



# aquaculture europe

VOL. 47 (2) SEPTEMBER 2022

**Use of GIS to manage production  
in protected natural coastal areas  
of the Iberian Southwest**

**What drives  
collaborative  
innovation?**



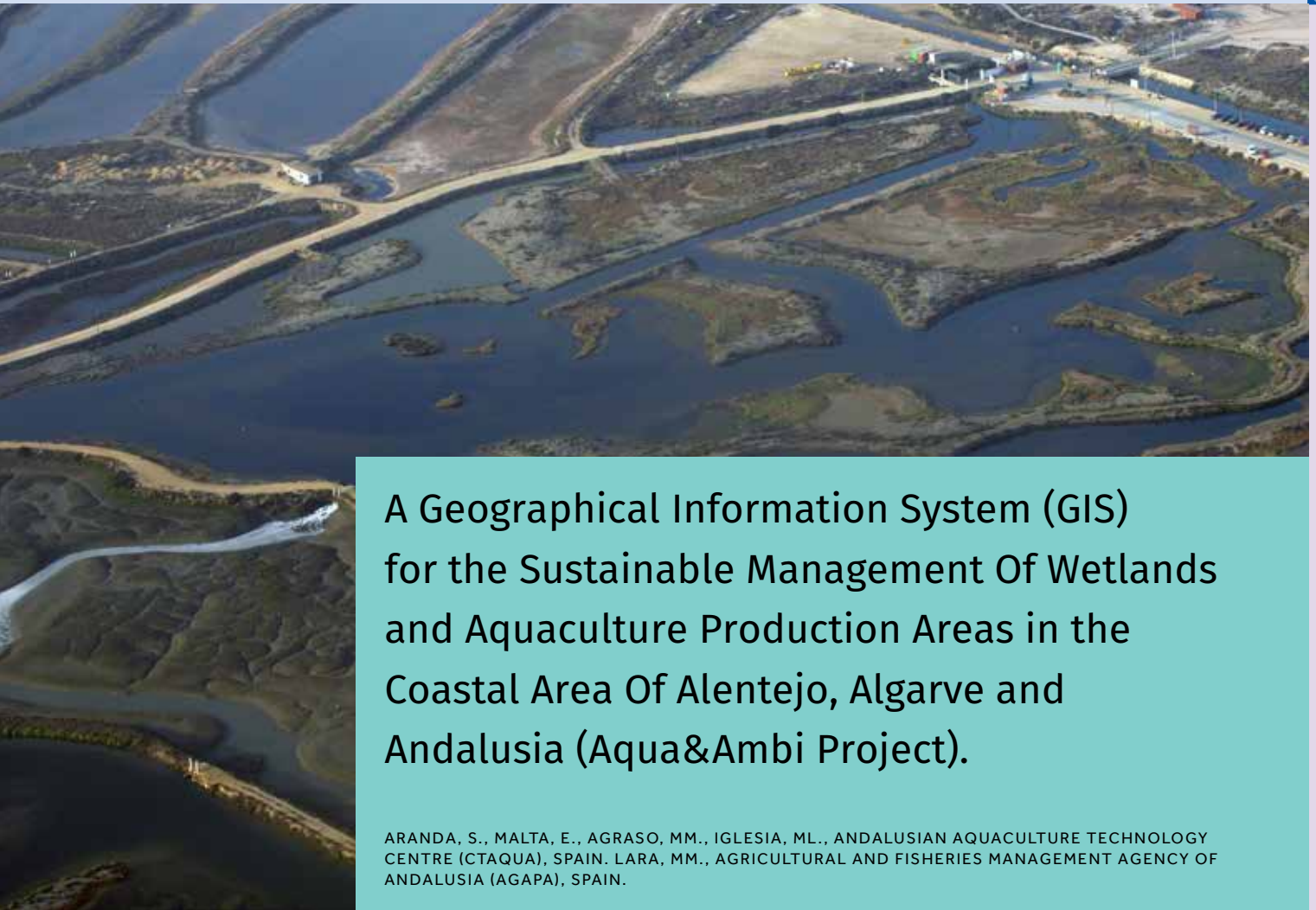
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## A Geographical Information System (GIS) for the Sustainable Management Of Wetlands and Aquaculture Production Areas in the Coastal Area Of Alentejo, Algarve and Andalusia (Aqua&Ambi Project).

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The project “*Apoio à gestão das zonas húmidas do litoral do Sudoeste Ibérico: interações entre Aquacultura e meio Ambiente na região transfronteiriça Alentejo-Algarve-Andalusia (AQUA&AMBI)*” is executed under the INTERREG VA Spain-Portugal Operational Programme (known as POCTEP by the Spanish-Portuguese abbreviation), which promotes cross-border cooperation. This project aims to improve the state of conservation and to increase the number of the restored areas, as well as its profitability in terms of economic activity in the Alentejo-Algarve-Andalusia cross-border region (AAA Euro-region). The project is developed to meet existing needs of having access to spatial information, as well as of tools allowing the most sustainable management possible of the coastal wetlands of the Iberian Southwest.

The protected natural areas located in the coastal areas of the Iberian Southwest (Alentejo-Algarve-Andalusia) feature a large number of activities fostering economic development of these coastal areas.

With the aim of assessing the compatibility of these protected natural areas with the various activities to be potentially developed in these locations, a mapmaking process has been conducted in Andalusia for the last decade. The aim of which was to identify the most suitable areas for an orderly development of aquaculture on the coast, for which technical criteria of the aquaculture activity itself, as well as the existing uses, activities and other occupations already established are considered, in addition to the compatibility of these with current regulations. Framed in these lines of work, in 2014 the document entitled “*Catalogue of suitable areas for the development of marine aquaculture in Andalusia*” was prepared, which is an especially useful instrument for the administration, but also a guarantee to investors in the aquaculture sector -updated in 2021.

In the case of Portugal, there was a previous mapmaking work conducted in the maritime area, but not in the land area. The “*AquaSpace: Making Space for Aquaculture*” project is an example of marine spatial planning, and Portugal is included in its area of study.

As stated in the European Union’s reports, major actions are needed to reduce stress on the sea and foster the sustainable use of marine resources and ecosystems, support the blue economy, and develop processes for a meaningful ocean governance. Thus, the concept of “Blue growth” arises, which perceives the marine space as an environmental and socioeconomic system that

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Figure 1: Area of study: Iberian Southwest coastline: Algarve (Portugal) and the Bay of Cádiz (Spain).

includes multiple and widely defined objectives that must be achieved using different means and measures (Lillebø et al., 2017).

In this context, the *AQUA&AMBI* project (*Support for the management of the wetlands of the Iberian Southwest coast: interactions between aquaculture and the environment in the Alentejo-Algarve-Andalusia cross-border region*), through the design of a geographical information system (GIS), has developed different cartographies analysing the compatibility of aquaculture and other economic activities in protected natural areas. Funded by the European Regional Development Fund (ERDF) through the Interreg Atlantic Area Programme, the project started in 2017 and will end in October 2022.

*AQUA&AMBI* supports cooperation between different sectors, including education, industry, and administration, thus strengthening collaborative networks in the area of the Iberian Southwest coast.

### Objectives

The goals of this project include to improve the state of conservation of coastal areas, and to increase the number of restored areas and their profitability. Also, it seeks to maintain and recover biodiversity and ecosystem services of the Natura 2000 network, through the promotion and implementation of sustainable production methodologies and systems appropriate to these protected wetlands. Lastly, this project aims to contribute to a more efficient management of these areas by increasing knowledge and technology transfer.

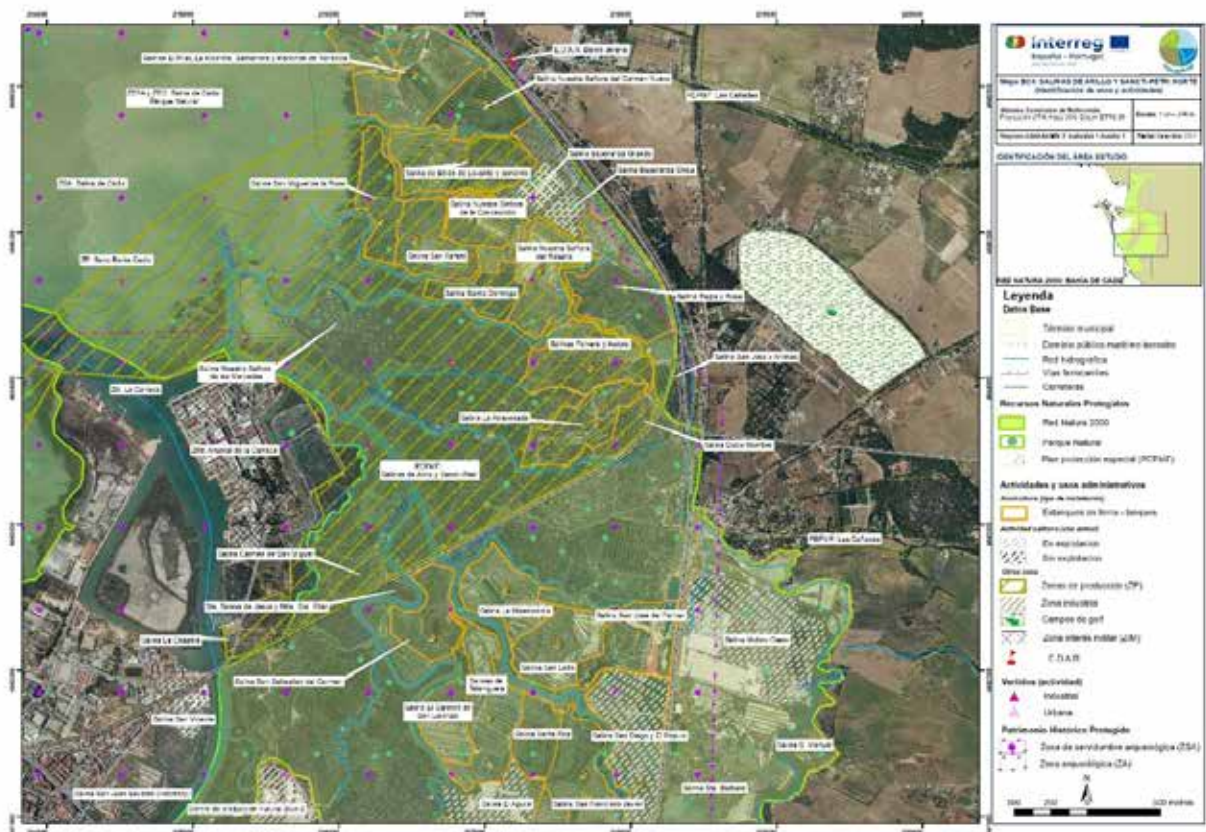


Figure 2: Current activities and administrative uses in the studied area (representation of a single sector).

All these targets have been achieved through the design of a geographical information system for aquaculture production and saline areas. This tool allows the sustainable management of these areas, the main goal of which is to promote the sustainable growth of aquaculture based on knowing the actual availability of spaces, considering potential constraints in the area of study.

At the same time, a study has been conducted on ecosystem services and natural capital, with the aim of identifying those directly provided by the aquaculture activity, and finally, developing actions that enhance those services.

## Materials and methods

As previously mentioned, the objective of Action one is to obtain a zoning and a regulation instrument that serves both companies and administrations in planning economic activities in the area of study. In order to do so, the methodology used has been divided into five steps: (1) identification of the field of study (Figure 1); (2) search and acquisition of data (review of bibliographic sources, regulations, previous studies, consultation with organisations and administrations...); (3) integration of the data into the system; (4) presentation of the cartography with the current activities and administrative uses (Figure 2); and (5) development of a cartography with the results.

### Public interest for aquaculture development compatible with other activities in the area of study: The case of the Bay of Cádiz.

After representing the cartography of administrative uses and the current activities in the area of study, in this phase, a spatial analysis was conducted to identify the areas where aquaculture was being deployed and which other areas were likely to host this activity, considering both technical criteria of the aquaculture activity itself and regulations. Other activities that traditionally take place in the area of study were also analysed.

The methodology used is based, on the one hand, on the individualised study of aquaculture and other activities taking place in the territory (Figure 3), and, on the other hand, on the analysis of the combination of all the activities considered to know the degree of compatibility among them all, which

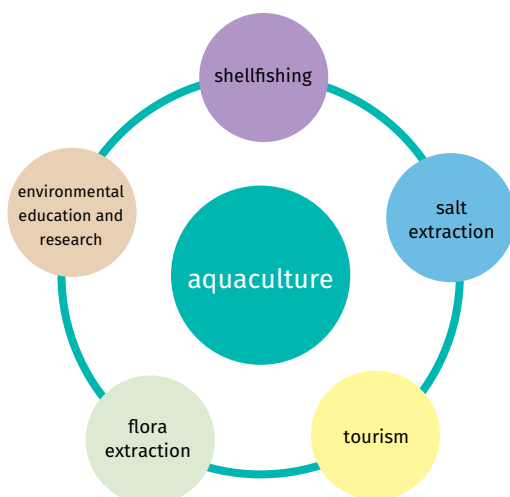


Figure 3: Analysed activities in the studied areas.

allows promoting the economic development of the studied areas.

An analysis of the different activities was conducted including aquaculture, shellfishing, salt extraction, tourism, flora extraction, and finally, environmental education and research. These activities were chosen due to their potential to be developed based on the specific characteristics of the area of study, all of them being identified in the regulations.

The first step was conducting an exhaustive analysis of aquaculture (the main activity in this study), therefore, the areas incompatible with this activity were discarded for the rest of the analysis. The regulations governing the area of study were considered, such as the Natural Resource Planning Plans, and Guiding Plans for the Use and Management. In addition, for each activity analysed, their relevant specific regulations were examined.

As a final result, a series of maps was developed showing the compatibility of aquaculture with the rest of activities (Figure 4 on page 9) selected within the context of the project.

## Confluence of activities in the Bay of Cádiz.

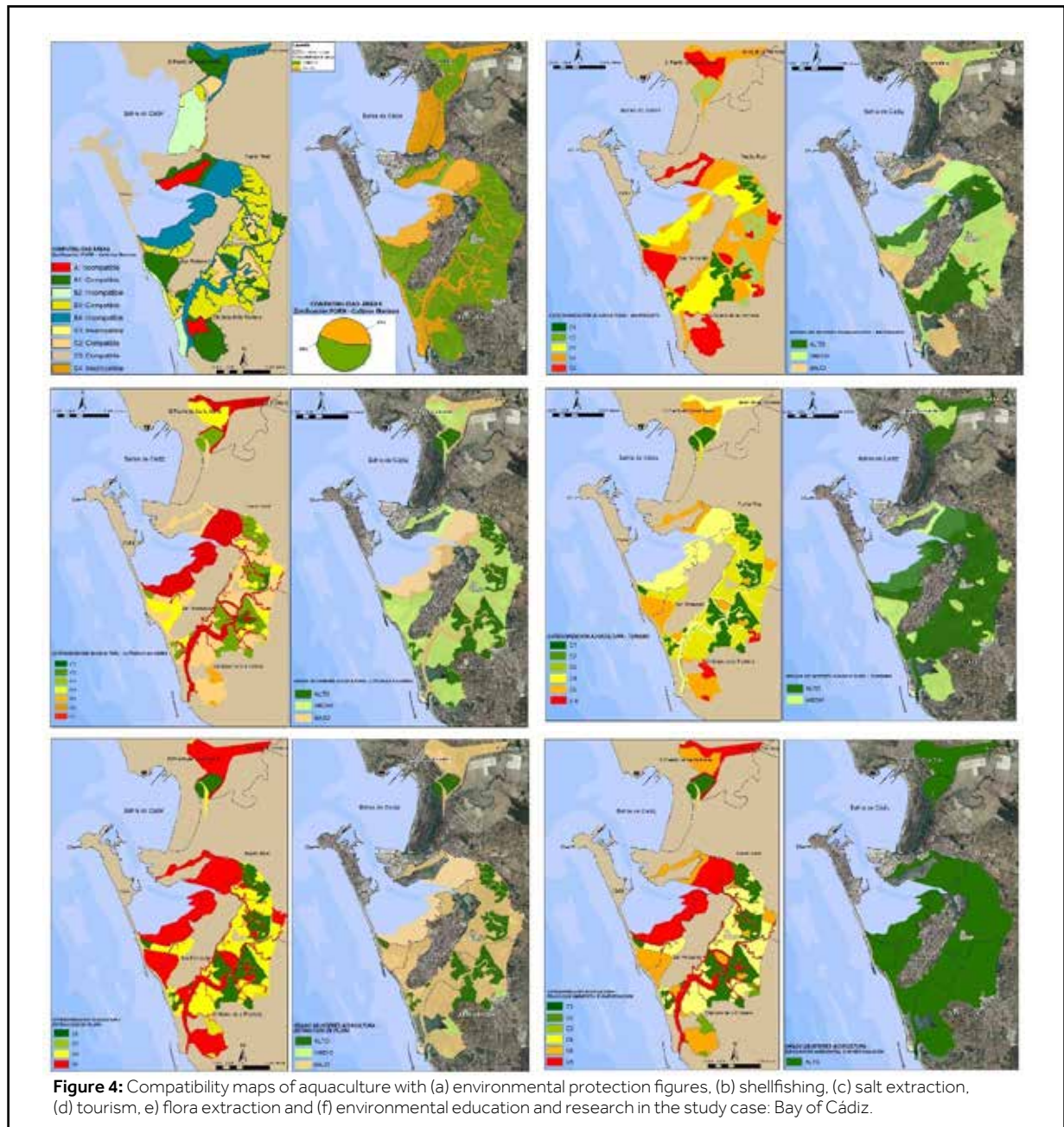
After a detailed analysis of the compatibility of aquaculture (and other activities) in the Bay of Cádiz, those areas in which applicable regulations prevented carrying out these activities were declined. Once the areas where the aquaculture production may be implemented were identified, a combination of all the analysed activities (Figure 3) was settled, giving rise to 14 areas in which the development of aquaculture is possible and in addition to this, the rest of activities are allowed to be developed (Table 1), but with a certain degree of interest; high, medium, or low. The final result is the level of convergence in each area (Figure 5).

## Final considerations for the development of aquaculture and other activities.

In the case of the aquaculture activity, among the steps a promoter should follow to develop an aquaculture initiative, it is essential, in addition to the viability of a business idea, to have a location in which the activity may be established. In a very general way, a promoter may be faced to two situations: (1) to have a space in which they may locate their project, as well as a viable aquaculture initiative adapted to that area; or (2) not to have identified the area in which locate their project, and therefore, be in the need to find one. In both cases, the aquaculture initiative will have to be adapted and referenced to the available space and be subject to an application for an authorization for marine farming.

In this context, the geographical information system developed in the *Aqua&Gambi* project is essential for both promoters and the administration in order to look for an available space where the sustainable development of aquaculture activity is possible together with other economic activities. In this way, a tool has been achieved for the sustainable unlocking of the potential of the seas and oceans, since, as promoted by the FAO, policies on sustainable fishing and aquaculture are necessary to achieve a sustainable use of living aquatic resources, the ecosystems and the services provided by them (Papadomanolakis, 2020).

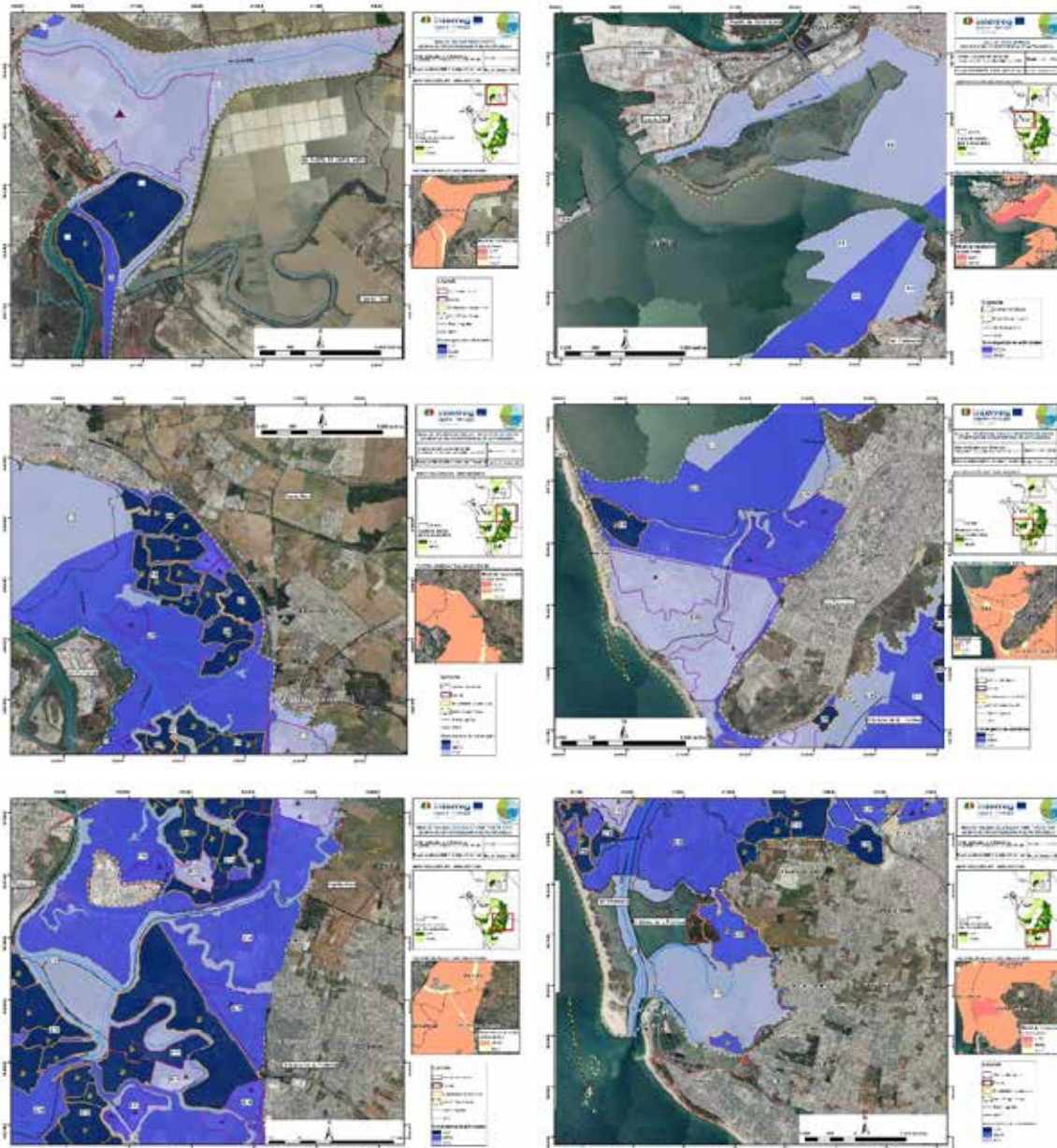
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**Figure 4:** Compatibility maps of aquaculture with (a) environmental protection figures, (b) shellfishing, (c) salt extraction, (d) tourism, (e) flora extraction and (f) environmental education and research in the study case: Bay of Cádiz.

ZONE	AQUACULTURE					CONFLUENCE LEVEL	AREA (ha)
	SHELLFISHING	SALT	TOURISM	FLORA	RESEARCH		
Z.1	Medium	Medium	High	High	High	HIGH	1,608
Z.6	Medium	Medium	High	High	High		
Z.9	Low	High	High	Low	High		
Z.12	High	Medium	High	High	High		
Z.16	High	Medium	High	High	High		
Z.2	Medium	Medium	High	Low	High	MEDIUM	3,559
Z.4	High	Low	High	Low	High		
Z.8	High	High	High	Low	High		
Z.11	High	Medium	High	Low	High		
Z.14	Medium	Medium	High	High	High		
Z.18	High	Medium	High	Low	High	LOW	3,561
Z.3	Low	Low	Medium	Low	High		
Z.7	Medium	Medium	High	Low	High		
Z.10	Low	High	Medium	Low	High		
Z.13	Low	High	Medium	Low	High		
Z.17	Low	High	Medium	Low	High		

**Table 1:** Confluence levels and resulting zones in the study case of Bay of Cádiz.



**Figure 5:** Confluence of activities maps in the different sectors analysed in the study case: Bay of Cádiz.

### Acknowledgements

We would like to thank AQUA&AMBI project coordinator IPMA and all partners (UCA, IFAPA, PISTRESA, CSIC and APA) for their efforts and support.

AQUA&AMBI is funded by the ERDF through the INTERREG Atlantic Area 2014-2020 Programme (project grant number 0750\_AQUA\_AMBI\_2\_5\_P).

For more information on the AQUA&AMBI project, please visit our website at [www.aquaambi-poctep.eu](http://www.aquaambi-poctep.eu)

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