



A Proposal for Boundary Delimitation for Integrated Coastal Zone Management

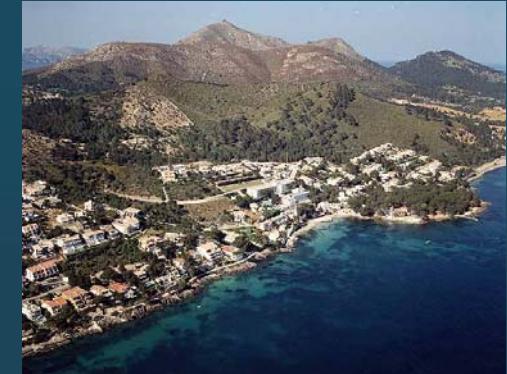
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3.- Universitat de les Illes Balears (UIB)

4.-Institut Mediterrani d'Estudis Avançants (IMEDEA)





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1.- Introduction

ICZM is a useful framework for addressing management issues in highly diverse coastal systems.

Effective ICZM requires that the issue being addressed is defined within appropriate geographic boundaries.

The works that constitute a reference in this field generally relate to a specific problem (Pollution and/or resource-use conflicts).

Other studies relate solely to the administrative divisions of local areas or regions.





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1.- Introduction

Data availability, ecosystems, and jurisdictional boundaries also need to be taken in to account.

These factors result in the fact that boundary delimitation continues to be a challenge for coastal managers and scientists.



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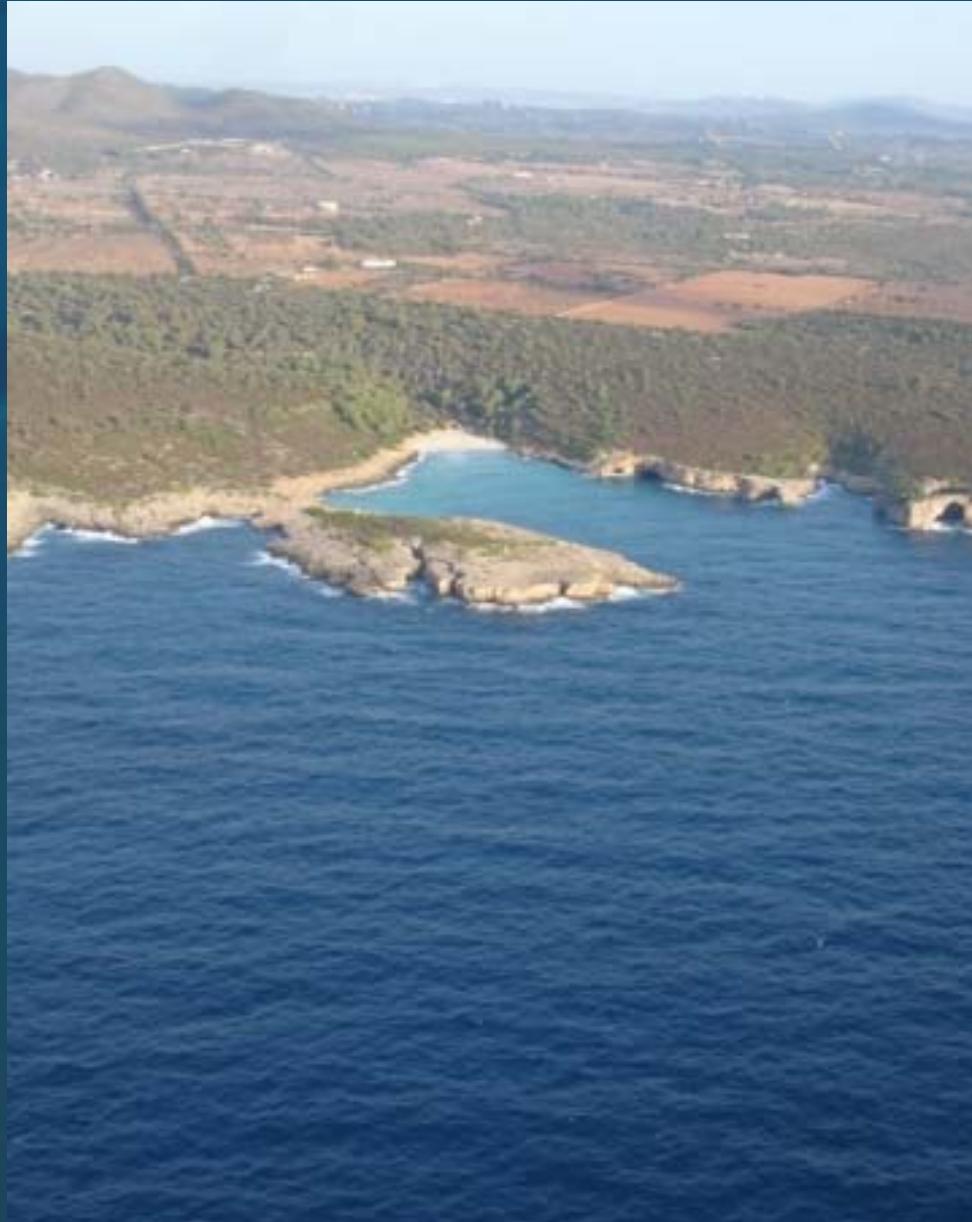
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1.- Introduction

The aim of this work is to propose a more proactive, widely-applicable method for delimiting boundaries of ICZM initiatives based not only on a specific problem.

The study depends on data availability and the geo-environmental, socio-economic and jurisdictional characteristics of the management area.



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1.- Introduction

Although presented in the context of an insular environment, the methodology may be applied to any coastal zone.

Defining territorial units using this method is a visual tool that can be used to make informed decisions about the area that needs to be taken into consideration for implementing ICZM at any given location.





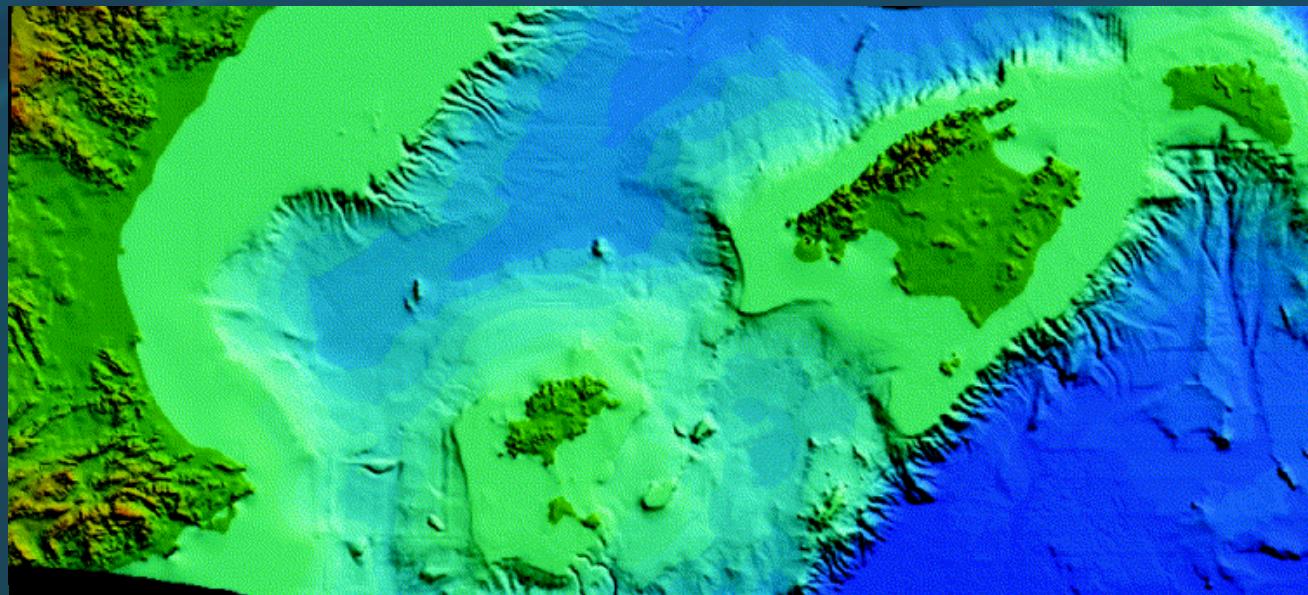
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2.- Study Area

The Balearic Islands constitute the prolongation towards the NE of the *Béticas Mountain ranges*.

The socio-economic structure of the Balearic Islands is based on a service economy. The tertiary sector occupies 80% of the economy, industrial activities occupy 10%, construction sector 8%, and the primary sector 2%.

Tourism is the main economic activity of the islands with a contribution of 75% of its 22 billion euros GDP in 2006





2.- Study Area

	Mallorca	Menorca	Eivissa	Formentera
Surface (km²)	3,623.4	694.5	571.8	82.5
Coastline (km)	722.6	349	291.3	104
Population	777,821	86,697	111,076	7,506
Municipalities	54	8	5	1
Main City (population)	Palma (285,869)	Maó (24,523)	Eivissa (42,421)	Sant Francesc (2,228)





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2.- Study Area

Development of tourism in the Balearic Islands has resulted in a substantial increase in urbanization

Leisure industry has transformed large areas and coastal zones constituted by rural and natural landscapes. It has created multiple conflicts

As insular environments, where space and resources are especially limited and vulnerable to change, the Balearic Islands constitute an important location for ICZM within a clearly defined spatial, context.



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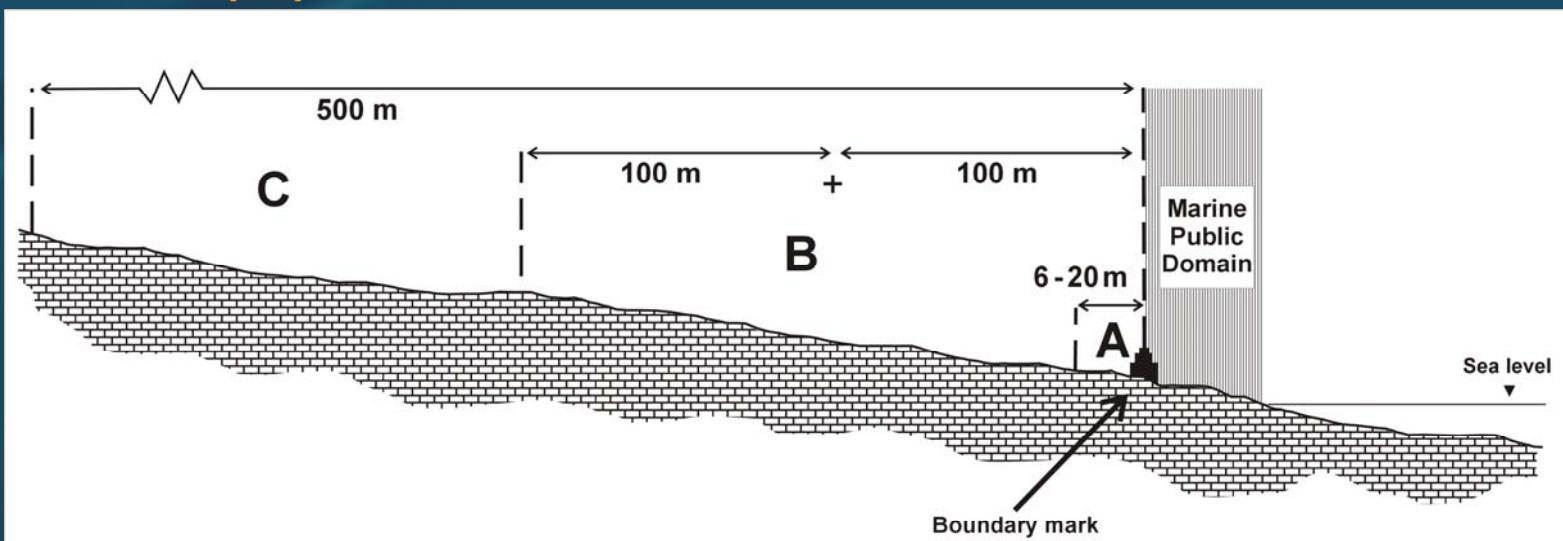
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2.- Study Area

2.1 Legal Framework of Mallorca Coastline

Coastal areas of Spain fall under the jurisdiction of the Coastal Law 22/1988.

This legislation was enacted by the Coastal General Directorate under the Spanish Ministry of the Environment. The Coastal Law differentiates some zones in the coasts and proposes some limitations.



A: servitude of transition

B: servitude of protection

C: zone of influence

3.- Methods for boundary delimitation: definition of territorial units

We define the three levels of analysis which comprise the proposed methodology for developing the decision-making tool to inform boundary delimitation for ICZM initiatives.

These levels correspond to decreasing scales of measurement

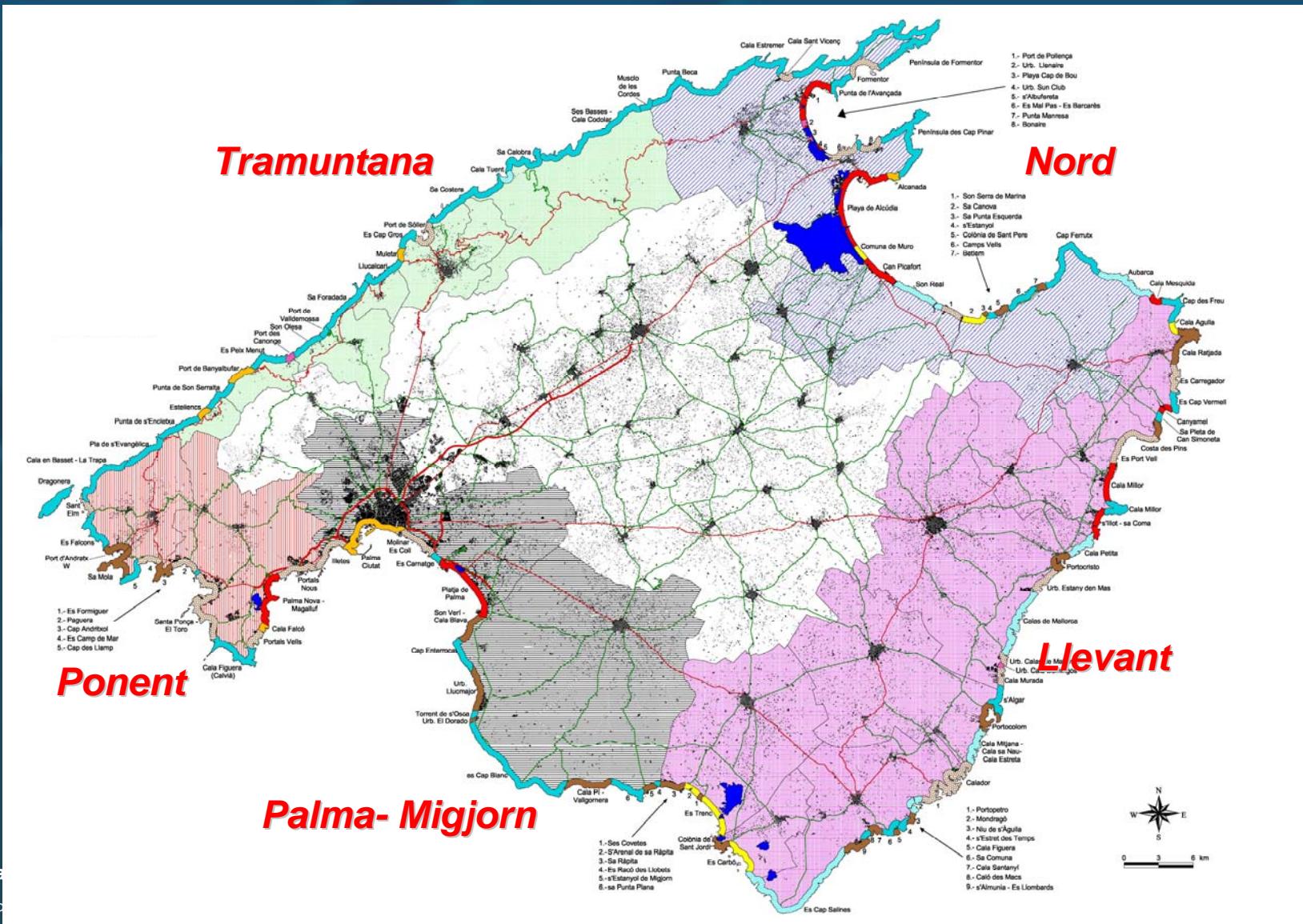
HEMUs (Homogeneous Environmental Management Units)

SU (Shoreline Units)

SU- Functional Areas



3.1 HEMUs (Homogeneous Environmental Management Units)





3.2 SUs (Shoreline Units)



Shoreline units represent a series of practical attributes that would influence the way an area is managed in an ICZM context, including:

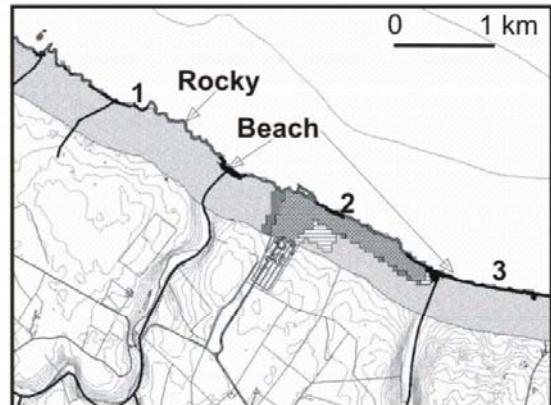
- Elevation levels (0 to 200m, higher than 200 m)
- Land uses: urban, rural and natural
- Coastal typologies (rocky coasts and beaches)
- Tourist sites (as defined by the *Arrangement Plan of Touristic Supply -POOT- of the Tourism Council of the Government of the Balearic Islands*)

Landward and seaward boundary of Shoreline Units:

- The inland boundary of SU is determined by the jurisdictional Zone of Influence defined by Spanish Coastal Law (i.e. 500m inland).
- Marine boundaries are determined by data availability of habitat and marine protected areas.



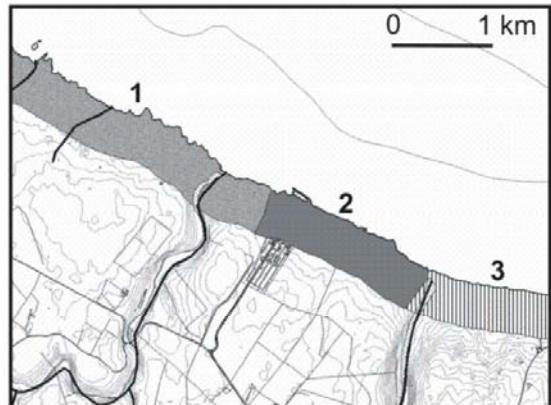
3.2 SUs (Shoreline Units)



Raster information concerning land use, height and coast type (rocky or beach)

→

Territorial homogenization
of Shoreline Units



Establishment of Shoreline Units
(territorial organization types of the coastline)



1.- Son Real
Natural mixed coast (rocky and beach)



2.- Son Serra
Tourist nucleus beach



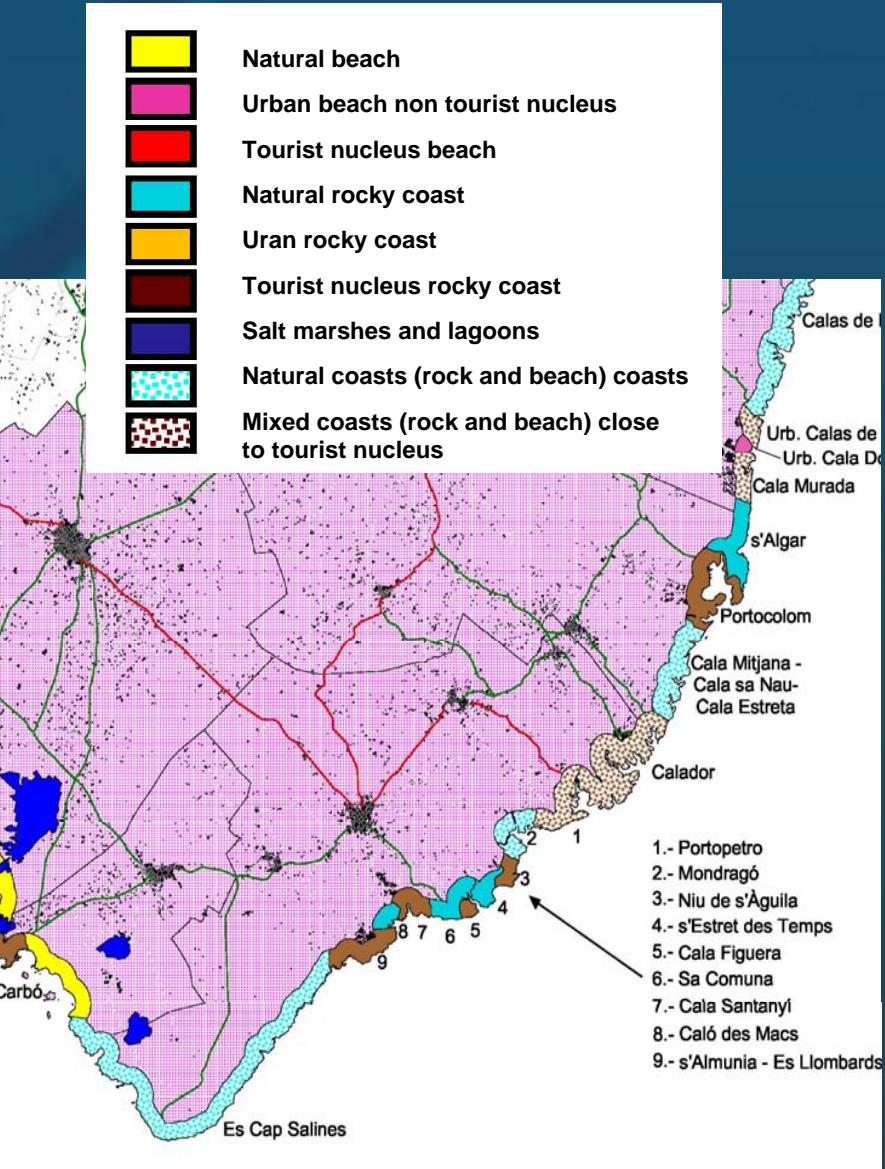
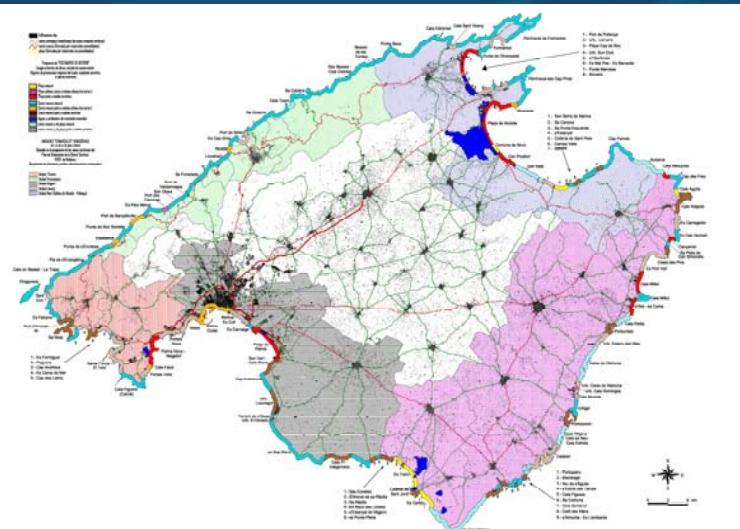
3.- Sa Canova
Natural beach

The maps were converted to raster data with a cell size of 50 m. The 500 m buffer was then applied and finally, the map of coastal typologies was overlaid.



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3.2 SU's (Shoreline Units)



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3.3 SU – Functional Areas and Analysis Units



SUs are located within larger territorial areas expanding landward to a distance greater than 500m or extending out into the territorial sea.

These areas have been defined as SU-Functional Areas, the largest zone defined by our methodology.

The boundary of the SU-Functional Area delimits the spatial area that needs to be taken into consideration for ICZM implementation in that zone.





3.3 SU – Functional Areas and Analysis Units

Three different sub-zones can be observed within a SU-Functional Area.

Management Nucleus:

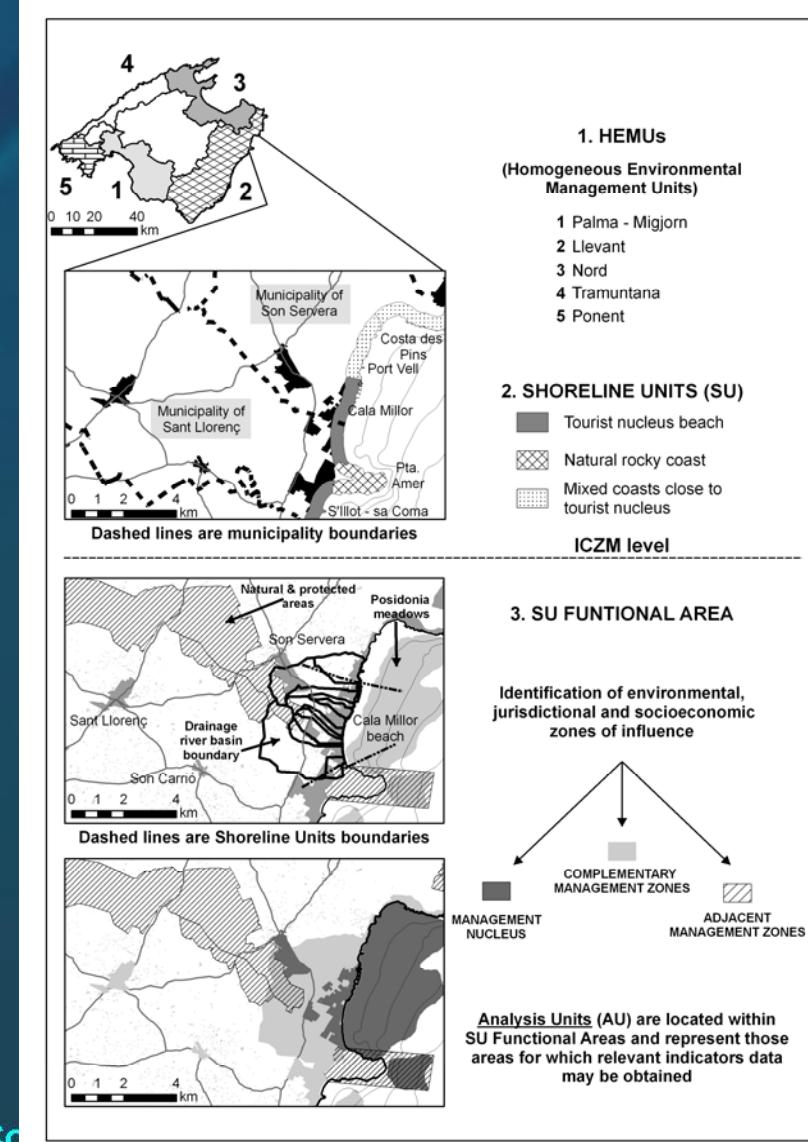
Represents the central focus of the ICZM initiative (urban zone, popular beach, critical habitat, protected area or an area of agricultural productions).

Complementary Management Zone:

This area takes in account the drainage basin, which may extend inland beyond 500 m.

Adjacent Management Zone:

Take into account jurisdictional limits defined by protected areas.



3.3 Analysis Units



Analysis units (AUs) are located within SU and SU-Functional Areas



Represents those areas for which relevant indicator data may be obtained.



Describes tangible activities (construction, reforestation...)



Also reflects less tangible aspects (consumption or generation of wastes)



AUs may overlap or be incorporated within other AUs

Each SU and their functional areas contains a number of AUs

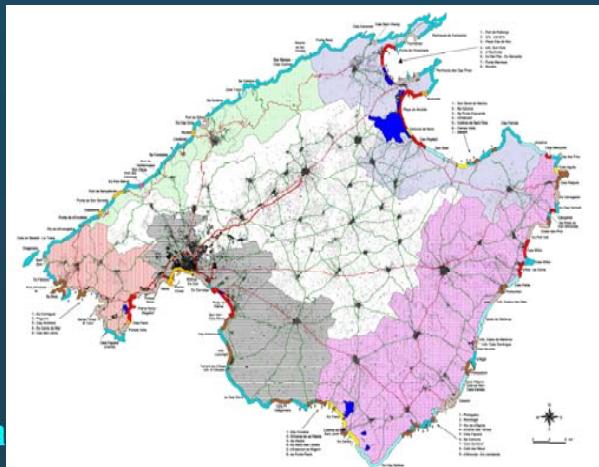
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Shoreline Unit (type)	Number of SU	Length of coastline (km)	% of coastline	
Natural beach	7	15.04	2.2	
Urban beaches non tourist nucleus	3	2.99	0.4	
Tourist nucleus beach	10	70.66	10.3	
Natural rocky coast	41	272.81	39.6	
Urban rocky coast	7	39.14	5.7	
Tourist nucleus rocky coast	22	96.31	14	
Salt marshes and lagoons	1	0.73	0.1	
Mixed natural coasts (rock and beach)	8	62.38	9.1	
Mixed coasts (rock and beach) close to tourist nucleus	23	128.24	18.6	
HEMUs	SU categories	Number of SU	Length of coastline (km)	% of coastline
Palma – Migjorn	5	15	103.63	15.1
Llevant	7	42	190.10	27.6
Nord	9	29	181.30	26.4
Tramuntana	5	18	85.38	12.4
Ponent	5	18	126.83	18.5

4.- Results

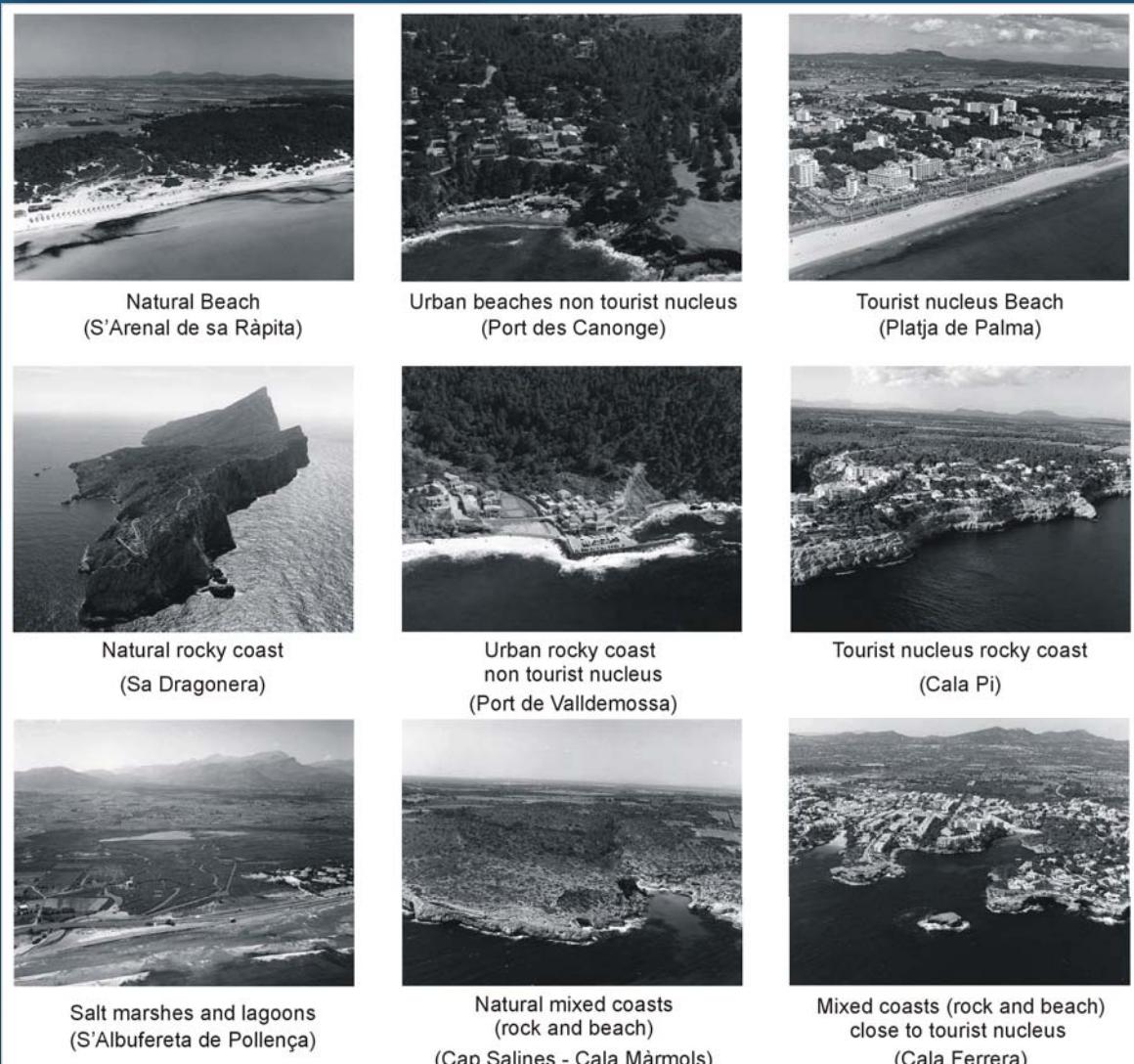
Composition of Shoreline Units and HEMUs of Mallorca





4.- Results

*Sample
photographs of
SHORELINE UNITS
categories*

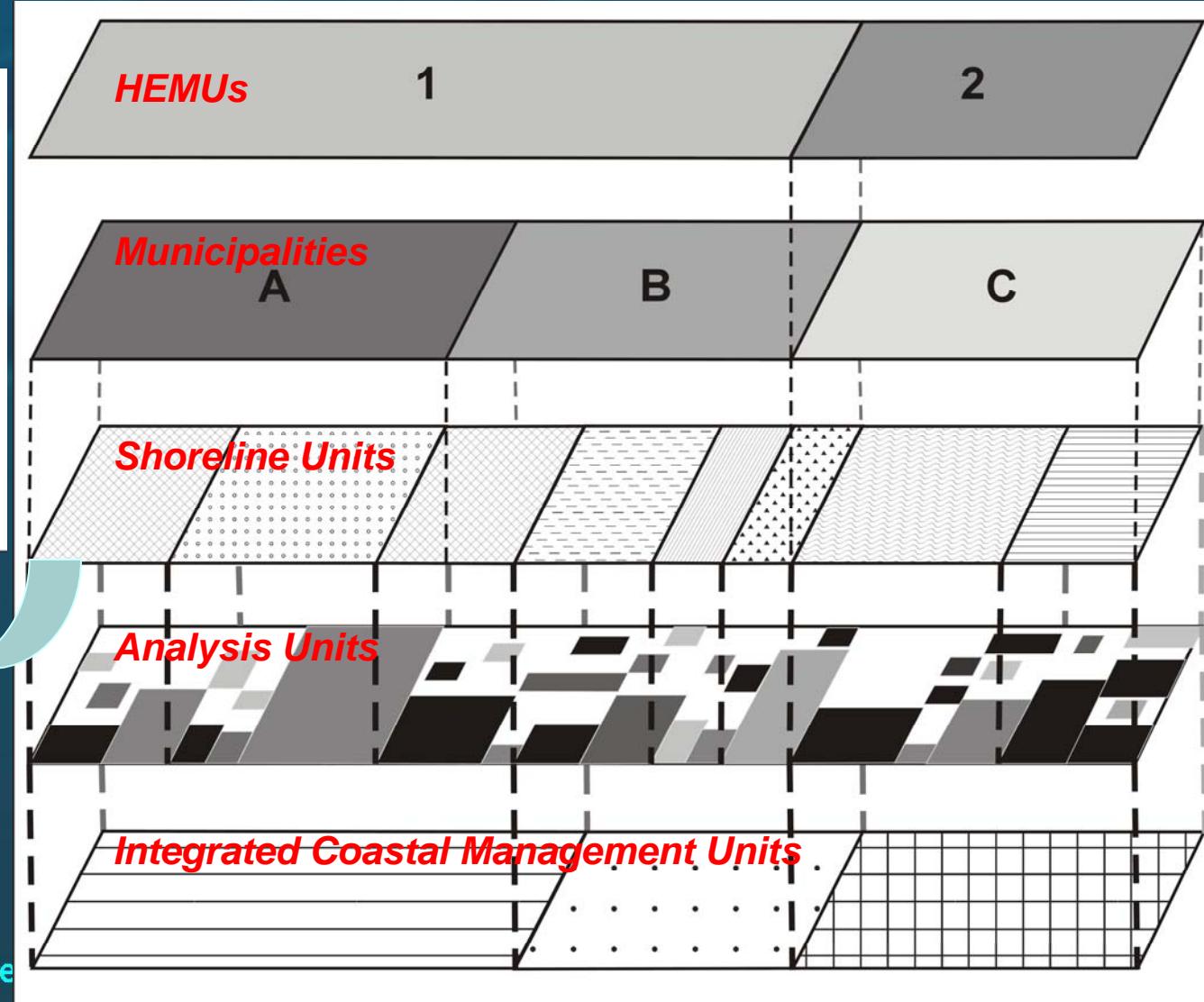




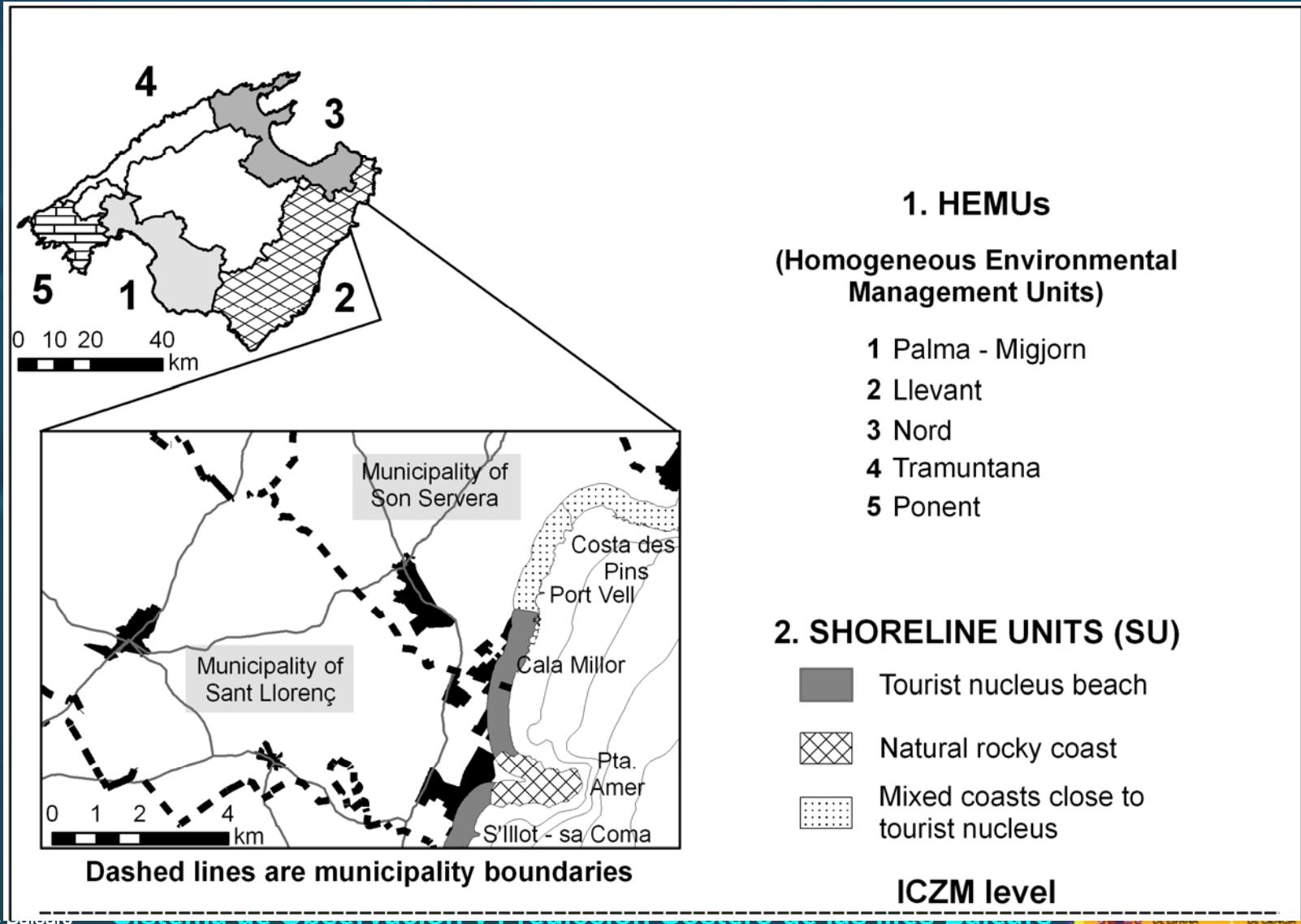
4.- Results



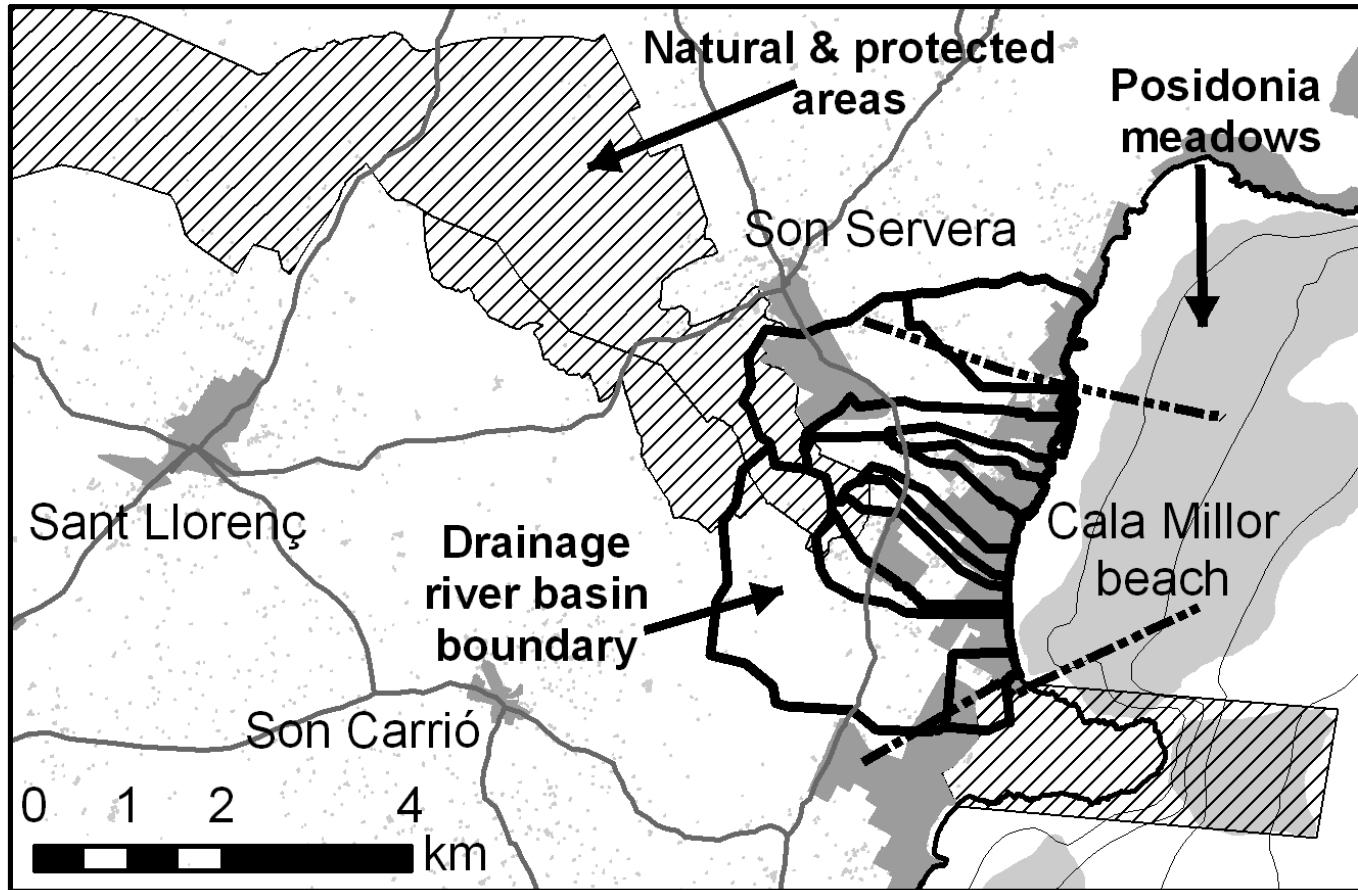
- Beach coast close to tourist nucleus
- Mixed rocky and beach coast close to tourist núcleos
- Beach coast close to urban nucleus (non tourist zone)
- Natural beach
- Lagoons and salt marshes
- Rocky coast close to urban nucleus
- Rocky coast close to tourist nucleus



4.1 Example of application



4.1 Example of application



Dashed lines are Shoreline Units boundaries



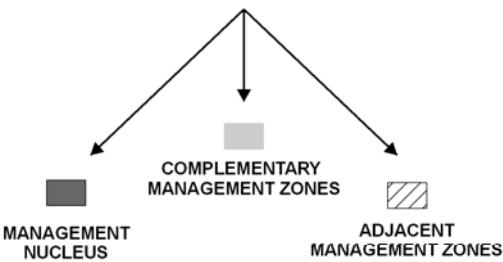


4.1 Example of application

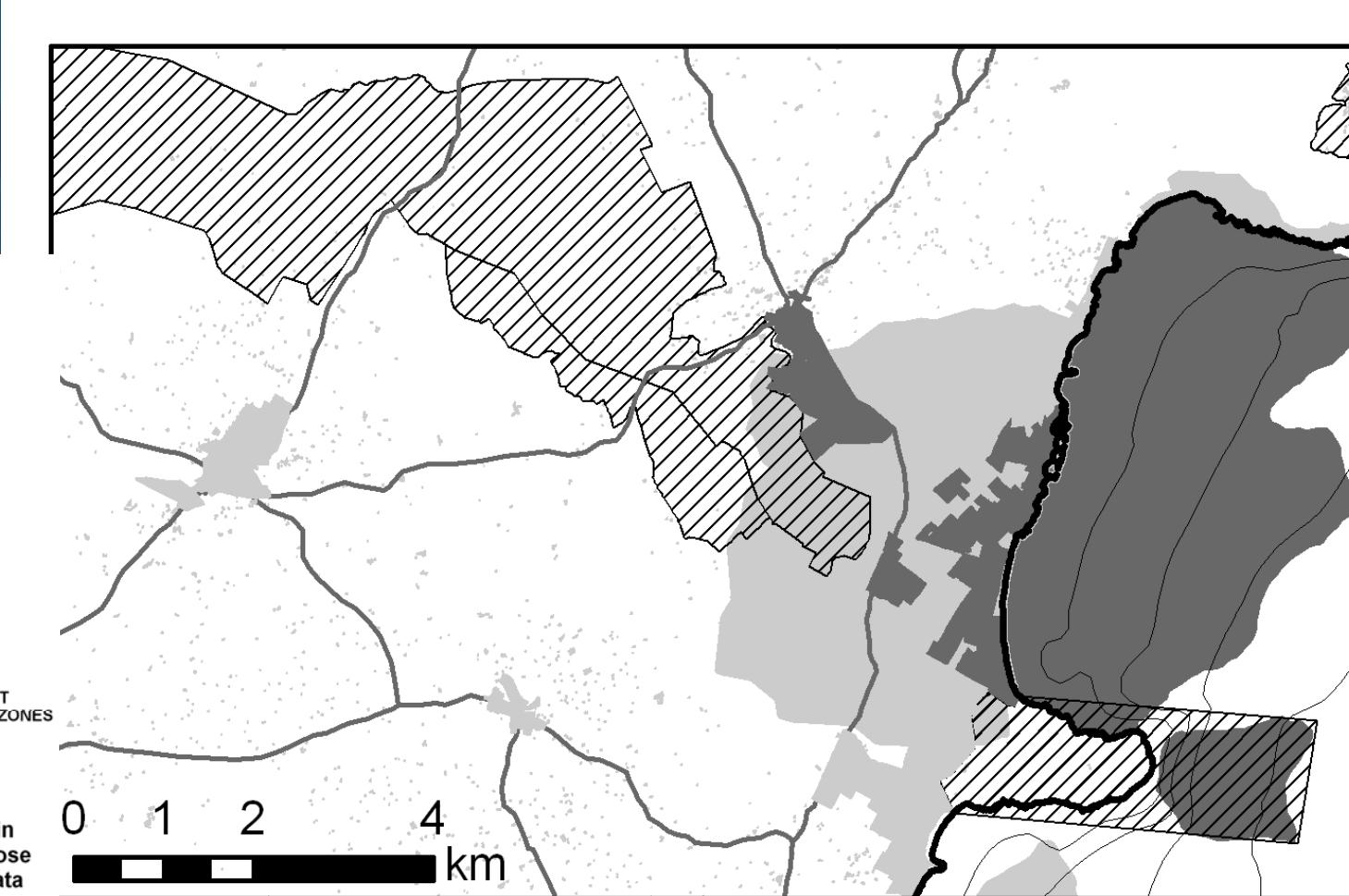


3. SU FUNTIONAL AREA

Identification of environmental,
jurisdictional and socioeconomic
zones of influence



Analysis Units (AU) are located within
SU Functional Areas and represent those
areas for which relevant indicators data
may be obtained



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Each apartment represents a Shoreline Unit (represents the state and organization of coastal areas). Every person, at home, is organized as best as can be...

EXISTING REALITY

SHORELINE UNIT AND MANAGEMENT UNIT

(Nucleus can include the entire area of the Shoreline Unit)

(i.e. Beach and Dunar System may extend inland beyond 500 m, limits of Shoreline Units)

COMPLEMENTARY MANAGEMENT ZONE

(stairs or common areas)

May suffer the effects of one or several Shoreline Units (apartments).

Shoreline Units can be influenced through the Complementary Management Zone

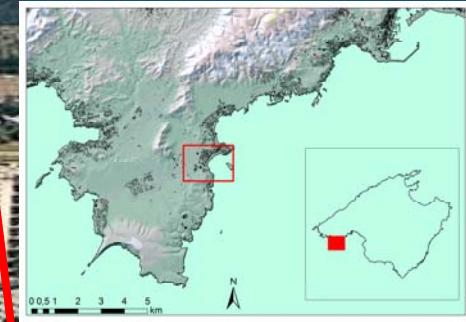
(i.e. marine environment of Badia de Palma)

ADJACENT MANAGEMENT ZONE

Homogeneous areas related to other Shoreline Units which incorporates a part in the complementary management area.

(p.e. part of a natural habitat or Natural protected area)

4.1 Example of application



Magalluf, Calvià

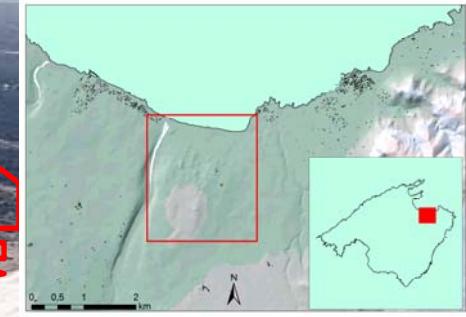
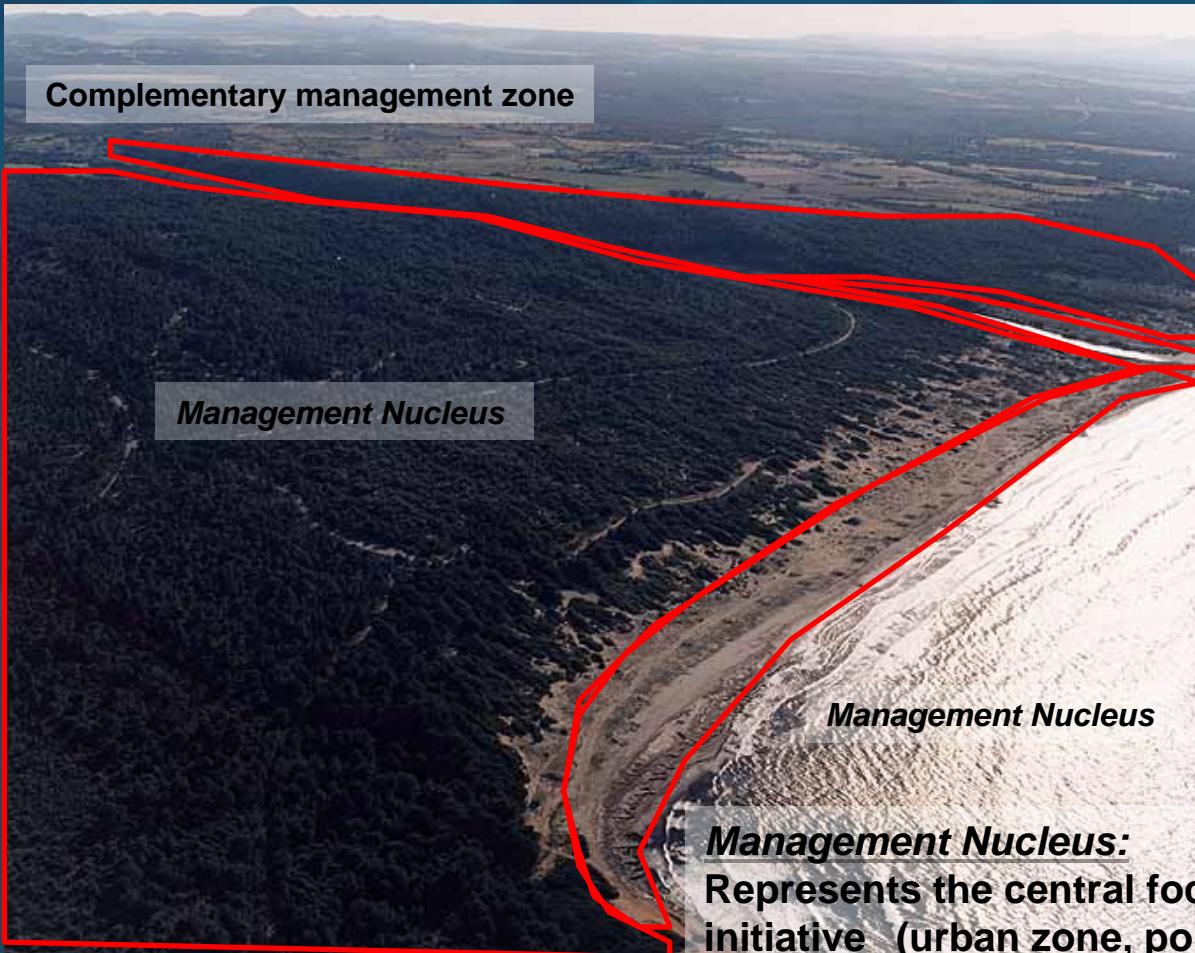
Management Nucleus

Management Nucleus
Management Nucleus

Management Nucleus:

Represents the central focus of the ICZM initiative (urban zone, popular beach, critical habitat, protected area or an area of agricultural productions).

4.1 Example of application



Sa Canova, Artà

Management Nucleus:
Represents the central focus of the ICZM initiative (urban zone, popular beach, critical habitat, protected area or an area of agricultural productions).



5.- Discussion and conclusions

A critical first step towards reaching this goal (ICZM) is to spatially define the area that needs to be managed.

It would be unrealistic to assume that every element of every dimension could be taken into consideration, so cartographic data sets must be created that are based on data availability

The implementation of ICZM in a small island environment such as Mallorca is challenged by the fact that the zone of influence of the coastal zone could easily end up being the entire island.

The plurality of urban and rural landscapes distributed throughout the territory and its physiographic variety confers to Mallorca the fact that coastal and inland areas are well differentiated.



5.- Discussion and conclusions

The tool presented in this paper represents an important data aggregation exercise that could help with decision-making in future ICZM initiatives.

The exercise of delimiting its boundaries brought to light the important consideration that two administrative zones (municipalities, province) should coordinate their efforts in order to manage the coastal area and the adjacent protected areas.

The decision-support tool presented has the advantage that it does not rely on the emergence of a specific problem or a particular resource.





5.- Discussion and conclusions



It is important to tailor this method to the socio-economic and environmental reality of the area.

Tourism may not be the most important economic sector in all places, adding cartographic information concerning the most dynamic economic sectors which influence the most substantial transformation of the territory.

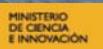


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5.- Discussion and conclusions

Limited data should not be a reason not to act since the method is based on making the best use of available data.

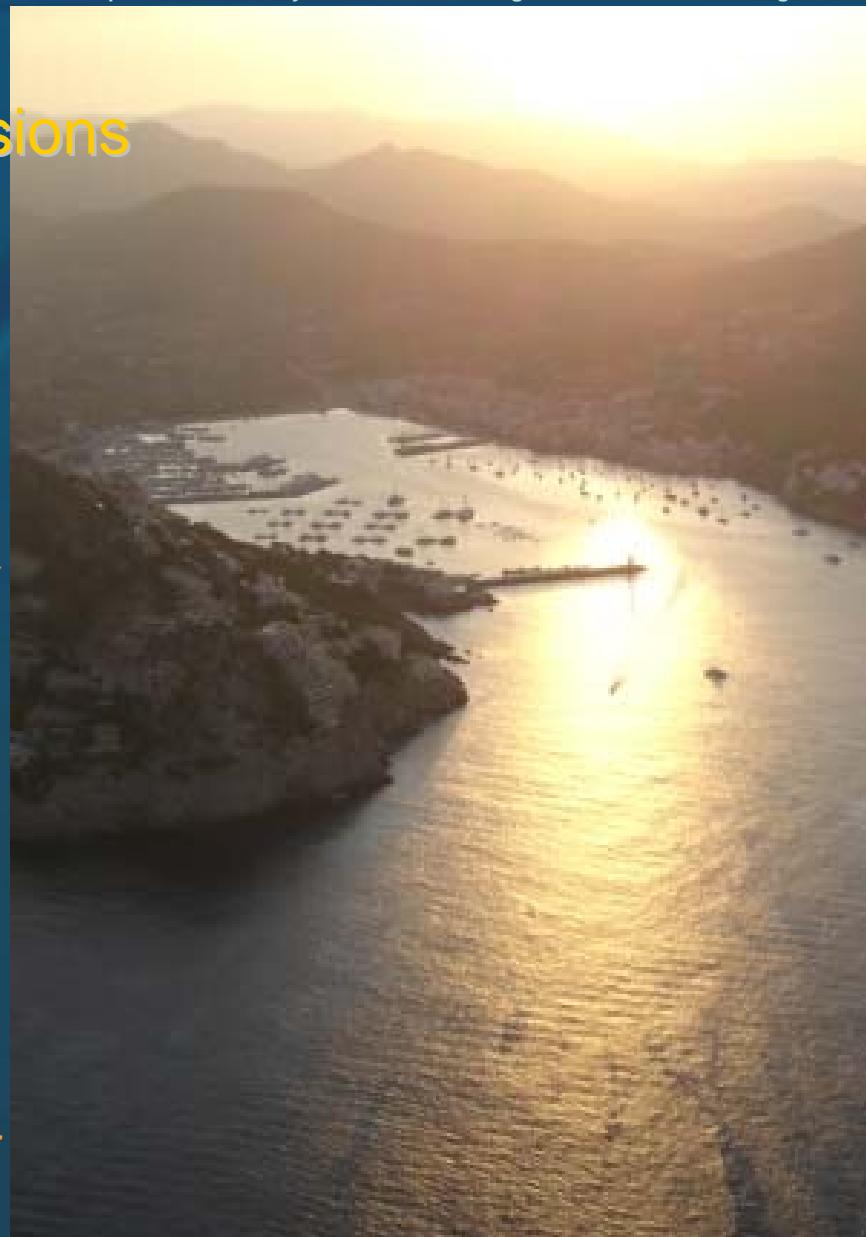
Corine Land Cover (land use) is freely accessible.

In countries where cartographic data is very limited, public resources such as Google Earth may be a good point of departure.

It is important to note that the current work does not enter into depth on how to delimit the marine boundary for ICZM initiatives.

The boundary was based on the existence on available data.

In Mallorca, activities that occur on land have the most profound impact on the tourism related economy and on the lives of residents.





5.- Discussion and conclusions

Consensus must be based on knowledge of the interactions between environmental, jurisdictional and socio-economic elements in the spatial area that is under consideration.

Decision-support tools are sparse and critical, particularly those that are data intensive and visual. The proactive tool presented in this paper represents a step towards improving our capacity to make ICZM decisions at a global scale.





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Acknowledgments

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2.1 Legal Framework of Mallorca Coastline



COASTAL JURISDICTION		
Nationwide	Autonomous Region	Municipality
terrestrial public dominion	servitude zone of terrestrial and marine public dominion	town planning
boundary, guidance and management	public works with interest for Autonomous Community	use, security and beach cleaning
research, projects and public works for public interest	land use planning coastal planning	health
fisheries legislation	fishing on rivers and inland waters	monitoring and security
protection and recover of natural values	seafood fishing and aquaculture health and hygiene	reports about land use application on terrestrial and marine public dominion
protection works / man-made structures		
pass and use rights		
planning of infrastructures, management and protection of water sources (when water runs through several Autonomous Region)	hydraulic resources and infrastructures (when water runs through one Autonomous Region) inland waters spills	sewage water treatment
offshore waters spills	water quality monitoring	water supply
biodiversity legal framework	management of protected natural areas and additional legal tools	
coordination and promotion of protection policies		
international agreements		
national parks		
commercial harbour	marinas and fishing harbours	
coastal lightning and maritime signs		
ship checking		
maritime rescue		

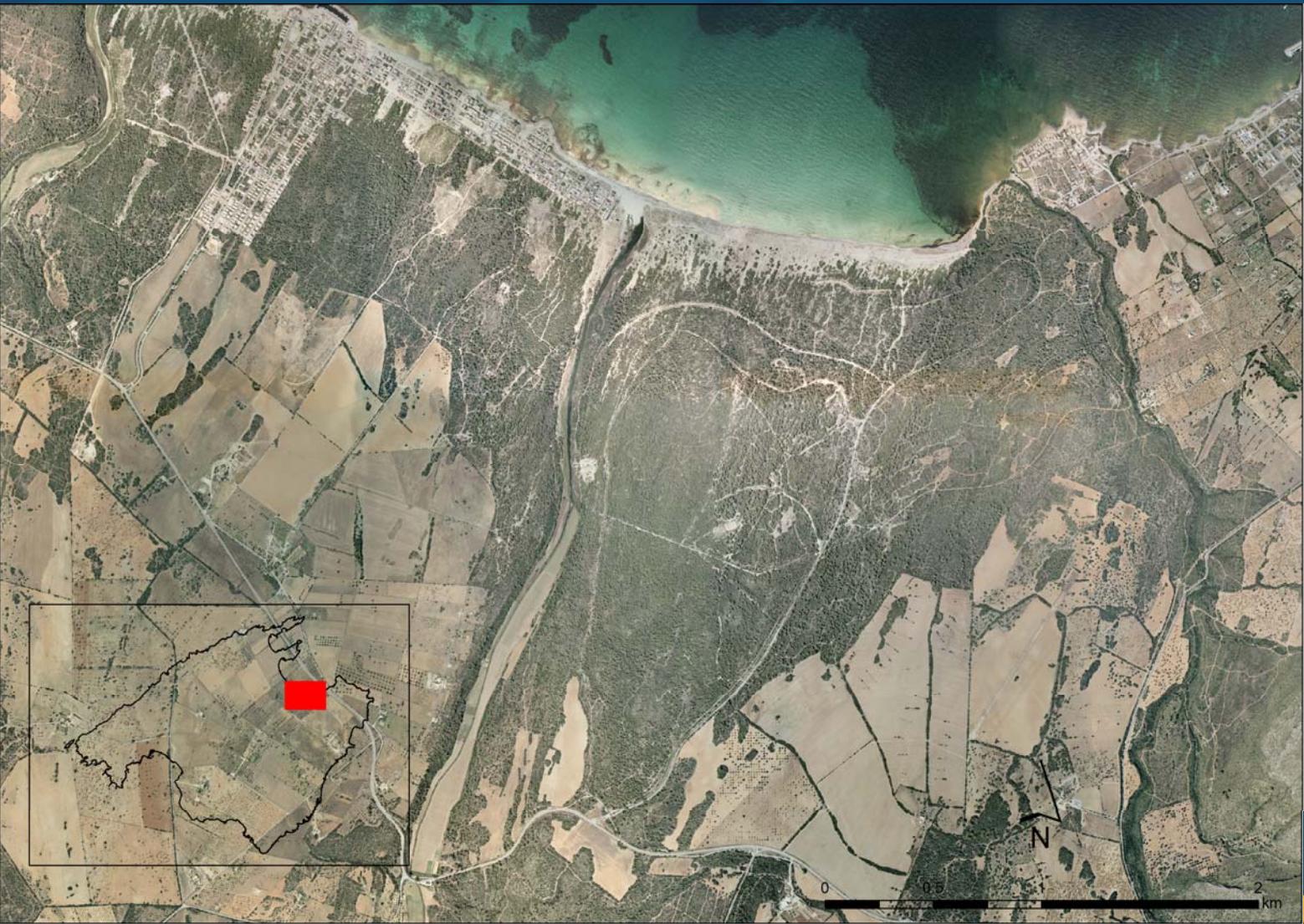
This multi-tiered, overlapping jurisdictional framework is confusing and often leads to ineffective management





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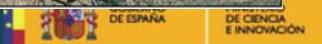


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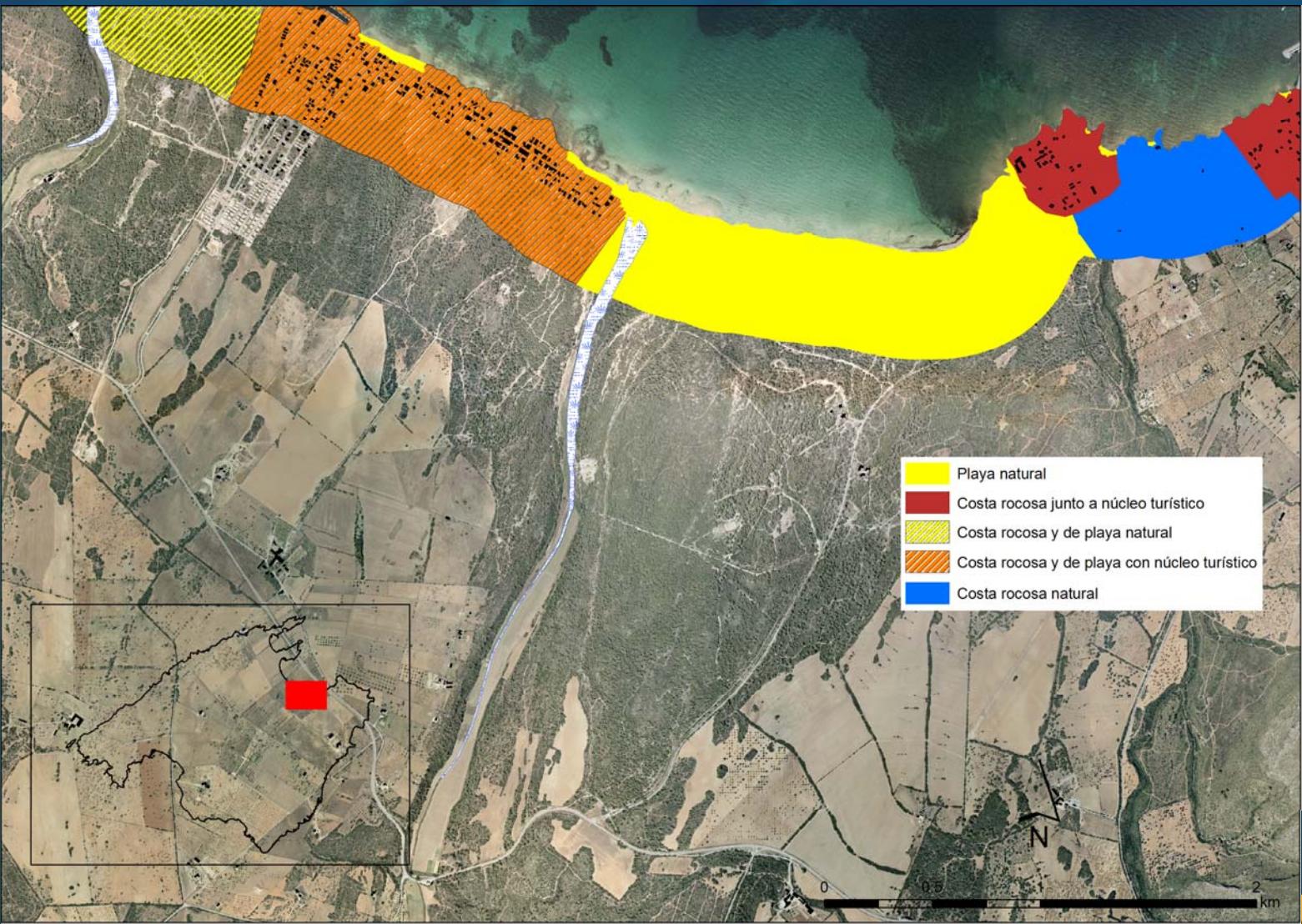


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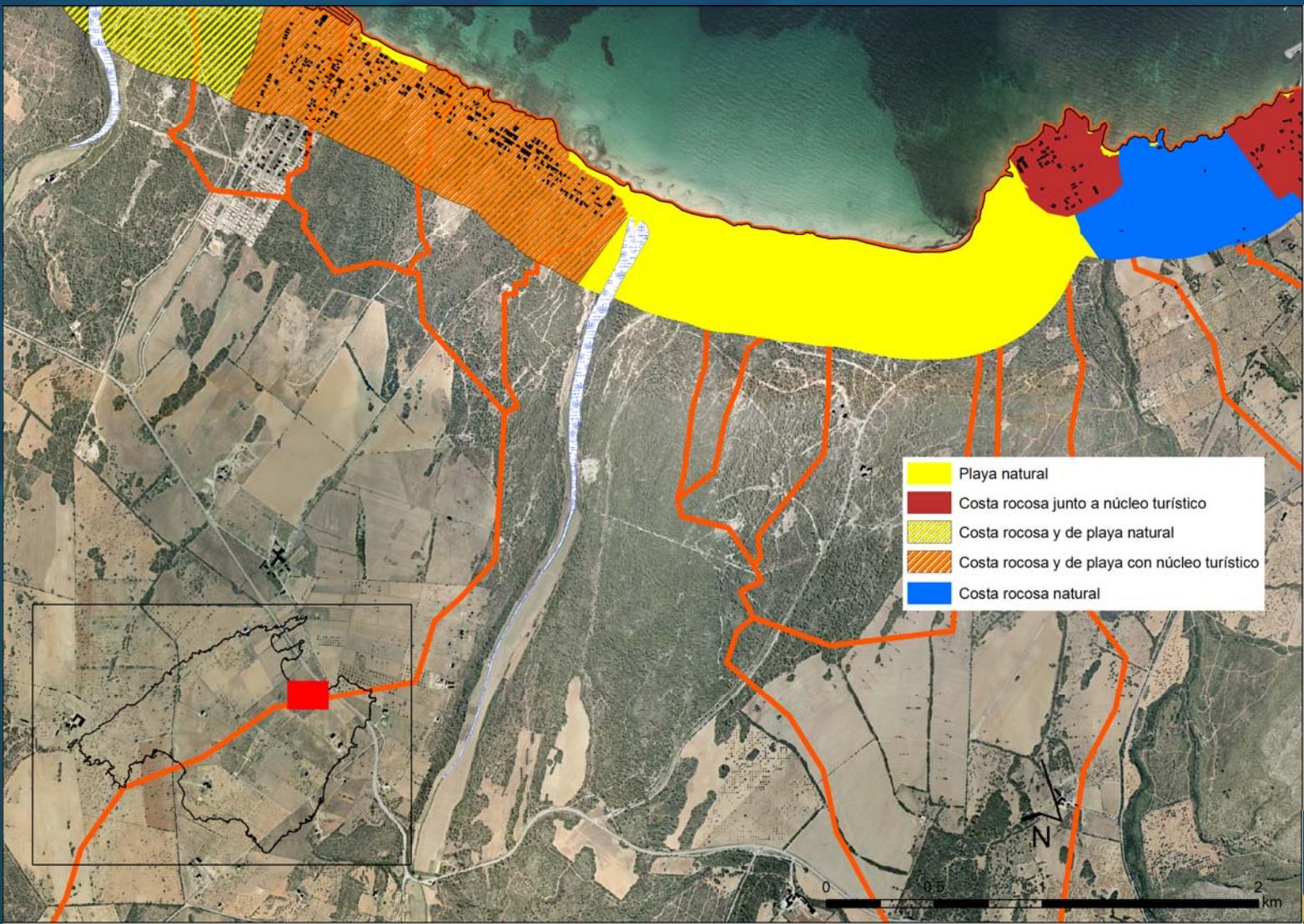


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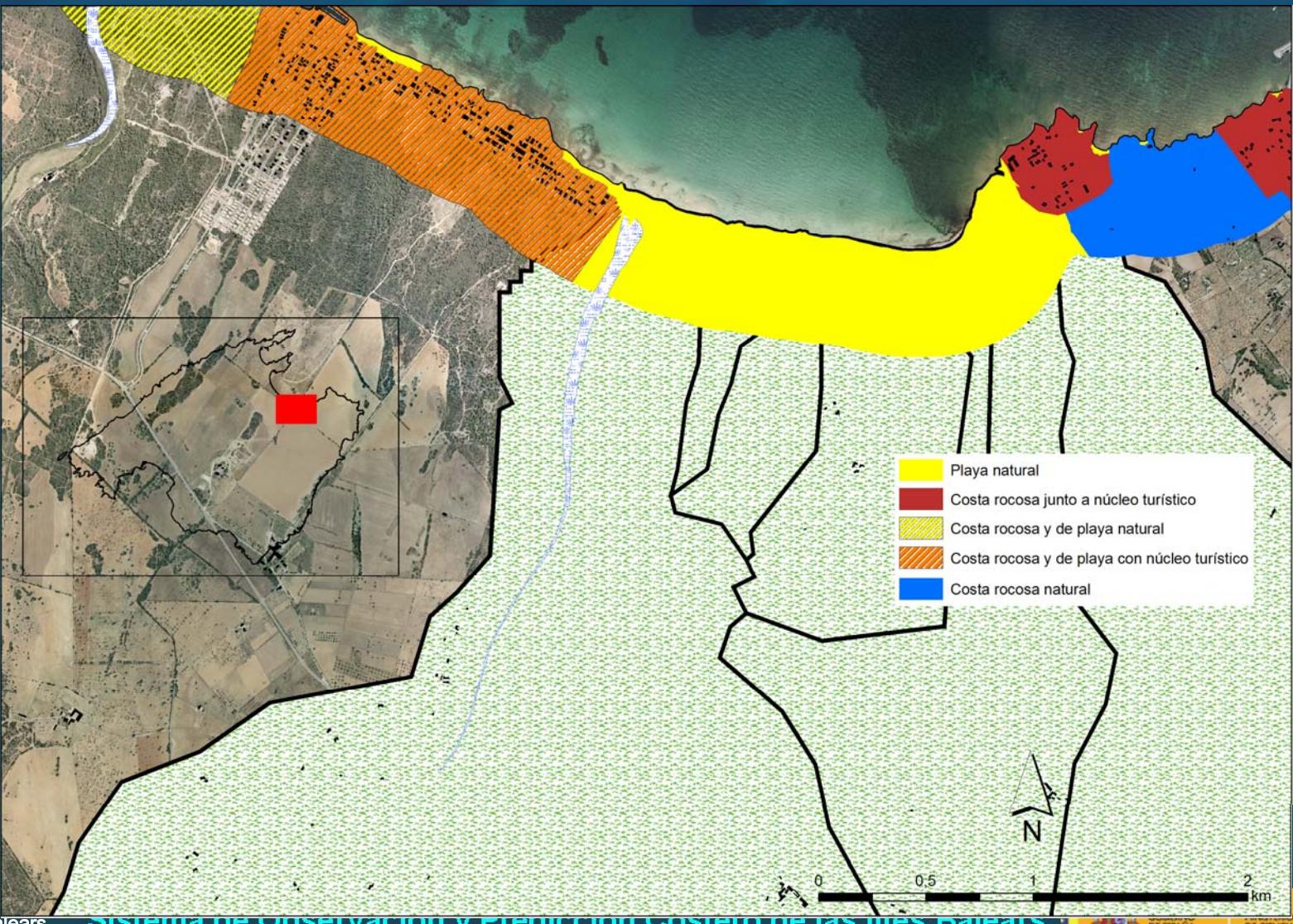


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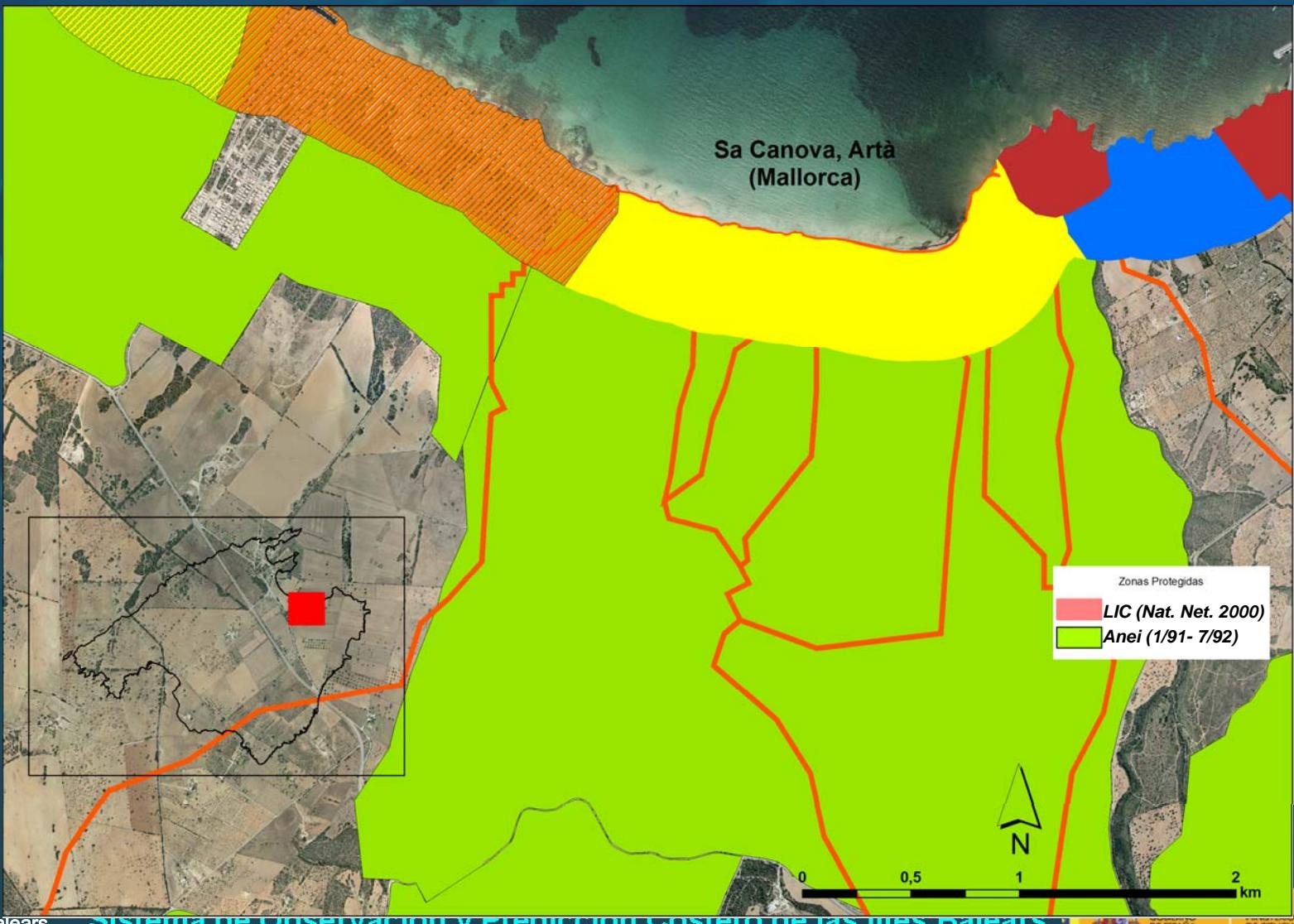


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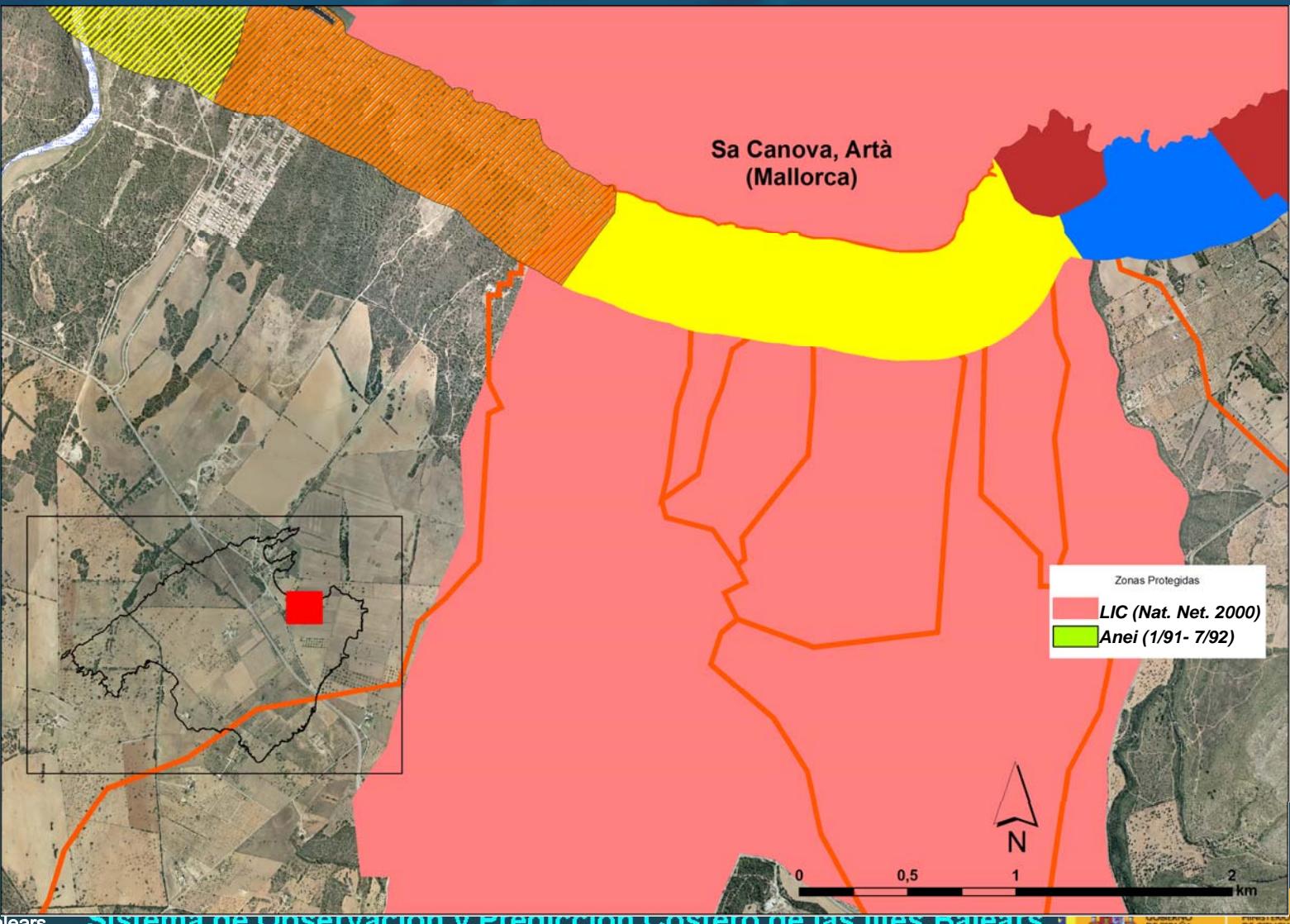


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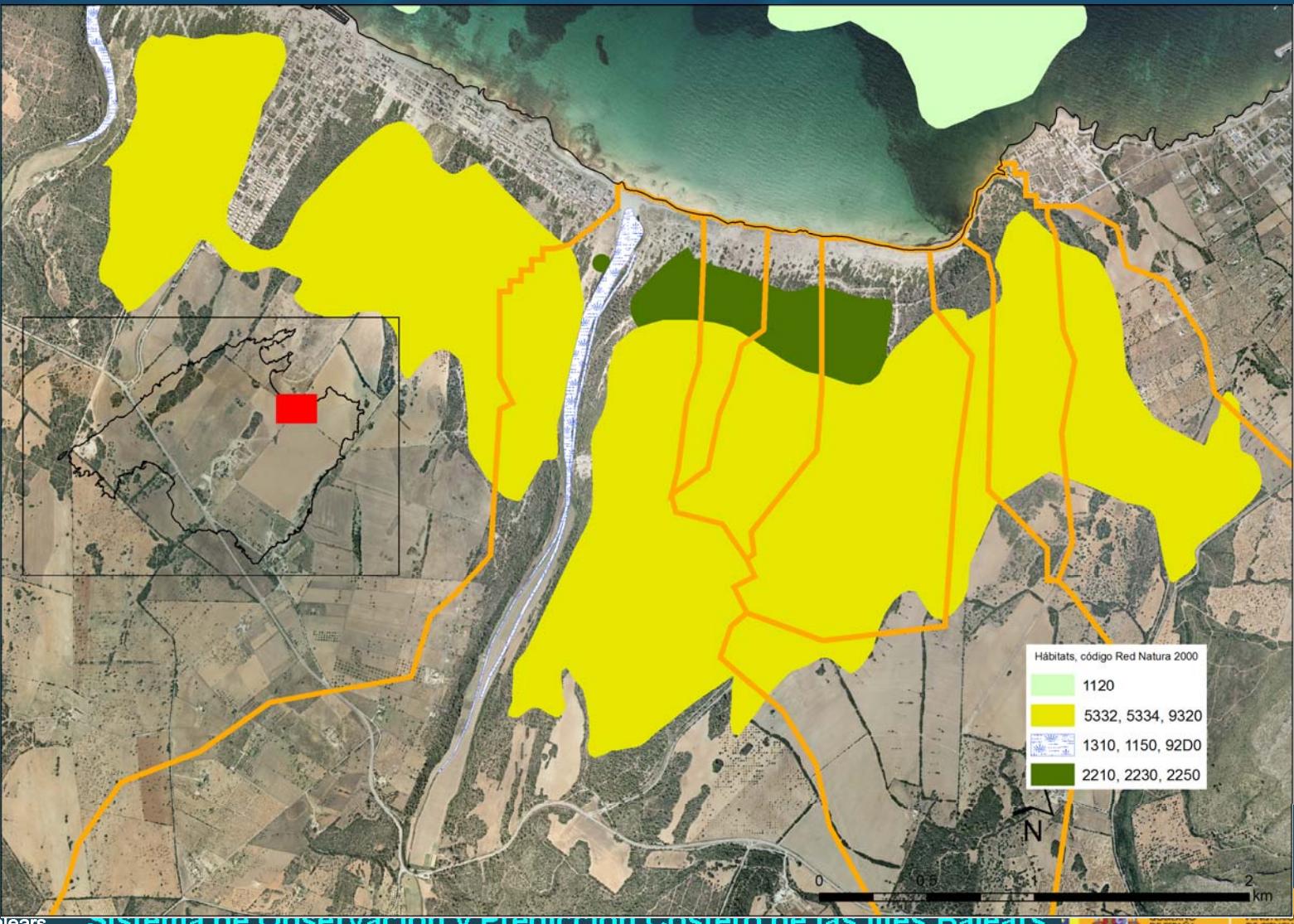


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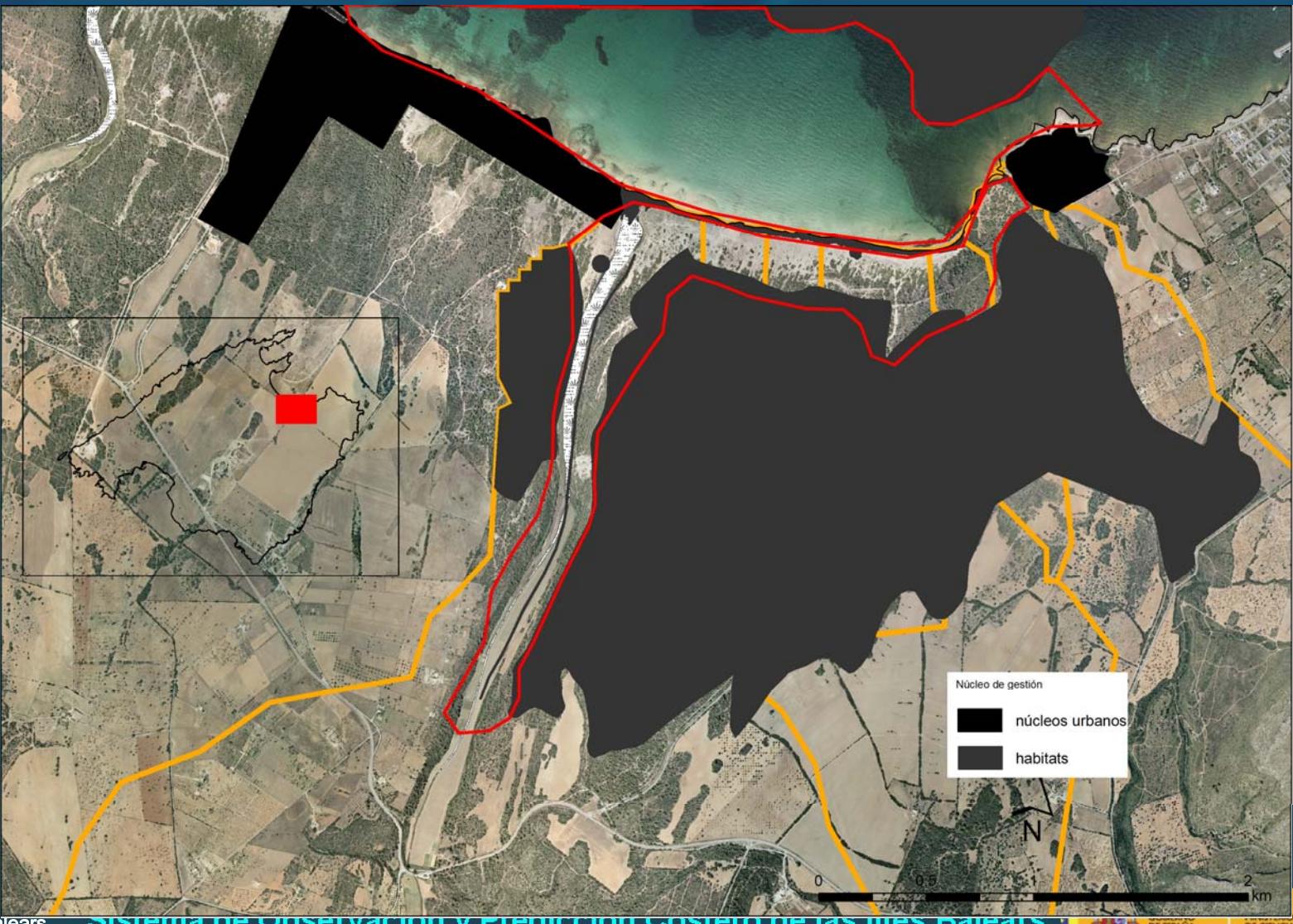
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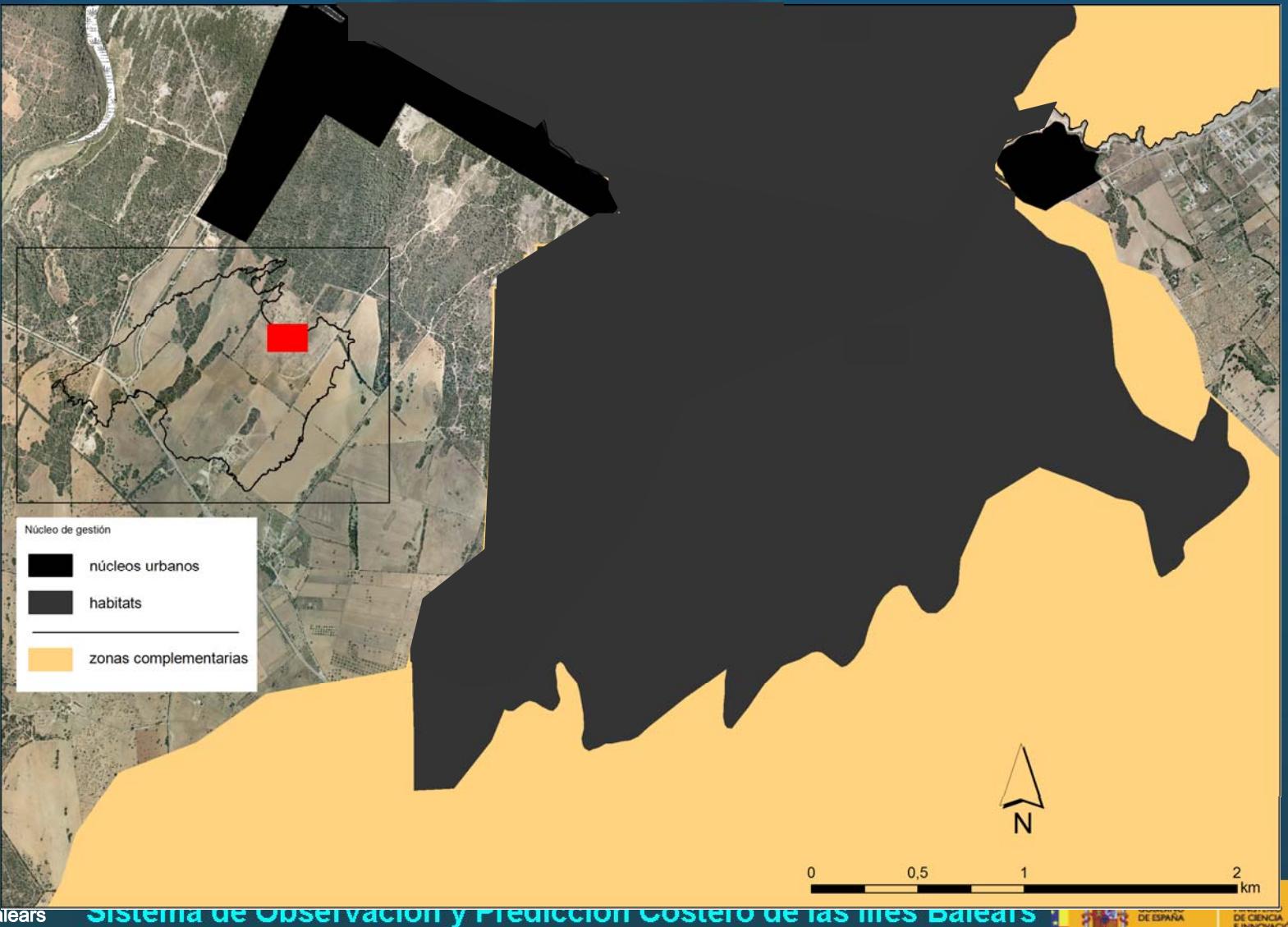


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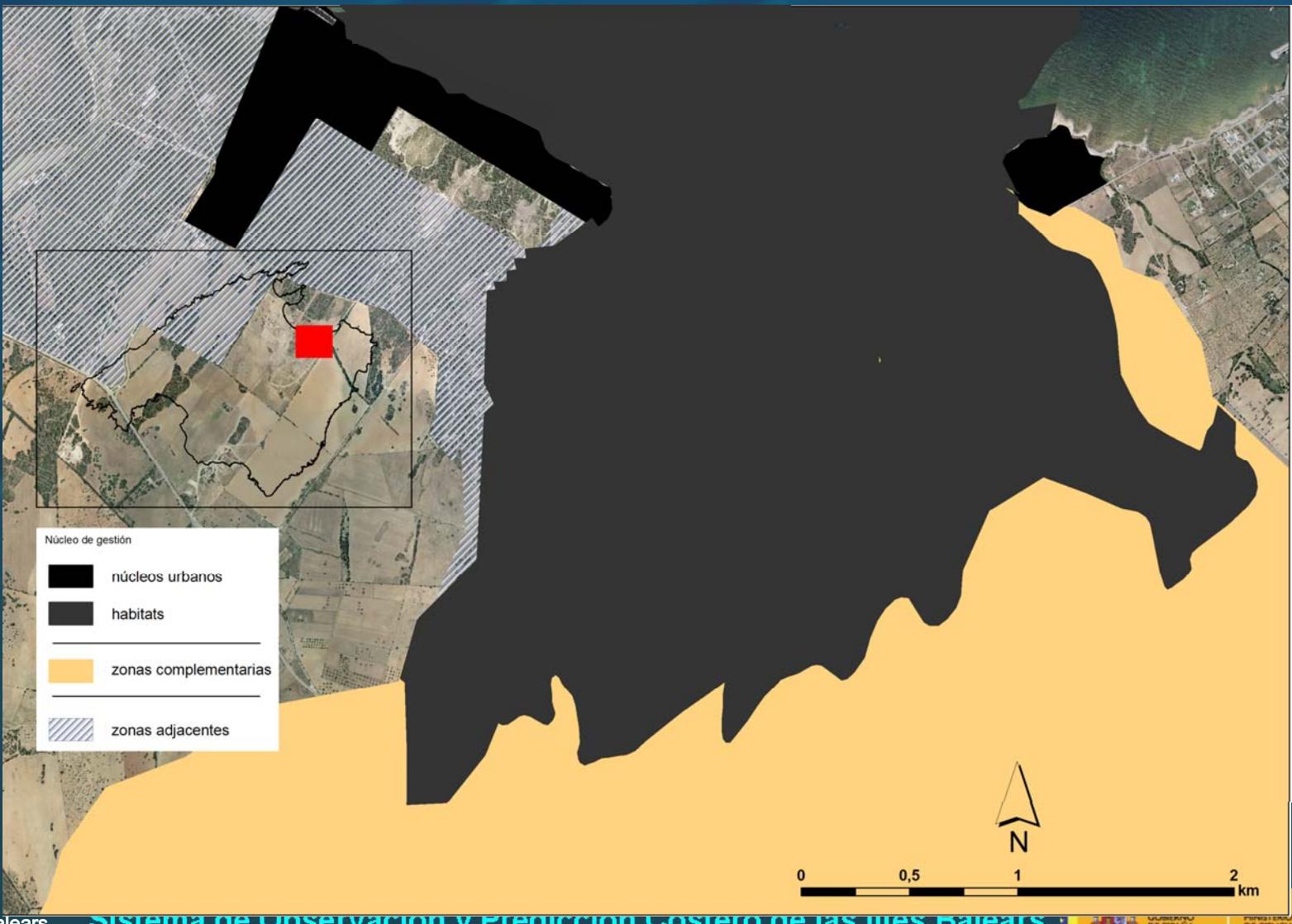


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Balearic Islands
Coastal Observing
and Forecasting
System

Sa Canova (Artà, Mallorca. Illes Balears) Example of application



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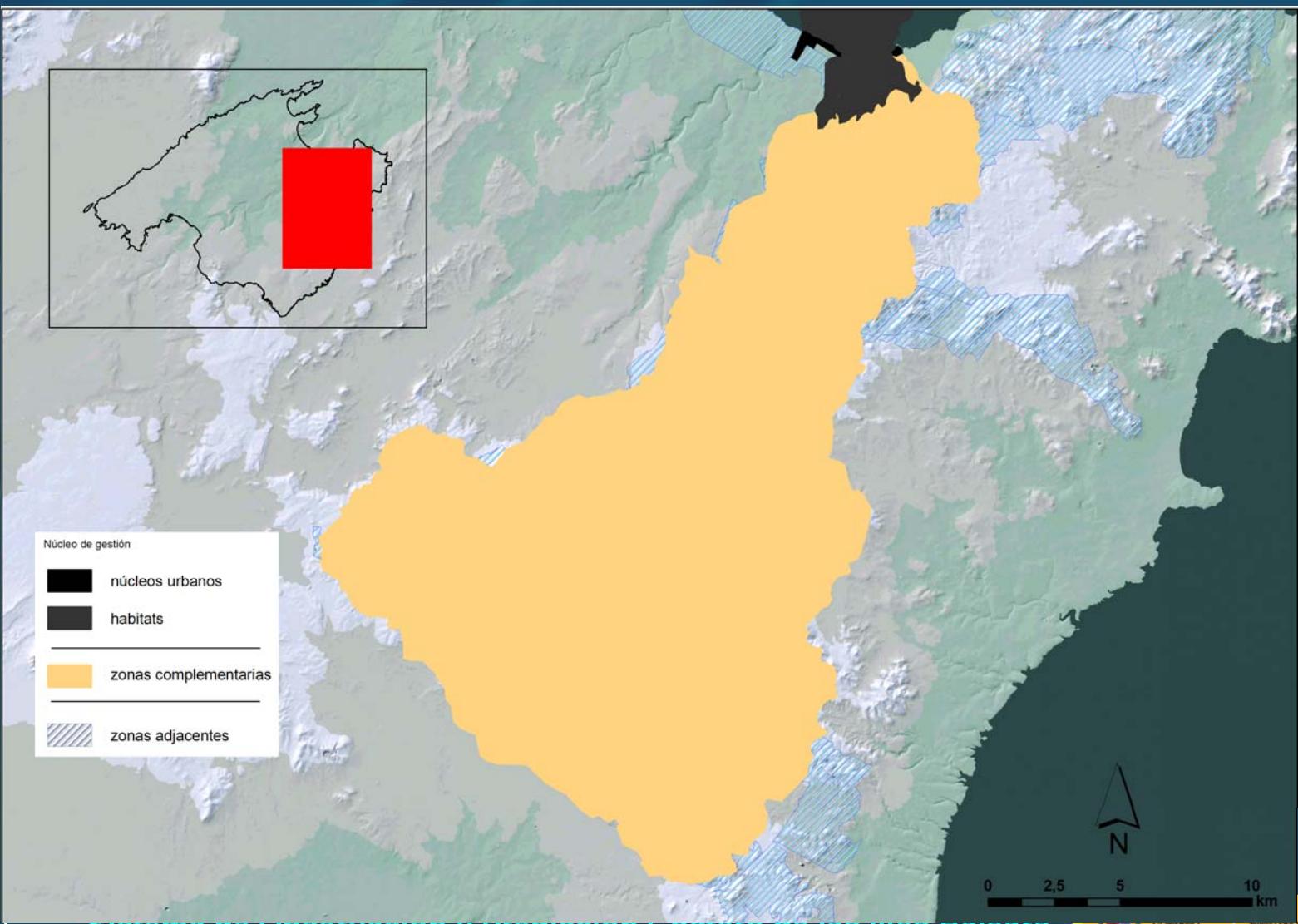


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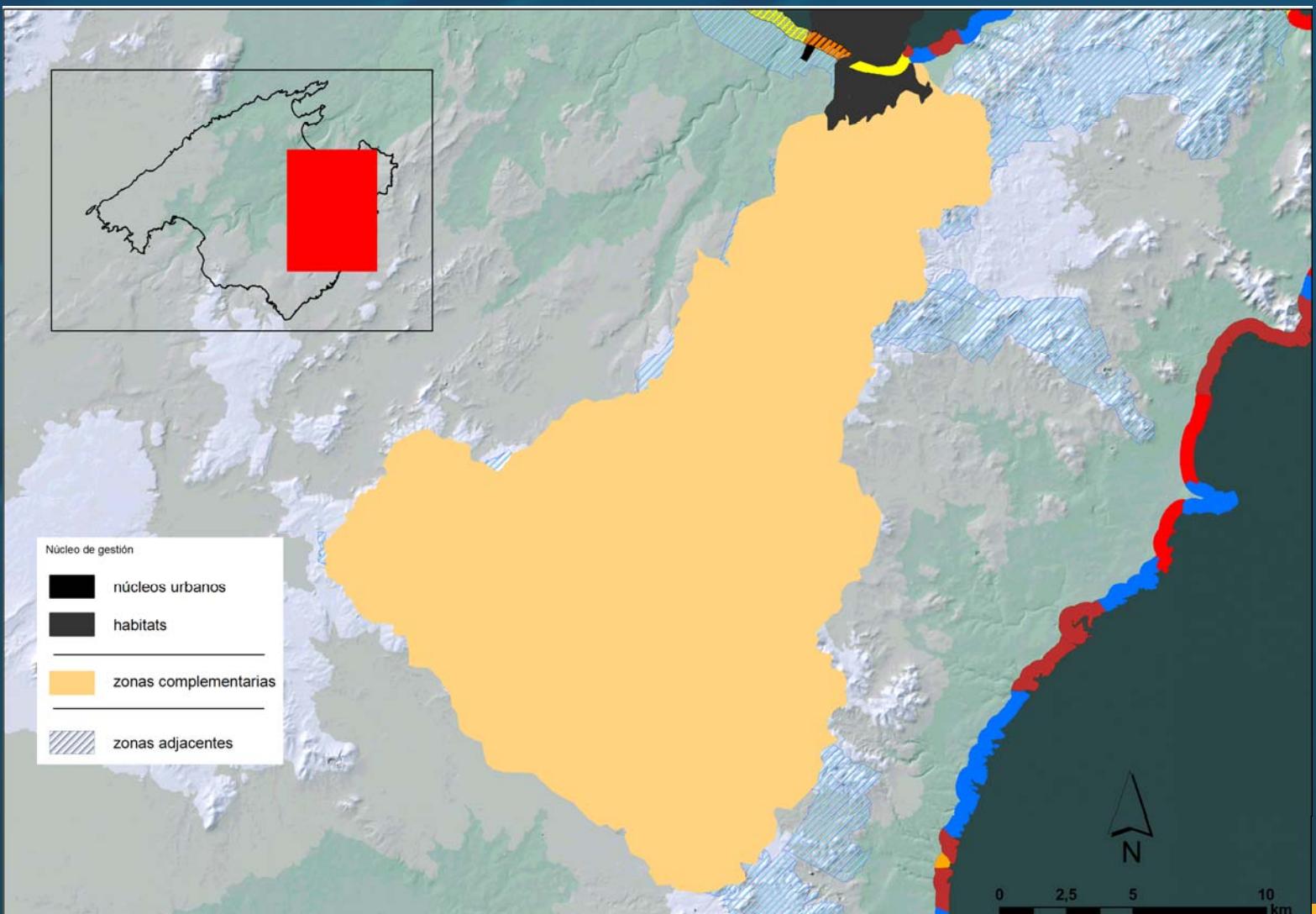


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