

# Synthesis



April 2021

## Mapping of environmental and sustainable development observation systems in the Mediterranean coastal area

## PREAMBLE

This report, «Mapping of environmental and sustainable development observation in Mediterranean coastal areas», is the result of a twenty-eight day mission commissioned to the association LittOcean by Plan Bleu. Plan Bleu is one of the Regional Activity Centres of the Mediterranean Action Plan. Its missions revolve around three main pillars: observation, analysis and prospective socio-economic studies. This activity, conducted during the months of July 2020 to March 2021, is part of the strengthening of the environmental observatory function and the development of Plan Bleu in support of public decision making. The mission will lay the foundation for updating and consolidating the Regional Observatory on the Environment and Sustainable Development supported and funded by Plan Bleu. The first stage of this study was to establish mapping of existing initiatives in terms of coastal observation at national, regional and local levels for each of the Contracting Parties to the Barcelona Convention. This mapping, far from aiming at exhaustiveness among the abundant and uncountable initiatives of marine and coastal monitoring, has instead attempted to outline a general panorama. Compiled secondly, the report focuses on this general mapping to identify some trends in marine and coastal observation activities in the Mediterranean. For this, a first section reviews the main issues of observation in the Mediterranean and the specificities of the Plan Bleu Observatory. The second section explores Mediterranean initiatives on information sharing. The third section provides a summary of the different practices and themes covered, in terms of the sharing of maritime and coastal environmental information as observed during the mapping phase. This analysis identifies some of the challenges and gaps in environmental information sharing, such as the collection, processing and distribution of socio-economic data, which, although essential for documenting social, political and economic environmental issues, is still insufficient. It also focuses on the definition of sub-regional information sharing areas.

**«The observatory is a tool with the dual challenge  
of producing a comprehensible and operational collective  
representation of territories, while at the same time restoring  
the complexity inherent in the systems they describe»**

**(Moine, de Sède Marceau, 2012)**

## ACRONYMS

**EEA:** European Environment Agency

**CGDD:** French General Commission on Sustainable Development

**GOOS:** Global Ocean Observing System

**ERDF:** European Regional Development Fund

**IFREMER:** French research institute for exploitation of the sea

**IOC:** Intergovernmental oceanographic commission

**MSFD:** Marine Strategy Framework Directive

**SDG:** Sustainable Development Goals

**OHM:** Human-environment observatory

**ONML:** French National Marine and Coastal Observatory

**ESPON:** European spatial planning observation network

**MAP:** Mediterranean action plan

**UNEP:** United nations environment programme

**RAC/SPA:** Regional Activity Centre for Specially Protected Areas

**GDPR:** General data protection regulation

**SDES:** Data and Statistical Studies Department

**MSDD:** Mediterranean Strategy for Sustainable Development

**UNESCO:** United Nations Educational, Scientific and Cultural Organization

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# 1. MARINE AND COASTAL OBSERVATION: GENERAL CONSIDERATIONS

## a. General issues and challenges to marine and coastal observation

If the beginning of the 21st century is proving to be particularly «productive in terms of the creation of observatories of all kinds» (Matthieu, 2008), it is because the anticipation and management of information are now essential prerequisites for decision-making and the proper management of the territory by the many stakeholders involved (Galop, 2012; Bersani, 2006). Observatories have their origins in astronomy, where they are «associated with places and instruments from where it was possible to examine the stars and their movement» (Matthieu, 2008). This latter meaning of the term is now overlooked to designate a multitude of initiatives, even though, in people's minds, the term still evokes a high place of research, associated with quality instrumentation and «intended to predict phenomena, to anticipate them through knowledge of the processes [and] to build a prospective» (Galop, 2012). Moreover, the observatory remains associated with three main characteristics: long-term observation; the use of heavy and sophisticated instruments; and finally, interaction between scientific disciplines to identify laws and predict short-, medium- and long-term developments (Matthieu, 2008). The geographer Nicole Mathieu suggests that observatories flourish notably during periods of crisis, when serious problems arise that are considered unsolvable. For Didier Galop, observation, analysis and prospective - whether simulated or not - are now the «keywords of a ternary specific to environmental observatories implemented to quantify, spatialise, model and, ultimately, anticipate the effects of the acceleration of global changes that affect our planet and the human societies that live on it on different time and space scales». In view of the concerns they generate and the issues they cover, observation and monitoring of the Mediterranean

basin are especially subject to public policy attention. Although the Mediterranean basin represents less than 1% of the world's ocean surface, it is home to up to 18% of the world's biodiversity, including 20 to 30% of endemic species. On the coast, where a third of the Mediterranean population lives, a small and complex area, ecological issues are in conflict with socio-economic issues. The Mediterranean basin also accounts for 11% of world trade imports and 17% of world oil tanker capacity. In view of the many hazards that can affect it and the numerous pressures that are exerted on it, and in order to provide the elements necessary for its proper management, continuous observation of the marine and coastal environment is essential. Observation on the scale of the Mediterranean region faces an additional challenge, that of sharing information relating to the understanding and monitoring of the state of the socio-ecosystems between the various States bordering the basin, a necessary step in the development and evaluation of public policies, although, these States do not all share the same culture and practices in terms of collecting environmental information.

There is no consensus on the terminology used for environmental observation among the various institutions and countries responsible for its creation and transmission. «Environmental observatories» can nevertheless be defined as institutes and agencies created by laws or decrees - whose status is specific to each country - that collect and pool information. This information may be administrative data (budgets allocated, number of inspections, etc.) or scientific observations (relating to the quality of bathing water, the number of species of fauna or flora, etc.). This information is produced by various stakeholders: administrations, organisations generating data from statistical surveys, but also observation stations. It can be compiled and distributed through various means and media, based on the nature of the observation and the purpose of its collection,

such as public reports or state of the environment reports. Consequently, «environmental observatories» collect information on various aspects of the environment (observation of ecosystems) and societies (socio-economic observations), through observation stations, statistical institutes, research laboratories, observation and research programmes. These observations require - in particular for physical or oceanographic observations - essential and expensive technical equipment, and involve a specific territory (seas, soils, surface waters, etc.). The stations ensure long-term monitoring of the environment. They are also part of observation programmes of limited duration which, for their part, enable the acquisition of new knowledge without, however, allowing the collection of information to be sustained. Therefore, these observatories depend on the proper functioning of monitoring activities. For this reason, for the mapping carried out prior to this study, it was decided to take into account national agencies, such as observation stations.

As explained below, environmental observation is governed by various international regulations, such as those concerning public access to environmental information (Aarhus Convention transposed into the EU in Directive 2003/4/EC, detailed hereafter); as well as reporting obligations at a European level (such as the Water Framework Directive or WFD (2000/60/EC); or the Marine Strategy Framework Directive or MSFD (2008/56/EC), requiring states to collect sufficient information to produce annual reports on the state of the environment. These national reporting obligations have an important role to play in the sharing of environmental information on a European scale, as is also demonstrated by the activity of the European Environment Agency.

To conclude this discussion of the challenges facing environmental observation, Lovett et al. (2007) point out that observation is not always considered to be a «true» science. Observation data is reportedly rarely used in practice and the resulting prospection capacity is inadequate. There is no shortage of literature dealing with these difficulties. Guides to good practice in the conduct of environmental observation programmes recommend that observation programmes should be built around clear scientific

questions; that they should include procedures to enable them to adapt to developments and changes; that they should anticipate the future when choosing variables; that they should maintain data quality and consistency over time; that they should develop a long-term plan for data accessibility and archiving; that they should continuously review, interpret and present the observed data; and finally that they include observation as part of an integrated research programme (Lovett et al., 2007). In addition to these challenges, the scale of observation is also a challenge in marine and coastal monitoring. The scientific and expert literature stresses the need to organise observation by basin rather than by observation station (de Jonge et al, 2006). Marine observation also raises the issue of the high cost of observing the open sea and the seabed. Marine observatories often depend on the status of the national navy fleet, its availability for scientific missions, or the allocation of advanced technology (probes, satellite imagery, submarine cables, etc.) and vessels equipped for research from the leading maritime research institutes. When observation requires stability of activity over time or even space, the burden of this investment is all the more problematic as observation programmes are often short-term and non-permanent. The literature also focuses on the stage of data sharing and data networking. Observatories are expected to have an information system for the management, analysis and synthesis of environmental observation data. They are also expected to publish data on the Internet in user-friendly and easily accessible formats, discoverable by others, and interoperable with data from other observatories (Horsburgh et al., 2011). However, information sharing practices remain extremely flawed and uneven from one system to another. The storage and construction of Geoportal and Dataportal implies the provision of trained staff, the harmonisation of shared data formats on a national scale, and access to functional servers, which, as the report will show, is the subject of numerous international funding programmes specifically linked to the construction of information systems.

## **b. The specific characteristics of Plan Bleu's observation activity**

This mission is part of Plan Bleu's commitment to strengthen its observation and evaluation capacities. Plan Bleu acts as the Mediterranean Observatory for the Environment and Sustainable Development. One of its missions is to provide the Contracting Parties to the Barcelona Convention with statistics, indicators and assessments relating to the environment and sustainable development in order to constitute a decision-making aid for the Mediterranean countries. The materials provided by Plan Bleu to the Barcelona Convention Contracting Parties are structured around priority axes for monitoring the

links between the environment and socio-economic realities. 28 priority indicators structured around 6 themes have been selected to monitor progress in sustainable development in the framework of the implementation of the Mediterranean Strategy for Sustainable Development (MSSD) related to Sustainable Development Goals (SDG) and their implementation in the Mediterranean region. Developing Plan Bleu's observation mission requires access to the data needed to measure these indicators. These data are collected by a heterogeneous set of ministerial departments, agencies, statistical institutes and national observatories, research laboratories and various observation programmes. They are validated by the Contracting Parties to the Barcelona Convention, and must be shared by Plan Bleu.

## **2. INTERNATIONAL INITIATIVES FOR SHARING ENVIRONMENTAL INFORMATION**

The constitution of maritime and coastal environmental information is structured by international conventions, strategies and programmes of international organisations. Article 12 of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (2004) - or Barcelona Convention - provides for the establishment of pollution monitoring programmes in the Mediterranean by the 22 Contracting Parties to the Convention (21 Mediterranean coastal states and the European Union) Moreover, 13 of these parties are also signatories to the Aarhus Convention (1998) on access to information, public participation in decision-making and access to justice in environmental matters. The primary objective of this Convention is to «improve the environmental information provided by public authorities in relation to key environmental data». It also aims to encourage web-based transmission of environmental statistical data to the general public.

Environmental information sharing is also at the heart of

strategies of international organisations. The United Nations Educational, Scientific and Cultural Organisation (UNESCO) Strategy for Action to Address Climate Change (2018-2021) includes among its areas of action the promotion of interdisciplinary climate knowledge and scientific cooperation for climate change mitigation and adaptation. The strategy stipulates that «this will be achieved through sustainable scientific actions in support of climate change research, assessment and monitoring, including through collaboration among UNESCO's capacities in the natural and social sciences, local and indigenous knowledge, ecological and socio-cultural systems, culture, education, communication and information» (UNESCO Strategy for Action on Climate Change, 2018-2021).

Finally, data sharing is structured around European Union programmes and directives. The Horizon 2020 programme for research (2014-2020) organises the funding of EU research and innovation. It extends open access to research



publications and in some cases introduces open access to scientific data. The Infrastructure for Spatial Information in the European Community Directive (INSPIRE, 2007) establishes an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment. It establishes the obligation to provide data according to common implementation rules; the constitution of data catalogues; the application of interoperability rules; free access to metadata as well as the existence of an appropriate organisation to ensure the proper implementation of the directive. Finally, EU framework directives set out reporting obligations at a national level. Among these, the directive on public access to environmental information (2003/4/EC) promoting the principles of the Aarhus Convention; the Water Framework Directive or WFD (2000/60/EC), which requires the adoption of management plans and programmes of measures appropriate to each body of water; and the Marine Strategy Framework Directive or MSFD (2008/56/CE). This establishes a framework for Community action in the marine environment. It aims to support EU countries in their pursuit of good environmental status in the marine environment,

the progress of which is documented by 11 descriptors and associated qualitative indicators. It provides for the establishment of continuous monitoring and assessment of progress in terms of environmental status. However, these initiatives are primarily concerned with data that focus on the criteria for achieving «good environmental status». They do not deal extensively with socio-environmental data on human-environment relationships. Article 20 of the UNESCO Strategy for Action on Climate Change does, however, encourage (it has no standardising dimension) monitoring that involves collaboration between the natural and social sciences, ecological and socio-cultural systems, culture, and education. The latest European normative frameworks on personal data protection (the General Data Protection Regulation, GDPR, 2016) also raise questions on the compatibility of open data in social sciences and personal data protection. However, social science research on the relationship between societies and their environment is in fact largely confined to the research laboratories to which they belong, and the data is essentially shared within scientific articles, as will be detailed hereafter:

### 3. MAIN STAKEHOLDERS AND TOOLS FOR MARINE AND COASTAL OBSERVATION IN THE MEDITERRANEAN

The programmes and actions of a number of international organisations play a major role in organising and harmonising environmental observation in the Contracting Parties to the Mediterranean Action Plan. The leading programmes in the field of environmental observation and maritime and coastal sustainable development are detailed here, as they are key players in the field of observation and environmental information networking. The report focuses on programmes specifically related to coastal and marine environments, or more broadly to environmental observation, although it is part of a wider context of territorial observation deployment.

#### a. The European Union mechanisms

The European Union, through the programmes of the European Commission and the European Environment Agency, has an important role in the organisation of environmental observation and monitoring

##### *The development of observation in interregional cooperation: Interreg programmes*

Interreg programmes aim to promote cooperation between European regions in the fields of urban, rural and coastal development, economic development and environmental management. Several are directly related to maritime and coastal observation. These programmes have the distinctive feature of building information systems between two or more Mediterranean regions, enabling the networking of environmental information. For example, PORTODIMARE 2018-2021 (geoPortal of Tools & Data for sustainable Management of coAstal and maRine Environment), of the Interreg Adrion (Adriatic-Ionian), enabled the creation of GAIR (Geoportal Adriatic-Ionian). It was designed to support risk analysis and assessment. It provides access to numerous datasets related to coastal and marine areas and several modules for analysis and risk assessment of Integrated Coastal Zone Management (ICZM) and maritime spatial planning. It operates in Italy, Greece, Slovenia, Montenegro, Croatia and Bosnia-Herzegovina. Its portal contains a catalogue of data, some of which relate to aquaculture, biological characteristics, submarine cables and pipeline routes, coastal land uses and activities, economic indicators, fisheries,

shipping, impacts of pressures, sources of pollution, tourism and recreation. However, data on «social indicators» - which have a dedicated tab - are not yet available. The Interreg VA Italia-Malta 2014-2020 programme, which is a cross-border programme covering the whole of the Maltese and Sicilian territories, aims to promote cooperation between Maltese and Sicilian entities through projects that contribute to research. It funds the Calypso South project, which aims to extend the existing radar network coverage to the western part of the Malta-Sicily Channel and the southern part of the Maltese archipelago. It intends to develop new surveillance and forecasting tools and provide tailored operational downstream services to assist entities in their maritime security, rescue and emergency response commitments.

##### *Funding instrument for the environment: The LIFE programme*

In addition to regional integration, the LIFE funding programme, created in 1992, is the European Commission's funding instrument for the environment. It is designed to «conserve species and habitats, protect soil, improve air or water quality, manage waste or mitigate or adapt to climate change». One of the priority areas of the 2014-2020 program is environmental and climate governance and information. 11 LIFE projects involve the latter field, amounting to 24 million euros. The project «Restoring Mediterranean wetlands to help mitigate climate change» (LIFE WETLANDS4CLIMATE) (2020-2024), for example, aims to maximize the carbon sink function of Mediterranean wetlands

by defining 30 measures related to vegetation, soil and water. The programme will also develop indicators for monitoring the ecological status of wetlands in Spain and then in 6 other European states. Finally, the LIFE+ Arcipelagu Ġarnija project (2015-2020) focuses on studying all known breeding sites of the Yelkouan Shearwater in the Maltese islands to assess the number of breeding pairs, breeding success and the threats they face at each site, as well as participating in the safeguarding of the species. The project aimed to set up a continuous observation programme for this species. However, little information is available on the accessibility of data within information systems at the European Union or Mediterranean basin level.

#### *Monitoring in research funding: Horizon 2020 framework programme*

The organisation of maritime and coastal environmental information on a European Union scale also involves research support mechanisms. This is illustrated in the framework of the governance of territorial and urban policies by the ESPON 2020 cooperation programme (2016), funded by the European Regional Development Fund (ERDF), which aims to consolidate a European Spatial Planning Observation Network (ESPON). It should support the production and distribution of territorial data covering the whole territory of the 28 EU Member States, as well as 4 partner states Iceland, Liechtenstein, Norway and Switzerland. Accordingly, it must improve territorial observation and analysis tools. More specifically, in relation to the observation of coastal and marine environments, the European Commission's Horizon 2020 research framework programme (2014-2020) funds large-scale observation programmes, sometimes with a specific component relating to data accessibility within information systems. For example, it enabled funding of the above-described ODYSSEA project. We also highlight the PERSEUS project (2012-2016), which established a collaborative framework including scientists, policy makers and the general public, to share knowledge and promote decision making. PERSEUS has developed both ocean

observation capabilities (new Argo floats were deployed in the Black Sea and sustained ship campaigns were supported in key locations) and information sharing and decision support tools (TEAP - «Tool for identification and assessment of Environmental Aspects in Ports»; as well as a Geographic Information System platform in the event of oil spills). This programme, together with its predecessor, are also the main funders of the projects that led the demonstration phases of the future Copernicus marine observation service: Copernicus: MyOcean (2009-2012), MyOcean2 (2012-2014) and MyOcean (October 2014-March 2015). Copernicus is involved in land observation, emergency management, marine observation, atmospheric observation and security and climate change via satellite. Finally, the Horizon 2020 programme funds the «EuroSea» project (2019-2023) (<https://eurosea.eu/>), which aims to co-design European ocean observing and forecasting services that deliver information and support decision-making in the areas of climate, coastal and maritime activities and ocean health fields. It aims to ensure the production of FAIR data, to support the integration of ocean data in the Copernicus Marine Service, EMODnet and SeaDataNet systems. It focuses on climate change impact indicators, coastal resilience and marine habitats and the projection of extreme coastal events.

#### *Sustainable fisheries fund monitoring: The EMFF*

The European Maritime and Fisheries Fund (EMFF) is the financial instrument of the EU's Maritime and Fisheries Policies for 2014-2020. It is intended to support the transition to sustainable fisheries and help coastal communities diversify their economies. For example, the Fund financed the project «Marine environmental monitoring: towards effective management of Malta's marine waters» (2017-2020), with the aim of implementing and updating the country's observation programme, developing a marine database system, and enabling the analysis of monitoring data, assessment of environmental status and development of environmental targets.

### *The role of the EEA*

The European Environment Agency (EEA) is an important instrument for sharing environmental information, as its mission is to provide sound, independent information on the environment. By establishing a regular assessment of the state of the environment in the EU countries and beyond, it allows the data collected to be transmitted back to the local, regional and national institutions of the various countries, in order to measure the evolution of the various parameters selected in relation to specific indicators, and the situation of the country with regard to the objective of good environmental status. The EEA also participates with UNEP in the ENI SEIS II South programme in the implementation of the Shared Environmental Information System (SEIS) principles and practices in the European Neighbourhood Regions (2016-2020). This programme involves Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, and Tunisia. This initiative is specifically focused on data sharing and management, according to predefined indicators (waste, water, industrial emissions, and socio-economic data).

## **b. The United Nations mechanism**

While the European Union's programmes and strategies also involve countries outside the Community, the UN programmes play a central role in the development and structuring of national and Mediterranean observation networks. Their funding helps to deploy information systems, enrich observatories with measuring tools, and harmonise data formats in non-EU countries.

### *MAP programmes*

UNEP's (United Nations Environment Programme) MAP (Mediterranean Action Plan) is structured around six Regional Activity Centres (RACs), including the Plan Bleu Regional Activity Centre - RAC/PB (France), specialising in the processing and analysis of environmental, economic and social data for decision-making, as well as the assessment of the interaction

between the environment and socio-economic development. The Regional Activity Centre for Specially Protected Areas - RAC/SPA (Tunisia) specialises in biological diversity and develops management plans and information tools for continuous environmental monitoring. It also works to distribute information to specialists and international organisations, as well as NGOs. In this context, it funds numerous projects working towards the establishment of marine and coastal observation systems in the Mediterranean, which are very present in our mapping. The EcAp-MED II project, «Mediterranean Implementation of the Ecosystem Approach, in coherence with the European Union Marine Strategy Framework Directive (MSFD)» (2015-2019) was targeted primarily at Algeria, Egypt, Israel, Libya, Lebanon, Morocco and Tunisia. It aimed to support these countries in the implementation of the EcAp roadmap - a strategy for integrated land, water and living resources management that promotes conservation - by assisting them in establishing new biodiversity observation programmes based on the IMAP IG 22/7 decision. This initiative enabled national training sessions on monitoring techniques for marine habitats, seabirds, sea turtles and cetaceans to be held across these different states. The Med Key Habitats project «Mapping key marine habitats in the Mediterranean and promoting their conservation through the establishment of Specially Protected Areas of Mediterranean Importance (SPAMI)» (2013-2016) brought together Albania, Algeria, Croatia, Egypt, Libya, Morocco, Montenegro and Tunisia to carry out mapping inventories of marine habitats of conservation interest with a view to extending the network of Specially Protected Areas of Mediterranean Importance (SPAMI). Action 3 of the project consisted in strengthening existing observation networks and initiating new ones for key habitats.

Among MAP's complementary missions, MEDPOL has been working since 1975 to assist Mediterranean countries in the implementation of three Barcelona Convention protocols: the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, the Protocol for the

Prevention of Pollution in the Mediterranean Sea by Dumping from Ships and Aircraft, and the Protocol on the prevention of pollution of the Mediterranean sea by transboundary movements of hazardous waste and their disposal. It must notably ensure the collection, analysis and distribution of data and information on pressures and on the state of the marine and coastal environment. It also supports the implementation of national action plans for monitoring and combating pollution by the Contracting Parties. REMPEC is responsible for assessing the status and trends of maritime traffic and offshore activities in the Mediterranean and associated marine pollution. It monitors the impact on the marine and coastal environment, including the health aspects of marine pollution.

### UNESCO's IOC

UNESCO's (Educational, Scientific and Cultural Organization) Intergovernmental Oceanographic Commission (IOC) plays an important role in funding information systems related to oceanography and the marine environment. Its International Oceanographic Data and Information Exchange (IODE) programme was established in 1961. Its objective is to facilitate the exchange of oceanographic data and information between Member States. It operates in support of the Global Ocean Observing System (GOOS), promoting good practice in data management and bridging the digital divide between countries. The IODE structure has two levels: data and information management coordination (such as the World Data Assembly Centres, which focus on the receipt and assembly of both marine and oceanographic meteorological data; or the 80 National Oceanographic Data Centres, which provide access and management for the national oceanographic data resource) and structural programme elements. These programmes aim to develop specific aspects of data collection, such as increasing

the amount of historical oceanographic data available on climate change (Global Oceanographic Data Archaeology and Rescue Project, GODAR). Since 2004, the IOC Tsunami Programme also includes an Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS). Among its four working groups, the third is responsible for the collection and exchange of sea-level data, including offshore tsunami detection tools.

### *The role of NGOs: the case of MedPAN*

The role of the NGO MedPAN in the networking of stakeholders managing Marine Protected Areas should also be highlighted. Its action enables MPAs to be federated and to coordinate their efforts in terms of observation. For example, the COMING project (Coordinated monitoring and management of marine turtle nesting activity in the western Mediterranean through MPAs), led by the BETATC of UVic-UCC (Fundació Universitària Balnes), unites five Spanish and Italian MPAs (MPA Costes del Maresm; MPA Delta de l'Ebre; MPA Costa degli Infreschi e della Masseta; MPA Santa Maria di Castellabate; MPA Isole Pelagie), carrying out coordinated action to detect, protect and monitor sea turtle nests. The MPA NETWORK project (2019-2022), co-funded by the European Union's Interreg Med programme, brings together France, Italy, Croatia, Greece, Slovenia, Albania and Spain for the networking of good practices by MPA managers. Training courses are organised on the observation of cetaceans, dolphins and their interactions with fishermen, as well as feedback from surveys (such as the recent one on the impact of COVID-19 on recreational fishing at sea). MedPAN also carries out a scientific watch to share environmental information, with a strong focus on the interactions between societies and their environment.

## 4. THE CONSTRUCTION AND SHARING OF ENVIRONMENTAL INFORMATION IN THE MEDITERRANEAN WITHIN IDENTIFIED STRUCTURES

### a. A typology of observatories and identified observation activities

Monitoring activities are conducted by a wide range of stakeholders, in the form of institutions (agencies, ministerial departments, observatories, research institutes), but also programmes, monitoring networks and observation systems. In order to clarify the structuring of the activity, observatory typologies have sometimes been devised, differentiating them, for example, according to their data collection practices (frequency, durability), the objectives pursued by the observatory (support for public decision-making, scientific publication), the scale of observation, the triggering of data collection and updating, and the means implemented. In their categorisation of coastline observatories in France, Bulteau et al (2008) differentiate between «operation» type systems (carrying out one-off or unplanned data collection on a local scale, on an ad hoc basis and without scheduled updating), «observatory» type systems (providing long-term monitoring to assist decision-making on a departmental or regional scale) and finally «meta-observatories» (constituting coastline information systems). The latter have the particularity of pooling rather than collecting data.

Nicole Mathieu (2008) identifies three main types: research observatories (data construction and continuous observation systems, dealing with complex, long-term, indeterminate objects); statistical observatories (they observe changes, based on the use of statistical information systems, the implementation of complex surveys and continuous measurements deploying significant State resources, without attempting to make the data

interact); and observatories for action (they are designed to solve a short-term problem, deal with critical issues, and are of short duration).

These typologies make it possible to identify elements that are fundamental to the understanding of environmental and sustainable development observation in the Mediterranean, including the issue of the sustainability of observation activities, as many programmes are short-term; the frequency of data collection; the objective monitored; the observatory's capacity to cross-reference complex and heterogeneous data; and their observation scale. In this report, the «meta-observatory» concept proposed by Bulteau et al (2008) is used to highlight the specific nature of these information systems, which are responsible for pooling data without actually collecting it. The following typology is recommended for the interpretation of the «Survey of environmental, marine and coastal observation activities» (Table I):

Table I - Typology of the observatories and observation programmes identified

Type	Definition	Example
Short-term, one-off observation/ research programmes	They provide one-off, time-limited monitoring of a given subject, without the competence or function of an observatory.	«Scientific monitoring programme at artificial reefs in MPAs of Paralimni, Ayia Napa, Amathounta, Dasoudi and Geroskipou» 2019-2022 (Cyprus)
Single-parameter observatorie	They provide regular monitoring on a specific and often only nature-related subject, for development or scientific research purposes.	Corsica coastal observation network (France) ACCOBAM for cetaceans
Multi-parameter observatories	Local, regional or national, they ensure the collection and pooling of complex data to assist public decision-making.	Research institute for exploitation of the sea (France); IFREMER (France); Water Agencies (France)
Meta-observatories	They do not collect data, but enable the pooling of multiple data, often with the presence of socio-economic data on a national or regional Mediterranean scale, for the purposes of public decision-making.	EIONET

## b. Themes covered by the observation and their representativeness

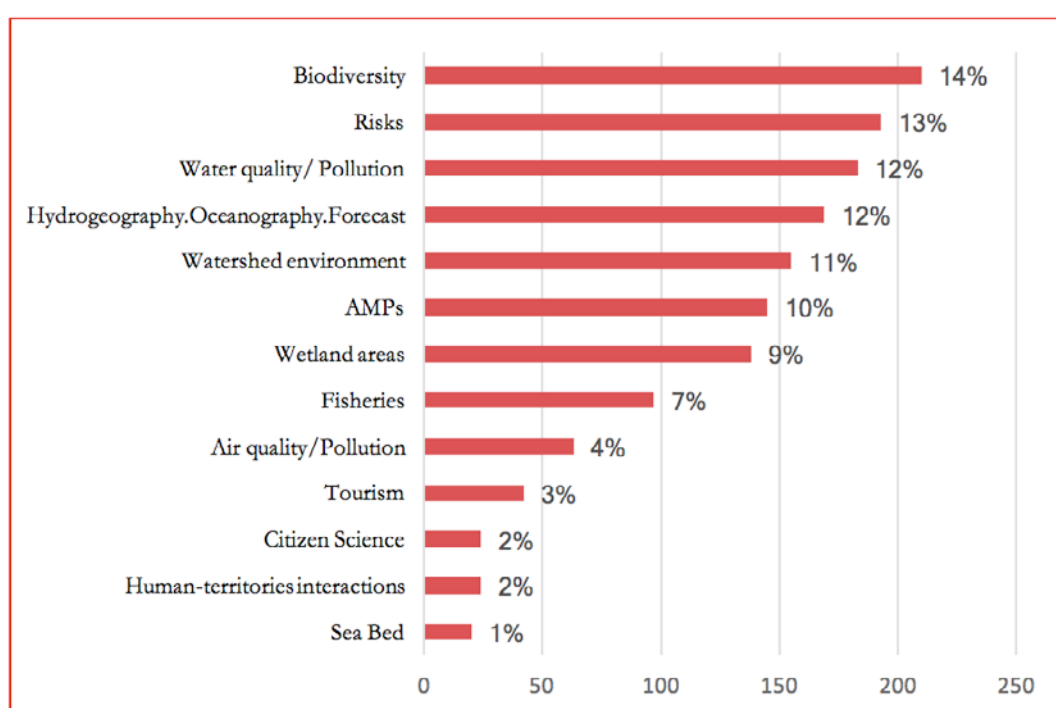
### Analysis method

In order to set out the themes most frequently covered by marine and coastal observation activities, a working document in the form of an Excel spreadsheet was drawn up, specifying the themes addressed by the organisations listed in the technical report. This technical report is not an exhaustive collection of observation activities in the Mediterranean, but aimed to provide a general overview of the observation process. Therefore, the representation of the most covered themes proposed here is indicative and not exhaustive. After an initial reading of the report, the following 13 categories appeared to be recurrent and formed the basis of the classification process we are using: biodiversity, wetlands, hydrography/oceanography/forecasting, marine protected areas, fisheries, tourism, environment/catchment area, risks, water

quality/pollution, air quality/pollution, human/territory, citizen science, seabed. The question of whether the above themes were addressed was indicated for each organisation. Where information was not available, we indicated by default that the topic was not covered by the organisation. It is important to consider this bias when analysing the themes covered by the observation activities.

A breakdown of the number of times a theme is covered by a Mediterranean environmental observation body has been used to create a bar chart (figure 1). The most frequently covered themes are 'biodiversity' (14% of the total number of themes covered), 'hazards' (13%), 'water quality/pollution' (12%) and 'hydrography/oceanography' (12%). Observations at the 'catchment basin scale' (11%) or within the 'Marine Protected Areas' (10%) and 'Wetlands' (9%) are also relatively frequent. 'Fisheries' (7%), 'air quality/pollution' (4%), 'tourism' (3%), 'participatory science' (2%), 'human-environment interactions' (2%) and 'seabed' (1%) are not widely covered.

Figure I - Number of times a theme is covered by an observatory (abscissa) and percentage representation (ordinate) of this theme out of all the themes covered



#### Low representativeness of socio-economic themes

One of the first explanations for the low representativeness of the 'fisheries', 'tourism' and 'human-environment relationship' themes lies in the predominance of strictly environmental indicators on which the reports on the state of the environment in the Mediterranean are built. Most of the reports on environmental data for the Mediterranean basin available online are from the UNEP/MAP Specially Protected Areas Regional Activity Centre; the United Nations Economic Commission for Europe (UNECE) Environmental Performance Reviews; and the state of the environment reports published by individual countries. These reports mainly present indicators constructed from

oceanographic or naturalist data. Socio-economic indicators are proposed by agencies, statistical institutes, ministries and national environmental observatories (such as the National Environmental Observatory in Morocco, or the Tunisian Observatory for the Environment and Sustainable Development). Given the poor accessibility to data within these structures, consultations with the various National Focal Points or the agencies and ministerial departments of these countries would be necessary. Consequently, for each Mediterranean country, the documentary research method used for the drafting of this report did not allow for the identification of the structures at the origin of the socio-economic data as well as those producing environmental



data *stricto sensu*. However, the latter are more extensively presented in reports produced by UNECE or the RAC/SPA. Generally speaking, the organisations or programmes responsible for documenting uses of the sea such as fishing and transport rarely use the term observation to describe their activity. They are mostly ministerial departments (Maritime departments; ministries responsible for fisheries or transport and maritime trade) or national research institutes dealing with fishing and aquaculture (such as the National Fisheries Research Institute in Morocco) in charge of establishing registers on fisheries, maritime transport of passengers and goods. Statistical services and institutes (see case 1, appendix 3) are also responsible for collecting national quantitative data on certain socio-economic aspects related to marine and coastal environments. Human and Social Sciences (SHS) laboratories, where the environment is generally not the main research theme, will also deal with these dimensions. The latter are the most capable of constructing detailed and qualitative data on the relationships between societies and their environment, and therefore of providing information on the «human-environment interaction» theme, which is rarely covered by Observatories in general. These structures work, for example, on representations of nature, environmental inequalities, environmental practices, etc. (see case 2 in Appendix 3)..

*The specific case of observation on the high seas: a still poorly represented theme undergoing development*

The low representativeness of the «seabed» theme coincides with the low number of sea-based observatories. Scientists also stress the urgent need to extend the DCSMM to deep waters and to define an ecosystem approach for their management and protection in the Mediterranean (Donovaro et al., 2020). For this area, most of the surveys and studies are carried out by satellite and reported directly in what we have called «meta-observatories» (most often

via Copernicus Marine Service). In this respect, the Israeli DeepLev station is an original initiative in the Levantine basin (Timor Katz et al., 2020). The IMED (Implementation of the MSFD to the Deep Mediterranean Sea) project (2017-2019), led by a consortium of 9 stakeholders, also aimed to understand, quantify and map anthropogenic pressures and impacts, current knowledge and spatial coverage of data related to MSFD indicators in the Mediterranean depths (beyond 200 metres). The project established a knowledge base on the subject, and developed an operational Geoportal on the issue. The Offshore Protocol for the Mediterranean (adopted in 1994 and re-launched in 2011) of the Mediterranean Action Plan also aims to ensure the safety of offshore activities in the Mediterranean, in the framework of the Protocol for the Protection of the Mediterranean Sea against Pollution resulting from Exploration and Exploitation of the Continental Shelf, the Seabed and its Subsoil. It should work towards establishing regional offshore monitoring procedures and programmes. Finally, ODYSSEA is also a recent flagship initiative in this field, financed by the European Union (Horizon 2020 programme) across the Mediterranean basin. It aims to set up a network of marine observatories in the Mediterranean (Greece, Egypt, Tunisia, Spain, Turkey), and to improve the existing databases in this field (Copernicus, GEOSS, GOOS, EMODNet, ESFRI, Lifewatch, Med-OBIS, GBIF, AquaMaps, Marine IBA e-atlas, MAPAMED). In addition to this, the ODYSSEA platform will provide access to data through a single public portal accessible by different end-user and stakeholder groups. For example, the observatory in Al Hoceima (Morocco) has recently been equipped with underwater gliders deployed off the Moroccan coast. It is designed to monitor marine life and pollutants. Its scope extends beyond the Alboran Sea into Spanish waters. Data from the Mediterranean open sea is being collected and shared.

### *Participatory observation programmes*

Finally, participatory observation programmes, which rely on citizen science to constitute their research data, are most often developed within NGOs and national research programmes. They combine the objectives of observation and raising public awareness of environmental issues specific to marine and coastal environments. Participatory observation mainly relates to biodiversity (counting of species, invasive and protected species) and macro-pollution (often plastic). In the case of France, the fundamental role of participatory science in biodiversity observation has been highlighted (Levrel et al., 2010), although this contributes to an imbalance of observations in favour of popular taxonomic groups. However, participatory observation programmes, which are now equipped with phone applications or online forms, suffer from the low financial stability of the associations or the short duration of the programmes that support them. They are also unevenly distributed in the Mediterranean, and are especially present throughout the countries of the European Union, notably via funding linked to the Horizon 2020 framework programme.

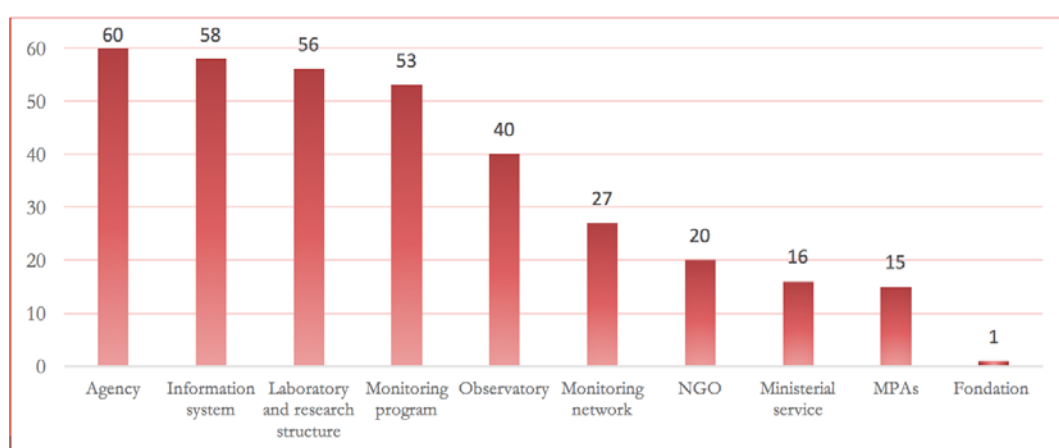
## **c. Environmental information sharing practices within the identified observatories and observation programmes**

### *Data sharing by type of structure or organisation*

During this mission, we noted that observation activities were not limited to the activities of Environmental Observatories (Figure 2). Moreover, this term appeared to us to be very French: de facto, very few structures carrying out environmental and sustainable development observation are labelled «Observatory». To understand what environmental observation is, it is necessary to detach ourselves from this notion and pay attention to data that are

not always classified under the «Environmental information» heading. In addition to observatories that have a physical existence, observation on a country scale must be thought of as a network in which a number of structures co-operate (Ministries, State agencies, Research centres, NGOs, etc.). For example, the collection of health-related data (air and water pollution, etc.) is often the responsibility of the Ministry of Labour or Health. Another example is that data on fisheries or maritime traffic are often collected by the ministries of transport, agriculture and fisheries, economy, or even interregional directorates of the sea (for France). On the other hand, the main data relating to coastal and maritime activity are produced by research laboratories subject to the vagaries of the short-term programmes that fund them. In order to illustrate this trend, we have classified the different organisations carrying out marine and coastal observation activities with the following categories: information system; agency (e.g. the Albanian National Coastal Agency); ministry or ministerial department (e.g. the Spanish Ministry of Transport); observatory (e.g. the National Sea and Coastal Observatory); monitoring programme (e.g. the Egyptian Environmental Monitoring and Information Programme), laboratory and research institute (e.g. Lebanese National Centre for Marine Sciences); non-governmental organisation (e.g. BirdLife Malta); Marine Protected Area (e.g. El Kala National Park in Algeria); monitoring network (e.g. Spanish regional and local air quality monitoring networks). The graphical representation of the addition of structures by type enables a quick grasp of the variety of organisations involved in observation (Figure 2).

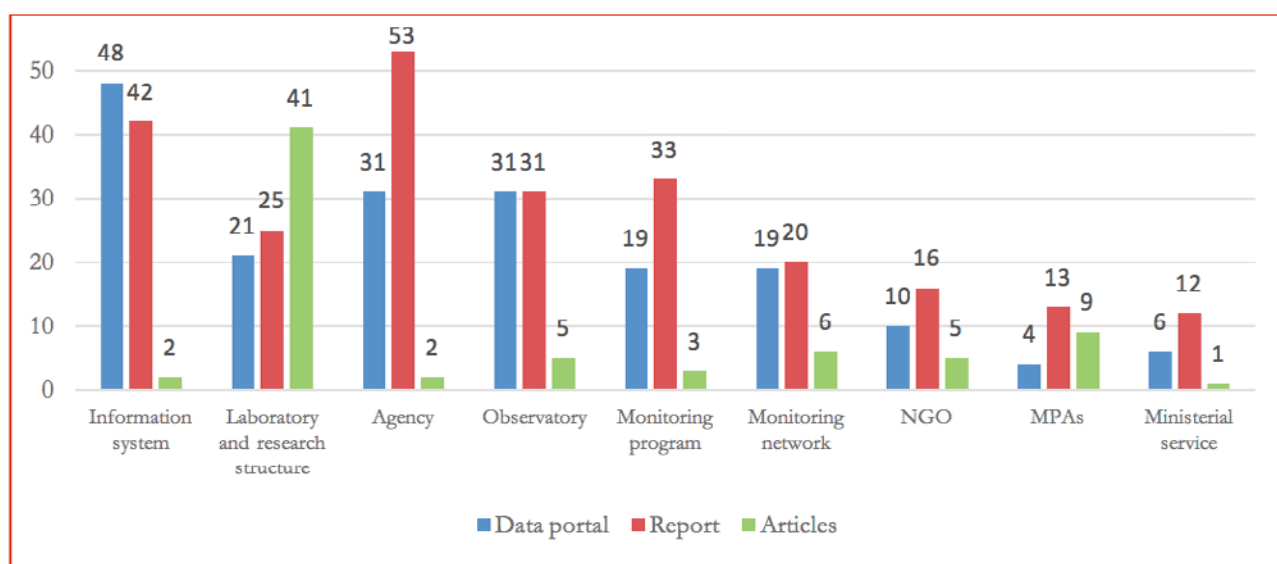
Figure 2 - Type of structure carrying out marine and coastal activities in the Mediterranean



Furthermore, not all these structures have the same practices for sharing environmental data (Figure 3). To observe this, for each organisation we drew up a table indicating whether data from monitoring and observation activities were available. Three main formats for making information available stand out: in the form of raw data; in the form of analyses, most often compiled in PDF

format reports; and data available in the form of scientific articles. When we did not find any available data, we considered that these data were not available. The below graph illustrates the form (data portals; reports; scientific articles) in which information is available by type of organisation. The ordinates represent the number of observatories concerned by type of provision and organisation.

Figure 3 - Number of organisations making environmental data available, by type of provision and mechanism



It appears that research centres and laboratories promote the data acquired during their observation activities through scientific articles. This is the format in which their work is most appreciated by the national and international evaluation procedures of these structures. Most of these articles are distributed by scientific journals to which access is subject to a charge and the information is not easily accessible to agents outside the scientific field in which the article is published. It should nevertheless be noted that the use of research data for the publication of data-papers is increasingly common in the environmental sciences, which allows access to the raw data without analysis and facilitates its integration into large international databases. Databases are increasingly considered a deliverable of research projects funded by international environmental donors such as the European Union. Furthermore, for the southern Mediterranean countries with fewer observation structures and where environmental data are least available, we invariably found information on the state of the marine and coastal environment in the form of scientific articles written by national researchers. As such, this form of environmental information sharing should not be neglected.

The graph (Figure 3) illustrates that the organisations that make the most raw data available are information systems (most often international) and observation networks. This is because the design of information systems is based on the sharing of data or their metadata in a very standardised form (most often within Dataportal). In addition, these systems usually offer partial data processing in the form of geographic information systems (GIS), interactive charts or maps. The structures set up in the form of observatories also mainly adopt this form of information sharing.

Most ministries and agencies favour the provision of reports in which raw data are not directly available, but are processed and analysed to draw up various observations on the state

of the marine and coastal environment and to prescribe management strategies to be adopted accordingly. It is also noticeable that these structures have a reduced practice of sharing data with the general public, whatever their form. In this respect, EU Member States are subject to the Aarhus Directive on access to environmental information, which is not the case for non-EU Mediterranean States.

#### *Data sharing by theme*

The availability and sharing of data covered by these themes are fundamental issues in the construction of effective information systems. The construction of an environmental information system implies that data should be understandable, easy to find, interpretable and interoperable (FAIR data). It was noted during this study that data accessibility varies greatly from one theme to another. Cartographic, oceanographic, toxicological and naturalist data are the most available. As far as «socio-economic» data is concerned, data on fishing and transport are relatively accessible, whereas data on tourism or «human-environment interactions» are not widely shared. This is partly due to the fact that the research laboratories that document them do not always practice open data, thus contributing to the confinement of information. This phenomenon is all the more significant within SHS research laboratories, where the issue of Open data is confronted with multiple questions of personal data protection and where the nature of the materials collected is often not very standardised (in the form of interviews, observations and survey logs).

As a result, scientists from these structures have difficulty in complying with FAIR criteria in the sharing of their data. On the contrary, the geomaticians community is the most advanced in terms of sharing, via spatial data. This is notably due to the fact that geographical environmental information is governed by the European directive INSPIRE, which has

made its provision mandatory since 2007 (INSPIRE, 2007). The latter community therefore usually relies on Spatial Data Infrastructures (SDI) that have been operational for several years. Finally, even when environmental information portals contain a catalogue reserved for socio-economic data, the study found that the catalogue tab often contained an empty or poorly updated page.



## 5. OBSERVATION NETWORKING AT MEDITERRANEAN AND SUB-REGIONAL LEVELS

### *Mediterranean and sub-Mediterranean information systems: an under-representation of southern Mediterranean countries*

Sub-regional and Mediterranean information systems (IS) are essentially, if not almost exclusively, maintained by international institutions. Table 2 lists the systems most frequently found during the mapping exercise. They are akin to meta-observatories and constitute an infrastructure for the permanent storage of data produced by the national observation systems that they periodically collect. The United Nations supports the most infrastructures, notably through UNESCO's IOC, which is a joint mechanism for the study of the oceans and administers the Global Ocean Observing System (GOOS). This system is divided into regional alliances, three of which cover areas of the Mediterranean basin: Euro Goos, My Goss and Goos Africa. GOOS is also funded by the United Nations Environment Programme (UNEP). It primarily contains oceanographic and hydrographic data and is designed for use by researchers, politicians (coastal managers, parties to international conventions, national meteorological agencies, marine and coastal

industries, citizens, etc.). UNEP also funds various systems such as the Euro-Mediterranean Information System on know-how in the Water, the Mediterranean Database of Cetacean Strandings (MEDACES) or the MedPol System Info (part of the INFO MAP Mediterranean environmental information system). The United Nations also supports the World Meteorological Organization (WMO) or via the Food and Agriculture Organization (FAO) the FAO AdriaMed. After the United Nations, the European Union is the second international organisation to support information systems on a Mediterranean scale. Among a multitude of infrastructures, the ones most consistently found are the National Reference Centres of Eionet, the Marine Water Information System for Europe (WISE) and The European Marine Observation and Data Network (EMODnet). These information systems are themselves supported by the SeaDataNet and Copernicus Marine Service. Other networks developed at the initiative of Non-Governmental Organisations exist, such as the International Birdlife Data-Zone or the Integrated Taxonomic Information System.

**Table2 - International and regional information systems** A cross-section of the Contracting Parties to the Barcelona Convention, least represented in these information systems makes it possible to draw up a list of the countries that are least involved in these systems. These include southern Mediterranean countries such as Libya (1 occurrence), Lebanon (2 occurrences), Algeria (4 occurrences), Morocco, Egypt and Tunisia (5 occurrences). These countries are also the least represented in the observatories and monitoring programmes operating at the Mediterranean basin level.

International and regional information systems	Institutions	Member states
EUROGOOS European Global Ocean Observing System	Intergovernmental Oceanographic Commission of UNESCO	France, Spain, Italy, Greece, Cyprus.
MONGOOS	Intergovernmental Oceanographic Commission of UNESCO	Morocco, Spain, France, Italy, Malta, Greece, Slovenia, Turkey, Israel, Croatia, Montenegro
GOOS Africa	Intergovernmental Oceanographic Commission of UNESCO	Morocco, Algeria, Tunisia, Libya, Egypt
SeaDataNet (human activities and fishing)	European Union	Croatia, Cyprus, France, Greece, Italy, Israel, Montenegro, Slovenia, Tunisia
Copernicus Marine Service	European Union	Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia, Spain
Eionet National Reference Centres	European Union	Spain, France, Italy, Malta, Cyprus, Greece, Turkey, Slovenia, Bosnia-Herzegovina, Montenegro, Croatia, Albania
WISE Marine (European Marine Information System)	European Union	Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia, Spain.
EMWIS - Euro-Mediterranean Information System on know-how in the water sector (socio-economic data)	United nations, UNEP	Albania, Algeria, Bosnia-Herzegovina, Croatia, Egypt, Jordan, Israel, Lebanon, Monaco, Montenegro, Morocco, Palestine, Syria, Tunisia, Turkey.
MED POL Info System	United nations, UNEP	Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Israel, Lebanon, Monaco, Montenegro, Morocco, Palestine, Syria, Turkey, Cyprus, Spain, France, Greece, Tunisia, Italy, Malta, Slovenia
MEDACES: Mediterranean Database of Cetacean Strandings (UNEP/MAP/SPA-RAC and the Spanish Ministry of the Environment):	United nations, UNEP	Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Israel, Lebanon, Monaco, Montenegro, Morocco, Palestine, Syria, Turkey, Cyprus, Spain, France, Greece, Tunisia, Italy, Malta
World Meteorological Organization (WMO) and Integrated Global Observing System (WIGOS)	United nations	Bosnia-Herzegovina, Croatia, Cyprus, France, Greece, Israel, Italy, Montenegro, Serbia, Slovenia, Spain, Turkey
FAO AdriaMed	United nations, FAO	Albania, Bosnia-Herzegovina, Croatia, Cyprus, France, Greece, Israel, Italy, Malta, Monaco, Montenegro
International Birdlife Data-Zone	NGO	Croatia, Cyprus, France, Greece, Israel, Italy, Malta, Montenegro, Slovenia, Spain

*Observatories and monitoring programmes on a sub-regional scale: thriving observation of the «Liguro-Provençal and Tyrrhenian» and «Adriatic and/or Ionian» basins*

When studying the sub-basins involved in the 20 programmes and observatories identified at this scale, a few sub-regions appear frequently (Table 3). It should however be noted

that the sub-basins (Figure 4) listed in this table correspond to the observation areas as described by the programmes and observatories, even if these sometimes cover only part of the sub-basin in question (e.g. within the «Liguro-Provençal Basin and Tyrrhenian Basin» area, some programmes cover Italy and Malta, others France, Italy and Monaco).

**Table3 - Observatories and monitoring programmes on a sub-regional scale**

Observation on a Mediterranean sub-basin scale	Number	Listed programmes and observatories
Liguro-Provençal and Tyrrhenian basins (Italy, France, Monaco, Malta)	6	<ul style="list-style-type: none"> <li>• Interreg Italia–Malta Calypso South (2007-2018)</li> <li>• Côtes méditerranéennes françaises. Inventaire et impact des aménagements gagnés sur le domaine marin (MEDAM)</li> <li>• Prévention et Lutte contre la Pollution du Milieu Marin (RAMOGEPOL)</li> <li>• Programme Cybelle Méditerranée</li> <li>• Institut de la mer de Villefranche sur Mer</li> </ul>
Adriatic and/or Ionian basins	4	<ul style="list-style-type: none"> <li>• Projet PORTODIMARE (2018-2020)</li> <li>• Projet Interreg «Explorer la biodiversité aquatique transfrontière» (2020-2023) entre Croatie-Bosnie-Herzégovine et Monténégro</li> <li>• Institut national italien pour la protection et la recherche environnementales</li> <li>• Institut de Biologie Marine de Koto, qui opère sur l'ensemble de l'Adriatique.</li> </ul>
Levantine Basin	3	<ul style="list-style-type: none"> <li>• Cyprus Coastal OceanForecasting and Observing System</li> <li>• The DeepSeaResearch Station (Israel)</li> <li>• Turkish Marine ResearchFoundation</li> </ul>
Eastern Mediterranean (Adriatic Sea, Ionian Sea, Aegean Sea)	3	<ul style="list-style-type: none"> <li>• TurkishSeaLevel Monitoring System</li> <li>• Marine and EnvironmentResearchLab (Cyprus)</li> <li>• Oceanography Centre (Cyprus)</li> </ul>
Southern Mediterranean (from the Alboran Sea to Levantine Basin)	3	<ul style="list-style-type: none"> <li>• ODYSSEA (2017-2021)</li> <li>• Mapping Key marine habitats and assessingtheirvulnerability to fishingactivities (2020)</li> <li>• National Institute of Oceanography and Fisheries (Egypt)</li> </ul>
Algerian Basin	1	<ul style="list-style-type: none"> <li>• ABACUS I to 5 – Algerian BASin Circulation Unmanned (2014-2019)</li> </ul>
Italy-Tunisia-Lebanon	1	<ul style="list-style-type: none"> <li>• COastal Management and MONitoring Network for tackling marine litter in Mediterraneansea - Tunisia (2019-2022)</li> </ul>



Figure 4 - Map of the Mediterranean sub-basins (Ayache, 2016)



However, this categorisation shows that the basin stretching from the Spanish coast to Italy, the Liguro-Provençal, Tyrrhenian and Southern Adriatic basins (Italy, France, Monaco, Malta, 5 occurrences) is covered by more monitoring programmes and observatories. The Adriatic and/or Ionian basins (4 occurrences) are also to be mentioned as an operative observation area, as the Interreg project PORTODIMARE (2018-2020) aims at creating a joint platform for data, information and tools focused on the coast and sea of the Adriatic-Ionian region; the Interreg project «Exploring transboundary aquatic biodiversity» (2020-2023) between Croatia-Bosnia-Herzegovina and Montenegro; the Italian National Institute for Environmental Protection and

Research operating on the southern and northern Adriatic coasts; and the Institute of Marine Biology in Kotor, which operates across the Adriatic. On the other hand, the Eastern Mediterranean (3 occurrences); the Southern Mediterranean (3 occurrences); the Levantine basin (3 occurrences) are less frequently observed on this scale, as is the Algerian basin (1 occurrence). There is also an observation area that is difficult to classify, due to its spatial configuration between three countries (Italy-Tunisia-Lebanon). The southern Mediterranean is therefore the most isolated from the observation networks at infra-regional and Mediterranean basin level, while having relatively few information systems at a national level.

## 6. CONCLUSION

Environmental observation is a complex activity that requires significant human and technical resources. Environmental observatories have a specific role - on a local as well as regional (Mediterranean) scale - in the construction and sharing of environmental information. They enable data collected by various stakeholders to be pooled, processed and shared in order to support public decision-making. Nevertheless, the regulatory frameworks relating to environmental information between the Contracting Parties to the Barcelona Convention are quite disparate. The integration of the different regions into sub-regional information systems relating to the marine and coastal environments remains uneven, despite an increase in information networking at a European and global level.

In addition to the observatories for the environment and sustainable development in the Mediterranean, Plan Bleu intends to focus on the socio-economic dimensions of monitoring. However, this report has rightly pointed out the lack of documentation on these themes - which may, for example, relate to human-environment interactions or marine and coastal activities - by observation activities in the region. Marine and seabed observation is also less covered than coastal observation, and is unevenly distributed from one country to another. However, it has recently increased thanks to the initiatives of international organisations. Moreover, this study has underlined the importance of the network organisation of environmental observation in the Mediterranean. The development in recent years of information systems on a European and Mediterranean scale attests to this. Nevertheless, the Southern Mediterranean countries remain less involved in these networks.

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## APPENDICES

### Appendix 1: Table of Conventions referenced and their contracting parties

Convention	Objective	Members	Members of the Barcelona Convention 2020
Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS)	Reduce threats to cetaceans in the Mediterranean, Black Sea and Atlantic area west of the Strait of Gibraltar.	Albania, Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Georgia, Greece, Italy, Lebanon, Libya, Malta, Monaco, Morocco, Montenegro, Portugal, Romania, Slovenia, Spain, Syria, Tunisia, Turkey and Ukraine	Albania, Bosnia and Herzegovina, Cyprus, Croatia, France, Greece, Italy, Malta, Monaco, Montenegro, Slovenia, Spain, European union
Regional convention for the conservation of the Red Sea and the Gulf of Aden Environment	To conserve the Red Sea and Gulf of Aden environment.	Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan, Yemen.	Egypte
Aarhus convention	Improve access to information concerning the environment that is held by public authorities, in relation to key environmental data.	Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kazakhstan, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Northern Macedonia, Malta, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of Moldova, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkmenistan, United Kingdom of Great Britain and Northern Ireland, Ukraine	Albanie, Bosnie-Herzégovine, Chypre, Croatie, Espagne, France, Grèce, Italie, Malte, Monaco, Monténégro, Slovénie, Union européenne
International Convention for the Prevention of Pollution from Ships (MARPOL)	Regulations for the prevention of pollution by oil, pollution by noxious liquid substances in bulk, pollution by harmful substances carried by sea in packaged form, sewage from ships, the prevention of garbage and air pollution from ships.	136 countries	Algeria, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Morocco, Montenegro, Slovenia, Spain, Tunisia, Turkey.

## Appendix 2: Marine and coastal environmental observation glossary

**Good environmental status:** in the Marine Strategy Framework Directive (2008/56/CE, DCSMM), means that «the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable». According to the Water Framework Directive (WFD, 2000/60/EC), «Good ecological status» is the objective set for all water bodies in the Member States.

**Data Paper:** article that describes a set of raw scientific data and informs the scientific community of its availability. Metadata (describing the reasons, the stakeholders of the data collection, the method and context of the data collection; its owner; its storage format) are presented there<sup>1</sup>.

**State of the environment report:** an analytical tool to assess the environmental situation of a territory at a given time. Uses indicators to assess the impact of pressures not only on the environment, but also on the economy and livelihoods of a country's citizens. Many international organisations see state of the environment reports as the basis for effective environmental planning.

**Géoportail:** is a type of web portal that provides access via the internet to search and visualise geographical or geolocalised data and information. It can combine this data with other geographical information services (interactive maps, analyses, etc.).

**Indicators:** the OECD defines this assessment tool as «a parameter, or a value derived from parameters, which provides information or describes the state of a phenomenon, environment, area with a significance extending beyond that directly associated with a parameter value<sup>2</sup>». They are designed to answer political questions and serve as a basis for public policy-making.

**Environmental monitoring:** UNECE defines environmental monitoring as a tool to assess environmental conditions and trends, support policy development and its implementation, and develop information for reporting to national policymakers, international forums and the public<sup>3</sup>.

**Environmental observatory:** A structure whose mission is to support the implementation of public environmental policies in the fields of environmental observation and access to environmental knowledge. It monitors the evolution of territories, notably through indicators, and can also coordinate the drafting of state of the environment reports.

**Environmental reporting:** EIONET defines reporting<sup>4</sup> as «the presentation of unbiased scientific data and information relating to the environment, providing insights into the state of the environment, to provide the basis for informed decision making so that individuals and policy-makers can take positive action».

**Observation station:** localized observatories that collect and analyze data within a given observation area. In this way, marine stations can carry out both observation (research vessels, scientific diving) and experimentation in controlled or natural environments.

**Information system (IS):** in information science and technology, an IS is the connected and structured set of tools or resources that enable information (text, images, sound, video, etc.) to be collected, stored, processed and shared. This definition is declined in a multitude of infrastructures. Information systems should not be confused with computer systems<sup>5</sup>.

**Environmental Information System (EIS):** EIS are GIS dedicated to environmental information<sup>6</sup>.

**Geographic information system (GIS):** GIS is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical or spatial data.

**Participatory Geographic Information Systems (PSIG):** tool to foster public participation in local territorial management processes (data collection, mapping operations, territorial decision, etc.).

4 This report may be subject to a regulatory framework: the Water Framework Directive (WFD, 2000/60/EC) requires EU Member States to report every six years on management plans and programmes of measures, as well as on the mid-term review of the programmes of measures; while the Habitats Directive (HFD, 92/43/EEC) requires Member States to carry out and transmit an assessment of the conservation status of the species and habitats covered by this directive every six years

5 In the field of marine and coastal observation, an I.S. can be considered as a collection of heterogeneous devices (ranging from an observation station to a research department or a digital storage service provider) which interact with each other in the collection, processing and distribution of environmental information. The use of the term information system in the context of this study refers to the set of autonomous entities responsible for linking the different collectors of marine and coastal environmental data within computer portals made up of different modules, some of which are dedicated to making data available in databases, while others provide data formatting via geo-catalogues or summary reports

6 Their number is growing in response to the European Inspire Directive (March 2007), which specifically aims to promote environmental protection in Europe. This protection involves opening up thirty-four types of geographical data to the public in the Member States, provided they are available in digital format. This also reflects the third pillar of the Aarhus Convention, which could be summarised as follows: «Everyone has the right to be informed, to participate in decision-making and to seek redress in environmental matters».

1 The University of Edinburgh maintains a list of journals where Data papers can be published. In the environmental field, several data warehouses exist, such as Biosharing (for Biosciences), Data Ifremer (for marine data), Data One (for terrestrial observations), Pangaea (Earth and environmental sciences) or Global Biodiversity Information Facility (Biodiversity).

2 [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=OCDE/GD\(93\)179&docLanguage=Fr](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=OCDE/GD(93)179&docLanguage=Fr)

3 <https://unece.org/environmental-monitoring> (visited on 18/03/2021)

## Appendix 3: Two schemes working on the socio-economic dimensions of the environment

### *Case 1 - SDES: statistical data sharing practices*

The Data and Statistical Studies Department (SDES), «organises the socioeconomic and statistical observation system for the environment and sustainable development in terms of housing, construction, transport, energy, the environment and sustainable development, in association with the national, European and international bodies concerned». Its Orléans office is responsible for environment and sustainable development. It took over from the IFEN, which was created in 1992 and abolished in 2008. This statistics departments attached to the French General Commission on Sustainable Development (CGDD), within the Ministry of Ecological Transition, operates on a national scale. It provides information in various forms relating to the sea and coastline, and fulfils the former functions of the National Marine and Coastal Observatory (ONML). Its specificity is to pool and analyse a large quantity of statistical data on socio-economic data and human/environmental relations. It produces, pools and analyses complex and heterogeneous data, in a permanent manner and with the aim of assisting public decision making. It produces thematic sheets on the «Personal situation of the French in relation to the sea» («Attachment of the French to the sea»; «Interests of the French for the sea»; «Uses of the sea by the French»); and on the «Perception relating to the protection of the sea and economic activities» («Opinions on the protection of the marine environment»). It provides access to reports such as raw data sets on various parameters, ranging from «freshwater uses», the «decomposition of the carbon footprint by components and consumption items», to the «French assessment of ecosystems and ecosystem services: continental wetlands and aquatic environments». These data are mainly from survey institutes. Socio-economic data (e.g. Unemployment and active population on the French coast in

2016 and its evolution since 1999; land occupation according to distance from the sea between 2012 and 2018; land occupation according to distance from the sea in 2012 and evolution since 2006; jobs in the maritime economy in 2015) mainly dealing with data from INSEE, Directorates (e.g. General Directorate for Infrastructures, Transport and the Sea) or departments (data and statistical studies department, SDES; Environmental Observation and Statistics Department (SOeS) of the Ministry of the Environment, Energy and the Sea). Data are available in the form of databases, maps, graphs, infographics as well as tables, videos and publications.

### *Case 2 - OHM Mediterranean Coastline: an interdisciplinary research observatory on human-environment interactions in relation to society*

The French mediterranean coastal zone Human-environment observatory (OHM) by the Institute of Ecology and Environment (INEE) and the French National Centre for Scientific Research (CNRS) is spread over three main study sites: Upper Corsica, Marseille and the Golf d'Aigues-Mortes (figure 5). In terms of our typology, it is a «between» the categories observatory, both a multiparameter observatory and a research programme. Founded in 2012, this observatory is part of the network of OHMs grouped under the LabEx 'Device for Interdisciplinary Research on human-environment Interactions' (DRIHM). OHMs were conceived as a tool for promoting interdisciplinarity aimed at studying the interactions between humans and their living environments. They also respond to the need to ensure the duration of scientific investigations in the environment and the reliability of conservation and sharing of research data (Chenorkian et Robert, 2014). OHMs also integrate the notion of sustainable development and aim to inform public decision-makers by providing an interface between the academic, political, economic and social worlds. Compared to other observatories, the specificity of OHMs is that they place humans at the heart of the environment and are interested in highly anthropised

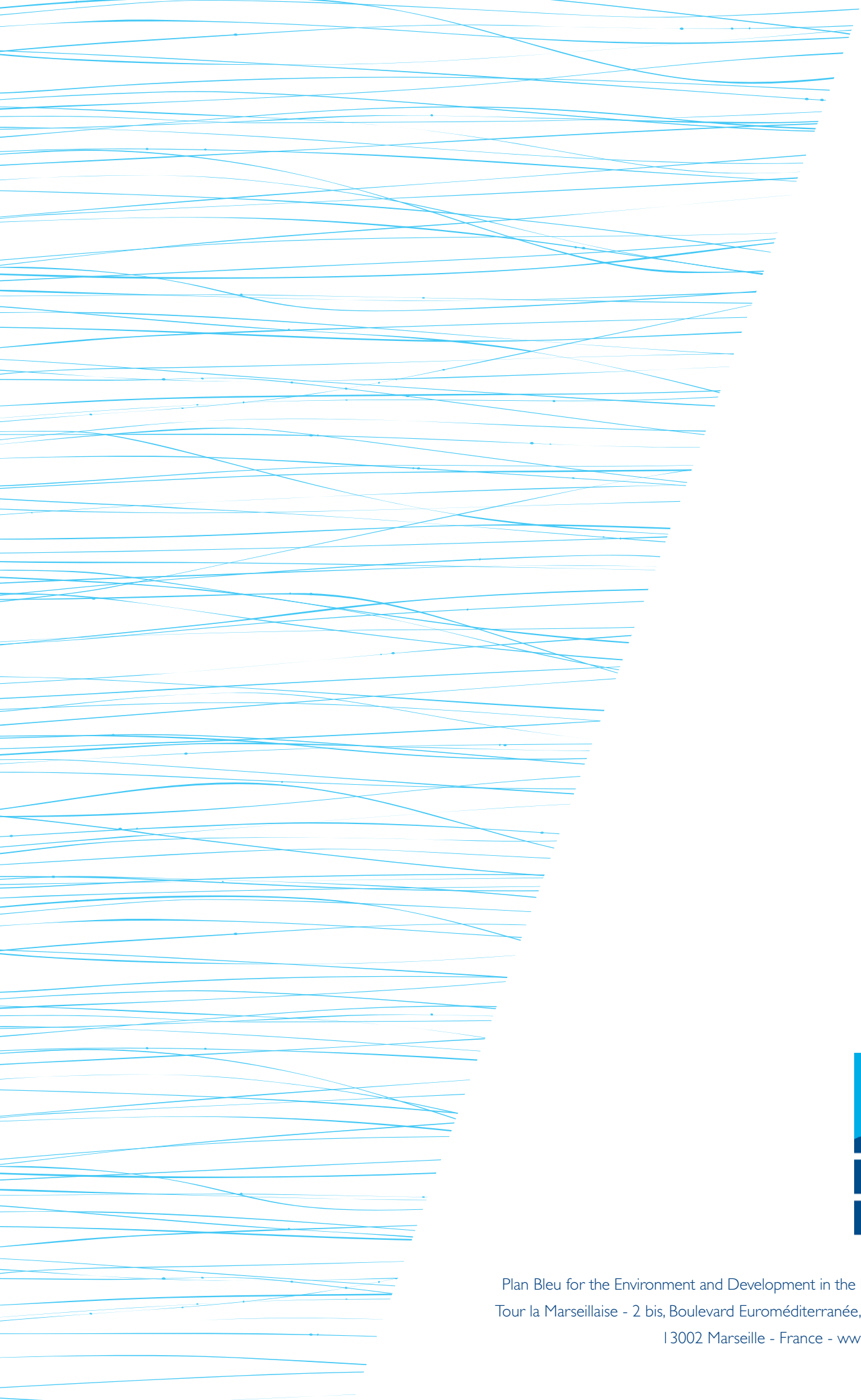


and anthropoconstructed contexts (Chenorkian, 2014). In order to bring about the interdisciplinarity necessary for the study of the socio-ecosystem, OHMs are built around an object shared by all the environmental sciences in the broader sense. Researchers at the OHM Mediterranean Coastline work mainly on beach, lagoon and port items, which allow studies in earth and environmental sciences as well as social sciences. The OHM produces a wide range of data, from hydrometric, taxonomic and toxicological data to population counts or data from survey procedures (on the perception of risks and pollution, on the documentation of collective mobilisations on the environment). The observatory implies a data construction system as well as interactions between their different scientific dimensions, which can also involve different scales of analysis (micro, meso, macro), time (observation and retro-observation) and temporality (social facts and natural cycles, etc). Nevertheless, there is not necessarily a continuous observation of these data. They are produced on the occasion of research projects financed by the scheme for one year and possibly renewable. The limitation of continuous observation is especially true for the humanities and social sciences on a relatively small site, but some continuity

of research, pooling of research and preservation of data is conducive to the analysis of social change. This is especially true since the understanding, analysis and qualification of social change is carried out for these sciences without recourse to systematic experimentation, as is the case for the so-called experimental sciences. Some of the data produced by OHMs are stored in an easily accessible geo-catalogue, while most of the research products are formalised in scientific presentations (seminars), sometimes open to the public, collective works and, above all, scientific articles (collection in the HAL bibliographic database). The problem facing this observatory is perhaps its duration. OHMs, initially funded entirely by INEE, are now financed by the ANR and consequently project-based research via their recognition in the framework of the Investment for the Future programme, which grants them LabEx status. Even if they have been renewed in 2019 for four years, their future renewal is uncertain.

Figure 5- Map of the sites covered by the OHM Mediterranean Coastline (2019 edition, source: LabExDrihm)





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