



## Topic summary:

*The Mediterranean Basin welcomes a tremendous diversity of habitats and species. Habitat loss, invasive species, overexploitation, pollution, tourism and other kind of anthropogenic activities –impacts are the primary causes of biodiversity degradation in the Mediterranean Basin. In this topic, some essential environmental issues related to the reduction of biodiversity in the Mediterranean are presented.*

### Main concepts covered:

- \* Endemic species
- \* Alien species

### Transversal competencies acquired:

- \* Communicating orally / writing in mother/foreign language
- \* Managing information
- \* Getting organized and planning
- \* Mobilizing reasoning
- \* Mobilizing computer/digital skills



### Definition of key notions:



#### Ecosystem:

A community of living organisms in conjunction with the non-living components of their environment, interacting as a system.



#### Biodiversity:

A contraction of biological diversity. It reflects the number, variety and variability of living organisms. It includes diversity within species (genetic diversity), between species (species diversity), and between ecosystems (ecosystem diversity).



#### Endemic species:

Any species whose range is restricted to a limited geographical area.



#### Alien species:

Any live specimen of a species, subspecies or lower taxon of animals, plants, fungi or micro-organisms introduced outside its natural range; it includes any part, gametes, seeds, eggs or propagules of such species, as well as any hybrids, varieties or breeds that might survive and subsequently reproduce (EU 1143/2014).



The Mediterranean is a semi-enclosed sea at the crossroads between Europe, Africa and Asia, representing just 0.82% of the surface area of the world's oceans. Its geological and human history has given the Mediterranean region its richness in terms of biodiversity, but also in terms of social, cultural and political diversity.

The Mediterranean region is considered to be one of the world's hotspots where biodiversity is exceptional.

The Mediterranean Basin is the third richest hotspot in the world in terms of its plant biodiversity (25,000 species), and one of the most important areas on Earth for endemic plants. The Mediterranean Sea, even though representing a small part of the world's oceans, is inhabited by an unusually rich and diverse biota. It is one of the major reservoirs of marine and coastal biodiversity, with 28% of endemic species and 7.5% of the world's marine fauna and 18% of its marine flora. About one-third of the Mediterranean fauna is endemic.

It hosts approximately 17,000 species, representing 4–18% of the world's marine biodiversity, and includes temperate, cosmopolitan, subtropical, Atlantic and indo-pacific taxa. Many of these species are rare and/or threatened and are globally or regionally classified by the International Union for Conservation of Nature (IUCN) as threatened or endangered.

Unfortunately, the Mediterranean is amongst the most impacted regional sea areas, as a consequence of different anthropogenic pressures on several coastal and marine ecosystems. Human activities such as overpopulation, coastal urbanization, littoralization, trade, pollution, uncontrolled expanding tourism, and unsustainable modes of consumption, are fundamentally and irreversibly responsible for biodiversity loss and ecosystem services degradation in the Mediterranean region. Furthermore the habitat modification and loss, the climate change (e.g. warming, acidification and sea level rise), the pollution, the overexploitation (e.g. overfishing), the scarcity of fresh water, and the intentional or indirect introduction of invasive species (also called alien species), largely contribute to the biodiversity reduction, degradation and loss.

To enable students to understand the value of biodiversity and the importance of its conservation in the Mediterranean Basin, a series of themes will be presented below. These themes address both important Mediterranean endemic species and the threats they face, as well as other issues affecting the conservation of biodiversity.

The student will be able to communicate more effectively about biodiversity issues

Such as:

- What is the status of biodiversity in the Mediterranean Basin?

(Students will be able to explore the status of the biodiversity in the Mediterranean and why biodiversity is declining in the basin. By learning about the causes and consequences of biodiversity loss, the students will be able to participate in maintaining biodiversity in the future)

- How can we protect biodiversity in the Mediterranean region?

Students will be able to identify ways to ensure that biodiversity will be adequately maintained for the future generations. Students should also be able to understand that the ecological integrity, the social equity, and the economic prosperity are connected and are important components of a sustainable society.



## Sustainable development issues identified in this topic:

According to the sustainable development goal (SDG) 15: “Life on Land” and to the SDG 14: “Life below water”, the preservation of biodiversity and the sustainable use of ecosystem services are required in order to ensure the survival of our planet, the well-being of all living creatures, including our own species. Concepts in this section help students to investigate on how the biodiversity affects their lives and supports life on Earth. Understanding the importance of biodiversity increases students’ awareness of why and how people’s actions affect biodiversity and why is it important to protect, maintain and (if possible) to restore biodiversity.

The issues raised by the proposed theme are given below:

- Endemic and/or keystone marine species and the threats they face (sea grass meadows, hard corals, white sharks, blue fin tuna, sea turtles, the Mediterranean Monk seal, cetaceans etc.);
- Alien species (Green alga species *Caulerpa taxifolia*, fish species, *Siganus rivulatus* and *Siganus luridus*, small mussel, *Brachidontes pharaonic*, *Pterois miles*, *Lagocephalus sceleratus* and *Plotosus lineatus* (the latter being the only marine alien species of Union Concern) etc.)
- Mediterranean Wetlands
- Marine Protected Areas (MPAs)
- Pollution

### 1. Endemic and/or charismatic species in Mediterranean

Among animals, freshwater fishes (about 400 species) and amphibians (108 species) have the highest rate of endemism with 253 species (63%) and 76 species (70%) respectively. Reptiles (349 species), including two resident marine turtles, have a 48% (168 species) rate of endemism with a high proportion of lizards (65%) and snakes (30%). Mammals include 297 species, 30% of which are terrestrial endemic species, including a great number of rodents, shrews, moles and hedgehogs. Considering the marine environment, it has a high rate of endemism as well as many emblematic or charismatic species of conservation concern, such as turtles, cetaceans and the endangered Mediterranean monk seal (*Monachus monachus*). There are several unique and endangered habitats, including the seagrass meadows of the endemic *Posidonia oceanica*, vermetid terraces built by the endemic gastropod *Dendropoma petraeum*, coralligenous assemblages, and deep-sea and pelagic habitats that support unique species and ecosystems. The avifauna includes about 600 species with around 500 bird species known as being permanent and breeding within the Mediterranean neighboring countries. Many sensitive habitats exist within the coastal ecosystems.

Further reference will be made to some important species such as:

- Sea turtles *Caretta caretta* and *Chelonia mydas*;
- The great white shark;
- Cetaceans fauna;
- Seagrass meadows (*Posidonia oceanica*);

- The monk seal (*Monachus monachus*).

## 2. Alien species

The introduction of non-native species into an ecosystem can threaten endemic wildlife (either as predators or competing for resources) and affect human health and ecosystem services (with quite important effects on the local/Mediterranean economies).

As alien species are considered plants, animals, fungi and micro-organisms that have been transported inadvertently or intentionally across ecological barriers and have established themselves in areas outside their natural range. They can create serious problems for the native species. Alien species spreading rapidly across the natural environment, interacting with native species and posing threats to native biota and/or ecosystems. More than 985 alien species are found in the Mediterranean Sea. There are various introduction pathways. The most important one is the Suez Canal, which is responsible for the introduction of more than 420 Lessepsian species. Most of these species are currently present in the Eastern part of the Mediterranean Sea and some gradually expanding their range of distribution westwards. The second most important pathway is shipping, responsible for the introduction of 300 alien species that are scattered all over the Mediterranean, especially close to the harbors. Aquaculture is responsible for the introduction of 64 alien species, which are mainly found in two areas with aquaculture facilities: the Thau Lagoon (Gulf of Lion, France); and the Venice Lagoon (Northern Adriatic, Italy). Last but not least, as the number of species is drastically increasing, is aquaria releases, including species that are deliberately released in the natural environment by aquarists.

Some indicative alien species are the following:

- Killer Algae (*Caulerpa taxifolia*)
- Blue-spotted Cornefish (*Fistularia commersonii*)
- Silver-cheeked Toadfish (*Lagocephalus sceleratus*)
- Devilfire fish or Lionfish (*Pterois miles*)
- Redcoat (*Sargocentron rubrum*)
- Nomad Jellyfish (*Rhopilema nomadica*)
- Indo-Pacific Mussel (*Brachidontes pharaonis*)
- Striped eel catfish (*Plotosus lineatus*), this being the only marine alien species of EU Concern.

## 3. Mediterranean wetlands

Mediterranean wetlands include a wide variety of natural habitats such as river deltas, freshwater, brackish, and salt lakes and marshes, permanent and intermittent rivers, floodable forests along rivers, as well as salt pans and dammed reservoirs.

Natural and human-made wetlands in the Mediterranean countries are estimated to cover ca. 0.15-0.22 million km<sup>2</sup>, about 1.1-1.5% of wetland area globally. Almost one-quarter (ca. 23%) of Mediterranean wetlands are now human-made (such as rice fields, reservoirs, salt pans and oases) – a much higher percentage than the global average of ca. 12%. The largest wetland areas are in Egypt, France, Turkey and Algeria, together making up

about two-thirds of the Mediterranean wetland area. Given the arid or semi-arid nature of the Mediterranean Basin, the percentages of national surface areas covered by wetlands are generally small, ranging from over 8% in Tunisia to less than 1% in eight countries, mostly in the Middle East and North Africa. But all these wetlands are of great importance to people's livelihoods and for maintaining biological diversity.

Mediterranean wetlands are in degraded condition and they are under threat. The last century has seen the loss of more than half of the wetlands, which has resulted in a dramatic degradation of their functions and in a loss of their values. The loss of wetlands in the Mediterranean region will affect endemic freshwater fish, amphibians, mammals and reptiles. Even if many attempts have been made to counteract this trend, the degradation and loss haven't been stopped or reversed yet.

Wetlands in the Mediterranean Basin provide many and varied benefits in terms of well-being to the Mediterranean population.

People directly harvest wetland-dependent plants and animals through fishing and hunting for food, and they use wetlands for grazing animals. Wetlands in increasingly dry regions, such as the Mediterranean, are particularly crucial for the sustainable management of water resources, in terms of both quality and quantity. They help to provide and purify water upon which people depend on for drinking, industry, energy production and irrigated agriculture. Mediterranean wetlands, particularly coastal wetlands, are important for helping to mitigate climate change as they help to manage extreme weather events through buffering floods and coastal storm-surges and providing water in droughts. Conversely, wetlands draining or the water resources reduction can result in the release of large amounts of stored carbon. Wetlands are also increasingly important for their aesthetics and beauty, and more and more people are visiting wetlands for education and tourism.

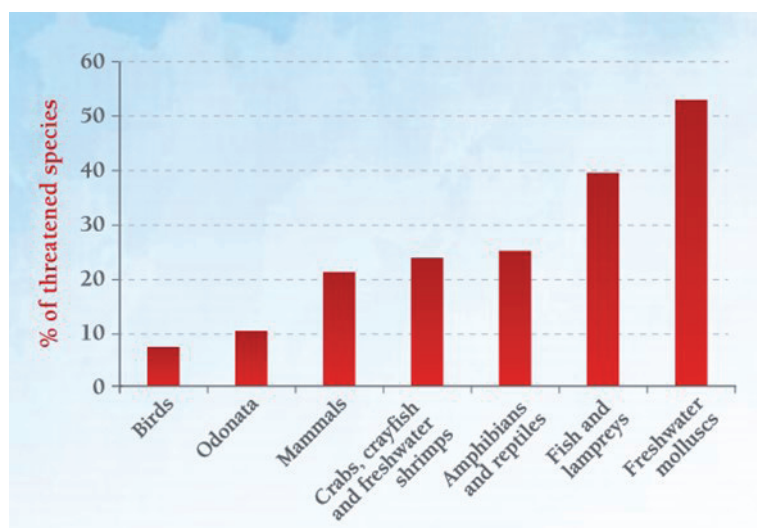


Figure 1: Proportion of species threatened (grouping together categories CR, EN, and VU) by taxonomic group –Source MWO, IUCN

#### 4. Marine Protected Areas (MPAs)

Marine protected areas (MPAs) are geographically distinct zones for which protection objectives are set. They constitute a globally connected system for safeguarding biodiversity and maintaining marine ecosystem health and the supply of ecosystem services. Almost 86 000 km<sup>2</sup> of the Mediterranean is classified as MPAs or are

considered as Natura 2000 sites. Since 2016, only 3 % of the Mediterranean Sea have been protected.

### 5. Pollution

Pollution is the release of harmful substances, such as pesticides and sewage, into the environment. Biodiversity is threatened by many types of pollution, including the build-up of carbon dioxide and other greenhouse gases in the atmosphere, acid rain and toxic chemicals (released into the air, soil, or water during manufacturing, farming, building, mining, transportation, and many other activities). All forms of pollution (air, water, soil, noise) pose a serious threat to the biodiversity.



### Position of the topic in the school program:

	11	12	13	14	15	16	17
Mother / Foreign language / Litterature	X	X	X	X	X	X	X
History	X	X	X	X	X	X	X
Geography	X	X	X	X	X	X	X
Mathematics							
Biology / Geology	X	X	X	X	X	X	X
Physic / Chemistry	X						
Social Science / Economy / Law						X	X
Art / Musics	X	X	X	X	X	X	X
Technology / Computer science							



### Ressources:

- <https://mio-ecsde.org/project/vlachogianni-t-vogrin-m-scullos-m-aliens-in-the-mediterranean-mio-ecsde-athens-2013/>
- [https://www.researchgate.net/publication/236231013\\_Ecosystem\\_and\\_Biodiversity\\_Hotspots\\_in\\_the\\_Mediterranean\\_Basin\\_Threats\\_and\\_Conservation\\_Efforts](https://www.researchgate.net/publication/236231013_Ecosystem_and_Biodiversity_Hotspots_in_the_Mediterranean_Basin_Threats_and_Conservation_Efforts)
- [www.medqsr.org/biodiversity-and-ecosystems](http://www.medqsr.org/biodiversity-and-ecosystems)
- [https://cmsdata.iucn.org/downloads/the\\_mediterranean\\_a\\_biodiversity\\_hotspot\\_under\\_threat\\_factsheet\\_en.pdf](https://cmsdata.iucn.org/downloads/the_mediterranean_a_biodiversity_hotspot_under_threat_factsheet_en.pdf)