

## INTRODUCTION

Several agreements for the protection of the coastal and marine environment are currently effective in the Mediterranean region. However, from a historical point of view, the attention to the "health conditions" of the Mediterranean is a concept born only recently. If we wanted to indicate a precise moment, we should identify it in 1975, the year of birth of the *Mediterranean Action Plan*<sup>1</sup>. The following year it was signed the Convention for the protection of the Mediterranean Sea against pollution (definitively entered into force in 1978), the so-called Barcelona Convention<sup>2</sup>. This agreement was revised and supplemented in 1995 (Convention for the protection of the marine environment and the coastal region of the Mediterranean). The Barcelona Convention is managed by the United Nations Environment Program (UNEP) with the aim of preventing, reducing, combating, and eliminating, as far as possible, sea pollution in order to protect and improve the marine and coastal environment and thus contribute to its sustainable development. The Treaty identified seven action protocols<sup>3</sup> concerning, for example, the protection of the sea from pollution of terrestrial or marine origin (including hazardous waste, exploration and use of the continental shelf), cooperation for the prevention and control of pollution from ships and Integrated Coastal Zone Management (ICZM).

Another important regulatory instrument for the Mediterranean, is the Framework Directive on the Strategy for the Marine Environment (2008/56/EC, Marine Strategy Framework Directive, MSFD).

Characterized by greater applicability than previous instruments, it provided that each State Member should develop a strategy for achieving or maintaining Good Environmental Status (GES) by 2020. In particular, it identifies marine monitoring as the first of the operational components in an appropriate governance system (Ferraro et al., 2017; Gianoli 2013).

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<sup>1</sup> <https://www.unep.org/unepmap/>

<sup>2</sup> <https://eur-lex.europa.eu/legal-content/IT/TXT/?uri=LEGISSUM:l28084>

<sup>3</sup> THE PROTOCOLS OF THE BARCELONA CONVENTION: 1. Dumping: Prevention of pollution due to diving operations of ships and aircrafts; 2. New Emergency Protocol: Cooperation to prevent pollution caused by ships and in emergency situations; 3. LBS (Land Based Sources): Protection from pollution of terrestrial origin; 4. SPA / BIO: Special Protection Areas and Biological Diversity; 5. Off Shore: Protection from pollution deriving from the exploration of the exploitation of the underwater continental shelf and of the subsoil (not yet entered into force); 6. Hazardous wastes: Cross-border handling of dangerous wastes and their disposal (not yet in force); 7. ICZM (Integrated Coastal Zone Management): Integrated Coastal Zone Management (defined by the Contracting Parties at the Conference of the Parties in Almeria and signed in Madrid, Spain, in January 2008).

However, today, when we talk about the Mediterranean Sea, we too often think about the millennia of history that saw it as a protagonist and about the many cultures that developed on its shores. We also consider that it was (and still is) a great source of sustenance and trade for many populations and, last but not least, we recognize the strategic role as a center of the world (at least of the western one) that this sea played for many centuries. Nevertheless, unfortunately, the Mediterranean is not always seen as an environmental entity that has been exposed, for a very long time, and particularly in recent decades, to enormous pressure on all the ecosystems that compose it: a pressure generated especially by the men who lived and still live along its coasts.

The coastline of the Mediterranean extends for a total of about 46000 km, with other 19000 km of the islands; of all coasts, almost half (46 %) is sandy and it includes important but fragile habitats and ecosystems such as beaches, dunes, lagoons, marshes, river deltas, estuaries, etc. (Gianoli 2013).

The main dangers for this complex and varied environment are represented by the fragmentation, the degradation and the loss of its habitats and landscapes. Among the various causes of degradation, population density plays a fundamental role, almost a third of the Mediterranean population (512 million in 2018, equal to 6.7 % of the world population) lives in the coastal areas and over 70 % in its cities. Nevertheless, the area demographic context is very different: Northern Mediterranean Countries (NMCs) are characterized by a low fertility rate, an aging population and a relatively low percentage of the workforce; Southern and Eastern Mediterranean Countries (SEMCs) are undergoing a demographic transition phase with a quite stronger growth, an overall younger population and therefore a larger active population (SoED 2020).

The population of the countries bordering the Mediterranean Sea was made up of about 450 million people in 1996 (EEA, 1999), it reached more than 525 million individuals in 2020 and, according to recent projections and estimates, it will reach 655 million of residents in 2050 (EEA, 2020). This steadily increasing population pressure is exacerbated by tourism. The mild climate and the natural and cultural heritage attract a large number of tourists, whose percentage, in fact, represents about one third of the world's international tourism. Moreover, tourism concentrates on a seasonal way in coastal areas, in particular on the coasts of the north-western basin (AEA, 2006). Furthermore, coastal tourism is one of the main factors associated with the production and management of waste, particularly marine litter. The strong spatial and temporal variations of tourism, mainly concentrated along the coast and with important peaks during the summer season, lead to an increase in waste production, untreated wastewater discharges and strong pressures on natural resources. Besides, the deterioration of the quality of the

environment, as well as that of water quality, can in turn have an impact on the environment and on the development of tourism, reducing the attractiveness of tourist destinations (EEA, 2020).

In addition, the intensification of urbanization (between 1965 and 2015 about three quarters of Mediterranean countries doubled or more than doubled the inhabited area in the coastal strip 1 kilometer from the coast) left less space for natural coastal ecosystems, reducing the contribution of ecosystem services and increasing the risks for biodiversity and for people living on the coast (SoED 2020).

The Mediterranean Sea is home to more than 17000 marine species (between 4 and 18 % of the known marine species in the world), but it represents only about 1 % of the global volume of the oceans. Furthermore, the Mediterranean Sea has the highest rate of endemics on a global level (from 20 to 30 % of species), for this reason it is considered a biodiversity hotspot.

Another serious threat is the chemical contamination of marine sediments and aquatic, animal, and plant bio-communities, as a result of the pollution produced by urban areas, industrial settlements, petroleum refining and air transport. Often these are substances that deplete oxygen, or heavy metals, persistent organic pollutants (POPs), hydrocarbons and nutrients in the water. Although in recent years some of these factors have seen, on average, an improvement in the situation linked to greater controls carried out on land-based activities, the risks of contamination associated with hazardous substances still remain a significant problem in many areas of the Mediterranean. Moreover, the release of nutrients into marine waters as a result of human activities is at the origin of the problem of the increase in induced eutrophication, especially in coastal areas in close proximity to large rivers and cities. Clearly, these phenomena also lead to immediate socio-economic implications, since they affect the quality and quantity of the catch, the conditions and landscape value of the coastal ecosystem, the deterioration of water quality and, consequently, also on tourism.

Another threat for the Mediterranean ecosystems, often linked to the change of the water conditions (such as temperature, excessive presence of nutrients, etc.), is the invasion of non-indigenous species. In recent years this is a worryingly increasing phenomenon, especially in the easternmost part of the Mediterranean where its impact on biodiversity, on predation habits, on alteration of the chain and, in general, on habitat modification, has been documented. All that has had repercussions on fishing, aquaculture, tourism, and human health. Furthermore, the problem of over-exploitation of fish resources is very widespread, often well beyond the limits of sustainability. The macroscopic result is the change in biodiversity between species, especially in terms of endangered or threatened species due to intensive and indiscriminate fishing techniques.

Paradoxically, even the development of fish farming (recorded especially since the 1990s) has not alleviated the problem of overfishing but, on the contrary, has ended up adding further pressures to the marine ecosystem due to the release of nutrients, organic pollutants and sometimes antibiotics for livestock into the sea. There is also a conflict with the tourism industry over the use of small natural bays and a degradation of the habitats near the cages (AEA, 2006). Other problems relate to the impact of noise caused by marine biological communities from intense maritime traffic (especially in the western Mediterranean basin) and from industrial installations or offshore military activities in specific areas. Underwater noise is a problem of growing concern in important cetacean habitats such as the Pelagos Sanctuary (the sanctuary is between France, Côte d'Azur and Corsica), the Principality of Monaco and Italy (Liguria, Tuscany and northern Sardinia) or the Strait of Sicily. Besides, it is important to point out the integrity of the seabed, threatened by deep fishing, dredging or other drilling and excavation activities, which have the effect of increasing the suspended particulate matter, together with sediments. Consequently, this modifies the habitats of numerous species in the medium / long term. But above all, it remains the key problem: the risks for biodiversity. As a matter of fact, this is the element on which all the other pressure factors affecting the Mediterranean (Gianoli 2013) group together. The Mediterranean Sea is also one of the areas in the world most affected by marine litter. More than 730 tons of plastic enter the Mediterranean Sea every day; these represent 95 to 100 % of floating marine litter and more than 50 % of seabed litter. Single-use plastic accounts for over 60 % of the total marine litter found on Mediterranean beaches, waste normally produced by recreational beach activities. The main causes of plastic pollution include: an increase in its use, unsustainable consumption patterns and inefficient waste management practices. In fact, less than a third of the plastic produced each year in the Mediterranean countries is recycled. Even wastewater represents an important way of entry of waste into the sea of waste hitherto, less than 8 % of wastewater is subjected to tertiary treatment. Other important sources of marine litter are fishing, tourism, and shipping. Litter affects marine organisms primarily through strangulation and ingestion, but also through colonization and buoyancy. They also have important socio-economic effects through the costs of decontamination, as well as the potential loss of income and tourism jobs, and reduction in the value of land and recreational and fishing activities (SoED 2020).

Therefore, in order to "*prevent, reduce, fight and, as far as possible, eliminate sea pollution and in order to protect and improve the marine and coastal environment and thus contribute to its sustainable development*", as stated by the Convention of Barcelona, it is indispensable an integrated approach based on the knowledge about the different ecosystems and landscapes of the Mediterranean Sea.

Furthermore, in order to better protect the environment, it would be appropriate: to fill the gaps in terms of knowledge; to perfect management practices; to increase the socio-economic capacity for environmental management; to strengthen Integrated Coastal Zone Management (ICZM); to decentralize actions, so as to take into account the specific contexts as well as the specific pressures, impacts and particular needs of each country or area that persists in its waters; to improve monitoring and evaluation plans, in order to ensure informed and adequate policies. And the environmental monitoring is precisely the key theme of this 9<sup>th</sup> Symposium.

Environmental monitoring defined by the European Environment Agency (EEA) as "*Periodic and/or continued measuring, evaluating, and determining environmental parameters and/or pollution levels in order to prevent negative and damaging effects to the environment*" becomes the fil rouge of the Symposium with the aim of considering both the environmental quality and the effectiveness of the management of the *Mare Nostrum*, with an Integrated and multidisciplinary Ecosystem Approach given the complexity and the dimensions of the phenomenon to be examined.

With these premises, it is possible to achieve a resilient and sustainable future of the Mediterranean Sea only through a holistic and integrated approach and this new edition of the Symposium will be able to provide new knowledge, new tools, new case studies useful for good governance processes and for stakeholders, contributing to identify those cause-effect phenomena that link particular human activities to documented environmental effects and, consequently, to provide information that allows policy makers to adopt policies and strategies able to avoid, or at least reduce, negative effects on the environment.

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