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Towards a cleaner Mediterranean: a decade of progress

Monitoring Horizon 2020 regional initiative

Joint EEA-UNEP/MAP Report

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UN environment programme

Mediterranean Action Plan
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Foreword

Nearly 15 years after the launch of the Union for the Mediterranean (UfM) Horizon 2020 initiative, we take stock of the progress achieved towards a cleaner Mediterranean, against the backdrop of the socio-economic, geopolitical and structural changes the region has witnessed during this time.

Halfway through the milestone year of 2020, when the initiative comes to an end, we have gathered a body of evidence on the key achievements whilst also taking stock of the challenges and gaps undermining progress, not only at the regional level but also in each individual Mediterranean country.

This is the fourth Mediterranean regional assessment published jointly by the European Environment Agency (EEA) and the UNEP Mediterranean Action Plan (UNEP/MAP) — the second consecutive report at the specific request of the UfM Ministerial conference. It comes six years after the *2014 Horizon 2020 indicator-based assessment*, the first review of the main pollution pressures (municipal waste, wastewater and industrial pollution) affecting the Mediterranean's environmental status.

The current report includes the entire Mediterranean region and broadens the scope to cover emerging issues, such as marine litter, hazardous waste and the quality of bathing water. Thus, the 2020 assessment provides a more complete and holistic evaluation of the regional efforts and achievements towards protecting the Mediterranean coast and sea.

Yet, the overarching message remains as relevant as it was in 2014: *'enhanced efforts, among which further and better implementation of policies supported by reliable, targeted and, above all, shared environmental information are still required'*.

Key accomplishments

At the same time, we acknowledge the engagement and efforts of the countries (national authorities, civil society organisations) and key accomplishments at the regional level to improve the mainstreaming of monitoring and assessment of environmental information, as well as the regional information system which facilitates regular and permanent data sharing and exchange.

The main principles of the European Shared Environmental Information Systems (SEIS) have served as an important framework in establishing the review process, contributing towards better information and knowledge management while steadily building the knowledge base.

Furthermore, we acknowledge that the available information is not entirely complete and significant data gaps remain. Nevertheless, the limited data, joint efforts and knowledge gathered in certain areas should be key drivers behind further actions on the ground.

The environmental status of the Mediterranean Sea has remained a high priority on the political agenda of the European Union (EU), the United Nations (UN) and the UfM. Ambitious commitments have been adopted by the partner countries. However, the next important step to make — building on our joint efforts — is to transposethe political commitment to the operational level, to upscale interventions at the country level, and to ensure proper enforcement.

Yet, most policies are end-of-pipe and the region is currently less well equipped to tackle systemic challenges and solve pollution issues in a truly integrated manner. In our view, that will be the main challenge for the next decade and initiative to come.

More solidarity and investment needed

The level of progress achieved is heterogeneous among the three subregions addressed by the report: countries in the MED EU, MED South and MED Balkans and Turkey. As this is the first effort to assess the challenges and progress at the regional level, there is an obvious need for more solidarity between these subregions and for more investments, particularly in the MED South.

This applies not only to infrastructure but also to developing the much-needed knowledge base that

will help better and more informed policymaking. More than ever, a stronger knowledge base in the Mediterranean is needed to respond to new and evolving challenges, notwithstanding those recently presented by the global COVID-19 pandemic and its after-effects.

Although 2020 marks the end of the UfM's Horizon 2020 initiative, it does not signal the end of the journey the region has embarked upon to achieve a cleaner Mediterranean — an aspiration and driver behind a number of regional actions over the past decade.

With the policies and initiatives currently in place under the auspices of UNEP/MAP and UfM, all in close institutional partnership with the EU, the momentum gained in Europe through the promising launch of the Green Deal, and globally through the 2030 Agenda and the Sustainable Development Goals, the region remains hopeful that the joint efforts will lead to fruitful actions on the ground in the years to come.

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The assessments included in the report synthesise the joint work of the European Environment Agency (EEA) and the United Nations Environment Programme/Mediterranean Action Plan (UNEP/MAP) in producing the Horizon 2020 second indicator-based report. They are based on the information reported by European Neighbourhood Instrument 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 H2020 Core Group, country Focal Points, national teams and organisations implementing and reporting on the monitoring and assessment of the Mediterranean environment. This H2020 synthesis 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.

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Background

Nearly 15 years ago, at the 3rd Euro-Mediterranean Ministerial Conference on the Environment in Cairo, Egypt, the Mediterranean countries launched the Horizon 2020 initiative for the de-pollution of the Mediterranean Sea. Following the mid-term review of the initiative in 2014, the initiative moved from de-pollution to pollution prevention and was renamed the Horizon 2020 initiative for a cleaner Mediterranean (H2020) — focusing on the sea but integrating all the other interactions with land and air — and established an important link with climate change.

Horizon 2020 has been a flagship initiative of the Union for the Mediterranean (UfM) since 2008, actively supporting effective pollution reduction and prevention projects. The complementary actions of the UfM and the commitment by the Contracting Parties to the Barcelona Convention to protect the Mediterranean's fragile ecosystems from the increasing pressures from human activities shape the operative context of this ambitious initiative.

In the last 15 years, the region has witnessed socio-economic, geopolitical and structural changes which, although they go far beyond the issue of pollution management, they have either directly or indirectly undermined the progress achieved not only at the regional level but also in each individual country. Therefore, when addressing the key policy question, 'What progress has been made towards a cleaner Mediterranean?', the pollution issue per se is to be analysed in the context of an evolving bigger picture. As we entered the milestone year 2020, the European Environment Agency (EEA) and the Mediterranean Action Plan/Barcelona Convention (UNEP/MAP) carried out a second ([1]) review of those pollution pressures (municipal waste, wastewater and industrial pollution) affecting the Mediterranean's environmental status. This took into account the current knowledge on the health of the Mediterranean ecosystems as well as the overall politico-socio-economic context of the region. This Horizon 2020 synthesis represents a tangible, pragmatic contribution towards the evaluation of regional efforts being made to protect the Mediterranean Sea and its coastal region from pollution.

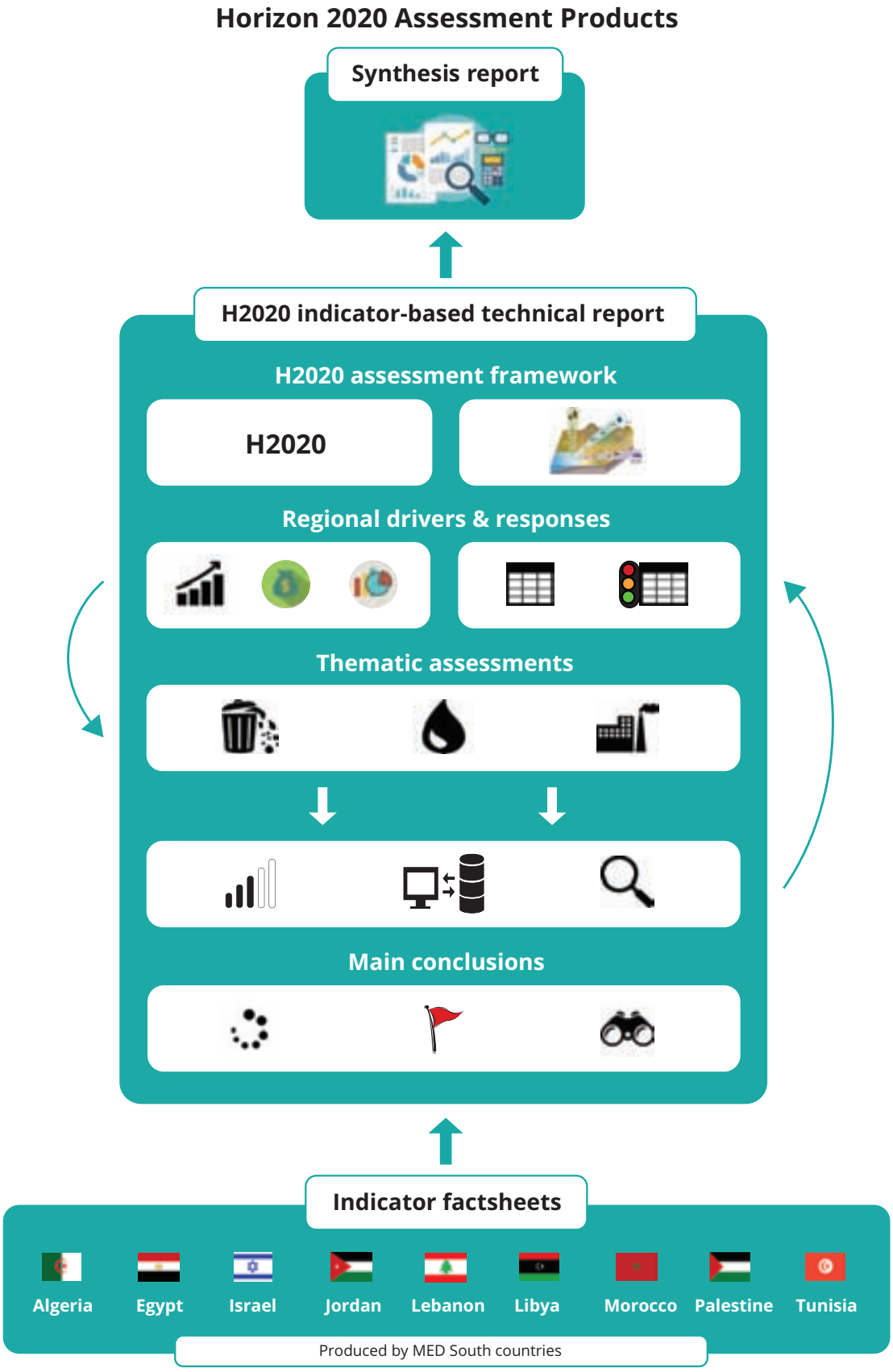
The second H2020 Mediterranean assessment

The second H2020 Mediterranean assessment report (EEA and UNEP/MAP, 2020) summarises the main outcomes of the indicator-based appraisal of the progress observed since the launch of the Horizon 2020 initiative. It is the result of a multifaceted collaborative process among both national and regional actors to set up a regular review and reporting mechanism ([2]) on pollution pressures in the Mediterranean region. It applies the principles of Shared Environment Information Systems (SEIS), as endorsed by the UfM Athens Ministerial Declaration (EC, 2014b), and commitments in the Ecosystem Approach (EcAp) Decision IG 17/6 under UNEP/MAP — Barcelona Convention (UNEP/MAP, 2008).

The second H2020 Mediterranean assessment comprises three products (Figure 1): a synthesis report (this document), an H2020 indicator-based assessment (Technical report), and national indicator fact sheets. Acknowledging the outcomes of the mid-term review of the initiative (EC, 2014a), and the work programme for its second phase (2015-2020) (EC, 2015), the geographical scope of the indicator-based appraisal has been enlarged to the whole Mediterranean area. For analytical purposes, the countries bordering the Mediterranean have been collated into three regional subsets: (1) Southern Mediterranean countries ([3]) (MED South); (2) Mediterranean countries which are EU Member States ([4]) (MED EU); and (3) Albania, Bosnia and Herzegovina, Montenegro and Turkey (MED Balkans & Turkey), reflecting the organisation of the cooperation in the region.

([1]) The first EEA-UNEP/MAP joint Horizon 2020 Mediterranean report was published in May 2014.
([2]) Detailed information on the reporting mechanism is provided in the H2020 Mediterranean Indicator-based Technical report (2020).
([3]) Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, Syria*, Tunisia. *Cooperation with Syria is currently suspended, where data is available it is included in the analysis.
([4]) Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia, Spain.

Figure 1 **Products from the second H2020 Mediterranean assessment**



Source: ETC/ICM — Deltares.

The current synthesis describes the policy boundaries, main regional drivers, key achievements and gaps, from which it draws a set of key messages. A detailed description of the methodological approach and the technical assessment of three thematic areas (municipal waste, wastewater and industrial emissions) is provided in the H2020 Mediterranean indicator-based Technical report (2020). The indicator fact sheets delivered by the Southern Mediterranean countries have served as input for the H2020 Technical report.

The second H2020 Mediterranean assessment comes six years after publication of the first (EEA and UNEP/MAP, 2014) which reported on progress in areas such as access to improved sanitation, as well as highlighting the remaining challenges (e.g. differences between urban and rural areas and ongoing pressures from industry and nutrient pollution). It also pointed out that while reporting capacities had greatly improved, for further capacity building and the production of reliable data through regular monitoring and reporting are still required. The need for a coherent and sustainable reporting system was identified as a priority at both the national and regional level.

Building on the knowledge base, infrastructure, data, and information compiled in the first H2020 assessment, the second one considers the wider scope of the H2020 work programme (2015-2020) by including the main land-based sources of pollution identified as well as the emerging issues of marine litter, hazardous waste and the quality of bathing water.

At its core, the second H2020 Mediterranean indicator-based Technical report (EEA and UNEP/MAP, 2020) is based on the production and reporting of a set of indicators. This set of H2020 indicators was revised and extended in the second phase and now includes a total of 17 indicators ([5]) covering the three H2020 thematic areas. The revised H2020 indicator set is the result of an extensive participatory process, including the setting up of national teams to translate the H2020 review mechanism into the national context and appointing national representatives in the H2020 Review and Monitoring (RM) Group ([6]). These renewed Horizon 2020 indicators are descriptive: i.e. they show what is happening to the environment and mainly comprise pressure indicators.

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 national (e.g. national action plan — NAP), regional (e.g. Integrated Monitoring and Assessment Programme, Mediterranean Strategy for Sustainable Development), and global (e.g. Sustainable Development Goals — SDGs) processes. Ensuring the alignment of H2020 indicators with other ongoing processes was paramount, not only to support an integrated assessment but also to reduce the reporting burden for countries 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 referred to as H2020/NAP indicators.

The second H2020 assessment complements other Mediterranean assessments studies, notably Plan Bleu State of the Environment and Development in the Mediterranean report (SoED 2020; UNEP/MAP-Plan Bleu, 2020) and the Mediterranean Quality Status Reports (2017 MED QSR; UNEP/MAP, 2018 and forthcoming in 2023) (see Box 1).

Although substantial efforts have been made to set up the H2020 reporting process from both the national and regional side, important data gaps remain. However, the H2020 regional 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, UNSTAT/SDG, Eurostat, ESCWA, etc.), recent national, regional and global assessments, expert judgement and documentation of examples and other evidence of progress as case studies, partly based on information/data produced by non-governmental organisations and academia. Where possible, data reported by MED EU countries under relevant EU Directives and as part of reporting obligations under the UNEP/MAP — Barcelona Convention were analysed to achieve full geographic coverage.

H2020 assessment framework

For the thematic assessment of the pressures on the Mediterranean Sea, we chose to take a holistic approach and structured it on the 'source-to-sea' framework. This allowed for a more integrated view

([5]) The full list of H2020 indicators is provided in the H2020 indicator-based Technical report (2020). Indicator methodological fact sheets are published here: https://eni-seis.eionet.europa.eu/south/areas-of-work/indicators-and-assessment

([6]) H2020 RM Group is one of the three H2020 initiative components. The other two are: investments for pollution reduction and prevention (PRPI, and capacity building (CB).

Box 1 Complementarities with UNEP/MAP assessment studies

Since the late 1970s, Mediterranean countries have agreed to cooperate to put 'at the disposal of political leaders and decision-makers all information that will enable them to develop plans likely to ensure sustained optimal socio-economic development without degrading the environment' (Intergovernmental Meeting UNEP/IG.5/7, UNEP/MAP, 1977). The Secretariat of the Barcelona Convention supports this objective. The 'monitoring and assessment' mandate of MAP/Barcelona Convention has been strengthened. In line with this, UNEP/MAP has delivered several regional assessment products.

The Mediterranean 2017 Quality Status Report (UNEP/MAP, 2018) was the first assessment based on the Mediterranean Action Plan Ecological Objectives and the Integrated Monitoring and Assessment Programme (IMAP) indicators adopted in 2016 by all Mediterranean countries. Despite the limited availability of data, the 2017 MED QSR provided relevant details on the status of marine and coastal ecosystems and the achievement of good environmental status (GES). A more complete version, benefiting from further IMAP development, will be prepared in 2023 (2023 MED QSR).

The Mediterranean State of the Environment and Development Report 2020 (SoED 2020; UNEP/MAP-Plan Bleu, 2020)), coordinated by Plan Bleu Regional Activity Centre, has a wider and more systemic scope. The SoED 2020 considers a range of sustainability issues related to the environment and development and outlines their interactions. Addressing the socio-economic aspects of major drivers and pressures, and assessing impacts and responses, SoED 2020 identifies key priority areas for Mediterranean policies and stakeholder action.

The Mediterranean Sustainability Dashboard, developed by Plan Bleu in relation to the SDGs and the Mediterranean Strategy for Sustainable Development (UNEP/MAP, 2016b), provides regular information and fact sheets on critical sustainable development indicators.

MED 2050, a strategic foresight to 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 Mediterranean Experts on Climate and environmental Change network (MedECC, www.medecc.org) from voluntary scientists across the basin.

While adopting different perspectives and information sources, these assessments build on each other. They have contributed to contextualising the current report in a broader Mediterranean context and will take advantage of information and analyses provided in this report.

linking all relevant flows from the upstream source to the downstream area of impact on the Mediterranean marine ecosystem (see Figure 2). It also provided the most appropriate assessment framework for assessing the land-based sources along the source-to-sea continuum.

By using this framework, the link between marine litter and poor prevention and management practices regarding municipal solid waste is clearer. The deterioration in coastal water quality can be related to point source discharges of untreated wastewater in the coastal hydrological basin. This is in line with UNEP/MAP guidance on the Integrative Methodological Framework (IMF) ([7]) for the sustainable management of the ecological continuum comprising the coastal zone, the river basin and the coastal aquifer. Furthermore, contaminated hotspots can be traced to hazardous waste and industrial emissions. 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.

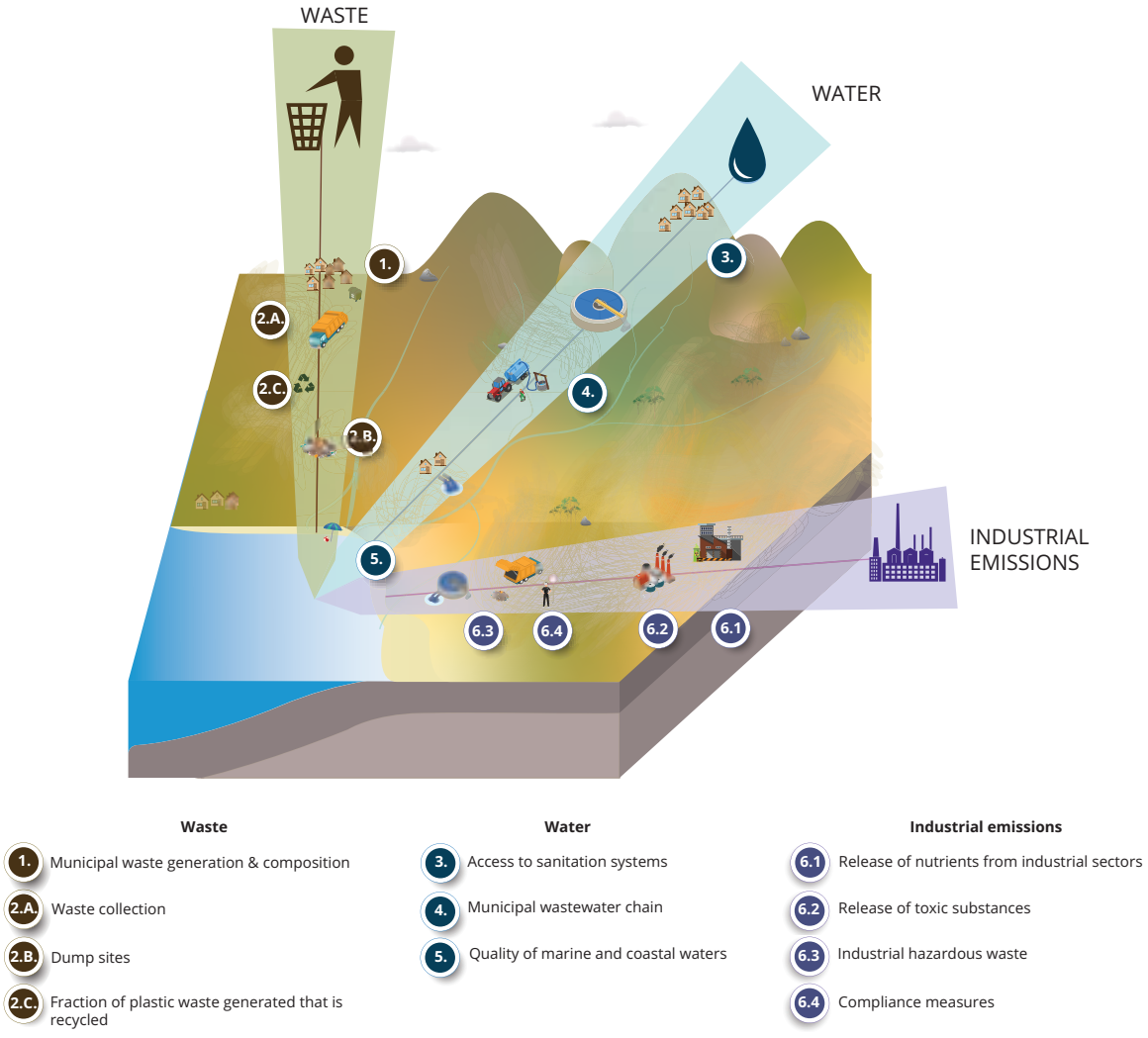
In the current assessment, this approach was particularly valuable in the conceptual framework. The most appropriate assessment scale would be the coastal hydrological basin, in order to include only those relevant flows that are connected to the Mediterranean Sea. However, data is often only available on the national scale and there can be limited consensus on the definition of the hydrological basin. The hydrological basin is still not fully endorsed as an assessment unit because it has yet to fit the commonly agreed area delineations. Also, due to data gaps along

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

the continuum (e.g. riverine inputs and diffuse sources, such as emissions from agriculture and settlements without sewage systems, are not covered by this assessment), the quantitative assessment of issues from source-to-sea remains a challenge for most countries, with the exception of Morocco. In the framework of H2020, it is important to note that Morocco has carried out an in-depth analysis and extensive assessment of the H2020 thematic indicators for the two coastal hydrological basins (Tanger-Tétouan-Al Hociema and l'Orientale) draining into the Mediterranean Sea (H2020 Progress report Morocco, 2020).

In its geographical scope, the source-to-sea approach incorporates the marine and land parts of coastal zones, as indicated in the Barcelona Convention and specifically defined in its 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 and use of resources. Pressures from these activities will result in cumulative impacts on the system, in addition to the pressures the Mediterranean is already under (see Box 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) that will ensure environmentally sustainable development of the marine and coastal area. This

Figure 2 **Source-to-sea schematic overview with consolidated lists of H2020 indicators for each thematic area**



Source: ETC/ICM — Deltares.

Box 2 The Mediterranean, an ecosystem under cumulative pressures

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

Many of the pressures on the Mediterranean ecosystem go beyond pollution and are a 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 fisheries-related activities, with 88 % of stocks being overfished. The impacts from fisheries go beyond stocks; they affect seafloor habitats, including benthic fauna damage, and contribute to marine litter and microplastic generation. This continued pressure on already largely degraded fishing stocks in the Mediterranean is in contrast 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, 2019b).

Furthermore, alien species invading the Mediterranean can severely impact native communities, causing significant impacts on aquatic ecosystems, processes which are further enhanced by the increase in seawater temperature as a consequence of climate change. In relation to the other regional seas, the Mediterranean has the highest number of invasive species (EEA, 2019b). Finally, the impact of climate change, sea-level rise and heat waves 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.

was also recognised during the UfM Ministerial Conference on Blue Economy (EU, 2015b), following which the Working Group on Blue Economy was set up to implement the Ministerial Declaration on Blue Economy. Development of a blue economy and the subsequent increase in the competition for maritime activities requires adequate spatial management of the Mediterranean waters through maritime spatial planning (Directive 2014/89/EU; EU, 2014). Finally, the sustainable use of the seas and a reduction in the pressures from human activities, both in the marine space and in the catchment area, are prerequisites for achieving GES under the Marine Strategy Framework Directive (MSFD) (2008/56/EC; EC, 2008).

The source-to-sea assessment framework was combined with the commonly used Drivers-Pressures-State-Impacts-Responses (DPSIR) analytical framework (EEA, 1999). In the second H2020 assessment, the *drivers of change*, including the driving forces (socio-economic trends, economic growth, geopolitical issues, climate change, etc.) and responses (policies, investments, initiatives, monitoring, etc.) were put collectively at the forefront. As this was the second H2020 regional assessment, it was important to first assess those key aspects which drive change and provide the necessary context for a better understanding of the characteristics of the Mediterranean Sea ecosystem (see Box 2), corresponding trends in pressures, and the progress achieved.

The assessment approach fully embeds the ecosystem approach (EcAp) (Decision IG 17/6, UNEP/MAP, 2008). Since 2008, the concept of EcAp has been the overarching principle of work carried out by the UNEP/MAP Barcelona Convention. The ecosystem-based management approach is also the backbone of European Directives, such as the MSFD and the Water Framework Directive (WFD). EcAp 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.

Framing the policy boundaries

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

In 1975, the Mediterranean Action Plan followed by the adoption of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) by 22 Contracting Parties ([8]). This was the first-ever Regional Seas Convention under the UN Environment Programme umbrella, in its original form in 1976 and amended in 1995, which provides the main regional policy and legal/regulatory and institutional framework 'to protect the Mediterranean marine and coastal environment while boosting regional and national plans to achieve sustainable development' (Barcelona Convention, 1995). On the northern shores, a set of environmentally related European Directives have been transposed and implemented by the European Member States, of which Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia and Spain are also Contracting Parties to the Barcelona Convention. In addition, 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, the Stockholm and Rotterdam Convention on promoting shared responsibilities in relation to the importation of hazardous chemicals, and the International Convention for the Prevention of Pollution from Ships (MARPOL) addressing sea-based pollution.

While looking at the raft of policies, strategies, protocols, regional plans, initiatives and associated targets ranging from global, to the EU and then to the Mediterranean region (see Table 1), 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 on sustainable development. While these instruments are aiming for an integrated approach, the implementation of integrated 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 a critical issue for the region, not only to fully embrace a source-to-sea approach but also to realise a clean Mediterranean. To help to close this gap, institutions across different policies would need to act in a truly coordinated manner, with targets measuring progress towards these objectives clearly defined (within a realistic timeframe 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 empowerment of public institutions to adequately address politically agreed commitments.

What drives change?

The Mediterranean region has witnessed dramatic changes in recent years. The unprecedented growth in population has led to major urbanisation, especially in coastal areas, as the consequence of the economic growth of specific sectors, such as tourism. This has been accompanied by other changes such as mass displacement and migration flows resulting from conflicts, political instability, livelihood insecurity, and the impacts of the ubiquitous threat from climate change. Despite commonalities that unite the region, such as culture, heritage, climate and gastronomy, there are stark differences between countries and subregions. These differences include, for example, access to natural resources, income, opportunities, implementation and enforcement of policies, economic stability and the impact of crises (financial, humanitarian, pandemics). These drivers have been extensively documented and assessed (UNEP/MAP-Plan Bleu, 2020). Whereas the nature of such drivers has not changed markedly in the last 30 to 40 years (with some exceptions — see Box 3), it is their persistence over time, their intensity, acceleration and cumulative effects which currently drive change in the region. These persistent environmental and sustainability challenges are inextricably linked to economic activities and lifestyles (EEA, 2019b).

The Mediterranean region is currently home to over 525 million people, 70 % of whom live in urban areas, a figure which is expected to increase by an additional 130 million by 2050, in particular in the eastern and southern countries (UNEP/MAP-Plan Bleu, 2020). The concentration of Mediterranean populations within the coastal hydrological basins, and more specifically along the coastal strip, puts immense pressure in terms of marine pollution resulting from the discharge of wastewater, contaminants and possibly mismanaged

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

Table 1 Overview of selected policies of relevance to the H2020 thematic areas (Mediterranean,European and global)

	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, 2015)	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 the activity of chlor-alkali. Prohibit installation of new chlor- alkali plants. Adopt national emission limit values (ELVs) by 2015 and 2019 for mercury emissions. Monitor releases of mercury into water, air and soil.

Table 1 Overview of selected policies of relevance to the H2020 thematic areas (Mediterranean, European and global) (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 wastes.		Prohibit and/or take legal and administrative measures necessary to eliminate the production and use, import and export of POPs and their wastes. Application of best available techniques (BAT) and best environmental practice (BEP) for environmentally sound management of POPs. Take appropriate measures to handle, collect, transport, store and dispose of POPs wastes, including products and articles when they become waste, in an environmentally sound manner.
	Regional Plan on Marine Litter (Decision IG.21/7; (UNEP/MAP, 2013a)	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).	
	Regional Action Plan on Sustainable Consumption and Production in the Mediterranean (COP Decision IG. 22/5; (UNEP/MAP, 2017)	**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 the 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 Overview of selected policies of relevance to the H2020 thematic areas (Mediterranean, European and global) (cont.)

	Policy	H2020 thematic areas		
		Waste	**Water**	**Industrial emissions**
MED region	**Ecosystem Approach (Decision IG.17/6;** (UNEP/MAP, 2008)	**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 EO 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.		
		Common operational targets in the NAPs under (EcAp) EO10: provide for the collection of XX % ([9]) 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.	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 biochemical oxygen demand (BOD) discharged to water bodies.	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.
	UNEP/MAP Criteria and Standards for Microbial Water Quality (Decision IG.20/9; UNEP/MAP, 2012)		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.	
	Mediterranean Strategy for Sustainable Development (MSSD) (UNEP/MAP, 2016b)	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.	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.	

([9]) 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 Overview of selected policies of relevance to the H2020 thematic areas (Mediterranean, European and global) (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, 2018), 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)			
	Industrial Emissions Directive (2010/75/EU; EU, 2010), European Pollutant Release and Transfer Register (E-PRTR) Regulation (EU, 2006b)			
Global	Basel and Stockholm Conventions (UN, 1989, 2004)			
	MARPOL (IMO, 1978)			
	Aarhus Convention (UNECE, 1998)			
	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.

waste. These pressures continue to increase as the result of growing populations and urbanisation, tourism and displaced communities, as well as greater demands for food, freshwater and a better quality of living. Society must respond by ensuring safe access to sanitation, the collection and treatment of waste, appropriate environmental regulations and enforcement on industrial emissions. In face of economic crises and geopolitical conflicts, pollution prevention is being pushed down the ladder of priorities on national agendas and budgets.

Over the last decade, Mediterranean countries have been heavily impacted by multifaceted crises: global financial crises in 2008; the EU debt crisis in 2009; political instability around the basin; and unrest resulting from the Arab Spring in the early 2010s. Although the resilience to these crises differs from country to country, southern countries have shown surprising endurance over these economic bottlenecks. The Mediterranean remains the most important global tourist destination, welcoming over 360 million international tourists annually. Coastal tourism is one of the main drivers associated with waste generation and management and marine litter. The high spatial and temporal variations in tourism, which predominates along the coastal strip and peaks during the summer season, result in an increase in waste production, discharges of untreated wastewater, and pressures on natural resources. In turn, environmental quality degradation, such as concerns water quality, may impact the development of tourism, reducing the appeal of tourist destinations and negatively impacting on the economy.

The Mediterranean region is also dominated by tension and geopolitical conflicts that have led to the severe displacement of populations, the disruption of institutions, and the collapse of infrastructures and industries, particularly in the last decade. In 2018, refugees in the Mediterranean region numbered 6.4 million, most of whom sought refuge in Jordan and Lebanon as the result of the neighbouring conflict inflicted Syria. Turkey also hosts around 3.6 million refugees (UNHCR, 2020). Other displacements, driven by climate change and environmental change, could be caused by environmental pressures and needs and could significantly impact human development. Access to water, food and sanitary services, as well as waste management, are of specific concern in refugee camp operationalisation. Meeting the basic human needs of incoming refugees demands a flexible and effective response in host countries.

The Mediterranean is one of the global regions most affected by climate change (MedECC, 2019). It is warming faster than the global average, with droughts

Box 3 Shock effect of sudden changes — the example of COVID-19 pandemic

In general, the main drivers of change in the Mediterranean region have remained unchanged in nature. Nevertheless, sudden unprecedented changes can occur which can have a shock effect on the region. One example of such is the rise of the COVID-19 virus in early 2020.

The rapid spread of the virus throughout the Mediterranean region, and the MED EU in particular, has implications for different sectors. For example, the availability of safe and clean drinking water, the treatment of wastewater and management of a larger amount of medical and plastic waste from disposal sanitary products are considered critical services. Quarantine could potentially impact the operation of wastewater treatment plants (WWTPs), affecting the wastewater treatment cycle and risking more pollution. The increased use of antibacterial products could potentially impact wastewater, although toxicity effects are thought to be minimal.

Lower economic activity could affect industries with lower pollution from industrial emissions and transport. As a consequence of the confinement in most countries, travel and tourism is limited. As this is a major source of income in the region, there will be economic consequences, as well as consequences for pollution. These environmental changes are expected to have only a short-term effect in the region.

Potentially longer-term impacts could impact the economy. With a high level of public debt, a significant share in the informal sector, and in some cases considerable dependency on tourism and oil prices, it is unclear whether MED South and MED Balkan countries will be in a position to support their national economies. Even in countries where large economic support policies will be possible, it is questionable whether conditions are in place for a new economic model based on blue, green and circular principles to emerge from post-crisis public investment. Among other recent regional assessments, this report can help draw attention to the structural importance of investing in environmental services, rather than in the carbon-based sectors.

Source: Based on EEA and UNEP/MAP.

increasing in frequency and intensity in the last few years. Water scarcity due to climate change and the rising demand from growing populations is expected to lead to an increase from 180 million to 250 million people in the Mediterranean classified as 'water-poor' (i.e. those with access to less than 100m^3 per capita per year) in 20 years (MedECC, 2019). Together with periods of damaging heat, these could create significant impacts on many systems and key economic activities such as tourism.

In recent years, there have been determined efforts to instil more preventive, circular and sustainable approaches in the Mediterranean region. Water scarcity has driven the reuse of wastewater, while awareness of plastic pollution has led to regulations restricting single-use plastics, such as plastic carrier bags, in countries all around the Mediterranean. Nevertheless, the generation and disposal of waste products and the consequent leakage of substances into the environment have yet to be decoupled from the demand for (mainly virgin) materials and energy coming from growing populations and economies. The concept of a sustainable blue economy was given a regional impetus in an effort to make marine and maritime activities more sustainable. However, from a resource perspective, economies in the Mediterranean 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. The region faces an overall acceleration of linear production and consumption patterns and the 'take-make-waste' paradigm.

Besides the typical external drivers (changes in demography, economy, climate change, etc.), responses such as awareness raising, capacity building, new policies and investments are also factors conducive to change.

During the last five years, the region and the world in general have witnessed a greater awareness of sustainable development and environmental issues presented by the 2030 Agenda. The SDGs provide a global forum for engagement and a common reference framework at various levels — local, national, regional and global. The MSSD (2016-2025; UNEP/MAP, 2016), as a strategic guiding document for all stakeholders and partners to transpose the 2030 Agenda for Sustainable Development at the regional, subregional and national levels, acts as a leverage for creating awareness of the potential of the green economy transition and sustainable lifestyles, sustainable tourism, urban resilience, climate change, etc. Overall, there seems to be greater awareness among the public and society of the need for sustainable development, as acknowledged by the adoption by the UfM Ministerial Meeting of May 2014 of the MSESD ([10]), while environmental issues are climbing up the priority ladder in policy agendas. However, this is not the case in all countries as other pressing issues, such as economic and political degradation, often take a higher priority.

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

Investments come in different shapes and forms. In general terms, they can be grouped into three categories: prevention at source (e.g. regulate/reduce use of plastic; build/extend sewage networks; upgrade existing industrial facilities with best available technology (BAT)/best environmental practices (BEP)); reduce pressures (e.g. construction or upgrading of wastewater treatment plants), and remediation (e.g. remediation of contaminated industrial sites) interventions. Other funds are allocated to training and to enhance capacities (see Box 6) for purchasing monitoring equipment, data collection and data infrastructure, e.g. the development and maintenance of environmental information systems. Horizon 2020 has contributed significantly to these overall efforts. However, up-to-date financial information on the investments made in the region to achieve a cleaner Mediterranean and details concerning their effectiveness are not available.

([10]) https://www.h2020.net/resources/publications/send/34-publications/2930-mediterranean-strategy-on-education-for-sustainable-development-arabic-english-and-french

What are the key achievements?

Several commonalities underlie the key achievements of the last 15 years. Based on the evidence collected, it can be concluded that, in general, progress is being made towards a cleaner Mediterranean, despite the turbulence in the region. In recent years, the ambitions for tackling pollution have been given greater priority on national, regional and global political agendas. There is progress in terms of fostering awareness on environmental issues and building capacity to address them. Undeniably, there has been definite progress in terms of creating and strengthening institutional capacities, legal instruments, direct actions (e.g. investments), regional data infrastructure and tools, and international commitments (H2020, 2019).

A snapshot of the current situation for a number of themes is provided below. Table 2 gives an overview of the perceived progress based mainly on expert judgement and supplemented by evidence where possible (see H2020 Mediterranean indicator-based technical report, 2020). In addition, the notion of the direction of progress is also indicated by arrows either going up (improvement in the situation) or down (deterioration). In some instances, the data/information available is insufficient to make a well-founded judgement on the direction of progress.

There is a general notion that the progress observed is insufficient (Table 2). Despite advances in terms of pollution prevention at source, pressures persist. As mentioned in the previous section, the context around the capacity to achieve a cleaner Mediterranean is complex and evolving. The environment is changing, as are societies and their habits, while key drivers, such as climate change and its impacts, are also changing the conditions. These are being exacerbated by the dynamism of changes that are occurring faster than the development of regional or national capacities to understand, respond to and mitigate their perceived impacts. There is a considerable time lag between reducing pressures and seeing improvements in natural capital, human health and well-being. There has not been enough progress to meet the cumulative pressures from ever-increasing populations, the drastic changes in consumption and production patterns, and the environmental challenges intensified by geopolitical instability, demographic displacements and economical bottlenecks. Among other factors, political instability and conflicts in the region have hindered steady progress by diverting funds and priorities. They are the root causes of high turnover of staff in the governmental institutions concerned and less continuity and sustainability in the implementation of actions and development of national capacities. The level of progress is heterogenous among the three subregions, with MED EU countries generally at the forefront of some of the identified themes. It remains questionable whether the 'impact on the ground' is fundamentally changing the challenges that remain.

Despite significant efforts to consolidate the data- and information base for substantiating statements on progress with factual data, full and concrete evidence is still lacking. The mechanism for data collection and data sharing has been set into motion with concrete achievements in terms of established data flows, reporting tools and platforms (see the following section on achievements). Yet significant gaps in data prevail, in part due to problems in the data collection resulting from a lack of monitoring capacities, equipment and resources, partly due to the lack of national agreements and proper infrastructure enabling the accessibility of data. In the absence of this body of evidence, the progress review relies on expert judgement and on the knowledge accumulated within institutions to fill in gaps and document progress. 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.

The next section gives an overview of the achievements within the key H2020 areas. In documenting progress, a pragmatic and factual approach is taken by identifying both those aspects which have improved as well as areas marked by a *lack* of progress.

Table 2 **Overview of perceived progress, regional outlook and prospects of meeting regional policy targets/objectives**

Theme	Trend 2014–2020			Regional outlook	Prospects of meeting regional policy targets/objectives			Justification
	MED EU	MED South	MED Balkans & Turkey	2030	2020	2025	2030	
PREVENTION OF POLLUTION AT SOURCE								
Waste collection coverage		↗	↗	↗				Waste collection is highest in MED EU. Significant efforts are being made to improve collection in MED EU, but data is limited.
Waste collected by formal system		↗	↗	↗				Informal sector is active especially in MED South, with several initiatives in place to integrate it into the formal system. However, data on informal collection are limited.
Waste treatment	↗	↗	↗	↗				There is still a high incidence of open dumps in MED South countries, although data are limited. Despite better waste performances in MED EU countries data shows that some countries are still behind in diverting waste from landfilling.
Urban wastewater collection coverage (access to sanitation)	↗	↗	↗	↗				Despite efforts in MED South to improve access to safely managed sanitation systems (SMSS), data show that the population currently NOT using SMSS is still on the rise as a result of the significant and steady increase in the overall population.
Urban wastewater treatment	?	↗	?	↗				Although more wastewater treatment is observed in specific MED South countries, in others the situation has deteriorated due to the malfunctioning of wastewater treatment plants (WWTPs) as a result of the geopolitical situation. For MED EU and MED Balkans & Turkey there has been progress since 2005 but data are only available up to 2015. Nevertheless, MED EU countries still face challenges to comply with the EU Directive 91/271/EEC (EU, 1991).
Compliance measures to reduce or eliminate pollutants from industrial sectors	↗	?	↗	↗				Compliance measures do exist but are not largely implemented. In addition, reporting by industrial sectors is not occurring on a systematic basis in MED South countries leading to a lack of data and information for any regional assessment. This could be improved by taking more actions are needed to increase reporting and the effective implementation of measures by 2030.

Table 2 **Overview of perceived progress, regional outlook and prospects of meeting regional policy targets/objectives (cont.)**

Theme	Trend 2014–2020			Regional outlook	Prospects of meeting regional policy targets/objectives			Justification
	MED EU	MED South	MED Balkans & Turkey	2030	2020	2025	2030	
REDUCTION OF PRESSURES								
Waste generation	↘	↘	↘	↘				In recent years, MED EU countries, like other Organisation for Economic Co-operation and Development countries, have generated higher amounts of solid waste per capita. Although MED South countries generate half of the municipal solid waste (MSW) per capita in MED EU countries, the trend and prospects are expected to increase in the future, driven by changes in consumption patterns, population and higher incomes.
Plastic waste generation	↘	↘	↘	↗				The fraction of plastics in the MSW generated varies widely between countries. MED EU data show an increase in plastic packaging waste in recent years. No trends for MED South and MED Balkans & Turkey are possible although we can infer that plastic waste generation increased with higher MSW generation. We can expect an improvement by 2030 as the result of the EU Directive 2019/904 (EC, 2019) and other policies to restrict single-use plastics in the region.
Waste that goes to uncontrolled dumpsites	?	?	?	?				Although data on uncontrolled dumpsites are very limited, there is evidence on breaches to Landfill Directive (1999/31/EC) by Italy, Greece, Slovenia, and Spain. In MED Balkans & Turkey, for example, Bosnia and Herzegovina need to align with the EU Landfill Directive by closing or rehabilitating non-compliant landfills.
Release of nutrients from urban wastewater	↗	?	?	?				Discharge of untreated wastewater is still common practice in certain MED South and MED Balkan & Turkey. An analysis of reported data on releases from WWTPs did not produce conclusive observations and trends.
Release of nutrients from industrial sectors	↘	?	?	↗				With implementation of NAPs and the greater efficiency of WWTPs, releases of nutrients from industrial sectors are likely to decrease by 2030. Higher quality data collection should also improve their assessment.

Table 2 **Overview of perceived progress, regional outlook and prospects of meeting regional policy targets/objectives (cont.)**

Theme	Trend 2014–2020			Regional outlook	Prospects of meeting regional policy targets/objectives			Justification
	MED EU	MED South	MED Balkans & Turkey	2030	2020	2025	2030	
Release of toxic substances from industrial sectors	↗	?	?	↗				Data indicate the high impact of industry on the release of toxic substances. In some industries, these substances are transferred urban wastewater treatment plants (UWWTPs), causing disturbance and malfunctioning of already insufficient UWWTPs. Despite some countries having separate treatments clustered under 'industrial zones', the transfer of heavy metals transferred to UWWTPs is likely to continue.
Environmentally sound disposal of industrial hazardous waste	↗	?	?	↗				Data indicate that an urgent focus is needed on this issue. Despite some efforts made on the collection and deposition of hazardous waste, disposal capacity remains low in MED South countries.
CIRCULAR APPROACHES								
Plastic-waste recycling	↗	?	?	↗				There is lack of plastic recycling data for MED South but total MSW recycling rates remain very low. For MED EU data exist for recycling plastic fraction and plastic packaging, which have improved significantly over the last decade.
Restriction of single-use plastics	↗	↗	?	↗				Recent laws have been put in place to restrict plastic bags in some MED South, as well as for broader single-use plastics in MED EU.
Reuse of wastewater		↗	?	↗				It is perceived that wastewater reuse is on the rise in certain MED South countries. With the development and implementation of the new regional plan on municipal wastewater treatment, including wastewater reuse, the extent of reuse is expected to increase by 2030.
STATE OF MARINE ENVIRONMENT								
Marine litter	?	?	?	↗				Recent efforts to curtail some single-use plastic items are likely to have some positive impact on inputs of plastic into the environment. However, these might be insufficient to compensate for the increase in plastic-waste generation resulting from the drivers of population, tourism and consumption. In addition, there are other sources of marine litter. Overall plastic tends to accumulate in the environment if both prevention and remediation measures are not implemented.

Table 2 **Overview of perceived progress, regional outlook and prospects of meeting regional policy targets/objectives (cont.)**

Theme	Trend 2014–2020			Regional outlook	Prospects of meeting regional policy targets/objectives			Justification
	MED EU	MED South	MED Balkans & Turkey	2030	2020	2025	2030	
Nutrients enrichment	?	?	?	?				Nutrient enrichment occurs in localised coastal areas throughout the Mediterranean region. Data availability should be improved to enable a trend analysis to be conducted of the key nutrient concentrations at eutrophication hotspots.
Bathing water quality	↗	?	↗	↗				Bathing water quality is a new indicator in MED South, with only a few countries reporting on this aspect. Most MED EU and MED Balkan countries and Turkey report excellent bathing water quality.
GOVERNANCE, POLICIES, CAPACITIES								
National cooperation and coordination	↗	↗	↗	↗		N.A.		National cooperation and coordination are increasing in all MED sub-regions, with some clear evidence in some countries, although the overall rating is based on expert judgement.
Integrated policies and systematic approaches	↗	↗	↗	↗		N.A.		Overall rating is based on expert judgement, which perceives a general improvement in all sub-regions. Some countries in MED Balkans & Turkey still require alignment with the EU acquis on sewage sludge and waste.
Mainstreaming environmental issues in policies	↗	↗	↗	↗		N.A.		Overall rating is based on expert judgement, which perceives general improvement in all sub-regions, in particular efforts in MED Balkans & Turkey to align policies with the EU acquis. However, significant efforts are still needed on implementation and enforcement, such as in waste management and water quality.
Public awareness and stakeholder participation	↗	↗	↗	↗		N.A.		Overall rating is based on expert judgement, which perceives a general improvement in all sub-regions.
Enforcement and compliance	↗	↗	↗	↗		N.A.		Overall rating is based on expert judgement, which perceives that enforcement and compliance remain critical issues, particularly in MED South.
Capacities (human resources, technical)	↗	↗	↗	?		N.A.		Overall rating is based on expert judgement: a lack of administrative capacity and financial resources at the national and local levels is delaying the implementation of an environmental strategy in MED South and MED Balkans & Turkey.

Table 2 **Overview of perceived progress, regional outlook and prospects of meeting regional policy targets/objectives (cont.)**

Theme	Trend 2014–2020			Regional outlook	Prospects of meeting regional policy targets/objectives			Justification
	MED EU	MED South	MED Balkans & Turkey	2030	2020	2025	2030	
MONITORING CAPACITY, DATA, INFRASTUCTURE								
Monitoring capacity, data production and collection	↗	↗	↗	?	N.A.			Overall rating is based on expert judgement, which perceives a general improvement in all sub-regions.
Data sharing, reporting, accessibility		↗		?	N.A.			In MED South, the situation differs considerably between countries and data streams.
Regional infrastructure and cooperation	↗	↗	↗	?	N.A.			A key milestone was achieved with the development of the InfoMAP platform. Although the infrastructure is in place, challenges remain on sustaining the system, and the value of data sharing and reporting is not fully recognised by national entities.

LEGEND for **trend** and **outlook**:

red — not acceptable/poor situation

yellow — reasonable situation but not sufficient

green — satisfactory/good situation

↗ — improving trend since previous milestone year (trend in data shows progress towards a more positive situation)

↘ — decreasing trend since previous milestone year (trend in data shows the situation has worsen)

'?' — impossible to assess due to lack of data

LEGEND for **policy targets**

red — largely not on track

yellow — partially on track

green — largely on track

Note: This classification should be regarded as a 'perceived trend' based on available information and expert judgement. The colour is assigned taking into account what could be achievable, e.g. using the best-performing EU country as a benchmark, rating of MED South is attributed considering the situation in most countries in the sub-region. Therefore, this is a relative rather than an absolute classification.

Source: EEA-UNEP/MAP, ENI SEIS II South team.

Progress on main sources of pollution

The H2020 indicator set provides the core tool for measuring the trends and state of the H2020 thematic areas, supplemented by data and information from other sources ([11]). Progress on the three thematic areas is synthesised below, and more details can be found in the H2020 Mediterranean indicator-based Technical report (2020).

Waste and marine litter

The key messages for the thematic assessment of waste and marine litter are summarised in Figure 3:

Marine litter has gained greater recognition as one of the main global environmental challenges and is specifically targeted by SDG 14.1 ([12]). As in other regional seas, marine litter in the Mediterranean originates predominantly from land-based sources, directly linked to the huge pressure of population in coastal areas and cities, intense activities such as tourism, and from maritime sectors such as fisheries. Mismanaged waste can also be transported into the sea from more inland areas, e.g. through rivers. Therefore, the source-to-sea and the catchment-basin approaches are crucial when assessing the prevention and reduction of marine litter.

Most marine litter is composed of plastic and results from poor waste-prevention and management schemes, as well as improper behaviour by consumers and economic actors when disposing waste items. The environmental pressure of mismanaged waste reflects a combination of economic performances, production and consumption patterns within society and the capacities and infrastructures to deal with waste. All of these factors present distinct dynamics among different Mediterranean subregions and countries. Ultimately, marine litter represents the loss of potentially valuable materials and is thus a consequence of linear exploitation and use of resources. This particular paradigm of sustainable consumption and production is addressed by SDG 12 ([13]).

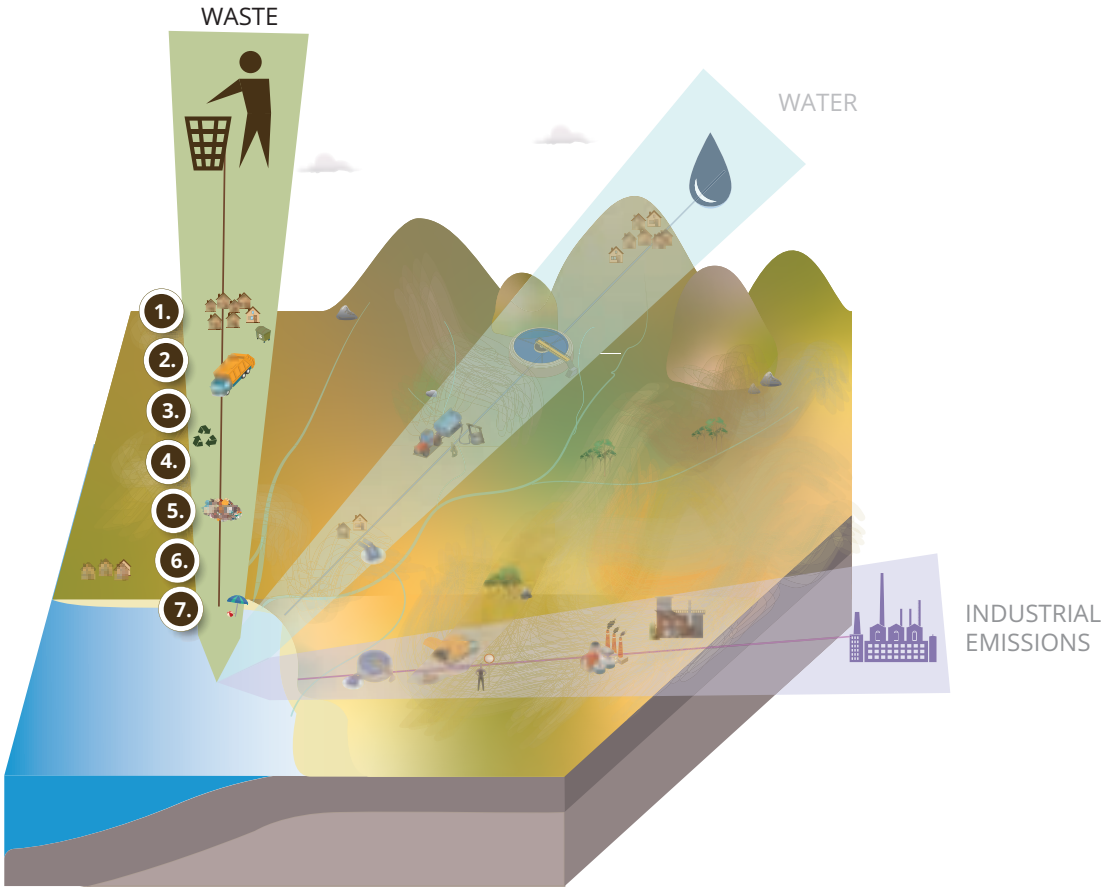
As is to be expected from OECD nations, MSW generation per capita is higher in MED EU countries (average of 498 kg/year/capita in 2017) and Israel (753 kg/year/capita) ([14]) than in the other MED South countries. Evidence shows that although there has been a slowly declining trend in MSW generation in both MED EU and Balkan countries in the period 2007-2014, MSW generation has increased since and remains high, even though a decoupling of waste generation and economic development and population growth is starting to emerge in some MED EU countries (EEA, 2019b). In MED South countries, a steadily increasing trend in waste generation per capita has been recorded, which is expected to continue in the future (+29 % in 2030 and +50 % in 2050; World Bank, 2018) as a result of population growth and the predominant linear economic paradigm shared by the rest of the region. Pronounced differences between rural and urban areas still exist.

The composition of MSW across the Mediterranean is dominated by organic waste, especially in MED South countries, while MED EU countries produce proportionally more glass, paper and cardboard, and metal. On average, the plastic fraction comprises 10 % of MSW in MED Balkans & Turkey, 12 % in MED South and 13 % in MED EU countries, although this fraction varies widely between countries (3 % in Turkey and 23 % in Croatia). Even though the data available for MED South countries are limited, in general there seems to be an increasing trend in the fraction of plastic generated in waste. On the other hand, with the exception of Malta and Croatia, plastic-packaging waste generation per capita seems to have declined in almost all MED EU countries in the period 2007-2018.

Despite significant improvements over the last decade, MSW collection remains a significant issue in most MED South countries, where only a few succeed in reaching full waste-collection coverage. This presents a particular challenge 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. In some MED South countries, the role of the informal sector in waste collection is particularly important for the creation of jobs, and their inclusion in waste management represents a significant opportunity to improve the coverage and efficiency of waste collection, with positive social and economic impacts.

([11]) Type of data sources were dependent on the thematic areas. Priority was given to data delivered under the H2020 reporting mechanism, followed by data provided directly by countries, e.g. national fact sheets and assessments, and finally, data retrieved from publicly available international databases.
([12]) SDG 14.1: by 2025, prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution.
([13]) SDG 12: ensure sustainable consumption and production patterns.
([14]) This figure includes industrial mixed waste.

Figure 3 **Key messages for the waste and marine litter thematic area**



1. Municipal solid waste generation has been increasing across the whole region since 2014, a trend which is expected to continue in the absence of any evidence of decoupling from economic growth
2. Plastic fraction of municipal solid waste generated varies widely within the region and seems to be increasing
3. Coastal population and tourism, associated with take-make-waste economic models, are the main drivers of plastic waste and marine litter generation
4. Landfill remains the main means of disposal of municipal solid waste across the region although data only includes the formal sector
5. Landfill remains the main means of disposal of municipal solid waste across the region although, in some MED South countries most of the waste ends up in open dumps
6. No trends can be derived for marine litter although the growing trend in waste generation, together with insufficient waste management efforts, would probably lead to more inputs and accumulation of litter in the sea
7. Capacity to monitor and enforce the implementation of waste legislation remains an issue in MED South countries

Source: Based on EEA-UNEP/MAP 2020, ETC-ICM-Deltares.

Waste treatment in the MED South subregion has benefited from improvements in capacity and infrastructure, especially at waste-transfer stations and sanitary landfills, and by closing dumpsites. These efforts should be further encouraged and expanded to meet the expected increase in waste generation in the future. The disposal of waste into landfills and sanitary landfills declined in the period 2014-2017 in MED EU countries, remained stable in MED Balkan countries, but increased in MED South countries. In the MED South subregion, waste is normally discharged into open dumps, with considerable negative impacts on the environment and human health. In these countries, there have been improvements in both capacity and infrastructure. Such efforts should be further encouraged and expanded to meet the expected increase in waste generation in the future.

Waste recycling is increasing across the whole Mediterranean, although at varying rates. The level of recycling in MED EU countries is relatively higher than in MED South and Balkan countries. Nevertheless, it is still lower than the average of the EU as a whole but is improving at a slightly faster rate than in the rest of the EU. With specific reference to the recycling of plastic-packaging waste, the rates in MED EU countries increased significantly in the period 2009-2016. However, in 2016, the performance rates were very

variable, ranging from 23.5 % (Malta) to 62.3 % (Cyprus) (average EU-27 plus the UK is 42.4 %) (Eurostat, 2020). Data coverage and reliability is limited in MED South countries, which is also due to the informal sector's role in the collection of recyclables. The role of the informal sector and community-based organisations in waste collection is particularly important in some MED South countries. Therefore, in addition to improving the coverage and efficiency of waste collection, their inclusion in waste management represents a significant opportunity to ensure the commercial viability of public-private MSW management partnership contracts. In the period 2007-2017, waste recovery and incineration showed a slowly increasing trend in MED EU and Balkan countries. However, these processes are limited in MED South countries because of relatively higher costs when compared to open dumping.

Although overall in the Mediterranean the capacity to deal with solid waste has been improving, it remains far from sufficient to cope with the growing volume of waste generated and, in particular, the plastic fraction. Even though, due to limited data, it is not possible to establish trends in marine litter in the Mediterranean, given the persistent nature of plastic in the environment it can be assumed that this issue will tend to become cumulatively worse unless there is an effective inversion in preventing plastic waste and its leakage into the sea. A change in the production and consumption paradigm, together with proper investment in collecting waste and creating new value chains from it, greater awareness and education, as supported by the MSESD, will not only prevent marine litter but will also have significant economic benefits for society.

As shown by successful experiences at national level, there is an opportunity to improve waste management in MED South countries. By exploiting the high share of organic waste and putting in place composting treatment plants, positive impacts on the environment could be achieved by a reduction in greenhouse gas emissions and enhancing the quality of other materials collected. As an UfM Flagship Initiative, H2020 allows specific and dedicated projects supporting national initiatives to be put in place (see Boxes 5, 6).

Overall, the data collected on waste is limited and the picture has not improved since 2014, mainly due to limited investments and human resources for data production, as concluded in the 2014 H2020 Mediterranean Assessment (EEA and UNEP/MAP, 2014). In particular for the MED South subregion, the production of reliable data and regular monitoring of waste streams remain insufficient to support informed decision-making. In comparison, the MED EU countries generally produce a higher quantity of data and regular monitoring is in place. Similarly, Mediterranean-scale and national monitoring programmes have been developed for marine litter and are currently being operated; and it is necessary to ensure a continuous dataflow and the generation of high-quality datasets. In most countries, further efforts are necessary to improve the access to data and information to ensure the capacity to produce indicators on waste generation and management. 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.

The Mediterranean countries are active parts of major international conventions on the regulation of waste and on marine litter. At the Mediterranean level, waste management is recognised as a priority area in the LBS Protocol, the Strategic Action Programme to Address Pollution from Land-Based Activities in the Mediterranean (SAP MED), and the related NAPs, and the Regional Plan for the Management of Marine Litter. In addition, the Regional Action Plan on Sustainable Consumption and Production in the Mediterranean, adopted in 2016, engaged Mediterranean countries in a shift towards sustainable consumption and production patterns and to establish a circular approach to the economy. In terms of litter, the Mediterranean countries have established laws and enhanced their legislative frameworks aimed at 'zero-waste' production, phasing out single-use plastic bags and recycling plastic material. In addition, in the COP 21 Ministerial Declaration (UNEP/MAP, 2020), countries reaffirmed their commitment to implementing the Regional Plan for the Management of Marine Litter, as well as ambitious reduction targets to prevent and significantly reduce plastic leakage into the Mediterranean Sea, aiming to progressively achieve 100 % plastic-waste collection and recycling by 2025.

Legislation on waste management has been in place for several decades in MED EU countries, and the recent EU Circular Economy Action Plan, one of the key pillars of the European Green Deal (EC, 2019), is expected to drive progress towards waste prevention and improved waste recycling and recovery. In addition, the EU Single-Use Plastics Directive will target and prevent at source specific plastic items commonly found in seas. Most MED South and Balkan countries have waste policies, plans or strategies for waste management at both the national and subnational level. However, several factors constrain the waste-management system in these countries, such as a weak legal framework and a low level of enforcement, market-based instruments, low public awareness, political instability and conflicts, and financial constraints. The capacities of public authorities needs to

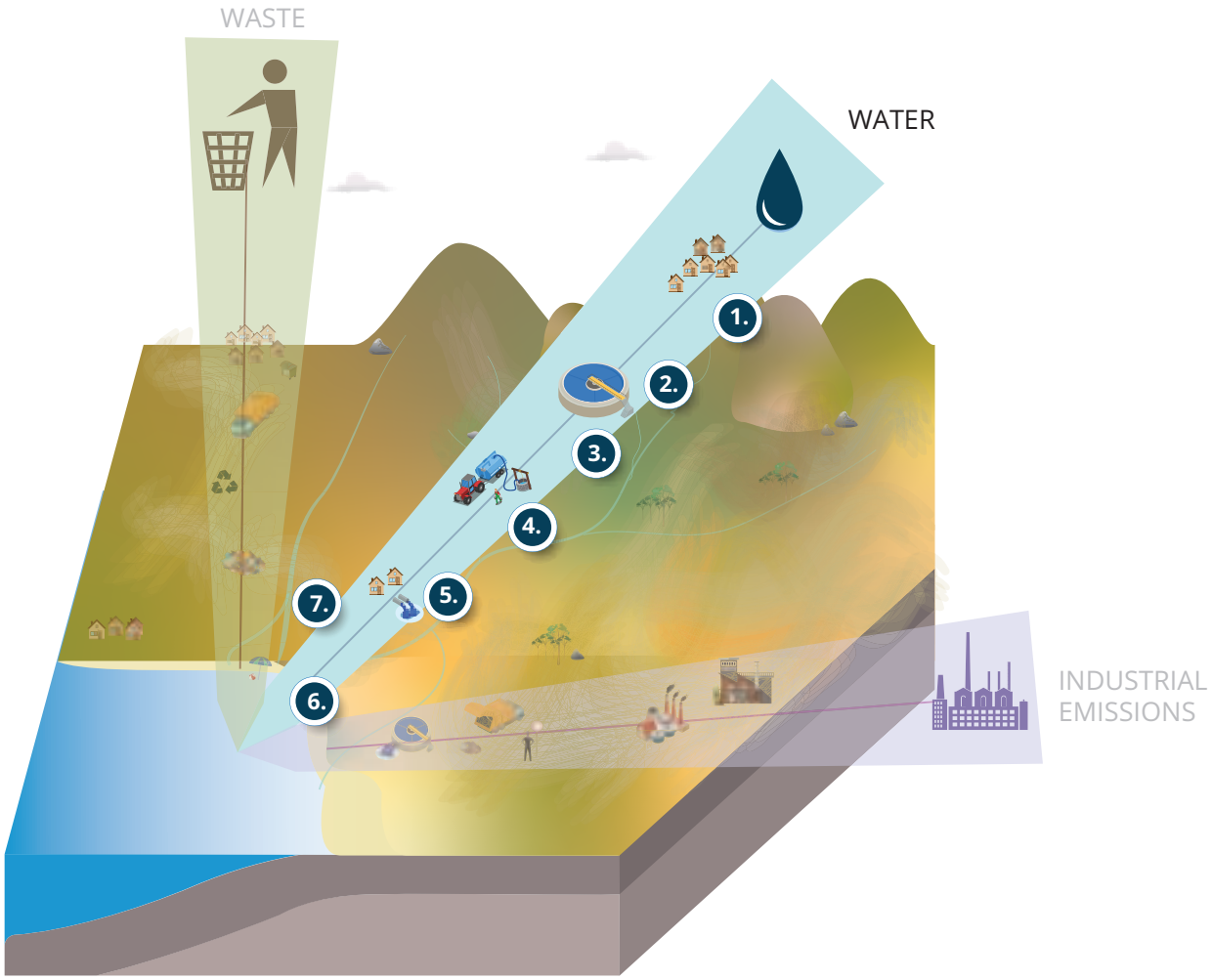
be enhanced in MED South countries, in particular their capacity to monitor and enforce the implementation of waste legislation, and to combat littering and illegal dumping activities, which are regarded as crucial for the protection of the environment and human health. The limited data and knowledge in this area should not delay actions on the ground.

Water

The key messages for the thematic assessment of water are summarised in Figure 4:

For the water thematic, the source-to-sea approach goes beyond the more established 'integrated water

Figure 4 **Key messages for the water thematic area**



1. Access to safely managed sanitation has increased in the region but efforts in the MED South subregion are unable to keep up with population growth sufficiently
2. Treatment of municipal wastewater is improving but in some MED South countries most of the wastewater generated is discharged untreated into the Mediterranean
3. The level of treatment has improved significantly. In particular in the MED EU, but tertiary treatment is lagging behind in three subregions
4. Reuse of wastewater is on the rise, with a few countries across the Mediterranean reusing a significant part of their treated wastewater
5. Nutrient inputs from wastewater largely originate from urban effluents. There is limited in situ monitoring data but eutrophication hot spots are well documented
6. Bathing water quality is improving in the region with the MED EU exceeding the EU average and monitoring in some MED South countries showing clear progress
7. While the importance of nature-based solutions is largely recognised, their application remains limited. This is mainly due to space limitations, their unique design, issues related to acceptability and adequate funding

Source: Based on EEA-UNEP/MAP 2020, ETC-ICM-Deltares.

resource management' (IWRM) concept which 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 (Matthews and Stretz, 2019; Berggren and Liss Lymer, 2016). 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.

Nevertheless, the aim was to achieve a more holistic assessment of the water issue in a region characterised by two challenging facets: limited quantities of water (water scarcity) and water quality degradation. Water is a limited resource in the Mediterranean region, particularly in the arid MED South subregion where all countries face water scarcity as a result of limited and sporadic precipitation (UNEP/MAP 2019/2020). Water as a resource is extremely imbalanced in the region, and nearly all countries have experienced a drop in total water resources per capita since 2012. Although traditionally water quantity and quality have generally been considered as separate issues, the strong interactions between the two are currently increasingly recognised through the concept of the water quantity-quality nexus (Gunda et al., 2019).

This nexus is captured specifically in SDG 6 ([15]) on clean water and sanitation. The countries' commitment to SDG 6 has provided an impetus to address water issues, both in terms of monitoring and investments in sanitation projects and wastewater infrastructure. In general, a positive trend in populations with access to *safely managed sanitation services* (SMSS) ([16]) has been observed in the Mediterranean over the last 20 years. The proportion of the total population *without* access to SMSS has been steadily declining despite significant population growth, indicating that the efforts are improving the current situation. A closer look at the trends in the three subregions shows a decline in the population *without* access to SMSS in both the MED EU and Balkan countries. In contrast, in most MED South countries, the actual population *without* access to SMSS has been on the rise since 2003 in line with the significant increase in the overall population. This implies that investments and efforts to reduce the population without access to safely managed sanitation cannot sufficiently keep up with the concurrent increase in overall population. Nonetheless, the proportion of the overall population with access to safely managed sanitation has increased for the MED South subregion by 6 % since 2003 while the populations experiencing less than basic levels of sanitation are declining, indicating that progress has been made. From 2003 to 2017, the gap between urban and rural sanitation coverage gradually narrowed . However, there are still differences between urban and rural sanitation service levels, with basic sanitation in rural areas still lagging behind. More than 5.7 million people living in urban areas and no fewer than 10.6 million rural dwellers were denied access to improved sanitation systems in 2017 and had to revert to limited, unimproved sanitation and open defecation. Thus, while progress is evident in the region, further developments are required regarding access to safely managed sanitation, specifically in rural areas.

The entire wastewater management chain goes from the wastewater generated, collected, treated to reused. Data on wastewater management for the three subregions are fragmented in space, time and coherence, hampering any overall assessment of progress. Based on data collected from various sources, it was possible to estimate the status of wastewater management in the MED South, MED Balkans & Turkey sub-regions both before and after 2012. For the MED EU, only the status before 2012 could be assessed. The MED EU subregion is responsible for the largest volume of wastewater generated in the region, and also treats nearly all of its municipal wastewater (96 %), followed by MED Balkans & Turkey (83 %) and MED South (63 %). The latter two regions have experienced a slight increase in the volume of generated wastewater treated since before 2012, although their large volumes of untreated wastewater still require attention.

Progress has been made in wastewater management in specific countries in the MED South which have reported under H2020 (Israel, Jordan, Morocco, Palestine and Tunisia). These countries show that while the volume of *wastewater generated* is on the rise, concurrent with the steady growth in population, in general, the amounts of *wastewater collected and treated* are also increasing. This reflects the investments in new, or the rehabilitation of, wastewater infrastructure resulting in more WWTPs. However, wastewater collected and treated per capita is fairly stable over time, indicating no net improvement that goes beyond serving the growth in population, with the exception of Palestine where increases in wastewater collection and treatment exceed the increase in population. As regards the type of wastewater treatment, countries have reported a shift towards tertiary treatment, indicating improvements in WWTPs.

([15]) SDG6: ensure availability and sustainable management of water and sanitation for all
([16]) https://www.unwater.org/publications/step-step-methodology-monitoring-drinking-water-sanitation-6-2-1/

Countries are at different stages in the development of the wastewater sector. Despite continuous efforts and investments to improve wastewater management in the region, the political, financial and institutional crisis faced by certain countries, notably in Lebanon, Libya and Syria, has hit the wastewater sector hard. In these countries, several WWTPs have ceased operation and the construction of new WWTPs has been discontinued. In nearly all areas, most of the wastewater generated is discharged untreated into the environment (estimated to be around 5 km^3/year), in streams, wadis or directly into the sea. This clearly represents a deterioration in the management of wastewater in countries that are experiencing other pressing crises.

In recent decades, the *treatment of urban wastewater* has shown a marked improvement in all parts of Europe, including the MED EU, as a direct result of the implementation of the Urban Wastewater Treatment Directive (UWWTD 91/271/EEC; EU, 1991). MED EU and Balkan countries have improved their connection to urban wastewater treatment (70 % and 54 %, respectively, in 2015) but remain below the European average (80 %). Full compliance with the UWWTD is still a challenge in some countries (EEA, 2017). Although treatment levels have improved significantly since 2005, particularly in the MED EU countries, tertiary treatment is lagging behind in all three subregions. Due to the lack of advanced tertiary treatment, the wastewater sector is a significant contributor to direct releases of contaminants, in particular nitrogen and heavy metals (see section on industrial emissions).

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, over 96 % of the wastewater collected is treated. These countries promote wastewater treatment and reuse as an integral part of their water management strategy. The new UNEP/MAP regional plan for municipal wastewater, with its broader scope extending to wastewater reuse and quality standards for effluents (Decision IG.24/10 (UNEP/MAP, 2019d)) and the proposal for a European regulation on minimum requirements for water reuse (European Parliament, 2020) will provide the right legislative framework for water reuse and its more holistic assessment in the future.

As a first step to linking the direct discharges to coastal and marine water quality, *nutrient releases from municipal wastewater treatment plants* in the Mediterranean coastal areas were compiled by combining different data sources (four cycles of the National Baseline Budget — 2003, 2008, 2013, 2018 — under the Barcelona Convention; and the E-PRTR (Version 17) under European Pollutant Release and Transfer Register Regulation ([17])). This analysis puts the nutrient emissions from WWTPs into perspective and in comparison to nutrient loads from industrial activities. The contribution of UWWTPs to nitrogen discharges is as high as 90 %, with the remaining 10 % attributed to industrial discharges. In general, urban wastewater discharges remain comparatively higher than industrial discharges in the region, exacerbated by the fact that industrial facilities also transfer some pollutants, such as heavy metals, to UWWTPs. Evaluation of the nutrient emissions from different sources raises questions on nutrient source apportionment in the Mediterranean, i.e. the relative contribution of riverine inputs, diffuse sources, such as agricultural run-off, and atmospheric deposition, which currently fall outside the scope of this work.

Assessment of the *coastal and marine water quality* focused on the analysis of nutrient concentrations and data on bathing water quality. In the absence of a regional dataset on nutrients with the appropriate spatial and temporal coverage, use of the Copernicus Marine Environment Monitoring Service (CMEMS) ([18]) products based on satellite and model results was explored. This exercise showed that despite the great potential of using alternative data products, more efforts are needed to tailor these products to be readily applied in policy-related assessments and to determine the impact of nutrient point sources. The availability of nutrient data should be improved so that a trend analysis of the key nutrient concentrations at eutrophication hot spots can be carried out. The next priority is to improve the quality of monitoring data related to nutrients that are regularly reported by Mediterranean countries to UNEP/MAP, in line with IMAP Common Indicator 13, as well as nutrient loads discharged through point and diffuse sources, in line with the LBS Protocol of the Barcelona Convention reporting requirements. According to Decision IG.22/7 on IMAP, adopted in COP 19 (UNEP/MAP, 2016a); and Decision IG.23/6 on the 2017 Mediterranean Quality Status Report, adopted in COP 20 (UNEP/MAP, 2019a), one of the priorities of the UNEP/MAP Programme of Work is to make progress in setting coastal-water type assessment criteria for reference conditions and boundaries for key nutrients in the water column, including their harmonisation throughout the Mediterranean region. This will be a huge help regarding implementation of a clear sampling strategy with a simplified approach for monitoring design and

([17]) https://ec.europa.eu/environment/industry/stationary/e-prtr/legislation.htm
([18]) https://marine.copernicus.eu/

data handling for future implementation of IMAP, as well as a full assessment of eutrophication and GES achievements. It will also support quantification of the required nutrient load reductions by more accurately determining the 'distance to target' (EEA, 2019a).

Bathing water quality is systematically and regularly reported across Europe, and in part in the MED South and MED Balkans & Turkey. However, analysing the trend in bathing water quality for the whole Mediterranean region is challenged by centralised and regular reporting in the MED South subregion, despite some countries having excellent national bathing water quality monitoring programmes in place. Fragmented data have been collated from different sources: H2020 reporting, NAPs, national H2020 assessment reports, and data available on the Water Information System for Europe ([19]). Other countries, such as Palestine, confirmed that bathing water quality data is not available. The MED EU analysis is thorough and complete thanks to the reporting established under the EU Bathing Water Directive (Directive 2006/7/EC; EU, 1975) and publication of the EEA's yearly bathing water quality report. In 2018, the MED EU countries showed an increase in the proportion of the number of bathing water sites along the Mediterranean that have enjoyed excellent water quality since 2010. Their subregional average for bathing water quality exceeds the EU average. However, MED EU countries are among the countries with both the best and the worst bathing water quality in Europe. Some MED EU countries experience difficulties in managing bathing waters after heavy rainfall. Despite a general improvement, with most sites being classified as sufficient/good or excellent and upward trends in countries that have reported back, poor bathing water quality sites were reported in Albania and Tunisia due to pollution from domestic and industrial effluents. Regular reporting of microbiological pollution via intestinal enterococci is expected in line with the MAP Common Indicator 21, following up on traditional reporting on bathing water quality within the framework of the UNEP/MAP-MEDPOL programme.

When it comes to water data issues, the use of global databases, such as SDG 6 data by the UN Statistics Division (2020), is somewhat limited, e.g. the source of data is unknown and the methodologies used differ from national ones resulting in data inconsistencies between different national and international sources. Although data on water are generally available, compared to other H2020 thematic areas, improved data coverage — e.g. on wastewater generation, treatment and reuse — will greatly benefit technical and policy efforts to improve wastewater management. Efforts to tackle the water thematic from source-to-sea with the level of spatial and temporal information and knowledge available is not able to yield a full understanding of the relationship between pressures from land-based sources and the efforts needed to achieve a cleaner Mediterranean.

Industrial emissions

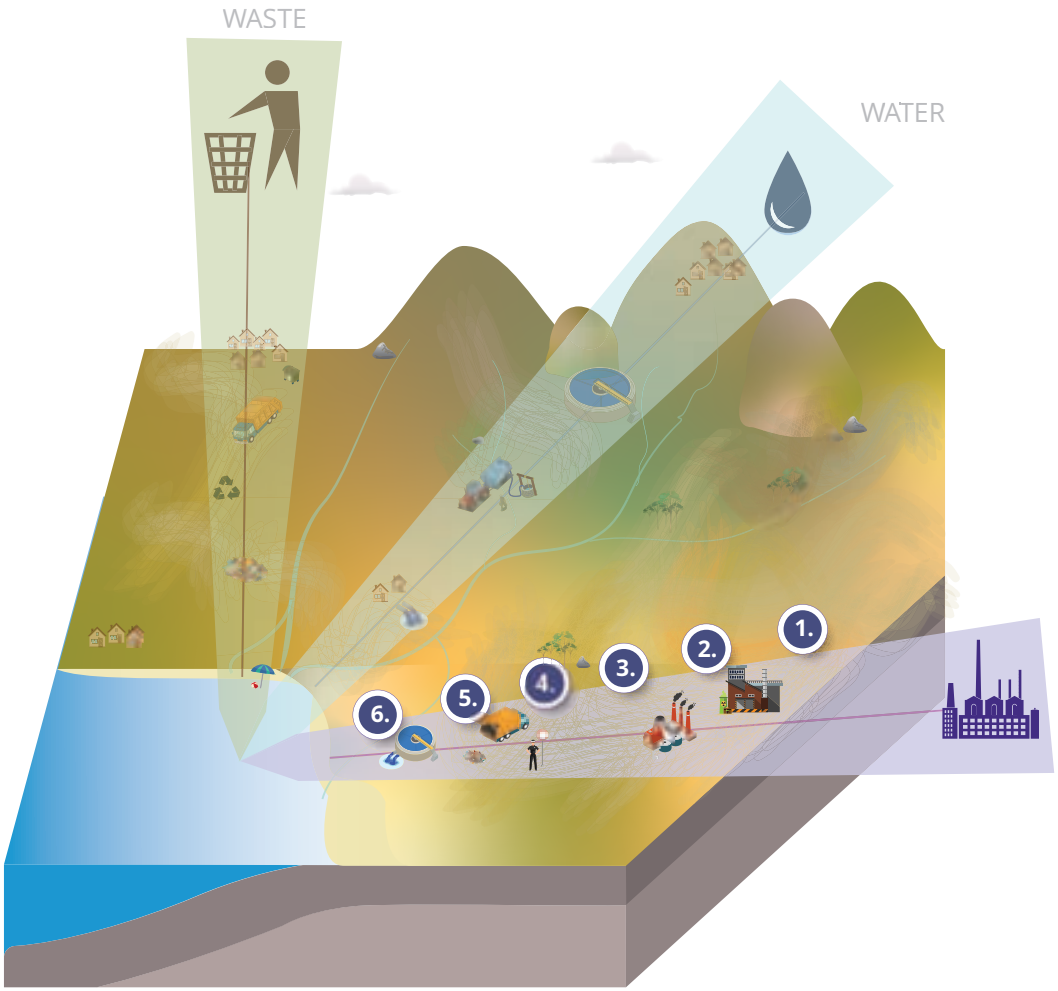
The key messages for the thematic assessment of industrial emissions are summarised in Figure 5:

Industrial activities (including construction) in the Mediterranean countries still contribute significantly to national economies — e.g. from 25 to 30 % of gross domestic product (GDP) in the MED South countries; 20 to 25 % in the MED Balkan subregion; and 15 to 20 % for in the MED EU countries ([20]). Over the last 20 years, agriculture and industry have lost ground while the services sector has developed (UNEP/MAP-Plan Bleu, 2020). Industry's contribution to GDP has obviously increased in Algeria, Egypt and Turkey (UNEP/MAP-Plan Bleu, 2020) as shown by more carbon-intensive manufacturing processes. Initiatives and policies such as sustainable consumption and production, the blue economy and the EU's Green Deal are important drivers for change.

Analyses in this section are based on reported loads which are: an aggregation of nutrient releases into the water; an aggregation of releases of heavy metals into water; and an aggregation of toxic substances, such as PAHs and volatile organic compounds to the air. Together, the four cycles of the National Base Line Budget (NBB) 2003, 2008, 2013 and 2019 and E-PRTR (Version 17) constitute the two main sources of reported data on industrial releases used for this assessment, assumed as being compliant with national and regional emission standards. However, bearing in mind that non-compliance issues are common in the region, another difficulty concerns acquiring a precise analysis of the actual releases. The analysis of industrial emissions was carried out in three categories of data: releases of nutrients; releases of toxic substances (heavy metals, etc.) from industrial sectors; and hazardous waste, complemented by an evaluation of compliance measures. Also, as part of the industrial sector, there was a special focus on the manufacturing sector, for which subregional data was retrieved from the SDG database ([21]).

([19]) https://www.eea.europa.eu/data-and-maps/data/bathing-water-directive-status-of-bathing-water-12
([20]) https://data.worldbank.org/indicator/NV.IND.TOTL.ZS
([21]) https://unstats.un.org/sdgs/indicators/database/

Figure 5 **Key messages for the industrial emissions thematic area**



1. There has been a slight fall in the release of BOD, including nitrogen and phosphorus, although not enough
2. In the MED South, over half of the BOD loads are discharged by the food-processing and beverage industries, followed by agriculture and animal farming
3. The main industrial sources of releases of heavy metals include oil refineries in the MED South, MED Balkans and Turkey, energy production and the manufacturing of metals in the MED EU countries
4. The manufacturing sector still needs further investment in cleaner technologies in order to retrofit the industrial production processes which would lead to resource efficiency and sustainable production
5. Only a few Mediterranean countries report on disposal of hazardous waste. Disposal facilities are limited in capacity. Most of the hazardous waste is exported and/or disposed of in unsafe ways
6. Measures to combat industrial pollution exist but enforcement remains a big challenge in the region

Source: Based on EEA-UNEP/MAP 2020, ETC-ICM-Deltares.

Although subregional trends for nutrients such as BOD/TOC (total organic carbon) have fallen slightly this is not enough to accommodate targets already set by regional measures, such as Regional Plans under the Barcelona Convention, the WFD and the MSFD. On the other hand, subregional trends in total nitrogen (TN) and total phosphorus (TP) do not indicate clearly a consistent downward trend. Even though the Mediterranean is not producing enough agricultural products to feed the ever-growing population (UNEP/MAP-Plan Bleu, 2020), the releases from diffuse sources must be assessed to have the complete picture.

For the MED South countries, the predominant sector is the food-processing and beverage industry which discharged more than half of the BOD loads, followed by agriculture and animal farming. In the MED Balkan subregion, the principal sectors are food processing,

animal farming and textile manufacturing (the textile industry is mainly in Turkey). Food-processing sector in MED Balkans and Turkey discharged almost two thirds of the BOD loads, followed by the manufacturing of textiles, agriculture and animal farming which together accounted for almost one third of the BOD loads (NBB, 4th Cycle, 2018). Food-processing seems to be linked to the service sector (including tourism) and both also have specific routes which lead to marine litter. Within this perspective, this service sector (including tourism) needs to be addressed through more targeted policies and initiatives.

Analyses for the MED South countries, along with data from the NBB Reports, 4th Cycle (NBB, 2018), show that the main sector is the manufacturing of refined petroleum products which contributes almost 90 % to the release of heavy metals, and includes transport and the marketing of petroleum products. In the MED Balkans & Turkey, the principal sectors are distributed mainly between the refining of petroleum products, tanning and dressing leather, and cement manufacture, which together contribute almost 75 % of releases. Further to data reported in 2017 (E-PRTR V17; EEA, 2019c) for the MED EU countries, the principal sectors responsible for releasing almost 80 % of heavy metals are energy production and the manufacturing of metals. As regards heavy metals, the data is insufficient for subregional trends, even though some countries, such as France, Greece, Israel, Italy, Spain, Tunisia and Turkey, show decreasing trends. In the MED EU countries, industries releasing heavy metals to water seem to be transferring these substances to UWWTPs (EEA, 2019b). The data indicate that this is also the case for Turkey, if these industries are not installed in the 'industrial zones' where certain sectors gather and have their own industrial wastewater treatment plants (IWWTPs). In addition, the 'light manufacturing' industries which are releasing BOD (such as food processing, etc.) are more likely to transfer their wastewaters to UWWTPs via proper collection systems. This requires profound attention regarding pretreatment standards which are key to avoiding malfunctioning of the UWWTPs which are designed to function within the margins of certain parameters, including heavy metals. Seasonal wastewater fluctuations caused by high rates of tourism (and, in some cases, an influx of refugees) are an additional pressure on the capacities for which the regional infrastructure was designed, i.e. collection systems, UWWTPs. Among the manufacturing sectors, aquaculture seems to be making a contribution, especially in the MED Balkans & Turkey and to a degree in the MED South countries. In addition, recycling activities are having a noticeable effect (based on the reported industry density index ([22])), as is the case in Algeria and Turkey indicating a trend towards more circular economy.

The reported data indicate that the management of hazardous waste needs more attention and more funding (hazardous waste-disposal sites are expensive to build and operate). Storing industrial hazardous waste cannot be seen as a sustainable way of managing it. Identifying the available means and capacities in countries for the treatment and disposal of hazardous waste is both critical and urgent. This challenge is related to difficulties countries face in collecting information from industrial installations to improve data management and processing. In addition, not all countries are party to the Basel Convention, and to the Hazardous Waste Protocol of the Barcelona Convention in particular.

Enforcement remains the big challenge in the region. All Mediterranean countries have developed measures to combat industrial pollution, such as the promulgation of regulations to set ELVs, and to specify methods of management and treatment of industrial waste. Yet, in most countries, decentralised infrastructure to monitor and implement the regulations adopted is limited to an extent. This poses a significant obstacle, particularly in the MED Balkans & Turkey and MED South countries, for sustainable data management and the development of an integrated knowledge base. In return, it hinders the enforcement authorities' ability to implement the respective regulations. Furthermore, there are cases, such as in Lebanon, where central reference laboratories are needed to assist with measurements during the compliance inspections. Other countries have limited resources for such reference laboratories which are not proportional to the number of industries under routine inspection. Another gap is linking the best available techniques (BATs) with permit issuing conditions at the national level. ELVs in MED EU countries are mainly linked to BATs and best available techniques reference documents (BREFs) ([23])

([22]) The Industry Density Index is a tool to benchmark the number of industries per particular National Baseline Budget sectors between the NBB cycles (every five years). It is indicative of the change in the number of industries inventoried at the country level.

([23]) The BREFs are a series of reference documents covering, as far as is practicable, the industrial activities listed in Annex 1 to the EU's IPPC Directive. They provide descriptions of a range of industrial processes and, for example, their respective operating conditions and emission rates. Member States are required to take these documents into account when determining BATs generally or in specific cases under the Directive.

which actively bring the innovative processes to the attention of the regulating authorities and industrial operators. This will enable regulators to push progressively for BATs which, over time, will reduce the releases. In the MED South countries, ELVs are not tied to BATs, which poses a critical disconnection with more effective, energy-efficient and sustainable processes leading to environmentally sound management.

Another major challenge facing industries in the MED South and Balkan countries is the need for investment in innovative and cleaner technologies and their continuous maintenance and control by qualified staff. Data for SDG 9 ([24]) segregated into three subregions indicate that investments are needed for the manufacturing industries in the MED South countries (where industry also makes a higher contribution to GDP) in order to retrofit the industrial production processes which would lead to resource efficiency and sustainable production (UNSTATS, 2020) ([25]). The same data indicate that investment in innovation (compared to GDP) in the Mediterranean region remains low, except in Israel, France and, relatively speaking, Italy. Average carbon emissions per unit of GDP show increasing trends for the MED South, as well as a slight increase for the MED Balkans & Turkey. Despite there being a general and consistent declining trend, there was a small increase in carbon dioxide emissions per unit of GDP after 2014 in the MED EU countries, requiring more continuous policies to further increase the efficiency and to apply BATs in the Mediterranean region. In the business-as-usual scenario, the current industrial processes in the region are unlikely to achieve SDG 9.4 ([26]).

The economic sectors, particularly the manufacturing sector, are mainly based on dominant linear business models and systemic unsustainable resource consumption generating detrimental impacts on the environment, including carbon emissions. In addition, the transportation of goods via maritime traffic seems to exacerbate these detrimental impacts. Therefore, not only is an urgent regional transition to a more sustainable economy needed for both production and consumption patterns, but also cleaner maritime transportation policies, such as Mediterranean Emission Control Areas, are necessary (UNEP/MAP Plan Bleu, 2020).

Progress on process and responses

The H2020 assessment process and reporting mechanism is built on the Monitoring — Data — Indicators — Assessment — Knowledge (MDIAK) chain and the Shared Environmental Information System (SEIS) framework and its principles. The MDIAK reporting chain has been developed by the EEA to support the provision of observations, data processing and the production of indicators that underpin assessments. These assessments can later support policymaking based on acquired knowledge and its application (EEA and UNEP/MAP, 2014). The conceptual framework of SEIS, 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 are necessary to establish the governance structure, networks, coordination and synergies required for setting up a regional integrated assessment process.

This process operates within the context of accumulated pressures on an already fragile Mediterranean ecosystem, enhanced regional cooperation supported by the UfM political dialogue and the implementation of concrete projects and initiatives, and the Barcelona Convention legal framework and action plans. By integrating H2020 into their respective workplans, the UfM and the Barcelona Convention ensure complementarities and effective links between the policy dimension and its operational translation into projects, investments and initiatives on the ground as part of the implementation of regional agendas for water, the environment and blue economy.

In this section, apart from aspects related to process, such as governance and cooperation, the progress in terms of *responses* are also evaluated. In general, *responses* refer to measures taken by societies to remove, minimise or accommodate changes in the system. In this specific context, *responses* comprise those actions taken to address pollution pressures, ranging from introducing new policies and legislations and integrating existing ones, developing tools and platforms for data and information management, investments in infrastructure projects, and building the necessary capacities.

([24]) SDG 9: build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.
([25]) https://unstats.un.org/sdgs/indicators/database/
([26]) SDG 9.4: 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.

The section is supported by concrete examples, mainly from the MED South countries, illustrating aspects related to the process and the responses compiled thanks to the cooperation with this sub-region through the ENI SEIS II South Support Mechanism ([27]) and the dialogue established through the H2020 Review and Monitoring Group.

Enhanced framework for cooperation

In the second phase of H2020, the national cooperation, coordination and governance set-up was strengthened by engaging and liaising with numerous stakeholders and entities, such as SDG national committees, MED POL Focal Points, ministries of the interior, industry, water and irrigation, health, and the local authorities. In a process driven mainly by the designated authorities representing environmental and statistical organisations, efforts were made to increase the ownership of both the process and the outcomes. These national committees acted as coordination platforms boosting synergies between H2020 issues and other processes, like SDGs. Some countries, such as Jordan, Palestine and Tunisia, took advantage of the momentum created by regional cooperation projects, such as ENI SEIS I and II, to establish national interinstitutional committees and working groups that also bring together representatives of several relevant authorities. In some cases, such agreements have been formalised through memoranda of understanding on data exchange, as in the case of Palestine. In recent years, more concrete examples of involvement and cooperation with civil society have emerged. Several civil society organisations have contributed to the overall H2020 efforts ([28]), the most notable being the SwitchMed initiative ([29]). This initiative supports and connects stakeholders to scale-up social and eco-innovations in the Mediterranean, including innovations from civil society organisations. This enhanced interinstitutional cooperation has become a major achievement since the mid-term review of the initiative in 2014 (EEA and UNEP/MAP, 2014). However, despite greater interinstitutional dialogue, in some case, cooperation among governmental institutions remains very limited, resulting in a lack of cohesiveness and hampering the efforts for more effective policy integration.

At the regional level, cooperation on issues related to the environment in the Mediterranean, primarily steered by the UfM and UNEP/MAP-Barcelona Convention Secretariat, remains strong despite difficult circumstances caused by geopolitical instabilities. These two entities have distinct yet complementary mandates. Their cooperation was formalised in COP 18 by the adoption of a memorandum of understanding (Decision IG.21/14; UNEP/MAP, 2013) and a joint programme of work aiming to provide a framework of cooperation on pollution prevention and control of Mediterranean coastal and marine waters, and on sustainable development. Cooperation takes different forms, not only through the implementation mechanisms of regional policy instruments but also through the setting up of regional platforms and fora, such as regional platforms on marine litter and the blue economy. These bring together stakeholders supporting dialogue, exchanging experiences and good practices and sharing information, including methodological sharing and exchange among observatories in the Plan Bleu network of Focal Points (e.g. through the MSSD indicator dashboard ([30])).

A better connection between science, policy and society has emerged, with a number of regional activities and processes benefiting from a more inclusive scientific contribution (e.g. the Mediterranean Experts on Climate and Environmental Change (MedECC) network, the Regional Plan on Marine Litter which relies on better scientific understanding of the impacts of marine litter on the coastal and marine environment, and improved science and policy connections in the context of IMAP ([31])). The science-policy interface now assumes a central role in the implementation of MAP policies. Other products and processes, such as the recent publication of the Mediterranean Quality Status Report 2017 (UNEP/MAP, 2018) and Mediterranean State of the Environment and Development Report 2020 (UNEP/MAP-Plan Bleu, 2020) demonstrate the importance being placed on mobilising science and research towards evidence-based policymaking (see Box 1). A clear move towards more policy-oriented research projects in the region, e.g. PERSEUS ([32]), ActionMED ([33]), MedCIS ([34]) and others funded by the European Commission, can be seen. In such projects, UNEP/MAP assumes an advisory role to ensure that there is an intrinsic link to policy.

([27]) https://eni-seis.eionet.europa.eu/south
([28]) https://www.h2020.net/component/jdownloads/category/340-10th-horizon-2020-steering-group-meeting-25-september-2019-athens-greece?Itemid=411
([29]) https://www.switchmed.eu
([30]) http://planbleu.org/sites/default/files/upload/files/SD_Dashboard_2019.pdf
([31]) https://web.unep.org/unepmap/ecap-med-ii-project-mediterranean-implementation-ecosystem-approach-coherence-eu-msfd
([32]) PERSEUS: Policy oriented marine environmental research in the Southern European Sea
([33]) ActionMED: Action Plans for Integrated Regional Monitoring Programmes, Coordinated Programmes of Measures and Addressing Data and Knowledge Gaps in Mediterranean Sea
([34]) MEDCIS: support Mediterranean member states towards coherent and coordinated implementation of the second phase of the MSFD

Although these efforts are beginning to yield fruitful results, a lot more knowledge, information and data must be generated by universities, research institutes and local communities than is currently being made available for policymaking. A science-policy-society collaboration is generally project dependent and thereby is short-lived. The instruments available for strengthening, structuring and sustaining the science-policy interface vary considerably among the three subregions, with more continuity and sustainability achieved in the MED EU countries fostered by strong support from the EU.

The revision and aligning of the H2020 indicators with other national (e.g. NAP), regional (e.g. IMAP, MSSD) and global (e.g. SDG) initiatives and their respective indicators have helped to foster synergies and encourage streamlining. As described in the introductory section, this alignment process was a central task which guided countries in identifying areas for integration, linking to different institutions at the national and regional level. Such alignment ensured the optimisation and use of data and information to serve different purposes and the organisation of information in a systematic and harmonised way. It also promoted a more holistic and integrated assessment of the progress related to the priority themes, in line with the principles of SEIS.

Shift in paradigms: opportunities for more integrated policies

Progress has been achieved in the region on the development and uptake of tools and guidance for a transition to a blue, green and circular economy, supported by the MSSD, the MSESD and the SCP Action Plan. The unique composition of the Mediterranean Commission on Sustainable Development (MCSD) — the advisory body that assists the Contracting Parties to the Barcelona Convention in their efforts to integrate environmental issues in their socio-economic programmes — brings together government representatives, local communities, socio-economic actors, international governmental organisations, non-governmental organisations, scientists and parliamentarians as a forum for sharing knowledge and experiences between different stakeholders. Yet mainstreaming environmental sustainability remains country-specific, depending on the capacities and challenges facing each country.

The previous section points out the clear need to embed policies, plans or strategies for waste management at both national and subnational level into a larger resource efficiency/circular economy framework or strategy that can lead to waste prevention and bring economic benefits. When it comes to water, there is a clear move from addressing water quality issues per se to IWRM that promotes coordinated and inclusive approaches for the development and management of resources. The progressive use of Pollutant Release and Transfer Register (PRTR) systems in the whole region could be an important tool for supporting integrated environmental management and policies. The recently launched EU Green Deal also offers promising development in the region.

However, the move towards integrated policies and sustainability transitions must be guided by the most up-to-date knowledge. In Europe, knowledge about systemic challenges and responses is growing and is increasingly reflected in EU policy frameworks (EEA, 2019b). Hence, it is necessary to invest in a stronger knowledge base that enhances the capacity to react quickly in crisis situations, while the need to respond to sustainability on more long-term issues remains across the whole Mediterranean region. Due to the complex interaction of cumulative pressures and their impacts, this knowledge for action should be anticipatory and transdisciplinary (EEA, 2019b). Despite advances in an 'integrated' way of thinking, full operationalisation has proven difficult and presents major challenges on the ground. True integration would mean that environmental institutions work more closely with other institutions — too many of which treat the environment as an externality ([35]). Consequently, the integration of pollution-related policies remains an aspiration for the region.

Developing tools and platforms for data and information management

Based on a survey carried out in 2017 (EEA and UNEP/MAP, 2017), most of the H2020-related data from nearly all MED South countries is not publicly accessible via web services or interfaces. The exceptions are Israel and Morocco which provides 100 % access. Almost none of the MED South countries have a spatial data infrastructure (SDI) platform and most countries do not have a data policy yet.

At the national level, important efforts have been made to further develop information systems. For example, in waste management, Jordan and Israel have started to develop a national waste information

([35]) https://www.unicef-irc.org/article/901-environmental-mainstreaming-plugging-the-gap-in-sustainable-development.html

system that is helping to monitor the enforcement of relevant legislative provisions; and Tunisia has designed a dedicated information system for hazardous waste and a process to monitor health and environment indicators. However, legally binding reporting obligations (law, by-law/legal binding instruction) with clear guidance on the data and information to be reported are generally lacking.

At the regional level, a key milestone has been achieved over the last two years with the preparation of a UNEP/MAP Data Management Policy (Decision IG.24/2, UNEP/MAP, 2019a) and the InfoMAP platform by UNEP/MAP's Information and Communication Regional Activity Centre, INFO/RAC. The InfoMAP Mediterranean knowledge platform was conceived to provide and share data, information services and knowledge for the benefit of the MAP components and Contracting Parties. It provides a unique access point for all the Barcelona Convention's mandatory reporting, including industrial emissions ([36]), 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; setting up a common platform to view, query and analyse data; and producing tools to support the dissemination of data and information. Although the technology is in place, the challenge of sustaining the system while maintaining a flexible environment, which can adapt to the relevance of changing policy, still remains. The value of sharing and reporting data has yet to be fully recognised and needs to be strengthened.

Improving data availability and reliability

The importance of data for the purpose of sound environmental management and evidence-based policymaking is now widely recognised. The recent setting up of IMAP and the SDG and their respective indicator sets has provided robust frameworks for collecting and assessing data in response to policy obligations. At the same time, they have increased the demands for high-quality data and information to track progress towards targets and development goals, both at the national and international levels. Over the period 2004-2017, statistical capacity, measured via SDG 17 ([37]), showed a steady increase in the capacity of the national statistical systems in most countries.

The H2020 reporting exercise showed that even if the data pass the quality control check they are still of poor quality. Data are not consistently available

Box 4 Morocco's ambition to integrate the H2020 indicators to serve the regular national production of assessments

The Observatoire National de l'Environnement et du Développement Durable (ONEDD) developed the Système d'Information Régional de l'Environnement et du Développement Durable (SIREDD) which can accommodate the H2020 indicators and MAP/Barcelona Convention reporting obligations. SIREDD is a spatial infrastructure that monitors the environmental situation via online dashboards, manages data flows, calculates indicators and provides analyses. It is also a regional network of territorial authorities, universities and economic operators represented by Focal Points for each sector.

The SIREDD system already has 733 environment-related indicators, 30 % of which are currently populated. With the technical support of the ENI SEIS II Support Mechanism project, ONEDD is working to ensure the interoperability of SIREDD with the regional InfoMAP platform. This interoperability will enable Morocco to avoid the manual compilation of spreadsheets for data exchange to migrate its reporting infrastructure to an automated system using the Extensible Markup Language (XML). This markup language defines a set of rules for encoding documents in a format that is both human-readable and machine-readable. Since the format is standardised, it is suitable for use when transferring data across devices/servers/applications. The reporting chain is automatised from data collection to data submission which means that data preparation is less time-consuming and datasets can be used for multiple purposes.

In addition, the ONEDD is making an important effort to harmonise the H2020 indicators and national indicators, in particular in the two Mediterranean regions of Tanger-Tétouan-Al Hociema and l'Orientale. The intention is to adopt all H2020 indicators as national indicators to give continuity to H2020 reporting and to comply with MAP Barcelona Convention reporting obligations. SIREDD could become the future entry point in Morocco for all environmental indicators.

([36]) National Base Line Budget NBB.

([37]) Measuring statistical capacities – SDG 17.18.1 is the proportion of sustainable development indicators produced at the national level with full disaggregation when relevant to the target, in accordance with the Fundamental Principles of Official Statistics: https://sdg-tracker.org/global-partnerships#17.18

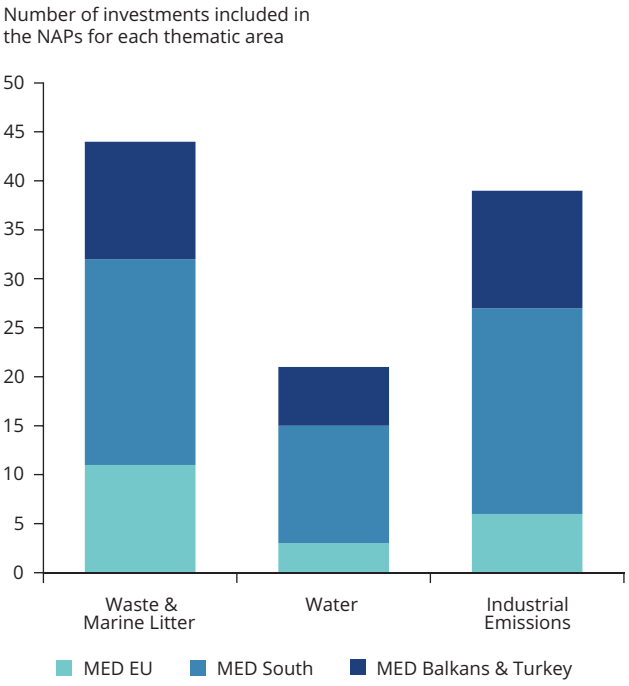
in time and space, which limits the comparisons that can be made among countries and between different geographical units (national level, administrative units, hydrological basin, coastal areas). The reliability of data varies significantly across thematic areas (water-related data are of acceptable quality, whereas waste and marine litter data are very poor quality) and countries. In addition to pollution issues, there is a lack of data and in-depth knowledge on Mediterranean ecosystems, while biological monitoring should be significantly improved (EEA, 2019b).

Investing in pollution prevention, reduction and remediation

In terms of investment, the revision of the NAPs under the LBS Protocol played a central role ([38]) in identifying and prioritising investments. The H2020 pollution reduction and prevention investment component (PRPI) steered the identification, preparation and financing of investment projects, mobilising facilities such as the Mediterranean Hot Spots Investment Programme (MeHSIP II) in the MED South countries (see Box 5), the Instrument for Pre-Accession Assistance (IPA) funds in the Western Balkans countries and Cohesion/regional funds in the MED EU countries. Although resources have been mobilised to improve the situation in the Mediterranean, no aggregated data is available to give a clear overview of the investments made in the last few years to prevent, reduce and remediate pollution. The list of depollution projects, compiled by the UfM in 2014 in the so-called investment portfolio, provided information on the location, characteristics of size/reduction of pollutant loads, implementation status, and cost or investment needed. This inventory has not been updated since. In the absence of more recent information, insights into the type of investment and measures planned by countries to target such pollution were retrieved from their updated NAPs and are presented in Figure 6 below.

There are clear differences in terms of priority areas and between subregions. Considerable attention is given to solid waste by all three subregions, with every Mediterranean country indicating at least one type of measure related to solid waste or marine litter. Investments related to industrial emissions encompass a similar number of measures by the region as a whole, with a relatively lower number proposed by the MED EU countries. Investment measures for urban wastewater are seen as a priority by all MED South countries, except Israel, in particular as regards extending access to sanitation and buildings or upgrading WWTPs.

Figure 6 **Distribution of NAP investment measures directly related to the three pollution areas**

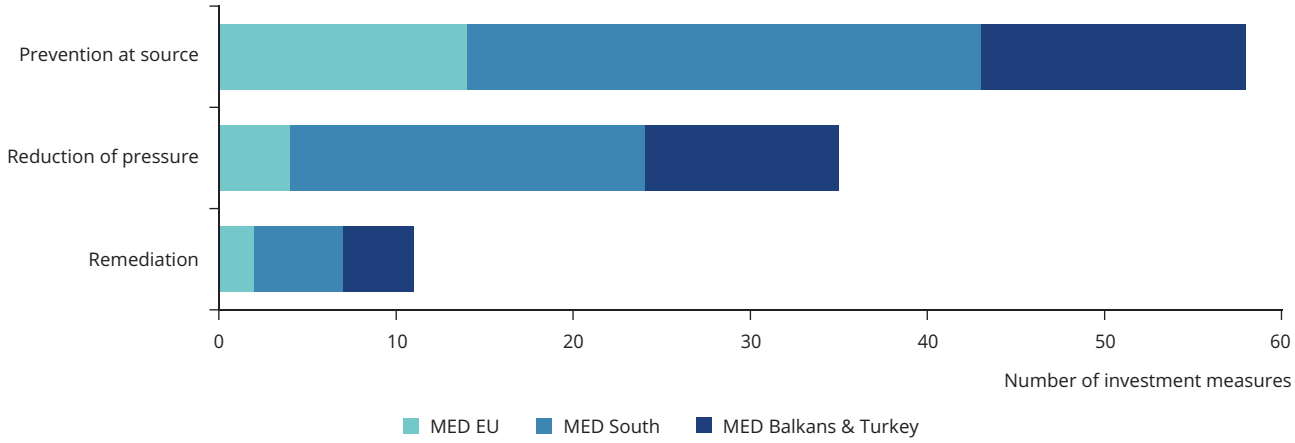


Source: Synopsis of updated NAPs 2015: Hotspots, sensitive areas, targets, measures, indicators and investment portfolios.

In a source-to-sea approach, prevention measures at source should prevail over the reduction of pressures and, ultimately, remediation measures. Such a concept is applied, for example to the *waste hierarchy*, whereby waste prevention/reduction should take priority over recycling and, even more so, over remediation or clean-up operations. The distribution of the type of measures presented in the NAPs (Figure 7) follow such a hierarchy: more than half of this type of measure concerns investments to prevent pollution at source (e.g. regulate/reduce use of plastic; build/extend sewage networks; upgrade existing industrial facilities with BAT/BEP), followed by a reduction in pressures (e.g. build/expand/upgrade hazardous waste landfill facilities). There is much less focus on clean-up and remediation interventions (e.g. marine litter clean-up campaigns, or remediating contaminated industrial sites). This observed hierarchy is valid for solid waste and urban wastewater measures, while for industrial emissions greater emphasis is

([38]) Even countries not party to the Barcelona Convention have developed NAPs, e.g. Jordan, Palestine.

Figure 7 **Distribution of NAPs' investment measures according to prevention at source, reduced pressures and remediation**



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

placed on end-of-the-pipe investments. However, these investments rely on the capacity of countries to adopt and enforce the right policy and regulatory frameworks that can attract and leverage sustainable investment. The impact of such investments has yet to be substantially reflected in measurements of the situation and seem insufficient to support the ambition put forward in the NAPs.

Recurrent need for enforcement and compliance

In general, the region has moved to strengthen the implementation of policies that protect the environment and reduce emissions of major pollutants. Successful implementation can only be achieved through effective enforcement and compliance measures. The role of the Compliance Committee of the Barcelona Convention in facilitating and promoting compliance has been reinforced through Decision IG. 24/1 (UNEP/MAP, 2019b) adopted at COP 21. The committee provides advice and assistance to the Contracting Parties on both general and specific compliance issues and recommendations for improving the effectiveness of compliance mechanisms. However, it suffers from a lack of capacity to achieve its objectives because not all Contracting Parties submit their national implementation reports on a regular basis and there are no consequences for not doing so.

At the national level, water and environment laws provide the vision and scope for the protection of water resources and the environment. However, in MED South countries often laws do not require the authorities to issue regulations and clear guidance/guidelines, including requirements in the form of operational standards and directives. The responsibilities of relevant institutions are often unclear, due to overlapping mandates, e.g. as might be the case for the environment and water ministries as regards drafting water protection regulations. In turn, new regulations have economic and technological impacts that are often not possible to implement due to a lack of financial and human resources.

Compliance-monitoring activities are generally difficult due to inadequate financing and human resources and the absence of monitoring and inspection plans. Inspections are often unplanned and restricted to response to accidents, complaints or credible information pointing to a probable offence. Follow-up visits are allowed to verify the implementation of corrective actions in response to a detected violation. In many cases, ministries lack human and other resources to carry out inspections. Although staff shortage issues are not limited to the field of enforcement and compliance, they are a common issue in departments dealing with the environment. Some countries have excellent inspection and monitoring capabilities in the environmental sector and relatively good capabilities, e.g. in the water sector. However, due to the lack of proportionate and intermediate sanctions, in many cases, the response to violations are slow and ineffective. The impact of penalties for non-compliance with the legislation is generally not proportional to the resulting damage; e.g. waste treatment is charged at a very low cost as part of the general user charges while fines for pollution remain symbolic.

At the national level, MED South countries have introduced ways to improve environmental compliance. For example, the Ministry of Environment in Lebanon

Box 5: Investments in pollution reduction and prevention

The Mediterranean Hot Spots Investment Programme (MeHSIP), led by the European Investment Bank (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. The specific objectives of MeHSIP 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 technical assistance (TA) for the preparation of investment projects in the above-mentioned relevant sectors. This was based on two phases: 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 cost 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). 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.

Of these 24 projects:	**Investment value**
8 have been approved for financing by the EIB board (Alexandria West, Deir Alla and Al-Karameh, Kitchener Drain, Fayoum, Ligne Verte, Ligne Bleue, Tripoli and Al Ghadir)	
EUR 1.43 billion	
13 projects have been prepared (TA completed): Bahr El-Baqar*, Egypt governorates water and WWTPs*, Bani Kenaneh**, Zarqa, Saida, Oued Martil, Morocco Integrated SWM, Gafsa, Djerba, Sebkhat Sijoumi, Tunisia 10 governorates integrated SWM, Bizerte, Tunisia 10 WWTPs	~ EUR 1.34 billion
1 project is still under preparation (TA ongoing): North East Ramallah Villages	tbd
2 projects have completed TA activities but are suspended (TA suspended)	-

Note: Update as per May 2020: * Interest in Bahr El-Baqar water and wastewater treatment plants rehabilitation and rehabilitation and extension of several water and wastewater treatment plants in different governorates was withdrawn by the Government of Egypt; ** For project in Bani Kenaneh, only the water supply component is to be taken forward.

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 their counterparts in several ways, including on-the-job training, dedicated workshops, conferences and training.

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

has issued Decision 202/1-2013 which defines the enforcement mechanism for environmental compliance and the preconditions for the classified establishments to obtain the environment compliance certificate. Cement industries and the fertiliser industry report monthly on their air emissions to the Ministry of Environment and, according to the Decision, all industries must be compliant by the end of 2020. MED South countries have benefited from the capacity-building component of H2020 support on the issue of environmental compliance (see Box 6).

One of the key elements of the European Industrial Emissions Directive (Directive 2010/75/EU; EU, 2010) is ensuring compliance through site inspection and the evaluation of data on pollutant emissions. The integrated permit takes into account the whole environmental performance of the plant covering,

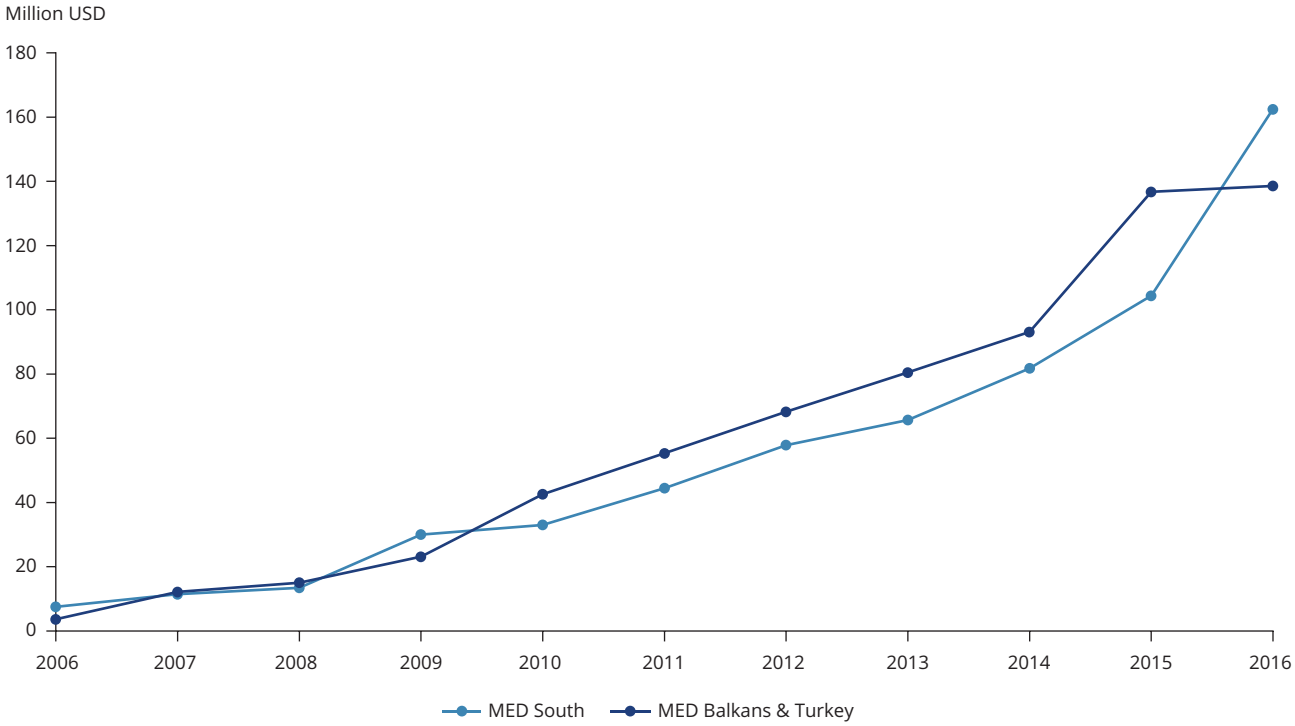
for example, emissions to air, water and land, waste generation, use of raw materials, energy efficiency, prevention of accidents, and restoration of the site upon closure. The Directive has helped to reduce the emissions of classical air pollutants from industrial plants, although there is still potential for further reductions — as well as the need for further reductions in nitrogen oxides (NO_x), fine dust and sulphur dioxide (SO_2). In addition to reducing pollutants, the requirement to operate in an energy-efficient way contributes to the Paris Agreement and the EU Green Deal.

Other instruments that promote compliance include voluntary environmental standards. These non-regulatory instruments are widely used in the MED South countries. Many industries in different countries, such as Algeria, Israel and Tunisia, are accredited under ISO 14001. This standard defines the requirements for controlling and improving the organisation's performance for those processes that have an environmental impact.

Economic incentives for industrial installations to adopt clean and non-polluting technologies are proposed in different countries. In some countries, funding subsidies, e.g. FODEP in Tunisia, are available for downstream and integrated measures in wastewater treatment, water conservation, air-pollution control and internal waste management as well as waste disposal and recycling measures. While downstream measures reduce environmentally harmful emissions at the end of the production process, integrated measures are used in the production process to directly prevent emissions by encouraging the use of clean and non-polluting technologies and BATs (upstream measures).

As is the case in the EU, the polluter pays principle is beginning to be applied more often in the MED South sub-region, e.g. Algeria has applied tax on industrial air pollution since 2007. In some countries, the polluter pays principle is used as a way to promote more integrated management practices, e.g. Lebanon adopted an integrated solid waste management law stipulating that the polluters bear the costs of managing the solid waste generated. Extended producer responsibility (EPR), based on the polluter pays principle, is also being introduced progressively, e.g. it is implemented in Israel and will soon be applied in Jordan where a legal basis for implementation is being prepared. The introduction of EPR in other countries in the MED South subregion

Figure 8 **International investments (USD, current value) made available to MED South and Balkan countries during the period 2006-2016 for the years available**



Note : Algeria — data not available for 2010 and 2012; Lebanon — data not available for 2010; Libya — only data for 2006 and 2016; Syria — data not available for 2013, 2014 and 2015; Tunisia — data not available for 2013; Montenegro — data not available for 2006, 2014 and 2015; Turkey — data not available for 2009

Source: Ritchie et al., 2018.

Box 6 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 the 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 MSESD. The project 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 which addressed national needs and priorities. Critical issues such as waste management, e.g. construction and demolition waste; the reduction of industrial emissions, such as heavy metal 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 framework of H2020, extensive work was carried on the 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 training provided by no less than 121 international and local non-key experts in interventions characterised by a strong participatory, interactive and hands-on set-up. This allowed for 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 benefiting 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

is planned through a pipeline project that will be implemented by the German development agency for international cooperation (Gesellschaft für Internationale Zusammenarbeit — GIZ).

Institutional capacities

Despite the efforts made to strengthen capacities in recent years (see Box 6), there is still a need to further enhance the capacities of public authorities in MED South countries. High fluctuations in human resources working in environmental authorities and institutions remains a challenge, especially in those MED South countries affected by political turmoil. This not only impacts on the sustainability and continuity of regular data/assessment activities but, more importantly, it impairs institutional capacities in terms of competences and mobilisation to address new challenges and adapt to change. The main underlying cause is the lack of adequate funding. With only about 1 % of national budgets being spent for the environment, financing is largely absent from environmental management ([39]). With the adoption of the 2030 Agenda, national statistical offices have now assumed a key role for integration under the SDGs, making greater demands on the need for data, statistics and knowledge. More resources are being made available in the MED South and MED Balkans & Turkey to strengthen statistical capacities, as shown by a significant rise in the period 2006-2016 ([40]) (Figure 8).

([39]) https://www.unicef-irc.org/article/901-environmental-mainstreaming-plugging-the-gap-in-sustainable-development.html
([40]) SDG Indicator 17.19.1 is the dollar value of all resources made available to strengthen statistical capacity in developing countries.

Key messages

1. Over the last 15 years, major efforts have been made towards a cleaner Mediterranean. It is undeniable that there has been clear-cut progress in terms of the creation and strengthening of institutional capacities, legal instruments, direct actions (e.g. investments), regional data infrastructure and tools, and international commitments.

2. Progress mainly concerns pollution prevention at source. However, the available data and knowledge are not sufficient to provide an affirmative evidence-based response to the policy question: What progress has been made towards a cleaner Mediterranean?

3. In most cases, the interventions put in place provide effective actions to keep up with increasing pressures, but the scale of intervention, if not followed up and upscaled at the country level, may not be enough to curb the situation overall. Further upscaling of interventions to reduce the key pressures, such as waste and marine litter, wastewater and industrial emissions, is required to achieve a cleaner Mediterranean and a 'good environmental status' for the Mediterranean Sea.

4. Despite the need to increase our systemic knowledge for more informed policymaking and investments, duly systemic actions (UNEP/MAP-Plan Bleu, 2020) to tackle pollution should not be delayed any longer.

5. There is room for improving the integrated management of pollution, going from source-to-sea, across thematic areas and sectors, and to integrate policy priorities. Targeted support is required to build national capacities for monitoring and data analysis, embracing the need for an integrated assessment.

6. The source-to-sea approach provides an appropriate assessment framework for assessing the land-based sources along the source-to-sea continuum.

7. The nature of the drivers of change has not changed markedly over the last 30 to 40 years; it is their persistence over time, intensity, acceleration and cumulative effects which are currently driving change in the Mediterranean region.

8. The Mediterranean is subject to a complex and heterogeneous policy landscape. Given the current nature of sectorial policies, the region is not equipped to address complex environmental challenges of an integrated nature, and the legal instruments are not sufficient to tackle ongoing pressures in a holistic way.

9. Mediterranean economies remain largely linear from a resource perspective, but clear-cut efforts have been made to ensure the transition to more preventive and circular approaches with direct links to the thematic areas (e.g. reuse of wastewater; 3Rs policies on waste that have a direct impact on the prevention of marine litter).

10. Ambitious commitments have been adopted by Mediterranean countries. However, it is critical that political commitment is transposed to the operational level, by updating national environmental legislation in line with regional decisions and policies. This should be achieved not only by involving the competent authorities but also by including other important stakeholders, such as civil societies, industries and educational institutions, in governance mechanisms.

11. Since the enforcement of policies and laws is still a key bottleneck, ensuring their enforcement and compliance has never been more urgent. This requires establishing and implementing mechanisms as well as capacity building at all relevant levels.

12. Although the establishment of regional data infrastructure has improved significantly, there has been little improvement in data availability

and quality. A huge investment is urgently needed to improve data and information coverage and quality. This process requires further efforts to develop and maintain dedicated data policies and governance structures, making them fully fit-for-purpose and able to cope with new challenges (big data, digital economy) and new topics (e.g. sulphur emission control areas — SECA).

13. Despite shifts on the policy front, achieving goals and targets set out 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, including inter-institutional cooperation.

What lies beyond the Horizon? Main conclusions

This second Horizon 2020 assessment shows that the Mediterranean region faces recurring systemic challenges, in particular regarding the efforts by the countries and regional governance to respond to the objectives of the sustainability agenda across the three main pillars: economic, social, and environmental. It also acknowledges the joint regional effort set in motion by the H2020 initiative, both through the implementation of its work programme and its three components as well through the individually targeted projects ([41]).

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 activities. 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 'good' ecosystem condition.

Combining the use of existing data with new data retrieved from novel scientific methods — e.g. earth observation, artificial intelligence, mobile phones, citizen monitoring, models and novel in situ measurements — should be considered to address policy or assessment needs. Despite efforts to link science and policy, the huge potential of this novel data remains locked. Opportunities for using big data in environmental assessments are endless, although they still face important challenges as the result of restricted capacities due to limited resources and funding, especially in developing countries. The situation in such countries regarding the potential use of big data and citizen science in environmental assessments is in stark contrast. The challenges concerning data are fundamental in nature, whereas citizen-science initiatives are given very little visibility (Pocock et al., 2019). For this reason, at the regional level, there are significant disparities between the three subregions in relation to unlocking the potential of data.

It is a priority for the region to close the gap between policy visions and implementation processes both at the regional and national level. This requires acting in a truly coordinated manner by establishing stronger, integrative and participatory processes organised around measurable targets for progress within a realistic time frame. It is urgent to strengthen inclusive and institutional set-ups to create efficient multistakeholder governance frameworks, including the operational involvement of civil society and industry, to break the 'silo effect' created by thematic/sectoral approaches and to enhance integrated and more systemic approaches. It is critical to enable and apply a more operational ecosystem approach, including the terrestrial, coastal and marine dimensions.

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 underlines the 'need for a systemic change supported by forward-looking and innovative strategies, policies, and behaviours'. As regards regional marine pollution polices and regulations, the regional plans currently being developed or updated by the UNEP/MAP within the framework of Article 15 of the LBS Protocol of the Barcelona Convention, in the fields of wastewater, storm water, sludge, agriculture, and aquaculture, marine litter and industrial pollution management, coupled with nature-based solutions where appropriate, would be streamlined with the nexus approach to environmental resources management of water, energy and food. This can be achieved by examining and further investing in the integration and interdependencies of environmental resources and their transitions and fluxes across spatial scales and sectors, thereby providing opportunities for trade-offs, including the internalisation of environmental costs.

Lessons learnt from the COVID-19 pandemic require a sound environmental response. Considering the interconnectedness of nature in all life on this planet

([41]) https://www.h2020.net/the-h2020-initiative

from land to sea and ocean, and as we continue to relentlessly encroach on nature and degrade ecosystems, endangering human health, it is crucial that we continue to work closely with partners to build integrated scientific knowledge on the links between ecosystem stability, the environment, and human health. 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. This will require a systemic shift towards a sustainable economy that allows us to live in harmony with nature. Therefore, COVID-19 should not be an excuse to step back on hard-fought environmental gains; it must provide clear affirmation that environmental protection is not a luxury but is part and parcel of the human life-support system.

The Mediterranean's resources should trigger economic prosperity and contribute to the stability of the region with green jobs and innovation opportunities for the maritime economy sectors (aquaculture, fisheries, tourism, shipping, ports) as well as for emerging ones (blue biotechnologies, marine renewable sources, services digitalisation), full respecting environmental protection. To this end, the Naples Ministerial Declaration of the Contracting Parties to the Barcelona Convention 2019 renewed a set of ground-breaking commitments in particular in four priority areas for action and commitments. These concern effectively tackling marine litter, strengthening and expanding the marine protected areas (MPAs) network, responding to the challenges arising from climate change, and supporting the sustainable blue economy and an ecological transition for the Mediterranean region.

These commitments are timely and encouraging as a regional transition to a more sustainable and circular approach and effective governance set-ups has never been so urgent. In Europe, the ambitious Green Deal will ensure the full integration of the SDGs. Finally, the common reference framework provided by the 2030 Agenda will ensure the holistic and integrated approach needed to reach the sustainability goals in the Mediterranean.

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