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Analysis of the vulnerability of tourism and leisure to jellyfish swarms on the eastern Costa del Sol. A multiscale and multi-temporal perspective

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Jellyfish swarms have been reaching a good part of the coast of southern Spain for decades (Prieto & Navarro, 2013; Red de Información Ambiental de Andalucía (REDIAM), 2018; De la Fuente et al., 2021). Although strandings year frequency are not regular, touristic and leisure activity in those beaches are sometimes quite affected (Rubio & Gutiérrez, 2020). There was a pick in the summer of 2018, so quite part of beaches on the coast of the provinces of Malaga and Granada were affected.

Due to the unquestionable importance of the good condition of the beaches for the economy of the coastal areas, it has been considered positive, in the analysis of the problem in question, to evaluate the consequences and implications on the users of the beaches, as well as in their area of influence, in which the coastal tourist activity is developed. A methodology has been provided in the article that allows to know the point of view of the users of the beaches, as well as of the businesses that depend on the tourist sector in the coastal areas in the face of a negative event such as the appearance of jellyfish. For this purpose, a pilot study area has been used as a sample in the beaches of Torre del Mar and Caleta de Vélez, in the municipality of Vélez Málaga (Málaga), understood as an excellent example of tourist dependence on sun and beach and therefore optimal for applying its vulnerability to events of massive appearances of jellyfish.

The methodology to evaluate the vulnerability of the tourism sector to the recurrence of jellyfish on the beach that has been taken as an area of study will be developed at different levels of both temporal and spatial scale. On the one hand, the spatial dimension will consider the study of vulnerability at three scales: beach, area of influence and municipal. On the other hand, a temporal scale, which is composed of two



dimensions: short-term, consider the possible immediate impact of the arrival of a jellyfish swarm and long-term, to address future impacts in a hypothetical scenario of more frequent jellyfish blooms.

In analysing these spatio-temporal contexts, two types of sources have been used. The official economic statistics offered by official statistics institutes (in the case of Andalucía, the Andalusian Institute of Statistics and Cartography) and, surveys and interviews performed through fieldwork. These sources have been used depending on the context, for the beach, its area of influence or both.

In the exposure analysis, the economic activities potentially exposed (restaurants, bars, pedal boat rental businesses, hammocks, street vendors, shops, hotels and tourist homes, activities derived from the nautical club, sports courts, hotels, restaurants, beach bars) have been inventoried.

In terms short term vulnerability, in the analysis at beach level, beaches whose users are more sensitive to the jellyfish problem, less aware of it, and have no alternatives have been considered more vulnerable. Discussions about user vulnerability, in relation to the degree discomfort experienced, in which the aim is to characterise the dependence on bathing when going to the beach in the presence of adverse elements that make it impossible, among others jellyfish. Therefore, on the one hand, the assessment of the state of the beach has been analysed, and on the other hand, the valuation of the state of the beach has been analysed and on the other hand the valuation with respect to the presence of annoying elements such as the presence of jellyfish. Concerning the evaluation of beach state, most of the users consider the dirtiness of both the water and the sand as negative elements that affect their experience. On the other hand, more than half of the users are willing to stay on the beach although of the presence of jellyfish in the water, while a high percentage of them indicate that the degree of annoyance is high or very high. Analysing the preventive measures taken by the users, the vast majority are unaware of mobile applications, such as Infomedusa, which evaluate the presence or not of jellyfish on the beach. In similar proportions, there are users who do not use any protective or mitigating element against jellyfish stings and those who do not know how to act in such a situation, which implies a high degree of vulnerability in this indicator.

Also at user level, the possible alternatives to bathing in case of elements that make bathing difficult have been analyzed. Of the total number of respondents, most of them would go to a swimming pool, although 25% would stay on the beach in case of disturbing elements and a small percentage said they would stay on the beach with the alternatives it offers. This means that more than half of the users would abandon the beach.

After the analysis of the economic vulnerability of the area of influence, carried out through interviews with the suppliers of tourist goods and services on the beachfront, it is concluded that the economic activity in a short time has not been altered by the presence of jellyfish on the beach, with no cancellations of reservations due to this reason. With respect to the hotel establishments, most of them determine that they have not suffered cancellations due to the appearance of jellyfish on the beaches, although there is a greater use of the hotel facilities (swimming pool and restaurant) on the days when jellyfish appear. Regarding the long-term consequences, it is important to emphasize that 23,7% of vacationers would choose not to continue going to this stretch of beaches. Despite this, 72,7% would repeat their holidays in this segment of the coast, motivated by the climate and the prices of restaurants and establishments.

In the analysis of the long-term consequences for the municipality, by consulting the source data available in the Multiterritorial Information System of Andalusia (SIMA), a high vulnerability of the municipal economy is perceived since 24.7% of the companies in the municipality are directly or indirectly linked to the tourism sector (Accommodation, recreational activities, employment agencies, construction, real estate, travel agencies...). In addition, taking into account the official data on contracts registered by the State Public Employment Service (SEPE) and the Andalusian Employment Service (SAE), it appears that 71.6% belong, directly or indirectly, to tourism, with 61% belonging to the service sector and 10.6% to the construction sector.

The results show a high vulnerability of the beach, especially in the short term, mainly due to a high net exposure, composed by users significantly affected by the consequences of a hypothetical case of impossibility to bath. Moreover, preventive measures, such as the use of mobile applications or jellyfish protection devices, are not very popular among users, most of whom do not know how to act in case of jellyfish presence or stings. Even so, the consequences are not so negative in the long term, since it is estimated that most of the respondents would return to this stretch of coast for holidays. As for the area of influence, it is not



affected in the short term, although it is highly vulnerable due to the high number of workers and businesses related to the tourism sector.

In conclusion, the phenomenon of jellyfish swarms tends to show a certain repetition in time and space conditioned by the predicted climatic contextual situation. Therefore, these spaces are exposed and vulnerable both on a social and economic level to the cycles observed which could alter the situation of the human environment in the Mediterranean framework. The existence of alternatives to the Costa del Sol destination in other geographical area of the world may have an impact and decrease on economic activities, which may result in the displacement of visitors and tourists to other geographical points that preserve the traditional characteristics of the tourist culture of this inland sea.

Knowing the vulnerability of the territory is fundamental for the application of measures to mitigate the problem and avoid the loss of visitors during periods of special affection. The application of the proposed methodology in other study areas would permit to compare results from different areas and it would also allow to obtain comparable maps of vulnerability in several study areas.