UNITED NATIONS

EP

UNEP/MED CC.16/Inf.6

UNEP

UNITED NATIONS
ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

5 May 2020
Original: Spanish

16th Meeting of the Compliance Committee of the Barcelona Convention and its Protocols

Teleconference, 16-18 June 2020

Agenda Item 7: Follow-up on previous Communication to the Compliance Committee under Paragraph 23.bis of the Procedures and Mechanisms on Compliance

Documentation submitted by Spain in support to its response to the communication from Ecologistas en Acción de la Región Murciana (Spain)

Note by the Secretariat:

This document presents documentation submitted by Spain supporting its response to the communication from Ecologistas en Acción de la Región Murciana (Spain) in document UNEP/MED CC.16/8.

For environmental and cost-saving reasons, this document is printed in a limited number. Delegates are kindly requested to bring their copies to meetings and not to request additional copies.

UNEP/MAP
Athens, 2020

MINISTERIO
PARA LA TRANSICIÓN ECOLÓGICA
Y EL RETO DEMOGRÁFICO

SECRETARÍA DE ESTADO
DE MEDIO AMBIENTE

DIRECCIÓN GENERAL DE LA
COSTA Y EL MAR

COURTESY TRANSLATION PROVIDED BY SPAIN

SYNTHESIS REPORT ON THE CURRENT STATUS OF MAR MENOR AND ITS CAUSES IN RELATION TO NUTRIENT CONTENTS

Juan Manuel Ruiz Fernández. Instituto Español de Oceanografía
Víctor M. León. Instituto Español de Oceanografía
Lázaro Marín Guirao. Instituto Español de Oceanografía
Francisca Giménez Casalduero. Universidad de Alicante
José Alvárez Rogel. Universidad Politécnica de Cartagena
Miguel Angel Esteve Selma. Universidad de Murcia Rosa Gómez Cerezo. Universidad de Murcia
Francisco Robledano Aymerich. Universidad de Murcia
Gonzalo González Barberá. CEBAS-CSIC
Julia Martínez Fernández. Fundación Nueva Cultura del Agua

1. Evolution of the lagoon marine ecosystem

For decades, the contributions of nutrients (mainly nitrates, although also phosphate and ammonium) and organic matter to the Mar Menor have forced the change of the system, originally oligotrophic, to a eutrophic state, which defines an enrichment in inorganic nutrients (nitrogen and phosphorous) beyond the critical level of capacity self-regulating of a certain system. The entrance of these elements to the lagoon of Mar Menor has been produced both through surface runoff, especially the *Rambla del Albujón*, as of the underground waters. Through the *Rambla del Albujón* they have Accessed to the Mar Menor for decades is part of the surplus irrigation of the Mar Menor (the *Campo de Cartagena*) that have raised the levels of the aquifer, the effluents of the Los Alcázares treatment plant until March 2014 and the downloads, many of them illegal waters of rejection of desalinization plants or brines, rich in nitrates, as well as other contributions of various kinds and whose origin is often difficult to identify.

The evolution of **chlorophyll a** is a macro descriptor of this eutrophic state that is related to the development of plankton in the water column and this development, in turn, is related to the availability of nutrients. Therefore, a greater content in Chlorophyll a indicates a higher contribution of nutrients. Figure 1 shows the evolution of the chlorophyll a from the late 1990s to 2017 in the water of the Mar Menor.

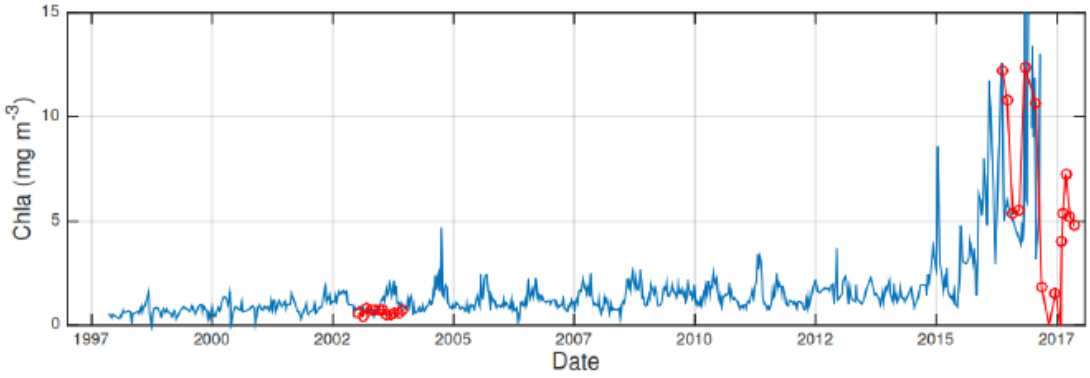

Figure 1. Evolution of chlorophyll a in the Mar Menor water column between 1998 and 2017. The blue line shows the evolution obtained from the spectral analysis of satellite images. Points and lines red are chlorophyll values obtained directly from water samples analyzed by spectrophotometry. Source: Belando et al (2019).

Until 2015 the chlorophyll a values were very low, typical of an oligotrophic system, although in the 2000s some peaks were already observed that warned of the risk of eutrophication, especially in the area of influence of the *Rambla del Albujón* (southwest of the lagoon). Since the end of 2015 and the first months of 2016, growth was confirmed unusual phytoplankton (Aguilar et al, 2016) and already in the summer of 2016 it shot up sharply the chlorophyll level as an indicator of said phytoplankton growth. The waters are they turned cloudy and green throughout the lagoon (it is the so-called **eutrophic crisis** of 2016 in the Mar Menor). The light stopped reaching the bottom and as a consequence 85% of the benthic vegetation of the Mar Menor disappeared, as shown in Figure 2 and, with it, all the organisms associated with the fund.

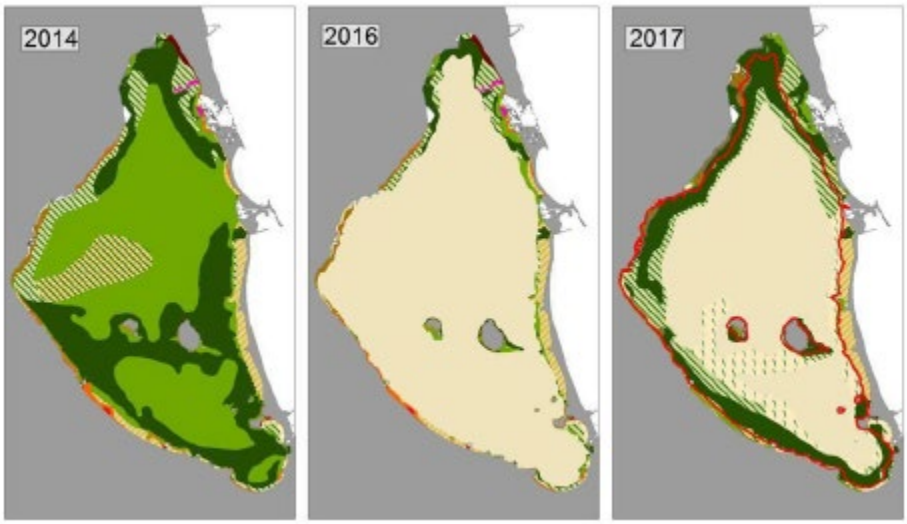

Figure 2. Evolution of the surface occupied by seagrass meadows in the Mar Menor. The Colors and green stripes represent the vegetation cover of the Mar Menor bottom between 2014 and 2017. Source: Belando et al (2019), IEO.

Figure 3 shows a comparison of the appearance of the background in 2014 (left) before of the massive phytoplankton growth event, fully colonized by vegetation and as it was after the episode in 2016 (right), which caused the death of the vegetation and bottom sessile fauna, in which the superficial bacterial layer of environments is perceived sedimentary affected by extreme eutrophication. Both images correspond to same place.

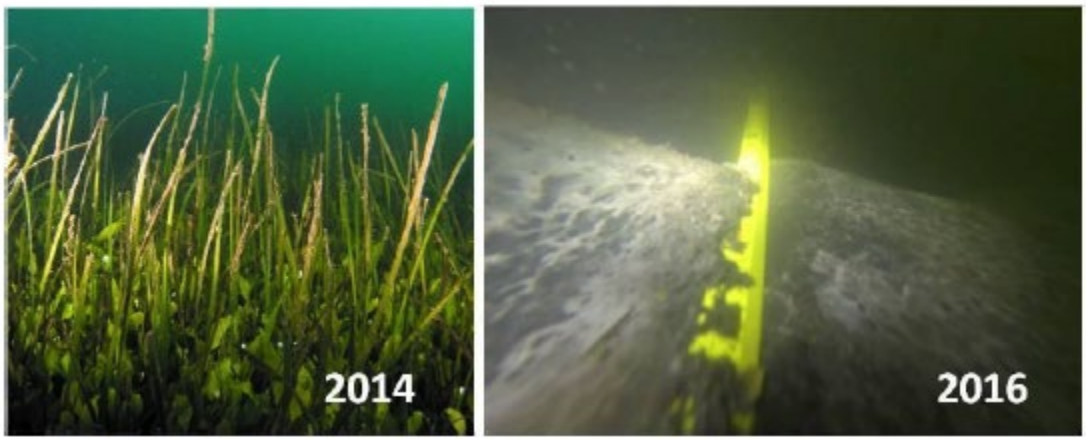

Figure 3. Cymodocea nodosa and Caulerpa community proliferates at 5 m depth in 2014 (left) and appearance of the same site during the 2016 sampling. Source: Belando et al (2019), IEO.

This episode caused the death of a high amount of plant biomass (of the order of 20,000 tons) and with it the accompanying sessile fauna and its subsequent decomposition. With it, not only organic matter but also nutrients Minerals were largely stored in the sediment. This compartment constitutes an important reservoir of nitrogen, phosphorus and organic matter of the ecosystem lagoon, both as a result of these contributions and the spills it has suffered as a result over the years. On the other hand, the disappearance of the benthic vegetation meant the loss of a key element in the regulation of nutrient levels in the column of water and its exchanges with the sediment. This unbalanced the biogeochemical cycles and converted the lagoon bottoms into a source of soluble carbon, ammonium and phosphate at expense of microbial activity in the sediment. Bliss, activity, that you see increased with the rise in summer temperature, accentuates the flow of nutrients and carbon from the sediments to the water column during the warmer months. Álvarez-Rogel et al. (2019) estimated that in 2018 the sediment contributed to the column of water about 130 tons of ammonia and about 1.5 tons of phosphate by diffusive flow. This reservoir of nutrients in the bottoms and the absence of benthic vegetation for regulate its flows to the water column, make the lagoon especially sensitive to re-suspension and abrupt oxygenation of the sediment, as this could cause a peak of release of these nutrients, bringing a bloom of phytopanctonic development.

In 2018, mainly due to environmental conditions and the succession of processes self-regulating inlets of the lagoon, the transparency of the water of the Mar Menor returned to values similar to those existing before the 2016 event and from certain areas interpreted as an ecosystem recovery. However, community members scientist that includes researchers from the Spanish Institute of Oceanography (IEO), the University of Murcia (UMU), the University of Alicante (UA), the Edaphology Center and Southeast Applied Biology of the Higher Council for Scientific Research (CEBASCSIC), the Polytechnic University of Cartagena (UPCT) and the New Culture Foundation of Water (CANF), we consider that **the scientific evidence and the real circumstances do not supported a recovery diagnosis**. Basically there was still a serious alteration of the ecosystem.

After the loss of vegetation, which was the main element that controlled the cycles and nutrient flows between the sediment and the water column, the vulnerability of the ecosystem increased, with no or very slow recovery rate. In fact, in 2019 the concentration of chlorophyll a in the water column, **progressively increased to reach levels similar to the 2015-2016 ranges**. This was evident in late August 2019, just before the DANA that occurred in September, as shown in figure 4.

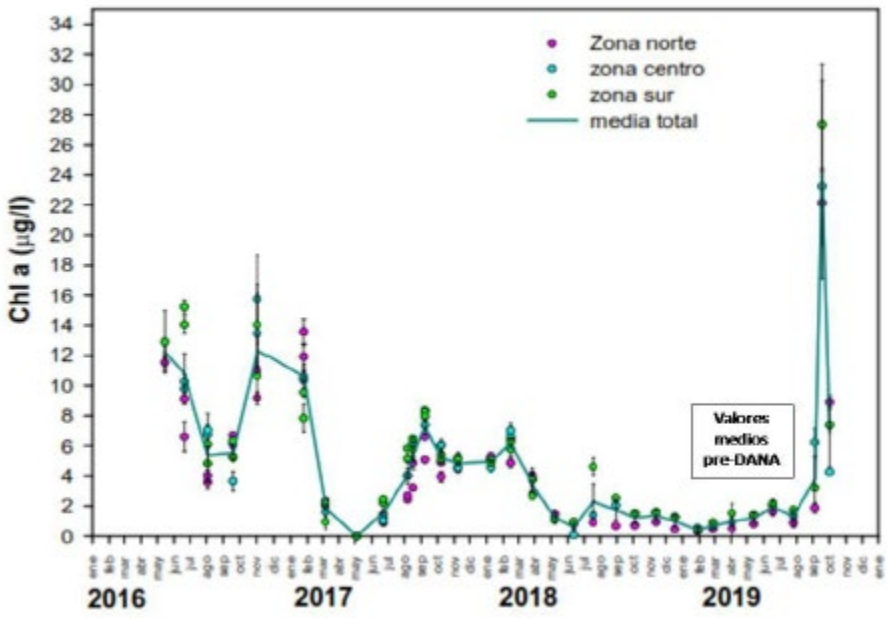

Figure 4. Evolution of chlorophyll a in the water of the Mar Menor between April 2016 and October 2019. Source: IEO (2019).

After DANA, the entrained water from the rain mixed with the surface layer of water from the lagoon and chlorophyll levels increased very sharply to levels above the 2016 highs, which has been attributed to the massive influx of nitrogen, phosphorous and organic matter associated with the entry of water, terrigenous sediments and materials carried from the Campo de Cartagena. Chlorophyll decreased few days later, although at the end of October it increased again to reach the ranges measured in 2016. Meanwhile, the deep-water layer (characterized by the conditions of salinity and phytoplankton load of the lagoon water prior to DANA) was isolated. The water column was stratified, forming a less saline surface layer, reducing the transfer of atmospheric oxygen to deeper parts of the water column. In parallel, the high turbidity of the water drastically reduced the light reaching the background, preventing the production of oxygen by the photosynthetic activity of the vegetation benthic. In the deep-water layer from 3m deep, oxygen is depleted and values of 0 ppm were reached, as a consequence of the decomposition of matter organic present (both existing and introduced during the floods). The black colour of the water and smell of hydrogen sulphide emanating from the lagoon, were clear indicators of the existence of a strong anaerobic sulfate-reducing metabolism in the deep layer anoxic (phenomenon called euxinia). One of the consequences of this metabolism is the appearance of dissolved sulfides in the water, which are toxic to many animals and plants. Euxinic water bodies are characterized by strong stratification, with an upper layer of water with oxygen and a lower layer of anoxic and sulfidic and documented in places like the Black Sea. The combination of the absence of oxygen and presence of sulfides in the deep-water layer caused the death of life associated with lagoon bottom and the massive flight of organisms of all species capable of displacement, towards the shallowest areas of the lagoon. It has been estimated that a surface over 9,000 hectares has been devastated again at the bottom of the lagoon.

On Saturday October 12 (one month after DANA) and as a result of the winds of lift, part of this anoxic and toxic layer emerged on the platform in the extreme north of the lagoon, causing an extreme oxygen deficit and release of products from the Anaerobic metabolism accumulated in deep waters, such as dissolved sulfides and hydrogen sulfide gas. The emergence of the anoxic

layer favoured the proliferation of certain types of microorganisms that accumulate sulfur, obtained by metabolizing sulfides. This is revealed by the appearance of whitish milky foams in some areas, which are formed by accumulations of this type of microorganisms. Both the lack of oxygen as the sulfides must have contributed to the death of the fauna present in an extensive area north of the lagoon. However, dead animals appeared in almost the entire length of the lagoon. Based on available data, it appears that the anoxic layer of the bottom would have been totally or partially mixed with the upper oxide layer, causing a general reduction in oxygen concentrations, with the consequent negative effects on the lagoon fauna. In late October a recovery of oxygen levels in most of the water column, especially in the central and southern part of the basin, leaving a residual layer of water in the northern zone sub-toxic (with low oxygen levels).

2. Causes of the ecological crisis in the Mar Menor

The Mar Menor has received large quantities of organic matter since the 1980s and **nutrients from discharges of diverse nature, among which are urban wastewater (currently practically suppressed, except episodes rain and point discharges) and, above all, the diffuse pollutant flows as punctual, coming from the agrarian and agricultural activity of the Campo de Cartagena**. However, while urban and agricultural discharges have been mostly focused on certain points (sewers, treatment plants, farms cattle, slurry rafts) and have concentrated on specific episodes or periods of the year with high occupation (for example, in summer), agriculture has caused, in addition to punctual discharges such as brines, a diffuse contamination both underground (to the Quaternary aquifer) as superficial (runoff, drag), due to the great extension that occupies in the basin. The main compound from the activity agricultural is nitrate, because it is the most used source of nitrogen for crops and it has a high solubility, not being retained in the soil due to its chemical structure. Phosphate applied as a fertilizer, in addition to being used in lower doses than nitrate, it is easily retained in the soils, so its leaching is scarce. In fact, the Quaternary aquifer is heavily polluted by nitrate but not by phosphate. Is difference is very important to identify the sources of contamination: waters with high nitrate content mainly have an agricultural origin and waters with high phosphate content come mainly from poorly purified wastewater, Farm and manure leachates. In addition, agricultural leachates contain little ammonium (another way in which nitrogen is applied as a fertilizer, but in this case it is retained in the soil) and very little organic matter, while the residual and those from farms can contain both components in high concentrations (García Pintado et al, 2007). Different hydrochemical and isotopic studies have made it possible to determine that the main source of nitrate contamination is the chemical fertilizers used in crops (MAGRAMA, 2015).

Between 1988 and 2009 intensive agriculture in the basin, based mainly on the fertirrigation (application of fertilizers through the irrigation system) but in which high amounts of manure are applied, it went from about 25,150 hectares to more than 55,000 hectares, according to the remote sensing studies available (Carreño, 2015). Since 2009 this transformation to irrigation has continued. The continued entry of part of the nutrients applied for decades by the superficial route (boulevards and discharge) and underground (seepage of the aquifer), it is considered a crucial factor for will trigger the 2016 eutrophic crisis. The massive death of benthic vegetation. It also constituted, together with the elimination of the main nutrient retention element, a massive contribution of organic matter and nutrients to the bottom of the lagoon, which triggered microbial activity in the sediment and made it mostly anoxic from the first millimetres. Much of the nutrients contained in the vegetation that died they were retained in the bottoms, along with the nutrients that had entered for years. In this way, to the external contributions of nutrients that it continues to receive in a continued the column of water **from the basin**, those **released by**

the own sediment (especially phosphorous and ammonium), due to mineralization processes of the accumulated organic matter. This problem is aggravated by acute episodes of ingress of water, sediment and nutrients, such as the DANA in September.

In short, the deep degradation of the Mar Menor has been caused by the process of eutrophication due to excess nutrients, degradation that the lagoon has been suffering since the eutrophic crisis of 2016 and which has been aggravated by what was caused by runoff during DANA. Preliminary estimates based on samples collected during the DANA quantify the nutrients that have entered dissolved in the water in a minimum of 500 and 1,000 tons of nitrates, 35 tons of ammonia and more than 100 tons of phosphate. The estimate is subject to sources of uncertainty that are being evaluated, but the figures provided here are considered conservative. To this we must add organic carbon and fixed phosphorus in various ways in huge amounts of sediment that entered the flood (more than 100,000 tons in an estimate also conservative). Therefore, the problem is not a consequence of the entry into itself of fresh water (which favored the formation of the two layers of water of different salinity and density), but of the nutrients carried by the water, which are the "fuel" of the eutrophic process and added to the nutrients that the lagoon already contained. In fact, As AMETSE (Southeast Meteorological Association) remembers, the rainfall data show that the avenue of November 1987 presented accumulated precipitation a third greater than this year's DANA, despite which in 1987 there were no episodes of mass mortality in the lagoon, as in many other historical episodes of avenue. A few days after DANA, water samples from the lagoon were analyzed finding nitrate concentrations around 13 mg / L, one hundred times above those that can be considered "normal". With these data and knowing the eutrophic state of the lagoon prior to the meteorological event and the tons of nitrogen and phosphorus that they entered with the floods, everything indicated that a new "green soup" would be unleashed generalized and a subsequent episode of anoxia due to system collapse**. Eutrophication, therefore, has supposed a deep degradation of the Mar Menor, which is being chronifying and it has also made it an extremely vulnerable ecosystem to multiple factors, which can vary** (DANA would be an example, but not the only one) **and acute episodes of mortality.**

The recovery of the Mar Menor will be **a long and very complex process** because, even with removing all nutrient inputs from the watershed, **releasing of nutrients from its bottoms will continue for quite some time**. Therefore the first step for recovery is to stop the entry of sediments and nutrients with **measures of prevention at source**, substantially improving the techniques and efficiency of agricultural fertilization in terms of quantities, time and application methods and to achieve that the basin itself is capable of retaining and eliminating most of the nutrients that even so, they could circulate, applying different **Nature-Based Solutions** (NBS, according to its acronym in English). Some of these solutions include: environmental recovery and functional of the channels and the whole of the hydrological network of the Mar Menor basin; the reduction of erosion risks by leveling the ground, implementing tillage systems less aggressive and improving the physical properties of the soils; the use of green covers and hedges that contribute to reduce the energy of runoff and to retain soil; the recovery of the **natural surfaces of peripheral wetlands** to the lagoon and the construction of artificial wetlands of strategic location, in combination with other systems capable of retaining and purifying runoff waters and effluents generated in the area (for example, wood bioreactors). Wetlands are also **the only systems capable of retaining and eliminating a good part of the sediments and nutrients transported in the event of floods**, which will be more frequent due to climate change. Furthermore, measures should be taken to reduce contributions from urban riverside centres, improving the sanitation network and avoiding discharges of treated or untreated urban effluents

into the lagoon. They should In this regard, the measures prioritized in the Zero Dumping Project, whose central actions in the basin are located on a different line, based mainly in public works, which do not have an analysis of its effectiveness in complying with objectives, neither risk analysis of the actions themselves, nor a cost-effectiveness analysis of the different options.

In relation to possible actions in the lagoon, it should be noted that approaches How to increase the contributions of water from the Mediterranean are not an option for solve the problem, since they do not act on its origin and would also cause effects Completely undesirable collaterals. Following the guidelines of the "Strategy state of green infrastructure and ecological connectivity and restoration ", always ***passive restoration*** should be considered as the first option, evaluating whether the elimination of the pressure caused by the impact results in a natural recovery. They must ***prioritize nature-based solutions*** and enhance the development of ***green-blue infrastructure***. It is necessary to evaluate the potential costs and the multiple benefits of ecosystem restoration at relevant scales, conduct studies of cost / benefit of actions in order to prioritize the most efficient actions and apply the precautionary principle and adaptive management when applying possible actions, in order to minimize the risks of possible unwanted effects.

Finally, the effectiveness of the actions that are launched has a clear thermometer: the real state of the habitats, communities and species of the Laguna del Mar Minor, as well as those of the adjacent strip of the Mediterranean, the coastal wetlands of the lagoon and other protected areas associated with the Mar Menor. An implementation hasty, insufficient or inadequate restoration measures, will compromise seriously applying recently approved planning and management instruments such as Decree No. 259/2019, of October 10, declaring Special Zones of Conservation (ZEC), and approval of the Comprehensive Management Plan for protected areas of the Mar Menor and the Mediterranean coastal strip of the Region of Murcia. Recover the good ecological status of all these spaces in an integral way, which have multiple national and international protection figures, must be the ultimate purpose of such performances.

References

Aguilar Escribano, J., Gimenez-Casalduero, F., Mas Hernández, J., & Ramos-Esplá, A. A. (2016). Evaluación del estado y composición de la Comunidad Fitoplanctónica de las aguas del Mar Menor, Murcia (mayo de 2016).

Álvarez-Rogel, J. (coordinador). 2019. Informe final de la Asistencia Técnica Estudio biogeoquímico de los fondos del Mar Menor (Murcia) – Caracterización geoquímica de sedimentos. Ref. Tec0004881. Grupos de Investigación Edafología Ambiental, Química y Tecnología Agrícola (ETSIA-Universidad Politécnica de Cartagena)-Seagrass Ecology Group-IEO (Centro Oceanográfico de Murcia)- Cartografía de suelos y paisaje, físicoquímica, degradación y recuperación de suelos y aguas (Universidad de Santiago de Compostela). TRAGSA-CARM-FEDER.

Belando-Torrente MD, García-Muñoz R, Ramos Segura A, Bernardeau-Esteller J, GiménezCasero J, Marín-Guirao L, García-Moreno P, Franco-Navarro I, Fraile Nuez E, MercadoCarmona J, Ruiz JM. 2019. Collapse of macrophytic communities in a eutrophicated coastal lagoon. XXth Simposio de Estudios del Bentos Marino. Braga (Portugal). Septiembre 2019.

Carreño, M.F. 2015. Seguimiento de los Cambios de Usos y su Influencia en las Comunidades y Hábitats Naturales en la Cuenca del Mar Menor, 1988-2009, con el Uso de SIG y Teledetección. Tesis Doctoral. Universidad de Murcia.

García-Pintado, J., Martínez-Mena, M., Barberá, G., Albaladejo, J., Castillo, V.M., 2007.

Anthropogenic nutrient sources and loads from a Mediterranean catchment into a coastal lagoon: Mar Menor, Spain. The Science of the Total Environment 373, 220–239. IEO. 2019. Informe parcial de resultados sobre la evolución de los efectos de la DANA en el Mar Menor. Seagrass Ecology Group-IEO, Centro Oceanográfico de Murcia.

MAGRAMA. 2015. Caracterización de las fuentes de contaminación de aguas subterráneas mediante técnicas multisotópicas. Ministerio de Agricultura, Alimentación y Medio Ambiente.

MINISTERIO
PARA LA TRANSICIÓN ECOLÓGICA
Y EL RETO DEMOGRÁFICO

SECRETARÍA DE ESTADO
DE MEDIO AMBIENTE

DIRECCIÓN GENERAL DE LA
COSTA Y EL MAR

COURTESY SUMMARY AND TRANSLATION PROVIDED BY SPAIN
OF THE CONTENTS OF THE
REPORT "ACTIVITIES, USES AND PRESSURES IN THE MAR MENOR. EXTRACT OF THE INFORMATION AVAILABLE IN THE MARINE LEVANTINO-BALEAR DEMARCATION AND THE MAR MENOR LITORAL EDGE PROTECTION PLAN (E.S.T. 2017-2020 / 66)"

This document summarizes the contents of the report "ACTIVITIES, USES AND PRESSURES IN THE MAR MENOR. EXTRACT OF THE INFORMATION AVAILABLE IN THE LEVANTINE-BALEARIC MARINE DEMARCATION AND IN THE MAR MENOR COASTLINE PROTECTION PLAN (E.S.T. 2017-2020/66", carried out by CEDEX at the request of the Directorate General of the Coast and the Sea (DGCM).

Document index:

MEMORY
1. BACKGROUND AND PURPOSE
2. THE MAR MENOR IN THE CONTEXT OF MARINE STRATEGIES
3. INVENTORY OF USES AND ACTIVITIES
4. PLAN FOR THE PROTECTION OF THE MAR MENOR COASTLINE

ANNEXES
Annex I. Analysis of activities in the Levantine-Balearic Marine Demarcation. Mar Menor Extract
Annex II. Analysis of pressures and impacts in the Levantine-Balearic Marine Demarcation, Mar Menor Extract.
Annex III. Extract from the Plan for the protection of the Mar Menor coastline.

1. BACKGROUND AND PURPOSE

The context of the request for this report by the Directorate General for the Coast and the Sea (DGCM) to CEDEX is explained:

Given the situation in which the Mar Menor lagoon that is aggravated by the effects of the recent cut-off low, the DGCM asked CEDEX for a report that should collect information related to the analysis and characterization of activities, uses and pressures in the geographical area del Mar Menor. The report should be prepared in the context of the work carried out by CEDEX in the framework of the existing contract "Applied research, technological development and innovation in matters under the jurisdiction of the General Directorate (2017-2020)". Through this contract CEDEX has been carrying out a series of works oriented to the implementation in Spain of European Directives for the protection of the marine and coastal environment such as the Framework Directive of the Marine Strategy and to the preparation of a series of Strategies for the protection of the coast in a selection of sites.

In this report, the detail referring to the Mar Menor has been extracted from the results of some of these works carried out by CEDEX for the DGCM, specifically:

- Update of the analysis of activities, pressures and impacts of the Levantine-Balearic demarcation within the process of updating the initial evaluation of the **second cycle of marine strategies** (hereinafter, EEMM), published in July 2019.
- The work carried out in relation to the Inventory of uses and activities for inclusion in the **Summary of the Maritime Spatial Planning Plan** that will shortly be released for public consultation, in application of the Maritime Spatial Planning Directive.
- The draft of the **Plan for the protection of the Mar Menor coastline**, which as of the date of issuance of this report is in its final phase of drafting.

2. THE MAR MENOR IN THE CONTEXT OF MARINE STRATEGIES

The Marine Strategy Framework Directive (MSFD) requires Member States to include in the Initial Assessment, for each of their marine regions, an analysis of the main impacts and pressures that influence the environmental state of the marine environment. The pressures to be analyzed must be based on the indicative list of elements collected in Table 2 of Annex III of the MSFD, which corresponds to Annex I of Law 41/2010, of December 29, on the protection of the marine environment. The complete analysis of the pressures in the Levantine-Balearic marine demarcation is included in the document **"Part II. Analysis of Pressures and Impacts"** of the Marine Strategy.

Likewise, in the framework of the economic and social analysis collected by the marine strategies, a characterization of the main human activities has been carried out, also determined by Annex III of the MSFD. The original document, without express references to the Mar Menor, is part of the document **"Part III. Economic and social analysis"**.

In the report summarized here, both analysis have been adapted to better illustrate the information related to the Mar Menor when this information is of interest or was available.[1]

In this update to characterize the pressures the data have been provided by the autonomous communities and other competent administrations ("data flows") such as the General Directorate of the Merchant Marine, the General Secretariat of Fisheries, the General Directorate of Wate, Ports of the State, among others, in response to requests made by the DGCM, within the data flow of human activity monitoring programs.

On the other hand, information published by the different competent authorities has not been included in the data flow due to its public nature, such as, for example, certain information related to Ports of the State, the Nuclear Safety Council or the General Sub-Directorate of Hydrocarbons. Information gaps, on certain occasions, have been remedied by direct requests for information.

It is highlighted that the treatment and characterization of the activities and pressures is carried out **at the level of the marine demarcation**, therefore including only overall aspects, without

[1] The complete analysis, including the sources of information consulted for its realization, can be found at the link https://www.miteco.gob.es/es/costas/temas/proteccion-medio-marino/estrategias-marinas/demarcacion- levantino-balear /default.aspx, along with the other documents that make up the second cycle Levantine-Balearic marine strategy.

addressing those other details such as the case of the Mar Menor, and using indicators whose data are available for the whole demarcation.

Annexes I and II of the report detail the human activities and pressures analysed in the Levantine-Balearic marine demarcation, for some of which it has been possible to extract specific information for the Mar Menor.

3. INVENTORY OF USES AND ACTIVITIES

The second of the works is related to the implementation in Spain of the **Maritime Space Planning Directive** and the commission made to CEDEX by the DGCM to describe and inventory the different maritime activities and uses included in article 10 of Royal Decree 363/2017 which includes a framework for the management of maritime space, in application of Directive 2014/89/EU, for the management of maritime space.

The Inventory of Uses and Activities for maritime planning plans, currently in preparation, gathers the information available in CEDEX, improved with a first round of contacts with the competent Administrations, and there is still work to be done for its completion, especially that which corresponds to the CCAA that have not been consulted yet.

These uses and activities to be considered in the Maritime Planning Plans are indicated below:

a) aquaculture areas;
b) fishing areas;
c) facilities and infrastructure for the exploration, exploitation and extraction of oil, gas and other energy resources, minerals and mineral aggregates, and the production of energy from renewable sources;
d) shipping routes and maritime traffic;
e) landfill areas;
f) the different types of areas defined in Law 8/1975, of March 12, of areas and facilities of interest to National Defence, as well as the marine areas used for the development of exercises by the Armed Forces;
g) protected areas, places and habitats that deserve special attention for their high environmental value and protected species, especially those available in the Spanish Inventory of Natural Heritage and Biodiversity;
h) raw material extraction areas;
i) scientific research;
j) the laying of submarine cables and pipelines;
k) tourist, recreational, cultural and sports activities;
l) underwater cultural heritage;
m) the elements among the lists or other additional elements that must form part of the green infrastructure of article 15 of Law 42/2007, of December 13, on Natural Heritage and Biodiversity.
n) The expansion of the port service areas;
o) The areas of water extraction and evacuation of brines in desalination plants;
p) The areas intended for CO2 storage;
q) The areas destined for the creation of artificial reefs

Much of the information corresponding to these uses and activities in the Levantine-Balearic marine demarcation comes from the Marine Strategy of said demarcation (section 1 of this report).

Although the inventory of uses and activities is in preparation, two maps are presented in the report that illustrate the location of the main uses and activities in the Mar Menor (Illustrations 1 and 2).

4. PLAN FOR THE PROTECTION OF THE MAR MENOR COASTLINE

This plan has been carried out at the request of the DGCM. The Plan has been divided into three parts:

1st Part: Description of the physical environment (coastal and river, coastal and port works) and environmental conditions, of great relevance in the Mar Menor strategy.
2nd Part: Description of the dynamics at work (maritime climate, coastal dynamics and climate change) and study of the past and recent evolution of the Mar Menor coast.
3rd Part: Proposals for action, prioritization and phases.

The first two parts are essentially a synthesis of a wide set of works, most of them very recent.

The third part is dedicated to detecting areas with coastal problems and envisioning a solution of scope, analyzing the solutions that other works have proposed, taking into account the variables that make up the problem and the multiple landscape, environmental and other types of values that converge in this area.

In summary, the actions that have been presented are aimed at achieving the following objectives:

On the coastal edge of the Mar Menor:

1. Review and, where appropriate, redefinition of the maritime-terrestrial public domain
2. Recovery of untitled DPMT occupations
3. Action on the causes of degradation, among which are:
    a. Agriculture (zero discharge)
    b. Town planning
    c. Ports
4. Improvement of the conditions of use:
    a. Edge treatments (walks, trails, etc ...)
    b. Accessibility to the sea
    c. Actions to be taken in relation to sludge and "dry"
    d. Actions to be carried out on the goals
    e. Beach regeneration

On the coastal edge of the Mediterranean Sea:

1. Review and, where appropriate, redefinition of the maritime-terrestrial public domain
2. Recovery of untitled DPMT occupations
3. Improvement of the conditions of use

Regarding the revision of the boundary, the recovery of the Public Terrestrial-Maritime Domain (DPMT) is one of the priority actions for the DGCM on the coast under study. Therefore, before defining specific works or actions on each beach, the occupations and their type are presented. This is one of the sections extracted from the Plan and presented in Annex III.

Of the group of 66 beaches, only in 23 of them there is no occupation, which corresponds to a third of the total, while in two thirds of the beaches some occupation of the Maritime-Terrestrial Public Domain has been observed.

ANNEX I. ANALYSIS OF ACTIVITIES IN THE MARINE LEVANTINO-BALEAR DEMARCATION. MAR MENOR EXTRACT

The questions specific to the Mar Menor are extracted from the analysis of activities of the Levantine-Balearic marine strategy. Period analysed: 2011-2016.

- Physical restructuring of rivers, the coast or the seabed.
    - Coastal defence and protection against floods- Detail of the infrastructure map in the Mar Menor (figure 1): 15 jetties, 11 walls, 4.62 km in length of breakwater sections and 3 exempt levees.
    - Restructuring of the morphology of the seabed, including dredging and the deposit of materials - Specific information for the Mar Menor: no dredging has been reported in the specified period
- Extraction of non-living resources
    - Extraction of minerals (rock, metallic minerals, gravel, sand, shells) - No actions of this type have been identified in the Mar Menor for the period analysed
    - Oil and gas extraction, including infrastructure- No actions of this type have been identified in the Mar Menor for the period analysed
    - Extraction of salt - active salt works located in the Mar Menor (map figure 4)
    - Extraction of seawater- There is a point of capture of seawater near the Mar Menor, although outside it, corresponding to the collection of the San Pedro del Pinatar desalination plant.
- Energy production
    - Renewable energy generation, including infrastructure- not existing in Levantine-Balearic DM
    - Transport of electricity and communications (cables) - In the period 2011-2016, several electric or fiber optic cables have been laid in the area, but none of them cross the Mar Menor (Figure 5).
- Extraction of living resources
    - Fishing and shellfishing (professional, recreational) - the Mar Menor is identified as a mollusc production area (map figure 7). There is no data on the Murcia seafood fleet. Data on the number of sport fishing licenses by autonomous community.
    - Collection of marine plants and Hunting and collection for other purposes- There are no segregated data on the live weight collected for the macroalgae species, so

it has not been possible to evaluate the activity of collecting marine plants in the Mar Menor.

- Cultivation of living resources
    - Marine aquaculture, including infrastructure-242 facilities in the marine area. None of these aquaculture facilities were located in 2016 in the waters of the Mar Menor (map figure 8)
- Transportation
    - Transport infrastructure- 8 Port Authorities in the district, none of them located in the waters of the Mar Menor. 14 commercial or industrial ports, none of them in the Region of Murcia.
    - Maritime transport- Maritime traffic is practically nil within the Mar Menor (AIS data analysis). Little relevant recreational fishing fleet density (figure 13)
- Urban and industrial uses
    - Treatment and elimination of waste- In the Levante-Balearic Marine Demarcation, there are 3 landfills located less than 2 km from the coastline (Table 1), none of them located near the Mar Menor.
- Tourism and leisure
    - Tourism and leisure infrastructures- Detailed information for the Mar Menor on the number of tourist establishments, places offered and trends, beach infrastructure, marinas and moorings (Puerto de Tomás Maestre stands out, in La Manga). Also on beaches with anchoring areas (41 beaches in Mar Menor) (Figures 19-23)
    - Tourism and leisure activities: data not disaggregated for Mar Menor for many of the activities. As for recreational navigation, it is a very present activity (figure 25)

ANNEX II. ANALYSIS OF PRESSURES AND IMPACTS IN THE MARINE LEVANTINO-BALEAR DEMARCATION. MAR MENOR EXTRACT

The issues specific to the Mar Menor are extracted from the pressure analysis of the Levantine-Balearic marine strategy. Period analyzed: 2011-2016

- Physical pressures
    - Physical disturbances of the seabed (temporary or reversible): - Specific information for Mar Menor: the bottoms of the Mar Menor are not disturbed by the aspects considered, except in the case of anchoring recreational vessels.
    - Physical losses (due to a permanent change in the substrate or the morphology of the seafloor and the extraction of substrate from the seafloor) - in the Mar Menor only one jetty has been identified that occupies about 284 m2.
- Pressures due to the contribution of substances, garbage and energy
    - Contribution of nutrients and organic matter: Diffuse sources, point sources, atmospheric deposition
        - Discharges from land: the information offered by the State Registry of Emissions and Contaminating Sources (PRTR Registry) is available. None of the facilities that provide data to the registry discharges to the Mar Menor (not all have the obligation to do so). Data on urban agglomerations near

the Mar Menor (relevant) are also analyzed. Murcia has not provided data to the DGA for the pressure inventory.

- River contributions: information from the General Directorate of Water. For the Mar Menor, there are data from the Rambla del Albujón on estimated nutrient loads (2014-2016). There is no information on whether the arrival of brines to the Mar Menor is due to runoff and underground flows or whether there are also direct discharges to the Mar Menor.
- There is no information on the spillage of nutrients or organic matter that may have occurred from ships. In the Mar Menor there are no aquaculture facilities or platforms that can contribute to the entry of nutrients or organic matter into it
- For atmospheric depositions, the data from the EMEP program are used: according to the modeling, the estimated deposited charge of oxidized nitrogen in the Mar Menor was about 40 tons for 2014

It is noteworthy that according to the General Directorate of Water, within the framework of the third cycle of hydrological planning, the Mar Menor falls within the category "Coastal and transitional bodies of water with impact by organic matter".

- Contribution of other substances: diffuse sources, point sources, atmospheric deposition, serious incidents

  This section analyzes the contribution of pollutants, for which practically the same sources of information have been analyzed as for nutrients. The Mar Menor does not fall into the category of water bodies with an impact from chemical contamination
- Contribution of garbage (solid garbage including micro-garbage) - There is no specific information from the Monitoring Programs of the Marine Strategies for the Mar Menor
- Anthropogenic sound input (impulsive, continuous) - not specifically analyzed for the Mar Menor. the pressure has focused on the contribution of noise by commercial shipping (AIS data). Since commercial ships do not enter the Mar Menor, the average levels of noise emission would be classified as low.
- Contribution from other energy sources: thermal discharges- no significant thermal discharges have been identified in the Mar Menor
- Water supply: point sources (for example, brine). No spillage of brines into the Mar Menor from desalination plants have been identified. There is no information on the quantity or location of the wastewater treatment plants in the Mar Menor area, although the Comprehensive Report on the Ecological Status of the Mar Menor (Scientific Advisory Committee of the Mar Menor) mentions that there has been a “proliferation of small desalination plants” in the area.

ANNEX III. EXTRACT FROM THE PLAN FOR THE PROTECTION OF THE LITORAL EDGE OF THE MAR MENOR

Environmental problems. This annex makes a first identification of these problems, distinguishing between agents and pressures:

Agents:

- Population increase: Fixed and floating (tourist)
- Mining activity
- Increase in urban areas
- Agricultural activity
- Fishing activity
- Land and sea motorization

Pressures:

- Inlet of water from the Mediterranean Sea, historically carried out and that has produced changes in the characteristics of the water that affect the natural ecosystem.
- Increase in the urban surface on the coast.
- The agrarian activity has created a strong pressure, especially with regard to discharge and contamination of aquifers; but it is also necessary to consider the reduction of other environmental units (occupation of the territory).
- Nautical activity, especially sports or recreational activity, produces pressure on the system in various aspects. In addition, it promotes the development of marinas and obliges to maintain navigable conditions in the channels.
- Even though there is currently no mining activity, the lack of treatment of the mining basins and boulevards (Beal, Ponce and Carrasquilla) means that, in view of the impact produced by the discharges, they must be assumed to be active

A detailed description of each of these aspects (agents and pressures) is made.

Summary pressures on the coastal system of the Mar Menor

Then, in its section 2, it analyzes **the problems on the beaches and the determining factors**. In this way, a diagnosis is made along the entire coastline of the Mar Menor, identifying the areas where erosion predominates, and those where sediment accumulation predominates.

Example of analysis in the section "problems on the beaches".

As a summary, the diagnosis can be seen in the following figure:

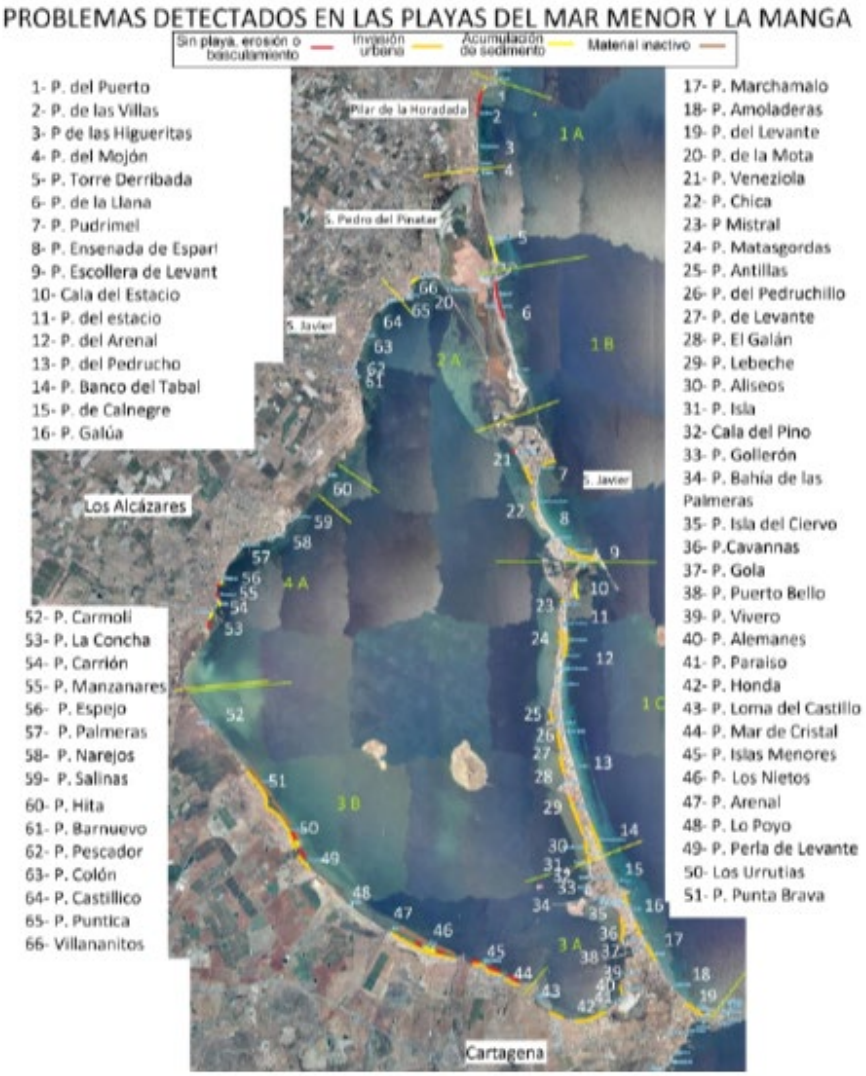

Figura 2.29: Resumen de los problemas detectados en La Manga y Mar Menor (Foto: Ministerio para la Transición Ecológica)

<u>Occupations in the Land-Maritime Public Domain (DPMT)</u>

The report has carried out a detailed cartographic analysis, with the 2016 PNOA orthophoto (National Geographic Institute) and the DPMT boundary line, thus identifying different structures that, according to the overlap of both geographic layers, would be occupying the Public domain. These include:

- Living place
- Beach bar
- Hotel
- Parking
- Restaurant
- Sport Center
- Kiosk
- Others

A total of **326 DPMT occupations are identified on 43 different beaches**.

Living place	Beach bar	Hotel	Parking	Restaurant	Sport Center	Kiosk	Others	**Total**
248	42	4	1	15	3	5	8	**326**

The annex provides detailed plans of all these beaches with their occupations.