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# THE MEDITERRANEAN SEA

The Mediterranean and its coastline education programme









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# THE MEDITERRANEAN SEA



The Mediterranean is much more than a sea trapped by three continents, its waters have witnessed the development of great civilizations, the birth of great empires and the splendour of immense cities that arose from the trade routes.

This sea is much more than a historical framework, it is a key site which houses Europe's greatest biodiversity in a constant delicate balance which we should make every effort to preserve.

We bathe in its waters, it is a food source and an economic driving force, but how much do you really know about it?




## 1.1

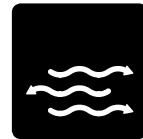
# CHARACTERISTICS OF THE MEDITERRANEAN SEA

The Mediterranean name comes from the Latin “Mar Medi Terraneum” and means “sea in the middle of the land”, a name which describes its position perfectly, since it is surrounded by the continents of Europe, Africa and Asia and is joined to the Atlantic Ocean at its westernmost point by the strait of Gibraltar. It covers an area of 2.5 million square kilometres (figure 1.1).

The sea is made up of two large basins, the western and the eastern basins, connected by the strait of Sicily, that give rise to quite a shallow sea with an average depth of 1,500 metres. However the eastern basin contains the deepest areas, exceeding 5,000 metres below the surface.

The relief of the seafloor (figure 1.2 page 4) causes some of the physical characteristics of the sea and influences the formation of **marine currents** .

Go to **CURRENTS** and find out more about the features of Mediterranean currents.



## EXPLORING THE DEPTHS OF THE MEDITERRANEAN

The Mediterranean sea is made up of two similar sized basins: the western and the eastern basins, which are connected by the Strait of Sicily which prevents the deep waters of the basins from mixing. This affects biological processes and the formation of currents (figure 1.2 page 4).

The high salinity of the Mediterranean is due to the fact that it is a semi-enclosed sea with high evaporation which rain and river discharges cannot compensate for. The water entering from the Atlantic doesn't make up for the loss of water by evaporation so the water becomes saltier, and the further away it is from the Strait of Gibraltar the saltier it is.





## CHARACTERISTICS OF THE MEDITERRANEAN SEA

Fig. 1.1

The water's surface temperature ranges between 21°C and 30°C in summer and 10°C and 15°C in winter.



It is one of the saltiest seas with 38 grams of salt per litre.



Its average depth is 1,500 metres. The deepest point is 5,150 metres under the sea's surface.



The Mediterranean is 3,700 km long, 1,600 km wide and covers over 46,000 km of coastline.



The Mediterranean region contains 10% of the world's biodiversity and 80% of all European Mediterranean species. 68% of the amphibians; 63% of the freshwater fish; 35% of the reptiles and 28% of the mammals are endemic to the Mediterranean.



The Mediterranean is a major breeding ground for Atlantic bluefin tuna, which is the most sought after marine species in the world.

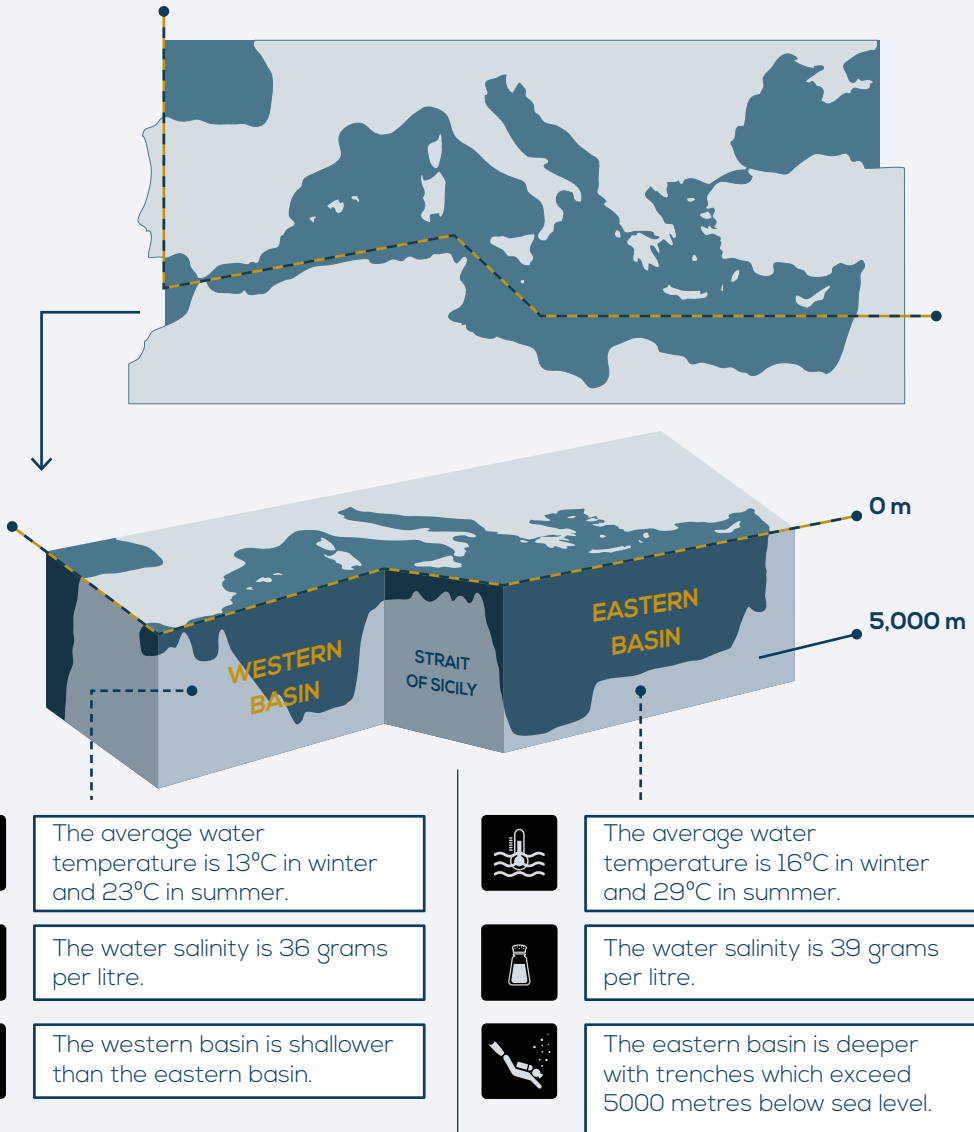


The sea is defined by a vast number of headlands and natural harbours. It is also the sea with the largest number of islands and archipelagos.





Fig. 1.2



Did you know...



The Mediterranean sea almost dried up completely and became a vast salty wasteland with a few dispersed and extremely salty water reservoirs. This event in the geological history of the Mediterranean was called the Messinian salinity crisis.

Find out more at:

<http://www.educaixa.com/-/la-desecacion-del-mediterraneo>



— THE COASTLINE TODAY

○ SALT PLAINS

● THE MEDITERRANEAN DURING THE SALINITY CRISIS



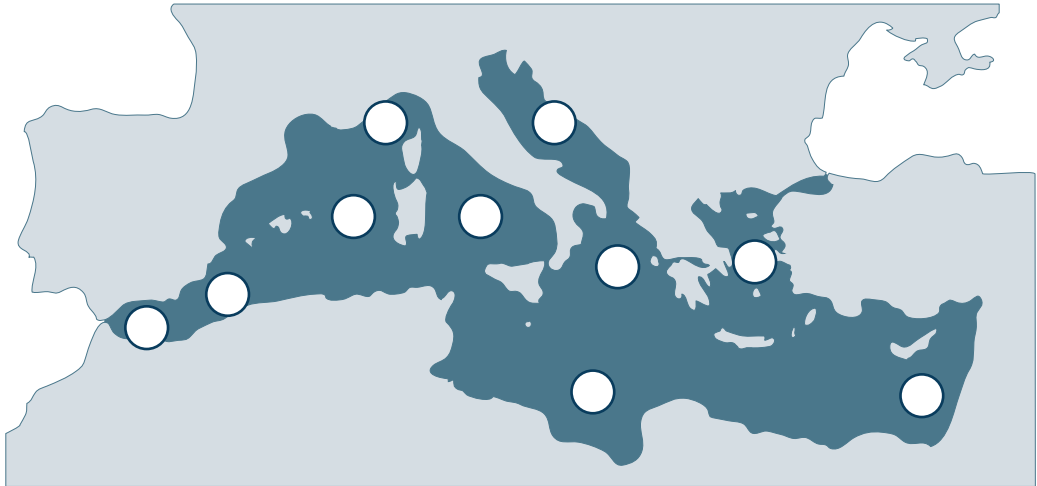


A.1.1.

## THE MEDITERRANEAN: A SEA OF SEAS

**The Mediterranean is sub-divided into a number of smaller seas, each with their own name.**

**Pinpoint the following on the map using the clues provided:**



- ① Ionian Sea, located from the south of Italy to Greece.
- ② Tyrrhenian Sea, located between Sardinia and the Italian peninsula and the north coast of Sicily.
- ③ Ligurian Sea, from Nice in France to the northwest coast of Italy.
- ④ Adriatic Sea, all of the east coast of Italy and the coasts of Slovenia, Croatia, Bosnia and Montenegro.
- ⑤ Aegean Sea, between Greece and Turkey.
- ⑥ Alboran Sea, between Spain and Morocco.
- ⑦ Mar Menor, a sea to the southeast of Spain, between Cartagena and San Pedro del Pinatar.
- ⑧ Balearic Sea between the east coast of the Iberian peninsula and the island of Sardinia.
- ⑨ Levantine Sea, bathing the coasts of Egypt, Lebanon, Cyprus, Israel, Syria and Turkey.
- ⑩ Lybian Sea.





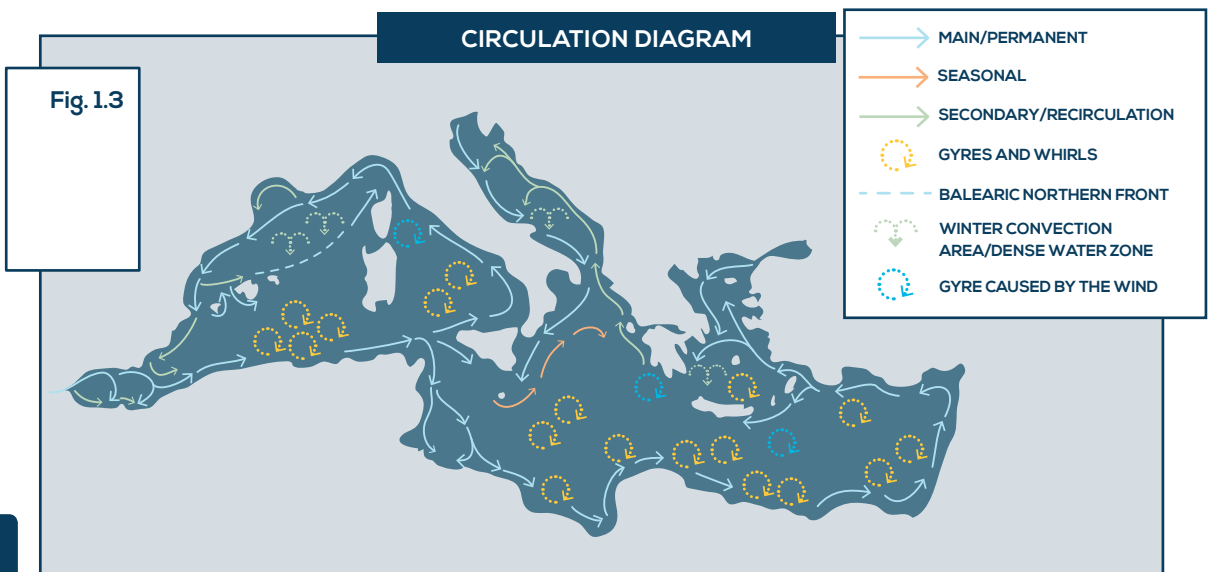
## 1.2

## WHERE DO THE MEDITERRANEAN WATERS COME FROM?

The Mediterranean has a single connection to the Atlantic Ocean via the strait of Gibraltar. At this point there is high water exchange. The less salty Atlantic water enters the Mediterranean basin, creating a surface current, and the Mediterranean water, which is more salty and therefore denser, sinks further and exits through the depths of the strait. Another important inflow comes from the rivers of the Mediterranean basin, the most prominent being the Nile, the Rhone, the Ebro and the Po.

In general, the volume of water entering via Gibraltar is greater than the volume exiting, therefore the Mediterranean gains water at the ocean interchange, but loses water into the atmosphere by evaporation. In effect, the huge evaporation caused by the wind and the sun, together with insufficient water input from the rivers and rainfall, create a chronic water deficit which is offset by the entry of Atlantic waters via the strait of Gibraltar.

The water that enters from the Atlantic forms a surface current which, after it has passed through the strait, flows along the African coast as a result of the **Coriolis force**\*, reaching the easternmost point of the basin. This main current branches out several times giving rise to current systems which ascend towards the north-western Mediterranean (Adriatic sea, Cyprus area) and descend again, giving rise to a cyclonic type of circulation where the currents advance in an anticlockwise direction.





The Mediterranean connects with the Black Sea via the Bosphorus and Dardanelles straits, and with the Red Sea via the Suez canal. These connections with the Atlantic, the Black and the Red Seas via the straits make it a semi-enclosed sea, which diminishes the effect of the tides and allows the waters to be renewed every 90 years.

You can find out more about the mechanisms of currents and large scale circulation in the Mediterranean by consulting the Currents topic.

Did you know...



The Mediterranean is quite a unique sea because it shows very little variation in sea level. The limited size of the basin and the narrow connection to the Atlantic mean that tides are greatly reduced: about 40 cm on average.

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## 1.3 THE TREASURE OF THE MEDITERRANEAN



The crystalline waters of the Mediterranean are a consequence of the lack of nutrients within them due to the small number of rivers feeding into the Mediterranean basin. This makes the Mediterranean an oligotrophic sea, that is rich in oxygen but low in plant nutrients.

Despite this, Mediterranean marine life presents wide biological diversity: it hosts 10% of the world's biodiversity, 12,000 marine species have been recorded in its waters, of which about 20% are endemic to this sea, that is to say, they are not found on any other place on the planet.

The Posidonia meadows are the most important ecosystem of the Mediterranean sea, equivalent to forests on land. **Why are they so important?**



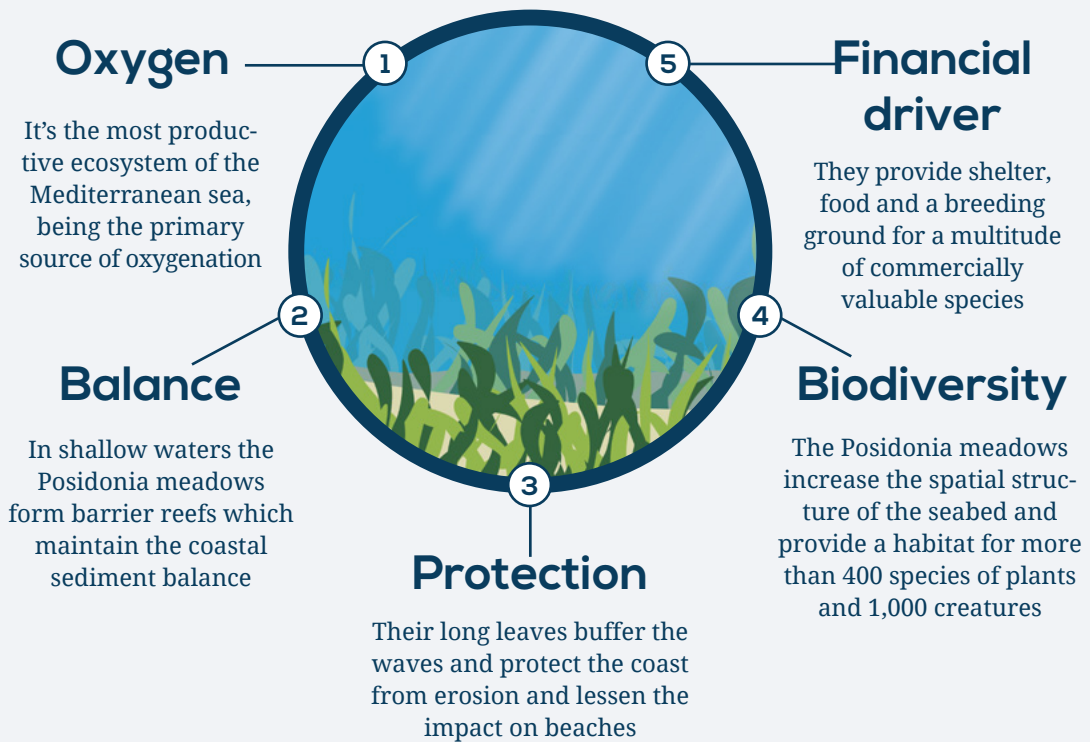


Fig. 1.4

Here are 5 reasons why posidonia meadows need conservation.



### WHY ARE POSIDONIA MEADOWS SO IMPORTANT?



However, this treasure is under threat. Habitat loss or degradation due to human activity, for example, dam construction, is the biggest cause of the high level risk of extinction for Mediterranean species. Pollution, droughts, invasive alien species and over-exploitation (over-fishing, over-hunting and over-gathering) are also important factors in the decreasing biodiversity of the Mediterranean.

Various studies on the biodiversity of the Mediterranean have detected the appearance of 900 invasive species, which are highly detrimental to native species.







A.1.2.

## IMMERSING OURSELVES IN THE MEDITERRANEAN

**Answer the following questions:**

- 1- *Is the sea temperature always the same?*
- 2- *If the average salinity of the Atlantic is 36 gr/l, can you explain why the Mediterranean sea is more salty?*
- 3- *Do you think the fact that it is almost an inland sea has contributed to the existence of a great number of endemic species?*

### 1.4

## THE SEA AND ITS SHORES

The Mediterranean sea has approximately 46,000 km of coastline. The coastline is predominantly rocky cliffs, except for some areas of coastal plains and broad beaches. There are also many islets and sand banks as well as a large number of capes and natural harbours.

The rocky coasts and high cliffs are formed by the erosive action of the waves whilst the coastal plains are formed by the accumulation of sediment dragged by the marine currents. These sediments are made up of sand, silt and gravel. The most characteristic formations of these areas are beaches, dunes and coastal wetlands.





Along the Mediterranean coast we can find different ecosystems which host a large number of **endemics**, of both flora and fauna, which are incredibly fragile in the face of any threat. Amongst these, on the sandy inshore seabeds three species stand out: *Posidonia oceanica*, *Cymodocea nodosa* and *Zostera marina*, which provide habitats for a multitude of marine species.

The coast is the zone where the marine environment and the terrestrial environment converge and interact, creating a strip of territory with very unique geomorphologic and biological characteristics which you can learn more about by referring to the topic *Coast*.

Have a look at **THE COASTLINE** and find out more about the Mediterranean coast.



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## More than just beaches: the deltas and estuaries of the Mediterranean

The semi-enclosed aspect of this sea frequently gives rise to accumulation processes at the river mouths.

**Deltas** (Fig. 1.5) are large deposits of sediments accumulated by a river in shallow coastal areas with no strong marine currents. In deltas the river gains territory from the sea and the delta forms a lobe on the coastline.

**Estuaries** (Fig. 1.5) are areas of the coast where the sea enters the last section of the river forming a wide river mouth where the freshwater of the river mixes with the salt water of the sea.

In the Mediterranean there are very few big **ivers** flowing towards the sea, those that do form large deltas made of sediments that are rich in organic matter, which makes these very productive areas. The longest river is the Nile, in Egypt. The deposits of the Nile created one of the largest **delta** plains in the world. The river Rhone originates in the Swiss Alps and runs out in to the Gulf of Leon (France) forming a typical triangular river delta. The river Po, in Italy, like the river Ebro in Spain, flows out forming a delta which has created new coastal habitats in plains consisting of rich sediments which are of great ecological wealth.



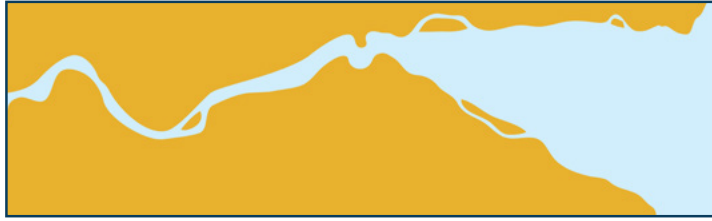


Fig. 1.5

DELTA



ESTUARY



## 1.5

### THE MEDITERRANEAN, A CALM SEA?



The Mediterranean sea is located over tectonic plate boundaries, so it is subject to earthquakes and volcanic eruptions.

The Mediterranean area has a long history of earthquakes. This seismic activity is the result of the colliding lithospheric plates (the Earth's surface layer) which causes major movement in the south of the Iberian peninsula, in the north of Italy, and strong earthquakes in the eastern part, especially in Greece and the Arabian peninsula, sometimes destroying whole towns.

Volcanoes can be found in the central part of the Mediterranean region. The most prominent active volcanoes are in Italy (Etna and Vesuvius) and in Greece (Santorini).

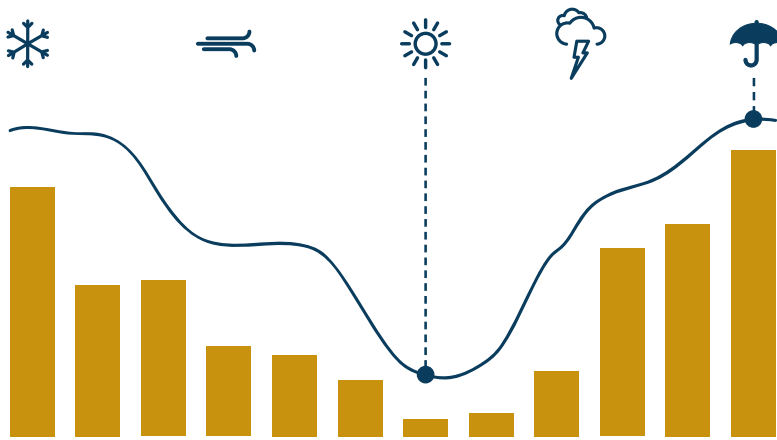
In addition to this the Mediterranean is also dotted with islands that are volcanic in origin, such as Elba or Pantelleria in Italy, or in Spain we have the Columbretes islands off the coast of Castellón.





## 1.6 THE MEDITERRANEAN CLIMATE

The Mediterranean region, despite the variations which exist between geographically distant places, maintains constant characteristics which make the Mediterranean climate an element unifying the landscapes, vegetation, agricultural calendar and products throughout the region.



The climate of the Mediterranean region, although complex and with strong contrasts because of its geography and the complex topography which exists along the coasts, maintains some constants which characterise it. The summer is almost entirely dry, with the highest rainfall being in spring and autumn.

The Mediterranean climate is typified by mild, windy and humid winters, whilst the summers are hot and dry. Rainfall is relatively scarce with the heaviest rainfall being recorded in autumn and spring.

The annual temperature variation is moderate, with warm summers and mild winters.

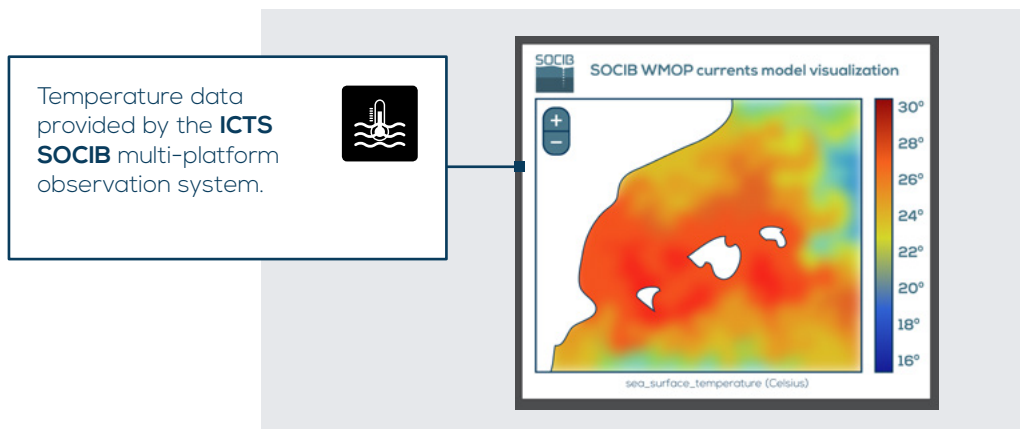
This climatology means that water loss from the Mediterranean is not compensated for, a chronic deficit is created by high rates of evaporation as a result of strong sunshine and prevailing winds, and insufficient water is contributed by rivers and rainfall (only half that evaporating). This deficit would lead to the Mare Nostrum drying up in little more than 2,000 years if the losses were not compensated for by the entry of Atlantic water via the strait of Gibraltar.



## 1.7 THE MEDITERRANEAN, A SMALL SCALE LABORATORY

Researchers view the Mediterranean sea as a “mini laboratory”. The physical processes of the great oceans (such as eddy current formation, the formation and descent of dense water masses, or the effects of climate change) occur in the Mediterranean on a smaller scale, making it an ideal system for addressing the complexity and advancing our understanding of the oceans.

The knowledge acquired from the 70-plus research centres located on its shores, and on board flagship research vessels from around the world which have carried out numerous field studies in these waters, has helped us to understand oceanography and marine biology on a worldwide scale. In order to study them, researchers require the data collected by satellites and observation systems. With this data, in the same way the (atmospheric) weather is forecast, they are capable of making forecasts about what will occur and why in the oceans.



The Coastal Observation and Prediction System of the Balearic Isles (SOCIB) has a modelling and forecasting system for the western Mediterranean, and particularly for the Balearic Sea, called WMOP (Western Mediterranean Sea Operational System) which offers a prediction of the temperature, the salinity and the currents in the Western Mediterranean for the next three days.

To verify the reliability of the model this system is evaluated on a daily basis, using the data provided by the ICTS SOCIB cross-platform observation system.







## A.1.3.

## THE SEA AND ITS WEATHER MAP

The sea is exactly the same as the atmosphere: they are two fluids that can be studied using the same physics laws. In the atmosphere there are fronts, anticyclones and depressions which also occur in the sea. In the same way life on land is marked by the weather, life in the sea is conditioned by the marine weather.

Check the marine weather forecast on the SOCIB WMOP display:

<http://thredds.socib.es/lw4nc2/index.html?m=wmop>:



- 1- *Can you identify the areas with the warmest water? And those with the coldest water?*
- 2- *Do you think this influences marine currents?*

You can get further information by consulting the topic  
**MARINE CURRENTS**



## 1.8

## THE MEDITERRANEAN, THE BIRTHPLACE OF CULTURES

The Mediterranean can be considered the aggregate of various seas with centuries-old names, such as the Ionian Sea, the Adriatic Sea or the Aegean Sea. If the Mediterranean is outstanding in a single aspect, it is for its significant role in history.





Fig. 1.6



The growth of **Greek** civilisation and its commercial expansion around the Mediterranean loom over the history of the “*Mesogeios Talasa*” or sea between lands. The Greeks have gone down in history as the creators of philosophy and modern science and the democratic government of its towns is the basis for Western thinking.

**The Phoenicians**, who lived in the Lebanon and the extensive regions of Syria, Palestine, Jordan and Israel, were a huge naval and commercial force in the central Mediterranean. They created a link between the civilisations of the Mediterranean Sea and left a significant cultural legacy, a trading system and the alphabet.



The **Bosphorus** has always been a highly significant point for trade flows.



**The Roman Empire** and its conquests made its mark on history by uniting the entire Mediterranean. The Mediterranean was no longer the “sea between lands”, it became “*Mare Nostrum*” (our sea).



The development of important civilisations in the Aegean Sea: **The Cyclades**, Cyprus, Crete and Mycenae, being strategically located, set up a veritable maritime empire in the area which was commercially and culturally magnificent.



The city of **Carthage**, which was a Phoenician colony, became highly developed as a commercial and cultural enclave.



The expansion of **Islam** from the Arabian peninsula to the Iberian peninsula united the south of the Mediterranean.



The first civilisations appear next to large rivers and on the coast. The large river basins of the Nile, Tigris and Euphrates were where **the Egyptian**, Mesopotamian and Palestinian cultures flourished.



**The Hebrews** were originally nomadic people who believed in the existence of a single God.





The Mediterranean has been the cradle of empires, religions and cultures, the stage where great civilizations have developed. Its waters a source of life and a supply of food, great routes emerged for conveying knowledge, products and philosophical and religious values which shaped the cultural heritage of the inhabitants of the Mediterranean (figure 1.6 page 15).

The Mediterranean has particular physical characteristics, it is very long and narrow and it has numerous islands, which serve to form links and facilitate crossings from north to south. These characteristics facilitate communications between the coastal villages of three continents: Europe, Africa and Asia.



A.1.4.

### THE MEDITERRANEAN AND THE FIRST SEAFARERS

**Separate groups and communities with different experiences of organisation and development have coexisted over time in the Mediterranean basin. The Mediterranean is the place where humanity learnt to live together.**

**Write down which cultures you know about and their contemporary legacies.**







## GLOSSARY

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### **Marine currents:**

Marine currents are masses of water moving within the oceans at different depths and in specific directions. They could be considered to be “rivers within the ocean”. Their existence so far is attributed to the differences in temperature and salinity between masses of water, the earth’s rotation and the winds, etc.

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### **Colioris Force**

The Earth’s rotation has an influence on the atmosphere and also on oceanic circulation. The Coriolis force drives marine currents clockwise in the northern hemisphere and anti-clockwise in the southern hemisphere. The same thing happens with the general circulation of winds, creating cyclonic and anti-cyclonic rotations in the atmosphere and the ocean.



All aspects of this unit have shown the Mediterranean to be a physically confined space, with characteristics which make it unique: its waters, its climate, its biological wealth and its historical legacy. The future of the Mediterranean sea depends on our knowledge of it, and on how much love and care we invest in it from now onwards..

