



## Mediterranean marine ecosystems: the economic value of sustainable benefits

Whilst the Mediterranean Sea represents a mere 0.3% of the volume and 0.8% of the total surface area of the World Ocean, its position between three continents, its semi-enclosed basin and its range of seasons have made this region a melting pot for biodiversity. It is home to almost 7% of known ocean flora and fauna. Many of the species present within this wealth of biodiversity are endemic. The continental shelf bordering the 46,000 kilometres of coastline hosts a variety of major habitats. Albeit limited (0-200 m), this shelf supports most of the Mediterranean marine biodiversity<sup>1</sup>.

With around 40% of the coastline being built-up, these habitats are subject to numerous pressures of human origin. The concentration of socio-economic activities along the coasts as well as the phenomenon of climate change further exacerbate the threats faced by biodiversity in the region.

These threats are all the more worrying in view of the major economic issues linked to biodiversity. In order to illustrate the scale of these issues, the Blue Plan decided to conduct an initial assessment at Mediterranean regional level of the annual economic value of the sustainable benefits resulting from the services provided by marine ecosystems.

### Key notions: ecosystem services, value of benefits and sustainability

In terms of economic analysis, the environment may be seen as natural capital composed of environmental assets or ecosystems having their own processes and delivering ecosystem services. This notion was developed by the Millennium Ecosystem Assessment<sup>2</sup> – MA, which establishes three categories of ecosystem services directly linked to individual well-being (*figure 1*): provisioning services, regulating services and cultural services.

The MA has been instrumental in highlighting the risk of loss of well-being through ecosystem degradation due to human activities affecting ecological processes (soil artificialisation,

pollution and other disturbances). The economic assessment of flows provided by environmental assets is addressed by numerous international initiatives, such as the TEEB<sup>3</sup> (*figure 2*).

The inappropriate use of ecosystem services, such as over-exploitation of natural resources, may lead to natural capital consumption and threaten the on-going provision of ecosystem services.

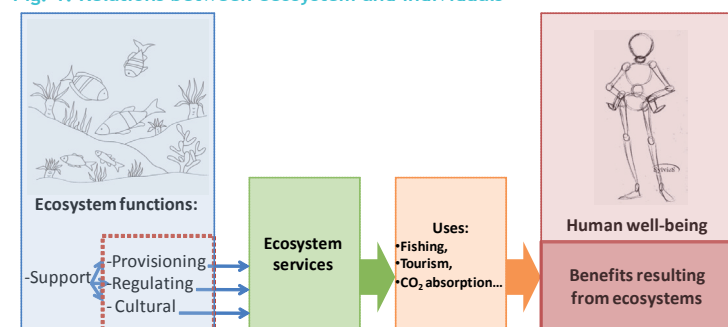
This aspect has been taken into account by the inclusion within the analysis of a sustainability criterion for the benefits resulting from marine ecosystems, based on the fraction of use deemed to be sustainable for ecosystems.

In the fisheries sector, for example, only 80% of the benefits produced are deemed to be sustainable.

### 26 billion Euros per year: a low estimate of the sustainable benefits resulting from Mediterranean marine ecosystems

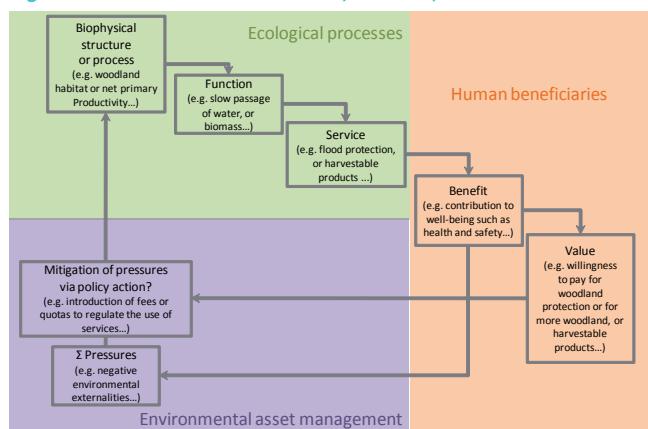
Five types of Mediterranean marine ecosystem were studied: Posidonia meadow areas, corallogenic areas, hard substrate areas with photophilic algae, soft substrate areas and the open sea. Each ecosystem is characterized by its biodiversity, its area and the ecosystem services it provides<sup>4</sup>.

Fig. 1: Relations between ecosystem and individuals



Source: Plan Bleu (2010)

Fig. 2: Relations between functions, services, benefits and values



Source: Adapted from Haines Young and Potschin (2010)

**Posidonia meadows** (*Posidonia oceanica*), an endemic species in the Mediterranean found in abundance between depths of 0 and 50 m along much of the coast, play a key ecological role, often compared to that of the forests. They constitute the Mediterranean’s leading ecosystem in terms of biodiversity, hosting a quarter of all recorded marine species in an area estimated to represent a mere 1.5% of the seabed. As a nursery and spawning ground for numerous commercial species, they are a crucial Mediterranean habitat for maintaining artisanal fishing. They play an important role in water oxygenation, whilst also trapping and fixing sediment, thereby protecting the coast against erosion and aiding water transparency, a major asset for seaside tourism. Finally, their roots form the duff (matte), which traps carbon at length, thus assisting the absorption of man-made CO<sub>2</sub>.

**Corallogenic concretions** are built up by the accumulation of calcareous algae which grow in low-light conditions, between depths of 40 and 120 m or near to the surface in caves and vertical walls. They support a vast range of sessile invertebrates and constitute the second Mediterranean ecosystem in terms of biodiversity, with over 1,700 species, a high percentage of which are also endemic. Many of the species present are of commercial interest, their traditional exploitation dating far back in history (sponges, red coral...).

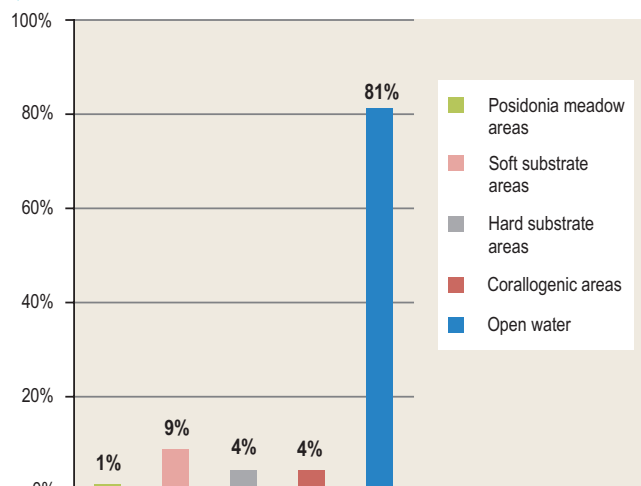
The other shallow water ecosystems (0-100 m) addressed by the study consist of areas of **hard substrate** and **soft substrate**.

Deep sea biotic communities, present in the **open sea** (over 100 m in depth), are markedly endemic and present some remarkable spots of biodiversity such as canyons, deep-water corals or sea-mounts. These particular ecosystems are extremely fragile, sensitive to macro-waste and chemical pollutants. They are currently undergoing procedures to protect them, through the banning of certain fishing techniques in particular.

The areas covered by these five ecosystem types were estimated using distribution hypotheses based on available analysis, supplemented by expert judgement (figure 3).

It is interesting to note that known marine biodiversity is mainly concentrated in shallow areas, even though they only account for about 20% of the Mediterranean area.

Fig. 3: Distribution of areas covered by marine ecosystems in the Mediterranean



Source: Plan Bleu, as advised by Prof. Francour, ECOMERS laboratory (Univ. of Nice).

With reference to the nature and specific processes of marine ecosystems as well as the use made of them in the Mediterranean, the economic assessment of the benefits resulting from these ecosystems focused on six ecosystem services (figure 4).

Fig. 4: Affiliation of the benefits assessed

Categories of ecosystem services	Ecosystem services	Benefits assessed
Provisioning services	Provision of food resources	Resource rent relating to the provision of food resources of marine origin
Cultural services	Amenities	Resource rent relating to the provision of amenities and recreational support
	Support for recreational activities	
Regulating services	Climate regulation	Value of man-made CO <sub>2</sub> sequestration
	Mitigation of natural hazards	Value of protection against coastal erosion
	Waste treatment	Value of waste treatment

Source: Plan Bleu

### Assessing the sustainable benefits resulting from marine ecosystems

Each benefit considered was specifically assessed, drawing on the recommendations from the United Nations System of Environmental and Economic Accounts (SEEA)<sup>5</sup>.

The aggregation of the results obtained from the evaluation of each type of benefit provides an initial approximation of the overall value of the sustainable benefits resulting from Mediterranean marine ecosystems.

At regional level, the aggregate value stands at over 26 billion Euros for 2005, which comparatively speaking corresponds to 120% of Tunisia’s Gross National Product (GNP). In terms of the area covered by the Mediterranean Sea, i.e. 2.5 million km<sup>2</sup>, the Mediterranean large marine ecosystem would thus contribute to an annual benefit of over 10.000 €/km<sup>2</sup>.

The distribution of the value by type of benefit (figure 5) shows that 68% thereof stems from the provision of amenities and recreational supports (some 18 billion Euros). These benefits are related to three sectors: hotels and restaurants,

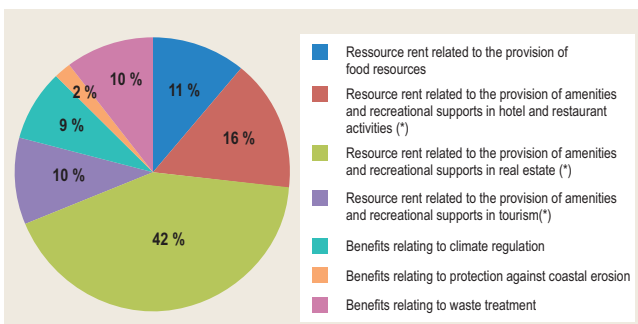
### Assessment method of benefits resulting from marine ecosystems

The economic value of the benefits resulting from ecosystems was assessed (i) either as a share of the value added (VA) created in marketed sectors (ii) or as the equivalent of avoided cost (iii) or on the basis of a reference value for benefits of a collective nature.

- Benefits relating to the provision of food resources were assessed using the VA from fishing and aquaculture. A sustainability coefficient of 80% of catches was applied.
- Benefits relating to the provision of amenities and recreational supports were evaluated using a statistical assessment focused on the “coastal effect” benefiting hotel and restaurant activities in coastal as compared to other areas, using coastline length as the explanatory variable. The coefficient which emerged from the statistical analysis of four European countries for which data was available was applied to all the countries in the region. For lack of data allowing the same kind of assessment of the coastal effect on real estate and tourism, the same coefficient was applied to household accommodation expenditure and to the estimated VA in tourism in coastal areas of each country.
- Benefits relating to climate regulation were assessed using an estimate of anthropogenic CO<sub>2</sub> volume absorbed by the marine environment based on recent scientific work, and then valued at the price per tonne of CO<sub>2</sub> in force under the European Emission Trading Scheme in 2005, the year of reference for the study.
- Benefits relating to erosion mitigation were assessed on the basis of the length of coastline where Posidonia meadows are present and which is threatened by erosion. The benefits were calculated as the avoided cost of replacement by defensive infrastructure and action.
- Benefits relating to waste treatment -a particularly crucial case in terms of sustainability of the service- were valued using a substitute, which is obtained by applying a fee, the amount of which would allow environmental standards to be met for the full volume of water consumed. This so-called reference and normative value was used for all riparian countries.

real estate and tourism. Total international tourist spending in the Mediterranean amounts to 108.5 billion Euros, in other words about one third of global tourist spending. The value of benefits arising from the provision of amenities and recreational supports thus amounts to about 17% of international tourist spending in the Mediterranean.

Fig. 5: Distribution of value by type of benefit resulting from Mediterranean marine ecosystems



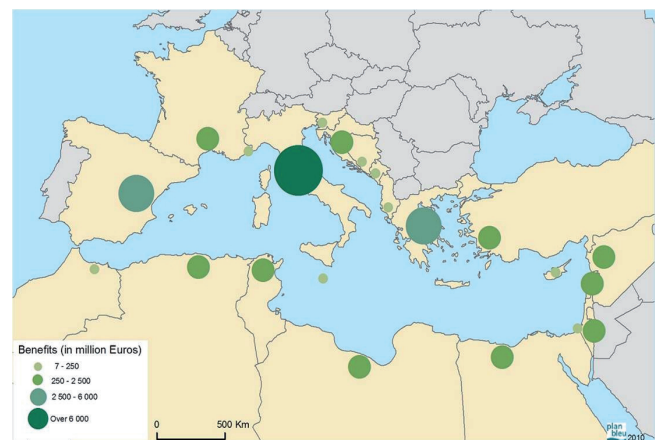
Note: (\*) share of sectoral activities in the coastal zone  
Source: Plan Bleu

Sustainable benefits relating to the provision of food resources apparently amount to 2.8 billion Euros, i.e. 11% of the total estimated benefit.

The distribution of the value of benefits by country (figure 6) shows that 8 countries would appear to account for about 90% of the overall value of benefits resulting from marine ecosystems: Italy, Spain, Greece, France, Turkey, Israel, Egypt and Algeria.

Italy alone would appear to account for 35% of the overall value of benefits, amounting to over 9 billion in 2005. This can be attributed to the intense activity in the coastal areas which represent an important part of the country. It is worth noting that the seafront of this country is entirely Mediterranean.

Fig. 6: Distribution of the value of benefits by country



Source: Plan Bleu

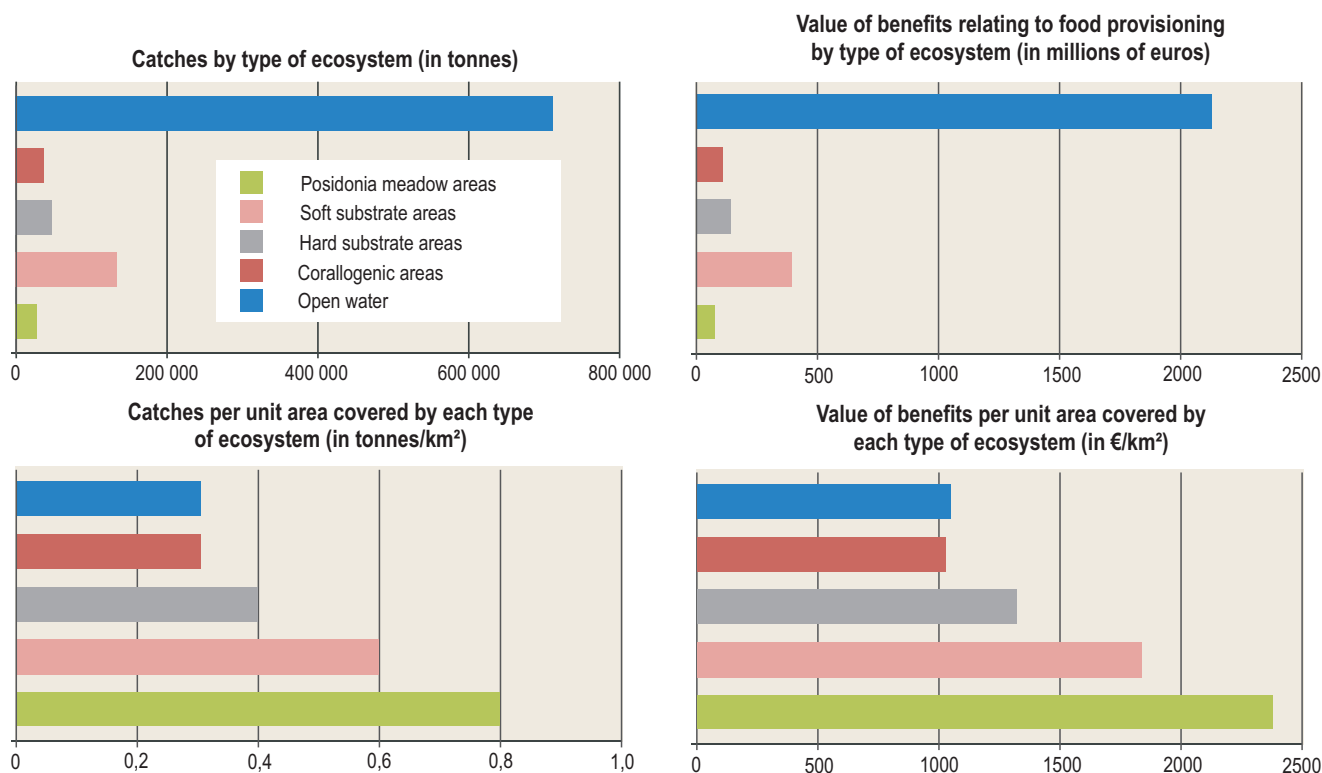
The distribution of the value of benefits relating to the provision of food resources can be presented by ecosystem type (figure 7). The high seas appear to contribute to the production of over 70% of the value of benefits relating to fisheries in proportion to the volume of catches they represent, whereas Posidonia meadows and rocky sea-beds provide the best fishing productivity in terms of catches per unit area.

### An initial assessment to be further refined

The choices and constraints which guided this analysis, whether concerning the application of a sustainability criterion for assessing benefits or the lack of data resulting in certain benefits being neglected, have given rise to what is most probably an underestimated initial assessment of the annual value of all sustainable benefits resulting from marine ecosystems.

Nevertheless, and despite the further work which will be required particularly in order to correct the shortcomings relating to specific data, it is clear that the sustainable benefits resulting from the Mediterranean marine ecosystems are of considerable economic value. Yet one more reason to preserve them.

Fig. 7: Distribution of fish catches and value of benefits relating to the provision of food resources by type of ecosystem - Source : Plan Bleu



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## Notes

- <sup>1</sup> 90% of the plant species and 75% of the fish species present in the Mediterranean Sea are concentrated in shallow waters, between 0 and 50 m in depth.
- <sup>2</sup> The Millennium Ecosystem Assessment (MA) is an international work programme initiated in 2001 at the behest of the United Nations (UNEP and UNDP), the WRI (World Resource Institute) and the World Bank. The MA was designed in order to shed light on the effects of changes within ecosystems on human well-being.
- <sup>3</sup> The Economics of Ecosystems and Biodiversity (TEEB) study is an international initiative supported by UNEP and intended to draw attention to the economic benefits of biodiversity whilst highlighting the cost of biodiversity loss and ecosystem degradation.
- <sup>4</sup> The ecosystems were largely classified using the expertise of SPA/RAC and the ECOMERS university laboratory (Univ. of Nice Sophia Antipolis).
- <sup>5</sup> A group of experts is currently responsible for revising the methodological approach for this system. The revised version, which will in particular take on board the issue of environmentally adjusted accounts, is expected for 2012.

## Blue Plan Notes

