

Lagoons Technical Brief

Integrated water resources and coastal zone management in European lagoons in the context of climate change

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The Mar Menor Lagoon, Spain

Although numerous studies have been carried out in the Mar Menor lagoon, a better understanding of the interactions between changes in the lagoon watershed and their consequences on the lagoon functioning is still necessary. Especially studies of the impact of nutrient loads from tourism and agriculture on the eutrophication of the lagoon are needed.

The Mar Menor Lagoon, Spain

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Abstract

The Mar Menor is a hypersaline coastal lagoon located in a semi-arid region of southeast Spain. The importance of the lagoon and its salt marshes in terms of biodiversity has been recognised in numerous international protection schemes. The lagoon and the associated watershed areas comprise a whole variety of human uses including large tourist resorts and intensively irrigated agriculture. During the last decades these human activities in the area have promoted several changes in the environment, including planktonic changes, macrophyte species substitution and undesirable jellyfish blooms. There is an increasing need to develop new strategies for a more sustainable development of the area in order to reduce human impacts on the valuable ecosystem goods and services provided by the lagoon, not least its biodiversity. An understanding of the interactions between watershed processes and lagoon function and health is crucial if we are to design successful strategies in the Mar Menor, which can reduce or alleviate the possible consequences of future global climate change. Although numerous studies have been carried out in the Mar Menor lagoon, a better understanding of the interactions between changes in the lagoon watershed and their consequences on the lagoon functioning is still necessary. This especially holds true for the impacts from tourism and agriculture on the eutrophication of the lagoon.

References

This Brief is based on the following research reports and scientific literature:

- Cabezas, F., Martínez, A. (2009) El Mar Menor. Estado actual del conocimiento científico. Instituto Euromediterráneo del Agua. 540 pp.
- Martínez, C., Esteve, M.A., Llorens, M. (2003) Los recursos naturales de la Región de Murcia: un análisis interdisciplinar. Universidad de Murcia. 438 pp.

Fact box

The distinctive natural landscape as well as the highly productive agricultural areas surrounding the Mar Menor lagoon have long been attractive for human populations in the area. It is nowadays one of the most productive and profitable agricultural areas in Europe and every summer thousands of tourists visit the lagoon. However, both activities have been shown to have a profound impact on the maintenance of the valuable ecosystem goods and services that make this area attractive.

Characteristics of the lagoon

The Mar Menor lagoon is a hypersaline coastal lagoon located in a semi-arid region of southeast Spain. It covers an area of about 135 km², and its watershed area Campo de Cartagena occupies a surface of about 1 440 km², mainly drained by El Albuji3n wadi (Figure 1).

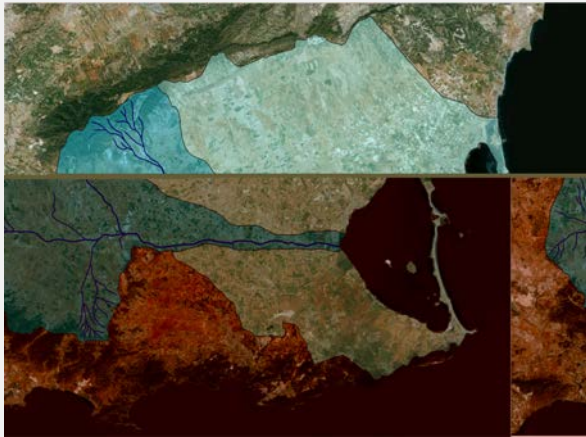


Figure 1 | The Mar Menor coastal lagoon and its watershed area Campo de Cartagena (light blue), drained by El Albuji3n wadi (dark blue).

The area presents a sub-desertic Mediterranean climate, characterized by warm and dry weather conditions. The scarce precipitations (<300 mm·yr⁻¹) mainly occur during storm events in autumn and winter (Figure 2).

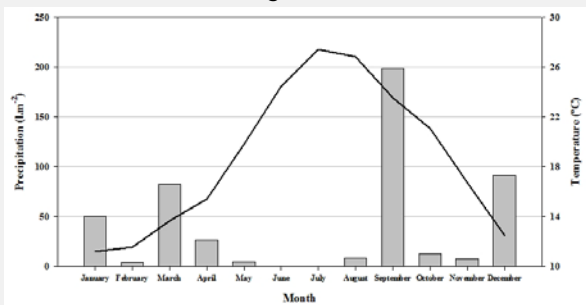


Figure 2 | Monthly temperatures and rainfall in the Mar Menor area (2009) (source: AERM 2009)

The importance of the lagoon and its salt marshes in terms of biodiversity has been recognized in numerous international protection schemes: It has been a Ramsar International site since 1994; it is considered a Special Protected Area of Mediterranean Interest (SPAMI) established by the Barcelona Convention in 2001; and it is a Site of Community Importance (SCI)

to be integrated in the Nature 2000 Network (EU Habitats Directive). The zone is also a Specially Protected Area (SPA) for the nest building, migration and wintering of aquatic birds, protected by Birds Directive 79/409/CEE.

A wide variety of uses are represented in the area, including mining and fishing activities, military facilities and urban areas. However, the most important activities in the Mar Menor lagoon and its surrounding areas are tourism and intensively irrigated agriculture (Figure 3).

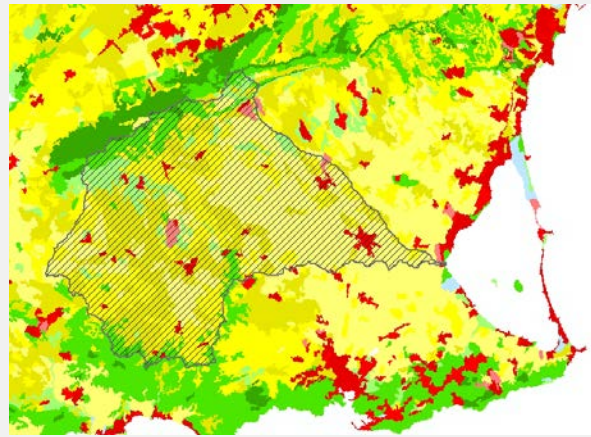


Figure 3 | Land uses in the Mar Menor area and El Albuji3n watershed. Urban areas are coloured red, agricultural areas are yellow, vegetated areas are green and wetlands are light blue (Source: CORINE Land Cover 2006)

Although tourism and agriculture together provide the basis for local economies, these activities constitute a source of conflict both for the use of water resources and for the maintenance of the ecological conditions that support these activities themselves. A clear example of such conflicts and their consequences can be observed every summer when nutrient inputs cause undesirable jellyfish blooms in the lagoon, with negative impacts on tourism. Other consequences are increasing eutrophication and diminished water quality, as well as the substitution of the main benthic macrophytes in the bottoms, caused by the enlargement of one of the channels that connect the lagoon with the adjacent Mediterranean, and aggravated by diminished water transparency due to increased inputs through El Albuji3n (Figure 4).



Figure 4 | The bottoms of the lagoon covered by a monospecific bed of the macroalga *Caulerpa prolifera*.

Socio-economic facts and conflicts

Historically, external nutrient inputs to the Mar Menor were mainly via groundwater and atmospheric deposition, in part due to the high ratio of sediment surface area to water volume and lack of major watercourses. However, the area surrounding the Mar Menor has experienced an intensification of agricultural practices and tourist activities that have resulted in increased nutrient inputs to the lagoon.

Tourism constitutes the main source of phosphorus to the lagoon waters. The situation is aggravated in summer when large numbers of tourists visit the area. The marked seasonality of tourism (July to September) is evident when comparing the numbers of the permanent local population of about 45 000 inhabitants to the tourist population that reaches about 450 000 during summer months (Figure 5).

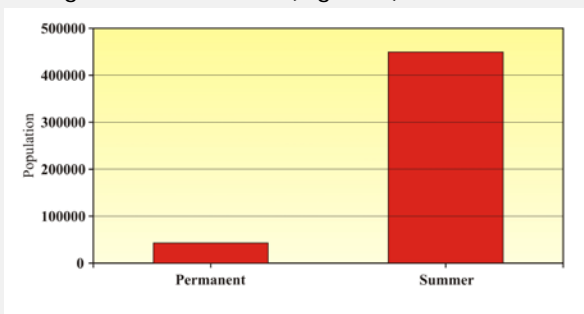


Figure 5 | Permanent and summer population in the Mar Menor area.

Water derived from the Tajo-Segura river diversion generated a profound transformation of

the agricultural practices in the adjacent agricultural area, Campo de Cartagena, changing from extensive dry crop farming of cereals, olives, almonds and carob beans to intensively irrigated crops (Figure 6). At present, Campo de Cartagena is one of the most productive and profitable agricultural areas in Europe, and the use of water, fertilisers and pesticides has increased dramatically.

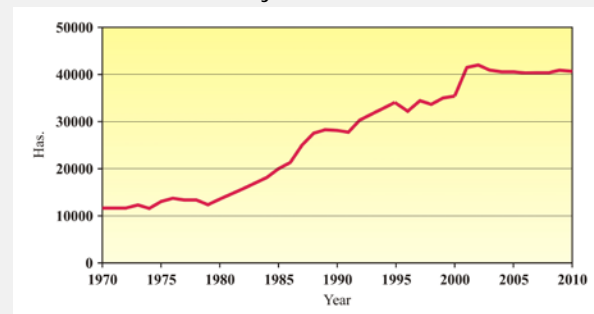


Figure 6 | Evolution of hectares occupied by intensively irrigated crops in Campo de Cartagena (1970–2010) (source: Martínez and Esteve, 2005; www.carm.es)

Laws, rights and conflicts

The Mar Menor is managed within a complex policy and legislative context, with a wide variety of local, regional and national institutions and actors involved. Although the main sources of conflicts are those derived from the use of the scarce water resources in the area, the consequences of human activities and their impact on the lagoon environment constitute a great challenge for the lagoon and its watershed management.

Knowledge gaps & recommendations

Although numerous studies have been carried out in the Mar Menor, a better understanding of the interactions between changes in the watershed and their consequences on the lagoon environment is still necessary, especially those related to biodiversity losses and the increase of eutrophication. The consequences of global climate change in the area and the possibility of aggravated eutrophication in the Mar Menor lagoon needs to be addressed in order to develop successful management strategies in the area to protect this valuable ecosystem and its services.



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