
MAR MENOR - SPAIN

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The Mar Menor (Spain) is a coastal lagoon in the SE of the Iberian Peninsula. It has a surface of approximately 135 Km² and a mean depth of 4 m. From the 1960s the lagoon has suffered from a continuous increase of the tourist population (with increased urban waste water discharge) during the summer. Furthermore, there has been a considerable increase of the irrigated land, which has increased the nutrient load to the lagoon.

These two factors have produced significant changes in the ecosystem with the abnormal proliferation of jellyfish during the last five years with considerable economical repercussions to the tourism and the local fisheries. The main problem in this lagoon is to formulate a sustainable development strategy able to combine all these competing factors.

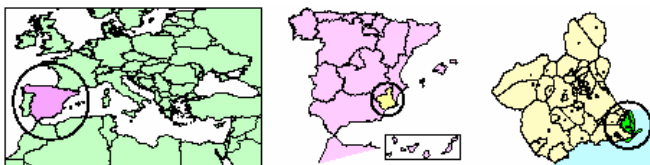


Figure 1: Location of the Mar Menor Lagoon

The lagoon is semicircular in shape; it is separated from the Mediterranean Sea by a 24 Km long sand strip with width varying between 100 and 1.200 m. There are several small channels that connect the lagoon with the Sea. Inside the lagoon there are five islands of volcanic origin.

The salinity in the lagoon oscillates between 42-47, which is higher than the Mediterranean Sea (36-37), and the water temperature has mean values of 12°C during the winter and 30°C during the summer, the shores reach even higher values. There is no permanent watercourse due to the low annual precipitation (around 300 mm), however; there are several riverbeds (dry for long periods) that channel water from the Campo de Cartagena. The oxygen content is high and the nutrient concentrations are low.

Protected site. Mar Menor is:

- RAMSAR Site since 1994 as habitat for aquatic birds
- Area of Special Protection for Birds
- Proposed as Special Conservation Site under the Habitat Directive
- Recently designed as Specially Protected Area of Importance for the Mediterranean Sea, according to the Barcelona Agreement

and protected Nationally through:

- Protected Area under Act 4/1992
- Area of Ecological Sensibility under Act 1/1995
- Area of Protection for Wildlife under Act 7/1995



Figure 2: Watershed and coastal zone of Mar Menor

The main characteristics of the *Campo de Cartagena* basin which drain into the Mar Menor are:

- The watershed is drained by several ephemeral channels (*Ramblas*) such as the *Rambla del Albuji6n*. Climate and hydrology are characterised by floods and torrential events due to heavy rainfall,
- Agriculture is the dominant land use,
- Sub-surface inflows coming from agricultural drainages generated by a recent increase of irrigation,

- There are five interconnected aquifers. The Andaluciense and Plioceno aquifers are the most important,
- Aboveground water has high levels of salinity and nutrients content.

There are a number of wetlands associated with the lagoon system including the protected area of Playa de la Hita, Marina del Carmolí and Lo Poyo. Located in the northern sector of the Mar Menor river basin are salt mines, which may be considered a key economical activity and a model of harmonization and sustainable management of natural resources

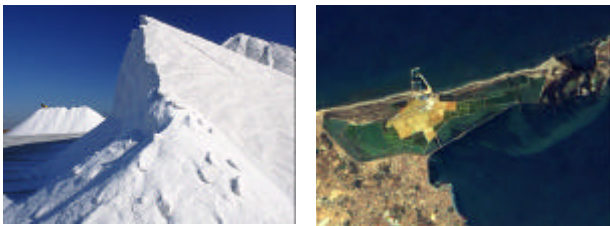


Figure 3: Salt mines in the Natural Park of Salinas de San Pedro del Pinatar

Fishing in the *Encañizadas* system by means of rectangular receptacles made in canes is another traditional and sustainable human activity



Figure 4: Traditional fishing system

Since historical times, the Mar Menor has been one of the main economic sources in the coastal zone of Murcia province and past and current human activities have had an impact on the lagoon. These include mining, agricultural, fishing, industry, tourist, recreational uses. Mining is one of the oldest activities. Until 1950, tailing wastes were disposed of through the watercourses flowing into

the Mar Menor. This generated an important input of heavy metals into the lagoon and which have accumulated in the bottom sediments.

In 1973 the opening in the lagoon of the *El Estacio* channel gave rise to strong hydrographical changes, with subsequent alterations in the biota. The increased water exchange with the Mediterranean brought about a process mixing, with a marked salinity decrease of salinity, although it is still higher than that of the Mediterranean. Extreme water temperatures conditions are also more moderate than before.



Figure 5: Tourism is one of the anthropogenic pressures affecting the lagoon

Other processes contribute to these changes: the filling-in of some parts of the Mar Menor shore to create artificial beaches, the construction of marine sports facilities. Urban-tourist and agricultural activities are main factors threatening the Mar Menor lagoon and associated wetlands.

Tourist infrastructure construction has lead to the proliferation of summer housing and the creation of artificial beaches by means of the filling-in of the Mar Menor shores. Between 1937 and 1976 the built-up area has increased from 12% to 54%.

Seasonal tourist population and deficiencies in sanitary infrastructure also have generated a waste management problem reflected in high levels of faecal coliforms concentrations in summer months (some days over 100 cell/100 ml, making waters unsuitable for bathing).

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