

**Book of Abstracts** submitted to the IV Congress of Marine Sciences. Las Palmas de Gran Canaria, June 11<sup>th</sup> to 13<sup>th</sup>



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## **A methodological proposal for the definition of management units by hierarchical analysis of the territory (Canary Islands), as a part of an ICZM process**

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### **Abstract**

#### INTRODUCTION

In the context of sustainable development the management of coastal areas is a complex process due difficulty of establishing a balance between socioeconomic development and coastal conservation (Brenner et al. 2006). In Spain the coastal zone is defined by the Coastal Law at least 500 m inland. In this narrow fringe converge different administrative units: national (Government of Spain), regional (Government of Canary Islands) and local (municipalities) levels (Balaguer et al. 2008). So it, there is another administrative entity: the inter-islands council of Canary Islands that are responsible for the preparation of the Island Territory Management Plans (ITMP), where land uses are established (and also sea uses to some marine bathymetric, except the fishing activity). All these elements form a poorly defined area in terms of planning and management (Brenner et al. 2006, Sanabria & García 2011). Thus, the conservation status of coastal zone is considered delicate and occasionally critical (Gesplan 2012). In Canary Islands the ICZM process has hardly been developed (Sanabria & García 2011) and always in a theoretical context. In any case, one of the first steps to establish an ICZM process requires the definition of management units and that is the purpose of this communication.

#### METHODS

The study area was the island of Gran Canaria (Canary Islands), but the necessary data are available on all the islands of the archipelago. After the analysis of specialized literature we have followed and adapted the methodologies developed by Balaguer et al. 2008, Brenner et al. 2006 and Sardá et al. 2005. The proposal uses tools provided by GIS (Geographical System Information) software.

#### RESULTS AND DISCUSSION

In the Canary Islands the main driving forces that impact on the littoral are of terrestrial origin (Gesplan 2012). Therefore, the need for proper definition of these units analysis focuses on the coastal land area. We opted for an arrangement of management units considering a hierarchical structure because it clarifies the territorial vision and adapts to the processes that are required to be implemented according IZCM (Doménech & Sanz 2010).

**Insular scale (Gran Canaria):** The insular condition of the study area means that practically all the territory may have a direct or indirect impact on the marine environment (Balaguer et al. 2008)

**Territorial scale (regions or comarcas):** The spatial heterogeneity of the coastal zone can be tackled by choosing territorial units with similar characteristics or attributes, from an environmental and economic standpoint, to be considered under the criteria of evaluation and planning (Brenner et al. 2006, Balaguer et al. 2008). In Gran Canaria there are 5 comarcas bordering the coast.

**Council scale:** The municipalities are the smallest geographical unit management official, and in turn, provide the highest level of administrative implementation and therefore the most effective planning unit for ICZM (Brenner 2006; Sarda et al. 2005). In Gran Canaria there are 14 councils bordering the coast.

Shoreline Units-functional area (SU-functional areas): The SU-functional areas are those that have to be taken into account when implementing ICZM processes. To define the SU vector information layers were created and then were raster with a cell size of 50x50 m. On these layers an overlay analysis was performed in the range of 500 m. These were the layers of information considered:

- Land cover: "Information System Land Cover of Spain" (SIOSE 2011; provisionally) and the natural protected zones from (e.g. Natura 2000).
- Existing beaches or related: more than 200 beaches, ponds and natural pools
- Population sites: more than 80 localities within or intersecting with fringe of 500 m (49% of the population of the island in 2013)
- Elevation levels: to differentiate locations, above or below 200 m, linked to shield growth, e.g. high cliffs)

Finally and to determine the spatial area defined by SU-functional areas, we must consider the Analysis Units.

Analysis Units (AU): Represent the minimum areas for which data must be obtained, e.g. through indicators. These AU are the beaches, canyons, cliffs, harbors, protected areas, characteristic habitats, etc.

The appropriate territory for a project that has as main purpose the implementation of ICZM, is a key task that must be approached from a multidisciplinary approach and applying multi-criteria analysis. However, determining the scales, make the availability of data, ecosystems, jurisdictional boundaries, etc., remains one of the main challenges of coastal managers and scientists (Brenner et al. 2006). The way to reduce the space complexity presented here is a method to link the decisions of the managers with the biophysical and socioeconomic properties of the littoral (Balaguer et al. 2008). All information is presented in a plane considering the different scales and SU obtained.

#### FINANCE

This work has been carried out within the framework of the OMARCOST Project, with the support of the European Union (EU) and co-funded by European Regional Development Fund (ERDF) and POCTEFEX Programme.



## Introduction

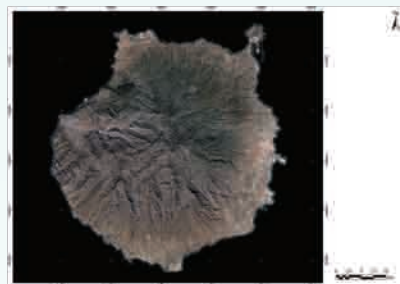
In the context of sustainable development, the management of coastal areas is a complex process due to the difficulty of establishing a balance between socioeconomic development and coastal conservation (Brenner et al. 2006). In Spain the coastal zone is defined by the Coastal Law at least 500 m inland. In this narrow fringe converge different administrative units: national (Government of Spain), regional (Government of Canary Islands) and local (municipalities) levels (Balaguer et al. 2008). So it, there is another administrative entity: the inter-islands council of Canary Islands that are responsible for the preparation of the Island Territory Management Plans, where land uses are established (and also sea uses to some marine bathymetric, except the fishing activity). All these elements form a poorly defined area in terms of planning and management (Brenner et al. 2006, García et al. 2011). Thus, the conservation status of coastal zone is considered delicate and occasionally critical (Gesplan 2012). In Canary Islands the ICZM process has hardly been developed (García et al. 2011) and always in a theoretical context. In any case, one of the first steps to establish an ICZM process requires the definition of management units (Doménech & Sanz 2010) and that is the purpose of this communication.

## Results and Discussion

In the Canary Islands the main driving forces that impact on the littoral are of terrestrial origin (Gesplan 2012). Therefore, the need for proper definition of these units analysis focuses on the coastal land area. We opted for an arrangement of management units considering a hierarchical structure because it clarifies the territorial vision and adapts to the processes that are required to be implemented according ICZM (Doménech & Sanz 2010).

## Methods

The study area was the island of Gran Canaria (Canary Islands), but the necessary data are available on all the islands of the archipelago. After the analysis of specialized literature we have followed and adapted the methodologies developed by Balaguer et al. 2008, Brenner et al. 2006 and Sarda et al. 2005. The proposal uses tools provided by GIS (Geographical Information System) software (ArcGIS 9.2), highlighting the Spatial Analyst.



**Insular scale (Gran Canaria)**

The insular condition of the study area means that practically all the territory may have a direct or indirect impact on the marine environment (Balaguer et al. 2008).



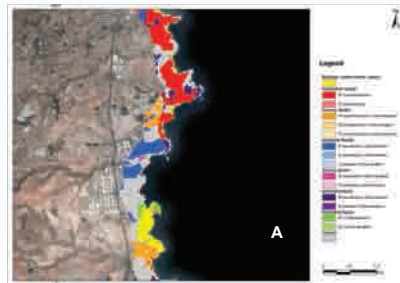
**Territorial scale (regions or comarcas)**

The spatial heterogeneity of the coastal zone can be tackled by choosing territorial units with similar characteristics or attributes, from an environmental and economic standpoint, to be considered under the criteria of evaluation and planning (Brenner et al. 2006, Balaguer et al. 2008). In Gran Canaria there are 5 comarcas bordering the coast (ISTAC)



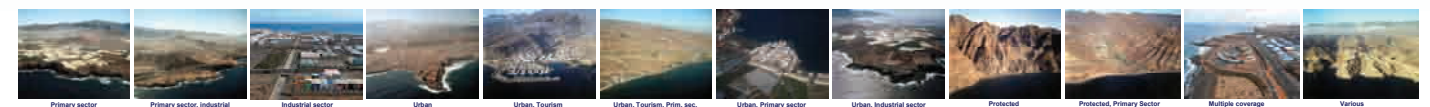
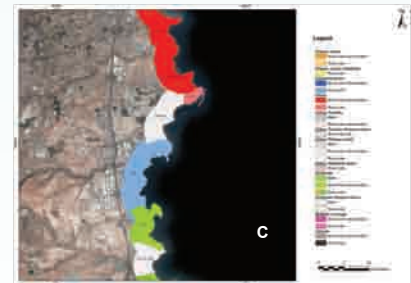
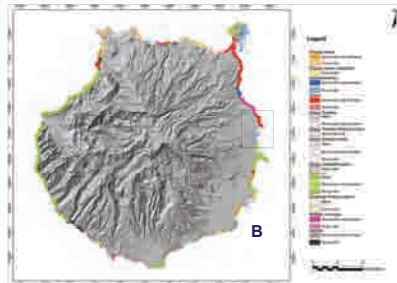
**Council scale**

The municipalities are the smallest geographical unit management official, and in turn, provide the highest level of administrative implementation and therefore the most effective planning unit for ICZM (Brenner 2006; Sarda et al. 2005). In Gran Canaria there are 14 councils bordering the coast.



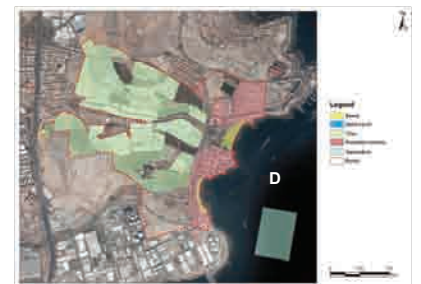
## Shoreline Units (SU)

To define the SU, vector information layers were created and then were converted to raster format with a cell size of 50 x 50 m. On these layers an overlay analysis was performed in the range of 500 m with the Spatial Analyst tool (an example on Fig. A) These were the layers of information considered: (i) Land cover: "Information System Land Cover of Spain" (SIOSE 2011; provisionally) and the natural protected zones from (Natura 2000 and the canarian network of protected areas), (ii) Existing beaches or related: more than 200 beaches, natural pools and dunes (iii) Population sites: more than 80 localities within or intersecting with fringe of 500 m (49% of the population of the island in 2013) and (iv) Elevation levels: to differentiate locations, above or below 200 m, linked to shield growth, e.g. high cliffs). Then considering vertical aerial photographs different SU found were plotted (see Fig. B, detail Fig. C). SUs found were 85. Below you can see a picture of each generic type of SU.



## Shoreline Units-functional areas (SU-functional areas)

The SU-functional areas are those that have to be taken into account when implementing ICZM processes (Balaguer et al. 2008). To determine the spatial area defined by these units, we must consider the Analysis Units (AU). This AUs represent the minimum areas for which data must be obtained, e.g. through indicators. These AUs are the beaches, populations nucleus, canyons, cliffs, harbors, protected areas, characteristic habitats, etc. The appropriate territory for a project that has as main purpose the implementation of ICZM, is a key task that must be approached from a multidisciplinary approach and applying multi-criteria analysis. However, determining the scales, the availability of data, ecosystems, jurisdictional boundaries, etc., remains one of the main challenges for coastal managers and scientists (Brenner et al. 2006). The way to reduce the space complexity presented here is a method to link the decisions of the managers with the biophysical and socioeconomic properties of the littoral (Balaguer et al. 2008). Finally note for a proposed definition of terrestrial boundaries arising after the definition of all SU-functional areas (an example on Fig. D) considering the fringe of 500 m and the major AU intersecting this strip. Regarding the seaward boundary should be considered key ecosystems, protected areas, fishing grounds, etc. In any case, in Gran Canaria, considering the fisheries issue would be appropriate to extend the marine boundary to a depth of 1000 m where own marine resources of the island are located (Castro & Bilbao 2013). When defined mapping information on the location of the fishing grounds, then this marine limit could fit better.



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