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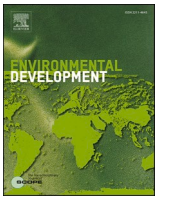

Stakeholder analysis and prioritization of management measures for a sustainable development in the social-ecological system of the Mar Menor (SE, Spain)

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ABSTRACT

Agricultural and urban activities over the last decades have caused an environmental degradation of the social-ecological system of the Mar Menor, compromising the ecosystem services it offers to society. This article describes a stakeholder analysis through a participatory methodology to identify and characterize them, know their preferences about possible management measures and compare their preferences with the preferences expressed by the group of local population to which such actors belong. Results include the identification of seven main stakeholder groups. Despite the discrepancies among them in the preferential order of the management measures, it is important to point out the consensus of all the interviewed actors to prioritize the measure: *Reduce the irrigated area* to limit the entry of nutrients into the lagoon. This consensus, which is different from the results obtained in previous studies, represents a recent change of opinion regarding the role of agriculture in the Mar Menor. Results also showed that there are discrepancies between the preferences expressed by some stakeholders and the group of population to which such actors belong. From these results, two interesting conclusions emerge regarding the design and implementation of a deliberative participation process: 1) it is possible to foresee difficulties, at least in its initial phase, in reaching possible consensus on the prioritization of measures and 2) the involvement of the identified stakeholders might be positive in such participatory processes, since they present a distance among their respective positions that is less than the one detected among their corresponding sectors in the local population. Therefore, the involvement of these actors in participatory processes can facilitate the generation of consensus that, later, could be extended to their respective sectors.

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1. Introduction

1.1. Social-ecological systems and the role of the stakeholders

The concept of the social-ecological system (SES) has generated a growing consensus among scientific disciplines, regarding its usefulness as a framework to understand the relationships between natural and social integrated systems, in the search for more guidelines for sustainable development (Binder et al., 2013; Fischer et al., 1993). The concept of SES is born as part of a new paradigm due to the concern of different researchers, from different disciplines, for the conservation of biodiversity and for the proper functioning of ecosystems and life support systems on the planet (Liu et al., 2007; Balvanera et al., 2017). Janssen and Ostrom (2006) define SES as complex adaptive systems in which social and biogeophysical agents are interacting through multiple spatial-temporal scales.

Participatory processes are key factors for the study of SES (Gadgil et al., 1993; Becker and Ghimire, 2003; Lunas-Reyes and Andersen, 2003; Tengö and Belfrage, 2004), especially when the objective is to contribute to the decision-making for the sustainability of the SES (Reed, 2008; Ban et al., 2013). Participatory approaches facilitate the direct involvement of the stakeholders associated with a SES in the different phases of the planning processes and the management of natural resources, promoting aspects such as the construction of dialogues and cooperation between the stakeholders, among others (Prell et al., 2009; Hauck et al., 2016).

Stakeholder analysis allows a better understanding of SES, identifying key actors and evaluating their interests in that system (Prell et al., 2009; Hauck and Col, 2016; Young et al., 2013), in addition to being a process to support decision-making and strategy formulation (Yang, 2014; Delgado-serrano et al., 2015). The identification of the key actors, their representativeness and legitimacy are decisive to implement an adequate governance process and thus successfully contribute to conflict resolution (Comino et al., 2016). Integrating and recognizing different types of knowledge and the values of the different stakeholders will contribute to a better understanding of the dynamics and processes of SES, as well as facilitating decision-making (Palomo et al., 2011; Hanspach et al., 2014;

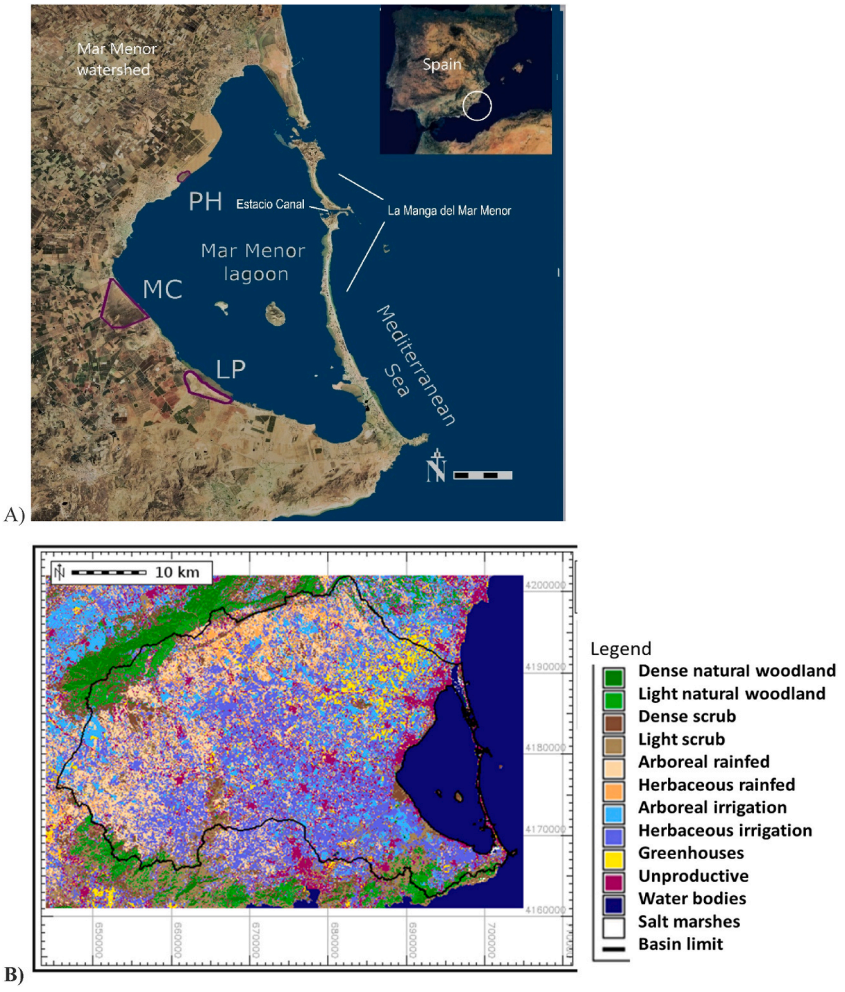

Fig. 1. A) Location of the SESMM (Mar Menor watershed; Mar Menor lagoon; PH (Playa de la Hita), MC (Marina del Carmoli) and LP (saladar de Lo Poyo) wetlands). B) Mar Menor watershed and coastal lagoon and the main land uses. Source: Carreño Fructuoso, M.F. 2015.

Villamor et al., 2014; Balvanera et al., 2017).

A stakeholder is defined as "any group or individual that can affect or be affected by a decision or action" (Freeman, 1984). The scientific literature includes several practical methods for the analysis of stakeholders such as surveys, interviews, participatory workshops, map of interest and influence, brainstorming, analysis of decision networks, among others (Bourne and Walke, 2008; Dente, 2014). Stakeholder analysis is applied in different fields (Friedman and Miles, 2006). It is increasingly used in natural resource management (Reed et al., 2009; Knontogianni et al., 2012), and in understanding SES (Rietbergen and Narayan, 1998; Koanda, 2006) and strategic decision-making, especially in complex SES, such as the social-ecological system of the Mar Menor (SESMM). The SESMM (SE, Spain) is a spatial entity whose limits are defined by biophysical and social criteria. The biophysical limits are marked by the ecosystem of the Mar Menor coastal lagoon, the surrounding wetlands and the hydrographic sub-basin, which together offer a variety of natural resources and ecosystem services to society (León and Bellido, 2016; Mar Menor Scientific Advisory Committee, 2017). In the Mediterranean context, human societies have shaped nature for thousands of years and in turn nature has shaped the development of human societies (Grove and Rackham, 2003). We understand the Mar Menor and its surroundings as a set of social processes deeply interconnected with the ecosystems from which it obtains a multitude of natural resources and services.

The SESMM currently deals with an environmental collapse (eutrophic crisis of the Mar Menor coastal lagoon) that is already resulting in significant social and economic costs to the local community, in terms of loss of quality of life and progressive decrease in socioeconomic opportunities. The impacts caused by agricultural and urban activities over the last decades have led the SESMM to a situation that compromises the ecosystem services it offers to society. Local community is demanding new development initiatives to get out of the social and economic situation caused by the environmental degradation of the area (Conesa and Jiménez-Cárceles, 2007; García-Ayllón, 2017; Guaita et al., 2020). A different development is necessary, a development that internalizes the environmental dimension to guarantee the sustainability in a medium-long term of economic sectors such as the tourism and fishing (Scientific Advisory Committee of the Mar Comité de Asesoramiento Científico del Mar Menor, 2017; Ruiz Fernández et al., 2019). This situation requires the urgent search for management measures with an integrated approach based on the best available knowledge and taking into account the stakeholders opinion involved in the system with the common objective of improving the environmental and socioeconomic situation. But who are these stakeholders? Who do they represent? What are their roles? What stakes do they have? What are their perspectives? What is their relationship among them? This article aims to present a stakeholder analysis in the SESMM, through a participatory methodology. To achieve these goals, we: 1) identified and characterized the stakeholders associated with the SSEMM to know their perceptions and interests; 2) evaluated their preferences regarding management measures for the restoration of the system and 3) analyzed the consensus and/or conflicts established among the stakeholders and between the stakeholders and the local community (Guaita et al., 2020) over the management measures.

1.2. The social-ecological system of the Mar Menor. Keys to the problem

The SESMM, in Southeastern Spain (Fig. 1), is an area with a sub-desert Mediterranean climate, characterized by high temperatures (average annual temperature of 15 °C to 17 °C) and low rainfall (around 300 mm per year). Its location, geography, and unique natural environment have made it known and valued both nationally and internationally (Martínez et al., 2003). The SES includes the Mar Menor lagoon, the surrounding wetlands and the Mar Menor watershed. The population of the seven municipalities fully or partially integrated in the watershed (San Pedro del Pinatar, San Javier, Los Alcázares, Torre Pacheco, Cartagena, Fuente Álamo and La Unión) amounts to 357,266 inhabitants in 2017. The local government of these municipalities along with the Ministry of Water, Agriculture, Livestock and Fisheries (regional government) and the Segura Hydrographic Confederation (national government) are the main government institutions.

The main uses and economic activities in the SESMM are agrarian activity, urban-tourist development, and some fishing activity. The Scientific Advisory Committee of the Mar Menor (advisory group set up with the objective of scientifically advising the regional government in all the actions carried out in order to improve the ecological status of the Mar Menor) highlights that these activities have operated as driving forces generating pressures and impacts on the SESMM for decades, which has induced environmental deterioration and the loss of natural and cultural values, as well as traditional uses and exploitation (Esteve et al., 2008, 2016; Martínez et al., 2014, 2017; Leon and Bellido, 2016).

The urban-tourist development started in the 1960s. Most of the activity was on the watershed coastline, mainly in La Manga del Mar Menor (Fig. 1), with second homes in a proliferation of tourist developments. These were generally medium-low quality residential, with a high environmental deterioration and negative effects even for tourism itself, including its future development in the medium and long term (Scientific Advisory Committee of the Mar Comité de Asesoramiento Científico del Mar Menor, 2017). Added to this tourist displacement is the opening of the coastline to global migratory flows of unskilled labor and the reinforcement of a tourist pattern based above all on the residential model, with a consolidated summer population. That population is mainly from other regions in Spain (77% in 2018) (Romero and Perez 2017), although in recent years a large population of foreigner's community (33% in 2018), mainly from the rest of Europe, has also settled. The population in summer season is estimated to reach half a million people (Verdiell et al., 2013; García-Ayllón, 2016). Consequently, one of the first pressures was the discharge of urban wastewater that historically affected the water quality of the lagoon in the summer due to breakage or overloading of the treatment infrastructures. These waters were discharged untreated, especially during the busy summer season (García-Ayllón, 2016). This problem, persistent for many years, currently (2020) is partially controlled by the construction and start-up of new treatment plants, except for specific situations due to the breakdown of any installation.

At the same time, tourism has demanded infrastructures such as the construction of roads, ports, dikes, boardwalks and beach regeneration that are often accompanied by environmental impacts. Other relevant effects include those generated by the opening of

the Estacio canal (port) (Fig. 1) in 1973 to make it navigable. This infrastructure increased the water connection between the lagoon and the Mediterranean Sea, which caused a reduction in the lagoon's salinity, as well as a tempering of the range of temperatures inside the lagoon. These modifications of the physicochemical conditions have induced profound changes in the communities and lagoon dynamics (Scientific Advisory Committee of the Mar Comité de Asesoramiento Científico del Mar Menor, 2017).

It should be noted that in the Mar Menor lagoon there are twelve ports, which represent 45% of the total number in the Region of Murcia, when the coastline that the Mar Menor lagoon occupies (22 km) is only a small fraction of the total coastline (250 km) in the autonomous community (Martínez et al., 2003). Also, 50% of hotels and 64% of the total of apartments on the coast in the Region de Murcia are in the Mar Menor coastline. The massive urbanization and the absence of a territorial urban planning has greatly exceeded the reception capacity of the territory (García Sánchez and García Garay, 2003).

But the degradation of the SESMM is mainly determined by an uncontrolled development of the agricultural sector and the agri-food industry in the entire watershed, especially since the conversion of rainfed agriculture to irrigation with the arrival of water from the Tajo-Segura Transfer in 1979, technological advances in agriculture and socio-economic changes, all driven by the great differential in profitability between rainfed and irrigated crops (Martínez and Esteve, 2000; Carreño, 2015). The irrigated area increased from 25.150 ha to more than 55.000 ha in the period 1988–2009 (Carreño, 2015). More than 80% of the total area of the Mar Menor watershed is dedicated to the intensive irrigated agriculture, mainly horticultural crops, citrus and greenhouses supporting these other crops (Carreño, 2015). These crops require a high demand of water, land and fertilizers. The agriculture sector has two very different groups: the farmer who manages his own land, and the large companies foreign owned multinationals or directly owned by large supermarkets, which farm their own land or lease from smaller landowners for the subsequent export of the products to the rest of Europe.

Estimates indicated that agricultural activity in the Mar Menor watershed would be responsible for around 85% of the total input of nutrients to the lagoon and the urban activity would be responsible for the 15% of the total input of nutrients (Martínez Fernández et al., 2014; Esteve Selma et al., 2016). This fact is causing an acute process of eutrophication of the water (Martínez Fernándezet al., 2005, 2014, 2017; Velasco et al., 2006; Esteve et al., 2008, 2016; Carreño, 2008, 2015; Ruiz Fernández et al., 2019). It should also be noted that another of the impacts of agricultural activity is nitrate contamination of aquifers. The Quaternary aquifer contained nitrate concentrations above 200 mg/l (Scientific Advisory Committee of the Mar Comité de Asesoramiento Científico del Mar Menor, 2017) which gives an idea of the magnitude of the problem, since the limit value established by the Nitrate Directive (91/676/EEC) is 50 mg/l. Also, this type of intensive agriculture modifies the soil, changes the slopes, and plans it to increase the efficiency of its farming machinery. The loss of the traditional soil retention mechanisms favors erosion and the massive entry of materials and solid waste into

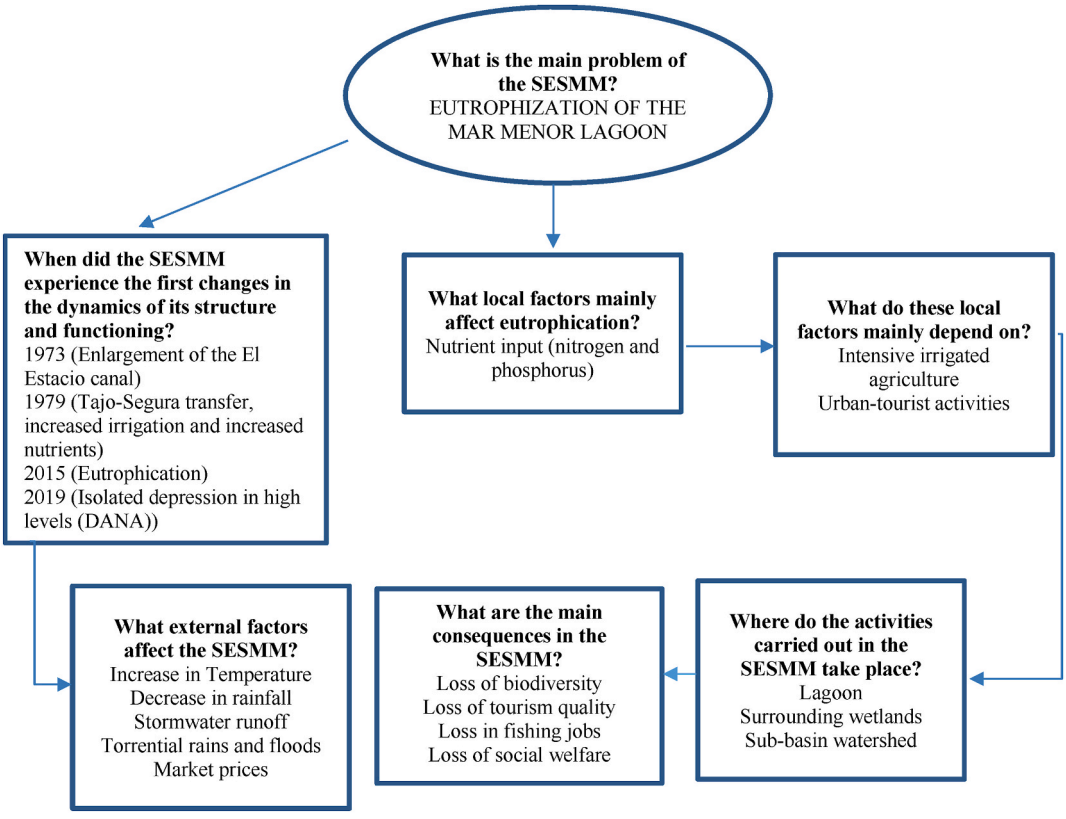

Fig. 2. Summary diagram of the main issues that define the SESMM, starting with the main problem observed.

the Mar Menor, contributing to increase the turbidity of water in episodes of heavy precipitation, due to sediment entrainment (Scientific Advisory Committee of the Mar Comité de Asesoramiento Científico del Mar Menor, 2017).

The continued input of nutrients into the Mar Menor lagoon in recent decades, associated mostly with agriculture and secondly with urban-tourist development, along with the increase in winter temperatures due to climate change, has meant that since mid-2015 the lagoon has entered a eutrophication process with a notable deterioration in the quality of the waters of the Mar Menor (Scientific Advisory Committee of the Mar Comité de Asesoramiento Científico del Mar Menor, 2017) (Fig. 2). The already deteriorated state of the lagoon has been aggravated by the runoff of nutrients and phytosanitary products and the runoff of sediments due to torrential rains such as DANA (Spanish acronym for a western Mediterranean meteorological phenomenon) that took place in September 2019 (Ruiz et al., 2020), which caused the entry into the lagoon of a significant volume of floodwaters. The massive entry of nutrients accumulated in the watershed into the lagoon during the DANA episode was estimated between 500 and 1.000 tons of nitrates, 35 tons of ammonium, and more than 100 tons of phosphates (Ruiz et al., 2020). This led to a significant loss of the biodiversity of the Mar Menor, which has numerous regional, national and international protection designations: San Pedro del Pinatar Regional Park, Protected Landscape of Open Spaces and Mar Menor Islands, declaration of the Mar Menor and surrounding wetlands such as SPA (Special Protection Area for Birds) and SCI (Site of Community Importance), declaration of the Mar Menor and its surroundings as a Ramsar area (Wetland of International Importance of the Ramsar Convention) and SPAMI (Specially Protected Area of Mediterranean Importance).

In addition, the eutrophication in the lagoon can lead to a "domino" effect, starting with the ecological impacts on the species and habitats, the loss of the traditional transparency of the waters and important damages to the economic activities that the lagoon directly supports, such as the tourism and fishing, and finally affecting to job losses. This phenomenon has motivated a strong social alarm that has given rise to multiple acts of protest, and the local community and stakeholders groups have demanded compliance with current regulations and effective management measures which consider all the stakeholders involved.

2. Methodology

The methodological approach of this research was carried out in three steps: 1) identification and characterization of stakeholders; 2) stakeholders' preferences on possible management measures to improve urban-tourist development and limit the entry of nutrients into the Mar Menor lagoon; and 3) analysis of conflicts and consensus among stakeholders and between the stakeholders and the local community (Guaita et al., 2020) on possible management measures for the restoration of the system.

2.1. Identification and characterization of stakeholders

For the identification and characterization of stakeholders, 20 structured interviews were conducted with members from different disciplines in the environmental, social, economic and institutional dimensions during the months of January to April 2017 (Appendix A). The selected people for the interviews were scientists, technical, managers, professionals from different social and economic sectors and local community that belong to: 1) the academic field (University of Murcia, Polytechnic University of Cartagena, University of Alicante, Center for Soil and Applied Biology Segura (CEBAS-CSIC), Oceanographic Center of Murcia), 2) the regional government institutions in the Region of Murcia (Office of Socioeconomic Impulse of the Environment and Ministry of Water, Agriculture, Livestock, Fishing and Environment), 3) Non-Governmental Organizations (Ecologistas en Accion and Naturalists Association of Southeast (ANSE)), 4) neighborhoods association (Federation of Associations of Neighbors, Users and Consumers of Cartagena and the Comarca), 5) citizen platform (Pacto por el Mar Menor) and 6) environmental journalists from the regional newspapers in Region of Murcia (La Verdad de Murcia and La Opinion de Murcia). The interviewed members were selected based on their previous experience and scientific knowledge in the lagoon, wetlands, and watershed as well as their experience in the management and commitment for the SESMM.

The structure of the interview was as follows: first, a block of five questions was carried out to know their opinion on the main ecological, social and economic processes that are taking place in the SESMM, and the solutions or management measures that, as experts, they would apply to restore the system. Finally, they identified the main groups of stakeholders and their interests, as well as the most representative entities within each stakeholder groups (key actors). Next, a second block was made on the characteristics of the respondents, such as their scientific-technical area of experience and knowledge of the SESMM and their personal relationship with the Mar Menor. To conduct the interview, the interviewed members were contacted by email and face to face.

In order to complete the stakeholders map, a bibliographic review of scientific articles was carried out (for example, Martínez Fernández et al., 2009; Carreño, 2015; Esteve et al., 2016) and technical reports (such as Vidal-Abarca et al., 2003; Leon and Bellido, 2016; Scientific Advisory Committee of the Mar Comité de Asesoramiento Científico del Mar Menor, 2017; among others) related to the study area, to verify and complete, where appropriate, the identification of stakeholders. The *Integrated Management Strategy for Coastal Zones in the Mar Menor and its surroundings* (2018) was also reviewed, because it showed one of the first process of citizen participation in the SESMM. The criteria to include these publications was based on choosing those publications more relevant in relation to the objectives and methodology of this article.

On the other hand, the findings from the study in Guaita et al. (2020) were also considered. In this study a survey was carried out with the local community to find out the social perception about pressures, impacts and possible management practices to improve the current status of SESMM. That Guaita et al. (2020) survey had 23 questions distributed in five blocks: 1) urban-tourist development, 2) agricultural activities, 3) state of the Mar Menor lagoon, 4) environmental values and ecosystem services and 5) metadata. It was answered by 498 people by email during the months of February to May 2017. The analysis of results was based on the classification of

respondents according to their profession and main economic activity because the classification of respondents according to other variables, such as age, gender or place of residence, did not give rise to significant differences of opinion. Some of the main stakeholders associated with SESMM are identified by their main economic activity, so that the results of the survey according to such variable allowed a first approximation to their perceptions.

The goal of using all these sources was to answer the questions of identification of key stakeholders: Who are the stakeholders involved in the use and activities carried out in the SESMM? Who are the stakeholders or potential beneficiaries of the ecosystem services of the SESMM? Who can be the most affected stakeholders by the situation of degradation of the SESMM? And who has information, knowledge, and experience about the degradation of the SESMM and its functioning as a system?

To guide the characterization process of the stakeholders, the questions and attributes collected in Tables 1 and 2 were formulated and completed with the information given by the sources mentioned above (20 interviewed members, bibliographic review of scientific articles and technical reports related to the SESMM, and the study carried out in Guaita et al. (2020) based on the local community perceptions). This information allowed to know who each stakeholder is, does, perceives and proposes as solutions regarding the situation of environmental degradation in the SESMM. Tables 1 and 2 show the information that was obtained on the position of the stakeholders and their relationship with the SES.

2.2. Stakeholders' preferences on possible management measures in the SESMM

During the months of January and February 2019, 14 structured interviews were conducted (Appendix B) with representatives of each stakeholder group previously identified, with the aim of knowing their perception of the SESMM status and their preferences regarding 1) ten management measures to improve the urban-tourist development of the Mar Menor area and 2) nine management measures to limit the entry of nutrients into the lagoon. The proposed measures were taken from the study carried out in Guaita et al. (2020), previously mentioned. As part of those past (Guaita et al., 2020) results, an order of preference was obtained for the performance of management measures to 1) improve the urban-tourist development of the Mar Menor area and to 2) limit the entry of nutrients into the lagoon, according to the average value of respondents.

The selection of the proposed measures was made based on the opinion of the 20 interviews to the inter and transdisciplinary group mentioned above, and some of the measures publicly proposed by the groups of stakeholders. All of them, except the tourism sector and the construction and real estate development sector, have publicly expressed proposals[1] for different solutions to improve the environmental degradation situation of the SESMM, mainly since 2016 (MITECO 2017, 2019; Scientific Advisory Committee of the Mar Comité de Asesoramiento Científico del Mar Menor, 2017). These sources allowed to propose a set of diverse measures aimed at the driving forces-pressures-state-impacts-responses of the SESMM and with integral and sectorial approaches.

To analyze the stakeholders' preferences on possible management measures in the SESMM, this order of preferences by the local community was given to the representatives of each group of stakeholders to know their assessment and preferences through the interview. Each actor, based on their knowledge and interests, updated the ratings according to their level of importance on a scale of 0–100. This technique is known as expert elicitation (O'Hagan, 2019), where the interest lies in estimating unknown parameters or values through the prior beliefs of experts. Each actor updates the ratings obtained in the survey, considering a high degree of certainty in each of their responses and allowing them to update their responses as many times as necessary until they are satisfied with their statements. This process and the anonymous participation, help us to avoid biases or anchoring problems by initial estimates like in the elicitation Delphi process (Winkler and Moser, 2016). Finally, the opinion of the representatives of each group of stakeholders (actors) was compared with the opinion of the local community surveyed in Guaita et al. (2020).

To carry out the interview, the representatives of each group of stakeholders (actors) associated with the SESMM were contacted by email, telephone and face to face. The representatives of each group of stakeholders (actors), were previously identified by the 20 interviews to the experts and the bibliographic review and technical reports regarding the SESMM. The participation of the actors in the interviews was made based: first on the availability and willingness of the actor to participate and, secondly, based on the most representative position within the entities who had greater decision-making capacity and influence in each of the stakeholder groups. Lastly, the entity itself appointed its own representative (actor) (Table 3). This preliminary selection allowed to have a representative sample of each stakeholder groups, with knowledge on the subject and diversity of opinions and interests.

2.3. Analysis of conflicts and consensus among stakeholders and between the stakeholders and the local community on possible management measures for the restoration of the system

For the analysis of the conflicts and consensuses among stakeholders regarding their preferences for the management measures to restore the system, two hierarchical cluster analyzes were performed, using the Euclidean distance and the Ward method (ward. D2) (Murtagh and Legendre, 2014). This multivariate technique, through the representation of two dendrograms, allowed the representatives of each group of stakeholders (actors) to be classified into clusters with similar opinions. The results for each cluster in relation to the preference order of possible management measures were represented by the median, to avoid bias introduced by extreme values. Finally, the opinion of the representatives of each stakeholder group was compared with the opinion of the corresponding group of

[1] https://www.laopiniondemurcia.es/comunidad/2019/10/17/ocho-medidas-salvar-mar-menor-31473945.html, https://cadenaser.com/emisora/2017/04/05/radio_murcia/1491387342_943273.html, https://www.laopiniondemurcia.es/comunidad/2017/02/22/calle-salvar-proteger-mar-menor-31931244.html, https://elpais.com/sociedad/2019/10/30/actualidad/1572457756_941576.html.

Table 1
Identification and characterization of stakeholders.

Stakeholders	Who are they?	What do they do?	What do they perceive?	What do they propose?

Table 2
Relationship of the stakeholders with the SES.

Stakeholders	Relationship to SES and its degradation	Main interest of the stakeholder	Main relationships among the stakeholders

Table 3
Representatives of each stakeholder group in the SESMM.

Stakeholder groups	Name of the stakeholder (entities/actors)
NGOs, citizen platform	Ecologistas en acción (NGO)
	Asociación de naturalistas del sureste (NGO)
	Citizen platform "Pacto por el Mar Menor"
Academic sector	PhD in Sociology
	PhD in Biology
	PhD in Economics
Fishing sector	Fishermen's guilds of San Pedro del Pinatar and Cartagena
Construction and real state sector	Regional federation of construction entrepreneurs of Murcia (FRECOM)
Tourist sector	Association of hotels and tourist accommodations of the Costa Cálida (HOSTETUR)
	Mar Menor nautical station
Agricultural sector	Agricultural cooperative societies Murcia federation (FECAMUR)
	Coordinator of farming associations (COAG)
Public administration	Office of socioeconomic promotion of environment of the Autonomous Community of Murcia (OISMA)
	Ministry of Water, Agriculture, Livestock, Fishing and Environment (CARM)

respondents, according to the profession and main economic activity of each respondent, obtained in the survey to the local community in Guaita et al. (2020) (Fig. 3).

3. Results

3.1. Identification and characterization of stakeholders

We identified seven stakeholder groups who were involved, interested, or affected by the status of environmental degradation of the SESMM. These were classified into the following categories: (1) public administration, (2) agricultural sector, (3) tourist sector, (4) fishing sector, (5) construction and real estate sector, (6) academic sector and (7) citizen platforms, neighborhood associations and NGOs.

The agricultural sector, the tourism sector and the construction and real estate sector were identified as the groups of stakeholders that generated the current status of environmental degradation due to their uses and activities carried out in the SESMM; the fishing sector was identified as an affected sector and recipient of the current status of environmental degradation; citizen platforms, neighborhood associations and NGOs were the group of stakeholders that showed the greatest interest in solving the identified problems and in the desire to participate in the solution by disseminating information to society, denouncing environmental illegalities and lobbying to government entities for compliance with current regulations. Finally, the academic sector and the public administration were identified as the groups of stakeholders that have the scientific-technical knowledge and competence, respectively, in

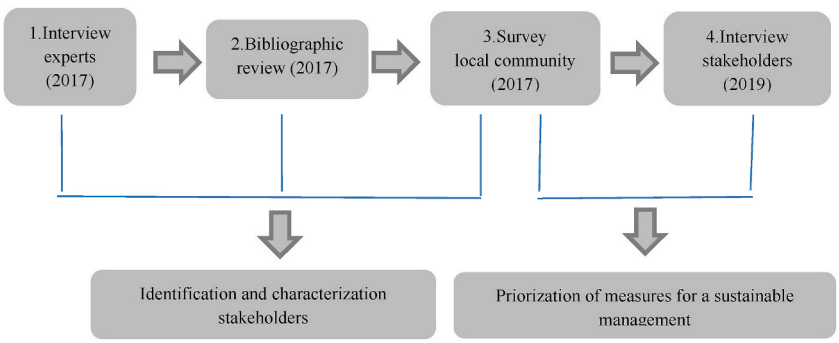

Fig. 3. Sequence of the iterative process for the analysis of the stakeholders.

relation to the current environmental status and future management.

The results of the characterization of stakeholders are shown in Tables 4 and 5 (Appendix C). Those detailed results served as the organizational basis for understanding their (stakeholders') preferences below.

3.2. Stakeholders' preferences on possible management measures in the SESMM

The resulting all-stakeholder preferences (D1-D10) regarding the management measures to improve the urban-tourist development of the Mar Menor area is shown in Fig. 4, showing a wide range of magnitude in preferences. The order of preference, from highest to lowest, is:

1. Do not make a greater offer of second homes (D1).
2. Improve the management and protection of natural areas around the Mar Menor, coastal wetlands and areas free of buildings (D7).
3. Urban moratorium (D8).
4. Improve the public transport network (D2).
5. Remodeling built buildings for an improvement of tourist image (D3).
6. Improvement of parking areas (D4).
7. Improve the bike lane and the spaces adapted for walking and sports (D5).
8. Do not carry out a greater construction of hotels (D10).
9. Improvement of the infrastructure for road traffic (D9).
10. Improvement of accessibility to urbanizations and beaches (D6).

These results indicated that, unlike the data obtained in the survey of the local community (Guaita et al., 2020), the stakeholders gave higher priority to the *Urban moratorium (D8)* and to *Improve the management and protection of natural areas around the Mar Menor, coastal wetlands and areas free of buildings (D7)* rather than the various actions on sustainable mobility (e.g., D2 and D5).

The resulting all-stakeholder preferences (L1 - L9) regarding the management measures to limit the entry of nutrients to the Mar Menor lagoon is shown in Fig. 5. The order of preference, from highest to lowest, is:

1. Reduce the irrigated area (L1).
2. Elimination of irregular uptake of groundwater (L3).
3. Require that each desalinator includes a brine treatment (L2).
4. Establish and monitor the application of maximum values of fertilizer contribution (L6).
5. Recover and enhance the lost surface of natural wetland in the periphery of the lagoon (L4).
6. Apply natural measures of water and nutrient retention at plot scale and in the watershed (L5).
7. Build a green filter to treat the flow of the Albujón watercourse (L7).
8. Do not collect the brines and pour them directly into the Mediterranean Sea (L8).
9. Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea (L9).

This order of preferences of all the stakeholders coincided with that established by the local community in the survey in Guaita et al. (2020), only that the stakeholders considered it a marginally higher priority to *Establish and monitor the application of maximum values of fertilizer contribution (L6)* before the processes to *Recover and enhance the lost surface of natural wetland in the periphery of the lagoon (L4)* and *Apply natural measures of water and nutrient retention at plot scale and in the watershed (L5)*. While those were marginal differences, both the stakeholders and the local community had dramatically lower preference for the processes associated with brine processing (L8, L9).

3.3. Analysis of conflicts and consensus among stakeholders and between the stakeholders and the local community on possible management measures for the restoration of the system

The hierarchical cluster analysis grouped the stakeholders into three groups according to the similarity in the responses they gave to order their preferences for management measures to improve urban-tourist development in the SESMM (Fig. 6). Cluster 1, formed by the stakeholders representing the construction sector and the tourism sector dedicated to services, considered that the priority measures would be to *Improve the bike lane and the spaces adapted for walking and sports (D5)*, *Improve the management and protection of natural areas around the Mar Menor, coastal wetlands and areas free of buildings (D7), Remodeling built buildings for an improvement of tourist image (D3)* and *improve the public transport network (D2)* (Fig. 7). Cluster 2 formed by the stakeholders representing the fishing sector, the public administration sector, the NGO sector and citizen platform, and two of the three actors representing the academic sector, gave preference to the measures of *Do not make a greater offer of second homes (D1)*, *Improve the management and protection of natural areas around the Mar Menor, coastal wetlands and areas free of buildings (D7)* and the *Urban moratorium (D8)* (Fig. 7). And thirdly, the cluster formed by the tourism sector dedicated to hotels and restaurants, the agricultural sector, the local community and an actor from the academic sector, who in their order of preference also placed in the first two positions, *Do not make a greater offer of second homes (D1)* and *Improve the management and protection of natural areas around the Mar Menor, coastal wetlands and areas free of buildings*

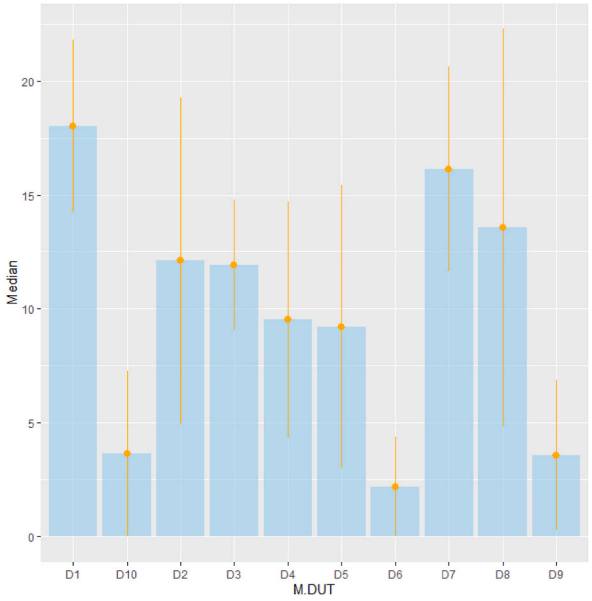

Fig. 4. Barplot error for the median (%) of the assessment of all the stakeholders, regarding management measures to improve urban-tourist development (M.DUT).

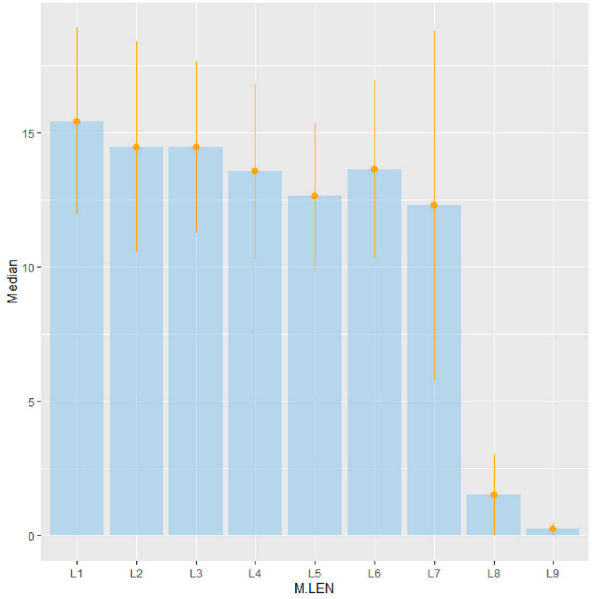

Fig. 5. Barplot error for the median (%) of the assessment of all the stakeholders, regarding management measures to limit the entry of nutrients into the Mar Menor lagoon (M.LEN).

(D7) (Fig. 7).

The comparative analysis of the representatives of each stakeholder group in this study, with the opinion of the respondents (classified in groups according to their profession and main economic activity) in the survey to the local community in Guaita et al. (2020) (Table 4), showed that only the stakeholder representing the fishing sector agreed with the opinion given by the respondents who belongs to that economic sector, regarding management measures to improve urban-tourist development. On the other hand, the stakeholders in this study representing to the public administration, the tourism sector dedicated to hotels and restaurants and the agricultural sector in this study, are the ones that most differed in their preferences for management measures with the respondents in the survey to the local community in Guaita et al. (2020) corresponding to their respective fields work. It should be noted that the stakeholders in the academic sector, the construction sector and the tourism sector dedicated to services, partially agreed with the

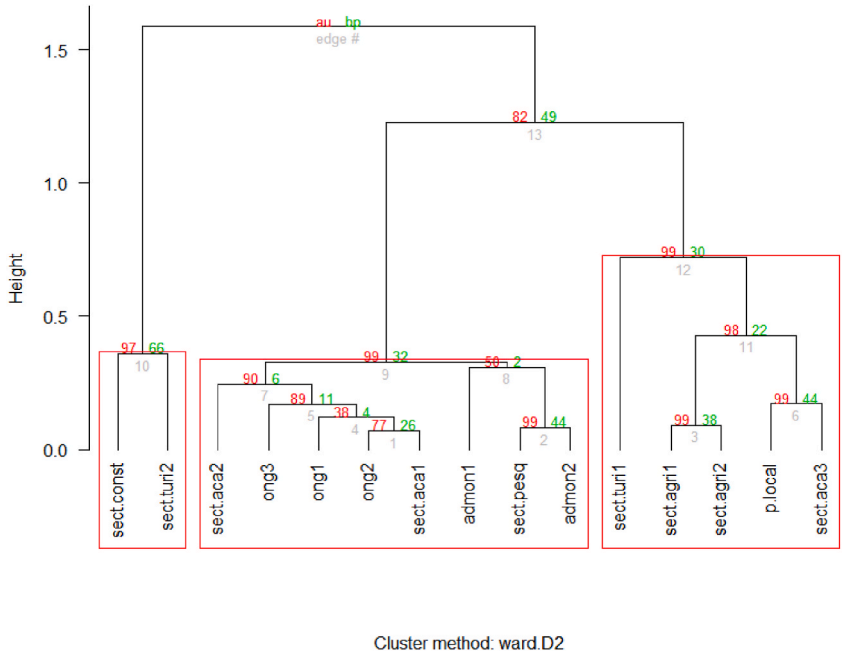

Fig. 6. Dendrogram for the stakeholder's preferences for management measures to improve tourist-urban development, highlighting the final clusters (red boxes). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

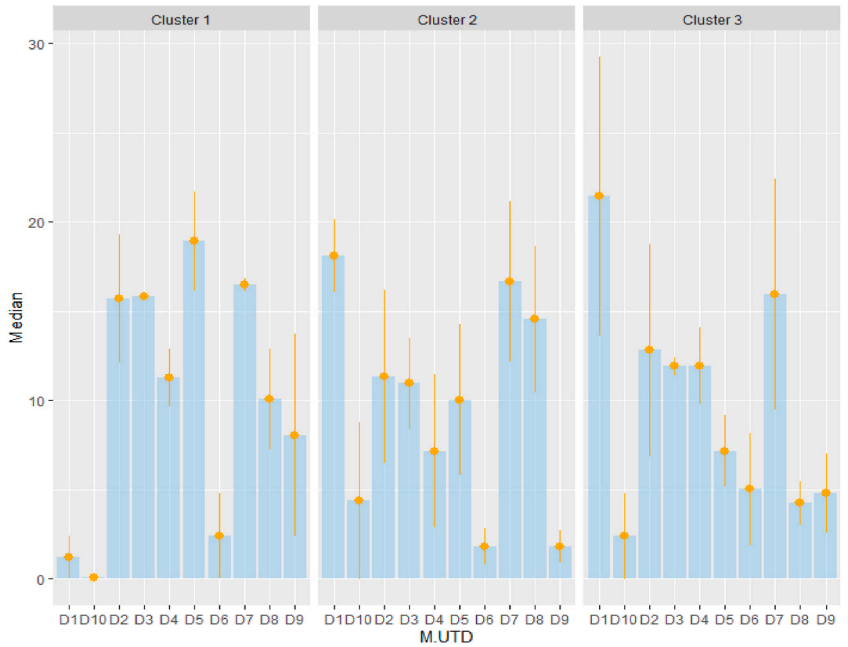

Fig. 7. Barplot error for the median (%) of the assessment of the stakeholders in cluster 1, cluster 2 and cluster 3 regarding management measures to improve urban-tourist development (M.UTD).

groups of respondents classified under these professions in the preferences of some measures such as, *Urban moratorium (D8), Remodeling built buildings for an improvement of tourist image (D3) and Improve the bike lane and the spaces adapted for walking and sports (D5)*.

Regarding the measures to limit the entry of nutrients to the Mar Menor lagoon, the hierarchical cluster analysis distinguished between two clusters based on the similarity in the responses that the stakeholders gave to order their preferences (Fig. 8). Cluster 1 formed by the agricultural sector, the fishing sector and the tourism sector dedicated to hotels and restaurants, considered that the

Table 4
Order of preference according to the level of importance of the management measures to improve urban-tourist development of the SESMM, established according to the average value of the groups of respondents. Source: Own elaboration from data in Guaita et al., (2020).

Groups of respondents according to their profession and main economic activity	Order of preference according to the level of importance of the management measures to improve urban-tourist development
Academic sector	-Improve the bike lane and the spaces adapted for walking and sports (D5) -Urban moratorium (D8). -Improvement of parking areas (D4). -Do not make a greater offer of second homes (D1).
Fishing sector	-Improve the management and protection of natural areas around the Mar Menor, coastal wetlands and areas free of buildings (D7). -Do not make a greater offer of second homes (D1). -Improve the public transport network (D2). -Improve the bike lane and the spaces adapted for walking and sports (D5)
Construction and real estate sector	-Improvement of parking areas (D4). -Do not make a greater offer of second homes (D1). -Remodeling built buildings for an improvement of tourist image (D3). -Improvement of the infrastructure for road traffic (D9).
Tourist sector (servicies)	-Remodeling built buildings for an improvement of tourist image (D3). -Do not carry out a greater construction of hotels (D10). -Improve the bike lane and the spaces adapted for walking and sports (D5) -Improvement of accessibility to urbanizations and beaches (D6).
Tourist sector (hotels and restaurants)	-Improvement of parking areas (D4). -Remodeling built buildings for an improvement of tourist image (D3). -Do not carry out a greater construction of hotels (D10). -Improvement of the infrastructure for road traffic (D9). -Urban moratorium (D8).
Agricultural sector	-Improvement of parking areas (D4). -Improvement of the infrastructure for road traffic (D9). -Urban moratorium (D8). -Do not carry out a greater construction of hotels (D10).
Public administration	-Remodeling built buildings for an improvement of tourist image (D3). -Improve the bike lane and the spaces adapted for walking and sports (D5) -Improvement of parking areas (D4). -Improvement of the infrastructure for road traffic (D9).

highest priority measures would be to *Reduce the irrigated area (L1)*, *Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea (L9), Recover and enhance the lost surface of natural wetland in the periphery of the lagoon (L4), Establish and monitor the application of maximum values of fertilizer contribution (L6) and Build a green filter to treat the flow of the Albujón watercourse (L7)* (Fig. 9). And the rest of the groups of stakeholders who thought that the priority measures were to *Reduce the irrigated area (L1)*, *Require that each desalinator includes a brine treatment (L2)*, *Elimination of irregular uptake of groundwater (L3), Establish and monitor the application of maximum values of fertilizer contribution (L6), Recover and enhance the lost surface of natural wetland in the periphery of the lagoon (L4)* (Fig. 9).

The analysis of the degree of coincidence of each stakeholder in this study with the respondents (classified in groups according to their profession and main economic activity) in the survey to the local community in Guaita et al. (2020) (Table 5), on measures to limit the entry of nutrients into the lagoon, showed that only the stakeholder in the fishing sector agreed with the opinion given by the corresponding group of respondents. The stakeholders representing the agricultural sector and the tourism sector dedicated to hotels and restaurants only agreed with those of the groups of respondents from their respective professional fields in two measures: *Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea (L9)* and *Establish and monitor the application of maximum values of fertilizer contribution (L6)*. Likewise, the opinion of the stakeholders in the administration sector, the academic sector, the construction sector and the tourism sector dedicated to services only agreed with those surveyed whose profession or main economic activity belonged to the respective sectors in to *Establish and monitor the application of maximum values of fertilizer contribution (L6)*. It should be noted that in the cases of the administration sector and in the tourism sector dedicated to services, the stakeholders also agreed with the corresponding groups of respondents in the measures of *Elimination of irregular uptake of groundwater (L3)* and in *Recover and enhance the lost surface of natural wetland in the periphery of the lagoon (L4)*, respectively.

4. Discussion

4.1. Identification and characterization of stakeholders

The objectives, interests and needs of the seven stakeholder groups identified are contradictory. The governmental institutions corresponding to the public administration (national, regional and local) have the objective of establishing policies for the management of the territory, of the uses and activities that take place in it, as well as the conservation of the environment of the SESMM. However, the results point out that, according to the interviews with 20 experts, at this point in time those institutions have shown a

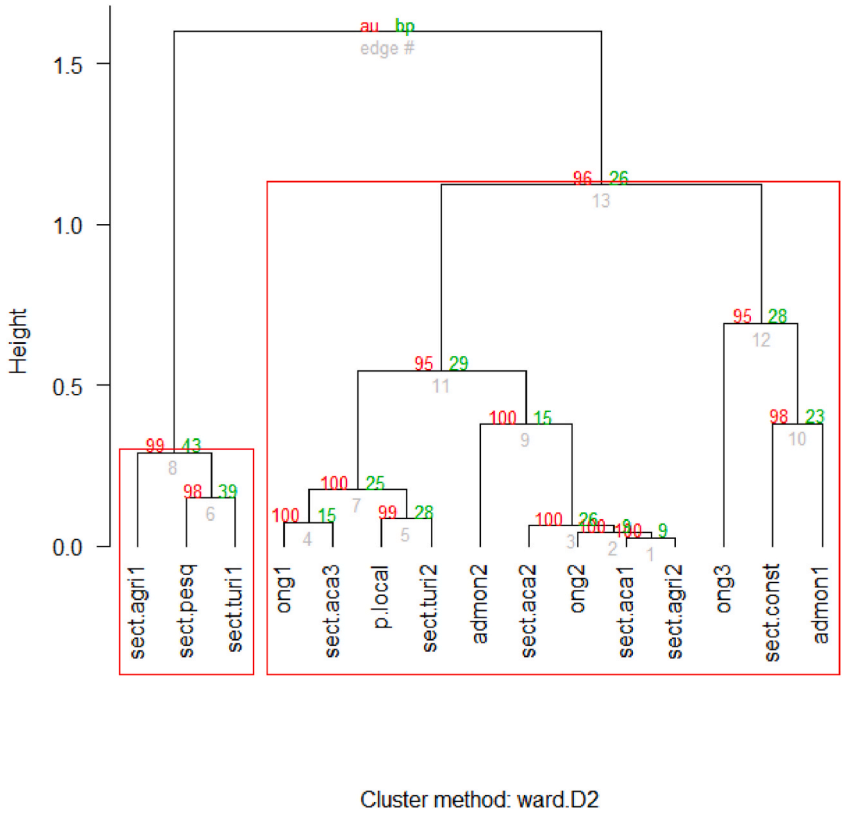

Fig. 8. Dendrogram for the stakeholder's preferences on management measures to limit the entry of nutrients into the Mar Menor lagoon, highlighting the final clusters (red boxes). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

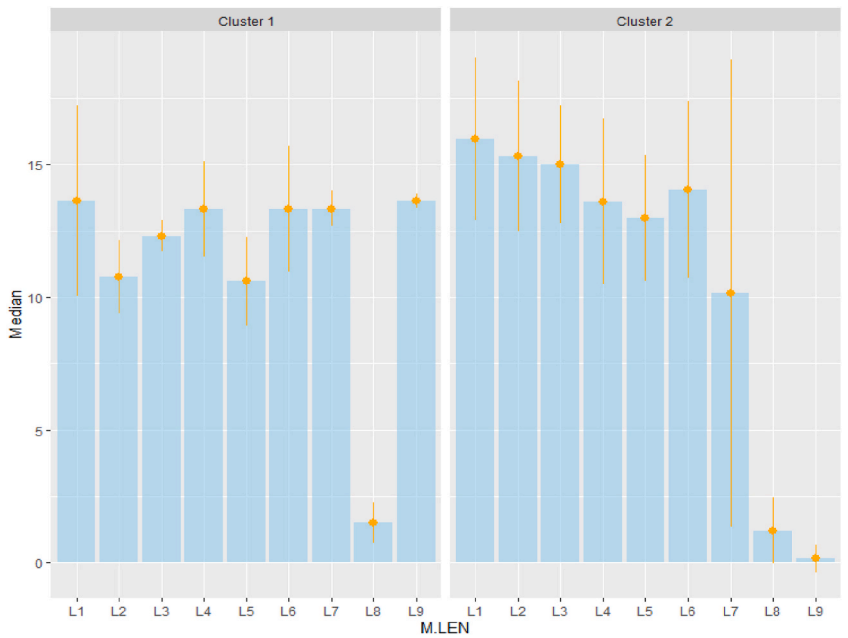

Fig. 9. Barplot error for the median (%) of the assessment of the stakeholders in cluster 1 and cluster 2 regarding management measures to limit the entry of nutrients into the Mar Menor lagoon (M.LEN).

Table 5
Order of preference according to the level of importance of the management measures to limit the entry of nutrients into the Mar Menor lagoon, established according to the average value of the groups of respondents. Source: Own elaboration from data in Guaita et al. (2020).

Groups of respondents according to their profession and main economic activity	Order of preference according to the level of importance of the management measures to limit the entry of nutrients into the Mar Menor lagoon
Academic sector	-Build a green filter to treat the flow of the Albujón watercourse (L7). -Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea (L9). -Do not collect the brines and pour them directly into the Mediterranean Sea (L8). -Establish and monitor the application of maximum values of fertilizer contribution (L6).
Fishing sector	-Require that each desalinator includes a brine treatment (L2). -Reduce the irrigated area (L1). -Recover and enhance the lost surface of natural wetland in the periphery of the lagoon (L4). -Elimination of irregular uptake of groundwater (L3).
Construction and real estate sector	-Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea (L9). -Do not collect the brines and pour them directly into the Mediterranean Sea (L8). -Build a green filter to treat the flow of the Albujón watercourse (L7). -Establish and monitor the application of maximum values of fertilizer contribution (L6).
Tourist sector (hotels and restaurants)	-Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea (L9). -Do not collect the brines and pour them directly into the Mediterranean Sea (L8). -Apply natural measures of water and nutrient retention at plot scale and in the watershed (L5). -Establish and monitor the application of maximum values of fertilizer contribution (L6).
Tourist sector (servicies)	-Establish and monitor the application of maximum values of fertilizer contribution (L6). -Build a green filter to treat the flow of the Albujón watercourse (L7). -Do not collect the brines and pour them directly into the Mediterranean Sea (L8). -Recover and enhance the lost surface of natural wetland in the periphery of the lagoon (L4).
Agricultural sector	-Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea (L9). -Establish and monitor the application of maximum values of fertilizer contribution (L6). -Do not collect the brines and pour them directly into the Mediterranean Sea (L8). -Require that each desalinator includes a brine treatment (L2).
Public administration	-Apply natural measures of water and nutrient retention at plot scale and in the watershed (L5). -Establish and monitor the application of maximum values of fertilizer contribution (L6). -Elimination of irregular uptake of groundwater (L3). -Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea (L9). -Do not collect the brines and pour them directly into the Mediterranean Sea (L8).

lack of coordination to adopt the necessary management measures and to comply with current national and European regulations. Different scientific and technical studies also confirm these results (Martínez and Esteve, 2020; Ruiz Fernández et al., 2019; Perni and Martínez-Paz, 2013). This poor coordination, along with other factors, has led to a lack of governance, which ultimately translates into weak government action, in which action only begins after the problem has already had a significant socio-ecological impact. This situation is repeated in the management of other social-ecological systems with high ecological value such as Doñana (Spain) (Novo and Cabrera, 2005; Palomo et al., 2011) or the Everglades (USA) (Estenoz and Bush, 2015; Atisa, 2020) where there are two opposite positions, conservation and developmentalism.

The 20 interviewed also indicated that stakeholder groups belonging to the economic sectors of agriculture, construction and tourism seek to maximize the benefit in their respective economic activities. All this agrees with recent investigations that document the environmental, social and economic impacts of these economic activities (Esteve Selma et al., 2016; Romero and Pérez, 2017; García-Ayllón, 2019; Ruiz Fernández et al., 2019; Martínez and Esteve, 2020). These three stakeholder groups have an important influence on the SESMM society and economy, as well as on local and regional political groups. According to interviews with the 20 experts, the tourism sector calls for a clean Mar Menor and focuses on urgently demanding solutions from the administration and points to the agricultural sector as being most responsible for the status of environmental degradation. For its part, the agricultural sector has taken an important step in recognizing its responsibility for the deterioration of the lagoon and the watershed, although they do not believe that they are the only ones responsible, mainly holding the administration responsible, who according to them has ignored all their demands for improvement of desalination facilities and their own practices. This finding confirms an important change of perception within the agrarian sector that so far had not occurred and that seems to confirm the hypothesis that what the stakeholders think does not depend only on their own interests but also on the degree of knowledge of the problem (Guaita et al., 2020). In the same way, the scientific literature includes other examples of social-ecological systems such as the Everglades (USA) where even though the SES has been immersed in an ecological restoration project since 2000, the funding and progress on restoration has been slow, with a range of stakeholder priorities and scientific uncertainties (Sklar et al., 2005).

The interviews with the 20 experts also highlight that the active protest pressure by the social, neighborhood and environmental movements since the end of 2015 (and which has been constant in the media) has demanded political responsibility. All this has contributed to increasing the level of awareness by civil society to the state of the SESMM, which may have contributed to this change of perception within the surrounding population (Guaita et al., 2020) and some of the stakeholders involved in the SESMM related to

the causes of environmental degradation of the lagoon. However, despite this recognition and interest in helping to improve the environmental situation of the lagoon, the experts point out that the agricultural sector considers that the solutions should not affect the reconversion of their activities, being reluctant to change current cultivation practices. This poses a potential threat to the approach of a sustainable management model in the SES. The Scientific Advisory Committee of the Mar Comité de Asesoramiento Científico del Mar Menor, 2017; Martínez Fernández et al., 2017; Ruiz Fernández et al., 2019, among others, point out that the agricultural management model in the Mar Menor must be modified to guarantee the sustainability of the SES.

On the other hand, the 20 experts also highlight that, because the construction and real estate development sector has been relatively inactive in recent years, it appears that the most proximate responsibility for the state of environmental degradation in the SESMM is the agricultural and tourist sectors. Similarly, the fishing sector identifies both of those sectors as mainly responsible for eutrophication in the lagoon. The representatives of this sector (fishing), along with the tourism sector, identify themselves as the most affected in their economic activities by the degradation of the lagoon. The stakeholders of the fishing sector observed a drop in sales of fish products from the Mar Menor, products which were previously marked as quality, but now under suspicion of toxicity. Some forecasts speak of a decrease in the number of fish catches in the immediate future. In the case of the tourism sector, those stakeholders observed a decrease in the number of tourists and a reduction in income in the service sector (Martínez Fernández and Esteve Selma, 2020).

Differing from other sectors, the 20 interviewed point out that the main interest of the academic sector is to generate scientific-technical knowledge about the SESMM and make it available to all stakeholders, especially to the public administration, with whom it has been working through a scientific committee with the aim of advising them on relationship with the SESMM diagnosis and the proposal of possible solutions. However, since 2018, news[2] reports in the media reflects abandonment of scientific committee by many of the academic sector members because the scientific committee is, in the opinion of these members, an agency instrumentalized by the regional Administration to divert attention from the true causes of the degradation of the lagoon and its solutions. All this implies a contradiction with the objective stated by the regional Administration itself of wanting to advance in effective solutions for the SESMM. On the other hand, citizen platforms and NGOs have disclosed the available information to society on the state of the SES.[3] These stakeholders are exercising active social pressure to denounce and demonstrate the SES degradation, to ensure that the administration enforces with current regulations and hastens to take management measures that are sustainable in the medium and long term.

4.2. Preferences and analysis of conflicts and consensus among stakeholders on possible management measures in the SESMM

Regarding the preferences of the stakeholders on possible measures to improve urban-tourist development in the Mar Menor, results from the 14 interviews with the representatives of each stakeholder groups show that there is a conflict between the stakeholders representing the construction sector and the tourism sector dedicated to services, and the stakeholders representing the rest of the sectors. The first ones prioritize to *Improve the bike lane and the spaces adapted for walking and sports (D5),* compared to the rest of stakeholders, who consider that the most urgent action should be *Do not make a greater offer of second homes (D1)*. In this line of action, several studies (Romero et al., 2011; Pérez et al., 2016) point out the irreversible impacts associated with the development of new urban areas and a tourism model based on second homes, which justifies that given the diagnosis of the SESMM, this is a priority measure for most of the representatives of each stakeholder group. Also, other studies in other socio-ecological systems of the Spanish Mediterranean, such as the Valencian coast (for example: Montgó Natural Park and the Mata and Torrevieja Lagoons Natural Park) have shown the negative environmental, social and economic consequences of this type of urban-tourist development model (Capdepon, 2016; Marti et al., 2011). Despite this discrepancy, it is important to point out that all the representatives of each stakeholder group agree that the second preference should be to *Improve the management and protection of natural areas around the Mar Menor, coastal wetlands and free areas of buildings (D7)*.

The Mar Menor lagoon and the surrounding wetlands were declared a protected natural space through various regional, national and international protection figures (see above). Despite all this, it has never been effectively managed as a natural space. The jurisdictions of the different Administrations (European, national, regional and local) related to the protection of the lagoon have not enforced the current regulations and have caused an inefficient outcome as shown by the degraded state of this SES. For this reason, it is necessary to have greater coordination and strong leadership of the public administration via the Autonomous Community of the Region of Murcia, which is the administration with more powers related to the problem of the SESMM. Most of the competences in the management of the SESMM are held by the regional administration, which are divided between two departments: 1) The Department of Agriculture, Water, Livestock, Fisheries and Environment and 2) the Department of Development and Infrastructures. Similar situations have been seen in other internationally recognized SES such as Doñana (Palomo et al., 2011) and the Everglades (Childers et al., 2019), which, despite having the declarations of Biosphere Reserve, World Heritage and Importance Ramsar International, have been threatened by human pressure and climate change. As weak as they may be, it is necessary to insist on enforcing the instruments of planning and management of protected natural spaces which, according to current legislation, must prevail over urban planning. However, as pointed out in the examples presented, reality shows that in general these instruments are subject to urban plans that sometimes take precedence.

Regarding the prioritization of measures to limit the entry of nutrients into the Mar Menor lagoon, the results from the 14

[2] For example, see https://www.laverdad.es/lospiesenlatierra/noticias/cuatro-expertos-abandonan-20191020213140-nt.html.
[3] For example, see https://pactoporelmarmenor.blogspot.com/2020/06/plan-para-la-proteccion-del-borde.html.

interviews with the representatives of each stakeholder groups indicate that all of them agree that the first measure should be to *Reduce the irrigated area (L1)*. This consensus represents an important change of opinion since the irrigated area has been increasing since 1979. Data from Carreño (2015) highlight that from 1988 to 2009, the irrigated area increased 141% and this expansion increased the water and nutrient flows reaching the Mar Menor lagoon and its surrounding wetlands (Martínez et al., 2005; Velasco et al., 2006; Carreño et al., 2008; Esteve et al., 2008; Martínez et al., 2014; Esteve et al., 2016). The increase in these flows has been confirmed by the rise in the piezometric levels of the Campo de Cartagena hydrogeological unit (Rodríguez Estrella, 2009; Aragón et al., 2009), as well as by the increase in the water table, the periods of flooding and soil moisture in the Mar Menor wetlands (Álvarez et al., 2007).

However, results highlight significant differences regarding preferences for other management measures. Representatives of the agricultural sector, the fishing sector and the tourism sector dedicated to hotels and restaurants, consider it to be a second priority measure to *Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea (L9)*. This measure is highly controversial because it does not act on the origin of the problem and against which the rest of the stakeholders disagree, placing it as the last option, and prioritizing measures such as *Require that each desalinator includes a brine treatment (L2)* and the *Elimination of irregular uptake of groundwater (L3)*.

We found that, in the design and implementation of a deliberative participation process towards consensus, it can be difficult to prioritize management measures which both improve urban tourism development and limit the entry of nutrients into the lagoon. However, it is necessary to highlight some consensus on the prioritization of management measures that represent a first important change of opinion, such as to *Reduce the irrigated area (L1)*. Although in this work the representatives of the agrarian sector agree with this measure, there is evidence in previous years[4] in which stakeholders belonging to the agrarian sector deny the need to reduce irrigation.

Secondly, the opinion of the stakeholders interviewed who represented the public administration group indicates that they are not closer to specific economic sectors, and that they prioritize measures that are their responsibility, such as to *Improve the management and protection of natural areas around the Mar Menor, coastal wetlands and free areas of buildings (D7)*, *Do not make a greater offer of second homes (D1)*, or *Reduce the irrigated area (L1)*. On the contrary and according to interviews with the 20 experts, the public administration has not enforced with current regulations, has had a practical absence of effective measures, and has protected business sectors such as agriculture sector and construction sector with a short-term economy; instead of the natural heritage as a guarantee of a sustainable future in the medium and long term, which is part of their governing mandate. An explanatory hypothesis to this contrast is that the 20 experts have evaluated the effective practices of public administrations, which depend on the political level (where decisions are made), while the representatives of public administration group interviewed belong to the technical level and their positions do not always reflect those of the political level. In fact, discordant criteria have been identified between these two levels, technical and political, in different environmental policies in the Region of Murcia in the last two decades, such as those related to the protection of nature (Esteve et al., 2012).

4.3. Analysis of conflicts and consensus between the stakeholders and the local community on possible management measures for the restoration of the system

It is concluded that there are discrepancies between the representatives of each stakeholder groups in this study, with the group of respondents belonging to their professional field in the survey to the local community in Guaita et al. (2020). In this sense, the interviewed stakeholders belonging to the public administration, the tourism sector dedicated to hotels and restaurants, and the agricultural sector are the ones who differed the most in their preferences for management measures to improve urban-tourist development with respect to the groups of respondents corresponding to these economic sectors. In the case of measures to limit the entry of nutrients to the lagoon, the level of discrepancy between the preferences of the interviewed stakeholders and the group of respondents was even greater than in the previous case. This indicates that the positions between the stakeholders and the sector that they represent in the local community are not always coherent. One possible explanatory hypothesis is that representative stakeholders are more technical than official spokespersons, so their positions tend to be more focused or close to those of other stakeholders.

Regarding the distance in the preferences on the measures, both to improve urban-tourist development and to limit the entry of nutrients to the lagoon, among the groups of respondents in the survey to the local community (Guaita et al., 2020) is greater than that observed among the interviewed stakeholders, where there are various clusters based on the similarity in the responses that the stakeholders gave to order their preferences. In the preferences for measures to improve urban-tourist development, three clusters are formed, the stakeholders representing: 1) the construction sector and the tourism sector dedicated to services, 2) the fishing sector, the public administration sector, the NGOs and citizen platform, and two of the three actors representing the academic sector and 3) the tourism sector dedicated to hotels and restaurants, the agricultural sector and an actor from the academic sector. To limit the input of nutrients, two clusters are formed: 1) the agricultural sector, the fishing sector and the tourism sector dedicated to hotels and restaurants, and 2) the rest of the stakeholders.

5. Conclusions

The interviews of the seven stakeholder groups identified show a broad consensus that the central and mobilizing problem

[4] For example, see https://www.murcia.com/region/noticias/2019/10/25-devolver-a-secano-y-regadios-intensivos.asp.

perceived by all is the degradation of the environmental quality of the SESMM and particularly of the Mar Menor lagoon, due to the current situation of eutrophication. They also agree that management measures are needed to limit the entry of nutrients to the Mar Menor lagoon and to improve the urban-tourist development of the Mar Menor environment. This consensus does not translate to stakeholder group preferences for solutions or management measures. However, it is necessary to highlight some consensus on the prioritization of management measures that represent a first important change of opinion, such as reducing the irrigated area. Although in this work the representatives of the agrarian sector agree with this measure, there is evidence in previous years and at present that the actors belonging to the agricultural sector deny the need to reduce irrigation.

From these results, two interesting conclusions emerge regarding the design and implementation of a deliberative participation process. In the first place, it is possible to foresee difficulties, at least in its initial phase, in reaching possible consensus on the prioritization of measures. Second, the involvement of the stakeholders identified and interviewed in the framework of this work in such participatory processes can be positive, since they present a distance among their respective positions that is less than that detected among their sectors, according to the results obtained with the population survey. Therefore, the involvement of these actors in participatory processes can facilitate the generation of consensus that, later, could be extended to their respective sectors.

One limitation of this work is that the interviews were carried out mostly to stakeholders belonging to the local community. This fact makes difficult to know to what extent the positions of the interviewed stakeholders are like the positions of other stakeholders belonging to the same group (e.g., farmers or Environmental NGOs) at wider spatial scales, such as the entire Murcia Region. In future works, the approach presented here will be applied to wider scales, to investigate this issue.

Another limitation is that face-to-face workshops with stakeholders, planned for year 2020, could not be carried out due to the restrictions imposed by the Covid-19 pandemic, which prevented the necessary feedback of the research to the stakeholders who contributed to it. In this sense, other future line of continuity work is the holding of participatory workshops with the stakeholders, to present this work and jointly commonly discuss some of the obtained results. This future work with the stakeholders must also incorporate a perspective that analyzes and considers the existing power relations among the different stakeholders and how such relations can be adequately managed within a participatory process.

The approach presented in this work might be of interest for other socio-ecological systems presenting conflicting interests and perceptions among stakeholders. For application in other cases, it is essential a complete identification of all stakeholders in each case, to ensure that no stakeholders are missed. Another important issue in future applications is take into consideration the motivations that stakeholders may have to be involved, to prevent the participatory fatigue.

Author statement

Noelia Guaita Garcia: Writing – original draft, Investigation, Conceptualization, Methodology, Writing-Reviewing and Editing. **Julia Martinez Fernandez:** Supervision, Writing-Reviewing and Editing, Methodology and Conceptualization. **Carlos Javier Barrera Causil:** Methodology, Validation, Writing-Reviewing. **H. Carl Fitz:** Supervision, Writing-Reviewing and Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Structure and content of the interview with the experts

Dear.

From the University of Alcalá in collaboration with the University of Florida (USA), we are carrying out a study to know the current situation and changes in the Mar Menor basin in relation to land use changes and its effects. The objective is to quantify and identify the current state of the main land use changes such as the urban tourism and agricultural sectors, as well as their impacts on the Mar Menor basin and how these have changed over time. It is also intended to have a diagnosis of the current state of the water resource and of the environmental values and ecosystem services, due to their importance for the surrounding community. Given his experience, his participation, completely anonymous, is very important for this research, as well as for his community and the improvement of the situation in the Mar Menor and its surroundings.

INTERVIEW

Current situation and changes in the Mar Menor basin

1. What are the main processes (ecological, social, economic) that affect the current socio-ecological crisis in the Mar Menor?
2. As an expert, what solutions could be provided?
3. Who are the main stakeholders in the basin and what are their roles?
4. What is the central and mobilizing problem perceived by the different stakeholders in the Mar Menor basin?
5. Regarding the solutions mentioned in question 2, which stakeholders (individuals or groups) could contribute to implement those solutions, or would they be potential allies to implement those solutions?

Respondent information

- Identify your scientific-technical area of experience or knowledge in relation to the Mar Menor theme.
- What is your relationship with the Mar Menor?

Appendix B. Structure and content of the interview with the stakeholders

Dear.

The Mar Menor socio-ecological system (SESMM) is facing a serious environmental degradation, which is generating significant economic and social costs. Faced with this situation, it is necessary to search for management measures with an integrated approach from the different groups of stakeholders involved with the common objective of improving their environmental and socioeconomic situation. From the University of Alcalá in collaboration with the University of Florida (USA), we carried out an interview between the months of February to May 2017 to find out the social perception of the Mar Menor area on the pressures, impacts and possible measures to adopt to improve the current situation of the SESMM and a list of preferred measures was obtained to 1) improve the urban-tourist development of the Mar Menor and 2) limit the entry of nutrients into the Mar Menor lagoon. Given your position as a stakeholder and experience, we want to know your opinion regarding the order of preference of these selected management measures and your perception of the SESMM diagnosis. Your participation, anonymous, is very important for this research, as well as for your community and the improvement of the situation in the Mar Menor and its surroundings.

INTERVIEW

1. What is the central and mobilizing problem that, as a stakeholder, you perceive in the socio-ecological system of the Mar Menor (hydrographic basin, lagoon and surrounding wetlands)?
2. The following management measures to improve urban-tourist development in the Mar Menor were rated according to their level of importance on a scale of 0–100. Update these ratings according to your knowledge.
   1 Improve the public transport network 74%
   2 Do not make a greater offer of second homes 100%
   3 Improve the bike lane and the spaces adapted for walking and sports 30%
   4 Do not carry out a greater construction of hotels 1%
   5 Improve the management and protection of natural areas around the Mar Menor, coastal wetlands and free areas of buildings 16%
   6 Remodeling built buildings for an improvement of tourist image 55%
   7 Improvement of parking areas 52%
   8 Improvement of the infrastructure for road traffic 14%
   9 Improvement of accessibility to urbanizations and beaches 19%
   10 Urban moratorium 16%
   Others. Which ones?

3. The following management measures to limit the entry of nutrients into the Mar Menor lagoon were rated according to their level of importance on a scale of 0–100. Update these ratings to the best of your knowledge.
   1) Establish and monitor the application of maximum values of fertilizer contribution 47%
   2) Elimination of irregular uptake of groundwater 60%
   3) Require that each desalinator includes a brine treatment 64%
   4) Apply natural measures of water and nutrient retention at plot scale and in the watershed 52%
   5) Reduce the irrigated area 100%
   6) Do not collect the brines and pour them directly into the Mediterranean Sea 13%
   7) Recover and enhance the lost surface of natural wetland in the periphery of the lagoon 53%
   8) Build a green filter to treat the flow of the Albujón watercourse 22%
   9) Collect the brines and part of the flows of the waters of the "ramblas" and after their dislocation and denitrification pour their reject flow into the Mediterranean Sea 1%
   Others. Which ones?

Are you totally sure of the ratings you provided for each measure? Review the qualifications, and if necessary, update the ones you consider.

Appendix C. Stakeholders characterization and their relationship with the SES

Table 4
Identification and characterization of stakeholders.

Stakeholder groups	Who are they?	What do they do?	What do they perceive?	What do they propose?

(*continued on next page*)

Table 4 (*continued*)

Stakeholder groups	Who are they?	What do they do?	What do they perceive?	What do they propose?
Public administration (National, Regional and Local)	Government agencies responsible for the management of the territory, the uses and activities that take place there and the conservation of the environment	National administration (Confederación Hidrográfica del Segura): it has not carried out a minimum control over the use of water in the watershed, it has not intervened in the development of new agricultural infrastructures, it has not controlled the dumping of brines with high nitrate content into awtercourses, especially that of Albujón. -Regional administration (Ministry of Water, Agriculture and Environment): it has not carried out any control over land uses, it has not implemented measures against erosion, it has not established the distance limits to the lagoon to which it can be cultivated, It has not carried out any control on the use of fertilizers and fertilizers until the current regulations have been released to the public, the Management Plans that the SESMM is endowed with have not been developed. -Local Administration (Town Halls): has carried out harmful practices on the lagoon such as; the poor regeneration of beaches and the dredging operations that it carries with it, have protected business sectors such as agriculture and construction sectors with a short-term economy against the protection of natural heritage as a guarantee of a sustainable future in the medium and long term.	-Regional administration: Socio-environmental impact in the SESMM. -Local administration: does not take seriously the current deterioration of the lagoon. Try to get the best economic return to the lagoon not always taking environmental care as a priority.	It is forced to take urgent action, although without quite knowing in which direction. The regional Administration created a social participation committee and a scientific committee for advice on making decisions on the management of the SESMM.
Agricultural sector	Influential primary sector in the society and economy of the SESMM, as well as in the political groups. There are two different groups, the farmer who manages his land and the multinational or large company that rents it.	Intensive irrigated agricultural activities that have had and continue to have a significant environmental impact on the lagoon, wetlands and watershed. Management and regulatory measures have not been applied to reduce the impact. They do not assume that resources and physical space are limited.	It is in the process of accepting its responsibility for the environmental degradation of the SESMM, especially the lagoon, but the sector lacks the organizational tradition to adopt coordinated and effective responses. The sector believes that they are in the crosshairs and there is negative publicity for their activity among society. But they do not believe that they are the only ones responsible for the deterioration of the Mar Menor lagoon and watershed.	The sector considers that the solutions should be adopted by the administration and should not affect the reconversion of its activities. They are reluctant to change current cultivation practices. The farmer who manages his land is available to take measures for recovery, while the multinational or large company that rents it, exploits the resources without respect for the ecosystem.
Tourism sector	Influential sector in the society and economy of the SESMM. There are two groups, the one dedicated to hotels and restaurants, and the one dedicated to services.	They maximize profit. It has had and continues to have a relevant environmental impact on the lagoon and its surroundings due to its connection and/or promotion of unsustainable uses with its own business activity. They do not assume that resources and physical space are limited.	Decrease in the number of tourists. Reduction of income in the service sector. The sector does not acknowledge his share of blame and points to the agricultural sector as the only responsible for the degradation of the lagoon. It is one of the sectors that may experience the greatest loss in value if the current situation continues. The	It is still committed to short-term and future-proof solutions that are incompatible with improving the lagoon's environmental and tourist quality. They want the lagoon to have a suitable aspect for the development of its short-term activity and the regeneration of sandy beaches. There is no impact on diversification, new

(*continued on next page*)

Table 4 (*continued*)

Stakeholder groups	Who are they?	What do they do?	What do they perceive?	What do they propose?
			tourism sector dedicated to hotels and restaurants perceives the impact differently than service tourism.	production niches based on sustainability or the circular economy.
Fishing sector	Economically marginal sector that constitutes a good indicator of environmental health and a key component of the identity of the lagoon, with an important potential for reconversion towards new forms of tourism.	It is a local, artisanal and traditional fishing, which operates with very particular and unique fishing gear from the lagoon itself.	Deterioration of the water quality of the lagoon. Changes in fishing catches of common species in the Mar Menor. Drop in product sales from the Mar Menor. Along with the tourism sector, it is one of the sectors most affected by the degradation of the lagoon.	They are in favor of adopting comprehensive measures for the recovery of the lagoon.
Construction and real estate sector	Influential economic sector in the SESMM society, as well as one of the main drivers of change.	The sector is waiting to recover after the bursting of the housing bubble to maximize profit.	The sector is aware of the situation of environmental degradation of the SESMM in recent years, although due to the inactivity of the sector in this same period, it points out that the agricultural and tourist sectors are the main responsible for this situation.	New urban constructions and infrastructures when the real estate market recovers. Meanwhile the remodeling of buildings and infrastructure already built.
Academic sector	Universities and research centers that focus their scientific activity on the SESMM by carrying out different basic and applied research studies.	It constitutes a powerful source of knowledge about the SESMM, with diagnostic capacity, an integrated aporach of the situation and the proposal of reasonable and reasoned solutions. They are the ones that have alerted the administration to the degradation situation of the SESMM.	They show the urgent need for action on the main driving forces. The numerous human pressures are generating serious impacts on the SESMM, which puts its uniqueness and sustainability at risk in the medium and long term.	Search for urgent measures and actions with an integrated approach from the stakeholders involved with the objective of improving the socio-economic and environmental state of the SESMM
Citizen platforms, NGOs	Neighborhood, sports, cultural and environmental protection associations.	They exert active social pressure on the complaint and evidence of the situation of the SESMM so that the administrations rush to take measures to solve the problems.	Loss of ecosystem services and quality of life. Failure to comply with current regulations, lack of coordination and effective measures, and social concern about the impact/deterioration situation in the lagoon and its watershed.	Protection of the lagoon, surrounding wetlands and its watershed. They demand action by the public administration.

Source: own elaboration from interviews with experts.

Table 5
Relationship of stakeholder with the SES.

Stakeholder groups	Relationship with SES and its degradation	Main interest of the stakeholders	Main relationships between stakeholders
Agricultural sector	Intensive irrigated agricultural activities	High economic productivity in crops	Public administration: influence and votes for regional and local governments
Tourism sector	Demand for infrastructures and leisure activities	Maximize profit with uses and activities with the claim of associated infrastructures without considering that natural resources are limited. The sector demands a clean Mar Menor	Agricultural sector: sector responsible for environmental degradation in the SES. Administration: votes for the regional and local governments.
Construction and real estate sector	Urbanization and infrastructure development	New urban development and infrastructure	Local administration: maximize the benefit in relation to urban development. Agriculture and tourism sectors: sectors responsible for environmental degradation.
Fishing sector	Overfishing	Traditional fishing of local species with high economic value in the market	Agricultural, construction and tourism sectors: responsible for the eutrophication of the lagoon.
Academic sector	Exchange of scientific-technical knowledge	Generation of technical studies and scientific research in relation to regarding ecological and socio-economic aspects of the SES	Public administration: collaboration through analysis and evaluations with scientific and technical reports. All sectors: contribution through the generation of useful information
Public administration (National, Regional and Local)	Establishment of management policies: apply the regulations and sustainable management measures.	Define management strategies that integrate the interests of different stakeholders	Relationship with all sectors, especially with the economic sectors of agriculture, construction and tourism. Underlying economic interest.

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Table 5 (*continued*)

Stakeholder groups	Relationship with SES and its degradation	Main interest of the stakeholders	Main relationships between stakeholders
NGOs, Citizen platform	Coordination between the three levels of administration Social pressure on the management of the SES to the administration and the economic sectors	Achieve sustainable development in the SSE. Apply the current legislation and regulations.	Public administration: social pressure to apply current regulations and report their non-compliance. Report illegalities or environmental damage. Agricultural sector, tourism sector and construction sector: inform civil society and institutional organizations about their uses and activities in the SES. Academic sector: disseminate scientific-technical studies in relation to the SES.

Source: own elaboration from interviews with experts.

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