019c; UNEP/MAP, 2017a).

In the absence of available and accessible data with appropriate spatial and temporal coverage (with the exception of Tunisia which reported nutrient concentrations under H2020), the use of CMEMS products based on satellite and model results was investigated using the ODYSSEA platform ([34]).

Using chlorophyll a (Chl a) concentration as a proxy for eutrophication and for hot spots of inorganic nutrient inputs, the maximum monthly concentration of Chl a in the 2003, 2012 and 2017 was retrieved based on CMEMS satellite products ([35]) (Map 3.2). The distributions of Chl a confirm that the Mediterranean Basin is largely oligotrophic in the centre, with a Chl a gradient from west to east. The recognised hot spots in the Alboran Sea, Gulf of Lion, Gulf of Gabès, Adriatic, Northern Aegean and the SE Mediterranean (Nile-Levantine) are clearly shown.

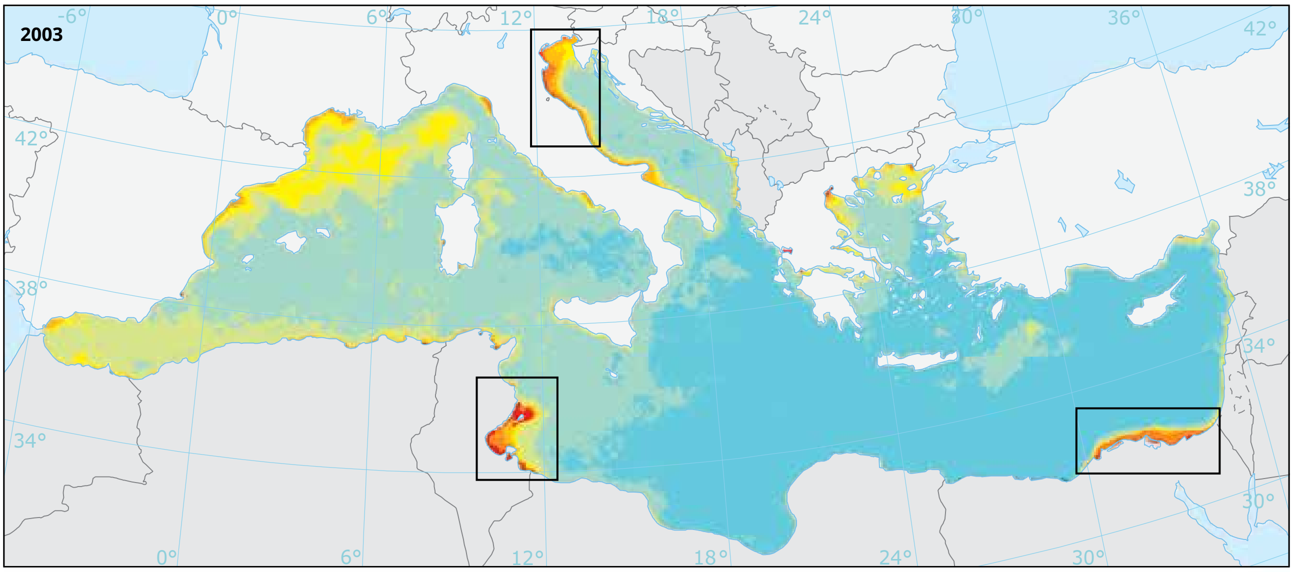
The potential use of CMEMS data products was further investigated by looking into nutrient concentrations between 2003-2017 in three hot spots: the outfall of the River Po in the Northern Adriatic, the outfall of the River Nile, and the Gulf of Gabès (Map 3.2), using the CMEMS reanalysis product ([36]). This reanalysis model for nutrient concentrations considers nutrient loads from rivers and other coastal nutrient sources based on the reconstruction of spatial and temporal water discharge variability, estimated according to the method described by (Ludwig et al., 2009). The aim was not to infer a full eutrophication assessment in these areas but to test the feasibility of using CMEMS products in future assessments as a way of overcoming limited spatial and temporal nutrient data coverage for the region. Therefore, results showing trends in Chl a and nutrients at these locations are not discussed but can be found in Annex C.

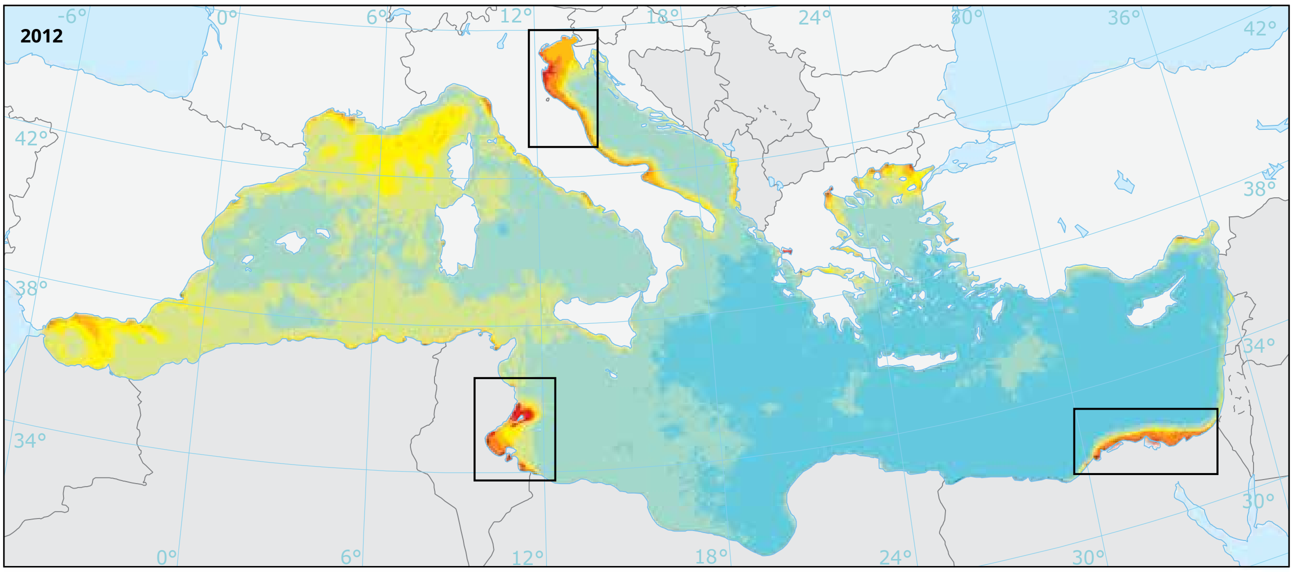
As CMEMS products for Chl a provide full spatial and temporal coverage, they can be used as a proxy to detect incidences of eutrophication and to identify potential hot spots for nutrient inputs. However, one shortcoming of the reanalysis product is that it does not take into account point sources, such as sewage outfalls, and aquaculture sites. Given the arid nature of the region, point sources are thought to make a relatively large contribution to overall coastal nutrient inputs. A second shortcoming concerns the nutrient form. The main H2020 indicator refers to TN and TP, with the inorganic nutrient forms of nitrate and phosphate among the sub-indicators; the parameters available in the CMEMS catalogue are limited to nitrate and phosphate. Analysis of these inorganic forms on their own is not enough to assess nutrient trends and coastal/marine water-quality issues. For the purpose of assessing eutrophication in the Mediterranean Sea, considering that eutrophication issues occur mainly in localised coastal areas, more specific localised data products that capture the main nutrient sources at the right spatial and temporal scale would be more fit for purpose than regional products.

In line with the conclusions from the QSR (UNEP/MAP, 2017a), data should be made more available to conduct a trend analysis of the key nutrient concentrations at eutrophication hot spots. The next priority is to improve the quality of monitoring data related to nutrients that are reported on a regular basis by Mediterranean countries to UNEP/MAP, in line with IMAP Common Indicator 13. According to Decision IG. 22/7 adopted in COP19 (UNEP/MAP,

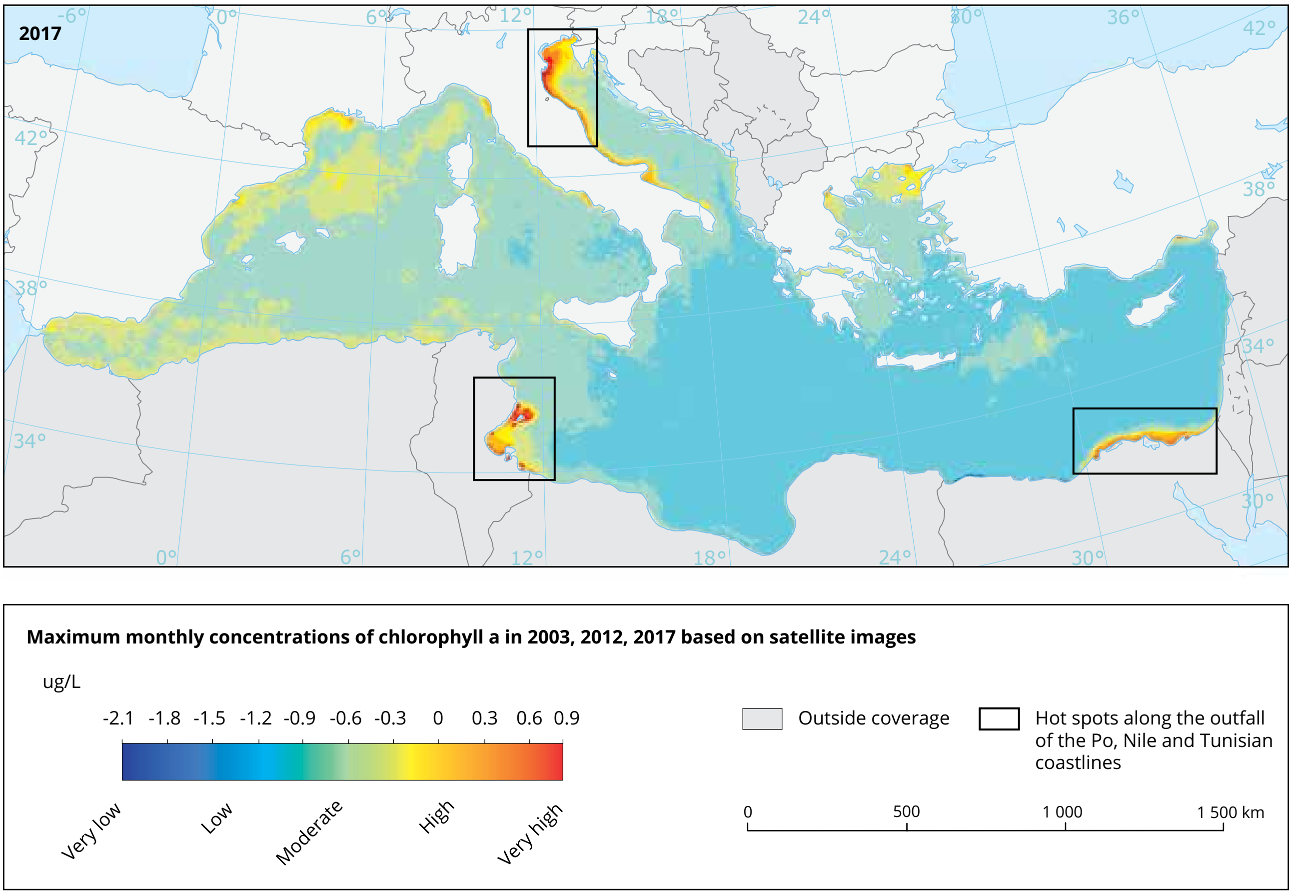
([33]) HEAT+: the new version of HELCOM eutrophication assessment tool (HEAT) developed for purpose of pan-European assessment.
([34]) http://odysseaplatform.eu/
([35]) OCEANCOLOUR_MED_CHL_L4_REP_OBSERVATIONS_009_078
([36]) MEDSEA_REANALYSIS_BIO_006_008: A reanalysis of Mediterranean Sea biogeochemistry at 1/16 degree was carried out over time starting from 1999, using the MedBFM biogeochemical model and data assimilation of surface chlorophyll concentration. This reanalysis provides on a monthly basis the averages of 3D fields of chlorophyll, nutrients (phosphate and nitrate) and dissolved oxygen concentrations, net primary production, phytoplankton biomass, ocean pH and ocean pCO_2.

Map 3.2 Maximum monthly concentration of chlorophyll a (ug/L) in 2003, 2012 and 2017





Map 3.2 Maximum monthly concentration of chlorophyll a (ug/L) in 2003, 2012 and 2017 (cont.)



Note: Chlorophyll hot spots along the outfall of the Po, Nile and Tunisian coastline are framed in red.

Source: Based on CMEMS data product OCEANCOLOUR_MED_CHL_L4_REP_OBSERVATIONS_009_078 through the ODYSSEA platform.

2016a) on Integrated Monitoring and Assessment Programme, and Decision IG. 23/6 adopted in COP20 (UNEP/MAP, 2019a) on the 2017 Mediterranean Quality Status Report, one of the priorities of the UNEP/MAP Programme of Work is to make progress on setting coastal water-type assessment criteria for reference conditions and boundaries for key nutrients in the water column, including their harmonisation across the Mediterranean region. This will significantly help the implementation of a clear sampling strategy with a simplified approach in monitoring, design and data handling for the future implementation of IMAP, as well as a complete assessment of eutrophication and GES achievement. It could also support quantification of the required nutrient load reductions through a more accurate determination of the 'distance to target' (EEA, 2019c).

Bathing water quality

Contamination from untreated wastewater degrades the quality of bathing water and poses health risks due to increased pathogenic concentrations. Bathing water quality is an important indicator for the region. On the one hand, it reflects the effectiveness of wastewater management, and on the other hand, it safeguards the epidemiological safety of Mediterranean beaches that are important for recreation and tourism. Bathing water quality is measured as the percentage of bathing water samples with intestinal enterococci concentrations within established standards, for which standards and criteria have been adopted in the Mediterranean ([37]) (Decision IG.20/9; UNEP/MAP, 2012) and which are also in line with the EU New Bathing Water Directive (2006/7/EC; EC, 2006).

([37]) IMAP Common Indicator 21: percentage of intestinal enterococci concentration measurements within established standards (EO9).

Regional overview

Bathing water quality is systematically and regularly reported across Europe and in part in the MED Balkans and Turkey. However, analysis of the trend in bathing water quality for the whole Mediterranean region is challenged by the lack of centralised and regular reporting in the MED South subregion, even though some countries having excellent national bathing-water-quality monitoring programmes in place. Other countries, such as Palestine, confirmed that bathing-water-quality data are not available. To assess bathing water quality at the regional level, fragmented data from different sources were put together: H2020 reporting, NAPs, WISE data reported to the EEA, and reporting under the European Bathing Water Directive. Based on available data, a regional overview of the percentage of excellent, good or sufficient, poor and not classified bathing waters is provided (Figure 3.31).

Focus on the MED South

Significant gaps in the data limit full subregional coverage for the MED South. However, reporting under H2020 shows marked improvements in the bathing water quality in specific countries (Figure 3.32).

Since 2010, Israel has been monitoring intestinal enterococci and reporting the percentage of samples with excellent results. As these are authorised public beaches, 14 km of Israel's shoreline are monitored for bathing water quality. When concentrations of the regulated beaches exceed the qualifications for excellent bathing water, bathing is prohibited (Israel NAP, 2015). In 2017, a total of 6 030 samples were taken from over 70 regulated beaches, of which the average excellent percentage was 96 %. As part of efforts to combat marine pollution, Tunisia monitors bathing water quality through a network of more than 500 sampling locations, managed by the Ministry of Health. Data for 2018 shows that 55 % of the beaches are of good to very good quality. Particular attention, however, must be paid to other beaches considered unsuitable for bathing (~15 % classified as bad or very bad) (Figure 3.32). Morocco has a national monitoring programme on bathing water quality and periodically publishes a national report on bathing water quality (Royaume du Maroc, 2016, 2019). In addition, national research laboratories responsible for pollution monitoring have developed an application called 'Iplages' which provides directly accessible information on bathing water quality for 169 Moroccan beaches from 45 stations. The information on monitored beaches is updated every 15 days ([38]).

According to the 2017 QSR (UNEP/MAP, 2017a), the lack of recent datasets on microbiological pollution in the Mediterranean Sea submitted to the MAP Secretariat is the main current gap and concern. Regular reporting of data in line with IMAP is required to assess whether or not levels of intestinal enterococci comply with established standards for GES.

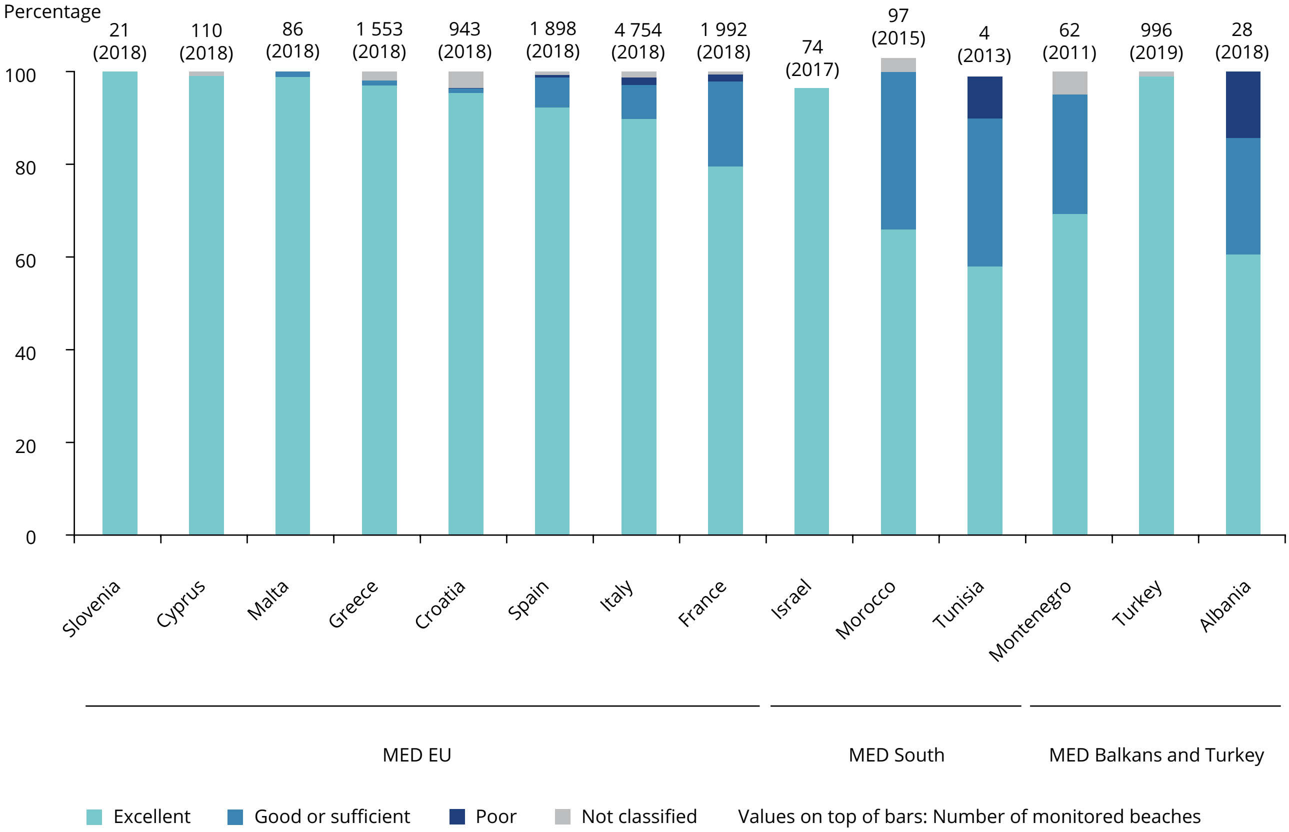
Focus on the MED EU and MED Balkans and Turkey

Analysis of bathing water quality in the MED EU is thorough and complete, thanks to the reporting established under the European Bathing Water Directive and the yearly report on bathing water quality published by the EEA. The percentage of excellent bathing water at the MED EU coastal beaches has been steadily increasing over time and has surpassed the EU average (Figure 3.33). Based on the EEA bathing water quality assessment (EEA, 2019c), the MED EU countries are among the countries with both the best and the worst bathing water quality in Europe. In the following countries, 95 % or more of bathing waters were found to be of excellent quality: Slovenia (100 % of 21 beaches), Cyprus (99.1 % of 110 beaches) and Malta (98.9 % of 86 beaches). At the same time, the three countries with the highest numbers of poor-quality bathing water sites in Europe were Italy (1.7 % of 4 754 beaches), France (1.4 % of 1 992 beaches) and Spain (0.5 % of 1 898 beaches) ([39]).

The proportion of bathing water sites with excellent water quality vary between 25-69 % in the MED Balkans and Turkey (Figure 3.33). However, no clear trend for this subregion can be deduced because of gaps in the data. Most of the Mediterranean beaches in Turkey have excellent water quality. The bathing water legislation in Turkey is also harmonised with EU Directive 2007/6/EC. In Albania, an improvement in bathing and overall water quality has been observed in recent years, associated with the construction of five WWTPs which provide wastewater treatment for almost half a million residents (EEA, 2019c).

([38]) http://www.environnement.gov.ma/images/a_la_une/Publications%20PDF/rapport-national-FR-eaux-de-baignade.pdf
([39]) 2019 data were published too late to be included in this assessment but are available in the latest bathing water quality assessment (EEA, 2020).

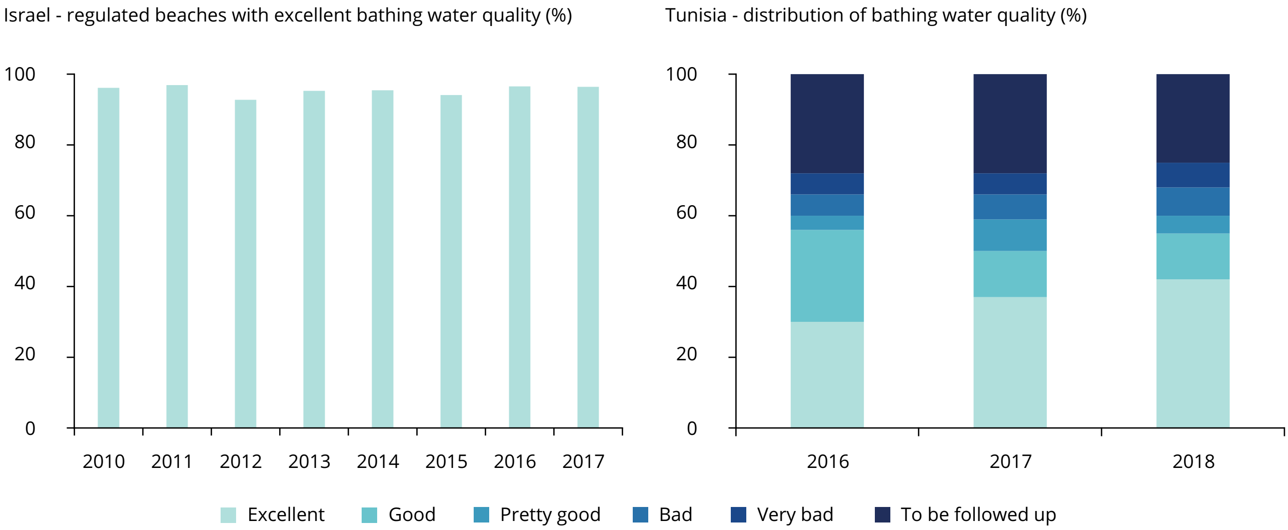
Figure 3.31 Status of coastal bathing water quality in Mediterranean countries in 2018 (%)



Note: Numbers at the top of each bar represent the number of beaches monitored and year, if other than 2018, in brackets. Tunisia uses a classification with seven categories — excellent, very good, good, satisfactory, to be monitored, bad, very bad (see Figure 3.32) adapted here to match the other countries.

Source: MED EU, Albania, Montenegro: (EEA, 2019c); Israel, Tunisia: H2020 reporting; Morocco: Morocco NAP (2016).

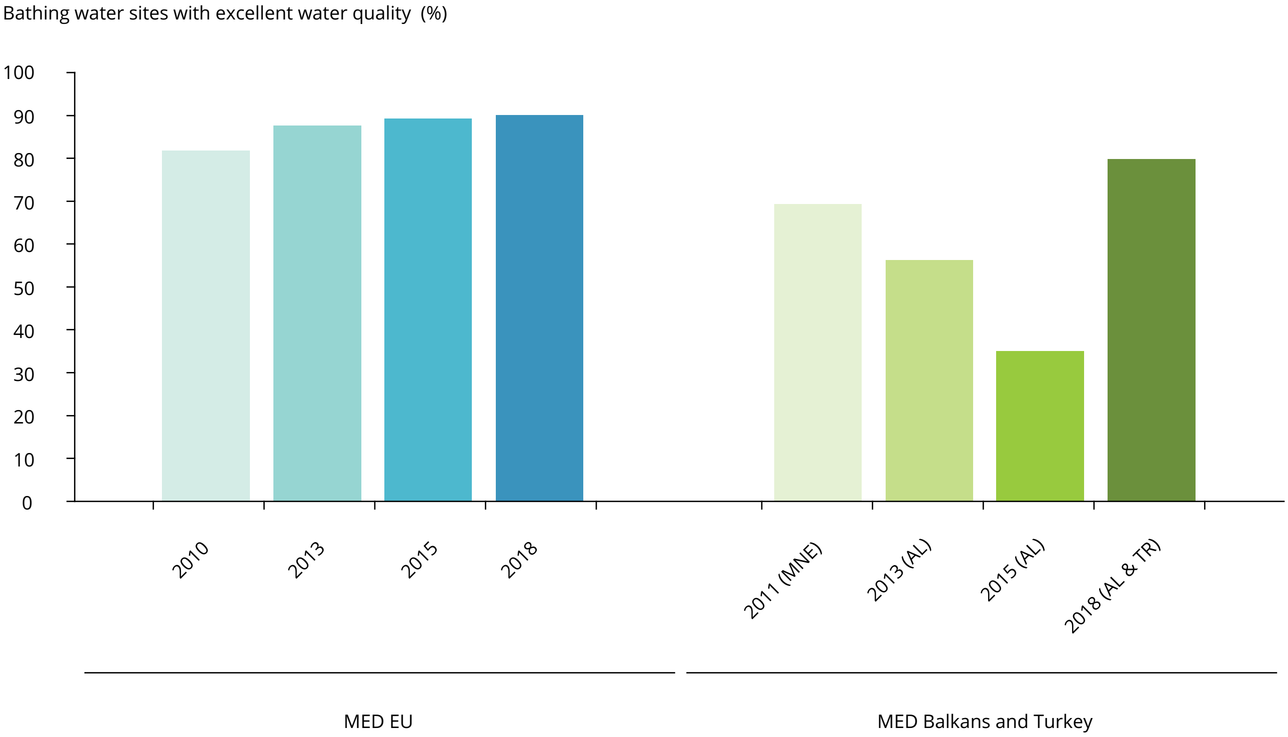
Figure 3.32 Bathing water quality in Israel and Tunisia (%)



Note: Percentage of regulated beaches with excellent bathing water quality in Israel (left); bathing water quality in Tunisia (right).

Source: H2020 reporting.

Figure 3.33 Evolution of the proportion of bathing water sites with excellent water quality in the MED EU and MED Balkans and Turkey between 2010 and 2018 (%)



Note: Date includes MED Balkans (Montenegro (MNE): 2011; Albania (AL): 2013, 2015, 2018; Turkey (TR): 2019 included under 2018), MED EU (2010, 2013, 2015, 2018).

Source: (EEA, 2019c) and Turkey personal communication.

3.2.5 Water data challenges

The water thematic assessment provides an in-depth analysis of the areas defined for water (sanitation, wastewater management and coastal/marine water quality) for the entire Mediterranean region. This assessment was primarily based on data delivered by MED South countries as part of the H2020 reporting mechanism, supplemented by other national sources (e.g. NAPs, NBB) and regional and global databases to achieve full regional coverage as far as possible.

Data for countries in the MED EU and MED Balkans and Turkey were extracted from European datasets and databases, such as the EEA indicator on urban wastewater treatment, WISE Bathing water quality database, E-PRTR, etc. in an effort to achieve full regional coverage. In some instances, differences were encountered in methodologies, definition of indicators, units, etc. which may give rise to uncertainties and a fragmented analysis.

The use of data from global databases, specifically data for SDG indicators, raised concerns among some MED South countries. Countries did not always approve of or trust data from global databases, claiming that the source of data for international organisations is unknown and methodologies differ from national ones. For instance, in the case of access to SMSS (SDG 6.2.1), discrepancies between national and international data for the same indicator were explained by differences in methodologies pertaining to the consideration of septic systems that are regularly emptied and wastewater collected and transported as SMSS at the national level but only as basic sanitation internationally. Another example is the proportion of wastewater safely treated in Greece. According to SDG 6.3.1 data, the proportion of wastewater treated in Greece is < 50 % (Figure 3.23) whereas the corresponding EEA indicator identifies Greece as a leader in tertiary treatment (data shown as part of the MED EU subregional overview in Figure 3.24). It is important that countries are aware of these discrepancies and take action to justify or resolve them.

As for nutrient data, the use of CMEMS satellite and modelled data products was explored to overcome the issue of limited data availability and accessibility. Although the use of such products for assessments is promising, it comes with a series of challenges. Such regional products would need to be tailored (parameters, geographical scale, etc.) for policy-relevant assessments.

The most significant data gaps were encountered when populating the indicators related to the wastewater management chain (volume of wastewater generation, collection, treated, directly reused). Reliable time-series data for assessing trends of wastewater generated, collected, treated and reused for the whole Mediterranean region remain a challenge. Patchy datasets could be obtained by combining different sources, especially for more recent years. However, this led to discrepancies in values for certain parameters, raising questions about data quality. The lack of wastewater data for Egypt which, due to its size, dominates the subregional overview, is a shortcoming in the assessment of progress on wastewater management. While efforts have been made in terms of regional data and infrastructure, many challenges remain in terms of harmonising and centralising databases, in particular related to wastewater data.

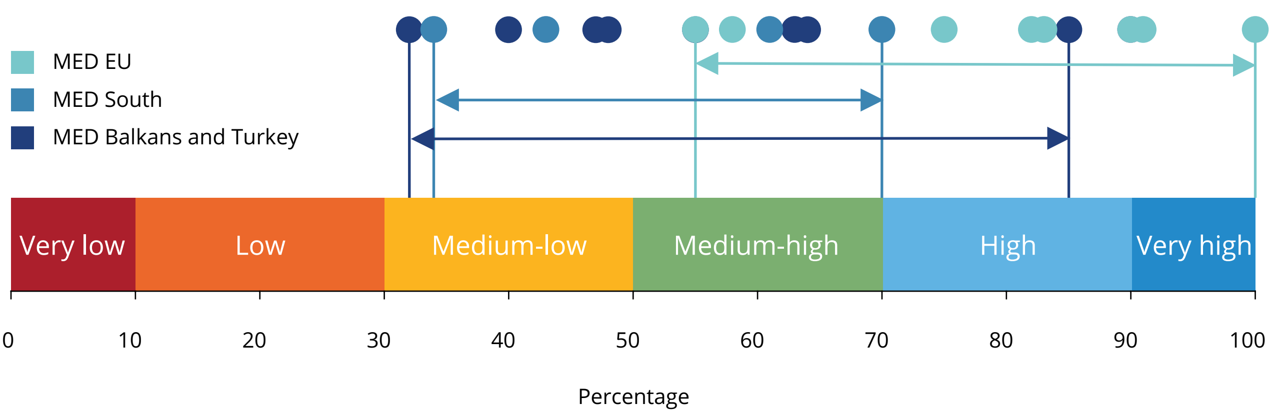
In the framework of H2020, the most appropriate geographical scale for assessing progress on water is the coastal hydrological basin. Despite efforts to focus on the coastal hydrological basin scale — for example, the release of nutrients from municipal WWTPs located in the coastal hydrological basins; and the assessment prepared by Morocco which focuses on the Tanger-Tétouan-Al Hoceima and l'Oriental regions located on the Mediterranean coast — developing sound methodologies for downscaling national data to the appropriate scale remains a challenge.

Progress on the development of national water information systems to support data sharing and exchange is assessed in Section B.

3.2.6 Towards more integrated management of water resources

As regards water, there is a clear move from addressing water quality issues per se to integrated water resource management. IWRM promotes coordinated and inclusive approaches for the development and management of resources, in line with SDG 6.5 which aims to implement IWRM at all levels. SDG 6.5.1 indicator tracks the *'Degree of integrated water resources management implementation (0-100)'* by assessing the four key components of IWRM: enabling environment, institutions and participation, management instruments, and financing (UN Water, 2020b). SDG indicator 6.5.1. shows that IWRM implementation in the Mediterranean region ranges from medium-low (30-50 %) to very high (90-100 %) (Figure 3.34). MED South countries score from medium-low (30-50 %; IWRM elements are generally institutionalised and implementation is under way) to medium-high (50-70%; capacity to implement IWRM elements is generally adequate and elements are generally being implemented under long-term programmes), with the exception of Israel where the degree of IWRM implementation is high. The range across the Mediterranean shows that, given the importance of water management for sustainable development, implementation of IWRM should be accelerated in certain countries. Also, there are opportunities for strengthening the capacities for IWRM implementation in the MED South and MED Balkans and Turkey subregions through collaboration, knowledge transfer and support from the MED EU subregion. The next step is to extend the scope to coastal and marine areas through the source-to-sea approach which recognises the need to address marine pollution from land-based sources and to manage freshwater and coastal pollution issues in a holistic way.

Figure 3.34 Degree of IWRM implementation (SDG 6.5.1)



Note: SDG 6.5.1 baseline scores (0-100) grouped into the three subregions (blue — MED South; red: MED Balkans and Turkey; green: MED EU). Figure adapted from UN ESCWA (2019).

Source: UNSTATS, 2020.

3.3 Industrial emissions

3.3.1 Industrial emissions assessment — key messages

- **Industrial installations in the Mediterranean region need support to upgrade the infrastructure and retrofit their industrial processes** in line with BAT with increased resource-use efficiency and greater adoption of clean and innovative technologies in order to attain the target set by SDG 9.4.
- **Primary sectors that should receive support for implementing BAT are the manufacturing industries,** such as the food-processing and beverages industry and the chemical industry responsible for the release of nutrients; and the manufacturing of refined petroleum products and chemical industry principally responsible for the discharge of toxic substances.
- **Reporting by industries on their production activities and polluting effluents must be regulated** to ensure full coverage of sources in the country and to enable industry to mainstream environmental management within industrial facilities.
- Industrial sectors need a **stable legal framework and comprehensive regulations to attract finance and investment for sustainable industrial infrastructure** in the MED South countries to modernise industrial processes and ensure return on investment in a more efficient manner.
- **Increasing the technical capacity of national reference laboratories** with greater capacity for the enforcement authorities should be a primary concern at both the national and regional levels.
- MED South countries need **targeted capacity building related to industrial infrastructure** not only to ensure modernisation, optimisation and maintenance of their industrial processes, but also to increase the level of control of releasing and monitoring pollutants effectively. This could be reached by: (1) establishing a national system of pollutant and activity data monitoring involving all stakeholders, with stringent enforcement methods for large/medium installations; (2) developing an international capacity-building programme connected to national programmes or initiatives to reinforce the different countries' institutional and individual capacities and expertise to monitor pollutant releases and enhance the knowledge of permit-issuing authorities and inspectors; and (3) designing pilot and/or twinning projects on BAT and BEP coordinated with other programmes (at both the international and national levels) to integrate more energy and water efficiency in industrial processes leading to a reduction in pollutants, including greenhouse gas (GHG) emissions.

3.3.2 Why do industrial emissions continue to be a priority in the Mediterranean region?

Industrial activities constitute an important source of pollution by releasing emissions into the atmosphere, water and soil, generating waste, and depleting natural resources (EEA, 2019e). Pollution is the leading environmental cause of diseases and premature deaths worldwide. Nearly one in four deaths are linked to unhealthy environments, and are avoidable, based on a 2016 World Health Organization (WHO) study (Prüss-Üstün et al., 2016).

Industrial emissions released to air include GHG such as carbon dioxide (CO_2) and acidifying pollutants such as sulphur oxides (SO_x). Several industrial

Table 3.19 Overview of progress on the H2020 industrial emissions indicators per subregion

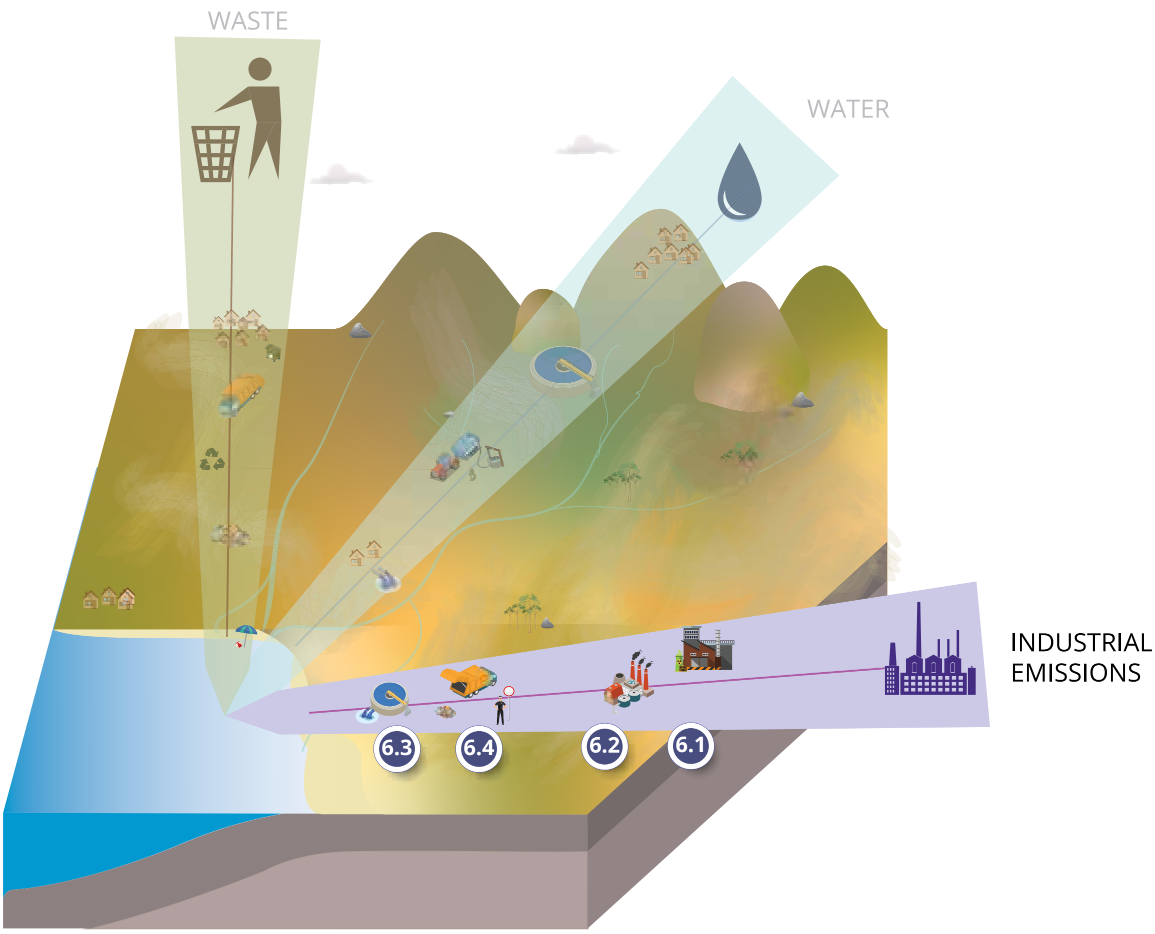
Industrial emissions	MED EU				MED South				MED Balkans and Turkey			
	Years		Outlook		Years		Outlook		Years		Outlook	
	2003	2014	2020	2030	2003	2014	2020	2030	2003	2014	2020	2030
Release of nutrients from industrial sectors	↗	↗	↗	↗		↘	↗	↗	↘	↗	↗	
Release of toxic substances from industrial sectors	↗	↘	↘			↘	↗	↗	↗	↘	↘	
Disposal of industrial hazardous waste	↗	↗	↗			↘	↗	↗	↗	↗	↗	
Compliance measures to reduce or eliminate pollutants from industrial sectors	↗	↗	↗			↘	↗	↗	↗	↗	↗	

Note: Rating for MED South is attributed considering the situation in most countries in the subregion.

air pollutants — including nitrogen oxides (NO_x), particulate matter (PM_{10}), volatile organic compounds (VOCs) and persistent organic pollutants (POPs) — have adverse impacts on human and environmental health. The release of industrial pollutants into water include compounds that contain nutrients, such as N and P that can cause eutrophication. Other relevant water pollutants are heavy metals, such as cadmium (Cd), lead (Pb), mercury (Hg) and copper (Cu), which have harmful effects on the environment and human health. In addition, industrial activities lead to soil contamination through the release of heavy metals, mineral oils and other types of hydrocarbons. These pollutants can negatively affect human health due to their carcinogenic, teratogenic or hormone-disrupting properties (EEA, 2019d).

Steps have been taken by all Contracting Parties in the Mediterranean region to monitor and control industrial pollution. From a regional perspective, industrial emissions are addressed under the LBS Protocol. Under the LBS policy and regulatory framework, 10 legally binding regional plans were adopted by the Contracting Parties to the Barcelona Convention, with concrete measures to prevent and control the release of nutrients, POPs, mercury and marine litter. At the national level, countries have adopted NAPs under the LBS regulatory framework, and introduced legal measures concerning ELVs for specific industrial sectors and/or specific pollutants, and environmental quality standards (EQSs) for receiving water bodies. The legislation encompasses measures regarding the establishment of monitoring and reporting systems for

Figure 3.35 H2020 industrial emissions indicators used to inform progress across the source-to-sea continuum



6.1 Release of nutrients from industrial sectors

6.2 Release of toxic substances from industrial sectors

6.3 Industrial hazardous waste disposed of in an environmentally sound manner

6.4 Compliance measures aimed at reduction of pollutants generated by the industrial sector

Source: ETC/ICM-Deltares.

SAP-MED priority pollutants, regulation of wastewater and air emission discharges from industrial and urban installations, and use of sanctions in the event of non-compliance. Of the 30 activity sectors primarily considered in Annex I of the LBS Protocol, 21 are industrial. Priority has been given to toxic, persistent and bioaccumulable pollutants (TPBs) owing to their effects on human health, biodiversity and the preservation of ecosystems and long-term/long-distance effects ([40]).

3.3.3 A 'source-to-sea' approach to the industrial emissions thematic area

Four core pressure and response indicators were developed, as illustrated in the source-to-sea releases of industrial pollutants depicted in Figure 3.35. These indicators reflect pressures exerted from industrial installations in terms of releases of nutrients and toxic substances into water (PAH and VOC to air) and responses taken by the countries; environmentally sound management of hazardous wastes; as well as compliance measures aimed at the reduction and/or elimination of pollutants generated by industrial sectors in the Mediterranean countries.

Box 3.11 Key questions

1. What are the main pressures (i.e. pollutant emissions) from the industrial sectors?
2. How are the trends in pollutant emissions related to the prevailing industrial sectors?
3. In view of existing data on pollutant loads, what is the regional data landscape on national and regional information systems?
4. What are the regional responses to preventing pollution from industrial sectors?
5. What are the key messages that can be extracted from this assessment to enable the countries to alleviate the adverse impacts of industrial emissions from land-based sources on the Mediterranean marine environment?

While this assessment provides an in-depth analysis of industrial pollution at the regional and subregional levels, the aim is to provide answers to 'five key questions' focusing on industrial emissions, as listed in Box 3.11. This is achieved by a quantitative analysis with available data for the four updated H2020 indicators (Figure 3.35).

Assessment findings are presented at the regional and three subregional levels: MED South, MED EU and MED Balkans and Turkey. It should be noted that the aggregated illustration at the subregional level (graphs, charts, etc.) may sometimes be impacted by the performance of an individual country. This is due to the heterogenous status of the countries clustered in these subregions, based on comparatively different socio-economic parameters such as size, economy and demographic performances, etc.

3.3.4 Approaches and tools for reporting pollutant releases from industrial facilities in the Mediterranean

Contracting Parties to the Barcelona Convention report their data and information on industrial emissions to the Mediterranean Pollution Assessment and Control Programme of UNEP/MAP in line with the legally binding requirements of the Barcelona Convention and its Protocols (Barcelona Convention, 1995; UNEP/MAP, 2012d). All Contracting Parties are legally mandated, as stipulated in Article 13 of the LBS Protocol, to report their inventory of pollutants into the Mediterranean Sea through the five-yearly (2003, 2008, 2013 and 2019) NBB. In the absence of an NBB, they should submit data and information obtained through their annually reported E-PRTR (E-PRTR; EEA, 2019) further to closing reporting gaps in order to convert E-PRTR data into NBB data.

A brief comparison of NBB and E-PRTR shows that the NBB is more detailed in terms of its sectors and sub-sectors. The NBB covers 30 sectoral categories and 97 subsectors, whereas the E-PRTR has 9 industrial activities and 65 subcategories. In terms of groups of pollutants, the NBB includes parameters such as BOD, COD and suspended solids (SS), whereas E-PRTR only considers TOC. Finally, it should be noted that NBB has

([40]) Less attention is paid to other pollutants, such as toxic and non-persistent or not-bioaccumulable substances, suspended solids, biodegradable organic matter and nutrients, because their effects are much more localised and less persistent in the marine environment.

Table 3.20 Links between NBB and E-PRTR main sectors and categories for industrial emissions

E-PRTR sector	Related NBB sector(s)
Energy sector	Production of energy
	Manufacture of refined petroleum products
Production or processing of metals	Manufacture of metals
Mineral industry	Manufacture of cement
	Manufacture of other inorganic chemicals
Chemical industry	Manufacture of other organic chemicals
	Manufacture of fertilisers
	Manufacture of pharmaceuticals
	Manufacture and formulation of biocides
Paper and wood	Manufacture of paper
Intensive livestock production and aquaculture	Farming of animals (cattle, sheep, swine, poultry) and slaughterhouses
	Farming of special animals (rabbits, goats, horses, asses, mules and hinnies, other)
Animal and vegetable products from the food and beverages sector	Farming of animals
	Aquaculture
Animal and vegetable products from the food and beverages sector	Food packing
	Agriculture
Other activities	Manufacture of textiles
	Tanning and dressing of leather

no thresholds for reporting releases of pollutants from industrial facilities, whereas E-PRTR applies specific thresholds for reporting.

The main sectors concerning this assessment and categories for NBB and E-PRTR are presented in Table 3.20. Detailed comparisons on the subsector and activity level for NBB and E-PRTR, respectively, are presented in Annex D.

Analyses in this report are based on reported loads which are an aggregation of releases of nutrients to water; aggregation of releases of heavy metals to water; and aggregation of toxic substances such as PAH and VOC to air. Both four cycles of NBB and E-PRTR (V17) constitute the two main sources of reported data used for this assessment on industrial releases, assumingly compliant with national and regional emission standards. In addition, data and information extracted from the Barcelona Convention Reporting System (BCRS) were used to assess the compliance aspect in the report ([41]). NBB reports are submitted by MED South countries as well as MED Balkans and Turkey. E-PRTR data are reported by MED EU countries. Data and information provided in the NBB reports are maintained in the NBB/E-PRTR Info System ([42]) which is embedded in the BCRS. This is a networked information system intended to provide overall support to NBB reporting. The system provides tools for managing, sharing and preserving data and information for MED POL users and Contracting Parties to the Barcelona Convention. E-PRTR data is maintained by the EEA and is accessible to the public ([43]).

The geographical scale for this assessment for MED South countries and MED Balkans and Turkey is based on the boundaries of the administrative regions in which the land-based sources of pollution affecting the Mediterranean Sea are located (pertaining to NBB data). The geographical scale for the MED EU countries is the hydrological basins delineated under the WFD, which flow into the Mediterranean Sea (pertaining to E-PRTR data).

Hence, for this assessment, four cycles of NBB reports are used for the countries in the MED South as well as the MED Balkans and Turkey. For MED EU countries, E-PRTR data reported in 2008, 2013 and 2017, referenced as E-PRTR V17, are considered. E-PRTR V17 includes detailed information on emissions and off-site

([41]) The BCRS provides records on the compliance of the Contracting Parties with implementation of the legally binding provisions of the Barcelona Convention and its Protocols https://idc.info-rac.org/

([42]) http://193.206.192.122/infomap/medpol/en

([43]) https://prtr.eea.europa.eu/#/home transfers of pollutants and waste from around 34 000 industrial facilities located in Cyprus, France, Greece, Italy, Malta, Slovenia and Spain ([44]). Data from Slovenia do not appear in this section since current emission sources into the Adriatic Sea from Slovenia are smaller than E-PRTR thresholds.

3.3.5 Key industrial emission trends

Updated H2020 industrial emission indicators

IND 6.1: Release of nutrients from industrial sectors:

- IND 6.1.1: Total BOD load discharged from industrial installations to the Mediterranean marine environment.
- IND 6.1.2: Total nitrogen load discharged from industrial installations to the Mediterranean marine environment.
- IND 6.1.3: Total phosphorous load discharged from industrial installations to the Mediterranean marine environment.

Assessment findings on the release of nutrients from industrial sectors

Many industries produce liquid wastewater with nutrients in their effluent with similar characteristics to discharged domestic wastewater from UWWTPs. Their main pollutants are biodegradable organic matter, N, P and suspended solids. Their pollution load may be reported and measured as BOD load and/or TOC.

The principal industrial sectors which contributed to the BOD loads discharged to the Mediterranean in their wastewater in 2018 are shown in Figure 3.36. For the MED South countries, the predominant sector is the food-packing industry which discharged more than two thirds of the amount of BOD loads, followed by agriculture and farming of animals at almost one quarter (National Baseline Reports — NBB, 2018).

For the MED Balkans and Turkey, the principal sector is the food-packing industry which discharged almost half of the BOD loads followed by the manufacturing of textiles (mostly in Turkey), and agriculture and farming of animals which together discharged almost one third of BOD loads.

For the MED EU countries, based on 2017 figures, the principal industries discharging nutrients are the chemical industry and paper and wood production, each constituting more than one third of the discharges. These are followed by the energy sector at almost one quarter of the discharged amount (E-PRTR V17, EEA 2019).

It is worth mentioning that aquaculture is an emerging sector in the region. For example, in 2014, Albania's marine fisheries constituted 68 % of the aquaculture sector (FAO, 2019a). In Turkey, the aquaculture sector has steadily grown since 1995 with exports of fish and fishery products worth USD 858 million in 2017 (FAO, 2019b). Similar growth is observed in Greece, where the export net worth of fishery products was reported at USD 743 million in 2013 (FAO, 2019a).

To assess releases of nutrients from industrial facilities in the Mediterranean countries, three sub-indicators were developed. These relate to the release of BOD, TN and TP. Discharged loads and trends for these pollutants at the country level for 2003, 2008, 2013 and 2017/2018 are presented below.

Loads and trends in the discharge of BOD

The BOD load is reflected in H2020 sub-indicator 6.1.1. The indicator is calculated on data obtained from four cycles of NBB pollutants reports and from the E-PRTR V17 ([45]). Figure 3.37 shows the BOD loads and their trends from 2003 to 2018 for the industrial sectors in MED South countries as well as MED Balkans and Turkey (NBB Reports — 1st to 4th Cycles, 2003-2018). Figure 3.38 shows loads and trends for TOC ([46]) in a number of MED EU countries (EEA, 2019f).

As can be inferred from Figure 3.37, discharged BOD loads for reporting countries from the MED South countries as well as MED Balkans and Turkey vary on average between 1 000 and 70 000 tonnes per year, with the exception of Algeria where discharged BOD loads are in excess of 400 000 tonnes/year.

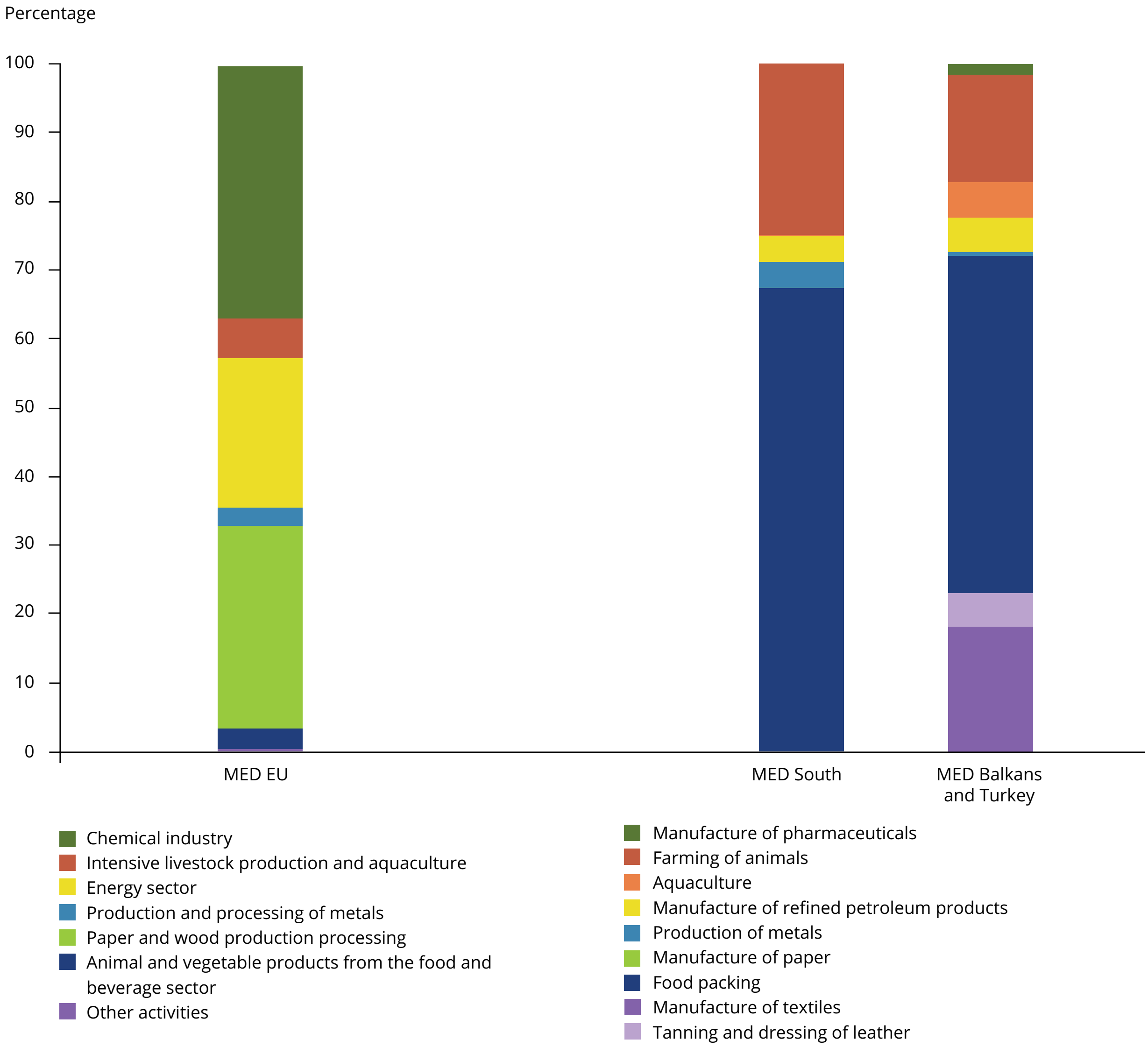
As regards trends in BOD discharge, Figure 3.37 does not yield a clear conclusion at the regional level.

([44]) https://ec.europa.eu/environment/industry/stationary/index.htm

([45]) Both the NBB and the E-PRTR aim to provide the most accurate data on pollutants released into the environment. Although their set-up and content are of similar characteristics, they vary in several aspects, as explained in Annex III.1. For the purpose of this assessment, data acquired from the pollutant loads released into the marine environment for the four cycles of NBB reporting (2003, 2008, 2013, 2018) and the three E-PRTR reports (2008, 2013, 2017) were analysed.

([46]) BOD is not used in regular E-PRTR reporting by EU Member States. Instead, the parameter TOC is utilised to measure the amount of carbon found in an organic compound and is often referred to as a 'non-specific indicator of water quality'.

Figure 3.36 Percentage distribution of BOC/TOC loads by industrial sector, discharged directly or indirectly into water



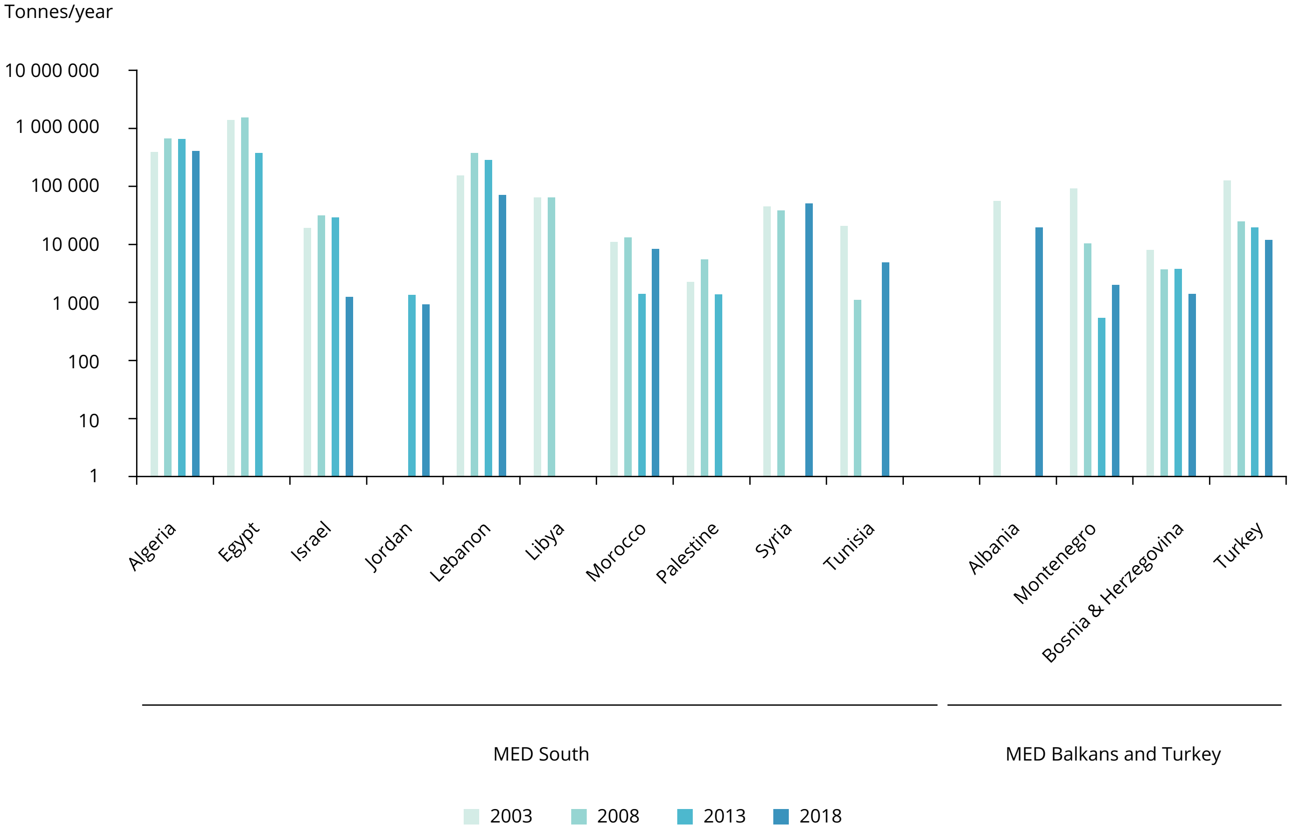
E-PRTR Sector
Chemical industry
Intensive livestock production and aquaculture
Energy sector
Production and processing of metals
Paper and wood production and processing
Animal and vegetable products from the food and beverage sector
Other activities

NBB Sectors
Manufacture of pharmaceuticals
Farming of animals
Aquaculture
Production of energy
Manufacture of refined petroleum products
Production of metals
Manufacture of paper
Food Packing
Manufacture of textiles
Tanning and dressing of leather

Note: Horizontal representation as a proportion of the loads per industrial sectors to the total reported loads. Total loads are an aggregation of the loads reported by each country, either to the NBB Info System or E-PRTR system. Percentage discharges of BOD in the MED South and MED Balkans and Turkey from the principal industrial sectors. Releases for the MED EU refer to TOC.

Source: NBB Reports — 4th Cycle 2018, E-PRTR V17; EEA (2019f).

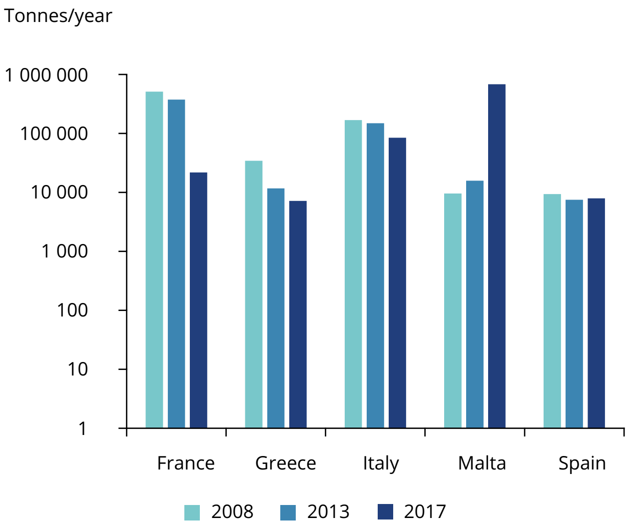
Figure 3.37 BOD loads from industrial sectors in the MED South and MED Balkans and Turkey



Note: Datasets plotted in logarithmic scale.

Source: NBB, 2003, 2008, 2013 and 2018.

Figure 3.38 TOC loads from industrial sectors in selected MED EU countries



Note: Datasets plotted in logarithmic scale.

Source: E-PRTR V17; EEA (2019f).

Variations in loads between 2003, 2008, 2013 and 2018 may be due to reporting issues related to methods of estimating discharged loads as well as the accuracy of the number of inventoried industries in different cycles. Nevertheless, a general decrease in observed BOD releases can be inferred from Figure 3.37 in Bosnia and Herzegovina, Israel, Montenegro and Turkey and a slight decrease for Lebanon. For Israel and Turkey, this decrease may be attributed to the stringent implementation of legislation and enforcement procedures on industries. For Montenegro, the decline in BOD releases may be attributed not only to further improved implementation of relevant national legislation but also to a shift in economic activities primarily to tourism and services.

As for the MED EU countries, releases of TOC into the Mediterranean are shown in Figure 3.38. As can be seen, discharges of TOC varied from 300 to almost 7 000 tonnes in 2017 ([47]). Trends in discharged loads indicate a general decrease in the release of TOC for France, Greece and Malta. For Italy and Spain, a slight increase can be seen.

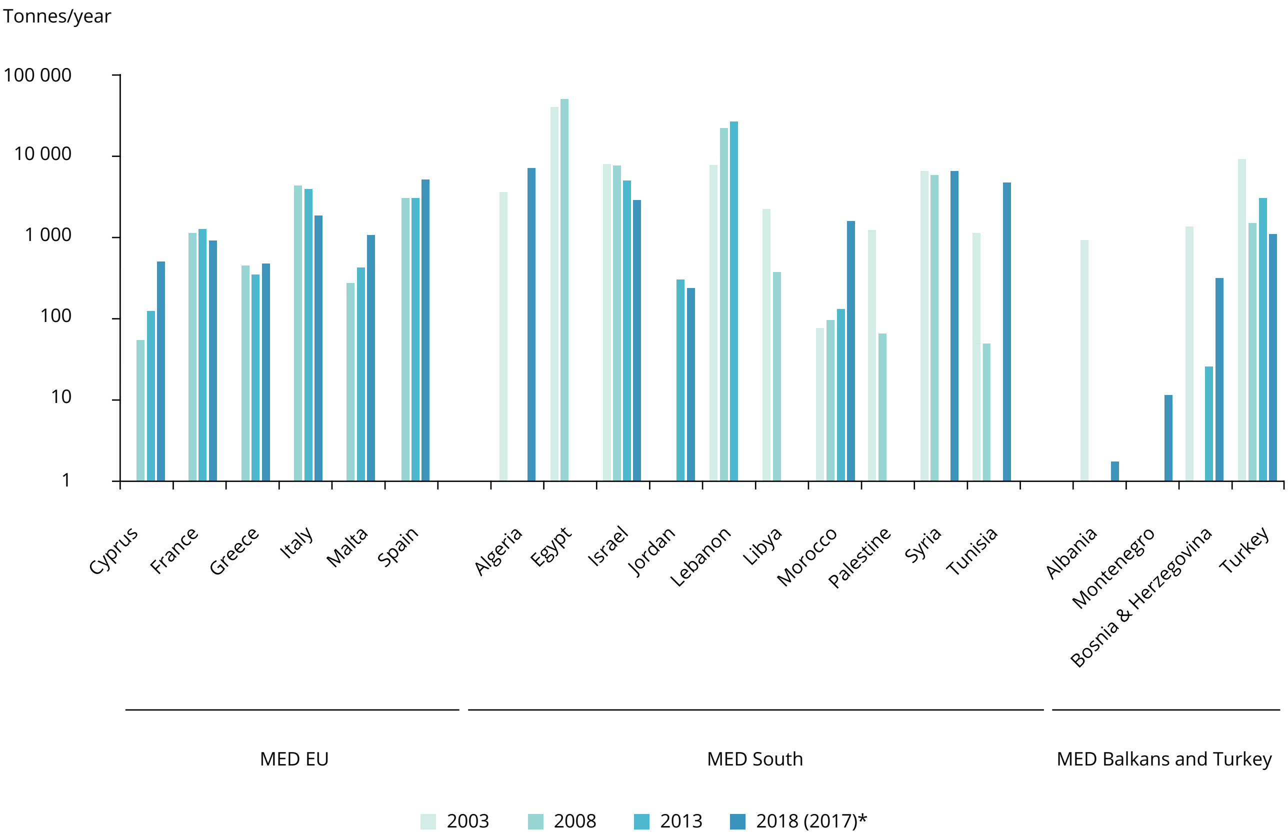
In order to assess the relative contribution of UWWTPs to the discharge of TOC to water, country industrial profiles for each MED EU country were analysed (EEA, 2019a). For Malta, discharges are released by a single sector, i.e. waste management. For France, 53 % of the TOC contribution originates from wastewater treatment, whereas 23 % and 13 % can be traced to the pulp, paper and wood industry, and to the food and beverages industry, respectively. For Greece, the wastewater sector amounts to 95 % of the TOC load, whereas only 5 % is attributed to the energy supply sector. For Italy, 77 % is contributed by wastewater treatment; 10 % and 5 % are attributed to the energy supply and chemical sectors, respectively. TOC contribution in Spain is 76 % from wastewater treatment, and 11 % and 6 % from the chemical sector and pulp, paper and wood sector, respectively.

Loads and trends in the discharge of total nitrogen

TN load is reflected in the H2020 Indicator 6.1.2, which is calculated on data obtained from four cycles of NBB reports and from the E-PRTR V17 (EEA, 2019f). Figure 3.39 shows the TN loads and their trends from 2003 to 2018 for the industrial sectors in the MED South, MED Balkans and Turkey (NBB, 2003, 2008, 2013, 2018) as well as MED EU countries (E-PRTR V17; EEA, 2019f).

At the regional level, and as can be inferred from Figure 3.39, discharged TN loads in 2018 for reporting MED South countries vary widely from 200 to 7 000 tonnes per year. For Montenegro and Turkey, TN loads vary from 10 to 1 100 tonnes. For MED EU countries, TN loads varied from 500 to 5 000 tonnes in 2017.

Figure 3.39 Cumulative loads of TN from industrial sectors, discharged directly or indirectly into water per country



Note: Datasets plotted in logarithmic scale.*For MED EU, year is 2017.

Source: NBB Reports — 1st to 4th Cycles: 2003, 2008, 2013, 2018; E-PRTR V17; EEA (2019f).

([47]) Discharges from UWWTPs are excluded.

Further to the assessment of the country industrial profiles for each MED EU country, there is an indication that the relative contribution of UWWTPs is about 85 % to 90 % of TN releases at the subregional level (MED EU countries). At the national level, and according to the country profiles, France releases 5 % and 3 % of TN loads from the chemical and energy supply sectors, respectively. Greece discharges 4 % from the chemical sector. For Italy, 4 % is attributed to the chemical sector and 4 % to waste management. In Spain, 2 % of discharged TN is from the chemical sector. Malta is different as all of the TN loads emanate from the energy sector. Lastly, for Cyprus, TN is released principally from WWTPs (EEA, 2019a).

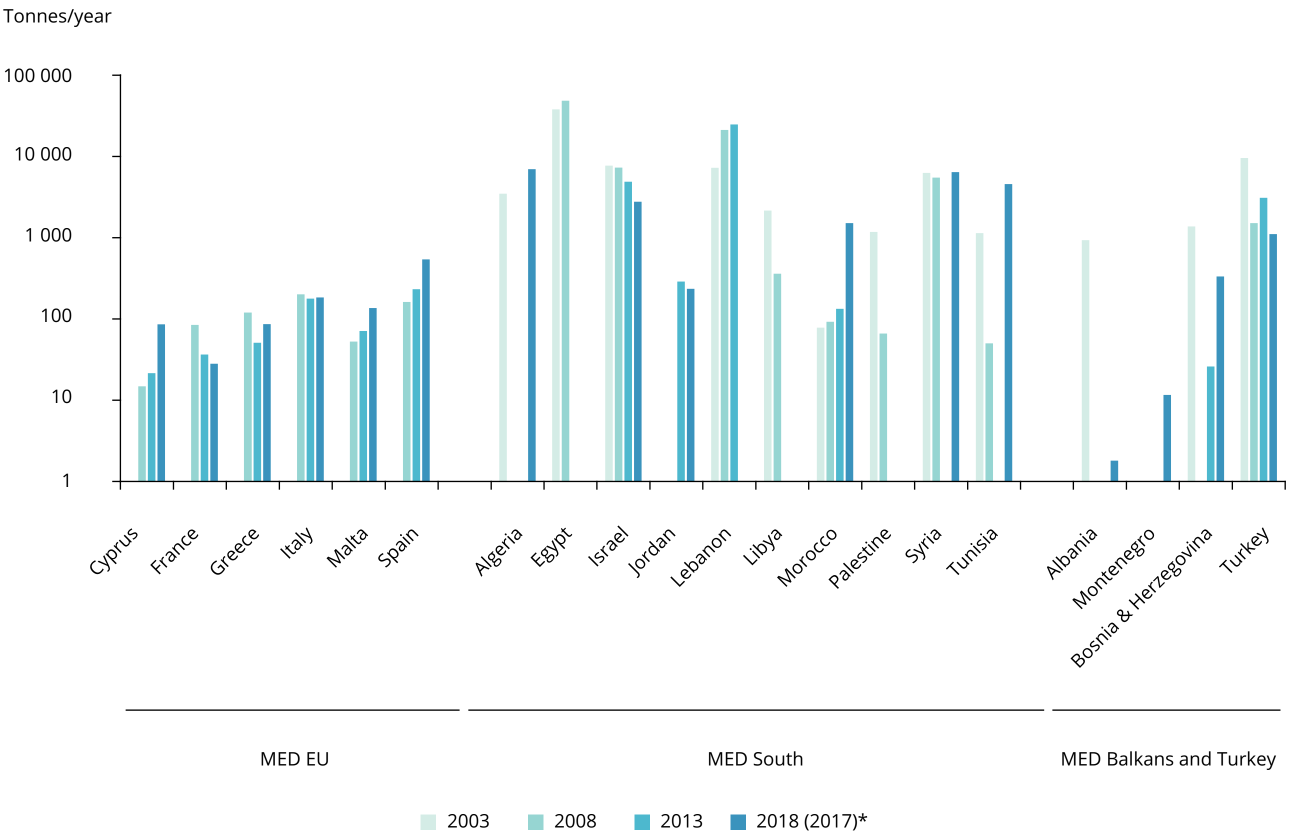
As regards trends in releases of nitrogen, and as can be inferred from Figure 3.39, loads of discharged nitrogen from previous years do not yield a clear conclusion at the regional scale. However, a consistent decline in releases of TN is observed in Israel and Turkey which is in line with the decrease of BOD releases mainly from the food industry. This can be attributed to more stringent enforcement of legislation targeting industrial facilities. On the other hand, a slight increase is observed in Syria which can be explained by the massive movement of industries from other parts of the country to the conflict-free coastal zone.

Loads and trends in the discharge of total phosphorous

TP load is reflected in H2020 Indicator 6.1.3. The indicator is calculated on data obtained from the NBB Reports of 2003, 2008, 2013 and 2018, and from the e-E-PRTR (E-PRTR V17; EEA, 2019f) for 2008, 2013 and 2017. Figure 3.40 shows TP loads and their trends from 2003 to 2018 for the industrial facilities situated in the coastal zones in MED South countries, MED Balkans and Turkey, as well as in a number of MED EU countries.

At the regional level, and as can be inferred from Figure 3.40, TP discharged in 2018 for reporting countries from the MED South vary widely from 10 to 3 500 tonnes per year. For the MED Balkans and Turkey, TP loads do not exceed 400 tonnes per year. For MED EU countries, TP loads varied in 2017 from 30 to

Figure 3.40 Cumulative loads of TP from industrial sectors, discharged directly or indirectly into water per country



Note: Datasets plotted in logarithmic scale. *For MED EU, year is 2017.

Source: NBB Reports — 1st to 4th Cycles: 2003, 2008, 2013, 2018; E-PRTR V17; EEA (2019f).

540 tonnes per year. Clearly, discharged loads of TP are highest in the MED South countries.

Further to the assessment of the country industrial profiles for each MED EU country, there is an indication that the relative contribution of UWWTPs is about 90 % to TP releases at the subregional level (MED EU countries). At the national level, and according to the country profiles, the main TP contributor in Greece is the chemical industry which releases 6 % of TP discharge nationally (the remaining 94 % is due to UWWTPs). In France, the food and beverages industry contributes 4 % of TP loads, followed by the chemical industry with 3 %. For both Italy and Spain, 6 % is released by waste management.

As regards trends in the discharge of phosphorous, Figure 3.40 does not yield a clear conclusion at the regional level for MED South countries. Variations between 2003, 2008, 2013 and 2018 may be due to reporting issues related to the methods used to estimate discharged loads. For MED EU countries, but with the exception of France, there is a general increase in the release of phosphorus into the Mediterranean. Once again, discharged loads of TP are highest in the MED South countries.

Assessment findings on the release of toxic substances from industrial sectors

Updated H2020 industrial emission indicators

IND 6.2: Release of toxic substances from industrial sectors:

- IND 6.2.1: Total heavy metals load discharged from industrial installations to the Mediterranean marine environment.
- IND 6.2.2: Furans and dioxins load discharged from industrial installations to the Mediterranean marine environment.
- IND 6.2.3: Polycyclic aromatic hydrocarbons (PAH) load discharged from industrial installations to the Mediterranean marine environment.
- IND 6.2.4: Volatile organic compounds (VOC) load discharged from industrial installations to the Mediterranean marine environment.

Most Mediterranean countries have an important public industrial sector which is composed of large industries, such as energy production, oil refineries, petrochemicals, basic iron and steel metallurgy, basic aluminium metallurgy, fertiliser production, paper and paper pulp, and cement production. Of concern are the pollutants released by these industries in both liquid and gaseous states, comprising organic and inorganic substances that are toxic, persistent and bioaccumulable (TPBs). The former are referred to as POPs and the latter include some heavy metals such as Cd, chromium (Cr), Cu, Pb, Hg and zinc (Zn) as well as other organometallic compounds. Other pollutants of relevance include furans and dioxins (PCDF and PCDD), PAH, and VOC. These pollutants are generated in large quantities by the aforementioned industries and their discharge into the environment can cause damage to human health, ecosystems, habitats and biodiversity.

In 2017/2018, the principal sectors which contributed to the release of heavy metals into water are depicted in Figure 3.41 for the MED South, MED Balkans and Turkey and MED EU countries.

For the MED South countries, and further to data from the NBB Reports, 4th Cycle (NBB, 2018), the principal sector contributing almost 90 % to the release of heavy metals is manufacturing of refined petroleum products. For the MED Balkans and Turkey, the principal sectors are distributed mainly between the refining of petroleum products, tanning and dressing of leather, and the manufacture of cement, contributing in total to almost 75 % of releases. For MED EU countries, and further to data reported in 2017, the principal sector responsible for the release of almost 80 % of heavy metals (E-PRTR V17; EEA, 2019f) is energy production.

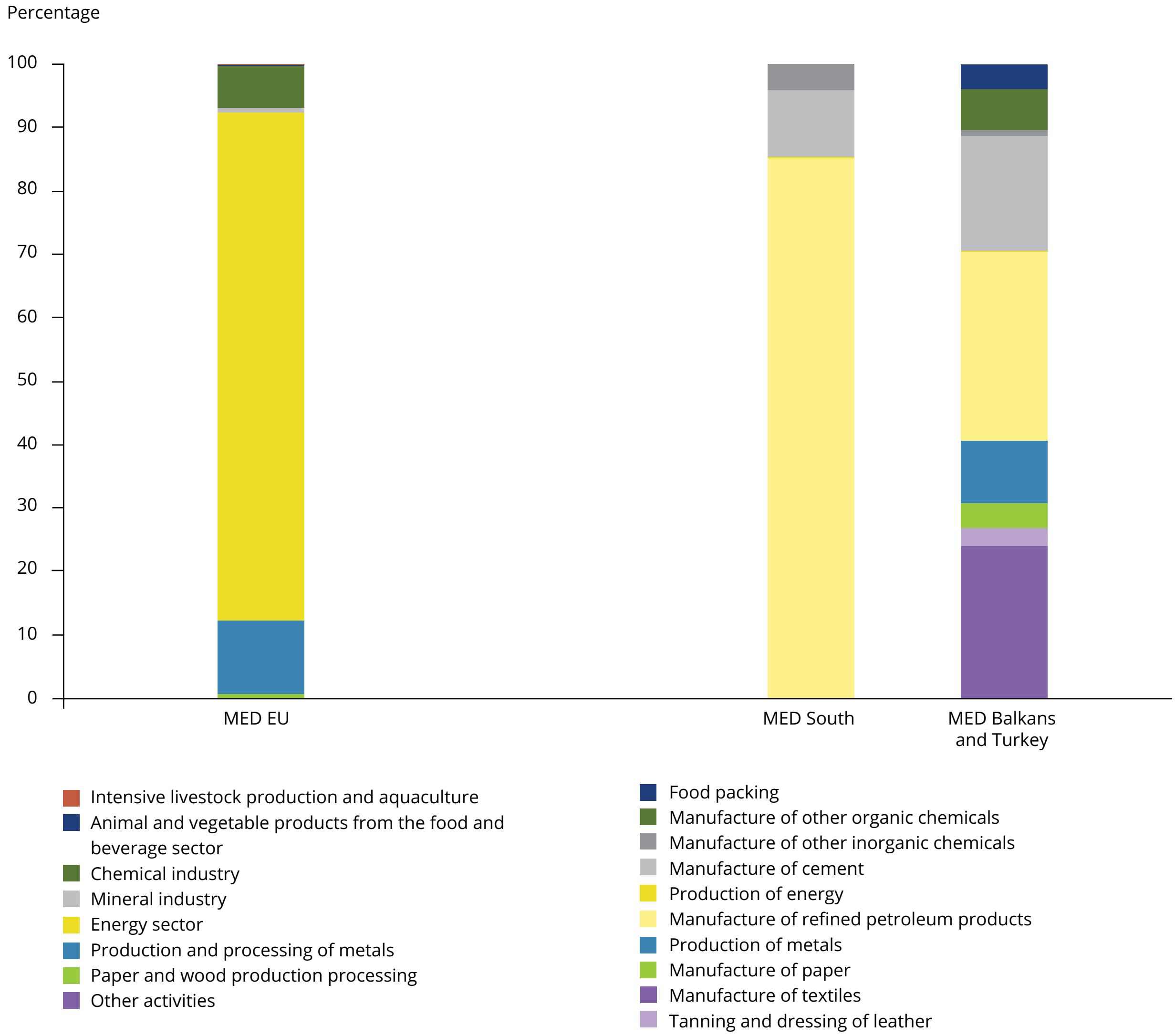
To assess releases of toxic substances from industrial facilities in the Mediterranean countries, four sub-indicators were developed. These relate to discharges of heavy metals (discharges to water), PCDF and PCDD, PAH and VOC. Discharged loads and trends for these pollutants at the country level for 2003, 2008, 2013 and 2018 are presented below.

Loads and trends in the discharge of heavy metals

Total heavy metals load is reflected in the H2020 Indicator 6.2.1 which is calculated based on data obtained from NBB reports (NBB, 2003, 2008, 2013, 2018) and from the E-PRTR V17. Figure 3.42 shows heavy metals loads (Arsenic (As), Cd, Cr, Cu, Hg, nickel (Ni), Pb and Zn) released into water and their trends from 2003 to 2018 for the industrial facilities in the Mediterranean countries.

At the regional level, and as can be inferred from Figure 3.42, discharged heavy metals in 2018 for reporting countries from the MED South varied on average from 1 000 to 100 000 kg/year, and in Albania and Turkey. Releases of heavy metals to water only

Figure 3.41 Percentage distribution of heavy metal loads by industrial sector discharged directly or indirectly into water



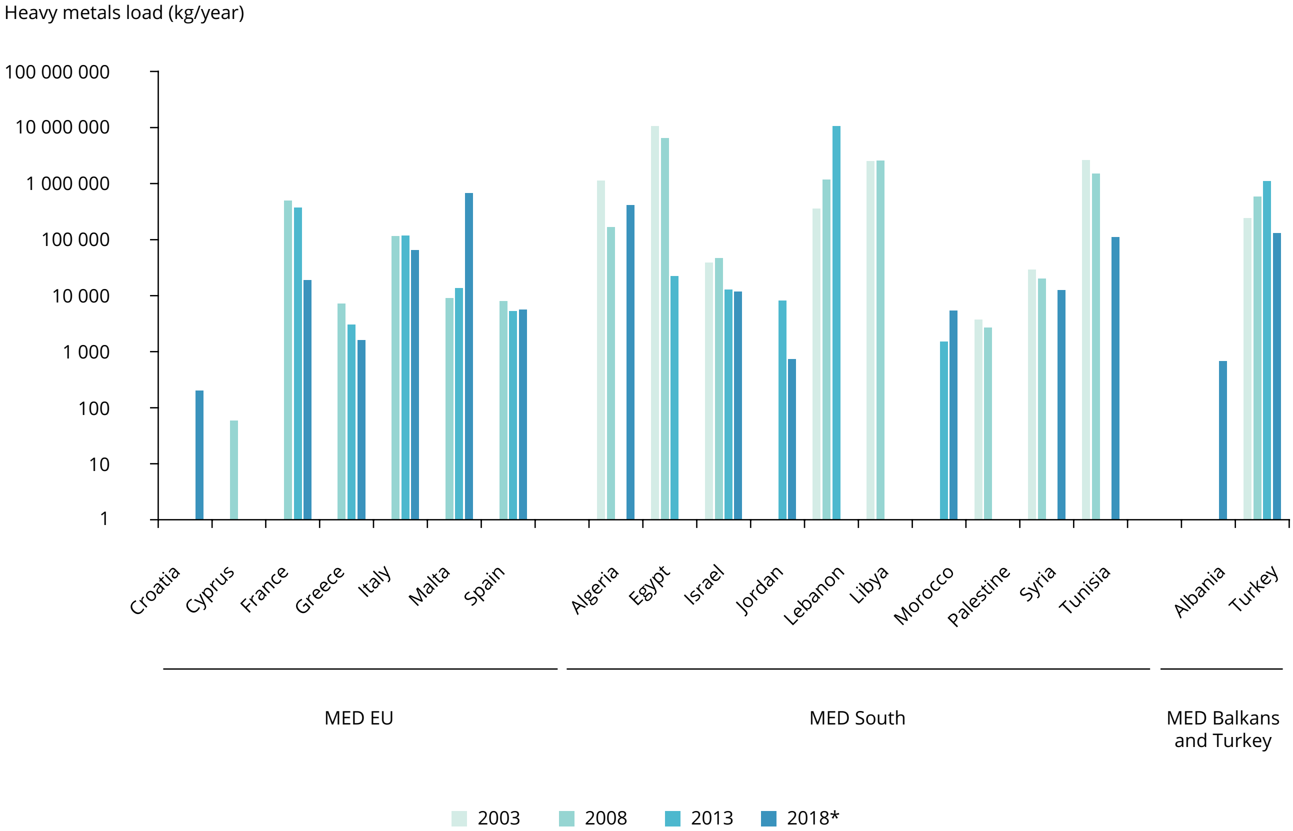
E-PRTR Sector
Intensive livestock production and aquaculture
Animal and vegetable products from the food and beverage sector
Chemical industry
Mineral industry
Energy sector
Production and processing of metals
Paper and wood production and processing
Other activities

NBB Sectors
Farming of animals
Aquaculture
Food Packing
Manufacture of other organic chemicals
Manufacture of other inorganic chemicals
Manufacture of cement
Production of energy
Manufacture of refined petroleum products
Production of metals
Manufacture of paper
Manufacture of textiles
Tanning and dressing of leather

Note: Horizontal representation as proportion of the loads per sector to the total reported loads. Total loads are aggregation of the loads reported by each country, either to the NBB Info System or the E-PRTR system.

Sources: NBB, 2018, E-PRTR V17; EEA (2019f).

Figure 3.42 Cumulative loads of heavy metals from industrial sectors, discharged directly or indirectly into the environment



Note: Datasets plotted in logarithmic scale. *For MED EU, year 2017.

Sources: NBB Reports — 1st to 4th Cycles: NBB, 2003, 2008, 2013, 2018, E-PRTR V17; EEA (2019f).

exceeded 400 000 kg/year in Algeria. For MED EU countries, heavy metal loads varied in 2017 from 200 to 65 000 kg per year, with the exception of Malta. Generally speaking, discharged loads of heavy metals are highest in the MED South countries.

At the national level, and in contrast to releases of nutrients, attributed mainly to UWWTPs, heavy metals are principally released from large industrial facilities. For instance, Albania reported five industrial facilities discharging heavy metals which are manufacturers of cement (Albania NBB, 2019). Bosnia and Herzegovina reported a single energy production facility and around 10 cement manufacturing plants as the main contributors to releases of heavy metals (Bosnia and Herzegovina NBB, 2019). In Israel, two fuel-manufacturing facilities and nine thermal-power-generation plants release most heavy metals into water (Israel NBB, 2019). In Lebanon, heavy metals are released mainly by 21 thermal-power-generation plants and other combustion installations as well as 8 mineral industries that produce cement clinker in rotary kilns (Lebanon NBB, 2019). In Tunisia, five relatively large cement manufacturing plants are reported to produce heavy metals (Tunisia NBB, 2018). Turkey has reported an increase of 54 % and 52 %, based on the industry density index ([48]), for energy production, and the transport and marketing of petroleum products sectors, respectively.

([48]) Industry index is a tool used in NBB to benchmark the number of industries in specific regions. It is used for comparison purposes for changes in the number of industrial facilities from one NBB cycle to another.

For the MED EU countries, direct releases from UWWTPs are also a significant contributor to the discharge of heavy metals which are transferred from the industrial facilities to the UWWTPs (EEA, 2019e). At the national level, and further to the assessment of the country industrial profiles for each MED EU country (EEA, 2019a), it has been found that water releases from UWWTPs in France contribute almost 45 % of heavy metals (weighted by eco-toxicity); 18 % from energy supply; 13 % from the chemical industry; and 8 % from the food and beverages sector. In Italy, 71 % is from UWWTPs, 12 % from the chemical industry and 8 % from ferrous metals industries. Spain is similar where 84 % of heavy metals releases into water are from UWWTPs, 10 % from energy supply and 2 % from the chemical industry.

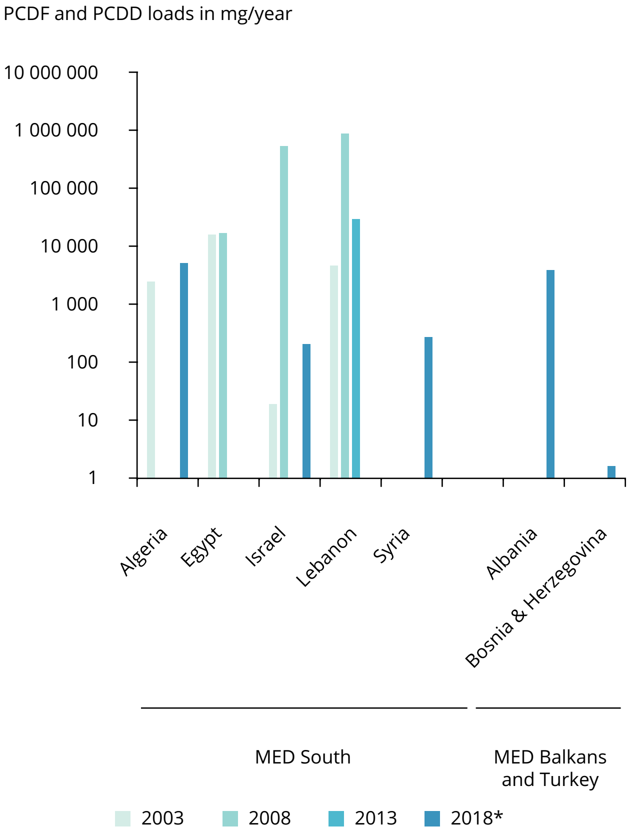
As regards trends in the discharge of heavy metals, Figure 3.42 does not yield a clear conclusion at the national level. Variations between 2003, 2008, 2013 and 2018 may be due to reporting issues related to the methods used to estimate discharged loads.

At the national level, there is a slight decrease in the release of heavy metals in Israel, Syria, Tunisia and Turkey. In Israel and Turkey, this can be attributed to the strict enforcement of legislation and the monitoring of large installations. For the MED EU countries, except Malta, there is a general decrease in the release of heavy metals into the Mediterranean.

Loads and trends in the discharge/emission of furans and dioxins

PCDF and PCDD loads to air are reflected in the H2020 Indicator 6.2.2. The terms furans and dioxins are used to describe two groups of environmental pollutants: polychlorinated dibenzofurans (PCDF) and polychlorinated dibenzo-p-dioxins (PCDD). Furans and dioxins can be found as contaminants in some products and can be produced in combustion processes.

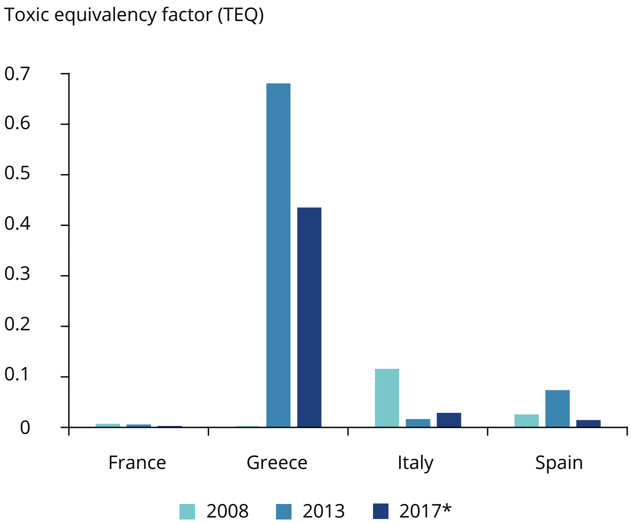
Figure 3.43 Furans and dioxin loads from industrial sectors discharged into the air in the MED South and MED Balkans and Turkey



Note: Datasets plotted in logarithmic scale.

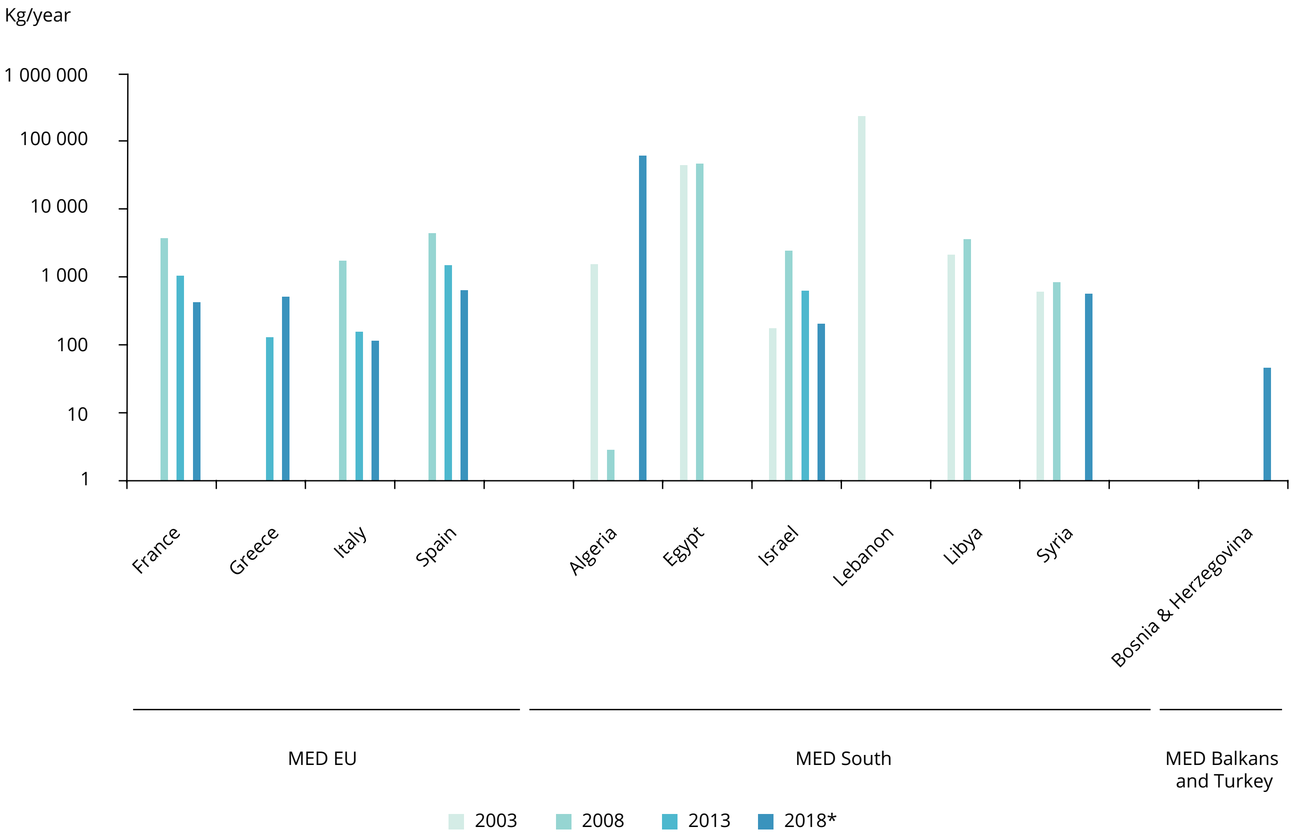
Sources: NBB Reports — 1st to 4th Cycles: NBB, 2003, 2008, 2013, 2018.

Figure 3.44 PCDF and PCDD TEQ from industrial sectors to air for MED EU countries



Source: E-PRTR V17; EEA (2019f).

Figure 3.45 Loads of polycyclic aromatic hydrocarbon from industrial sectors discharged into air in selected Mediterranean countries



Note: Datasets plotted in logarithmic scale.*For MED EU, year 2017.

Sources: NBB Reports — 1st to 4th Cycles: NBB, 2003, 2008, 2013, 2018, E-PRTR V17; EEA (2019f).

Figure 3.43 shows PCDF and PCDD loads from 2003 to 2018 for the industrial facilities situated in the MED South countries as well as Albania and Bosnia and Herzegovina (NBB Reports — 1st to 4th Cycles, 2003-2018) (NBB, 2018). As can be inferred from the data, the PCDF and PCDD emitted by reporting countries in 2018 were lower than 5 kg per year. Data from the MED EU countries are reported in toxic equivalency factor (TEQ) ([49]). These are shown in Figure 3.44 for France, Greece, Italy and Spain.

It is not possible to infer the actual trends in the discharge of PCDF and PCDD from the limited number of best available data in the MED South countries and in Albania and Bosnia and Herzegovina. Gaps in the data made it difficult to undertake comparative analyses with previous NBB cycles. Therefore, no conclusive statements can be reached regarding PCDF and PCDD at the Mediterranean basin level. However, for MED EU countries, and further to Figure 3.45, there was a decreasing trend in emissions of PCDF and PCDD in France, Greece, Italy and Spain from 2008 to 2017.

Loads and trends in the discharge/emission of polycyclic aromatic hydrocarbons

PAH loads are reflected in the H2020 Indicator 6.2.3 which is calculated on data obtained from NBB Reports for 2003, 2008, 2013 and 2018, and from the E-PRTR for 2008, 2013 and 2017. PAHs, one of the most widespread organic environmental pollutants, pose a potential risk to human health via marine biota. PAHs can occur in air attached to dust particles and have toxic, carcinogenic and mutagenic properties. PAHs enter the air mainly as releases from volcanoes, forest

([49]) TEF expresses the toxicity of PCDF, PCDD and PCBs in terms of the most toxic form of dioxin, 2,3,7,8-TCDD.

fires, burning coal, and automobile exhausts from the incomplete combustion of organic matter.

As can be inferred from Figure 3.45, on average, PAH emissions to air in 2018 varied from 50 kg to 500 kg per year, with the exception of Algeria which reported over 60 000 kg/year. For Bosnia and Herzegovina as well as the MED EU countries, PAH emissions varied between 50 and 600 kg/year. While diffuse emissions from industry are not the focus of this report, for some substances such as mercury and PAHs, they produce significant loads to water in Europe (EEA, 2018).

With regards to the trends of discharge of polyaromatic hydrocarbons, it is not possible to infer from the limited number of best available data the actual trends in their emissions. Gaps in data created difficulties for undertaking comparative analyses with previous NBB cycles. Therefore, no conclusive statements can be reached regarding this pollutant at the Mediterranean Basin level.

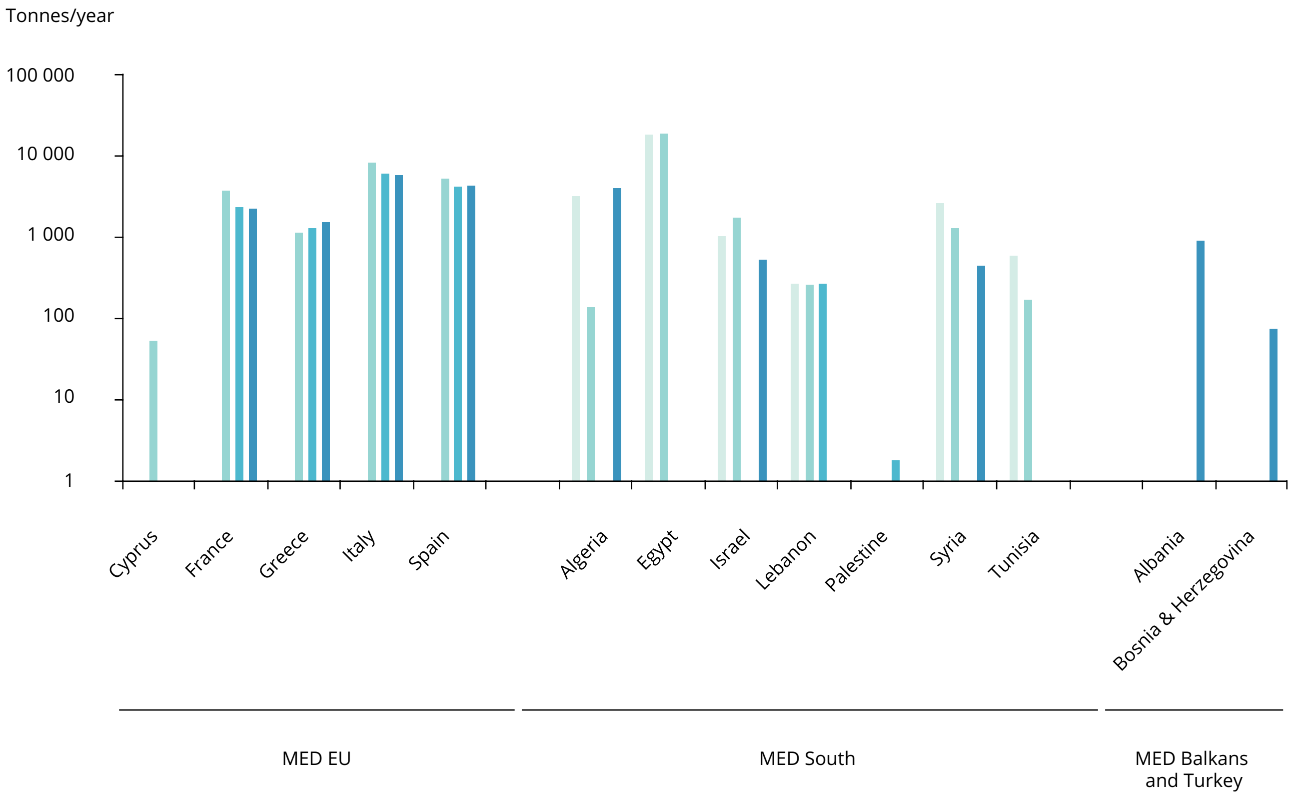
Loads and trends in the discharge/emission of volatile organic compounds

VOC loads are reflected in the H2020 Indicator 6.2.4. They are emitted as gases and include a variety of chemicals, some of which may have short- and long-term adverse health effects.

As can be inferred from Figure 3.46, in 2018, emissions of VOCs to air in reporting countries from the MED South varied on average from 1 000 to 10 000 tonnes per year. The range was lower in Albania and Bosnia and Herzegovina (3 500 tonnes/year). For MED EU countries (France, Greece, Italy and Spain), and with the exception of Cyprus, the range varies from 6 000 to 30 000 tonnes per year further to 2017 E-PRTR V.17 data (EEA, 2019f; no data for Cyprus were available for 2017).

It is not possible to infer from the limited number of best available data the actual trends in the emission of VOCs. Gaps in data made it difficult to undertake

Figure 3.46 Loads of volatile organic compounds from industrial sectors discharged into the air in selected Mediterranean countries countries



Note: Datasets plotted in logarithmic scale. *For MED EU, year 2017.

Sources: NBB Reports — 1st to 4th Cycles: NBB, 2003, 2008, 2013, 2018, E-PRTR V17; EEA, 2019f.

comparative analyses with previous NBB cycles. Fluctuations in values between different years may be due to the use of different emission values or as a result of calculations based on actual measurements. Therefore, no conclusions can be reached regarding trends in emissions of VOCs at the Mediterranean Basin level.

Management of hazardous waste

As regards the management of hazardous waste in the Mediterranean countries, two key sources of information were reviewed:

1. Contracting Parties' reports to the BCRS for the period 2016-2017 on progress in the implementation of the Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal (Hazardous Wastes Protocol); and

2. Mediterranean Countries' national reports submitted to the Secretariat of the Basel Convention between 2016 and 2017.

This review enabled the extraction of some data on the management tools used by these countries to handle hazardous waste, particularly in relation to the data required for populating H2020 Indicator 6.3 with its two sub-indicators on the quantities of generated and disposal of hazardous waste in an environmentally sound manner.

Quantities of hazardous waste generated

Updated H2020 industrial emission indicators

IND 6.3: Industrial hazardous waste disposed in environmentally sound manner:

- IND 6.3.1: Total quantity of generated hazardous waste from industrial installations.

- IND 6.3.2: Quantity of industrial hazardous waste disposed in environmentally sound manner relative to total quantity of generated hazardous waste from industrial installations.

The quantities of hazardous waste generated are reflected in H2020 Indicator 6.3.1. According to the Contracting Parties' reports to the BCRS, 'measures aimed at reducing to a minimum or where possible eliminating the generation of hazardous wastes are at the heart of the domestic legislation on waste management adopted in all reporting Contracting Parties, as per the requirements of the Hazardous Wastes Protocol'. Further to the national countries' reports submitted to the Basel Convention (Basel Convention, 2017), the total volume of hazardous waste generated varies widely between various countries and regions, as shown in Table 3.21. In the MED South countries, the hazardous waste generated varies from 2 500 to 2.7 million tonnes/year. In the MED Balkans and Turkey, the amount varies between 10 000 and 1.4 million tonnes per year. While in MED EU countries, the hazardous waste generated varies from 36 000 to 11 million tonnes/year. At the Mediterranean level, Egypt, France, Italy and Spain are among the countries generating the largest amounts of hazardous waste (11 million tonnes/year for France and Italy and 2.7 million tonnes/year for Egypt).

Quantities of disposed hazardous waste

The quantities of disposed hazardous waste are reflected in H2020 Indicator 6.3.2. As regards the quantities of industrial hazardous waste disposed of in an environmentally sound manner (IND 6.3.2), only one third of the Mediterranean countries reported on disposal aspects in their national reports to the Basel Convention, as shown in Table 3.21. Basically, as indicated in the table, disposal facilities are limited in capacity and do not exceed 100 000 tonnes. Countries' reports further indicate that hazardous waste is generally managed in two ways: one part is recycled locally, incinerated or exported, while a second part is stored without any appropriate treatment. Figure 3.47 provides a visual comparison between the amounts generated by Mediterranean countries and their disposal capacities. As can be inferred from the table, the amount of disposed waste does not exceed one quarter to one third of the amount generated, the remainder being exported and/or disposed of in an unsafe way.

In this respect, it should be noted that the storage of industrial hazardous waste cannot be seen as a sustainable way of managing it. Identifying countries' available means and capacities for the treatment and disposal of hazardous waste is a critical and urgent step towards coping with the amounts of hazardous waste generated annually that accumulate in storage centres. This challenge is related to difficulties countries face in collecting information from industrial installations to improve data management and processing at the central level.

Table 3.21 Hazardous waste management in Mediterranean countries

Country	Total amount of hazardous waste generated in 2017 (tonnes/year)	Disposal facilities total capacity (tonnes)	Recovery facilities total capacity (tonnes)
MED South			
Algeria	11 850	NA	NA
Egypt	2 745 000	NA	NA
Israel	317 456	NA	NA
Jordan	2 490	2 000	NA
Lebanon	3 503	Not occurring	Not occurring
Morocco	263 692	NA	114 300
Palestine	715	1.6	200
Tunisia	NA	102 400	16 000
MED Balkans and Turkey			
Albania	NA	3 105	8 000
Bosnia and Herzegovina	10 078	NA	25 000
Montenegro	NA	NA	0
Turkey	1 425 045	32 803	646 105
MED EU			
Croatia	179 646	NA	NA
Cyprus	72 480	1 299 545	1 710 447
France	11 010 282	NA	NA
Greece	450 000	NA	NA
Italy	9 609 056	NA	NA
Malta	36 190	NA	95 821
Slovenia	133 000	NA	NA
Spain	1 768 100	888	555

Source: Basel Convention national reports; Basel Convention, 2017.

Compliance measures aimed at the reduction and/or elimination of pollutants generated by industrial sectors

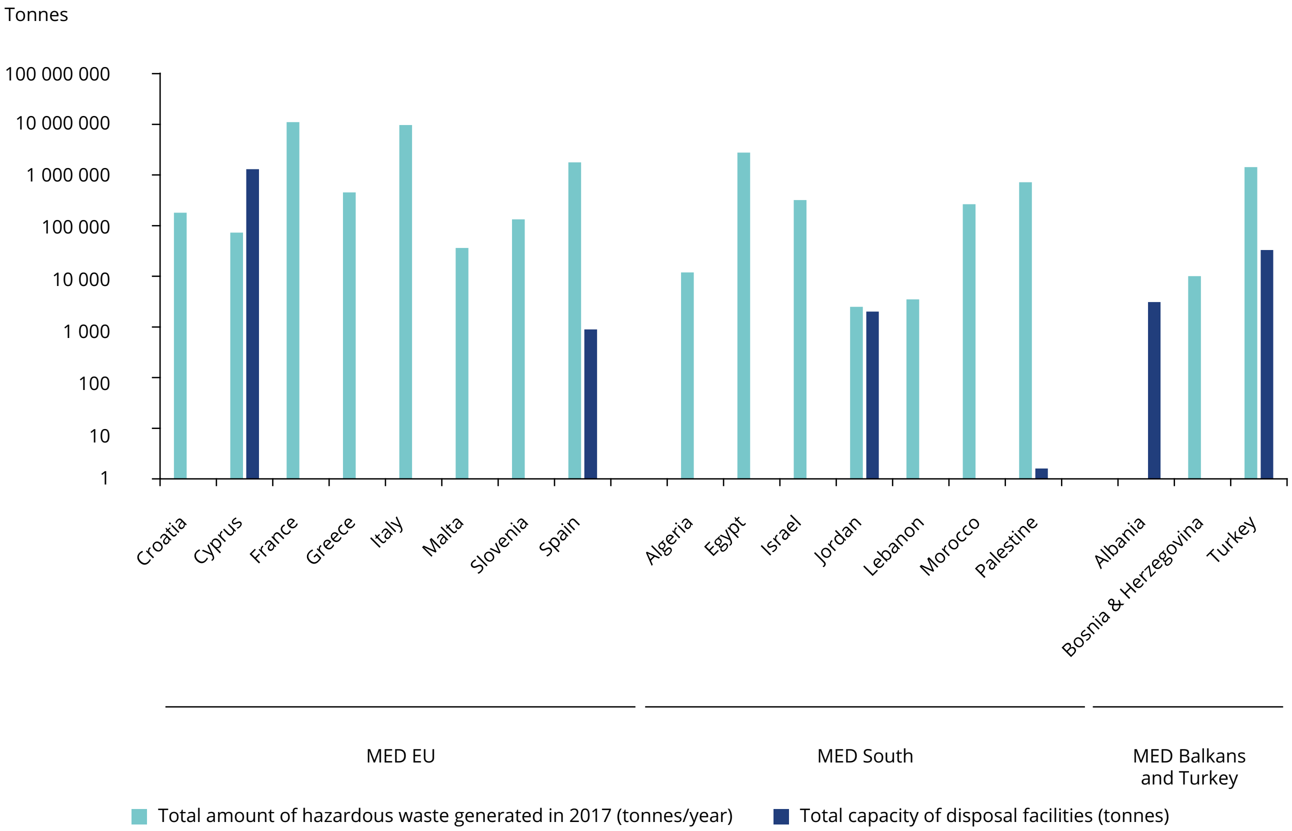
In order to assess compliance measures aiming to reduce and/or eliminate pollutants generated by industrial sectors, three sub-indicators were developed. These relate to reporting by industrial installations and compliance; environmental inspections; and the elimination of hot spots. These three sub-indicators are assessed below.

Updated H2020 industrial emission indicators

IND 6.4: Compliance measures aiming at the reduction and/or elimination of pollutants generated by industrial sectors:

- IND 6.4.1: Number of industrial installations reporting periodically loads of pollutants discharged to the marine and coastal environments relative to the total number of industrial installations.
- IND 6.4.2: Number of environmental inspections carried out by enforcement authorities in which industrial installations were found to be in breach of laws and regulations relative to the total number of executed inspections.
- IND 6.4.3: Number of eliminated hot spots identified in the updated NAPs relative to the 2001 and 2015 baselines.

Figure 3.47 Quantities of hazardous waste generated and disposed of in Mediterranean countries



Note: Datasets plotted in logarithmic scale.

Source: National countries' reports; Basel Convention (2017).

Reporting by industrial installations

Due to the lack of data on the H2020 Indicator 6.4.1 on 'the number of industrial installations reporting periodically loads of pollutants discharged to the marine and coastal environments', an assessment of the countries' compliance with reporting based on the national implementation reports for the biennium 2016-2017 submitted by the Contracting Parties to the BCRS ([50]) is used to provide information on this indicator. According to Figure 3.48, the legal and regulatory framework is in place. However, there is a need to enforce this framework, which includes the reporting of emissions by these industrial installations to the national relevant authorities.

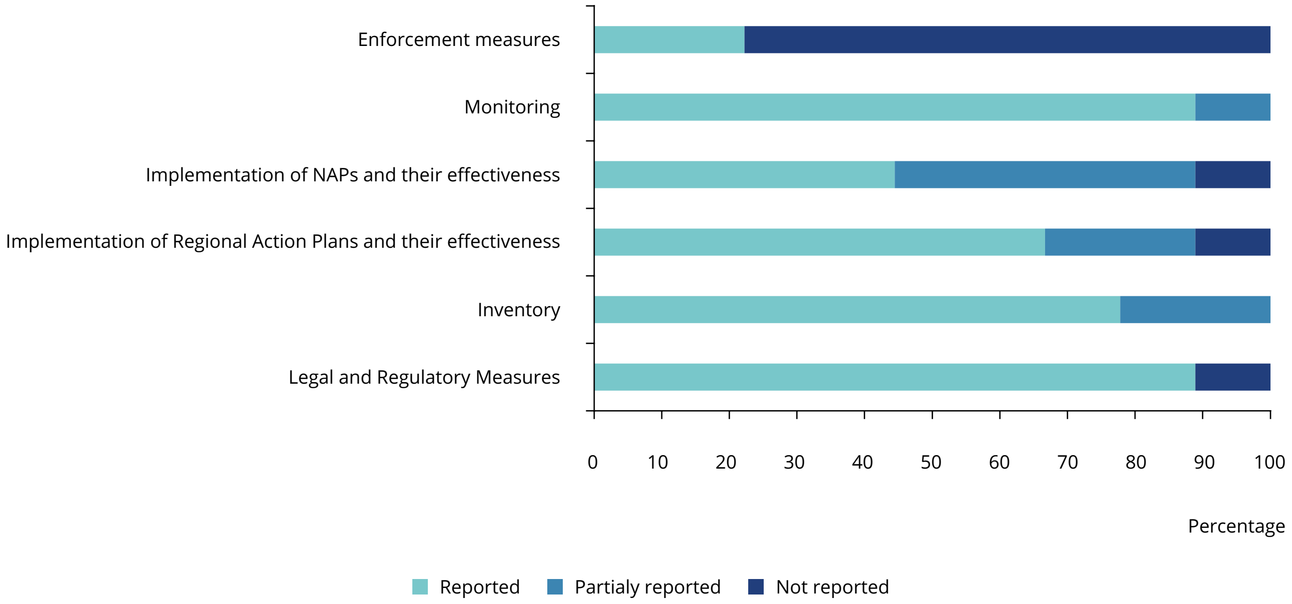
Environmental inspections and compliance

The H2020 Indicator 6.4.2 refers to the number of environmental inspections carried out by the enforcement authorities. Due to the fact that reporting on this particular indicator was not achieved, for the purpose of assessing this indicator, data were extracted from the national implementation reports pertaining to the LBS Protocol for the biennia 2014-2015 and 2016-2017, which were submitted by the Contracting Parties through the online BCRS (UNEP/MAP and InfoRAC, 2020).

The number of Contracting Parties reporting on the legal, institutional and enforcement frameworks with regards

([50]) The online system has been updated to provide an overall assessment of progress in implementation of the Convention and each of its Protocols by the biannual submission of online reports compliant with SEIS principles, whereby data is collected once and used for multiple purposes: https://idc.info-rac.org/

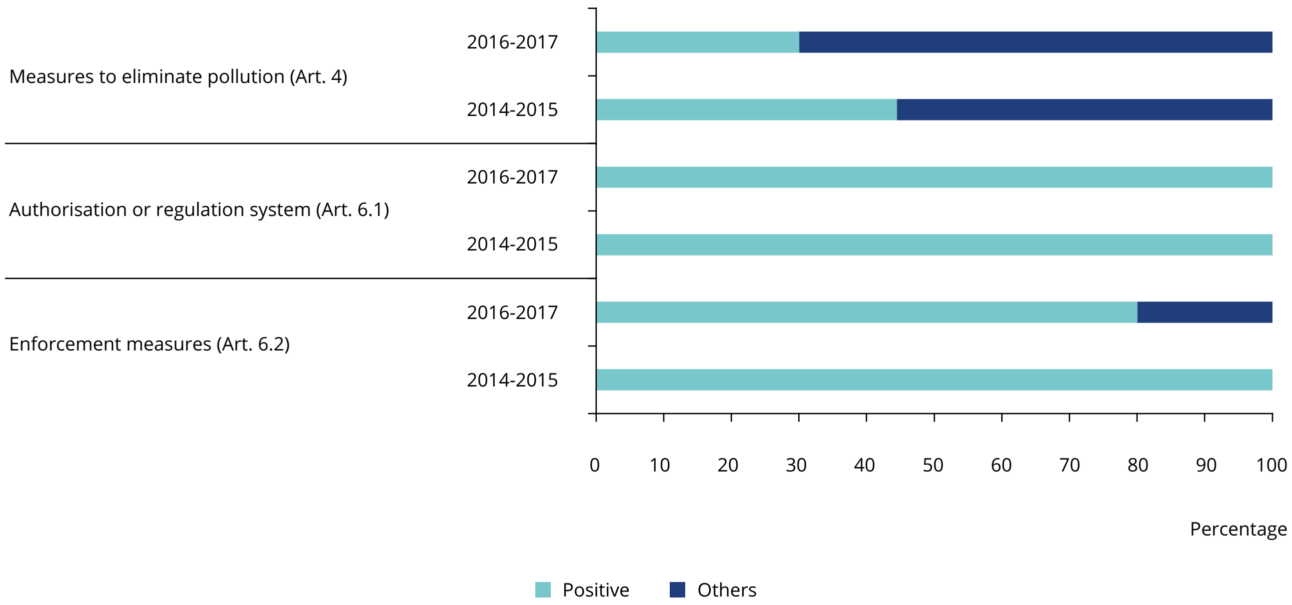
Figure 3.48 Compliance with reporting as regards the Land Based Sources Protocol by the Contracting Parties to the Barcelona Convention for the reporting period 2016-2017



Note: As of September 2019, during the biennium, only nine Contracting Parties completed reporting under the LBS Protocol. The figure illustrates the proportion of number of 'Reported', 'Partially Reported' or 'Not Reported' data to the total number of fully completed reporting by these respective Contracting Parties.

Source: Barcelona Convention Reporting System, UNEP/MAP and InfoRac, 2020.

Figure 3.49 Legal, institutional and enforcement framework, 2014-2015; 2016-2017



Note: Figure shows number of Contracting Parties (CPs) reporting on the legal, institutional and enforcement frameworks with regards to the Land Based Sources Protocol of the Barcelona Convention for the reporting periods 2014-2015 and 2016-2017.

Source: Barcelona Convention Reporting System, UNEP/MAP and InfoRac, 2020.

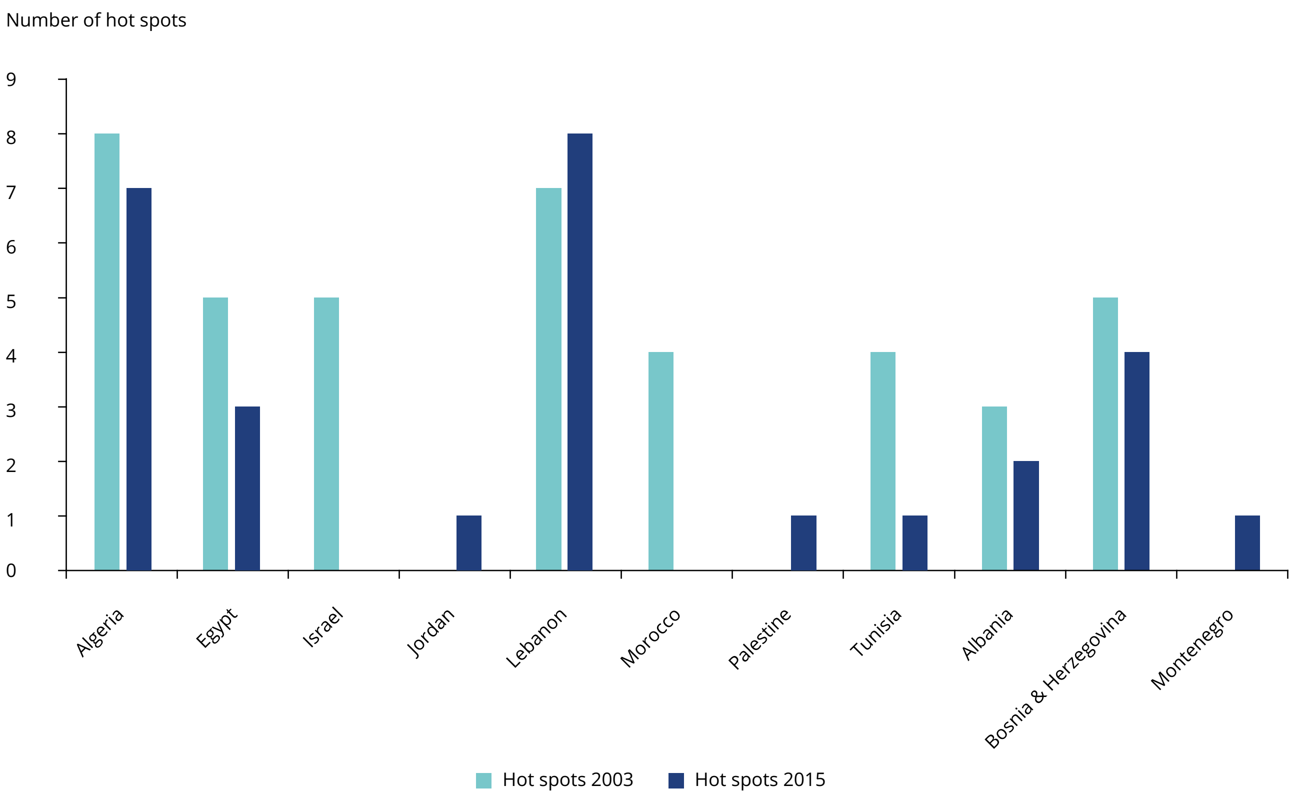
to the Land Based Sources Protocol of the Barcelona Convention for the reporting periods 2014-2015 and 2016-2017 is shown in Figure 3.49. As can be inferred, the Contracting Parties have appropriate measures in place to eliminate land-based sources of pollution as well as institutional, legal and regulatory frameworks to address pollution, including an authorisation and permitting system for industrial installations. However, Figure 3.49 shows that almost two thirds of the countries are unable to enforce the adopted measures or monitor the level of compliance by industrial installations.

The enforcement measures remain a major challenge. Weak institutional structures, a lack of competences and skilled enforcement officers, and a limited number of personnel are all considered to be among the main obstacles to the implementation of proper enforcement and sanctioning mechanisms. In addition, the lack of well-established infrastructure enabling public access, and the poor management of records are also exacerbating this situation. This gap is flagged in the findings of the SoED 2020 report (UNEP/MAP-Plan Bleu, 2020) which recommends increasing efforts and capacity building for the inclusion of systematic operational and enforcement instruments in environmental policies (UNEP/MAP-Plan Bleu, 2020).

Elimination of hot spots

The elimination of hotspots is the third H2020 sub-indicator on compliance measures (IND 6.4.3). It refers to the number of eliminated hot spots reported in the updated NAPs (Decision IG.22/8; UNEP/MAP, 2015) relative to the 2001 and 2015 baselines. The 2001 hot spots baseline is defined further to the first assessment undertaken in 1999 and updated in 2003, whereas a comprehensive and multidisciplinary methodology was introduced reflecting SAP-MED priorities and public health. The 2003 hot spots assessment yielded the identification and prioritisation of 101 Mediterranean hot spots. Hotspots are defined either as 'point sources on the coast of the Mediterranean Sea which potentially affect human health, ecosystems, biodiversity, sustainability or economy in a significant manner', or 'defined coastal areas where the coastal marine environment is subject to pollution from one or more point or diffused sources on the coast of the Mediterranean which potentially affect human health in a significant manner, ecosystems, biodiversity, sustainability or economy'. In 2014, the assessment methodology for hot spots was further updated according to criteria comprising three main steps: (1) screening for the listing of potential pollution hot spots

Figure 3.50 Change in number of hot spots between 2003 and 2015



Source: Barcelona Convention Reporting System, UNEP/MAP and InfoRac, 2020.

and sensitive areas; (2) assessing potential hot spots and sensitive areas based on updated criteria; and (3) testing the implementation of the updated assessment criteria on specific examples. Accordingly, the number of hot spots reported in the updated NAPs (UNEP/MAP, 2015) dropped to 28. This number corresponds to the elimination of 73 hot spots from the 2001 baseline of 101. Hence, IND 6.4.3 indicates 72 % for the number of eliminated hot spots reported in the updated NAPs (UNEP/MAP, 2015) relative to the 2001 baseline. Figure 3.50 provides a graphical illustration of the reduction in the number of hot spots reported in 2003 in comparison with 2015. As can be seen, the number of hot spots declined in all Mediterranean countries with the exception of Lebanon.

3.3.6 *Regional data landscape of national and regional information systems*

Data availability

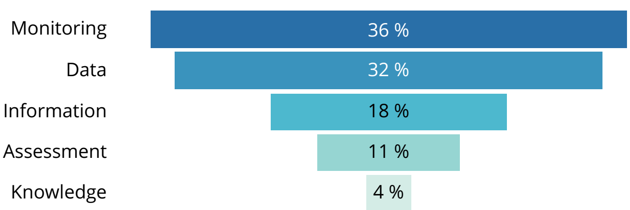
In contrast with the MED EU countries, the inventory of industrial emissions in the MED South countries must still be further developed and streamlined with E-PRTR at the national level. Data on pollutant releases and production activities from these industries in MED South countries are not always available. The coverage of industrial pollutants remains limited when considering the number of existing sources identified by the countries in the NBB reports. The number of industries for which pollutant loads are quantified are based on best available data and the application of emission factors.

Main data gaps and uncertainties

The main data gaps and uncertainties can be categorised according to the EEA's MDIAK chain (see Section B; Figure 2.7).

Further to the 4th cycle of NBB reports submitted by the countries in 2018, a detailed analysis of the information provided was undertaken regarding difficulties and

Figure 3.51 Classified challenges in relation to the MDIAK chain reported by the countries



Source: NBB, 2018.

challenges the countries faced. The challenges were grouped under each aspect (monitoring, data, indicators, assessment and knowledge). Funding-related issues were added in each step as an overarching challenge.

An analysis of the results revealed that these aspects can be associated with each step of the MDIAK chain, as shown in Figure 3.51. As can be inferred, most challenges and difficulties facing countries are related to monitoring processes and data collection, both of which account for more than 65 % of the total difficulties reported.

With reference to the findings in Figure 3.51, it is important to invest in improving the monitoring and data-collection infrastructure and related human capacities, particularly for the MED South countries, as well as MED Balkans and Turkey. Technical and financial support is an important prerequisite to establish and fortify the sustainability of producing knowledge for policymakers in the region.

The findings in Figure 3.51 further illustrate that most of the MED South countries are facing difficulties, for various reasons, in moving towards the assessment and knowledge production that can be used by policymakers in an integrated way. A typical example of data gaps preventing the sound management of hazardous waste is illustrated in Box 3.12.

Regional response to data reporting

An in-depth examination of the NBB reports (NBB, 2003, 2008, 2013, 2018) provided by the MED South countries and of national reports submitted to the Basel Convention reveals that national institutions are facing some difficulties in collecting monitoring data from industrial facilities on a regular basis, due in part to the lack of national legislation for regular reporting by industry. Another challenge is the lack of qualified human resources for processing and analysing collected data in order to develop syntheses and produce reports on the levels of pollutant discharges from industries. And even when data are available at the enterprise level, they are not routinely collected for centralisation, processing and exploitation at the local or regional environmental service level.

To address the above aspects, the EU funded the 'SEIS South Support Mechanism' project which aimed to support the countries by enhancing their national infrastructure and data systems and adjusting and extending, where appropriate, the regional data infrastructure and management systems to cover data management for assessing the agreed H2020 initiative indicators. At the core of the InfoMAP System (Annex F),

Box 3.12 Data gaps in hazardous waste management

Most MED South countries do not have data on their capacity to process and recover hazardous waste. Identifying available means and capacities for the treatment and disposal of hazardous waste is a critical and urgent step to cope with the amounts of hazardous waste generated annually. This challenge is related to the difficulties countries face in collecting information from industrial installations to improve data management and processing at the central level.

Table 3.22 Countries' priority investment measures to respond to requirements of the Strategic Action Programme (LBS Protocol) and the related regional plans

Priority investment measures in the NAPs	Albania	Algeria	B&H	Cyprus	Egypt	France	Israel	Jordan	Lebanon	Malta	Monaco	Montenegro	Morocco	Palestine	Spain	Tunisia
Build/expand/upgrade industrial wastewater treatment plants	Yellow		Yellow		Orange	Blue	Orange	Orange								Orange
Upgrading existing industrial facilities with BAT/BEP	Yellow					Blue	Orange	Orange								
Collection/containment/treatment of mercury-contaminated wastes	Yellow	Orange					Orange			Blue			Orange			
Collection and traitement of waste containing POPs	Yellow		Yellow				Orange			Blue		Yellow				Orange
Build/expand/upgrade hazardous waste landfill facility	Yellow		Yellow		Orange		Orange	Orange						Orange		Orange
Remediate contaminated industrial sites	Yellow	Orange	Yellow		Orange		Orange					Yellow				Orange

Source: Barcelona Convention Reporting System, UNEP/MAP and InfoRac, 2020.

the Info/RAC Data Centre (IDC) ([51]) was established with the aim of providing a reporting system, to be officially used by countries, based on common standards and aligned with the EEA's reporting system Reportnet2 ([52]). Currently, the IDC manages two data flows, BCRS and NBB, both of which were used extensively for the H2020 assessment ([53]).

3.3.7 Countries' responses

Countries' responses are assessed for implemented investment measures; improvements in legal and institutional structures; and capacity building activities.

Investment measures: Mediterranean countries prioritised their investment measures according to the Programme of Work developed for the NAPs. Table 3.22 presents a summary list of six common priority investment measures proposed to combat pollution from land-based sources, and also indicating the Mediterranean countries which subscribed to their implementation.

The MED South countries (represented in orange cells), in addition to the MED Balkans and Turkey (yellow cells), selected measures related to building/expanding/upgrading industrial WWTPs; upgrading existing industrial facilities with BAT/BEP; collection/containment/treatment of mercury-contaminated wastes; collection and treatment of waste containing POPs; building/expanding/upgrading hazardous waste landfill facilities; and remediating contaminated industrial sites. In contrast, the MED EU countries (blue cells) focused on measures related to prevention or reduction of emissions to air, water and land; and to preventing the generation of waste to achieve a high level of protection for the environment, as set out by the EU Industrial

([51]) https://idc.info-rac.org/
([52]) https://www.eionet.europa.eu/reportnet
([53]) Two project countries did not report via the 4th Cycle of the NBB update, namely Jordan and Palestine: Palestine is an observer to the Convention while Jordan is not party to the Barcelona Convention.

Box 3.13 SDG 9.4

- **SDG goal:** Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.
- **SDG target:** By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.
- **SDG indicator:** CO_2 emission per unit of value added.

Figure 3.52 SDG 9.4.1: CO_2 emissions per unit of GDP between 2000 and 2016

Source: UNSTATS (2020).

Emission Directive (2010/75/EU; EU, 2010). This aims to promote resource efficiency and curtail the use of hazardous chemicals by setting agreed standards (BATs) for different industrial activities.

To better assess the situation in the Mediterranean concerning industrial manufacturing processes in terms of sustainable industrialisation and the application of innovative technologies, including resource and energy efficiency, data for three subregions were extracted and segregated from the platform for SDG 9.4 (UNSTATS, 2020). The definition of SDG 9.4, its target and indicator are presented in Box 3.13.

SDG 9.4 measures the amount of CO_2 emissions from fuel consumption produced by an economic activity per unit of economic output. When computed for the whole economy, it indicates the combined effects of: (1) the average carbon intensity of the energy mix (linked to the shares of the various fossil fuels in the total); (2) the structure of an economy (linked to the relative weight of more- or less-energy-intensive sectors); and (3) the average efficiency in the use of energy. This is shown in Figure 3.52 for data extracted from the SDG platform.

Figure 3.52 indicates that CO_2 emissions per unit of GDP are increasing for MED South countries, which reflects a carbon-intensive economy, in contrast to MED EU countries which show a declining trend. Bearing in mind the recent economic crises in the EU region, this implies that MED EU countries' economies are moving towards becoming less carbon-intensive.

When the SDG 9.4 indicator is computed for the manufacturing sector, as illustrated in Figure 3.53 (CO_2 emissions per unit of manufacturing added value (MVA)), it measures the combined effect of: (1) the carbon intensity of the manufacturing economic output (average carbon intensity of energy mix used); (2) the structure of the manufacturing sector (the energy efficiency of production technologies in each subsector); and (3) the economic value of the various output. In general, manufacturing industries are improving their emission intensity as countries move to higher and more efficient levels of industrialisation. But emission intensities can also be reduced through structural changes, the modernisation of industrial processes, improvements in emission control and pollution abatement technologies, and product diversification in manufacturing. Lower values of CO_2 per unit of MVA could be interpreted as more efficient manufacturing structures and less pollutants.

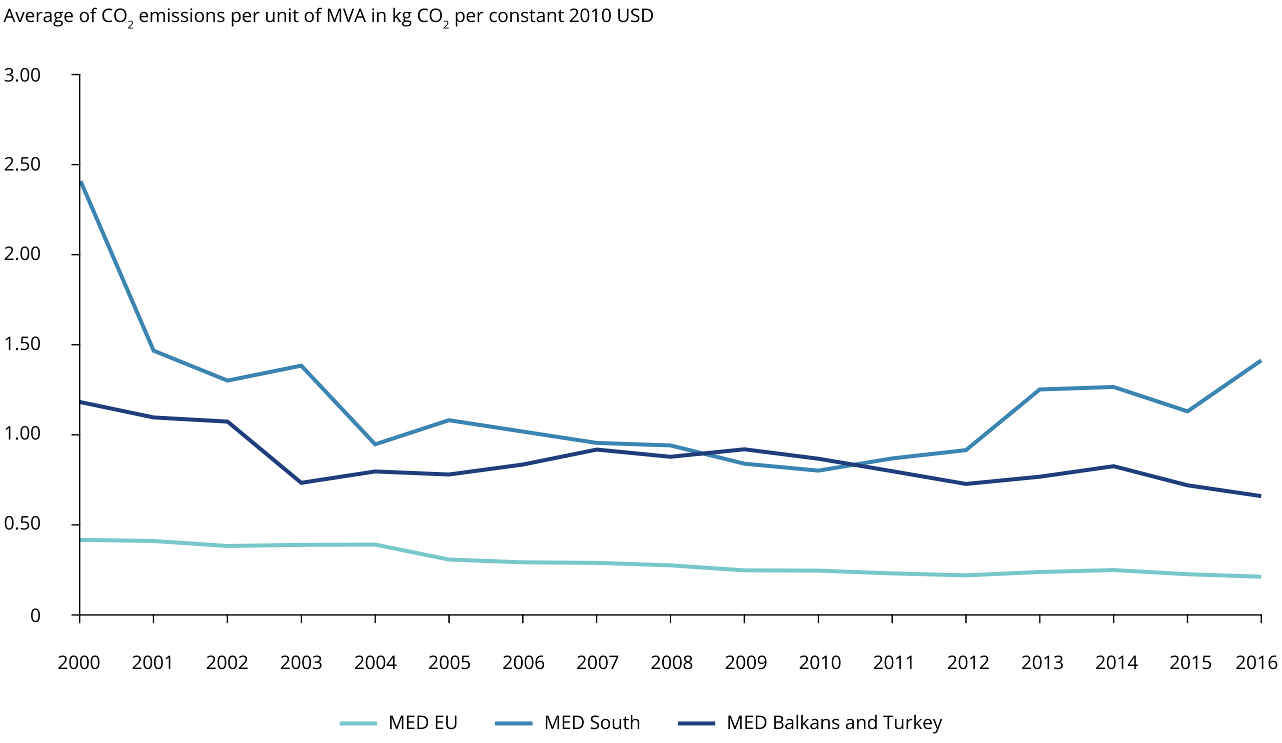
Figure 3.53 further indicates that MED South countries have a carbon-intensive manufacturing industry in contrast to MED EU countries, taking into consideration that the manufacturing sectors addressed by the SDG 9.4 indicator are linked to NBB sectors and subsectors (presented in Annex D).

It may be concluded, based on Figure 3.52, that the major challenge facing industries in the MED South, and to a lesser extent in the MED Balkans and Turkey, is the need for investment in innovative and clean technologies and their continuous maintenance and control by qualified staff.

This also requires an urgent need for large investments in research and development where, based on Figure 3.54, the Mediterranean governments have allocated limited resources amounting on average to less than 1 % of GDP. The exceptions are France, Israel and Slovenia which allocate around 2 % and 4 % of national GDP, respectively, for research and development. Therefore, the region needs substantial support for industry to upgrade the infrastructure and retrofit industrial processes in line with BAT to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies, in compliance with the SDGs.

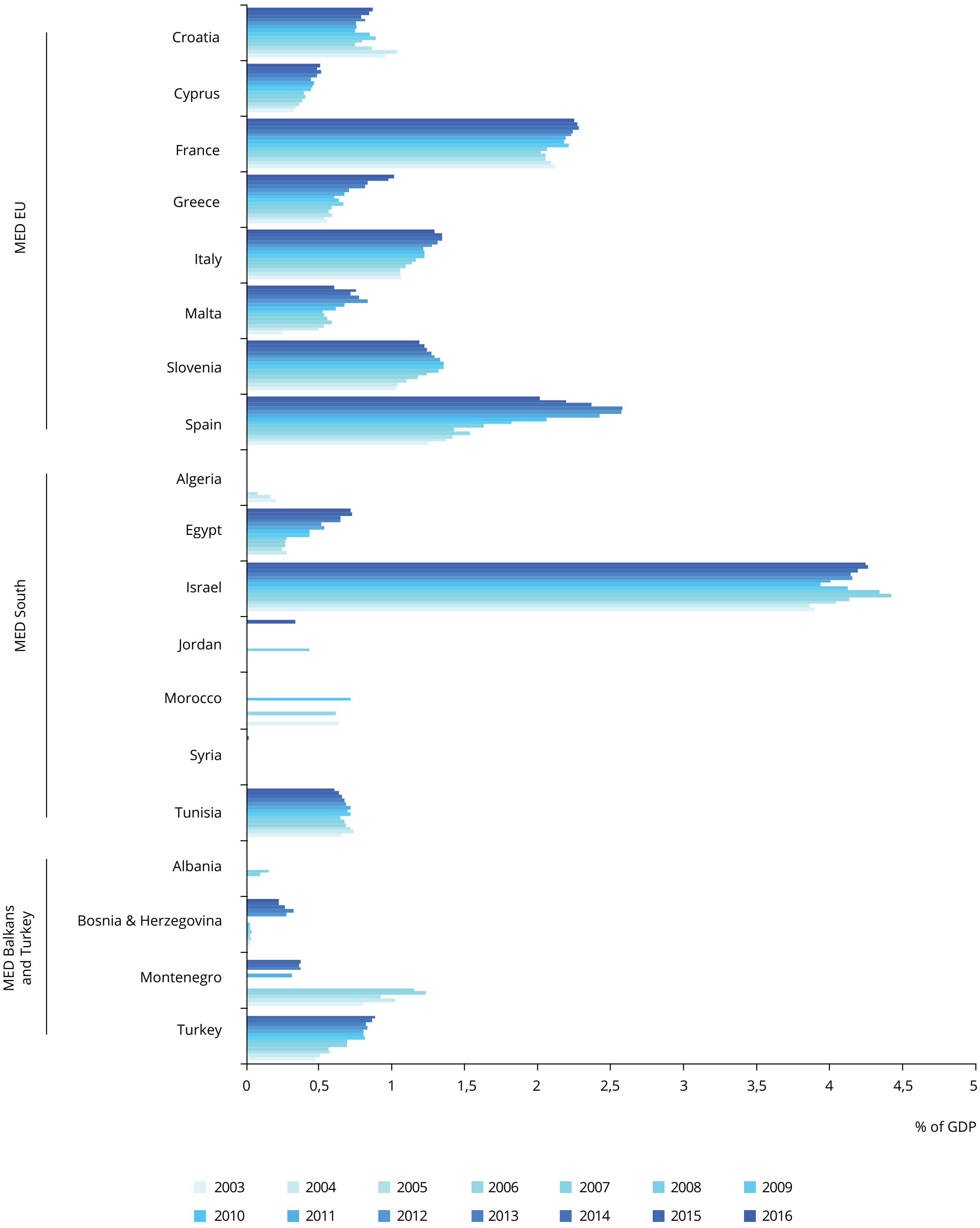
Accordingly, there is an urgent need for an assessment of pollution abatement within the industrial sector, and for more sustainable industrial processes in the MED South and MED Balkans and Turkey to identify the support needed to attract the investment required

Figure 3.53 SDG 9.4.1: Carbon dioxide emissions per unit of MVA



Source: UNSTATS (2020).

Figure 3.54 Research and development expenditure as a proportion of GDP (%)



Source: UNSTATS (2020).

over the next 10 years (i.e. 2030) to attain SDG 9.4 (and commitments in the Paris Agreement). For the MED EU, the European Commission has initiated the European Green Deal (EC, 2019a) which aims to achieve the EU's climate and environmental goals by adopting a new industrial policy based on the circular economy and innovative technologies. These measures include an initial roadmap of key policies including, among others, cutting emissions by investing in cutting-edge research and innovation to preserve the natural environment.

Legal and institutional structures: All the Mediterranean countries have developed measures to combat industrial pollution, such as the promulgation of regulatory texts to set levels of releases to the environment (ELVs), and to specify methods of management and treatment of industrial waste. However, in most cases, countries have limited, decentralised infrastructure to monitor and implement the adopted regulations. This poses a significant obstacle, particularly in the MED South and MED Balkans and Turkey for sustainable data management and for the development of an integrated knowledge base which, in turn, hinders the ability of enforcement authorities to implement the respective regulations.

The MED EU countries have adopted the Industrial Emissions Directive (2010/75/EU; EU, 2010) which sets authorisation conditions for industrial installations, including permits, monitoring and reporting requirements. Furthermore, in Turkey, the online environmental permits system, which sets authorisation conditions for industrial installations and enables facilities to apply for environmental permits and licences, has been in operation since 2014.

In terms of regulations, and even though this assessment report focuses on releases to water, the control of liquid, solid and gaseous emissions require the enforcement of regulations by developing detailed methodologies to conduct measurements and analysis of all polluting forms at the site level of each type of industry using a standardised reporting format. Reporting by industries on their production activities and polluting discharges must be also regulated to ensure full coverage of sources in each country and to enable industry to mainstream environmental management within the industrial facilities.

As regards inspections, work is also under way to consolidate monitoring and reporting plans in Albania, Bosnia and Herzegovina and Montenegro. In other countries, such as Algeria, Egypt, Lebanon, Morocco and Tunisia, there is limited evidence of the systematic implementation of monitoring and reporting systems. Based on the review of the NAPs (Decision IG.22/8, UNEP/MAP, 2015) these countries conduct ad hoc monitoring campaigns which are limited in geographical scope, the number of parameters, and/or frequency. As regards the implementation of BAT, MED EU countries have set permitting conditions which include ELVs. These conditions are associated with a corresponding monitoring and reporting system (UNEP/MAP, 2019d).

Capacity building: From a technical point of view, reinforcing the capacities of relevant departments dealing with industrial emissions, particularly in South MED countries, with equipment for measuring and analysing pollutants as well as training to conduct inspections for emission compliance is essential for the effective implementation and monitoring of regulations. Enforcement authorities are working with national reference laboratories which analyse samples for compliance. Therefore, increasing the technical capacity of national reference laboratories by improving the capacity of enforcement authorities should also be a primary concern at both the national and regional level.

The sustainability of competent human resources within the institutions in charge of environmental evaluation, monitoring and enforcement is critical for regulating industrial emission releases and achieving national and regional targets. Therefore, continuous support for and capacity building of human resources is of the utmost importance.

3.3.8 Overall assessment summary and key messages

Further to the information provided in this assessment on the release of nutrients and toxic substances into the Mediterranean marine environment, answers to the questions posed at the beginning of this section are addressed below.

Main pressures from the industrial sectors

Regarding the release of nutrients:

- The assessment indicates that UWWTPs are releasing higher nutrient loads than the industrial sector, whereas industry is more dominant on the release of heavy metals;
- The main sectors responsible for the highest loads of nutrient discharges to water at the Mediterranean level are the food-packing and beverages industry, followed by agriculture and animal farming in the MED South countries. For MED Balkans and Turkey, the principal sector is the food-processing industry, followed by the manufacturing of textiles and agriculture and the farming of animals. For the

MED EU, the main sectors are the chemical industry followed by paper and wood production. Aquaculture is also a growing sector and is expected to grow further in the region in the future.

- Reported releases of BOD loads in 2018 for countries in the MED South and the MED Balkans and Turkey vary on average between 1 000 and 70 000 tonnes per year. For MED EU countries, discharge of TOC ranged from 300 to almost 7 000 tonnes in 2017.

- In 2018, the reported releases of nitrogen loads in MED South countries varied widely from 200 to 7 000 tonnes per year. For Montenegro and Turkey, nitrogen loads vary from 10 to 1 100 tonnes per year, while for MED EU countries, nitrogen loads vary from 500 to 5 000 tonnes per year.

- Reported releases of phosphorus loads for the MED South countries, in 2018, varied widely from 10 to 3 500 tonnes per year. For Albania and Turkey, phosphorus loads did not exceed 400 tonnes per year. For MED EU countries, in 2017, phosphorus loads ranged from 30 to 540 tonnes per year.

Regarding toxic substances:

- The impact of industry is more prominent in the releases of toxic substance, particularly heavy metals. Data also indicates that some light industries are transferring their loads of heavy metal to UWWTPs;

- The principal sector contributing to the release of heavy metals in MED South countries is the manufacturing of refined petroleum products. For the MED Balkans and Turkey, the main contributing sectors are refining of petroleum products, the tanning and dressing of leather and the manufacturing of cement. For the MED EU, the principal sector responsible for the release of heavy metals is energy production.

- In 2018, the reported releases of heavy metals by MED South countries varied on average from 1 000 to 100 000 kg/year. The same range is also reported for MED Balkans and Turkey. For MED EU countries, heavy metal loads varied in 2017 from 200 to 65 000 tonnes/year.

- Direct releases of heavy metals to water (weighted on ecotoxicity) are mainly attributed to UWWTPs (EEA, 2019e) for MED EU countries. E-PRTR confirms that direct releases of heavy metals are transferred to UWWTPs by industrial installations.

- PCDD and PCDF emitted by reporting countries in 2018 are lower than 5 kg per year for the MED South and MED Balkans and Turkey. For the MED EU, the highest toxic equivalency is in Greece.

- PAH emissions to air in 2018 by the MED South countries ranged on average from 50 kg to 500 kg per year. The same range was also found in Bosnia and Herzegovina as well as the reporting MED EU countries.

- In 2018, emissions of VOCs to air from the MED South countries varied on average from 1 000 to 10 000 tonnes per year. The range was lower in Albania and Bosnia and Herzegovina. For the MED EU countries, the range varied on average from 6 000 to 30 000 tonnes per year.

Trends in pollutants' emissions related to the prevailing industrial sectors

- As regards the trends in the discharge of nutrient and toxic substances, it is not possible to infer from the limited number of best available data for MED South countries, as well as Albania, Bosnia and Herzegovina, Montenegro and Turkey, the actual trends in emissions over time. Variations in emissions from previous years (NBB 2003, 2008, 2013) may be partly due to reporting issues related to the methods used to estimate discharged loads. Therefore, no conclusive statements can be reached regarding trends in the discharge of pollutants at the Mediterranean Basin level.

- For MED EU countries, trends in the discharge of TOC loads show a general decline for France, Greece and Malta, whereas for Italy and Spain, a slight increase is observed. There was a general increase in the discharge of nitrogen (except France and Italy), and a general increase in the discharge of phosphorus (except France) to the Mediterranean Sea.

- For MED EU countries, trends in the release of toxic substances indicate a general decrease in the release of heavy metals to the Mediterranean (except Malta), and a general decline in the release of PCDD and PCDF, PAH and VOC (except Greece).

Regional data landscape on the national and regional information systems

- Data and its availability must be further developed and streamlined with E-PRTR/NBB systems at the national and regional level. Data on pollutant releases and production activities from these industries are not always available.

- Data gaps:
  - Most of the MED South countries are facing many challenges and difficulties to move towards the assessment and production of knowledge for policymakers;
  - Difficulties and challenges are related to lack of financing and capacity building. At the national level, the countries are still pinned down to monitoring and data collection, which account for more than 65 % of the total difficulties reported.

Regional responses to preventing pollution from industrial sectors

- Investments are needed for the industrial sector in the MED South countries in order to retrofit industrial production processes which would lead to resource efficiency and sustainable production.
- In the business-as-usual scenario, it is unlikely the current state of industrial processes will not achieve SDG 9.4 in 2030.
- There has been a small increase in CO_2 emissions since 2014 in the MED EU countries; this requires more continuous policies to further increase the efficiency and to apply BATs in Mediterranean region. Such policies are already on the horizon, such as the Green Deal (EC, 2019a).
- On the legal and institutional side, all Mediterranean countries have developed measures to combat industrial pollution, such as the promulgation of regulatory texts to set levels of releases to the environment (ELVs), and to specify methods of managing and treating industrial waste. However, in most cases, countries have limited, decentralised infrastructure to monitor and implement the adopted regulations. This poses a significant challenge, particularly in eastern and MED South countries for sustainable data management and the development of an integrated knowledge base which, in turn, hinders the ability of enforcement authorities to implement the respective regulations.
- From a technical point of view, reinforcement of the capacities of different departments with the equipment to measure and analyse pollutants, as well as strengthening the capacity of national reference laboratories, are essential for the effective implementation of and compliance with regulations.
- The major challenge facing industries in the MED South countries and, to a lesser extent, in the MED Balkans and Turkey, is the need for investment in wastewater treatment systems and their continuous maintenance and control by qualified personnel. For MED EU countries, industries still require support from the EU (e.g. Green Deal) for the implementation of BAT as well as for increasing resource efficiency and applying emerging innovations.

4 Section D: main conclusions

Main pollution pressures

Detailed key messages for each H2020 thematic area have been presented in the previous section, drawing on the indicator-based thematic assessment. In general, in terms of pollution, clear progress has been made on pollution prevention. This is most notably illustrated by efforts towards restricting single-use plastic bags, improved access to sanitation narrowing the gap between urban and rural areas, and the application of BAT/BEP for reducing industrial emissions and eliminating hot spots. However, these interventions are not sufficient to curb the pressures. They cannot compensate for the increase in plastic-waste generation — in line with growing population, tourism and production-consumption drivers — and to ensure that the provision of safely managed sanitation keeps up with rampant population growth. Pollution pressures remain persistent, particularly in rural areas, suburbs and slums where waste and wastewater-collection services are either limited or non-existent, but also in the coastal areas along the Mediterranean where urban and industrial centres are located. A further reduction in key pressures, such as waste and marine litter, wastewater and industrial emissions, is required to achieve a clean Mediterranean and the GES of its sea.

The indicator-based thematic assessment relied primarily on the harmonised datasets delivered through the established H2020 reporting mechanism. For many indicators, data is scattered between different national stakeholders and coverage remains poor — both spatially and temporally. Data for waste indicators requires the adoption and use of international standards and adequate statistical capacities; data on water is generally managed by water-supply companies, whereas wastewater falls in-between the responsibility of the Ministries of Environment and Municipalities; data on industrial emissions is under the remit of MED POL as part of the regional inventories on pollutant releases and production activities. The lack of time-series data (e.g. marine litter) makes it difficult to determine trends. Although the coastal area is the most appropriate geographical and analytical scale to assess progress in terms of pollution into the Mediterranean Sea and to devise effective spatially and ecosystem-based measures accordingly, data is mainly available at the national scale, with the exception of industrial emissions data that only covers industries located in coastal areas. Substantial efforts have been made to set up the H2020 reporting process on both the national and regional side. However, the regional H2020 database is still in the making. For this reason, the data and information base for the assessment was supplemented by publicly available data collected from open databases (e.g. World Bank, UNSTAT/SDG, Eurostat, ESCWA, etc.) and recent national, regional and global assessments, expert judgement and documentation of examples and other evidence of progress as case studies. In some cases, the use of global databases was disputed by certain countries on the basis that the source of data for international organisations is unknown and the methodologies used differ from national ones. In other instances, data inconsistencies were encountered between different national and international sources. In the case of industrial emissions, data on pollutant releases and production activities from industries in MED South countries have not always been available and industrial pollutants are under-reported. Overall, data availability and quality have not improved much since the previous H2020 reporting exercise in 2014 (EEA and UNEP/MAP, 2014). The available data and knowledge base are not sufficient to provide an affirmative evidence-based response to the policy question — *What is the progress towards a cleaner Mediterranean?* Which, however, can be better explained by understanding the context and in particular the drivers of change.

Drivers of change

The assessment of progress on the main pollution pressures was conducted against a backdrop of the key drivers of change, such as population, coastal urbanisation, economic growth and related changes in consumption patterns, tourism and the general aspiration for a better quality of life in the region (Diwan et al., 2017). Although the nature of the drivers of change have not changed markedly in the last 30 to 40 years, their persistence over time, intensity, acceleration and cumulative effects are what drives change in the Mediterranean region. These societal drivers are compounded by the widespread and ubiquitous impacts of climate change which is exacerbating the pre-existing challenges in the region (UNEP/MAP-Plan Bleu, 2020).

Coastal population and tourism, associated with take-make-waste economic models, are the main drivers of plastic-waste generation and marine litter in the Mediterranean. The periodic geopolitical instabilities and conflicts trigger population displacements, leading to surges in migration, such as the refugee crisis in 2015. The influx of refugees exacerbates the need for, among others, access to sanitation services and waste management. Political tensions affect the performance of industrial activities, sometimes causing their relocation to conflict-free areas. In more general terms, political instabilities disrupt the progress in tackling pollution through discontinuities in implementing actions and developing national capacities, the high turnover of staff in the authorities concerned, causing a lack of sustainability and ownership. Shock events, such as the 2020 sanitary crisis and associated quarantine due to COVID-19, have caused a sharp drop in pollution pressures, although this is only expected to be short term.

Major efforts and progress

Major efforts have been made over the past 15 years towards a cleaner Mediterranean. Undeniably, clear progress has been achieved in terms of legal instruments, the creation and strengthening of institutional capacities, direct actions, regional data infrastructure and tools.

Significant achievements have been made possible through regional collaboration under the umbrella of the Barcelona Convention and countries' commitment to the 2030 Agenda. In implementation of the H2020 Initiative, concrete synergies with the SDGs have been identified, for example by aligning the H2020 indicators with SDG indicators, and using SDG indicators to supplement and strengthen the analytic components of this assessment.

The region has moved towards more integrated policies, such as the EcAp and ICZM, which link different areas of work by UNEP/MAP and provide a more holistic approach to management. In response, in recent years, efforts have been made to strengthen institutional and technical capacities, not only to sustain and enhance staff skills but also to develop competences to address these new challenges. These efforts build on the sustainability of established cooperation and expert networks, both at the national and regional level.

Direct actions, including investments to prevent pollution at source, reduce pressures or remediation of hot spots, capacity building and awareness raising have also contributed to the progress made. An analysis of investment measures put forward by countries in their NAPs shows the prevalence of pollution-prevention measures in all three subregions. Other investments have been allocated to strengthening capacities — among others, statistical capacities in view of the higher demand for data, statistics and knowledge and the key role of national statistical offices in responding to the requirements of the 2030 Agenda. When it comes to awareness raising among civil societies and citizens' involvement, concrete evidence documenting these activities and their effectiveness was difficult to retrieve.

In terms of regional data infrastructure, the development of the InfoMAP platform by Info/RAC for the provision and sharing of data, information services and knowledge marked a key milestone. The InfoMAP platform represents a unique access point to all the reporting modules at the regional level, including reporting under the seven mandatory Protocols of the Barcelona Convention, NBB, IMAP pilot platform as well as H2020. Cooperation between UNEP/MAP and the EEA within the framework of the ENI SEIS II South Support Mechanism was instrumental in adjusting and extending the regional data infrastructure and management systems to include data management for reporting on the H2020 Initiative, and to support the countries in further developing their national infrastructure and data systems. Overall, national infrastructure and tools have evolved significantly with countries putting in place dedicated information systems for monitoring and management of, for example, municipal and hazardous waste. A summary of the progress on aspects related to data infrastructure in the MED South countries is provided inTable 2.1.

Integrated management of pollution

The application of the EcAp, adapted to the source-to-sea paradigm as a tool for organising the H2020 indicators, guided the development of a more integrated assessment of pollution which takes into account systemic approaches, cross-linkages between thematic areas (e.g. waste and water through marine litter; water and industrial emissions; waste and industrial emissions), and tools that support integrated environmental management and policies, such as the E-PRTR. Despite advances in an integrated way of thinking, full operationalisation and implementation have proven difficult and present major challenges on the ground. Management approaches to pollution, including data collection and analysis, policies and legal instruments, remain predominantly sectorial in most countries. More integrated legal instruments, inclusive institutional set-ups, and multi-stakeholder governance frameworks are required for a more holistic and transdisciplinary approach. It is a priority for the region to close the gap between policy visions and implementation processes, both at the regional and national level.

Transition to more preventive and circular approaches

Progress has been achieved in the region in the development and uptake of tools and guidance for the transition to a blue, green and circular economy, supported by the MSSD, the MSESD and the SCP Action Plan. These regional efforts are yielding results across the whole Mediterranean, albeit at different rates. In most MED EU countries, improvements in waste prevention, reduction/reuse/recycle have been observed as a result of the EU polices on waste management and the EU Circular Economy package. Waste recycling is still limited in MED South countries, while waste recovery is uncommon. Most countries in the MED South and MED Balkans and Turkey have adopted waste policies, plans, or strategies for waste management, both at the national and subnational level. However, they must be embedded in a larger resource efficiency/circular economy framework or strategy that can lead to waste prevention and bring economic benefits. When it comes to the reuse of wastewater, overall, an increasing trend in direct reuse is seen across the Mediterranean region as a whole, indicating a more efficient use of the limited water resources.

Additional improvements required

Improved availability of data, especially for policy/decision-makers, including timely and reliable policy-relevant statistics would ensure sound and information-based decision-making. At the same time, greater availability and accessibility of information to other users/public institutions (collect once, use for different purposes) would make data collection more cost-effective. Although the principles and benefits of data sharing are well understood, implementation is lagging behind. However, data production is a long-term process which also needs to capture longer-term changes and delays in what can be observed in the environment. For this reason, continuous investment in the data-information business is even more critical. The data management policy document presented at COP21 was a key step in the right direction. This reference document details the main elements and roadmap for the preparation of a UNEP/MAP data management policy, acknowledging the need for a common data policy in the region that addresses the environmental data and information collected, acquired, processed and disseminated by UNEP/MAP through the InfoMAP system (Decision IG.24/2; UNEP/MAP, 2019). The EU-funded SEIS projects (ENPI SEIS I and ENI SEIS II South) have paved the way to the data management policy by putting in place the SEIS principles in the region (access, share, use of data, etc., as detailed in Box 1.1). A data policy will ensure that data and environmental information are accessible to enable comparisons of the environment at the appropriate geographical scale and are fully available to the general public and users to encourage citizen participation.

The maintenance and enhancement of technical capacities on monitoring, data and statistics, especially in the MED South countries, is another area requiring attention. More regular and better data collection by national and provincial offices will greatly benefit technical and policy efforts to improve pollution management. As regards industrial emissions, MED South countries need targeted capacity building related to industrial infrastructure not only to ensure the modernisation, optimisation and maintenance of their industrial processes, but also to increase the level of control over pollutant releases and monitoring in an effective way. Boosting the technical capacity of national reference laboratories through better capacity for the enforcement authorities should be a primary concern at the national and regional level. Special attention should be paid to statistical capacities, in particular environmental statistics, in relation to the statistical authorities' coordination role in monitoring SDGs. Financial support is essential for sustaining institutional capacities, with dedicated resources allocated to knowledge management, based on data/information/indicators, and to strengthening capacities for monitoring and enforcing the implementation of environmental legislation. This support should be part of a long-term commitment that is not subject to changing priorities in response to emergency issues, for example, refugee and sanitary crises. With specific reference to the COVID-19 pandemic, a clear commitment to 'building back better', focusing on the sound management of hazardous and chemical waste; strong and global stewardship of nature and biodiversity; renewable resources and facilitating the transition to a carbon-neutral future, will be key to a resilient and sustainable future.

Lack of enforcement was highlighted several times as an issue that is hindering the progress and effectiveness of technical, legal and institutional measures. A case in point concerns industrial emissions. Whereas all Mediterranean countries have adopted measures to combat industrial pollution, most countries have a limited, decentralised infrastructure to monitor and implement the adopted regulations. From a technical point of view, capacities in the relevant departments dealing with industrial emissions, equipment for measuring and analysing pollutants, and training in conducting compliance inspections, particularly in MED South countries, must be enhanced. Similar challenges apply for the area of waste, where a low level of enforcement is limiting improvements to waste-management systems.

High-level political support is necessary for investments to advance and to ensure their continuity. Access to funds should be facilitated, including access to new financial instruments for green start-ups. Investment capacities should be strengthened, especially in MED South countries, to support the identification of bankable projects and preparedness for project preparation and implementation.

Outlook

After 40 years of investments, the region needs to take serious action towards the coherent development and reporting of data, to invest massively in structuring the information needed to evaluate progress and to better use the knowledge gained through monitoring for action. To achieve real/tangible progress, the knowledge base must be actively strengthened to provide the scientific evidence required for environmental targets and threshold values to determine a 'good' ecosystem condition. To sustain progress, countries need to build on what has been accomplished so far, by establishing a regular reporting mechanism, national infrastructure and cooperation network.

Promising new developments related to data (e.g. earth observation, artificial intelligence, mobile phones, citizen monitoring, models and novel in situ measurements) and innovative approaches (e.g. nature-based solutions) should be further explored. Despite recent advances, developing countries still face important challenges underlined by limited capacities due to limited resources and funding. Targeted initiatives and investments could help unlock the potential of more innovative approaches.

Closing the gap between policy visions and implementation processes will require acting in a truly coordinated manner via the establishment of stronger, integrative and participatory processes, organised around measurable targets for progress within a realistic time frame. This is urgent to strengthen inclusive and institutional set-ups towards efficient multi-stakeholder governance frameworks to break the 'silo effect' created by thematic/sectoral approaches and to enhance integrated and more systemic approaches. It is critical to enable a more operational application of EcAp, including terrestrial, coastal and marine dimensions, and to move from visions and pilot activities to actual implementation. The recent Naples Ministerial Declaration of the Contracting Parties to the Barcelona Convention, 2019, notably describes 2020 as a 'critical turning point for the conservation and sustainable management of the Mediterranean Sea and coast' and underscores the 'need for a systemic change supported by forward-looking and innovative strategies, policies, and behaviours'.

The Naples Ministerial Declaration also renewed a set of ground-breaking commitments, in particular in four priority areas for action: by effectively tackling marine litter, strengthening and expanding the network of marine protected areas, responding to the challenges arising from climate change, and supporting a sustainable blue economy and an ecological transition for the Mediterranean region. This is most coherent with Europe's promise for a set of deeply transformative policies in response to calls for climate and environmental action, the EU Green Deal. Underpinned by the 2030 Agenda as the common reference framework, these commitments are timely and encouraging as a regional transition to a more sustainable and circular approach and effective governance set-up has never been so urgent.

5 List of acronyms

ANGED	National Agency of Waste Management
ANPE	National Agency for Environment Protection
AQUASTAT	FAO's Global Information System on Water and Agriculture
As	Arsenic
AVAC	Automated vacuum collection
BAT	Best available technique
BCRS	Barcelona Convention Reporting System
BEP	Best environmental practice
BOD	Biological oxygen demand
BREFs	Best available techniques reference documents
Cd	Cadmium
CEDARE	Centre for Environment and Development for the Arab Regions and Europe
Chl a	Chlorophyll
CMEMS	Copernicus Marine Environment Monitoring Service
COD	Chemical oxygen demand
COP	Conference of the Parties
CO_2	Carbon dioxide
CPs	Contracting Parties
Cr	Chromium
Cu	Copper
DPSIR	Drivers-Pressures-State-Impacts-Response
EBM	Ecosystem-based management
EBRD IPPF	European Bank for Reconstruction and Development Infrastructure Project Preparation Facility
EEA	European Environment Agency

EcAp	Ecosystem approach
EGP	Egyptian pounds
EIB	European Investment Bank
EIONET	The European Environment Information and Observation Network
ELVs	Emission limit values
ENI	European Neighbourhood Instrument
ENPI	European Neighbourhood Partnership Instrument
EO	Ecological objective
EPR	Extended producer responsibility
E-PRTR	European Pollutant Release and Transfer Register
EQS	Environmental quality standard
ETC/ICM	European Topic Centre /Inland, Coastal and Marine waters
GDP	Gross domestic product
GEF	Global Environment Facility
GEO	Global environment outlook
GES	Good environmental status
GHG	Greenhouse gases
GIZ	German Corporation for International Cooperation GmbH
HDPE	High-density polyethylene
Hg	Mercury
H2020	Horizon 2020
ICM	Integrated coastal management
IE	Industrial emissions
IMAP	Integrated Monitoring and Assessment Programme
IMF	Integrative Methodological Framework
IND	Indicator
InfoMAP	Information and Communication Mediterranean Action Programme
InfoRAC	Information and communication Regional Activity Centre
ISS	Improved sanitation system

IWRM	Integrated water resources management
JICA	Japan International Cooperation Agency
JRC	Joint Research Centre
LAS	League of Arab States
LBS	Land-based sources
MAP	Mediterranean Action Plan
MDG	Millennium Development Goal
MDIAK	Monitoring- Data-Information-Assessment- Knowledge
MED 5P	Public-Private Partnership Project Preparation in the Southern and Eastern Mediterranean
MED Balkans and Turkey	Albania, Bosnia and Herzegovina, Montenegro and Turkey
MED South	South Mediterranean Countries
MED EU	EU Mediterranean Countries
MED POL	Mediterranean Pollution Assessment and Control Programme of UNEP/MAP
MeHSIP	Mediterranean Hot Spot Investment Programme
MoLG	Ministry of Local Government
MRF	Material Recovery Facility
MSESD	Mediterranean Strategy on Education on Sustainable Development
MSFD	Marine Strategy Framework Directive
MSSD	Mediterranean Strategy for Sustainable Development
MSW	Municipal solid waste
MVA	Manufacturing added value
NAP	National action plan
NBS	Nature-based solution
NBB	National baseline budget
NGO	Non-governmental organisation
N	Nitrogen
Ni	Nickel
NO_x	Nitrogen oxides

NSWMP	National Solid Waste Management Programme
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
P	Phosphorous
PAH	Polycyclic aromatic hydrocarbon
PANACeA	Protected Areas for Enhanced Natural Conservation and Protection
Pb	Lead
PCBS	Palestinian Central Bureau of Statistics
PCDD	Dioxin
PCDF	Furan
p.e.	Population equivalent
PM_{10}	Particulate matter
PNA	Wastewater Treatment and Purification Programme
POP	Persistent organic pollutant
PRPI	Pollution reduction and prevention
PSS	Policy support system
RM	Revision and monitoring
RPMLM	Regional Plan on Marine Litter Management
QSR	Quality status report
SAP-MED	Strategic Action Programme in the Mediterranean Region
SCP	Sustainable consumption and production
SDG	Sustainable Development Goals
SDG-PSS	Sustainable Development Goals Policy Support System
SEIS	Shared Environmental Information System
SoED	State of Environment and Development
SO_x	Sulphur oxides
SMSS	Safely managed sanitation systems
SS	Suspended solids
SSF	Single Support Framework

SUP	Single-use plastics
SWIM	Sustainable Water Integrated Management
TA	Technical assistance
TEQ	Toxic equivalency factor
TN	Total nitrogen
TOC	Total organic carbon
TP	Total phosphorus
TPB	Persistent and bioaccumulable pollutant
UfM	Union for the Mediterranean
UNEP/MAP	United Nations Environment Programme
UNESCWA	United Nations Economic and Social Commission for Western Asia
UNSD	United Nations Statistics Division
UNSTAT	United Nations Statistics Division
UNICEF	United Nations Children's Fund
UWWTD	Urban Wastewater Treatment Directive
UWWTP	Urban Wastewater Treatment Plant
VOC	Volatile organic compound
WFD	Water Framework Directive
WHO	World Health Organization
WISE	Water Information System for Europe
WMRA	Waste Management Regulatory Authority
WWTP	Wastewater Treatment Plant
Zn	Zinc

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7 Annexes

A. Mapping of H2020 indicators and other processes

Table A.1. Mapping of H2020 indicators and other processes

	Policy theme	H2020 Indicator	SDG	EU	LAS	MSSD	IMAP	SCP	NAPs
IND 1	Municipal waste generation	1.1. Municipal waste composition		Green	Orange	Green		Yellow	Green
		1.2. Plastic waste generation per capita		Green		Orange		Yellow	Orange
IND 2	'Hardware' of waste management	2.1. Waste collection	Orange	Orange			Yellow		Orange
		2.2. 'Environmental control' (Waste controlled treatment or disposal)	Orange	Orange	Orange	Orange	Yellow		Orange
		2.3. Waste resource recovery	Green	Green		Orange	Yellow		Orange
IND Q	'Software' of waste management	Q. 'Software' of waste management		Yellow			Yellow	Yellow	Yellow
IND3	Access to sanitation	3.1. Share of total, urban and rural population with access to an improved sanitation system (ISS)	Orange			Green			Green
		3.2. Proportion of population using safely managed sanitation services (SMSS)	Green			Orange			Orange
IND4	Municipal wastewater management	4.1. Municipal wastewater collected and wastewater treated	Orange	Green	Orange	Green		Orange	Green
		Additional Information: – Type of Treatment – Annual design capacity and number of functional MWWTPs		Green	Orange				Green
		4.2. Direct use of treated municipal wastewater	Yellow	Yellow		Orange			
		4.3. Nutrients from Municipal effluents		Orange			Yellow		Green
IND5	Coastal and marine water quality	5.1. Nutrient concentrations in transitional, coastal and marine waters		Green			Green		Green
		5.2. Bathing water quality		Green			Green		Green
IND6	Industrial emissions	6.1. Release of nutrients from industrial sectors		Orange			Yellow	Orange	Green
		6.2. Release of toxic substances from industrial sectors		Orange			Yellow	Orange	Green
		6.3. Industrial hazardous waste disposed in environmentally sound manner	Green	Orange	Orange	Orange			
		6.4. Compliance measures aiming at the reduction and/or elimination of pollutants generated by industrial sectors	Orange	Yellow				Yellow	Orange

Notes: Green — Indicators are either identical or can be easily converted

Orange — Indicators have some common parameters

Yellow — indicators are different but relevant to consider in assessments

Source : EEA-UNEP/MAP

B. Waste

Table B.1 Municipal solid waste composition (%) in MED South countries

Country	Year	Organic material	Paper, cardboard	Textiles	Plastics	Glass	Metal	Other inorganic material
Algeria	2011 ([a])	62	9		12	1	2	14
	2014* ([b])	54	10		17	1	3	15
Egypt	2012 ([a])	55	11	5	16	5	3	5
	2013* ([b])	53	14	0	7	4	3	19
Israel	2005* ([a])	40	25	4		3	3	12
Jordan	2013* ([a])	50	16		15	2	2	16
	2013 ([b])	50	15		16	3	2	14
Lebanon	2010 ([a])	53	16	3	14	3	2	9
	2012 ([b])	50	17	3	13	4	6	7
Morocco	2011 ([a])	65	8		10	2	1	14
	2014* ([b])	60	7		8	2	3	7
Palestine	2012 ([a])	59	15	0	12	4	4	6
	2014 ([c])	59	10		14	2	3	12
	2015 ([b])	59	15	0	12	4	4	6
	2016 ([d])	50	12		15	2	2	19
Tunisia	2007 ([b])	68	10	2	11		4	5
	2011 ([a])	68	9		11	2	2	8

Source: ([a]) Horizon 2020 report (2014);

([b]) Country Files from the UNSD/UNEP data collection on environment statistics, 30 Apr 2018;

([c]) GIZ-SWEEPNET (2014);

([d]) MoLG-JICA (2017); * in the original source data, the total is not 100%.

Table B.2 Municipal solid waste collection in selected MED South cities

Country	City	Latest year available	Municipal waste collected (1000 tonnes)	Latest year available	Total population of the city (1000 inhabitants)	Latest year available	Population served by municipal waste collection (%)	Municipal waste collected per capita served (kg)
Algeria	Algiers	2015	1 000	2015	3 500	2015	92	311
	Djelfa	2015	400	2015	1 400	2015	100	286
	Adrar	2015	11	2015	490	2015	12	187
	Constantine	2015	257	2015	1 100	2015	80	292
	Wahran	2015	380	2015	1 800	2015	70	302
Egypt	Cairo	2002	3 869	2014	9 181			
Jordan	Amman	2015	1 559	2015	4 019	2015	100	388
	Irbid	2015	469.8	2015	1 775	2015	100	265
	Zarqa	2015	371.2	2015	1 369	2015	100	271
Lebanon	Beirut	2012	740	2012	668	2012	100	1 108
	Tripoli	2012	128	2012	370	2012	100	346
Morocco	Marrakech			2014	912	2014	93	
	Rabat			2014	578	2014	100	
	Casablanca	2015	1 431	2014	3 360	2015	100	

Source: UNSTATS, 2018.

Table B.3 List of data sets used to fill the country level data gaps on marine litter

Data Set and Source	Indicators	Spatial coverage	Temporal coverage
World Bank Development Indicators	Population; Tourism	20 Countries	1990-2018
H2020 Indicators - Demographic data Source: InfoRac System	Total Population; Urban Population; Rural Population; Coastal Population per hydrological Basin; Urban Population per hydrological Basin; Rural Population per hydrological Basin; Total Coastal Population in the Buffer Zone	6 Countries	
United Nations (UN)	Total amount of municipal waste collected	20 Countries	2000-2016
UNSD-ESCWA	Municipal waste managed in the country; Plastics; Recycling; Landfilling (Total); Controlled landfilling	6 Countries	2000 – 2015
World Bank 'What a waste' (2018)	City level: Composition plastic (%); Population; Waste treatment (open dump, marine waterways, controlled landfill, recycling); Plastic waste share on total waste generated (%) Country level: Population; Total MSW generated; Waste treatment (open dump, recycling, %)	20 Countries	Snapshot – 2016
Mediterranean_South_db-2014	MSW treatment coastal region; MSW subject to landfilling; MSW subject to recycling; Number of landfills; Number of open dump sites;	5 Countries (Egypt, Israel, Lebanon, Palestine, Tunisia)	2000 – 2012

C. Water

Table C.1 Regional overview of wastewater (WW) generated, collected, treated and directly reused

					Before 2012					
	Year	**WW Generated (Mm³/yr)**	**Year**	**WW Collected (Mm³/yr)**	**Year**	**WW Treated (Mm³/yr)**	**Year**	**WW Directly used (Mm³/yr)**	**Year**	**WW Directly used (Mm³/yr)**
Algeria	2012	820	2012	705	2012	324			2011	17 [i]
Egypt	2012	7078	2012	6497	2012	4013	2007	1300	2010	1300
Israel	2010	500	**2010**	**490**	**2010**	455	**2007**	**387**	**2010**	**416**
Jordan	**2010**	**195.3**	**2010**	**117.2**	**2010**	103				
Lebanon	2011	310	2009	103	2012	24.8 [ii]				
Libya	2010	598.2	2008	167	2010	53.2				
Morocco (54)	**2010**	**– (700)**	**2010**	**76.2 (490)**	**2010**	**18.3 (149.6)**			**2010**	**0 (17.4)**
Palestine	2003	81 [iii]	**2011**	**90**	**2011**	**62**			**2011**	**0.5**
Syria					2012	550.0	2004	370	2012	550.0
Tunisia	2009	287	**2012**	**239**	**2012**	232	2003	43	**2012**	**25.23**
MED South		**10569.50**		**8898.20**		**5416.60**				**1776.13**
Albania	2012	38.2			2012	14.5*				
Bosnia and Herzegovina	2012	65.56			2012	3.0				
Montenegro	2011	31.0			2011	8.6				
Turkey	2012	4073			2012	3257	2004	49		
MED Balkans		**4207.76**				**3283.10**				
Croatia	2012	329			2012	259				
Cyprus	2005	24	2010	23	2010	23	2007	19	2008	22
France	2012	4000	2008	3770	2008	3770	2004	411	2008	411
Greece			2007	568	2007	566	2003	27	2010	104
Italy	2007	3926			2007	3902	2004	45		
Malta	2012	21.2			2003	3.0 [iv]	2004	4	2000	2.0 [v]
Monaco	2009	8.0			2009	6.0				
Slovenia	2012	201			2010	126				
Spain	2007	5204 [iv]			2007	4570 [iv]		496	2007	487 [v]
MED EU		**13713.20**		**4361.00**		**13225.00**				**1071.00**
Total		28490.46		13259.20		21924.70				2847.13

Key for sources of data:

H2020 reporting and national assessment

For Morocco: coastal (national)

AQUASTAT

NBB reporting

*estimated

Other:

i. NAP

ii. SWIM/H2020 Country Report

iii. Palestine H2020 Country Level Assessment 2014

iv. UNU IWEH

v. UN Water 2017

(54) Morocco reported data for coastal hydrological basin and national data (indicated in brackets)

Table C.1 Regional overview of wastewater (WW) generated, collected, treated and directly reused (cont.)

	After 2012							
	Year	WW Generated (Mm³/yr)	Year	WW Collected (Mm³/yr)	Year	WW Treated (Mm³/yr)	Year	WW Directly used (Mm³/yr)
Algeria	2017	902 *	2012	705 **	2018	400 ii	2016	50
Egypt	2017	7713 *	2012	6497 **	2017	4282	2017	1200
Israel	2017	560.3 v	2017	519.9	2017	503.3	2017	520
Jordan	**2018**	**280**	2018	173.9	2018	166.6	2018	29.9
Lebanon								
Libya	2017	494.2	2017	6.7 v	2017	6.7		
Morocco (55)	2019	122.5 (900)	2019	113. 36 (648)	2019	29.9 (382)	2019	14.4 (49.5)
Palestine	2016	118 iii	2017	122	2017	83	2017	12
Tunisia	2018	318.0 v	2017	270	2017	266	2017	46
MED South		**11285.27**		**8942.50**		**6089.60**		**1907.40**
Albania	2017	54			2017	20.5		
Bosnia and Herzegovina (56)	2017	90.1	2018	15.3	2018	3.1	2018	0
Montenegro	2014	31			2014	9.5		
Turkey	2016	4499			2016	3842	2016	25
MED Balkans		**4674.10**		**15.35**		**3875.16**		**25.0**
Croatia	2017	312			2017	264		
Cyprus					2017	30.2	2017	15.4
France								
Greece								
Italy								
Malta	2017	23.3	2017	23.3	2017	23.3	2017	0.6
Monaco								
Slovenia	2017	217.7			2017	156		
Spain	2016	5206			2016	4686	2016	592
MED EU		**5759.0**		**23.30**		**5159.50**		**608.0**
Total		**21718.37**		**9069.80**		**15169.50**		**2540.40**

Key for sources of data:

H2020 reporting and national assessment

For Morocco: coastal (national)

For Bosnia & Herzegovina: coastal

AQUASTAT

NBB reporting

* estimated

** assumed same as Before 2012

Other:

i. NAP

ii. SWIM/H2020 Country Report

iii. Palestine H2020 Country Level Assessment 2014

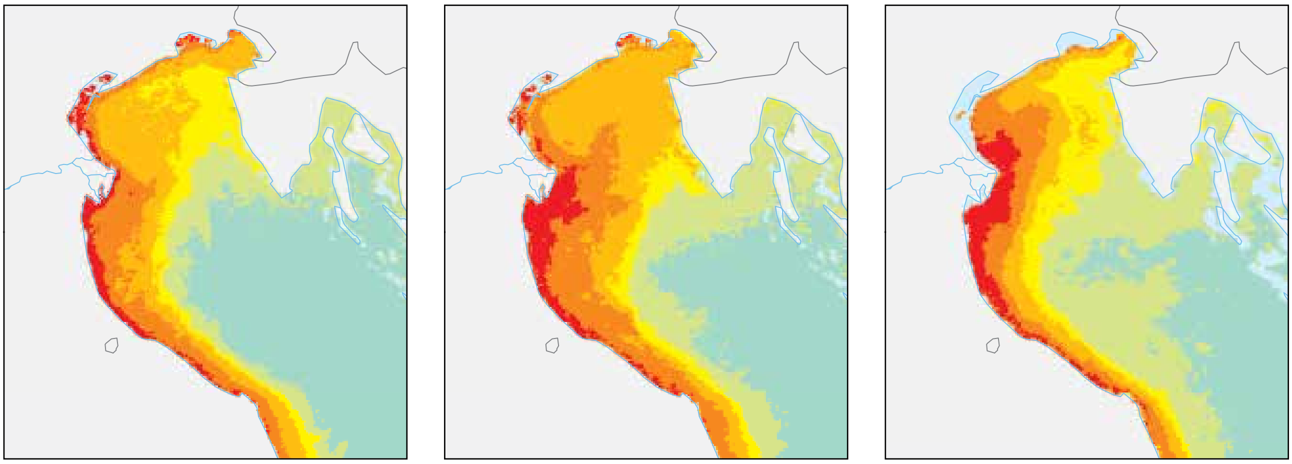
iv. UNU IWEH

v. UN Water 2017

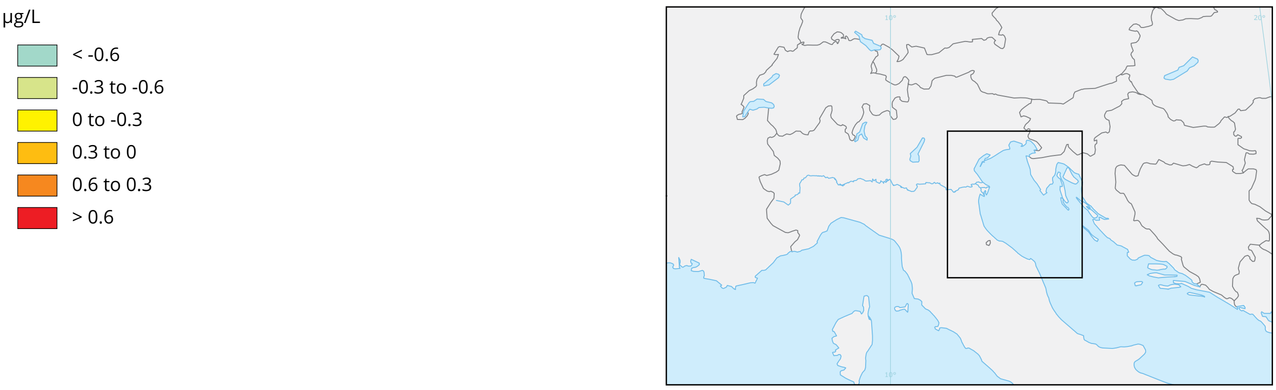
(55) Morocco reported data for coastal hydrological basin and national data (indicated in brackets)

(56) Bosnia & Herzegovina reported data under H2020 for 2018 for the coastal hydrological basin. These values are therefore lower than the country based values from UNSD database.

Figure C.1 **The Po zone of influence satellite image for 2003, 2012 and 2017 (based on CMEMS OCEANCOLOUR_MED_CHL_L4_REP_OBSERVATIONS_009_078 satelite data product), mean yearly nitrate (mmol/m³) (A) mean yearly phosphate (mmol/m³) (B) and mean yearly Chl a (µg/L) (C) concentrations between 2003-2017 based on CMEMS MEDSEA_REANALYSIS_BIO_006_0088 data product. Data products through ODYSSEA platform(http://odysseaplatform.eu/).**

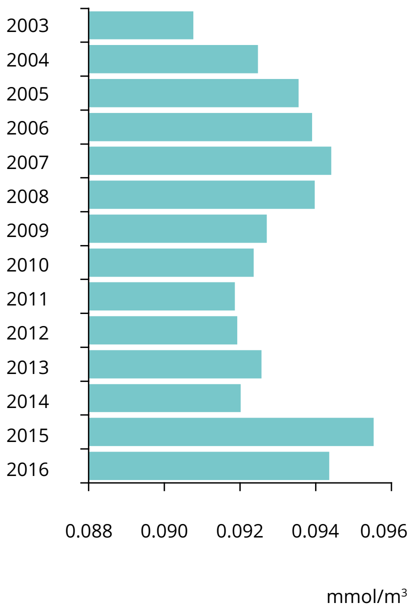


Maximum annual concentration chlorophyll a in 2003, 2013 and 2017 in the Po outfall area based on remote sensing

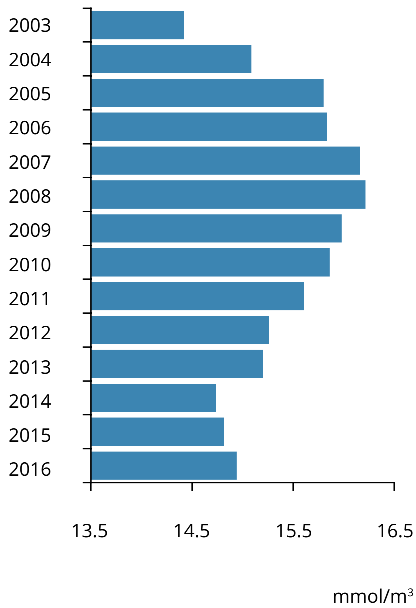


Reference data: ©ESRI

Mean yearly phosphate



Mean yearly nitrate



Mean yearly chlorophyll a

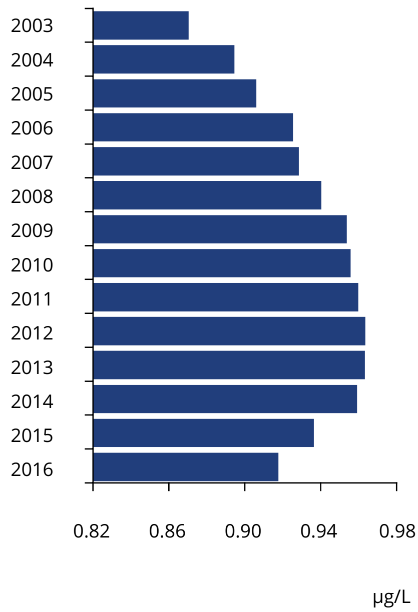
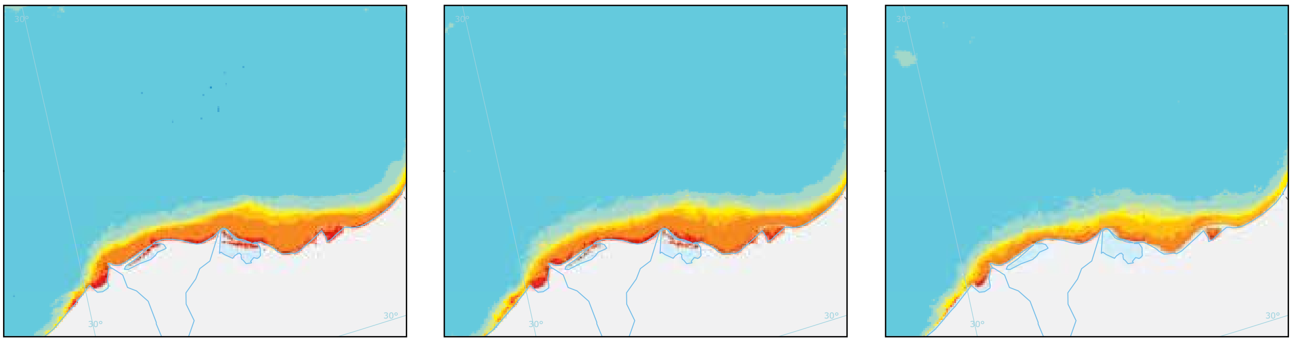
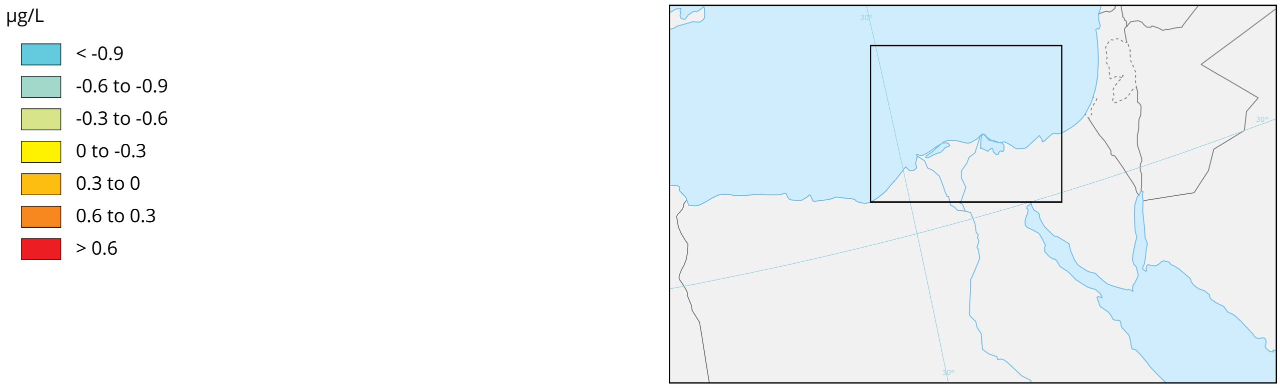


Figure C.2 **The Nile zone of influence satellite image for 2003, 2012 and 2017 (based on CMEMS OCEANCOLOUR_MED_CHL_L4_REP_OBSERVATIONS_009_078 satelite data product), mean yearly nitrate (mmol/m³) (A) mean yearly phosphate (mmol/m³) (B) and mean yearly Chl a (µg/L) (C) concentrations between 2003-2017 based on CMEMS MEDSEA_REANALYSIS_BIO_006_0088 data product. Data products through ODYSSEA platform(http://odysseaplatform.eu/).**

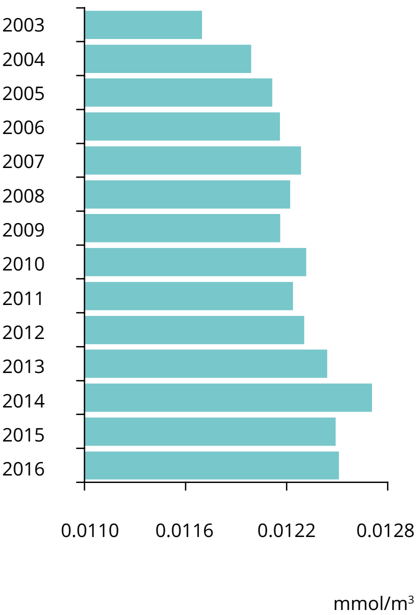


Maximum annual concentration chlorophyll a in 2003, 2013 and 2017 in the Nile outfall area based on remote sensing

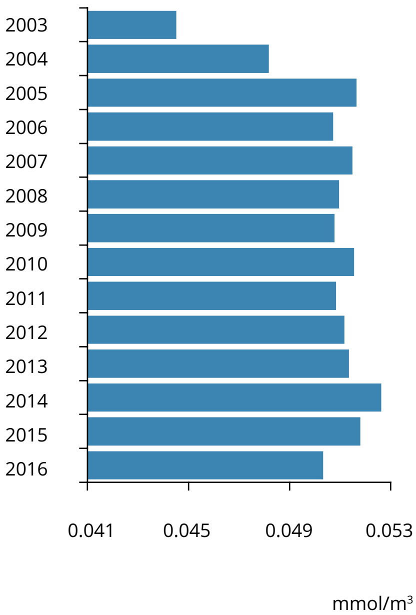


Reference data: ©ESRI

Mean yearly phosphate



Mean yearly nitrate



Mean yearly chlorophyll a

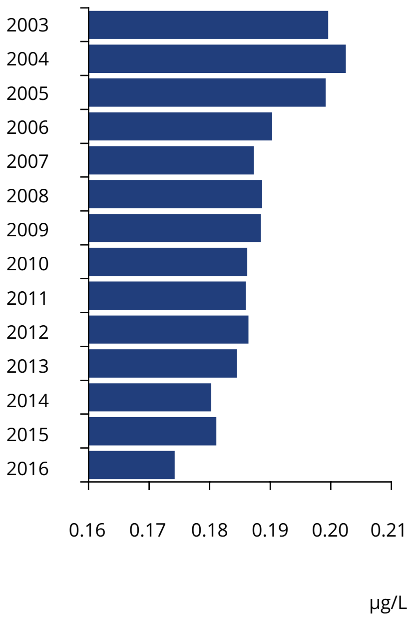
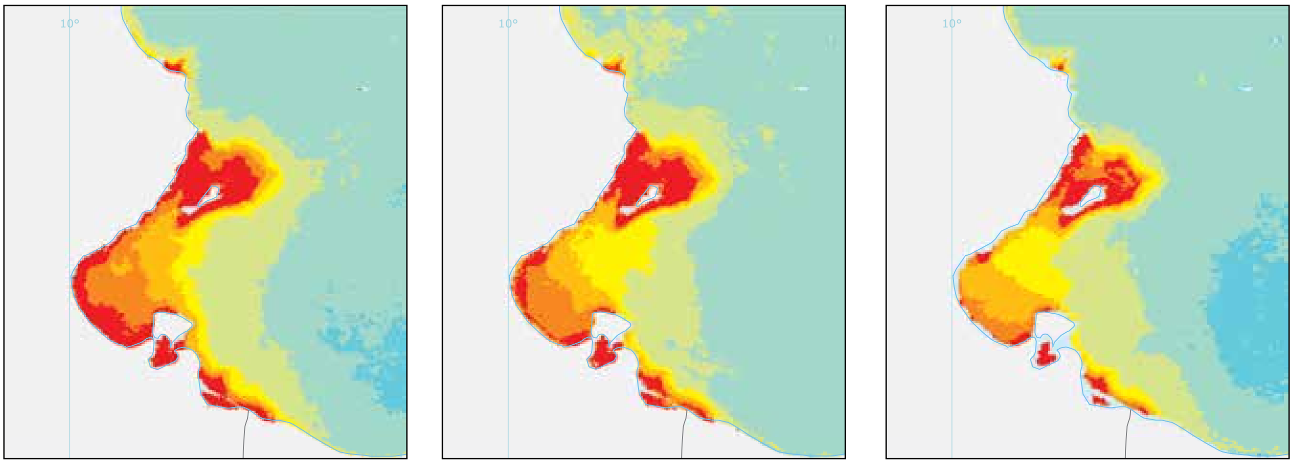
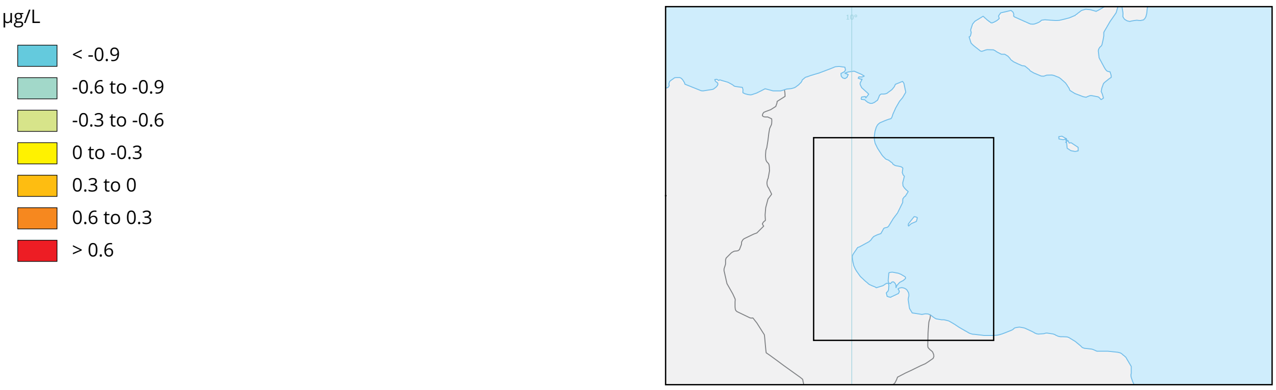


Figure C.3 **The Gulf of Gabes along the Tunisian coast satellite image for 2003, 2012 and 2017 (based on CMEMS OCEANCOLOUR_MED_CHL_L4_REP_OBSERVATIONS_009_078 satelite data product), mean yearly nitrate (mmol/m³) (A) mean yearly phosphate (mmol/m³) (B) and mean yearly Chl a (µg/L) (C) concentrations between 2003-2017 based on CMEMS MEDSEA_REANALYSIS_BIO_006_0088 data product. Data products through ODYSSEA platform (http://odysseaplatform.eu/).**



Maximum annual concentration chlorophyll a in 2003, 2013 and 2017 in the Gulf of Tunisia outfall area based on remote sensing



Reference data: ©ESRI

Mean yearly phosphate **Mean yearly nitrate** **Mean yearly chlorophyll a**

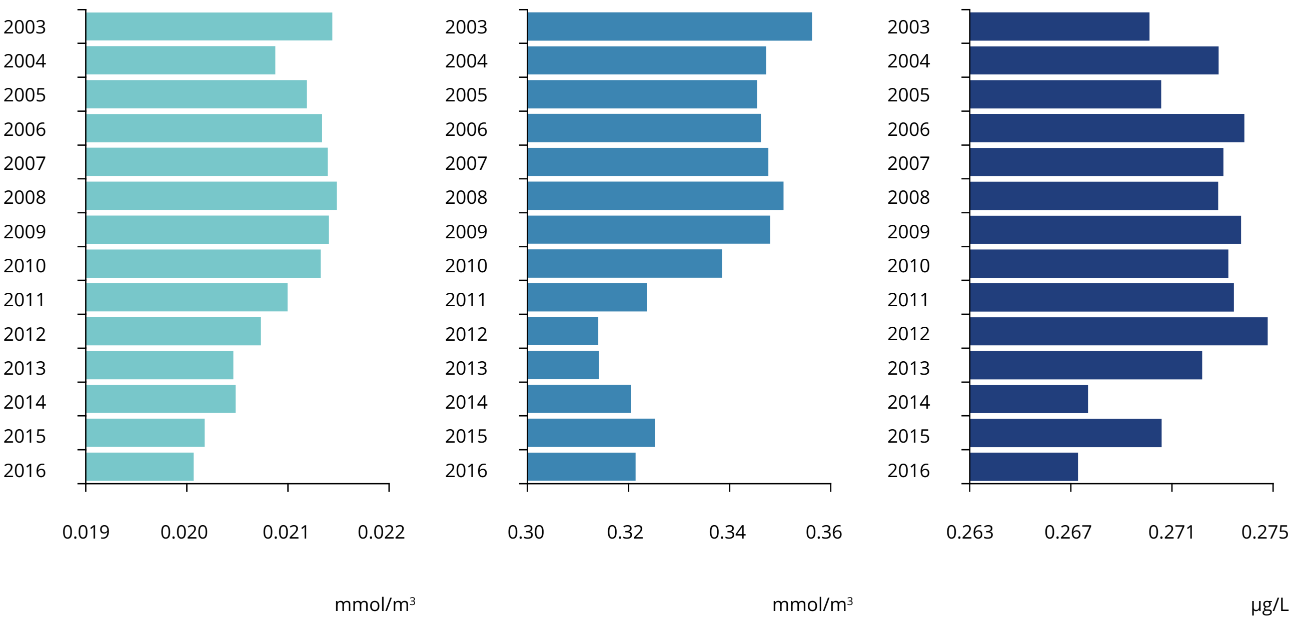
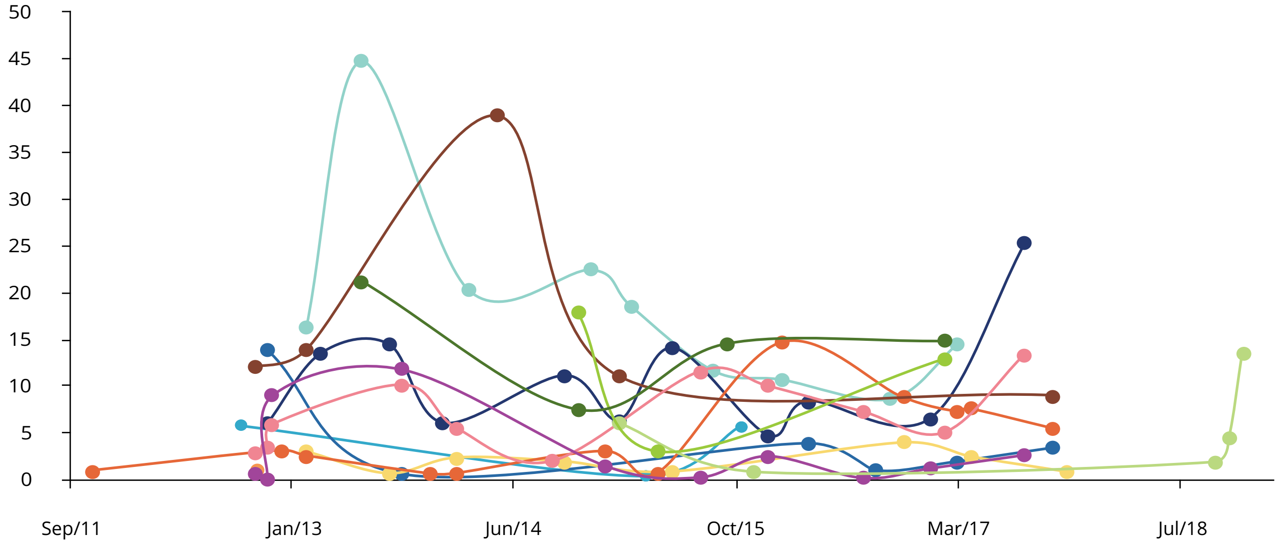
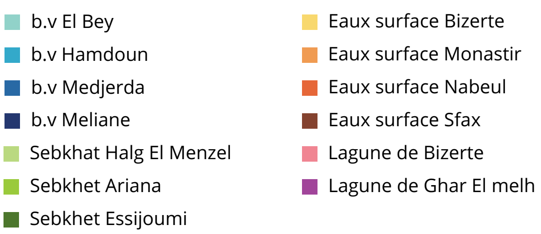


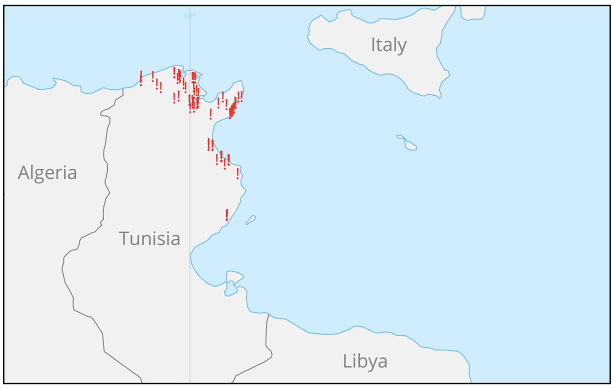
Figure C.4 **Average phospohate and anderage nitrate concentrations along the Tunisian coast (delivered data). Monitoring locations are mapped, with a zoomed in section of the hotspot area selected for the modelling exercise**

Phosphate per location monitored along the Tunisian coast

Concentration (mg/l)







Reference data: ©ESRI

Nitrate per location monitored along the Tunisian coast

Concentration (mg/l)

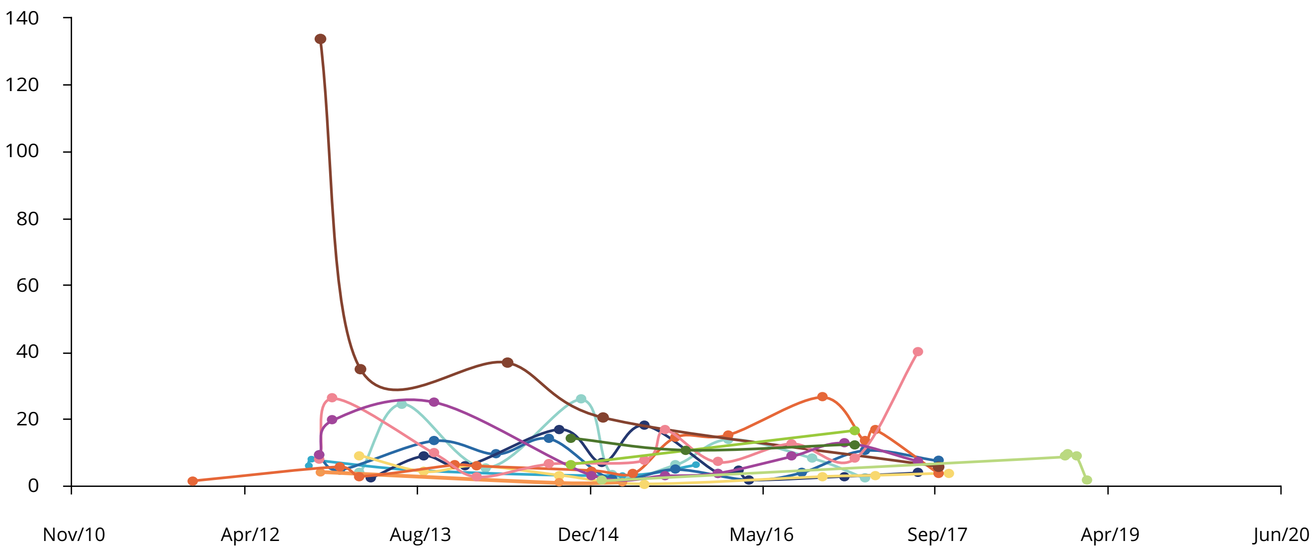


Table C.2 **Regional overview of Biological Oxygen Demand (BOD), Total Nitrogen (TN) and Total Phosphorus (TP) loads**

	BOD Wastewater treatment (ton/yr)	BOD Other industries (ton/yr)	TN Wastewater treatment (ton/yr)	TN Other industries (ton/yr)	TP Wastewater Treatment (ton/yr)	TP Other Industries (ton/yr)
	2018	**2018**	**2018**	**2018**	**2018**	**2018**
Algeria	4862	407000	2917	6960	972	2320
Egypt						
Israel	786.2	1265	201.5	2770	29.8	507
Jordan*		920		234.58		13.31
Lebanon**	65700	72000	10220		2628	
Libya						
Morocco	16658	8367	2159	1509.4	518	120.4
Palestine**	35418					
Syria**	18904	51613	3093	6435	343	3561
Tunisia	15041	4876	9687.6	4562	1183.6	2886
MED South	**157368.9**	**546041.0**	**28278.1**	**22470.9**	**5674.4**	**9407.7**
Albania	1503.5	19882	902.04	1.8	120.9	390
Bosnia and Herzegovina**	14.8	2040	24.4	11.6	2.7	68
Montenegro	626	1401	218.2	333	70.2	103
Turkey	31149	12130	18643	1106	3371	180.7
MED Balkans	**33293.3**	**35453.0**	**19787.6**	**1452.4**	**3564.8**	**741.7**
	TOC* Wastewater treatment (ton/yr)**	**TOC*** Other industries (ton/yr)**	**TN Wastewater treatment (ton/yr)**	**TN Other industries (ton/yr)**	**TP Wastewater Treatment (ton/yr)**	**TP Other Industries (ton/yr)**
	2017	**2017**	**2017**	**2017**	**2017**	**2017**
Croatia			1178		99.2	
Cyprus			56.7	500	9.5	85.8
France	8455.9	22.12	12748	896.4	1202.2	28.06
Greece	5583	7.24	3422	475.7	789.2	86.3
Italy	23898.6	86.01	21776.9	1839.9	2573	183.93
Malta		694.39	525	1037	139	136.2
Monaco						
Slovenia						
Spain	10184.1	8.04	32240.4	5070.6	2468.4	541.69
MED EU	**48121.6**	**817.8**	**71947.0**	**9819.6**	**7280.5**	**1062.0**

Source of data: MED South and MED Balkans NBB 2018 reporting; MED EU E-PRTR V17, following extraction of data for coastal RBDs. Note that E-PRTR data only considers UWWTPs of over 100 000pe. This means smaller discharges are not included and hence actual loads are higher.

* MED South does not include data for Jordan. As this indicator considers loads from municipal wastewater originating from urban agglomerations ≥ 2000 p.e. situated in coastal hydrological basin and those agglomerations with direct access to the Mediterranean, it is not applicable to Jordan due to lack of direct accessibility to the Mediterranean Sea. Nevertheless, after the rehabilitation of the Khirbat Al-Samra WWTP in 2008, BOD5 and Total Nitrogen and Total Phosphorus are within limits but these need to be monitored due to unplanned emission of effluents resulting from the presence of Syrian refugees (Jordan NAP, 2016).

** In the case of Lebanon and Bosnia & Herzegovina, values refer to nutrient loads of the untreated wastewater. The same is assumed for Syria as WWTPs are currently not operating optimally. In Palestine, BOD loads refer to both treated and untreated wastewater.

*** Under E-PRTR reporting, TOC is reported instead of BOD.

D. Industrial emissions

The approach used by the MEDPOL National Baseline Budget of Releases (NBB) system for data collection differs from the approach used by the European Pollutant Release and Transfer Register (E-PRTR) for the EU member states. The following table gives the correspondence between the Industrial sectors and activities within E-PRTR and the corresponding sectors and sub-sectors within NBB.

Table D.1 Comparison of NBB and E-PRTR sectors for industrial installations

Energy sector	
Activities:	**Related NBB sector: Production of energy**
• Mineral oil and gas refineries • Installations for gasification and liquefaction • Thermal power stations and other combustion installations • Coke ovens • Coal rolling mills • Installations for the manufacture of coal products and solid smokeless fuel	• Combustion of heating oil • Combustion of lignite • Gas production **Related NBB sector: Manufacture of refined petroleum products** • Manufacture of petrochemicals • Transport and marketing of petroleum products

Production or processing of metals	
Activities:	**Related NBB sector: Manufacture of metals**
• Metal ore (including sulphide ore) roasting or sintering installations • Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting • Installations for the processing of ferrous metals • Ferrous metal foundries • Installations for the production of non-ferrous crude metals from ore, concentrates or secondary raw materials and for smelting of non-ferrous metals including recovery • Installations for surface treatment of metals and plastics using electrolytic or chemical processes	• Casting of grey iron • Casting of other non-ferrous metals • Casting of steel • Electroplating • First-stage aluminium smelting • First-stage copper smelting • Manufacture of accumulators • Manufacture of basic iron and steel • Manufacture of lead oxides and lead-based colouring matter • Manufacture of other non-ferrous metals • Manufacture of zinc or tin • Second stage aluminium smelting • Second stage copper smelting • Second stage lead smelting

Table D.1 Comparison of NBB and E-PRTR sectors for industrial installations (cont.)

Mineral industry	
Activities:	**Related NBB sector:** **Manufacture of cement**
• Underground mining and related operations • Opencast mining and quarrying • Installations for the production of cement clinker in rotary kilns; lime in rotary kilns, cement clinker or lime in other furnaces • Installations for the production of asbestos and the manufacture of asbestos based products • Installations for the manufacture of glass, including glass fibre • Installations for the melting mineral substances, including the production of mineral fibres • Installations for the manufacture of ceramic products including tiles, bricks, stoneware or porcelain	• Manufacture of cement • Manufacture of lime and plaster **Related NBB sector:** **Manufacture of other inorganic chemicals** • Manufacture of ceramic products • Manufacture of glass and glass products **Related NBB sector:** **Mining and quarrying** • Extraction of petroleum and gas • Metal mining

Chemical Industry	
Activities:	**Related NBB sector:** **Manufacture of other organic chemicals**
• Chemical installations for the production on industrial scale production of basic organic chemicals • Chemical installations for the production on industrial scale production of basic inorganic chemicals • Chemical installations for the production on industrial scale production of phosphorous, nitrogen or potassium'; based fertilizers • Chemical installations for the production on industrial scale of basic plant health products and of biocides • Installations using a chemical or biological process for the production on an industrial scale of basic pharmaceutical products • Installations for the production on an industrial scale production of explosives and pyrotechnic products	• Manufacture of explosives, glues, gelatine, essential oils • Paints and varnishes • Plastics, rubber, synthetic resins • Polyethylene tetraphtalate • Polyvinyl chloride • Synthesis of pigments • Lead Alkyl **Related NBB sector:** **Manufacture of fertilizers** • Nitrogenous fertilizers • Phosphate fertilizers and phosphoric acid **Related NBB sector:** **Manufacture of pharmaceuticals** • Cosmetics and perfumes • Pharmaceuticals • Soaps, detergents and sanitary preparations **Related NBB sector:** **Manufacture and formulation of biocides** • Formulation of pesticides • Synthesis of phytosanitary products

Table D.1 Comparison of NBB and E-PRTR sectors for industrial installations (cont.)

Chemical Industry	
Activities:	**Related NBB sector:** **Manufacture of other organic chemicals**
• Chemical installations for the production on industrial scale production of basic organic chemicals • Chemical installations for the production on industrial scale production of basic inorganic chemicals • Chemical installations for the production on industrial scale production of phosphorous, nitrogen or potassium'; based fertilizers • Chemical installations for the production on industrial scale of basic plant health products and of biocides • Installations using a chemical or biological process for the production on an industrial scale of basic pharmaceutical products • Installations for the production on an industrial scale production of explosives and pyrotechnic products	• Manufacture of explosives, glues, gelatine, essential oils • Paints and varnishes • Plastics, rubber, synthetic resins • Polyethylene tetraphtalate • Polyvinyl chloride • Synthesis of pigments • Lead Alkyl
	Related NBB sector: **Manufacture of fertilizers**
	• Nitrogenous fertilizers • Phosphate fertilizers and phosphoric acid
	Related NBB sector: **Manufacture of pharmaceuticals**
	• Cosmetics and perfumes • Pharmaceuticals • Soaps, detergents and sanitary preparations
	Related NBB sector: **Manufacture and formulation of biocides**
	• Formulation of pesticides • Synthesis of phytosanitary products

Paper and wood	
Activities:	**Related NBB sector:** **Manufacture of paper**
• Industrial plants for the production of pulp from timber or similar fibrous materials • Industrial plants for the production of paper and board and other primary wood products • Industrial plants for the preservation of wood and wood products with chemicals	• Manufacture of articles of paper or paperboard • Manufacture of paper and pulp • Printing activities

Intensive livestock production and aquaculture	
Activities:	**Related NBB sector:** **Farming of animals**
• Installations for the intensive rearing of poultry or pigs • Intensive aquaculture	• Farming of animals (cattle, sheep, swine, poultry) and slaughterhouses • Farming of special animals (rabbits, goats, horses, asses, mules and hinnies, other)
	Related NBB sector: **Aquaculture**
	• Fish breeding • Fish processing

Table D.1 Comparison of NBB and E-PRTR sectors for industrial installations (cont.)

Animal and vegetable products from the food and beverage sector	
Activities:	**Related NBB sector:** **Food packing**
• Slaughterhouses • Treatment and processing of animal and vegetable materials in food and drink production • Treatment and processing of milk	• Animal feeds • Animal raw materials, Vegetable raw materials • Dairy industry • Manufacture of beer • Manufacture of non-alcoholic beverages • Manufacture of olive oil • Manufacture of other vegetable oils (other than olive oil) • Manufacture of sugar beet • Manufacture of wines and spirits • Other prepared foods • Preserving fruit and vegetables
	Related NBB sector: **Agriculture**
	• Growing of cereals (wheat, rice, maize, soyabeans, other) • Growing of fruit and vegetables • Horticultural specialties, nurseries • Industrial crops (cotton, tobacco, sugar cane, sugar beet, potatoes, other) • Manufacture of wines

Other activities	
Activities:	**Related NBB sector:** **Manufacture of textiles**
• Plants for the pretreatment of dyeing of fibers or textiles • Plants for the tanning of hides and skins • Installations for the surface treatment of substances, objects, or products using organic solvents • Installations for the production of carbon or electrographite through incineration or graphitization • Installations for the building of, painting or removal of paint from ships	• Manufacture and dyeing of textiles
	Related NBB sector: **Tanning and dressing of leather**
	• Tanning and dressing of leather

Table D.2 Linkage between manufacturing industries as defined in SDG 9.4 and NBB sectors and subsectors

SDG 9.4 Manufacturing Industry	NBB (ID) Sector	NBB (ID) Sub-sector
Iron and steel industry	Manufacture of metals	41. Manufacture of basic iron and steel
		36. Casting of steel
Chemical and petrochemical industry	Manufacture of refined petroleum products	66. Manufacture of petrochemicals
		67. Manufacture of refined petroleum products
	Manufacture of other organic chemicals	53. Manufacture of explosives, glues, gelatine, essential oils
		54. Other chemicals
		55. Paints and varnishes
		56. Plastics, rubber, synthetic resins
		57. Polyethylene tetraphtalate
		58. Polyvinyl chloride
		59. Synthesis of pigments
		99. Lead Alkyl
	Manufacture of other inorganic chemicals	48. Industrial gases
		51. Other (activated carbon, composed of Al, Ba, Ca, Ni)
		52. Synthesis of pigments
Non-ferrous metals basic industries	Manufacture of metals	35. Casting of other non-ferrous metals
		38. First-stage aluminium smelting
		39. First-stage copper smelting
		42. Manufacture of lead oxides and lead-based colouring matter
		43. Manufacture of other non-ferrous metals
		44. Manufacture of zinc or tin
Non-metallic minerals such as glass, ceramic, cement, etc.	Manufacture of cement	27. Manufacture of cement
		28. Manufacture of lime and plaster
	Manufacture of other inorganic chemicals	49. Manufacture of ceramic products
		50. Manufacture of glass and glass products
Transport equipment	Transport	87. Manufacture of aircraft and spacecraft
		88. Manufacture of motor vehicles
		89. Manufacture of other transport equipment
Machinery comprises fabricated metal products, machinery and equipment other than transport equipment	Manufacture of electronics products	29. Manufacture of electric machines and appliances (condensers, transformers)
Food and tobacco	Food packing	14. Animal raw materials, Vegetable raw materials
		15. Dairy industry
		16. Manufacture of beer
		17. Manufacture of non-alcoholic beverages
		18. Manufacture of olive oil
		19. Manufacture of other vegetable oils (other than olive oil)
		20. Manufacture of sugar beet
		21. Manufacture of wines and spirits
		22. Other prepared foods
		23. Preserving fruit and vegetables
	Other	75. Other

Table D.2 Linkage between manufacturing industries as defined in SDG 9.4 and NBB sectors and subsectors (cont.)

SDG 9.4 Manufacturing Industry	NBB (ID) Sector	NBB (ID) Sub-sector
Paper, pulp and printing	Manufacture of paper	60. Manufacture of articles of paper or paperboard
		61. Manufacture of paper and pulp
		62. Printing activities
Wood and wood products (other than pulp and paper)	Other	74. Manufacture of Wood
Textile and leather	Manufacture of textiles	69. Manufacture and dyeing of textiles
		70. Manufacture of clothing and other finished products made of fabric
	Tanning and dressing of leather	84. Tanning and dressing of leather
Non-specified (any manufacturing industry not included above)	Manufacture of metals	37. Electroplating
		40. Manufacture of accumulators
	Manufacture of pharmaceuticals	63. Cosmetics and perfumes
		64. Pharmaceuticals
		65. Soaps, detergents and sanitary preparations
	Manufacture of fertilizers	32. Nitrogenous fertilizers
		33. Phosphate fertilizers and phosphoric acid
	Manufacture of other inorganic chemicals	48. Industrial gases
	Building and repairing of ships and boats	8. Drydocks
		9. Shipyards
	Other	73. Installations for melting mineral substances
	Manufacture and formulation of biocides	25. Formulation of pesticides
		26. Synthesis of phytosanitary products
	Mining and quarrying	71. Extraction of petroleum and gas
		72. Metal mining
	Recycling activities	81. Recycling of lubricating oils
		82. Recycling of metal waste and scrap
		83. Recycling of non-metal waste and scrap (paper, glass)
	Manufacture of electronics products	30. Manufacture of integrated circuits
		31. Manufacture of radio, television and communications equipment

E. Overview of H2020 indicators reported by countries (July 2020)

Table E.1 Overview of H2020 indicators reported by countries (July 2020)

		MED South										MED Balkans			
Indicators	**Indicator Code**	**AL**	**EG**	**IL**	**JO**	**LB**	**LY**	**MA**	**PS**	**SY**	**TN**	**AL**	**BA**	**ME**	**TR**
Waste indicators															
Municipal waste generation	IND 1.1		■	■	■		■	■	■		■		■		
Municipal waste composition	IND 1.A			■	■		■	■	■		■		■		
Plastic waste generation per capita	IND 1.B			■	■		■	■	■				■		
% of population living in coastal areas	IND 1.C			■	■		■	■	■		■				
% of tourists in coastal Areas/ population in coastal areas	IND 1.D			■	■		■	■	■		■				
Waste collection coverage	IND 2.A.1		■	■	■			■	■				■		
Waste covered by the formal sector	IND 2.A.2		■	■	■			■	■				■		
% of waste to uncontrolled dumpsites	IND 2.B.1			■				■					■		
Uncontrolled dumpsites in coastal areas	IND 2.B.2			■				■					■		
Waste going to dumpsites in coastal areas	IND 2.B.3			■				■					■		
% of plastic waste generated that is recycled	IND 2.C		■	■				■					■		
Set of questions	IND Q		■	■				■	■		■		■	■	
Water indicators															
Share of national population with access to an improved sanitation system (ISS)	IND 3.1.1		■	■	■				■		■				
Share of population in the catchment/ hydrological basin at the coastal area with access to an improved sanitation system (ISS)	IND 3.1.2		■	■	■			■	■				■		
Proportion of national population using safely managed sanitation services (SMSS)	IND 3.2.1		■	■	■				■		■				
Proportion of population in the catchment/hydrological basin at the coastal area using safely managed sanitation services (SMSS)	IND 3.2.2		■	■	■				■				■		

Table E.1 Overview of H2020 indicators reported by countries (July 2020) (cont.)

		MED South										MED Balkans			
Indicators	**Indicator Code**	**AL**	**EG**	**IL**	**JO**	**LB**	**LY**	**MA**	**PS**	**SY**	**TN**	**AL**	**BA**	**ME**	**TR**
Municipal wastewater collected and wastewater treated at national level	IND 4.1.1			■	■			■	■		■				
Municipal wastewater collected and wastewater treated per catchment/ hydrological basin at the coastal area	IND 4.1.2										■		■		
Direct use of treated municipal wastewater at the national level	IND 4.2			■	■			■	■		■				
Release of nutrients from municipal effluents per catchment/hydrological basin at the coastal area	IND 4.3							■			■				
Nutrient concentrations in transitional, coastal and marine waters (station)	IND 5.1.1										■				
Nutrient concentrations in transitional, coastal and marine waters (parameters)	IND 5.1.2										■				
Bathing water quality	IND 5.2			■							■				
Industrial Emissions															
Total BOD load discharged from industrial installations to Mediterranean marine environment	IND 6.1.1	■		■	■			■	■		■				
Total Nitrogen load discharged from industrial installations to the Mediterranean marine environment	IND 6.1.2	■		■	■			■	■		■				
Total phosphorus load discharged from industrial installations to the Mediterranean marine environment	IND 6.1.3	■		■	■			■	■		■				
Total heavy metals load released from industrial installations to the Mediterranean marine environment	IND 6.2.1	■		■	■			■			■				
Furans and dioxins load released from industrial installations to the Mediterranean marine environment	IND 6.2.2	■		■											

Table E.1 Overview of H2020 indicators reported by countries (July 2020) (cont.)

		MED South										MED Balkans			
Indicators	**Indicator Code**	**AL**	**EG**	**IL**	**JO**	**LB**	**LY**	**MA**	**PS**	**SY**	**TN**	**AL**	**BA**	**ME**	**TR**
Polycyclic aromatic hydrocarbons (PAH) load released from industrial installation in the Mediterranean marine environment	IND 6.2.3			■											
Volatile Organic compounds (VOC) load released from industrial installations to the Mediterranean marine environment	IND 6.2.4			■											
Total quantity of generated hazardous waste from industrial installations	IND 6.3.1	■		■	■						■			■	
Quantity of industrial hazardous waste disposed in environmentally sound manner relative to total quantity of generated hazardous waste from industrial installations	IND 6.3.2				■						■			■	
Number of industrial installations reporting periodically loads of pollutants discharged to the marine and coastal environments relative to the total number of industrial installations	IND 6.4.1				■			■						■	
Number of environmental inspections carried out by enforcement authorities in which industrial installations were found to be in breach of laws and regulations relative to the total number of executed	IND 6.4.2	■			■						■				
Number of eliminated hotspots identified in the updated NAPs relative to the 2001 and 2015 baseline	IND 6.4.3							■						■	
Demography															
Demography				■	■			■	■		■				

F. Supplementary information on InfoMAP regional infrastructure

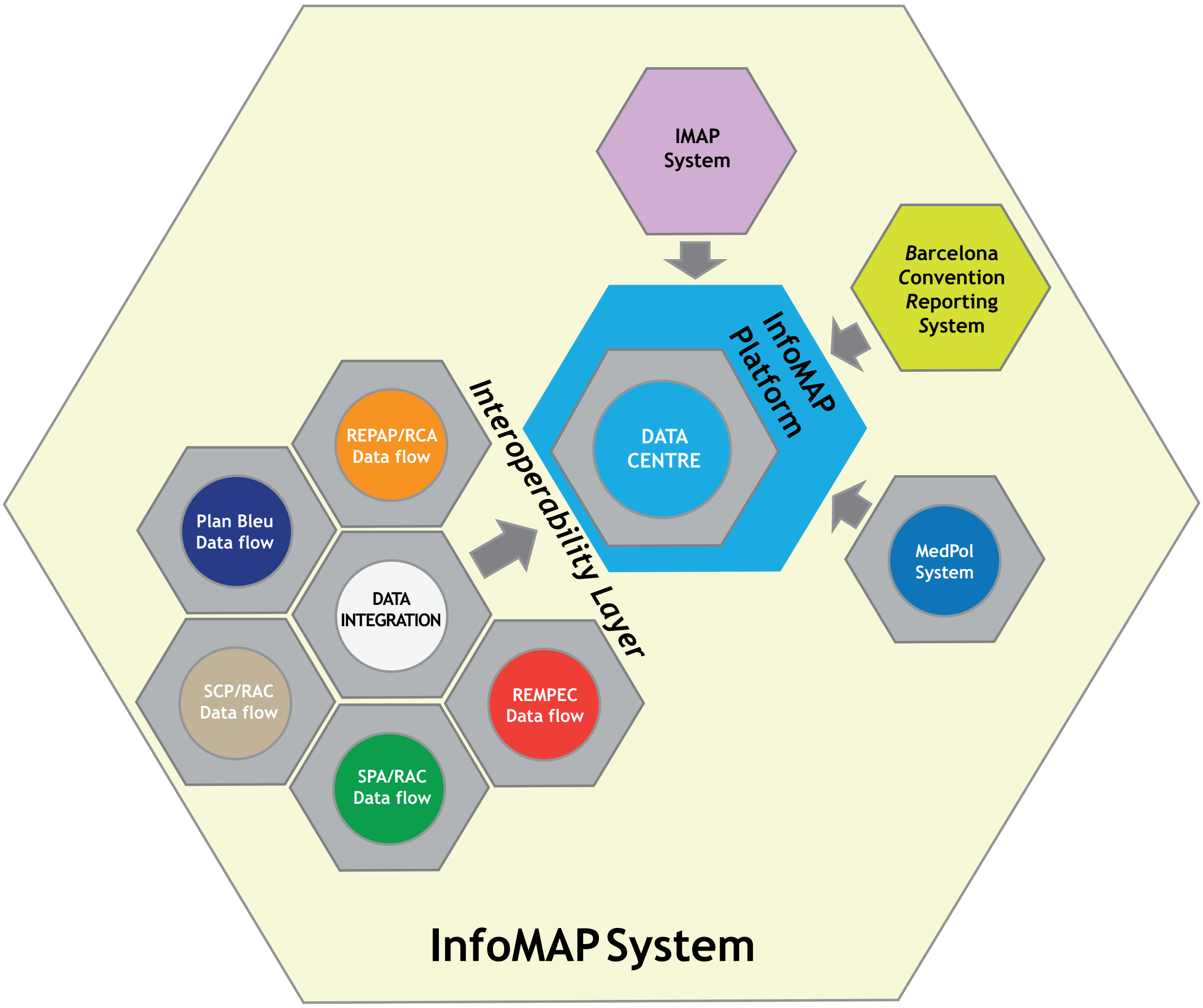
Established by the Barcelona Convention, the mission of the Information and Communication Regional Activity Centre (INFO/RAC) is to provide adequate information and communication services and infrastructure technologies on public participation of Barcelona Convention (Article 15) and on reporting (Article 26) related to the issue for the protection of the Mediterranean marine and coastal environment. From January 2010, the functions of INFO/RAC in ensured by the Italian Institute for Environmental Protection and Research (ISPRA).

INFO/RAC is responsible to manage dataflows related to the Barcelona Convention reporting obligations (BCRS, NBB, and IMAP), data policy, data exchange protocols, online reporting tools, as well as further developing the governance IT platform for common standardisation and specification of data.

INFO/RAC has designed the InfoMAP System that is the UN Mediterranean knowledge platform conceived to provide and share data, information services and knowledge for the benefit of the Mediterranean Action Plan (MAP) components and Contracting Parties, based on the Shared Environmental Information System (SEIS) principles. It is also able to support the Mediterranean Quality Status and the State of Environment Report. Its main scope is to:

- Provide access to reporting system;
- Harmonise data structure and models;
- Create a common catalogue of resources;

Figure F.1 InfoMAP System



- Integrate data with interoperability layer;
- Create a common platform to view, query and analyse data;
- Produce tools to support data & information dissemination.

The InfoMAP platform represents the unique access point to the all the InfoMAP nodes and other data services at regional level. The InfoMAP platform is composed of:

- InfoMAPNode (Geoportal to orchestrate the Spatial Data Infrastructure);
- The Data Centre Reporting system;
- The MEDPOL Info System;
- The IMAP Pilot Platform.

InfoMAPNode

The InfoMAPNode is the portal to manage and access to the Spatial Data Infrastructure (SDI). Developed in the biennium 2018-2019, the InfoMAPNode is an open source geoportal for sharing with different level of authentications, geospatial data, maps and related metadata of relevance for the Mediterranean area. It represents, also, the entry point to InfoMAP Spatial Data and Metadata catalogue based on open source suite. It is composed by a set of technical and non-technical components that facilitate the sharing of geographic information. The main components are:

- Spatial Data Management system to store, query and manage directly the data in the database;
- A Catalogue system with a specific discovery service to harvest, search and query metadata and with integrated Metadata editor. the system is implemented on the open software component GeoNetwork;
- Network Service system based where data are distributed and elaborated via Web Service (mainly following OGC/INSPIRE Standard);
- A portal within a client to search, view, query and analyze the spatial data. It is based on the software package GeoNode.

The main functionality of InfoMAPNode application are: upload, manage and share geospatial, non-spatial data; create and modify metadata; create and share interactive maps and collaborate and interact with other users or group of users.

In the framework of the EU funded 'ENI-SEIS II South Support Mechanism' project, UNEP/MAP and EEA collaborate to support the implementation of the infrastructure and data management component of the project. This implies specific support to ENI South countries in enhancing their national infrastructure and data systems, as well as adjust and extend as appropriate the regional data infrastructure and management systems to cover the data management needs for assessing the agreed H2020 Initiative Indicators. The ENI SEIS II South project further builds on the Decision IG.21/3, COP 18, Istanbul, regarding data management in Mediterranean by developing a Shared Environmental Information System (SEIS) supporting the regular production and sharing of quality assessed environmental data and indicators.

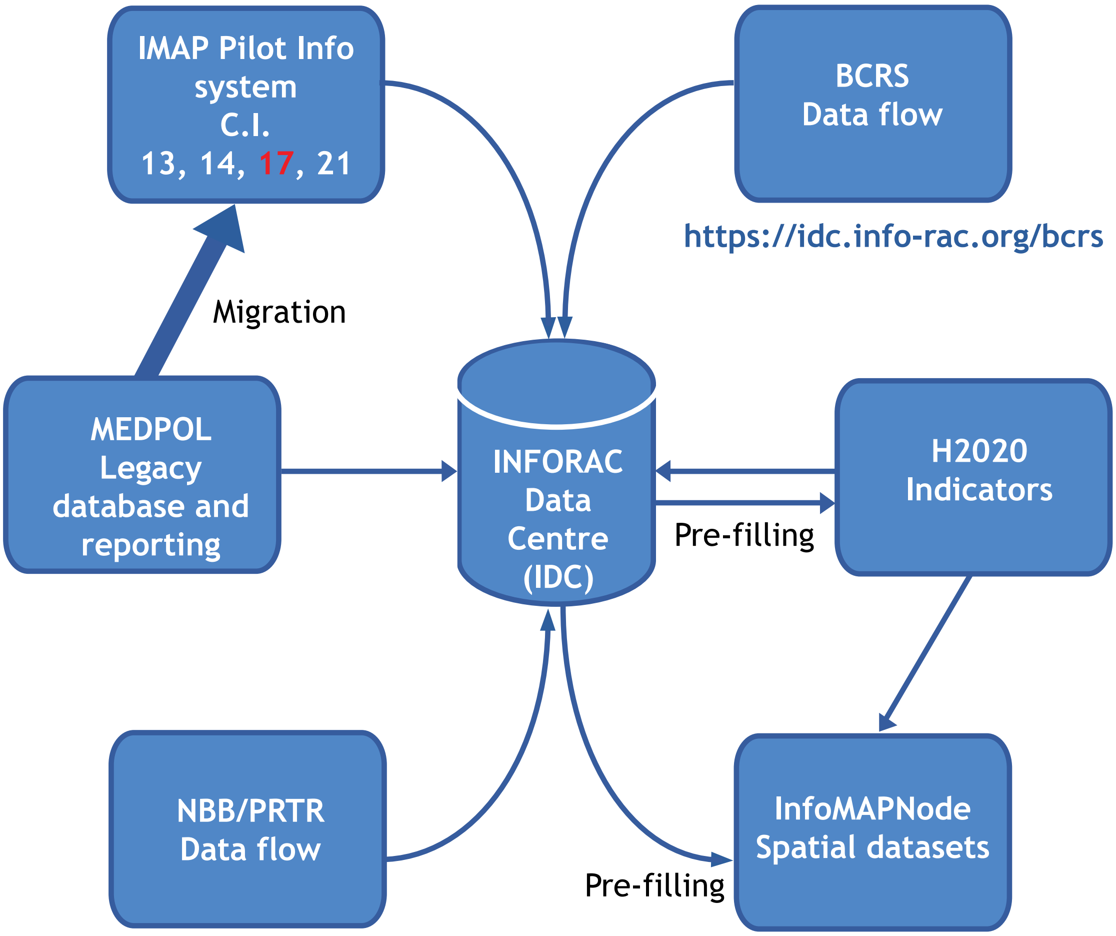
The InfoMAPNode is now available as final release version 1.1 online at: http://infomapnode.info-rac.org/. All the SDI components are realized within the INFO/RAC mandate and are already available and running in the Infrastructure. The platform provides users with visualisation and interaction features with the most advanced maps. Enabled users have the possibility to create maps by superimposing data loaded on the platform together with visualization services provided by other servers.

The Data Centre

At the core of the InfoMAP System, the INFO/RAC Data Centre (IDC) aims at offering a reporting system that is officially used by the countries, based on common standards and aligned with the EEA's reporting system Reportnet2. The IDC is like a bookshelf with data reports on the environment as submitted to International clients. Each country either has a collection for its deliveries or a referral to a different preferred repository. The data reports within each country collection are arranged under the relevant reporting obligations or agreements. The scope is to improve the harmonisation and standardisation of the management of data flows, from the detailed definition of the required data to the delivery of the final information products such as reports or environmental indicators. The services available through the IDC are the following:

- People directory: stores users credentials and information, allows to implement a single sign-in mechanism between InfoMAP services;

Figure F.2 **Schematic representation of the reporting system - Data integration in InfoMAP database**



- Groupware: web application that offers a set of tools useful to share documents; drafts, minutes, etc. among the MAP Components of UNEP/MAP;
- Data Dictionary: component system able to manage the different data flow, with defined vocabularies/ code lists, quality control, etc;
- Data Repository: share directory where each country can upload their data, following the different data flow procedures;
- Web form: web tool to compile the reporting obligation data flow.

Currently, the IDC manages two data flows to support the obligation of Barcelona Convention (Barcelona Convention Reporting System (BCRS), National Baseline Budget Reporting (NBB)) as well as the Horizon 2020 data flows.

The Barcelona Convention Reporting System (BCRS) is the InfoMAP module that allows Contracting Parties to report under article 26 of the amended Barcelona Convention and several articles of different Protocols of MAP. The main objective of the system is to collect, store, manage and process compliance reporting data (textual and numerical) regarding the implementation of the Barcelona Convention and its Protocols. The MAP Secretariat has the legal responsibility of BCRS, whereas INFO/RAC is responsible for its operation and development.

The BCRS data flow within the Data Center is subdivided in seven mandatory protocols that Contracting Parties have to report:

- Dumping Protocol;
- Land-Based Sources (LBS) Protocol;
- SPA Protocol;

- Prevention and Emergency Protocol;
- Offshore Protocol;
- Hazardous Wastes Protocol;
- ICZM Protocol.

The National Baseline Budget (NBB) is an inventory of the pollutant's releases from all substantial Land Based Sources of pollution reported by the Contracting Parties on yearly basis in order to monitor the implementation of the Strategic Action Programme (SAP) and the National Action Plans (NAP) adopted by the Contracting Parties in agreement with the Art. 5 of the LBS protocol. MEDPOL Programme is in charge for the follow up work related to the implementation of the LBS and Hazardous Wastes Protocols. MEDPOL Unit assists Mediterranean countries in the formulation and implementation of pollution monitoring programmes, including pollution control measures and the drafting of action plans aiming to eliminate pollution from land-based sources. INFO/RAC is responsible for the operation and development of the NBB data flow. NBB data flow is integrated into the Data Centre since 2018.

The BCRS and NBB data flows are completely operational, and the data are provided by the Contracting Parties through the web forms.

The Data Centre hosts also the **Horizon 2020 data flows** put in place with the support of the ENI SEIS II South project to enable ENI south countries to report data needed for the production of the Horizon 2020 indicators. In the first step a specific repository for the countries reporting on H2020 is set-up to provide indicators via excel file template, defined and prepared by INFO/RAC in a standard way.

The MEDPOL Info System

This system provides tools to collect, manage, share and store MEDPOL pollution monitoring data and information (including defined location of monitoring stations). MEDPOL has the legal responsibility of the MEDPOl Information system, and INFO/RAC is responsible for its operation and development.

The IMAP Pilot Platform

In the framework of the Programme of Work and Budget for 2018–2019 of UN Environment/MAP (Decision IG.23/14), INFO/RAC is leading the work on the development of the 'InfoMAP platform for the implementation of IMAP fully operative and further developed, connected to MAP components' information systems and other relevant regional knowledge platforms, to facilitate access to knowledge for managers and decision-makers, as well as stakeholders and the general public' (output 1.5.1).

The EU funded EcAp-MED II Project is supporting this output by the development of a Pilot IMAP Compatible Data and Information System (IMAP (Pilot) Info System), that would enable the Contracting Parties to start reporting data as of mid-2019 for selected 11 IMAP Common Indicators and laying down the basis for building a fully operational IMAP Info System as provided for by Decision IG.22/7.

The IMAP (Pilot) Info System has been developed by INFO/RAC in close consultations with UN Environment/MAP Components. The IMAP (Pilot) Info System receives and processes data according to the agreed Data Standards (DSs) and Data Dictionaries (DDs) that set the basic information on data reporting within IMAP.

INFO/RAC has also developed the Data Standards and Data Dictionaries for each of the 11 selected common indicators, covering all three clusters of IMAP (Biodiversity and non-indigenous species (NIS), Pollution and Marine Litter, Coast and Hydrography).

The IMAP Pilot Info System is ready, fully operational and able to collect data from 1st July 2019. The IMAP Pilot Info System website is accessible to the general public.

The Horizon 2020 data flow

The Horizon 2020 data flow collects data for the set of indicators selected for the second phase of H2020 (2015-2020). National reporting is managed and coordinated by data focal points and data reporters nominated by each country. They have different roles and tasks, which are the following:

- Data Focal Point - an expert or group of experts nominated by the country and authorised to be the main contact point for the data submission to INFO/RAC. The main role of Data Focal Point is to coordinate the national network, review the data uploaded and validate the data submission.
- Data Reporters - responsible for delivering national data to the data repository. They receive upload permissions for specific folders only. The main role of data reporter is to collect data from the national team in the standard format and upload them into the information system.

The data flow followed the agreed common reporting format and detailed indicator factsheet developed for each H2020 indicator ([57]). All data flows are subject to Quality Checks (QC), allowing to document methodological aspects, such as definition, units, geographical and temporal coverage, method for gap filling and uncertainties. Horizon 2020 data flow and reporting from partner countries is monitored via a dedicated dashboard ([58]).

Data structure definition: The H2020 dataflow is based on templates 'spreadsheets' ([59]) (excel files processed by an automatic procedure) developed by thematic experts, distribution of 'geotemplates' ([60]) or shapefile (coastline, administrative units, hydrological basins, coastal cities, etc.).

Developing webforms and data model for H2020 reporting: Webforms can offer users templates with pre-filled data harvested from different databases (external databases or other reporting for example first phase of the Project ENPI SEIS). The logical structure of a database needs to be defined to determine in which way data can be stored, organized and manipulated. For that reason, data model is the entry point for webforms development.

Considering the data delivery for the H2020 reporting coincides with the finalisation of the webforms two options were proposed to the countries:

1. Access the webforms that have been prefilled in order to double check the consistency with the spreadsheets and to make the necessary changes before submitting.
2. If there is no discrepancy between the spreadsheets and the webforms, country will upload the spreadsheets that will be transformed in xml to be processed for quality check procedures.

Code lists: In order to store all the data in a database code lists need to be adopted to model the database and relate all the elements in the different tables. Furthermore, standardized code lists ensure integration with other reporting tools such as Reportnet or international reporting. ISO standards are used to ensure internationally recognized codes that designate every element ([61]), for instance countries using two-letter codes (ISO alpha-2).

Pre-filled solutions: Pre-filling is already implemented in InfoMAP system for instance for the BCRS and NBB reporting, however it has not been deployed for the H2020 data flow.

Towards integration of Mediterranean data flows: As part of the development and maintenance of relevant Mediterranean data flows, EEA and Info RAC explored the possible integration of data flows from different sources, e.g Horizon 2020 data flows are fully integrated and accessible both from the InfoRAC Data Centre and from the recently launched WISE MARINE platform under the Regional Sea Convention Section. The long term objective of such development is to ensure integration of data flows from Barcelona Convention Integrated Monitoring and Assessment Programme (IMAP) Information System developed by INFO/RAC with the EU Marine Strategy Framework Directive (MSFD) reporting contributing to a coordinated assessment of Good Environmental Status (GES) of the Mediterranean Sea.

([57]) **Indicator factsheets:** https://eni-seis.eionet.europa.eu/south/areas-of-work/indicators-and-assessment
([58]) Dashboard https://eni-seis.eionet.europa.eu/south/areas-of-work/data-and-statistics
([59]) **Link to Data submission (spreadsheets):** https://eni-seis.eionet.europa.eu/south/areas-of-work/data-management-and-infrastructure
([60]) **Link to Geotemplates and geotemplates documentation:** https://eni-seis.eionet.europa.eu/south/areas-of-work/data-management-and-infrastructure/spatial-data-collection-and-update-under-eni-seis-ii-south-project
([61]) **Link to data dictionaries:** https://eni-seis.eionet.europa.eu/south/areas-of-work/indicators-and-assessment/all-data-dictionaries/view

European Environment Agency

Technical assessment of progress towards a cleaner Mediterranean
Monitoring and reporting results for Horizon 2020 regional initiative

2021 — 164 pp. — 21 x 29.7 cm

ISBN 978-92-9480-254-5
doi:10.2800/898759

TH-AL-20-017-EN-N
doi:10.2800/898759

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