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MEDITERRANEAN ACTION PLAN**

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6th Meeting of the Ecosystem Approach Coordination Group

Athens, Greece, 11 September 2017

Agenda item 4: Review of Quality Status Report (QSR)

Quality Status Report (QSR) Cross-cutting and horizontal issues

Quality Status Report (QSR) Cross-cutting and horizontal issues
(Plan Bleu, Version 10/07/2017)

Note: The maps and illustrations are provisional

2. Environmental characteristics

2.1. The Mediterranean Marine and Coastal Environment

Introduction

As the Ecosystem Approach is a strategy for integrated management of land, water and living resources, the assessment recognizes interactions not only between organisms and their environment, but also takes into account humans as in integral component of ecosystems. Indeed, humans are unquestionably dependent on the status and future of ecosystems and of what these may provide them. In turn, it can be said that the ecosystem's conditions are affected by human actions and influences.

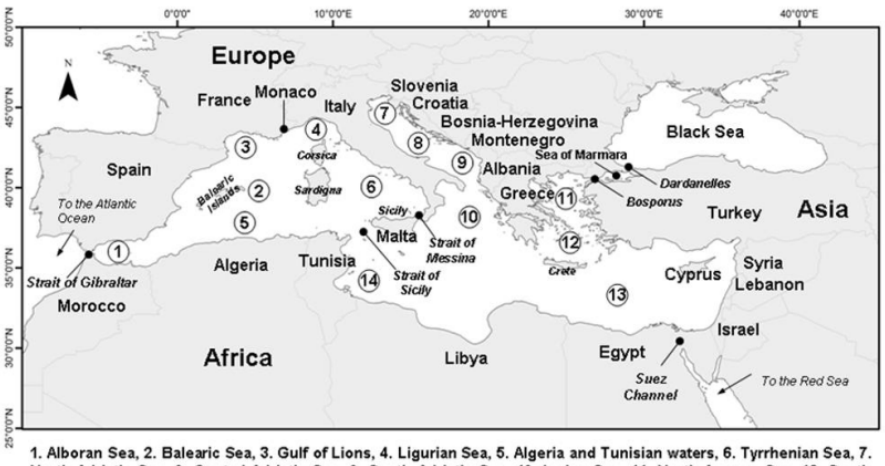
In the case of marine and coastal ecosystems, resources face a well-known and growing list of pressures and demands – *from long-standing activities such as fisheries and extraction of fossil fuels, to newer uses such as wind and wave energy.*

The Integrated Ecosystem Assessment identifies socio-economic and biophysical attributes that maintain ecosystem structure and function assess human activities and their independence with the natural ecosystem. This assessment also evaluates management alternatives that will maintain or improve the coupled social-ecological system.

Before introducing the socio-economic elements and their interactions with the marine and coastal ecosystems, environmental characteristics of the Mediterranean Sea are essential to be included in order to have a clearer overview of the unique marine and coastal ecosystem.

Description of the Mediterranean Sea (area, depth, water cycle, streams ...)

Among its 22 riparian countries and territories, the basin shares a unique climate and natural cultural heritage where environmental and development issues are notably severe. The Mediterranean Sea is a marine biodiversity hot spot.

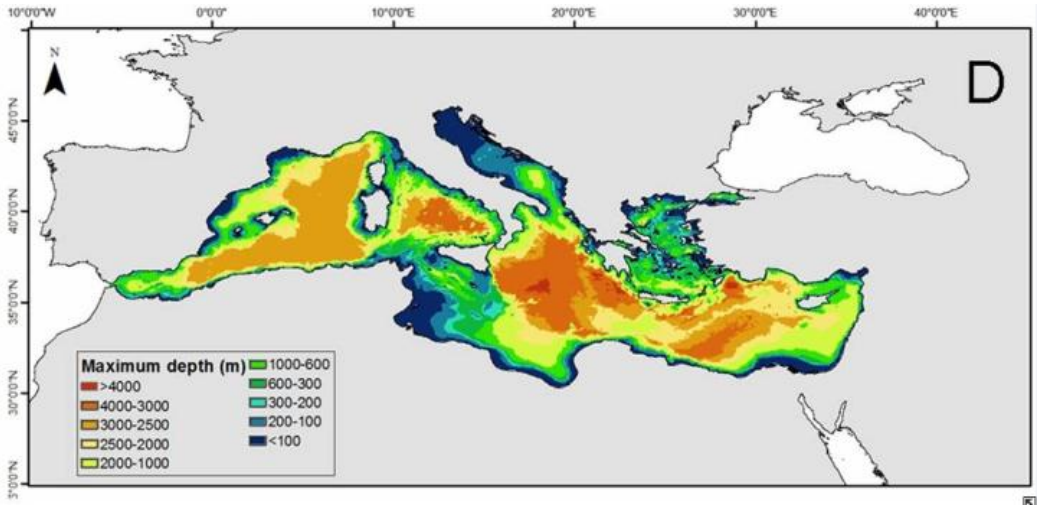


1. Alboran Sea, 2. Balearic Sea, 3. Gulf of Lions, 4. Ligurian Sea, 5. Algeria and Tunisian waters, 6. Tyrrhenian Sea, 7. North Adriatic Sea, 8. Central Adriatic Sea, 9. South Adriatic Sea, 10. Ionian Sea, 11. North Aegean Sea, 12. South Aegean Sea, 13. Levant Sea, 14. Gulf of Gabès.

Main biogeographic regions, basins, and administrative divisions of the Mediterranean Sea (Source: Coll et al., 2010)

The intercontinental sea stretches from the Atlantic Ocean on the west to the Asian continent on the east, and separates Europe from Africa. Also named the incubator of Western civilization, the ancient "sea between the lands" occupies a deep, elongated, and almost landlocked irregular depression lying between latitudes 30° and 46° N and longitudes 5°50W and 36°E. This basin is the largest (2.969.000 square kilometers) and deepest (average 1.460 meters, maximum 5.267 meters) enclosed sea on Earth.

The Mediterranean has narrow continental shelves and a large area of open sea. Therefore, a large part of the Mediterranean basin can be classified as deep sea and includes some unusual features such as variation of temperatures from 12.8°C–13.5°C in the western basin to 13.5°C–15.5°C in the eastern and high salinity of 37.5–39.5 psu.



Bathymetry map (Source: Coll et al., 2010)

Mediterranean hydrodynamics are driven by three layers of water masses: a surface layer, an intermediate layer, and a deep layer that sinks to the bottom. The Mediterranean Sea receives from the rivers that flow into it only about one-third of the amount of water that it loses by evaporation. In consequence, there is a continuous inflow of surface water from the Atlantic Ocean. After passing through the Strait of Gibraltar, the main body of the incoming surface water flows eastward along the north coast of Africa. This current is the most constant component of the circulation of the Mediterranean. It is most powerful in summer, when evaporation in the Mediterranean is at a maximum. This inflow of Atlantic water loses its strength as it proceeds eastward, but it is still recognizable as a surface movement in the Sicilian channel and even off the Levant coast. A small amount of water also enters the Mediterranean from the Black Sea as a surface current through the Bosporus, the Sea of Marmara, and the Dardanelles.

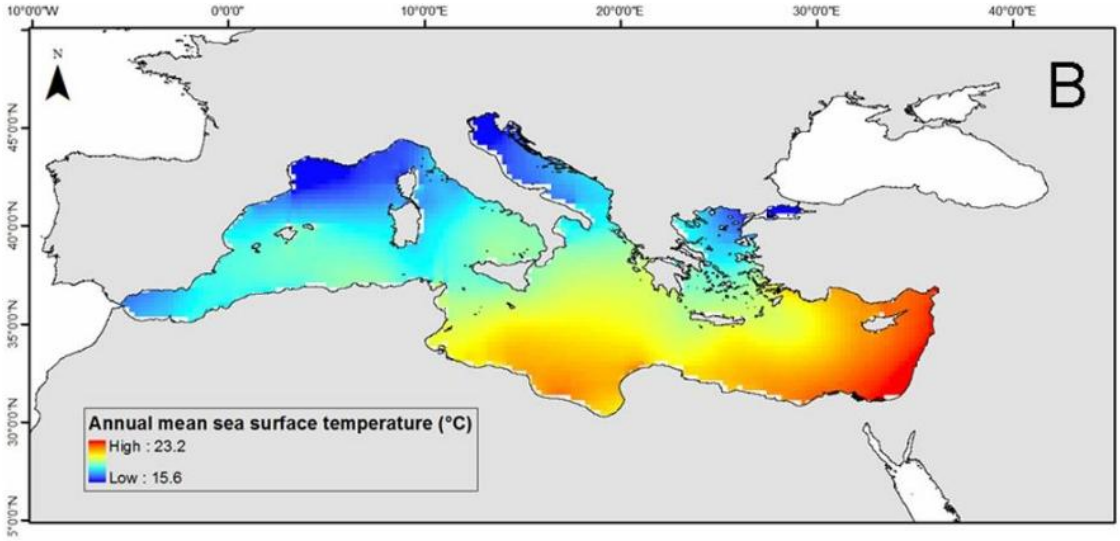
Distribution of the coastline per type

The coasts of the western Mediterranean, just as those of the eastern basin, have been subjected in recent geologic times to the uneven action of deposition and erosion. This action, together with the movements of the sea and the emergence and submergence of the land, resulted in a rich variety of types of coasts. The Italian Adriatic coast, revealing the Apennines, is typical of an emerged coast. The granite coast of northeastern Sardinia and the Dalmatian coast where the eroded land surface has sunk, producing elongated islands parallel to the coast, are typical submerged coasts. The deltas of the Rhône, Po, Ebro, and Nile rivers are good examples of coasts resulting from silt deposition.

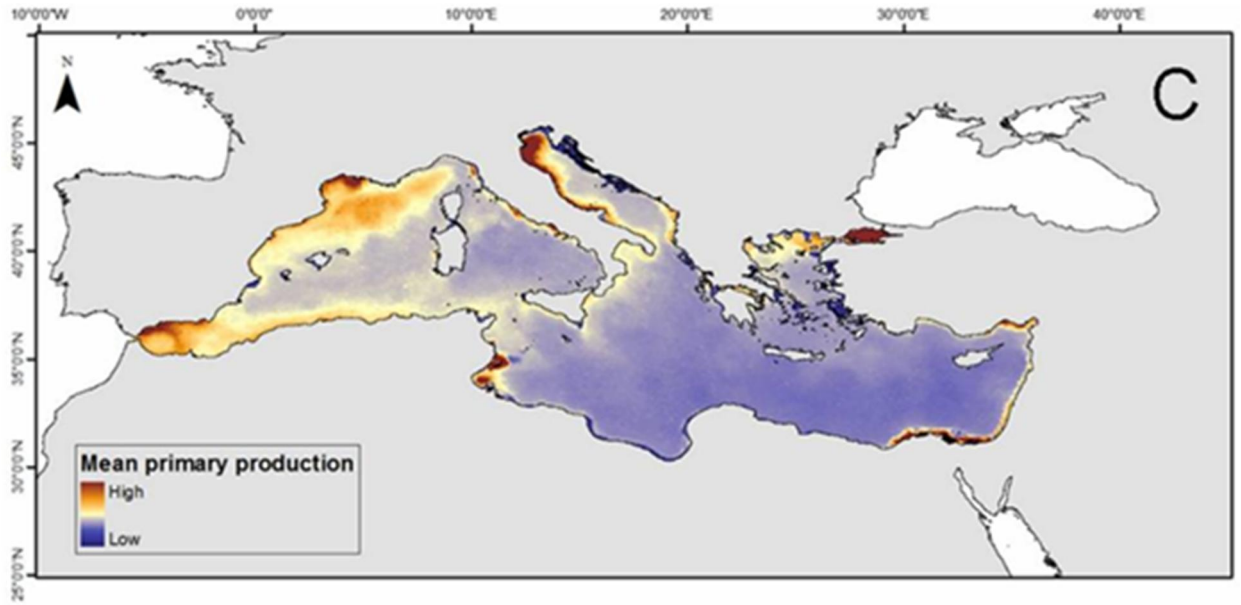
Climate: Temperature and precipitations

The amount and distribution of rainfall in Mediterranean localities is variable and unpredictable. Along the North African coast from Gabès in Tunisia to Egypt, more than 10 inches (250 mm) of rainfall per year is rare, whereas on the Dalmatian coast of Croatia there are places that receive 100 inches (2,500 mm). Maximum precipitation is found in mountainous coastal areas. The climate in the region is characterized by hot, dry summers and cool, humid winters. The annual mean sea surface temperature shows a high seasonality and important gradients from west to east and north to south

The basin is generally oligotrophic, but regional features enrich coastal areas through changing wind conditions, temporal thermoclines, currents and river discharges. The basin is characterized by strong environmental gradients, in which the eastern end is more oligotrophic than the western. The biological production decreases from north to south and west to east, and is inversely related to the increase in temperature and salinity.



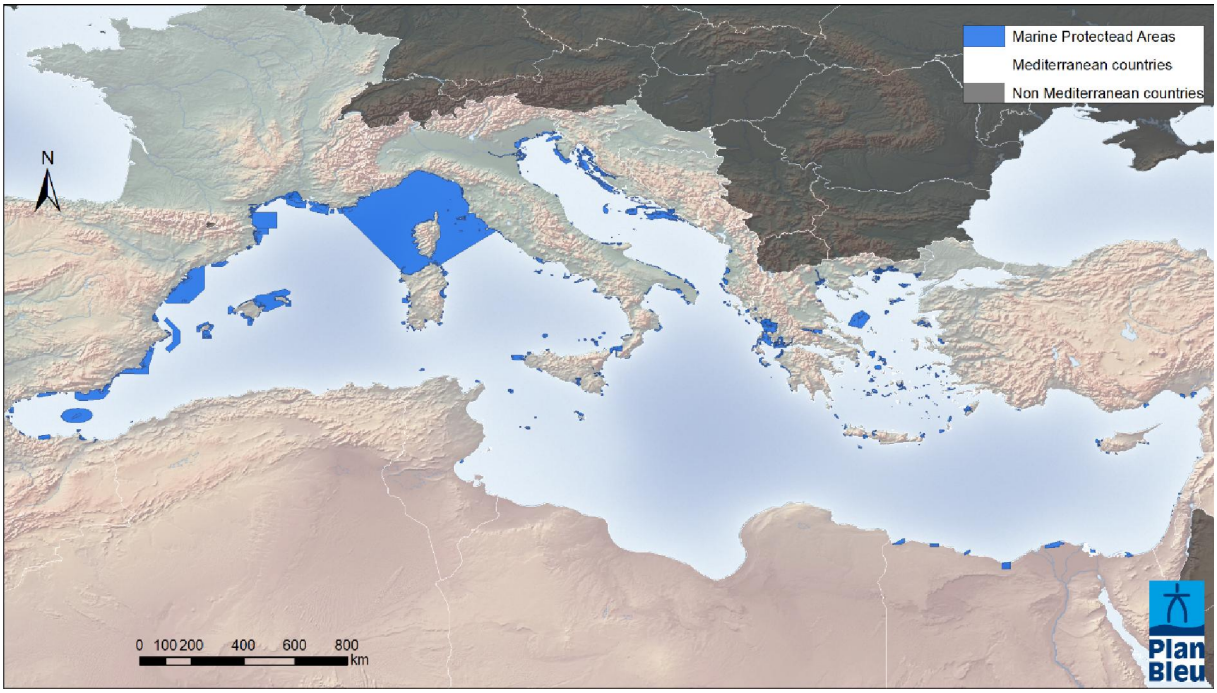
Annual mean sea surface temperature (Source: Coll et al., 2010)



Annual mean net primary production (Source: Coll et al., 2010)
(*The map was generated from SeaWiFS chlorophyll distributions according to the Vertically Generalized Production Model - VGPM, Behrenfeld and Falkowski, 1997)*

Biodiversity (Key species, habitats, MPA)

The Mediterranean is one of the world's 25 hot spots for biodiversity. Its highly diverse marine ecosystem hosts around 4 to 18% of the world's marine biodiversity. It is defined as "under siege" due to historical and current impacts of multiple stressors. Among them, fishing practices, habitat loss and degradation, eutrophication, and more recently, the introduction of alien species and climate change effects. Since the intensity of these stressors is increasing throughout most of the Mediterranean basin, temporal analyses are increasingly needed to inform effective current and future marine policies and management actions.



Marine protected Areas (Source WDPA)

Almost 86 000 km² of the Mediterranean is classified Marine Protected Areas (MPAs) or Natura 2000 site. In 2016, only 3 % of the Mediterranean Sea is protected. The target of 10% protection of the CBD convention is far from being achieved. New Marine Protected Areas must be created in high and deep sea which are not represented in the current network.

Water flows in the Mediterranean: Watersheds/Water resources

The Mediterranean region is characterized by winter dominated rainfall and hot dry summers. Even though large spatial climate variability and diversity exist within the Mediterranean basins, many areas can be classified as arid or semiarid. The Mediterranean is an area of transition between a temperate Europe with relatively abundant and consistent water resources, and the arid African and Arabian deserts that are very short of water.

The Mediterranean region is experiencing a large stress on its water resources due to a combination of effects ranging from climate change to anthropogenic pressures due to an increasing water demand for domestic and industrial use, expansion of irrigated areas, and tourism activities.

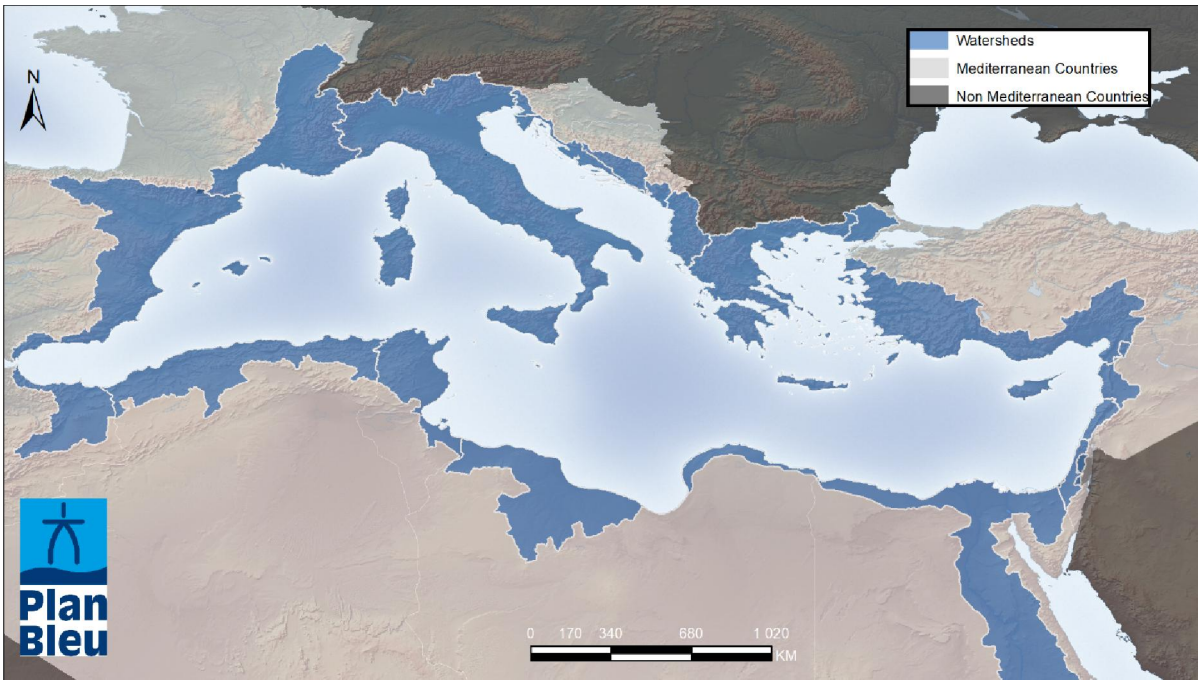
More than half of the water-poor population of the world is concentrated in the Mediterranean basin, which holds only 3% of the world's fresh water resources.

Drastic actions have already been taken to mitigate water shortage such as large scale water transfers within and between countries. Holding structures are being built to conserve as much water as possible

to sustain the domestic, industrial, and agricultural demand. However, these measures are severely affecting the freshwater input and associated sediment and nutrients in the Mediterranean Sea, endangering ecosystems including coastal wetlands, by increased coastal erosion and aquifer salinization.

Of particular interest is the riverine input of freshwater into the Sea, which is with precipitation the unique source of fresh water entering the Mediterranean Sea. In fact, the riverine water inflow is estimated to be half the precipitation amount falling onto the Sea. Surface runoff is thus one of the critical components for computing the hydrological water budget for the Mediterranean Sea. Estimates for all of the components of the water cycle are available however with great uncertainties leading to net water losses from the Sea varying from 470 to 1310 mm yr-1.

The region is characterized by its link to the Mediterranean, with many islands of various sizes and peninsulas dividing the Mediterranean Sea into many sub basins connected by narrow straits and the presence of steep mountain ridges close to the coast. This complex land-sea pattern helps to explain the spatial heterogeneity of climate in the Mediterranean region and provides a better understanding to face the issues of its current and future climate change.



Watersheds in the Mediterranean region (Plan Bleu)

2.2. Climate Change.

The Mediterranean region: a climate change Hot-spot

The Mediterranean region has been referenced as one of the most responsive regions to climate change and was defined as a primary "Hot-spot" by Giorgi (2006), based on the results from global climate change projection scenarios. The last report from the International Panel on Climate Change (IPPC, 2013) highlights the Mediterranean as one of the most vulnerable regions in the world to the impacts of global warming. The context of global warming stresses the necessity to assess the possible consequences of climate change on this sensitive region which would become warmer and drier (IPCC 2007, 2013).

In the Mediterranean, the far distant past has witnessed some major climatic changes (with temperatures which could on average be 8°C below current ones (20, 000 years ago) or 1 - 3°C higher (6,000 years ago). Landscape, fauna and flora and coastal layout were very different depending on the

period (due to variations in sea level of several tens of meters). These developments took hundreds if not thousands of years.

The current situation, however, and the one expected to prevail over coming years is marked by the speed of the changes coming about. This factor amplifies the expected impact since relatively rapid developments give ecosystems or societies no chance to acclimatize and gradually adapt.

During the 20th century, air temperature in the Mediterranean basin was observed to have risen by 1.5-4°C depending on the sub-region. Over the same period and with clear acceleration since 1970, temperatures in south-western Europe (Iberian Peninsula, south of France) rose by almost 2°C. The same warming effect can also be seen in North Africa, albeit more difficult to quantify given the more patchy nature of the observation system.

Major climate change impacts in the Mediterranean region

The conclusions drawn by climate specialists converge on several points of general consensus:

- Even if the European Union's objective of not exceeding a global average temperature increase of 2°C is met, temperature increases in the Mediterranean are likely to be above 2°C and, because of the ecological and socioeconomic characteristics of the areas, the impact will be more marked than in many other regions of the world; The Mediterranean has thus been qualified as the « hot spot for climate change» (Giorgi, 2007).
- A general decrease in average rainfall is expected throughout the Mediterranean basin.
- The most vulnerable areas of the Mediterranean are the north African ones bordering on the desert areas, the major deltas (Nile, Po and Rhone, for example), the coastal zones (both Northern and Southern shores) as well as socially vulnerable areas and those with rapid demographic growth (southern and eastern banks, dense towns and suburbs) (IPCC AR4, 2007).
- The impact of climate change on the environment is already noticeable in the Mediterranean, and is already producing observable effects on human activity.
- Given the uncertainty previously referred to, more optimistic or more pessimistic scenarios (breakdown scenarios with abrupt and rapid change) around the central ones presented here are not to be ruled out. Thus a consensus has been reached on temperature increase and precipitation decrease in the Mediterranean Basin as a whole.
- According the 4th IPCC Report under the scenario A1B, air temperature will increase between 2.2°C and 5.1°C in the Southern Europe and Mediterranean region if the 2080-2099 period is compared to that of 1980-1999 (with some sub regions differences).
- The same projections assume a decrease for the precipitations between 4 and 27% in the Southern Europe and Mediterranean region (while the Northern Europe region will record an increase between 0 and 16%). An increase of drought periods (associated to land degradation) being declined by a high number of days recording more than 30°C is also expected (Giannakopoulos and al. 2005).
- Extreme event such as heat waves, drought or floods could be more frequent and stronger.
- As for the sea level trend/change there is still a need for longer time-series from satellite altimetry and for an improved in-situ tide-gauge network to attain robust conclusions. Only a few climatological studies estimate that a mean 35 cm sea level increase could occur during the 21st century.

Water at the heart of the main expected impacts of climate change on the natural environment in the Mediterranean, which are:

- Water: A rapid change in the water cycle due to increased evaporation and less rainfall;

- Soil: A drop in water storage capacity (because of changes in porosity as a result of temperature change, making it drier), accelerated desertification which is already underway (soil over-use and depletion);
- Land and marine biodiversity (animal and plant): A northwards and altitude shift of certain species, extinction of the most climate-sensitive or less mobile species and the appearance of new ones;

Sea level rise

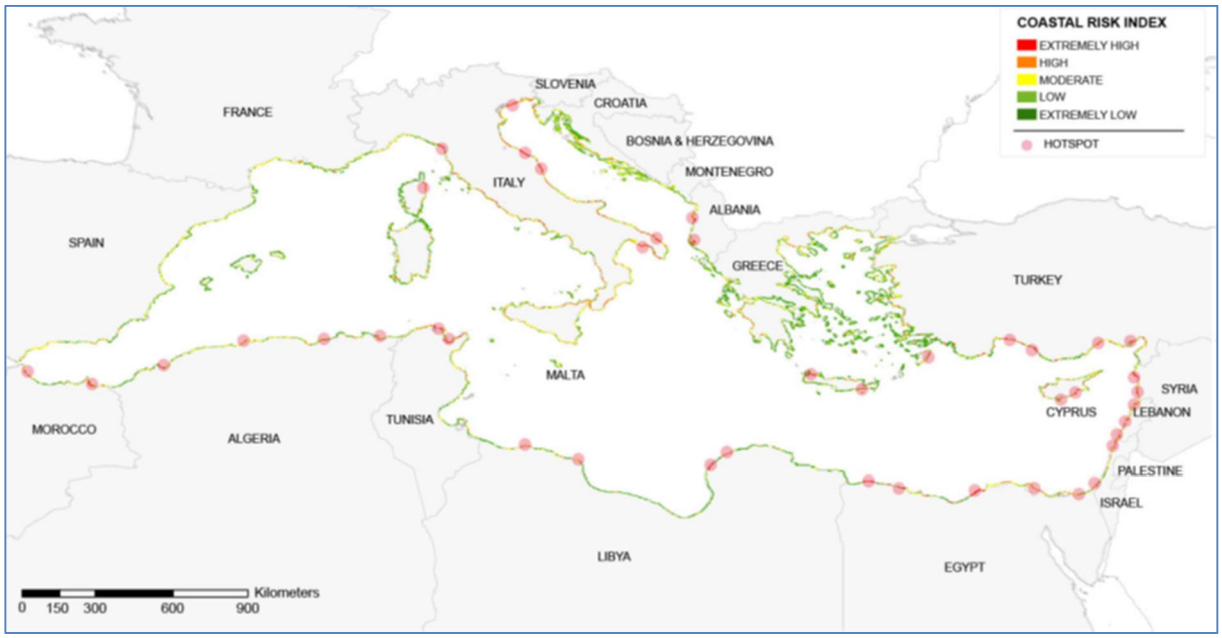
Based on the existing models available for assessment, the central values for projections of sea level rise by 2100 range from about 30 to 40 cm, and about 60% of this increase would be due to the thermal expansion of sea water.

The Mediterranean Sea displays rugged coastlines indented into several smaller seas: Adriatic, Aegean, Alboran, and Ionian that require high-resolution observations for complete analyses. Altimetry from space (i.e., the TOPEX/Poseidon program launched in December 2001) has supplied scientists with time-series of exceptional quality for the study of global sea level variations. For example, it has been found that most of the temperature variations cause most of the overall steric sea level change in the upper 400 m of the Mediterranean Sea (MEDAR13 datasets). Between 1960 and the 1990s, cooling of the upper waters of the Eastern Mediterranean caused a reduction in the steric heights, while after 1993 warming caused the sea level to rise. The steric sea level changes in the upper waters of the Adriatic and the Aegean Sea seem also to be correlated with the NAO.

Climate Change related risks

Climate change is arguably one of the most critical challenges that the Mediterranean region is facing. The Mediterranean basin has been identified as one of the two most responsive regions to climate change globally. The IPCC Fifth Assessment Report considers the Region as “highly vulnerable to climate change”, also mentioning that it “will suffer multiple stresses and systemic failures due to climate changes”. The overall risks of climate change impacts can be reduced through mitigation, i.e. by limiting the rate and magnitude of climate change. However, even under the most ambitious mitigation scenarios, risks from adverse climate impacts remain, due to already locked-in climate change. Therefore, adaptation policies and measures anticipating a wide range of potential climate-related risks are essential.

Climate change impacts put coastal communities and assets at risk. Relevant authorities are encouraged to undertake adaptation measures that are compliant with the Protocol on Integrated Coastal Zone Management in the Mediterranean (Barcelona Convention) and national Integrated Coastal Zones Management strategies.



Coastal Risk Index (Source: MedSea Foundation, 2016)
Source http://planbleu.org/sites/default/files/publications/notes28_en_revisee.pdf

The Regional Risk Assessment Map of coastal risk to climate and non-climate forcing, displays the result in terms of qualitative risk classes in the coastal zones investigated. The map shows the values of risk assumed by each location (cell) by applying the equation defined for the method CRIMED. Sites that assume "extremely high risk" values are indicated in red and in the context of the study these are defined as "hot-spots".

Beyond the north-south gradient in the Mediterranean, particularly vulnerable landscapes include deltas and coastal zones (vulnerable to sea-level rise), as well as rapidly growing cities without adequate infrastructure and institutions. In the Mediterranean regions, about 50% of the urban population lives less than 10m above sea level. Tourist destinations (concentrated along the coast) are vulnerable not only to sea-level rise but also to higher summer temperatures, which may turn tourists away toward more northern and cooler locations.

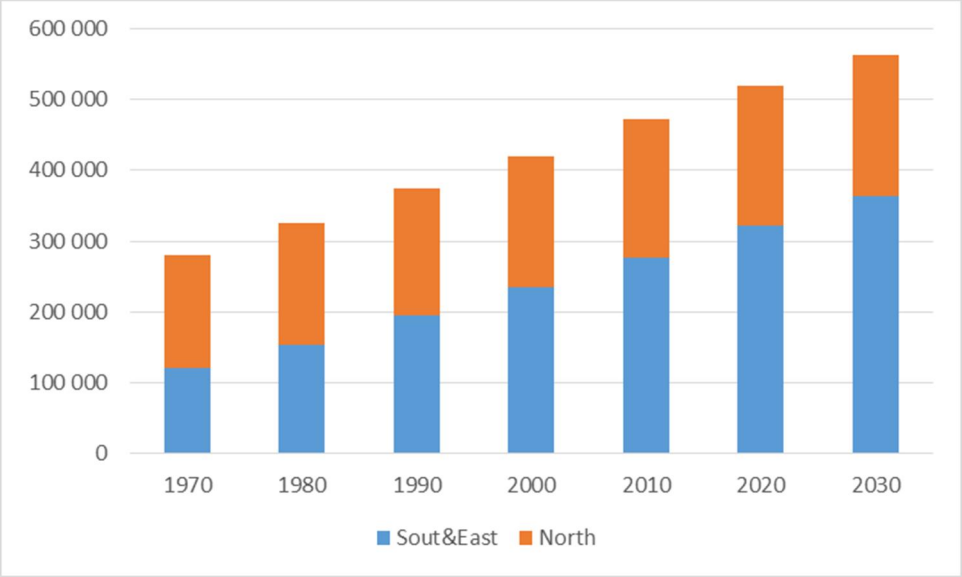
3. Socioeconomic characteristics of the Mediterranean

National level

The Mediterranean basin is characterized by strong socioeconomic disparities, in particular between the northern countries and the southern and eastern countries of the region.

Population

While population development in the north is almost stagnant, strong population growth in the southeast (in combination with a lack of effective policies) results in overexploitation of water, land, and other resources, driven by land clearing, cultivation of marginal land, overgrazing, and firewood harvesting. Land productivity is decreasing accordingly.

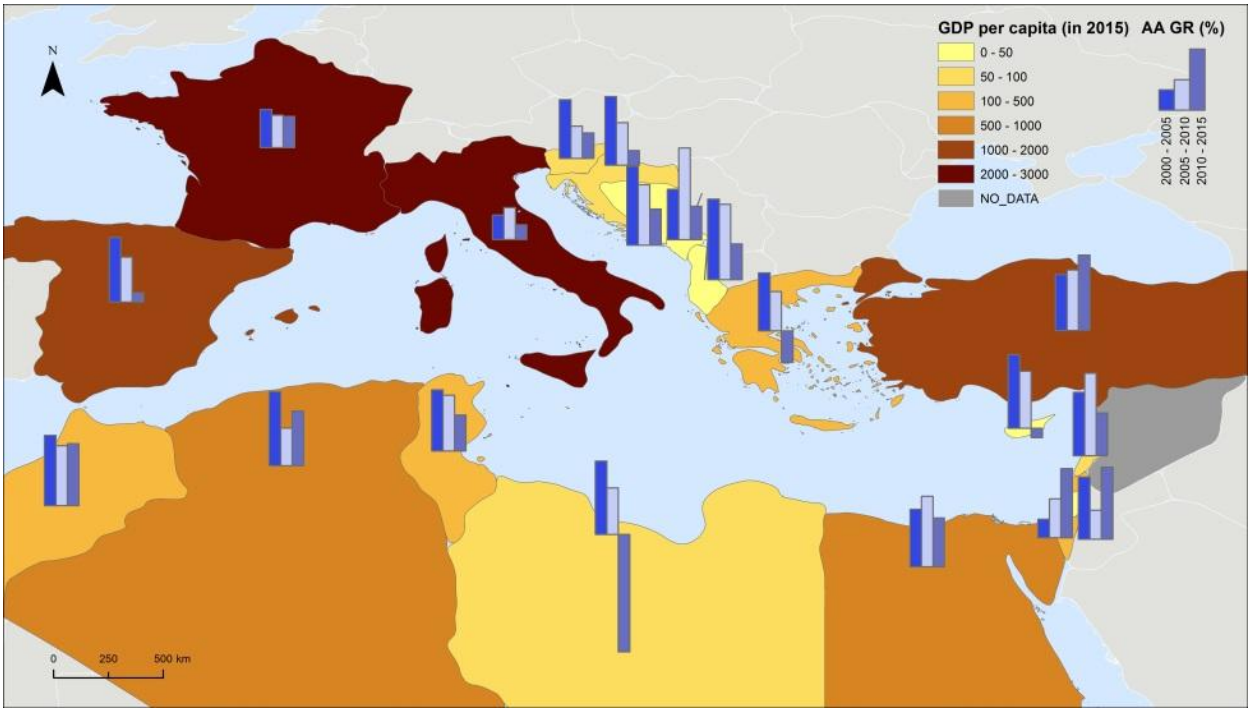


Population in the Mediterranean countries (100 inhabitants) (Source UN WPP 2015)

In contrast, many rural areas in the northern countries experience abandonment of agricultural land, with subsequent encroachment of shrubs and trees and a greening of the land. The southern and eastern countries of the Mediterranean are rapidly urbanizing – with almost all of the future population growth projected to be in the cities – while urbanization rates in the north are more or less stable.

Economic disparity in the Mediterranean region

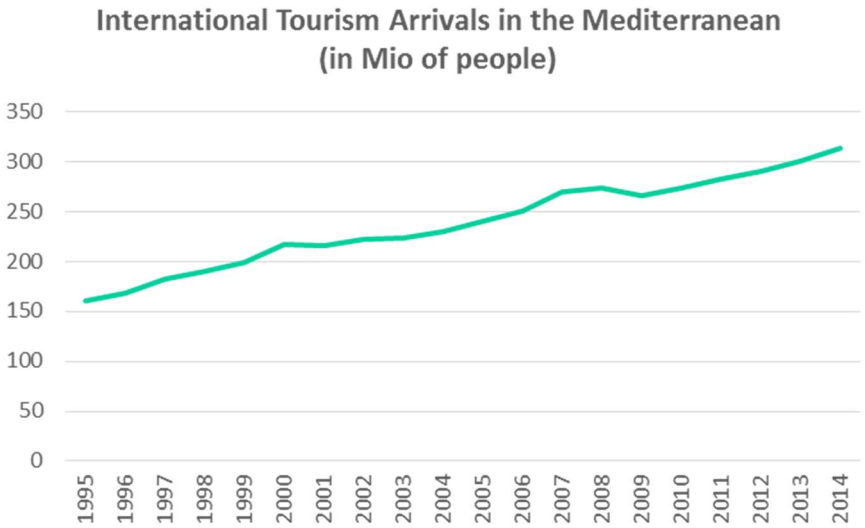
In 2015, the average income per capita in the South and East Mediterranean countries is 2.5 times lower than the average income in the EU Mediterranean countries. The GDP growth rate in the south and east Mediterranean countries are much higher than those of the EU Mediterranean countries. However, they are considered low when compared to the population growth rates, as the demographic growth is still high in the southern Mediterranean countries. The share of the Mediterranean GDP in the world GDP is decreasing: from more than 13.5% in 1990 to 11.5% in 2010 and 9.7% in 2015. Meanwhile, the share of the Mediterranean population remains constant in the world population (about 7%).

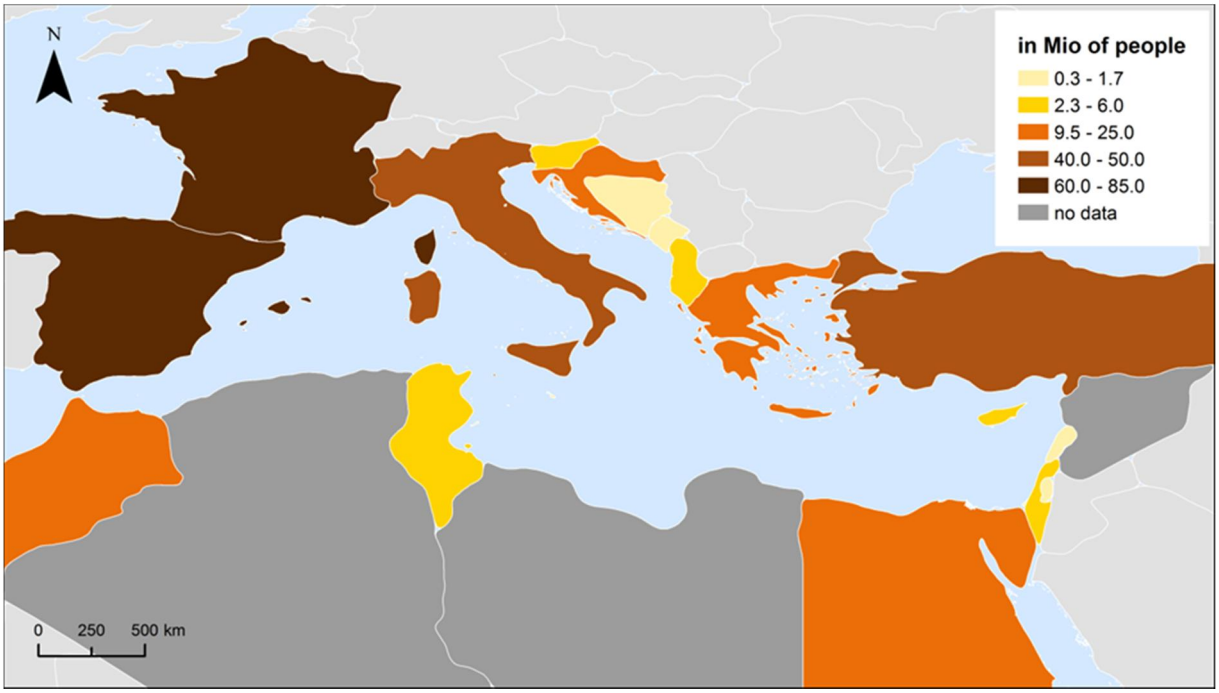


Gross Domestic Product (World Bank)

Tourism

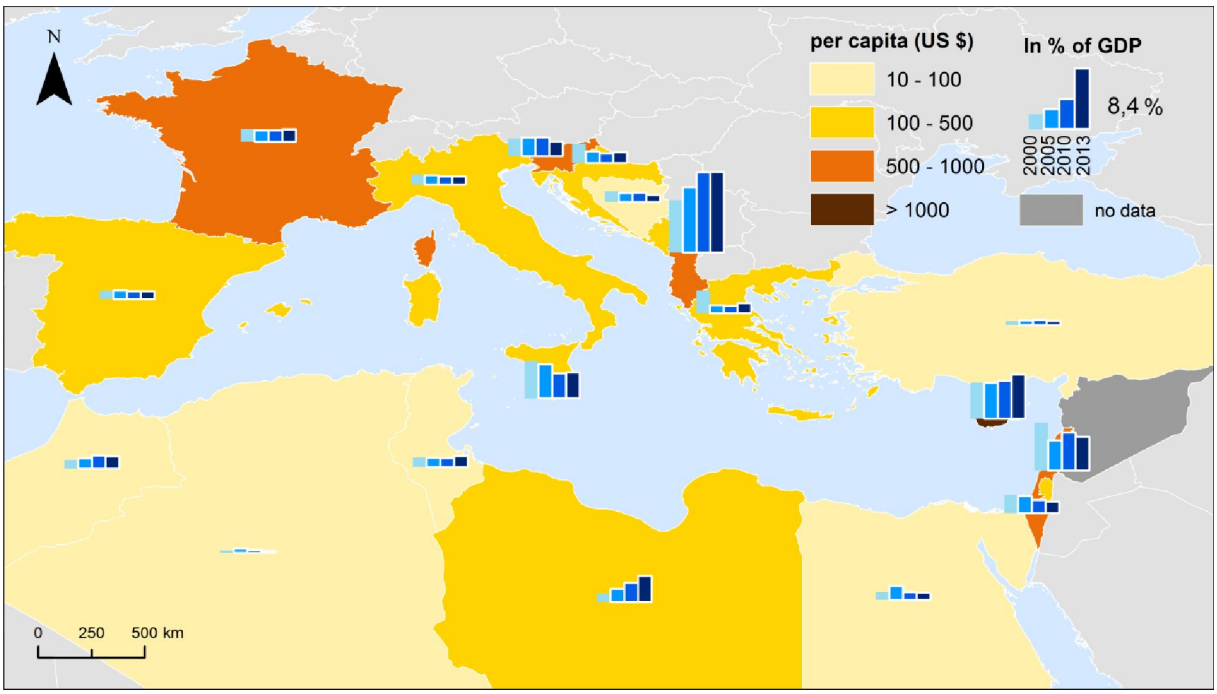
Mediterranean is the world's leading tourism destination in terms of both international and domestic tourism with more than 300 million international tourist arrivals representing 30% of total world tourists for 2014. International tourist arrivals have grown from 58 million in 1970 to nearly 314 million in 2014, with a forecast of 500 million by 2030. About 50% of these arrivals are in coastal areas.





International Tourism Arrivals in the Mediterranean countries in 2014
(Source UN-WTO)

In 2016, Tourism contributed to create 333.2 billion US$ in the Mediterranean countries. During the last 20 years, the direct contribution of tourism to GDP in the Mediterranean region has increased by 53%. Tourism is a major pillar of Mediterranean economies, offering consistent employment (11.5% of total employment in 2014) and economic growth (11.3% of regional GDP). In the Mediterranean basin, tourism is vital for many countries: considering exclusively coastal areas economy, tourism represents over 70% in terms of Production Value and Gross Value Added.

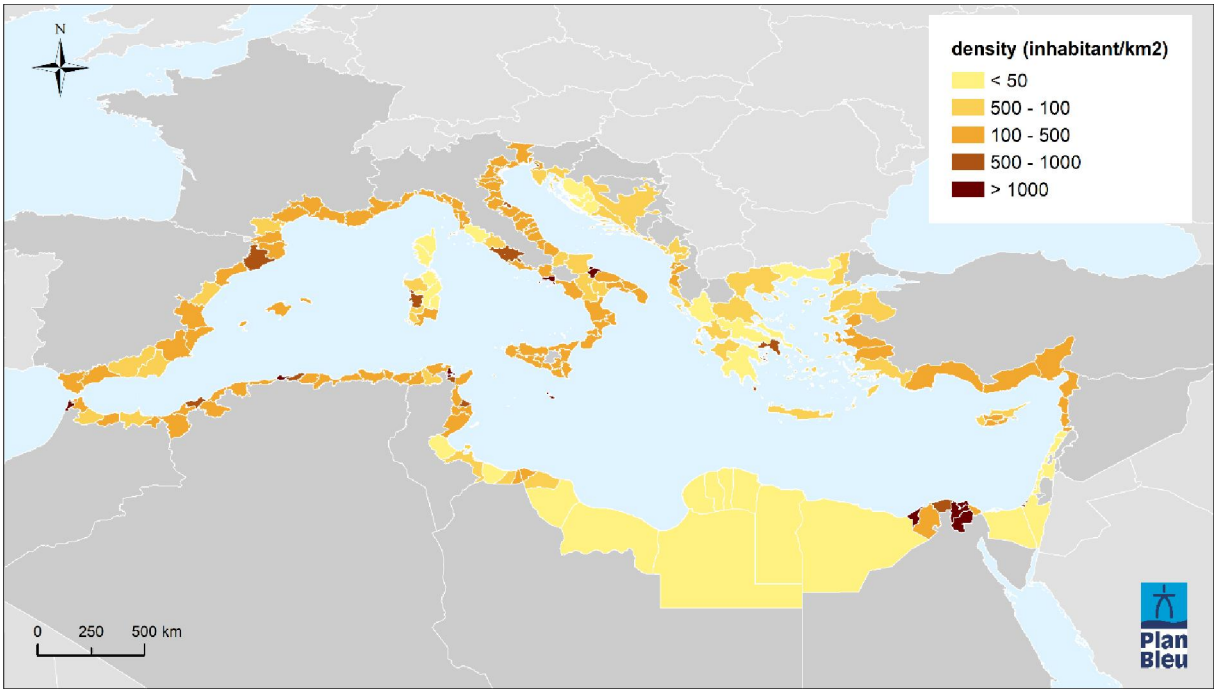


International Tourism Receipts (Source UN-WTO)

Coastal level

Population on the coast.

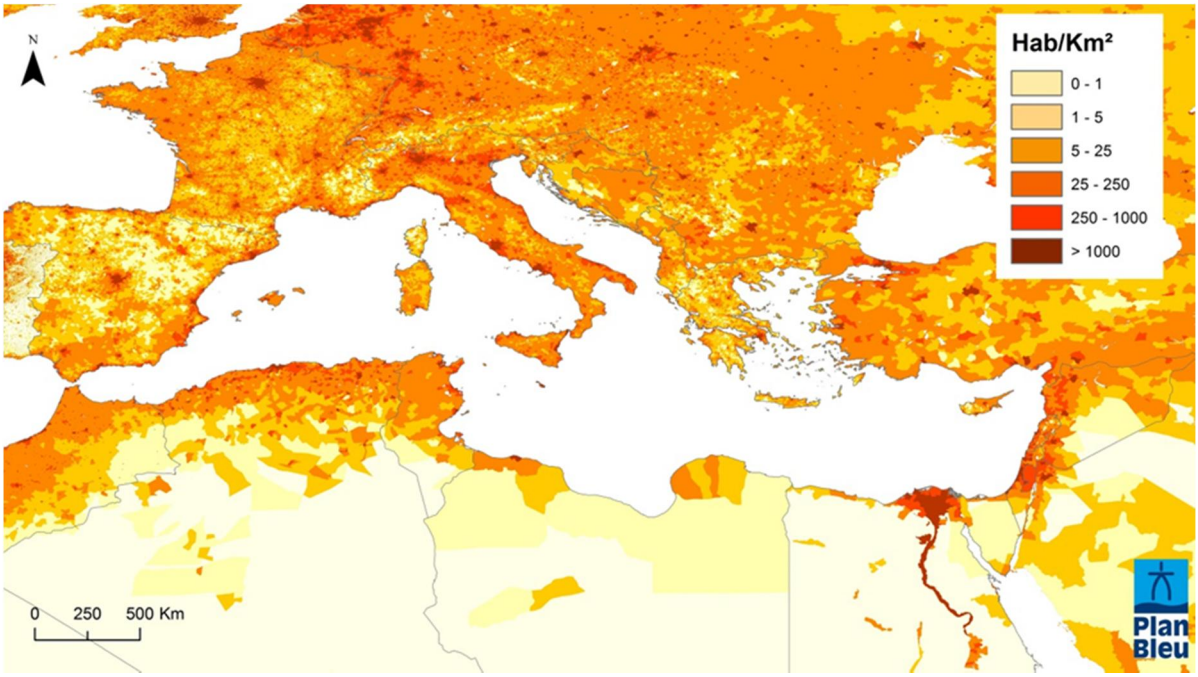
Coastal areas are usually rich in their natural resources that provide great opportunities for economic activities, especially resource-based economic activities such as agriculture, fisheries, tourism, oil and gas extraction, and maritime transport that tend to locate in these areas.



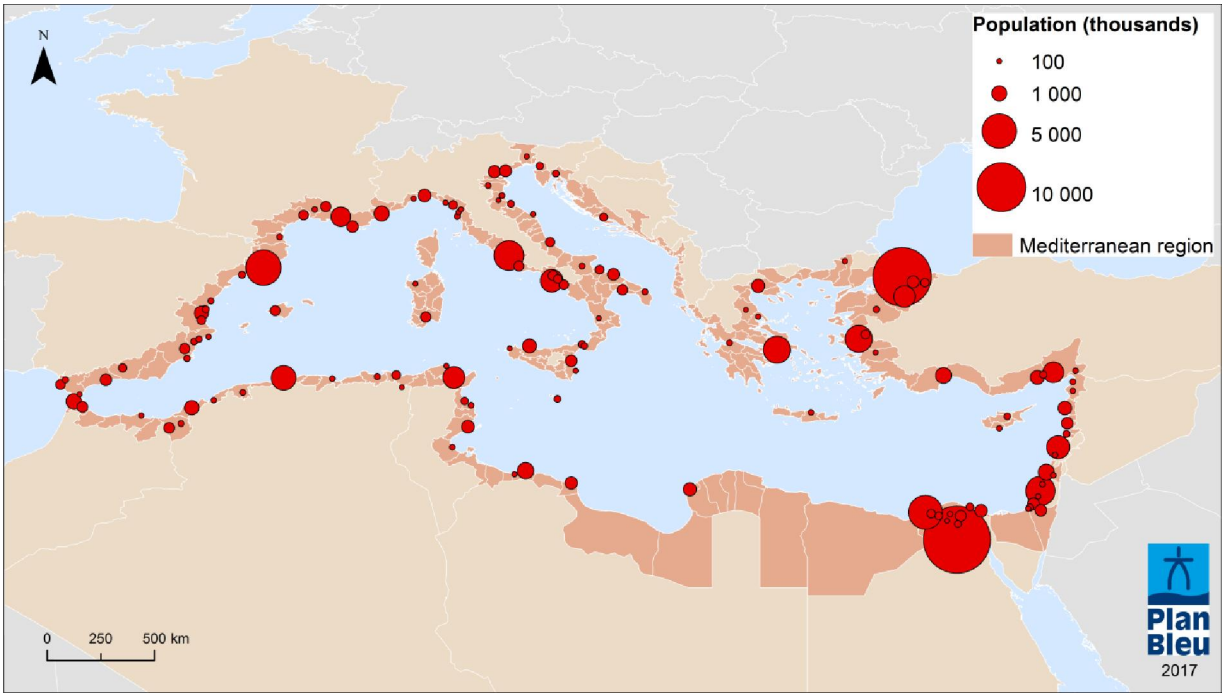
Population density of the Mediterranean coastal regions (Source: Plan Bleu from various sources)

Approximately one third of the Mediterranean population is concentrated along its coastal regions, whereas more than half of the population resides in the coastal hydrological basins. Around 40% of the total coastal zone estimated to be under some form of artificial land cover. Close to 100% of the population in the coastal region reside in urban localities

Mediterranean coastal areas are threatened by coastal development that modifies the coastline through the construction of buildings and infrastructure needed to sustain residential, tourism, commercial, and transport activities. Coastal manmade infrastructures cause irreversible damage to landscapes; habitats and biodiversity; and shoreline configuration by disrupting the sediment transport. The population density is different between the countries of the north of the Mediterranean and the countries of the south and the east. The density is more homogeneous in the European Mediterranean countries.



Adjusted Population Density, 2015 (http://sedac.ciesin.columbia.edu/data/set/gpw-v4-population-density-adjusted-to-2015-unwpp-country-totals)



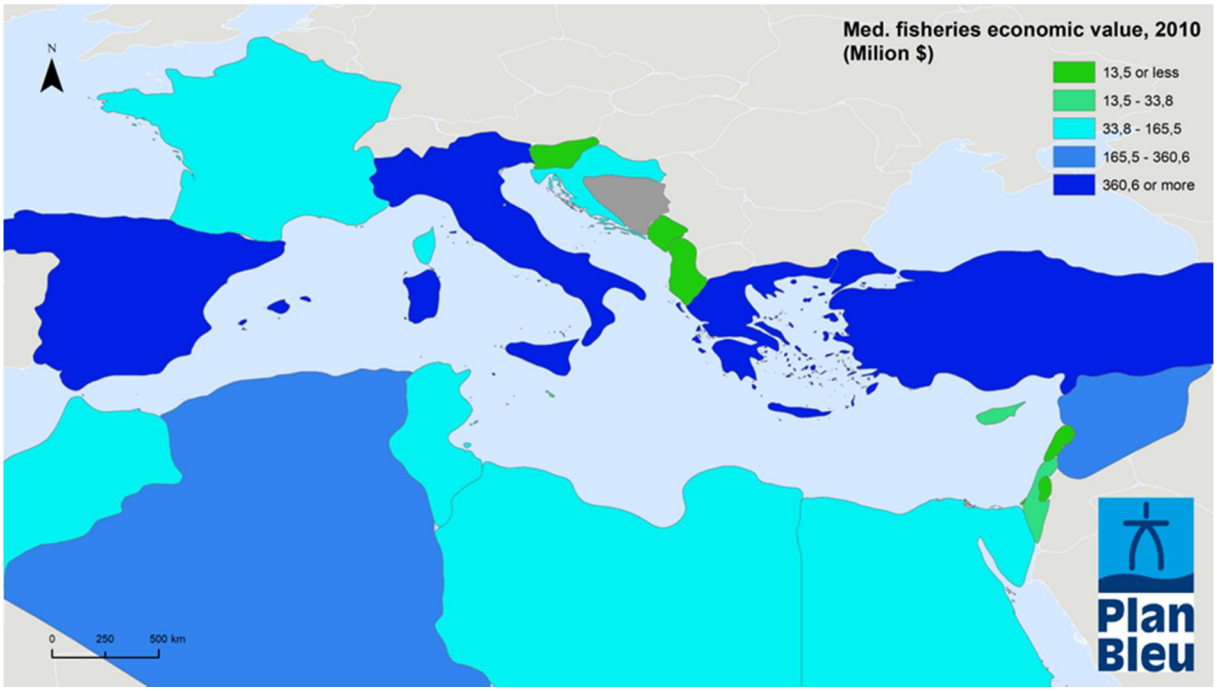
Major Mediterranean cities (more than 100 000 inhabitants) (Source: Plan Bleu from various sources)

Moreover, about 1 600 cities (more than 10 000 inhabitants) with around 100 million inhabitants are located in the Mediterranean coastal regions

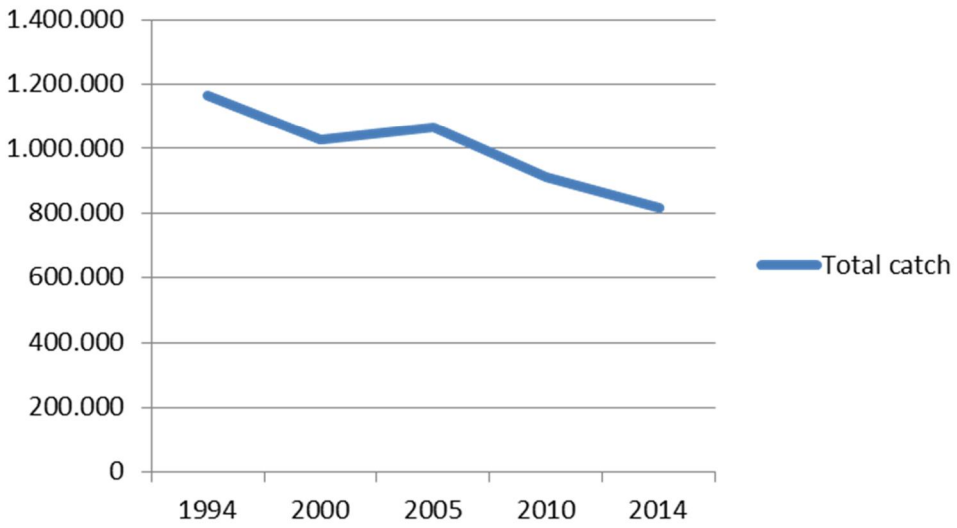
Sea related activities

Fisheries and aquaculture

Despite the steady decrease of Med captures (over 30% since 1994), the value of the sector has steadily increased (over 160% since 1990), in part because of the fast development of the aquaculture sector.



From 1990 to 2010 the total value of Mediterranean fisheries have risen 160 %



Total fish catch 1994 – 2014 in 1000 tonnes

The decrease in fish catch is mainly due to exhausted fish stocks, not because the pressure of fishing decreased.

Cruise

The Mediterranean Sea is among the most important cruise areas in the world: it reached 27 million passengers in 2013, with a sustained increase of around 5% per year. Cruise infrastructures remains located on northern shore: 75% of Mediterranean ports are in Italy, Spain, France, Greece, Croatia and Slovenia, while 9% of ports are in Turkey and Cyprus; and 7% in Northern Africa.

Maritime transport

The Mediterranean Sea is one of the busiest seas in the world, harvesting 20% of seaborne trade, 10% of world container throughput and over 200 million passengers. Furthermore, as maritime traffic is steadily increasing it adds environmental pressure, such as rising CO2 emissions, pollution, marine litter, collisions with large cetaceans, underwater noise and the introduction of non-indigenous species. Container port traffic development shows a clear trend of rapid growth of the sector, which undoubtedly increases the environmental pressure and strengthens the need for a transition to a sustainable maritime.

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