

MARINE SPATIAL PLANNING IN THE CANARY ISLANDS: AN OPPORTUNITY TO DEVELOP OCEAN RENEWABLE ENERGIES AND SYNERGIES WITH OTHER OFFSHORE ECONOMIC ACTIVITIES

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1. Introduction – The demographic growth of the last decades has caused both the increase in food and energy demand as the high level of occupation of the territory, among others. Cities grow around coastal areas, so coastal waters around the world are experiencing increasing demand for their diverse human uses, or ecosystem services. Demand comes from existing sectors such as fisheries, tourism and transport, which seek to expand their activities and emerging sectors, such as renewable energy and aquaculture on the seas. Future outlooks for offshore activities confirm that this trend will continue, and even more likely accelerate, in the next decades.

All these activities have already considerably increased the demand for ocean space. It's necessary a comprehensive study on the interactions among different kind of uses from analysing in time, space and overlap to mutual exclusion, because not all uses are compatible with one another, some of them are competing for ocean space or have adverse effects on each other. The need to coordinate these human uses to reduce impacts across sectors is prompting calls for ecosystem-based coastal and marine spatial planning (MSP).

MSP is an essential tool for the development and management of any coastal region like The Canary Islands. This is an Archipelago surrounded by an extensive maritime territory. Therefore, the need to develop a sustainable ocean planning to exploit the marine economic sectors in this territory has been gaining relevance in the last years.

2. Methodology – The methodology to be followed to develop a suitable maritime zoning that preserves the environment and that takes into account all the uses and restrains in the process of obtaining a MSP is suggested after review different papers of how to carry out an MSP, and based on the study of the practical cases in several places like Portugal, Massachusetts, East Scotia, Belgium and Norway.

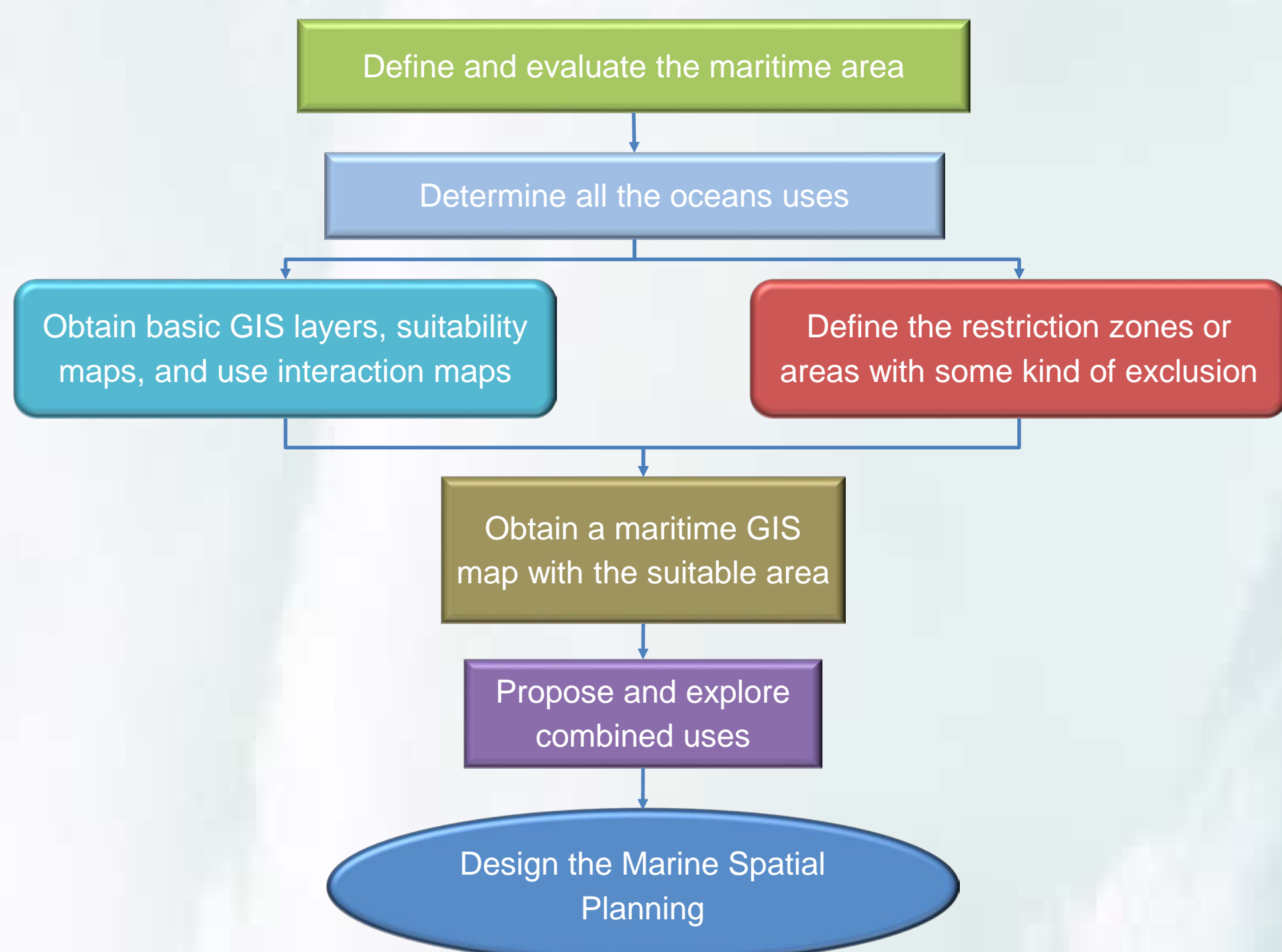


Image 1. Flux diagram of the proposal methodology

The proposal methodology is similar from the one used for spatial land-use planning. Stakeholders, policies makers and marine scientific experts and jurists specialised in maritime laws, between others, must be implied in the final decisions in order to contemplate all point of view.

3. Oceans uses – Uncontrolled growing use of oceans and seas together with the emergence of new forms of exploitation, such as renewable energy and large-scale aquaculture, added to the fact that human population moves to live on the coasts, is worsening the state of coastal waters.

The spatial planning process should analyse a range of alternative measures for managing the interactions, whether positive or conflicting, to reduce impacts, restore ecosystem functioning, and deliver sustainable use. Therefore, it's clear that MSP must include all sectors of economic use as well as environmental and social issues.

The following diagram proposes a classification of the different uses of the sea, depending on its typology:

Exploitation Uses	Restricted Uses	Renewable Energy Production Uses	Other Uses
<ul style="list-style-type: none"> Aquaculture Extraction areas of raw materials Fishery Oil and gas exploitation 	<ul style="list-style-type: none"> Military facilities Ports Protected areas Routes of maritime transport Submarine cables and pipelines Under water cultural heritage 	<ul style="list-style-type: none"> Offshore wind energy Current energy Wave energy Tidal energy Salinity gradient energy Thermal energy 	<ul style="list-style-type: none"> Scientific Research Tourist, recreational, cultural and sports activities Not specific sector

Image 2. Ocean uses classification

4. Restrictions – In order to restructure the marine space, it's necessary to take into account that there are a number of restricted spaces or layers, in which, for diverse circumstances, it's not possible to implement the shared exploitation for other uses.

In this division or assignation of zones and disposal of spaces, it must be considered that the coastal waters, including its seabed and subsoil, are an integral part of the marine environment.

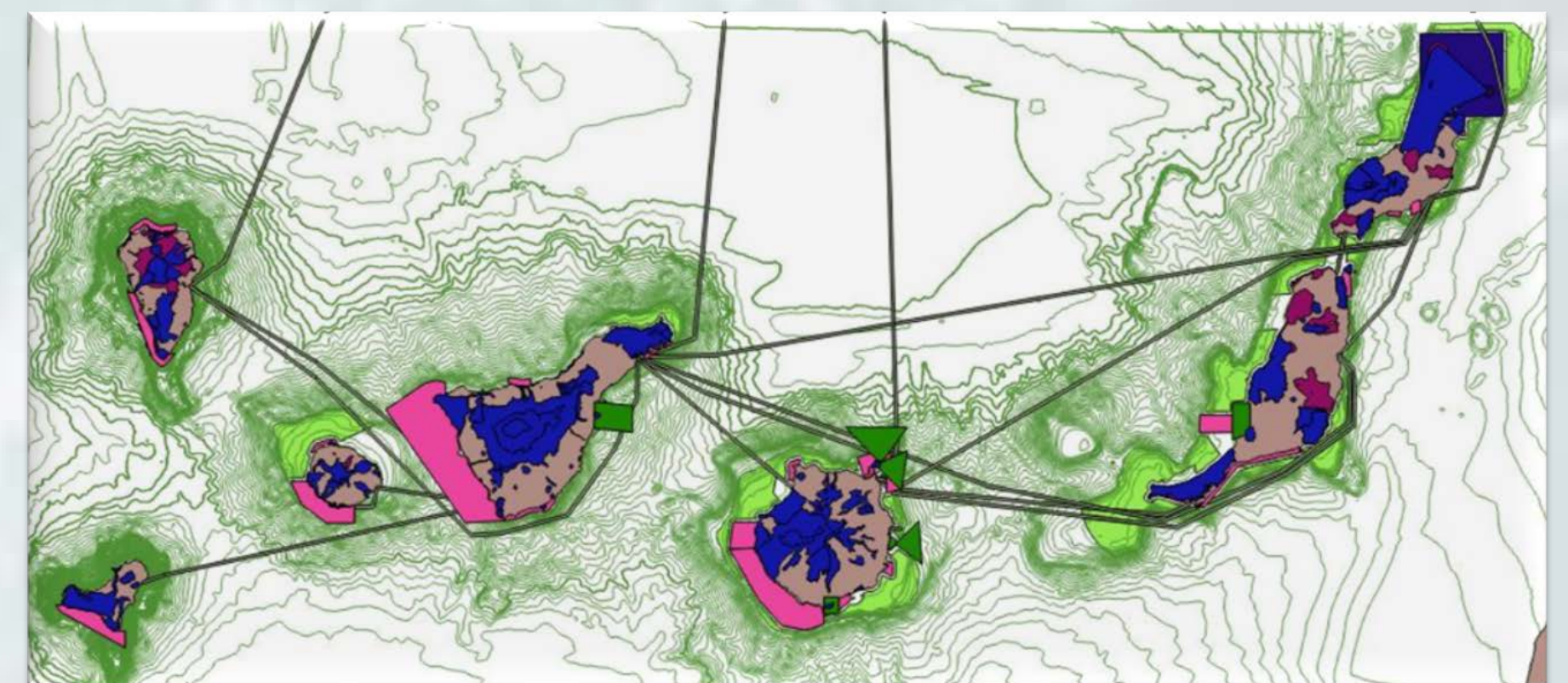


Image 3. GIS – different areas and layers from Canary Islands

For example, underwater noise and electromagnetic fields produced by the Offshore Wind Farms (OWF) constitute a potential risk for some kind of fish and other species situated in the area.

Of all the ocean uses contemplated previously, those that are of exclusive or restricted exploitation are the following: Military facilities and infrastructures for the National Defence, and reserved zones for the practices for the Armed Forces; Ports; Protected areas (marine reserves, biosphere reserves and NATURA 2000); Routes of maritime transport; Submarine cables and pipelines and Under water cultural heritage.

Finally, attention must be paid to the approach areas to airports, due they have a limitation in height for the infrastructures. In this case, the uses that could have some type of problem are those of energy production, namely, the installation of OWF.

5. Possible combined uses – The MSP must create a more efficient and rational use of marine space to provide a balanced view between competing uses, highlighting where one human activity might preclude another, helping avoid or minimise conflicts of interest, and, where possible, optimising the co-location of compatible activities. And must be enable a better understanding of the cumulative effects of different types of human activities, both on marine ecosystems and each other.

6. Results and Discussion in the Canary Islands Case – The Canary Islands, comprising seven larger islands and six islets lying at latitude 28°- 29°N, form an archipelago of volcanic origin in the Atlantic Ocean, some 100 km off the western coast of Africa. Their total area is 7.273 km². For administrative purposes, they are divided into two provinces: Las Palmas (comprising Gran Canaria, Lanzarote and Fuerteventura) and Santa Cruz de Tenerife (comprising Tenerife, La Palma, La Gomera and El Hierro).

These areas are processed in a GIS software tool, overlapping the different layers and intersecting the free space obtaining the suitable areas. These suitable areas could be used for different marine economic activities: ocean renewable energies in combination with other marine activities like aquaculture, recreation, tourism, offshore ship services, etc. The information of the suitable areas has been combined with wind and wave's resource information and the bathymetry, to get the areas that are interesting for the exploitation of renewable energies. In any case, these zones should not be exclusively devoted to energy exploitation, looking for synergies with other offshore economic activities (see Image 3).

The Territorial Waters of the Canary Islands represent an area of 31.900 km². Considering that the bathymetry is one of the most restrictive conditions to develop any marine activity and that current technology makes developments in deep water uneconomical, a maximum bathymetry of 500 m has been considered as feasible. The result is an available marine extension of 15.000 km². Once all above mentioned constrains have been considered, the result is an exploitable area of about 5.500 km². Therefore, only a maximum of 20% of the Territorial Waters of the Canary Islands are exploitable for economic activities.

7. Conclusions – The marine areas that can be exploited for any economic activity are limited. Consequently, it is a priority to develop a MSP to manage the space surrounding the islands and to propose a combined use of these areas where possible. Exploitation of combined platforms (wind-wave or wind-aquaculture, for example) in pre-defined areas, lowers final costs and reduces the environmental impact on the ocean concentrating the marine areas to be exploited.