



10.- APPENDICES

10.1.-APPENDIX 1: THE MEDITERRANEAN SEA

The Mediterranean is recognized as an ecoregion, for its climate, the common sea that links three continents, for the richness of its biodiversity, for its classical heritage and the diversity of its landscapes and cultural places. For multiple reasons the question of sustainable development is particularly acute, especially since climate change proves to be particularly sensitive there (UNEP/MAP-Plan Bleu, 2009). Figure 44 shows the whole Mediterranean region and the 22 bordering countries.4444



Figure 44.-A multi-dimensional Mediterranean region (Source: Plan Bleu, 2009).

According to UNEP/MAP-Plan Bleu, 2009, the 22 countries and territories that border on the Mediterranean represented host:

- 5.7% of the planet's land mass, including a large number of desert and mountain areas,
- 10% of known higher plant species,
- 7% of marine species in less than 0.8% of its total ocean area
- 7% of the world's population with 460 million inhabitants (stable),



- 31% of international tourism, with 275 million visitors,
- 12% of world GDP (decreasing),
- 60% of the population of the world's "water-poor" countries,
- 8% of CO2 emissions (increasing).
- every year, 30% of international maritime freight traffic
- 20 to 25% of maritime oil transport transits the Mediterranean Sea.

These data highlight the importance of the sustainability of use of goods and services in the Mediterranean area. Therefore, conservation and management measures are required by habitats and ecosystems at a national and regional scale.

10.2.-An ever changing climate and physiological history

Pangaea, shown by figure 45 was the last supercontinent that existed during the late Paleozoic and early Mesozoic eras, formed about 300 million years ago. Since the forming of supercontinents and later breaking up, appears to be cyclical through Earth's 4.6 billion year history; there may have been several others before Pangaea.



Figure 45: Map of Pangaea with modern continents outlined (Source: <http://Wikipedia.es/>).



Roughly 200 million years ago the Pangaea supercontinent began to rift, within the breaking up of it there were different phases, which allowed the formation of Tethys Ocean. This ocean was a mass of equatorial water open in the eastern part which divided the two mega-continents (Laurasia and Gondwana) that had emerged from the fragmentation of Pangaea and are shown in figure 46.

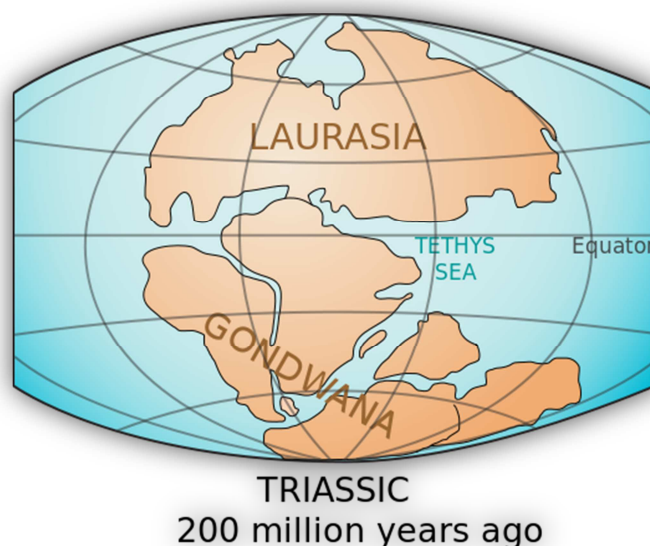


Figure 46: First phase of the Tethys Ocean's forming: the (first) Tethys Sea starts dividing Pangaea into two supercontinents, Laurasia and Gondwana (Source: <http://Wikipedia.es/>).

During the Cretaceous period, after the Atlantic Ocean opened up, Tethys linked this newly formed ocean with the old Indo-Pacific Ocean; at that time Tethys had a highly diversified tropical fauna and flora (Figure 47).

At the beginning of the Miocene epoch (10 million of years) the Suez isthmus was formed, cutting the Mediterranean off from the Indo-Pacific. Thus, towards the end of Miocene, the communication with the Atlantic was closed as well the Mediterranean became an almost isolated area. Within the Messinian period these situations occurred for approximately 0.5 to 1 million years, each time almost drying up the Mediterranean (Figure. **Error! No se encuentra el origen de la referencia.**).



Figure 47: Mediterranean Sea during the Cretaceous period (Source: <http://Wikipedia.es/>).



Figure 48: Messinian salinity crises (Source: <http://Wikipedia.es/>).

During these situations, the Indo-Pacific biota became almost extinct, only a few forms survived in refuges. When communication with the Atlantic was re-established after the



opening of Gibraltar Strait, the Atlantic water flooded the whole Mediterranean basin leading to the development of a new Mediterranean biota, the ancestors of the present-day biota came.

The Quaternary period alternated glacial periods (cold) with interglacial periods (warm), promoted migratory waves of boreal or subtropical forms of life. However, the eastern part of the Mediterranean remained under-colonized by species from the Atlantic, not because these could not reach these regions but probably because they did not find favourable conditions to establish themselves in these relatively warmer areas. The opening of Suez Canal re-established the communication between the Mediterranean and the Indo-Pacific Ocean, allowing tropical species to enter and exploit the tropical conditions present at eastern Mediterranean (RAC/SPA Tunis 2010).

10.3.-Exceptional biological interest

The alteration of hot and cold seasons, linked to hydrological features of the Mediterranean basin, together with its geo-morphological characteristics, geological history and position, are the main factors that explain the prevalence of two essentially surface biotas: tropical-affinity species in summer and boreal-affinity species in winter.

The Mediterranean has particular sub-systems, seas, islands, wetlands and lagoons, including numerous Ramsar sites¹, deltas, dunes, forest, maquis, garrigue and cliffs among others.

Therefore, the Mediterranean region can be considered as a true crossroads of marine biodiversity. Its marine fauna and flora are composed by species belonging to several biogeographical categories: over 50% have their origins in the Atlantic Ocean, 4% are relic² species and 17% come from the Red Sea. In this last category very old species, have been found dating from the time when the Red Sea and the Mediterranean formed a single entity, and species that recently entered the Mediterranean when the Suez Canal was dug, fact that is deemed to be introduced species (RAC/SPA, Tunis 2010).

In the Mediterranean sea the inventories show from 10.000 to 12.000 species, equivalent to 4% to 18% (depending on taxonomic³ groups) of known marine species in the world, over 0.82% of the Earth surface and 0.32% the volume of the world ocean. Covering 10% of the world's biodiversity, the Mediterranean is one of the 25 recognized biodiversity poles on a worldwide level (UNEP-MAP-RAC/SPA, 2010).



There is a high percentage of endemism species; actually endemism is greater in the Mediterranean than in the Atlantic. From the bio-geographical viewpoint, the Mediterranean biota has 55 to 77 % of Atlantic species, 3 to 10 % of pan-tropical species, and 5% of Lessepsian species and between 20 to 30 % of endemic species. The following *table 9* shows an impressive range of particular animal and plant species, which offers us the level of endemism by means of number and percentage.

Phylum	Number of species in the Mediterranean	Number of endemic species	% of endemic species
<i>Vascular plants</i>	25.000	12.500	50
<i>Freshwater fishes</i>	300	132	44
<i>Reptiles</i>	165	113	68.5
<i>Amphibians</i>	63	37	58.7
<i>Mammals</i>	197	50	25.5
<i>Birds</i>	343	58	17
<i>Insects</i>	150.000	?	?

Table 9: Level of endemism in the terrestrial environment

¹ **Ramsar sites:** Ramsar sites are wetlands of international importance, designated under the Ramsar Convention, an international agreement signed in Ramsar, Iran, in 1971, which provides for the conservation and good use of wetlands.

² **Relics:** In biology a relict (or relic) is an organism that at an earlier time was abundant in a large area but now occurs at only one or a few small area. In this case, relic species are species from very old periods when the Mediterranean was subjected to a tropical climate.

³ **Taxonomy:** is the [academic discipline](#) of defining groups of biological organisms on the basis of shared characteristics and giving names to those groups. Each group is given a rank and groups of a given rank can be aggregated to form a super group of higher rank and thus create a hierarchical [classification](#). The groups created through this process are referred to as taxa.