Science based Integrated Coastal Zone Management in the Balearic Islands

Understanding multidisciplinary processes and their interactions at different spatial and temporal scales as a basis for achieving sustainability

Prof. Joaquín Tintoré and co-workers
IMEDEA (CSIC-UIB)

Abstract

Science-Based Integrated Coastal Zone Management (ICZM) in the Balearic Islands (Western Mediterranean)

Joaquín Tintoré, IMEDEA (CSIC-UIB), E-07071 Esporles, Mallorca, SPAIN - jtintore@uib.es

The preservation, restoration and science based management of the coastal zone requires a comprehensive understanding of the multidisciplinary processes and their interactions that affect the natural variability of the eco-system. This requires a strong state of the art backing from the natural and earth sciences.

Understanding disciplinary biological, physical and chemical factors in the coastal environment represents a significant challenge to the implementation of ICZM. In addition, there exists a deficiency of multi-disciplinary research to build our understanding of the interrelationship among the natural, physical and social realms. However, in reality, it is the social-economic-political system behind the impacts and the management of these areas that, more often than not, is the limiting factor to conservation and restoration.

Humans appear to be far less predictable than ecosystems. They require, among others, incentives, legislation, enforcement, and awareness in order to change their behavior. Understanding the processes that govern the actions and choices of humans and how those elements affect natural resources is essential to the conservation of coastal habitats.

This reality is especially relevant in the Balearic Islands, one of the most significant tourism destinations in the Mediterranean region. Since 2005, the IMEDEA, an internationally well established research center, is working together with the Government of the Balearic Islands towards implementing science-based ICZM in the archipelago.

The challenges associated with the transfer of updated scientific information (variables, indicators, natural ranges of variability, thresholds, etc.) in meaningful formats to policy makers and of finding a balance between the natural and social sciences are inherent in this process.

The objective of this presentation will be to present the experiences of IMEDEA related to maintaining this critical, often evasive balance between scientific and socio-political realities.

Objectives

1. To illustrate the importance of adopting a multidisciplinary, scientific, ecosystem based, integrated management approach to conserving coastal and marine habitats using the case of the Balearic Islands as an example

2. To show the relevance of high quality scientific research and new technology developments for achieving habitat conservation and Integrated Coastal Zone Management (ICZM) as a way to advance towards a real sustainability and using also specific examples from a new ICZM Balearic Islands Project

3. To recommend future directions for coastal and marine habitat restoration, conservation and implementation of useful ICZM strategies

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change scenario
2. The Balearic Islands: present, historical evolution, a privileged environment and unique habitats
3. General frame, basic principles and challenges: sustainability
4. The new role of science. IMEDEA: some examples of coastal research
5. The ICZM Balearic Islands project (2005-2007): a starting point
6. The future: recommendations for ICZM, Coastal Observatories and guidelines for sustainable tourism

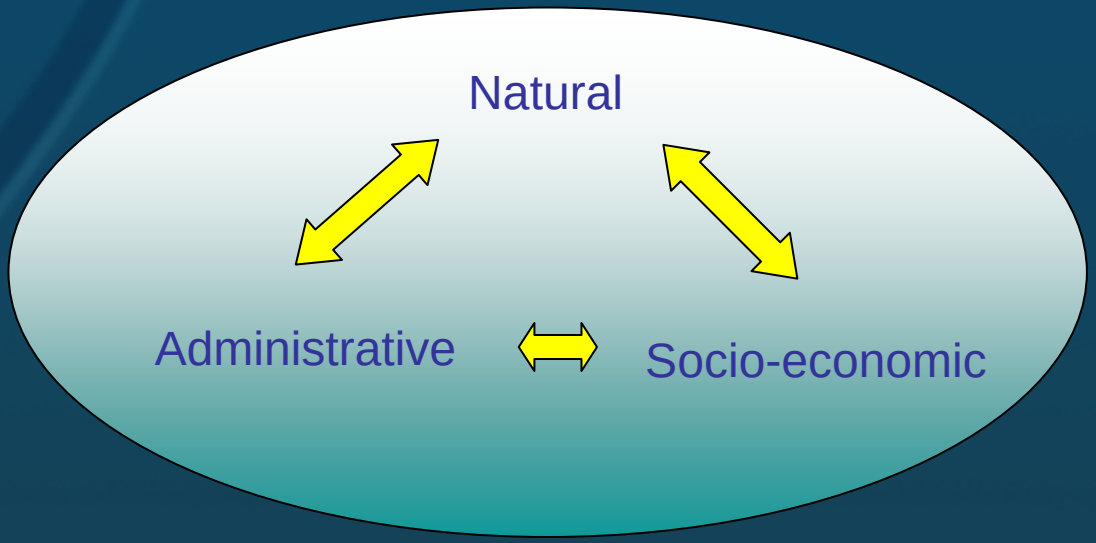
The coastal zone, complexity, problems and threats in a global change scenario

What do we understand by Coastal Zone

- In “small” islands, the coastal zone is really the whole island.
- It is a dynamic, fragile and complex area where a diversity of forces, processes and pressures are in place, all inter-related: waves, currents, sediment transport, bio-geochemical fluxes, biodiversity, socio-economic, cultural and institutional processes.
- It has a unique biodiversity in terms of flora and fauna: unique, fragile and scarce
- It provides a number of well known services and functions
- It is of high economic, social, cultural and recreational importance
- It has faced significant changes in the last 20-30 years
- A large number of administrations and institutions have competencies on the coastal zone.

The coastal zone, complexity, problems and threats in a global change scenario

Three sub-systems:



Very complex system

“Things have to be made as simple as possible, but not simpler” (A. Einstein)

The coastal zone, complexity, problems and threats in a global change scenario

Environmental threats in the Balearic Islands

- Degradation of water quality
- Beach erosion
- Loss of coastal dunes
- Red tides, HABS
- Loss of fisheries resources
- Degradation of *Posidonia oceanica* meadows
- Proliferation of invasive species
- Coastal artificialization
- Marine debris
- Accidental oil spills
- Proliferation of jellyfish

Theses threats are not only local, **global change scenario**

Theses threats are already problems with significant **economic and social** effects
There is a strong pressure on the coastal zone as a resource

“The natural resource is not unlimited” (limitation concept)

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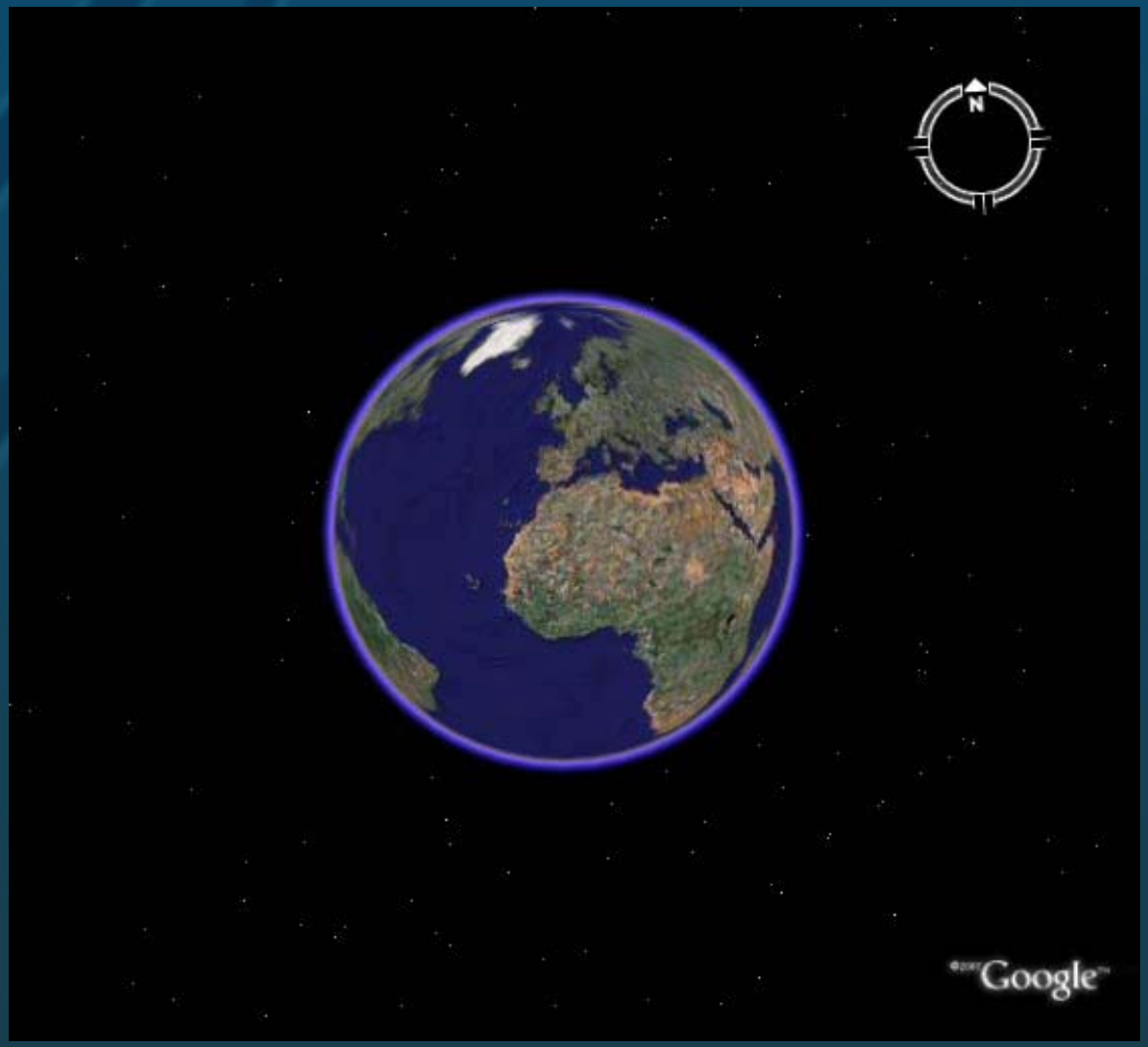
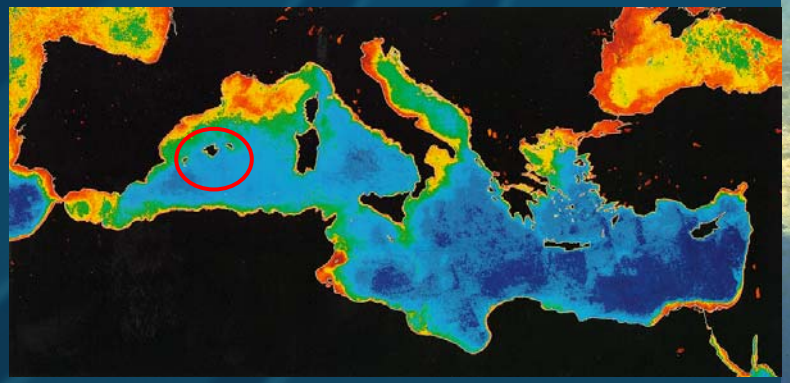
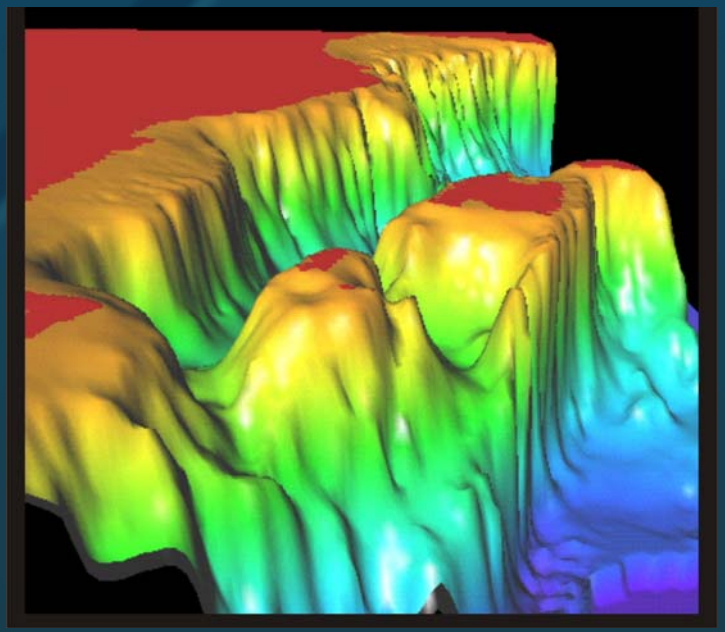
The Balearic Islands



The Balearic Islands

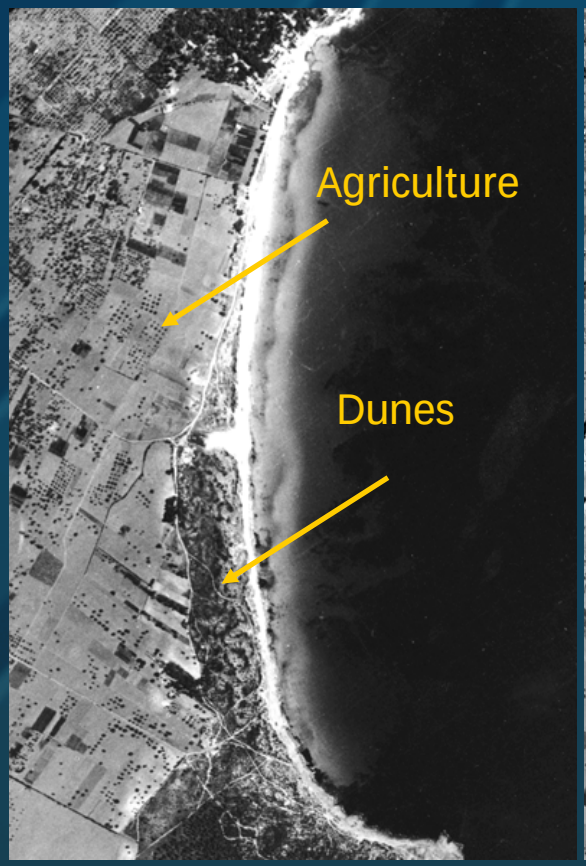




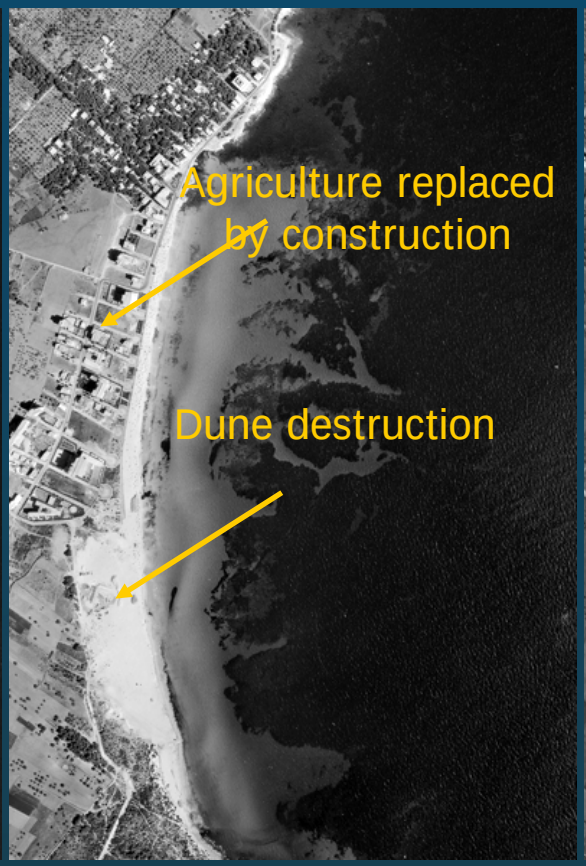
The Balearic Islands

- Area 5.014 km^2
- Length of coastline 1.428 km
- 1.001.062 inhabitants (INE, 2006)
- GDP 24.391.053.000€ (IBAE, 2006)
- 80% of GDP generated from activities in the coastal zone
- Mature tourism destination
  - 12.577.829 tourist arrivals in 2006 (CITTIB)
  - 48% GDP (INESTUR 2006)
  - 39.5% of jobs in the high season (ibid)
- Insular environment – limited resources and heightened sensitivity/vulnerability to change
- Large number of governing agencies and actors with competence in the coastal zone

The Balearic Islands



1956

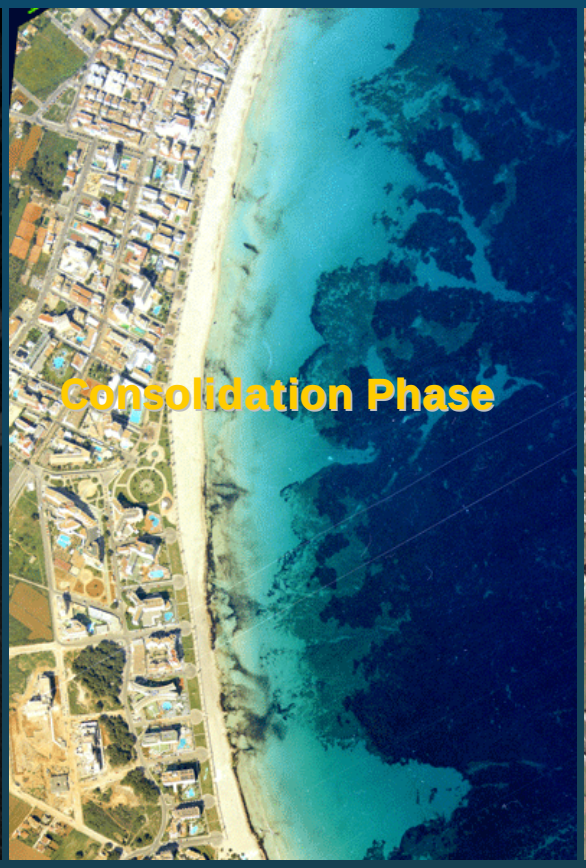


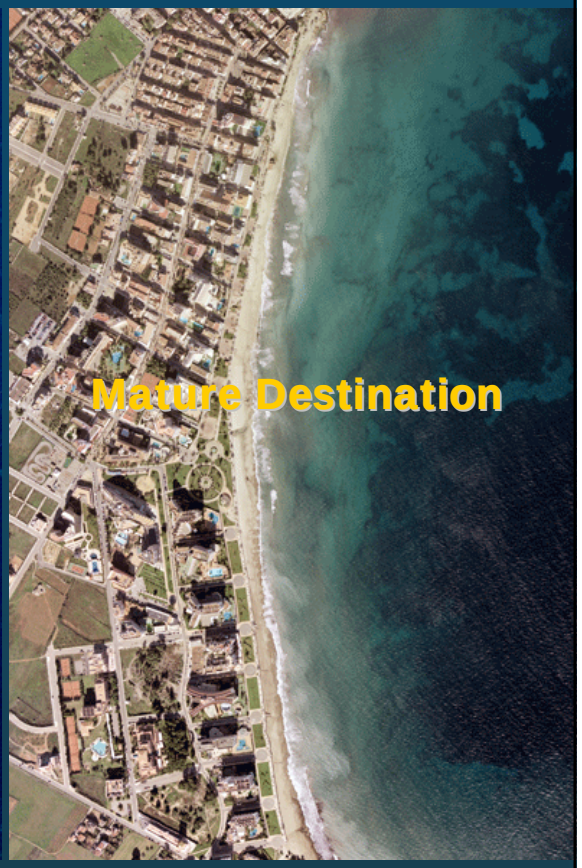
1968

1973

Cala Millor, Mallorca

The Balearic Islands





1979 1997 2002

Cala Millor, Mallorca

The Balearic Islands

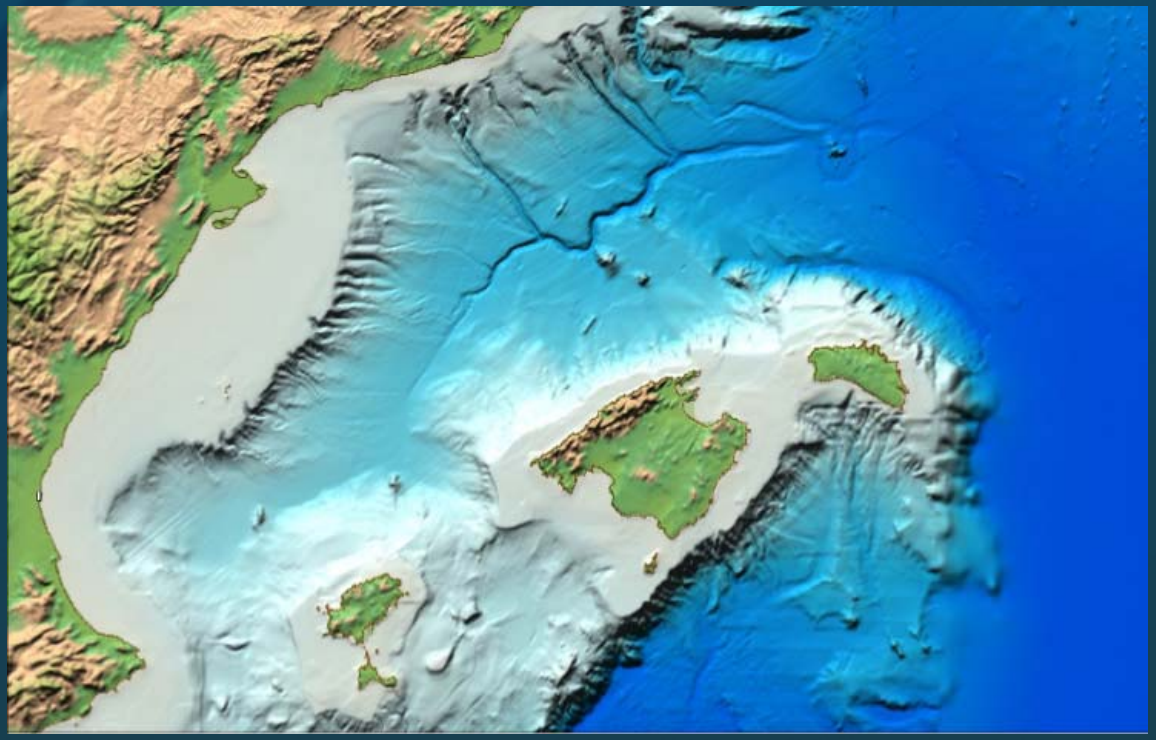
The 1960s

Today

Cala Millor, Mallorca

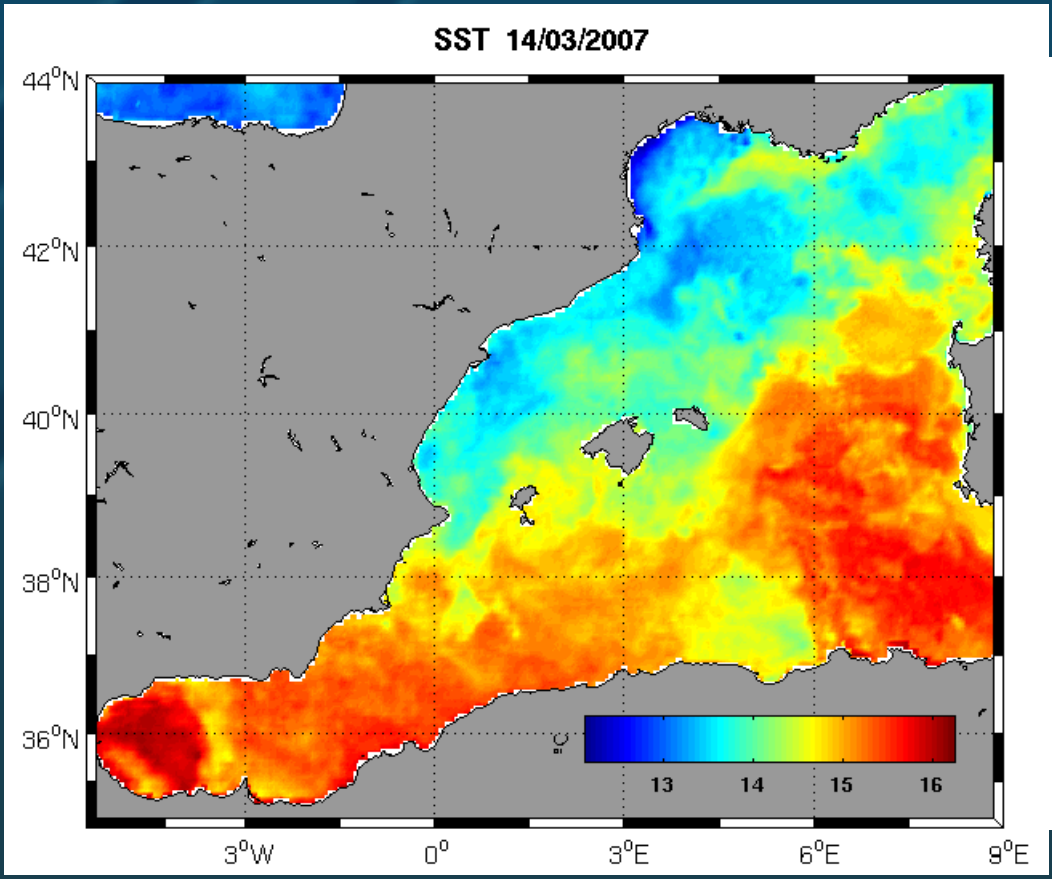
Balearic Islands coastal zone characterization

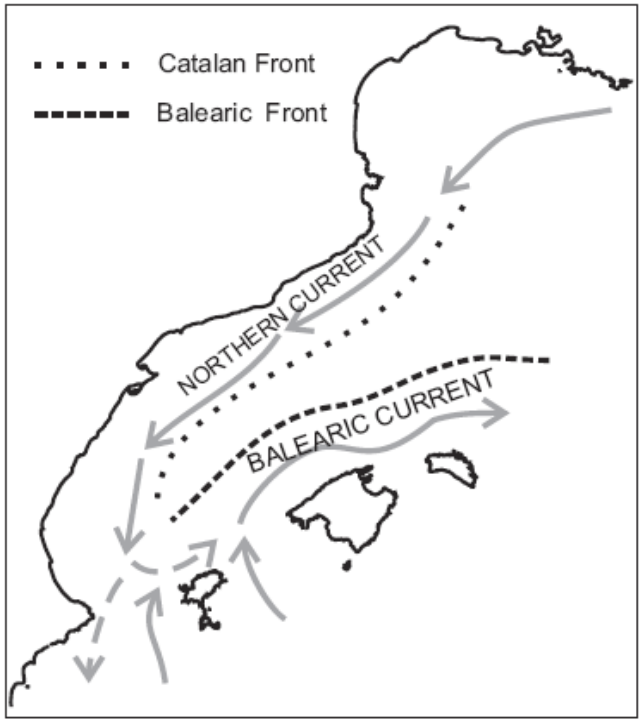
- Oceanic
- Shoreline geomorphology



Balearic Islands coastal zone characterization

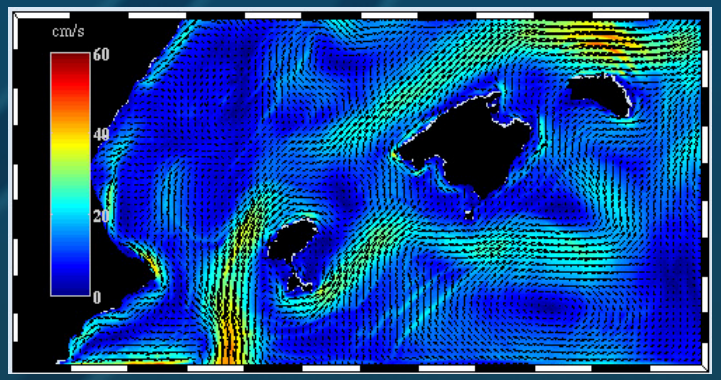
- **Oceanic features**
- Shoreline geomorphology

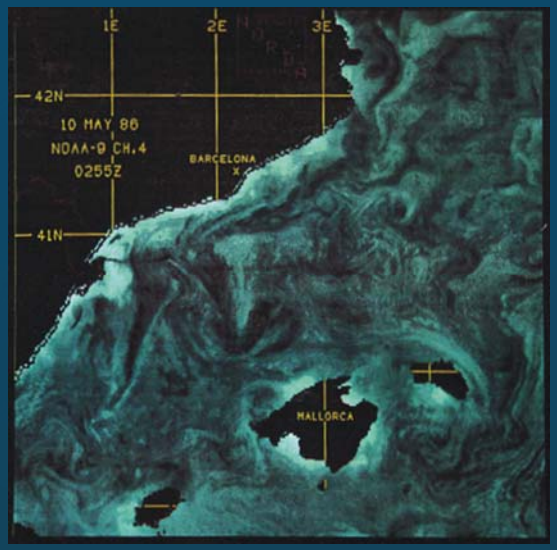


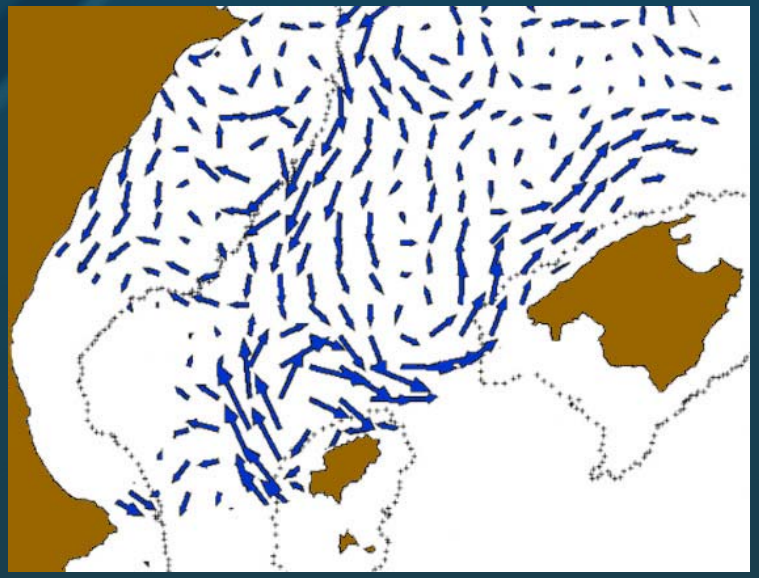


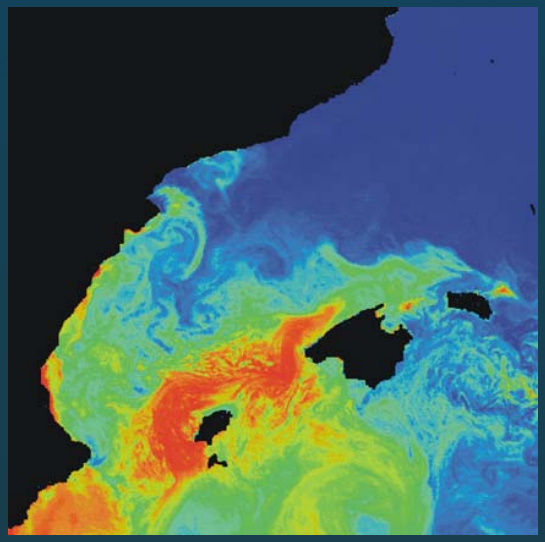
Balearic Islands coastal zone characterization

- **Oceanic features**
- Shoreline geomorphology



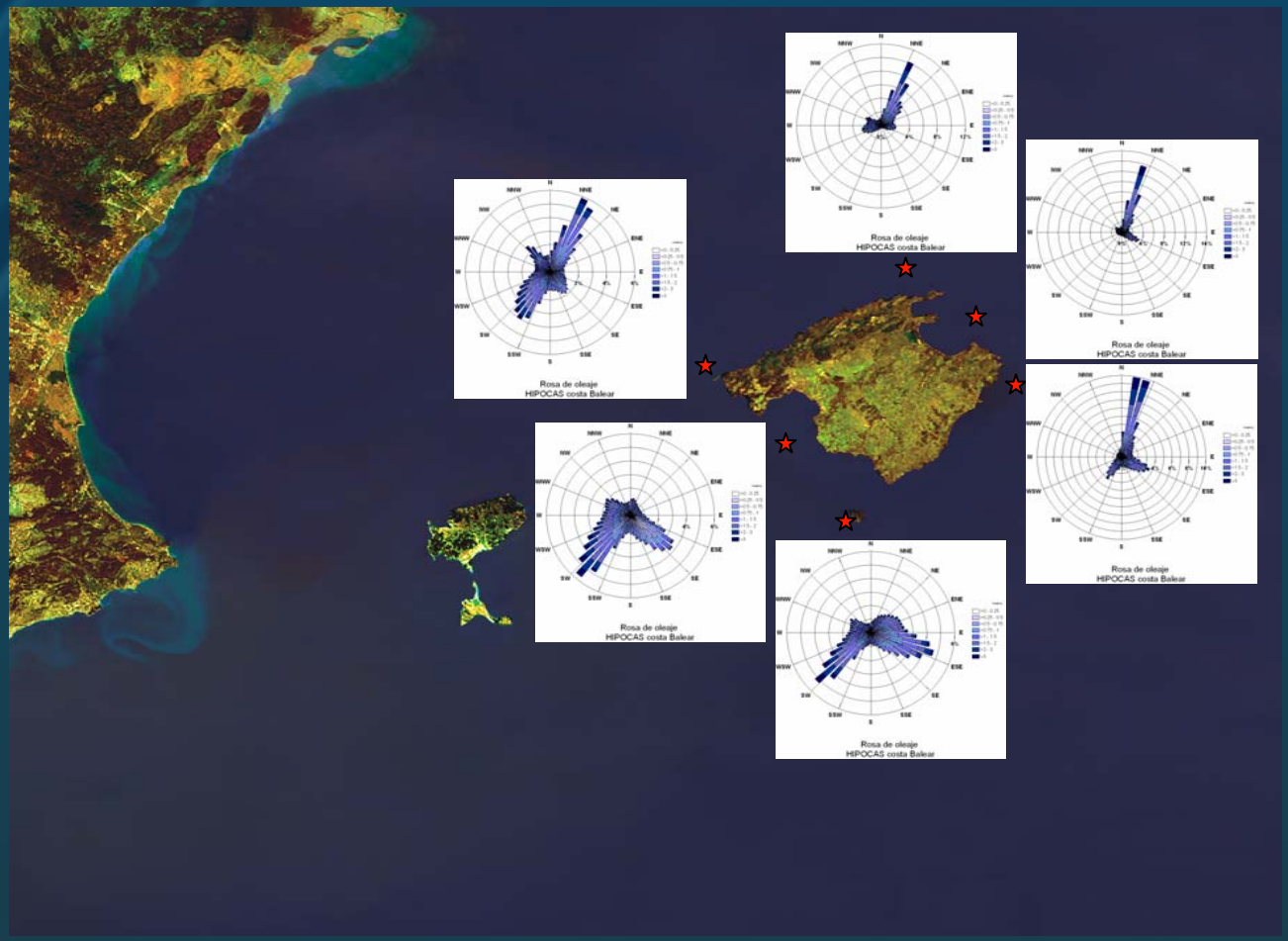




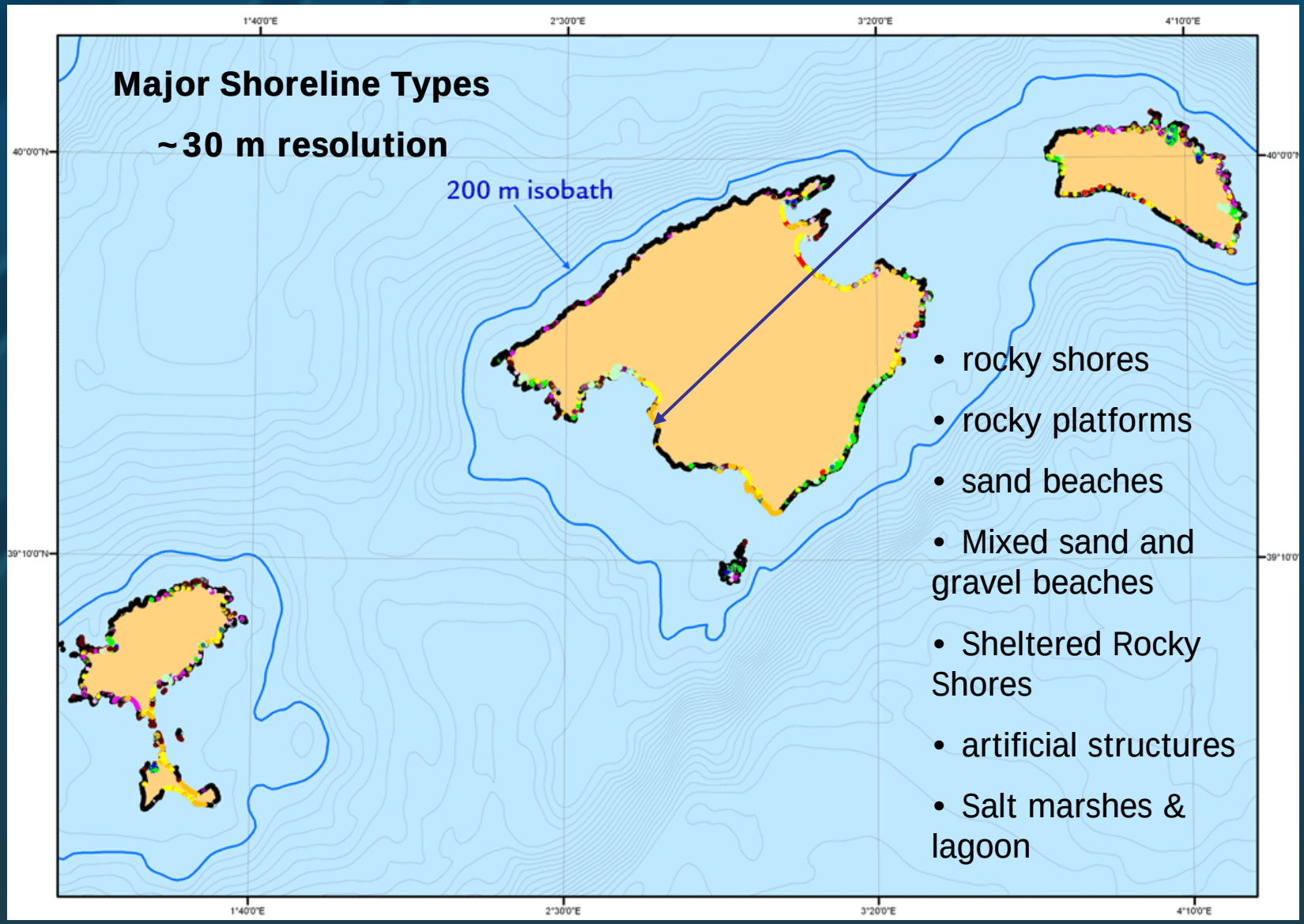


Balearic Islands coastal zone characterization

- **Oceanic. Wave climate**
- Shoreline geomorphology



Balearic Islands coastal zone characterization.

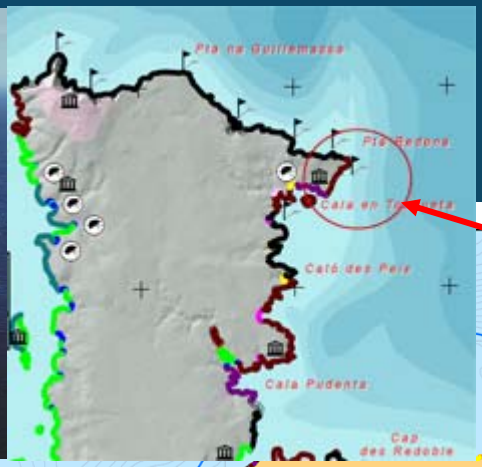


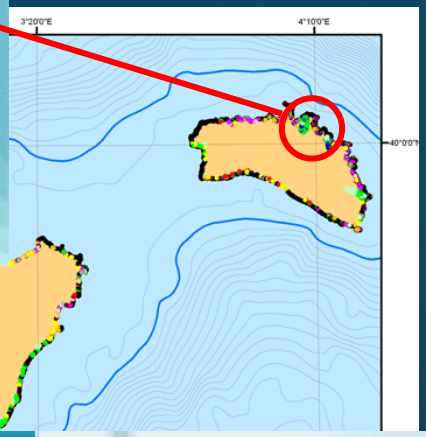
Balearic Islands coastal zone characterization

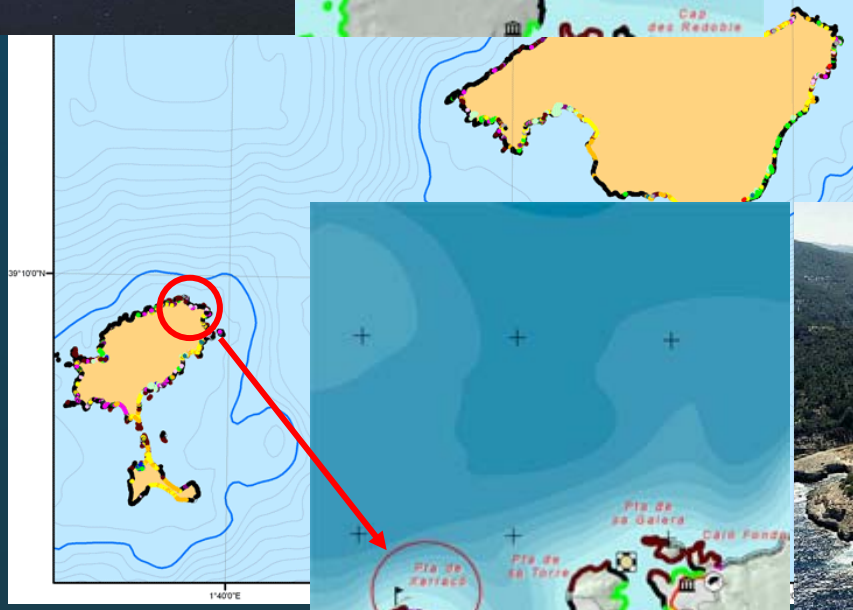
- **Shoreline geomorphology. Examples rocky shores. Cliffs**

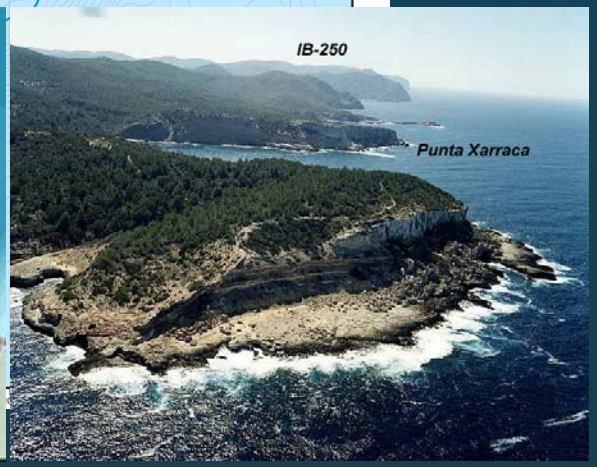
Balearic Islands coastal zone characterization

- **Shoreline geomorphology. Examples rocky shores. Platforms**







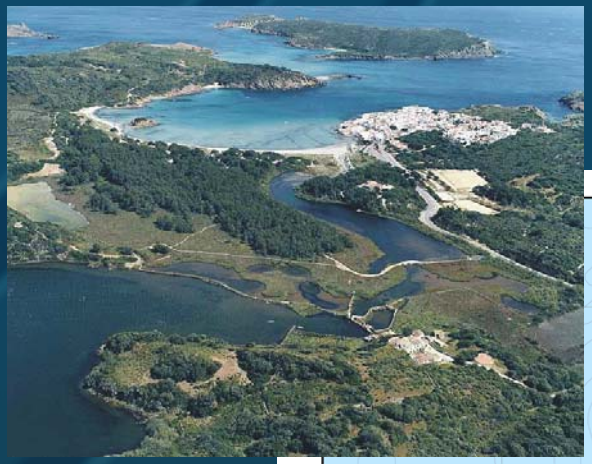


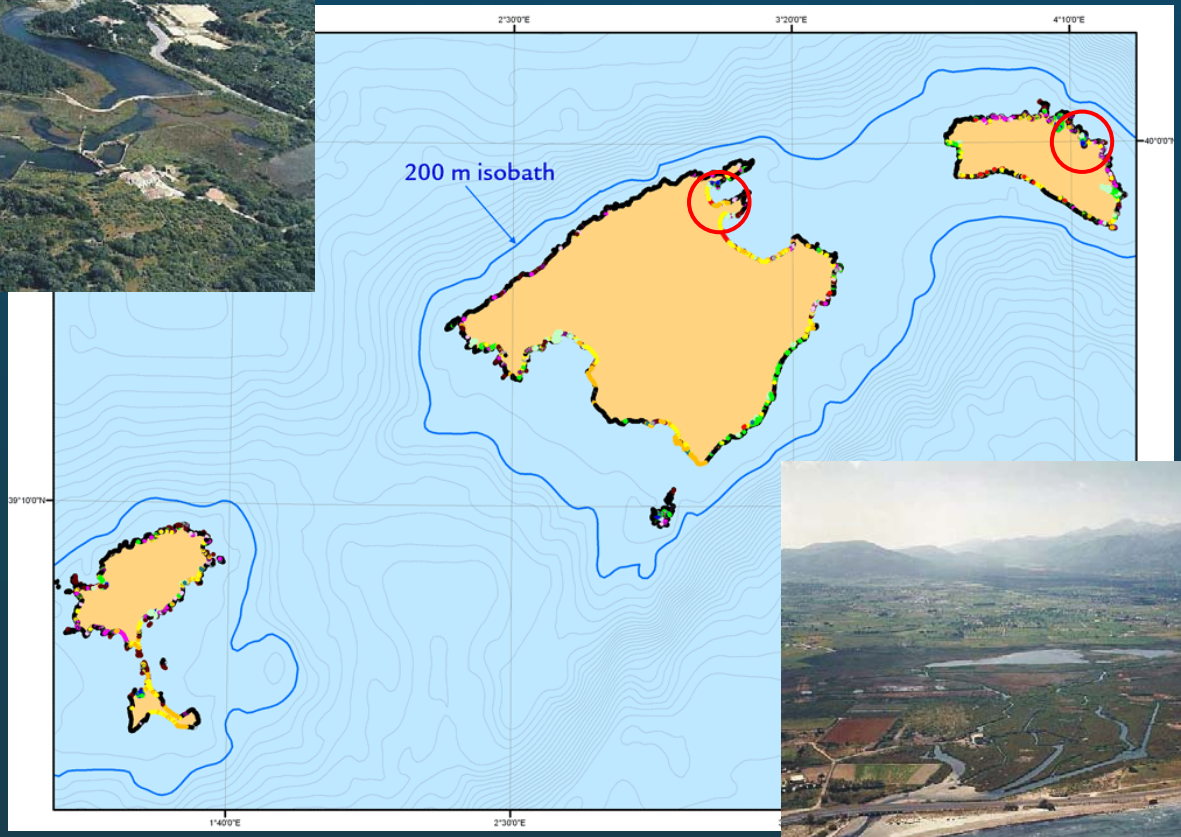
Balearic Islands coastal zone characterization

- **Shoreline geomorphology. Examples salt marshes & lagoon**

Balearic Islands coastal zone characterization

- **Shoreline geomorphology. Examples sandy beaches**



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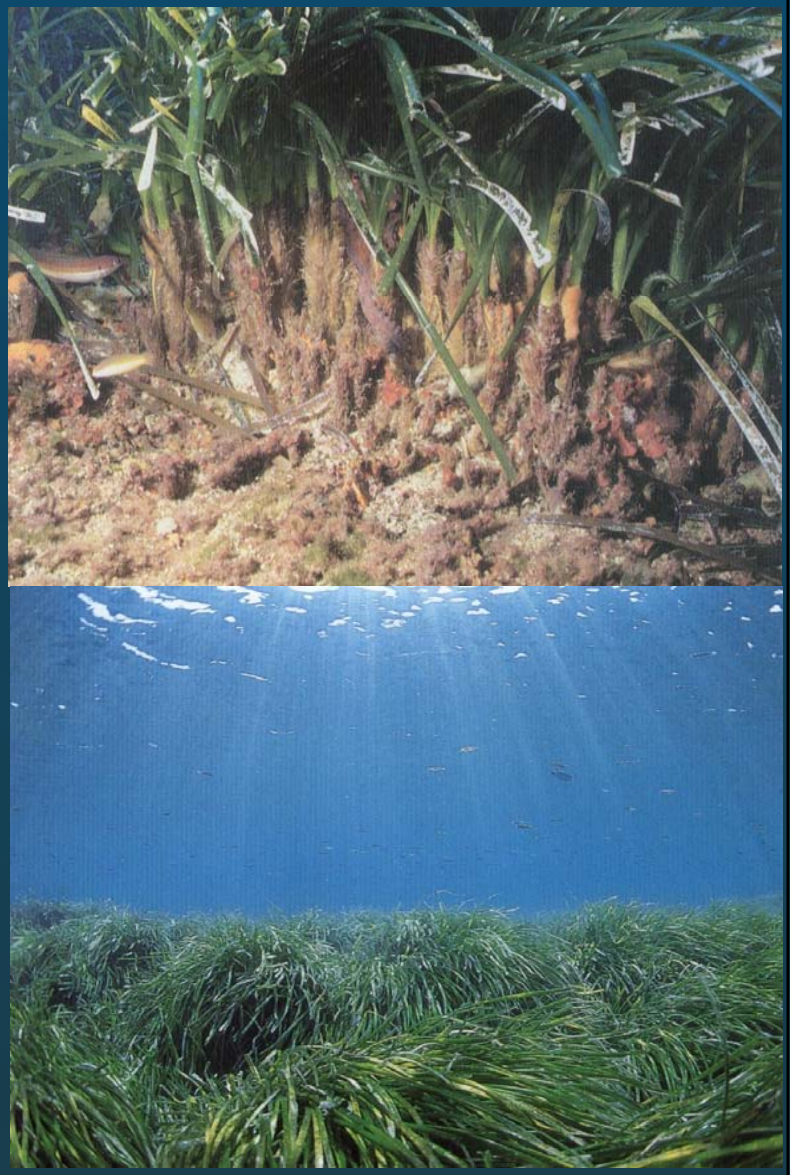
Coastal and Marine Habitats of the Balearic Islands

Marine Coastal Habitats of particular relevance

Absence of rivers

Low turbidity of the water

- Communities of high ecological value
- Seagrass meadows of *Posidonia oceanica* and *Cymodocea nodosa*
- *Cystoseira sp* beds
- Maerl beds
- Structural complexity provided by the macrophytes



Different Jurisdictional Levels Affecting Habitat Conservation in the Balearic Islands

Natura 2000

Directive 79/409/EC for Conservation of Wild Birds

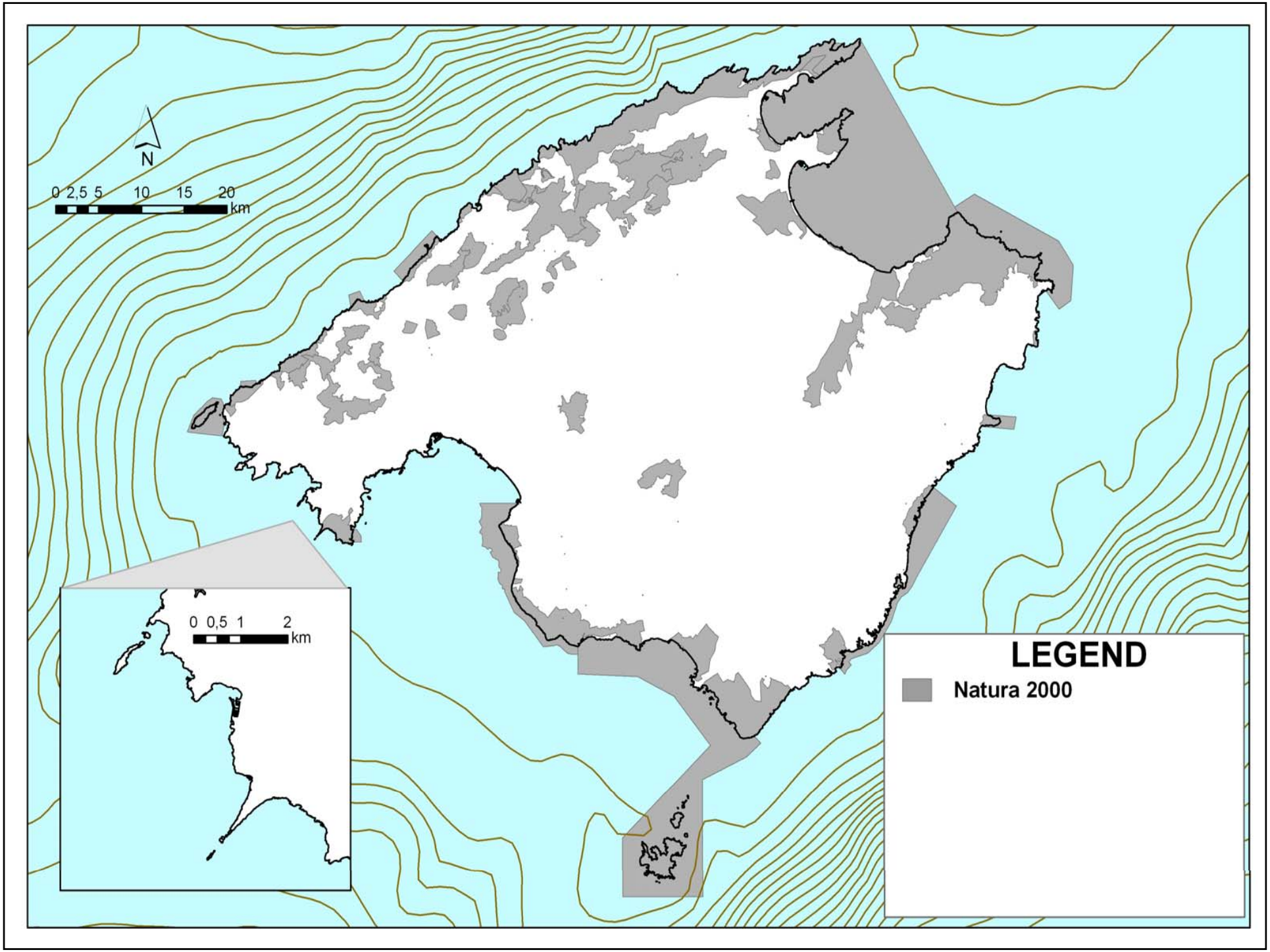
Directive 92/43/EC for Conservation of Natural Habitats of Wild Flora and Fauna

Law 4/1989 of Wild Flora and Fauna

Law 5/2005 for Conservation of Areas of Environmental Importance

Series of decrees for declaration of Marine Reserves (7 reserves)

Law 1/1991 of natural areas and urban management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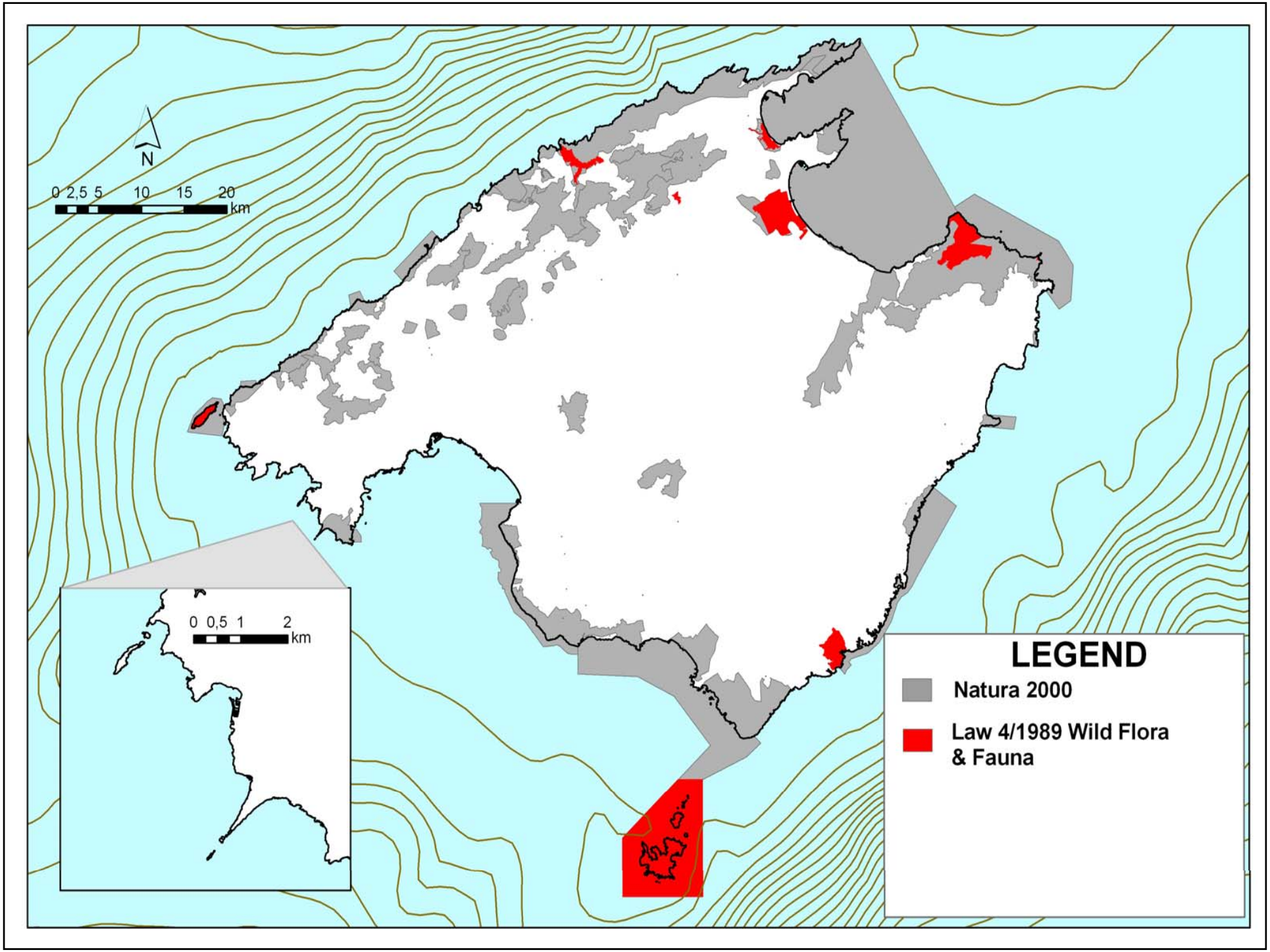
Natura 2000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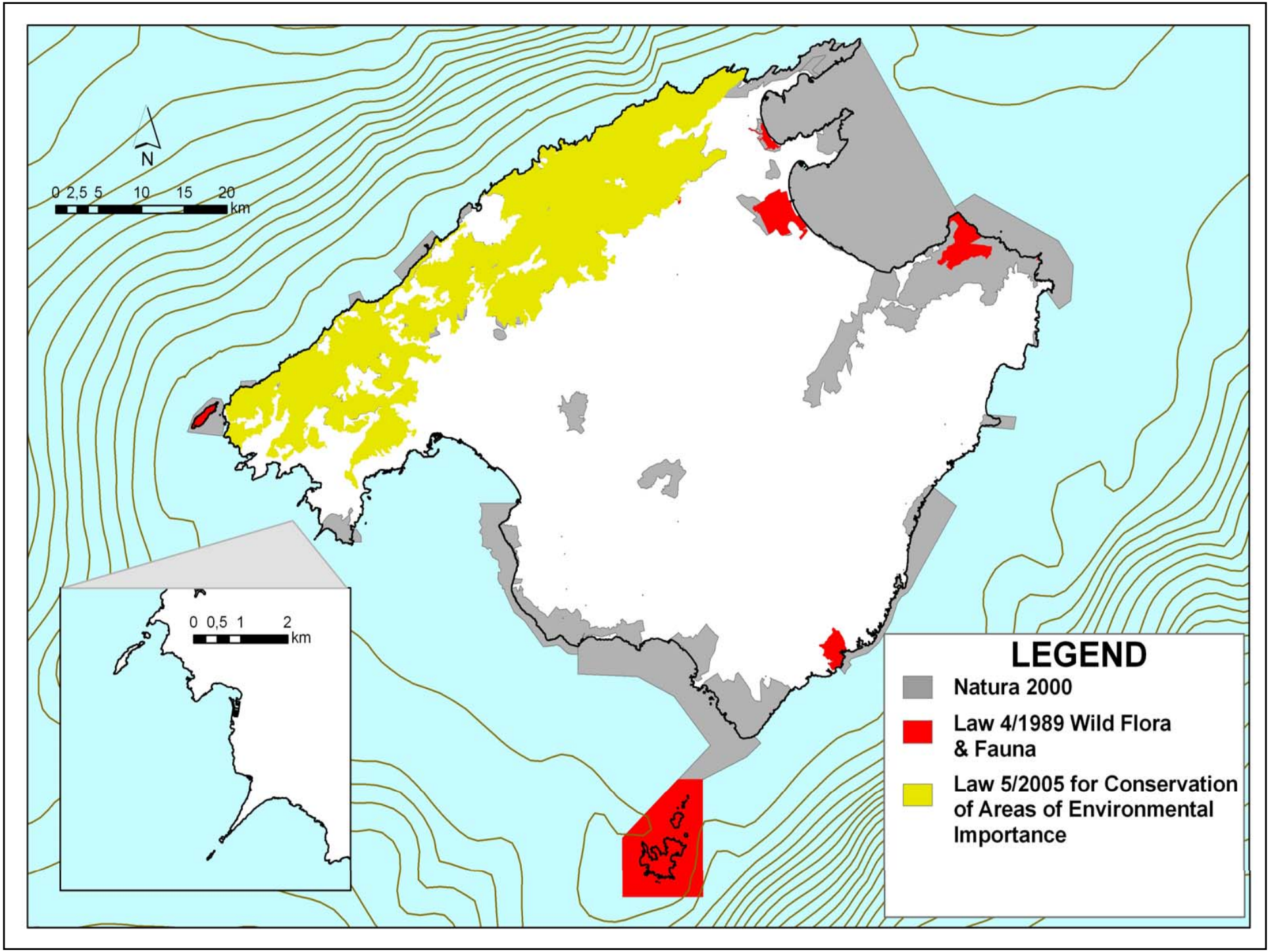
Natura 2000
Law 4/1989 Wild Flora & Fauna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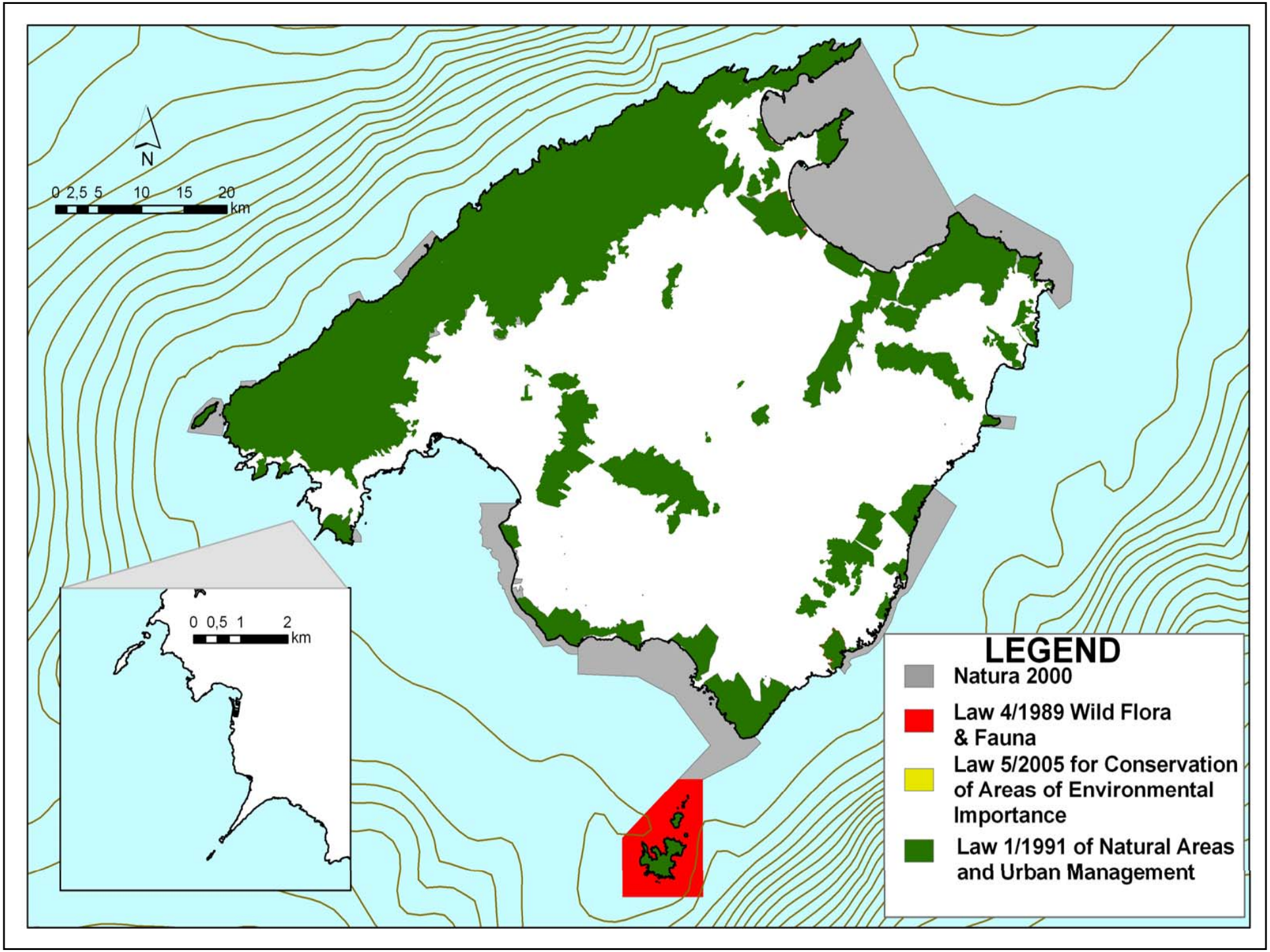
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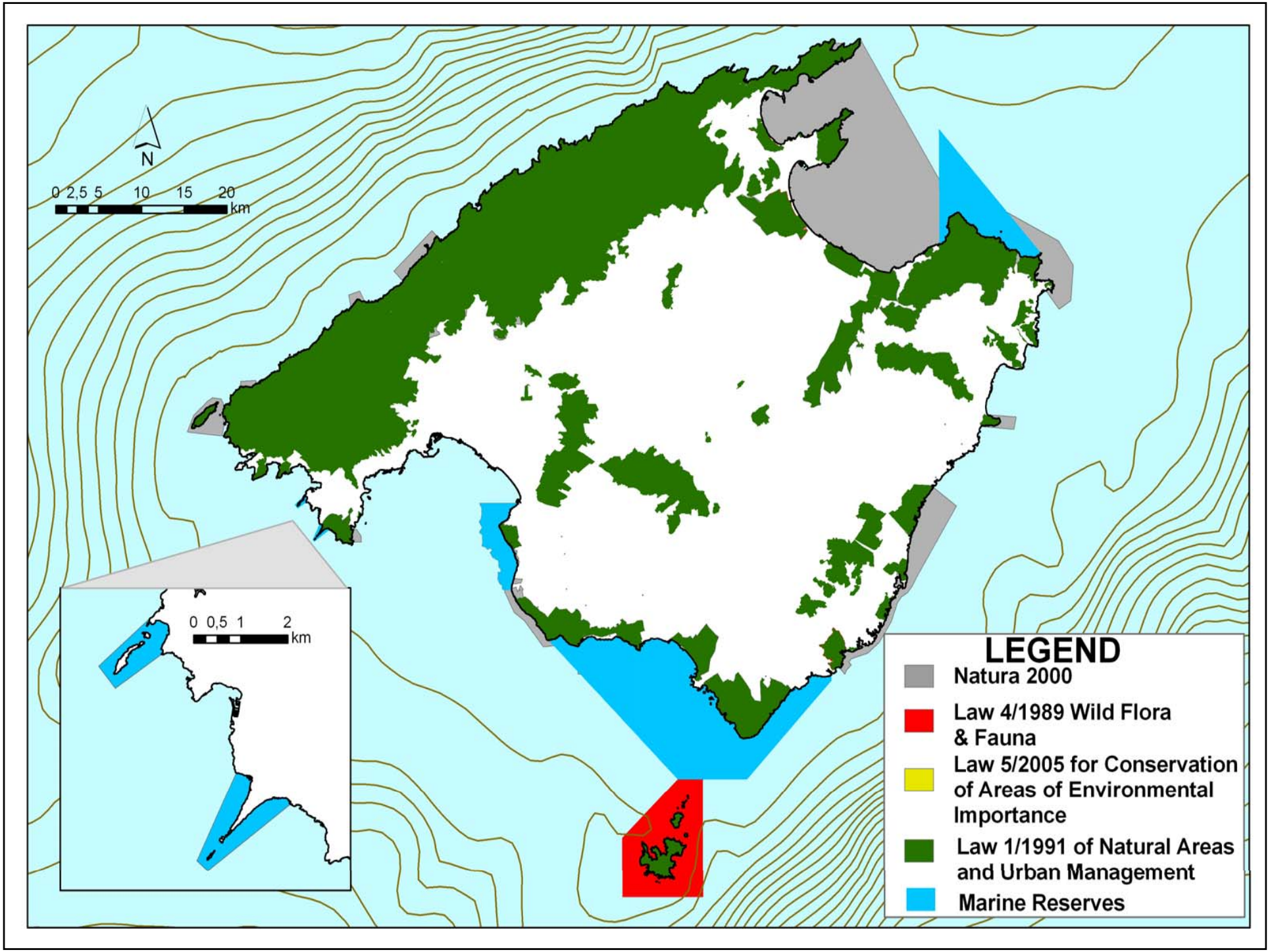
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Law 4/1989 Wild Flora & Fauna
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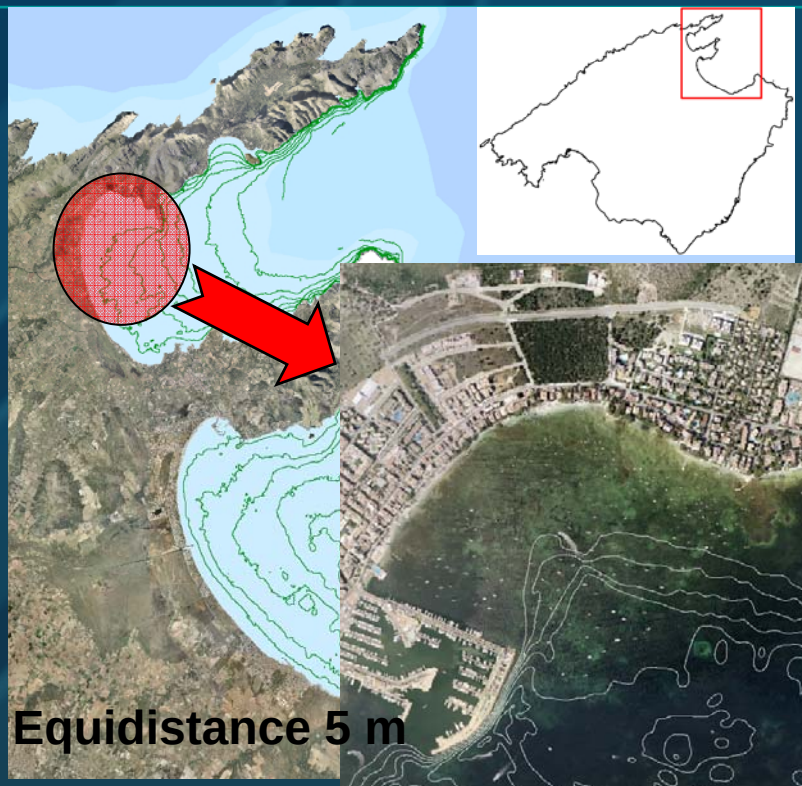
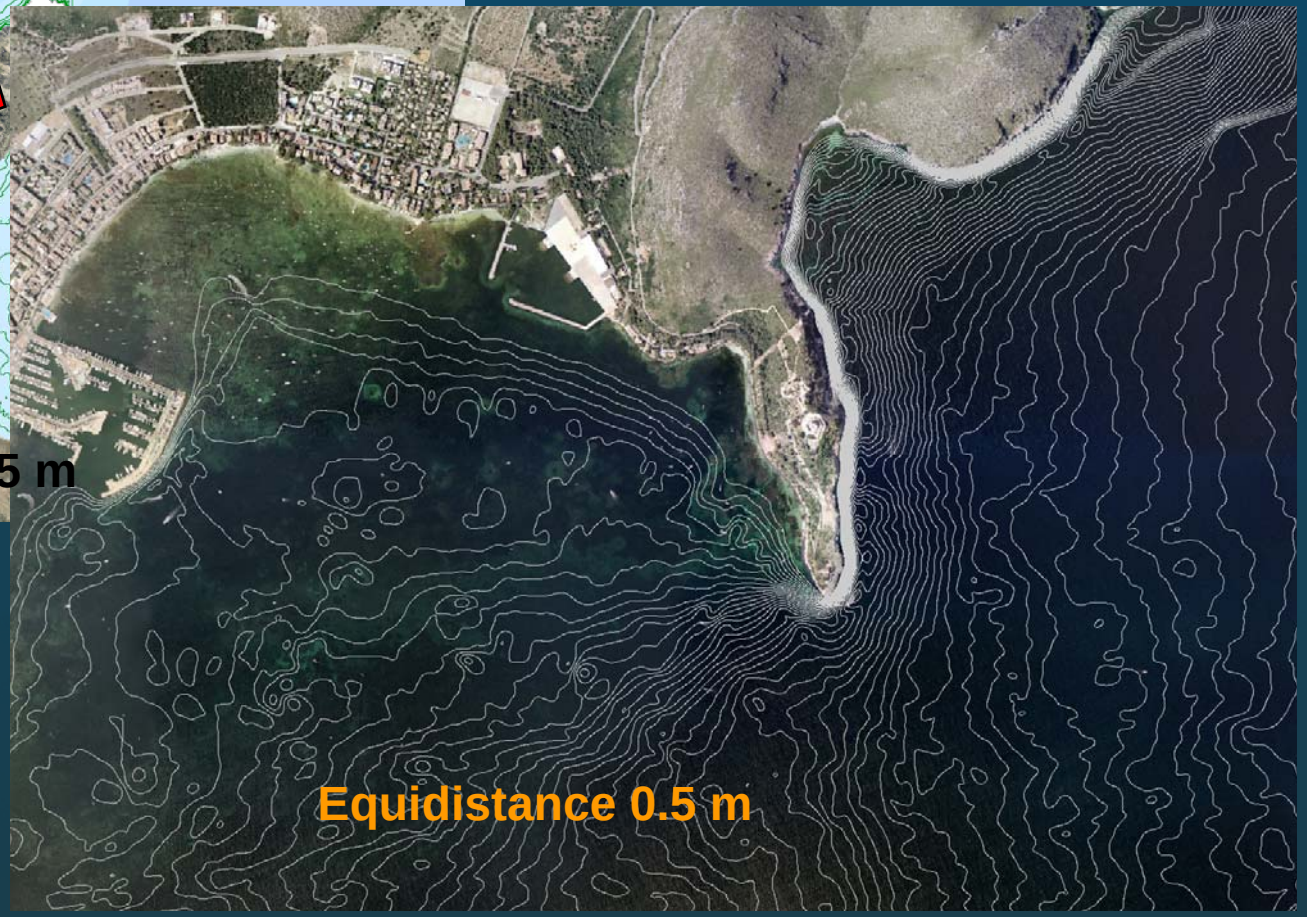
Law 1/1991 of Natural Areas and Urban Management
Marine Reserves

Example of Habitat Conservation in the Balearics: Life Posidonia Project (EC funded)

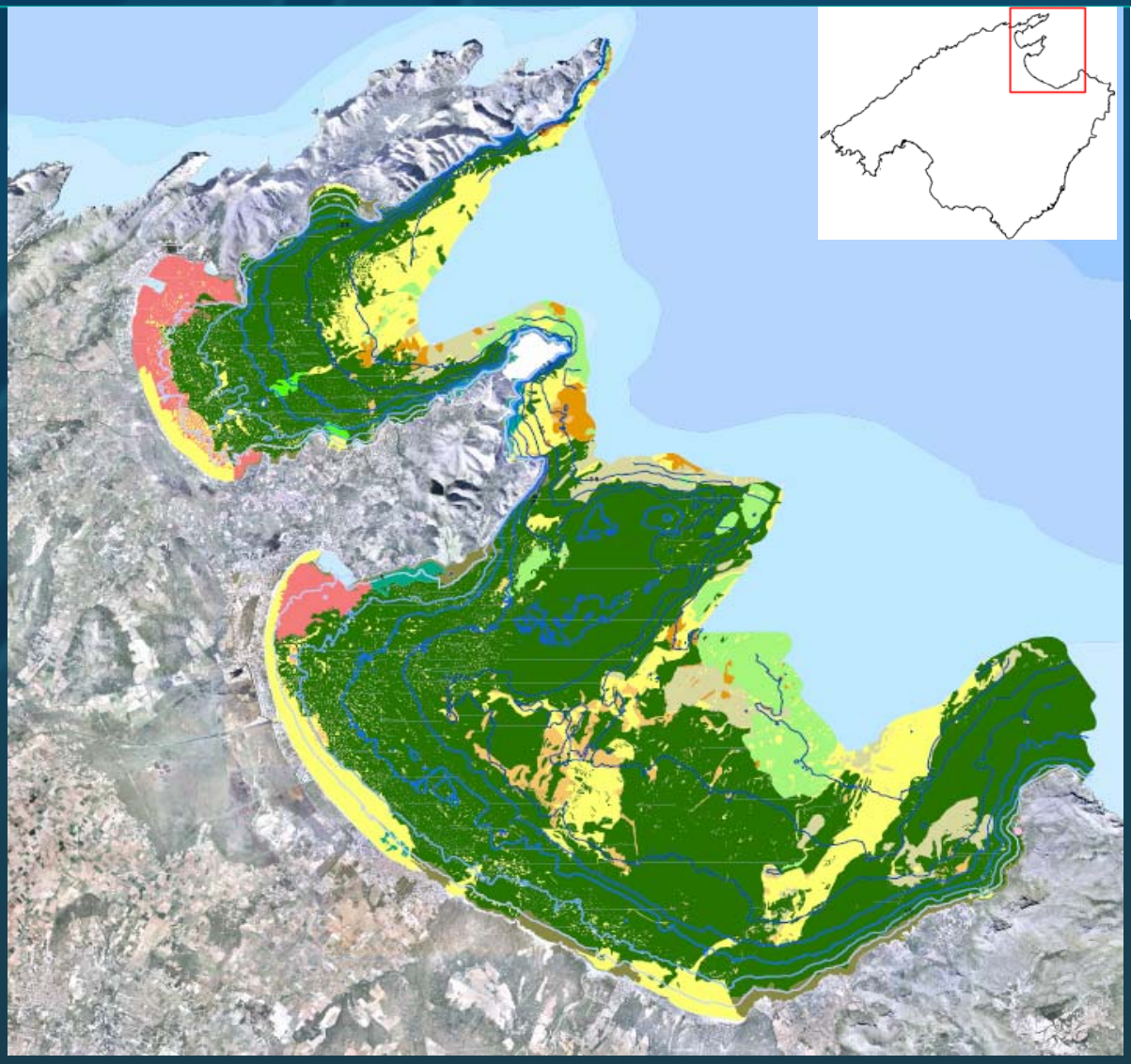
ISLAND	AREA	SAMPLING AREA (ha)	*Posidonia* (ha)	*% Posidonia*
MALLORCA - CABRERA	Cabrera-es Trenc	11652,5	5175,9	44,4
	Artà	15436,9	5326,0	34,5
	Alcúdia	22798,1	15161,5	66,5
	Enterrocat	6759,4	2311,0	34,2
	Llevant	4277,2	2095,9	49,0
	Dragonera	368,1	44,6	12,1
MENORCA	S Menorca	1064,5	856,5	80,5
	N Menorca	27751,3	1999,7	7,2
FORMENTERA	Barabaria	1361,8	878,8	64,5
	Es Vedrà	284,9	159,3	55,9
	La Mola	825,0	486,4	59,0
	Es Freus	7407,1	4864,2	65,7
EIVISSA	Illots Sta Eulàlia	80,3	62,6	78,0
	Tagomago	136,0	107,2	78,9
BALEARIC ISLANDS	TOTAL	100203,1	39529,8	39,5

Life Posidonia: Physical description, Bathymetry



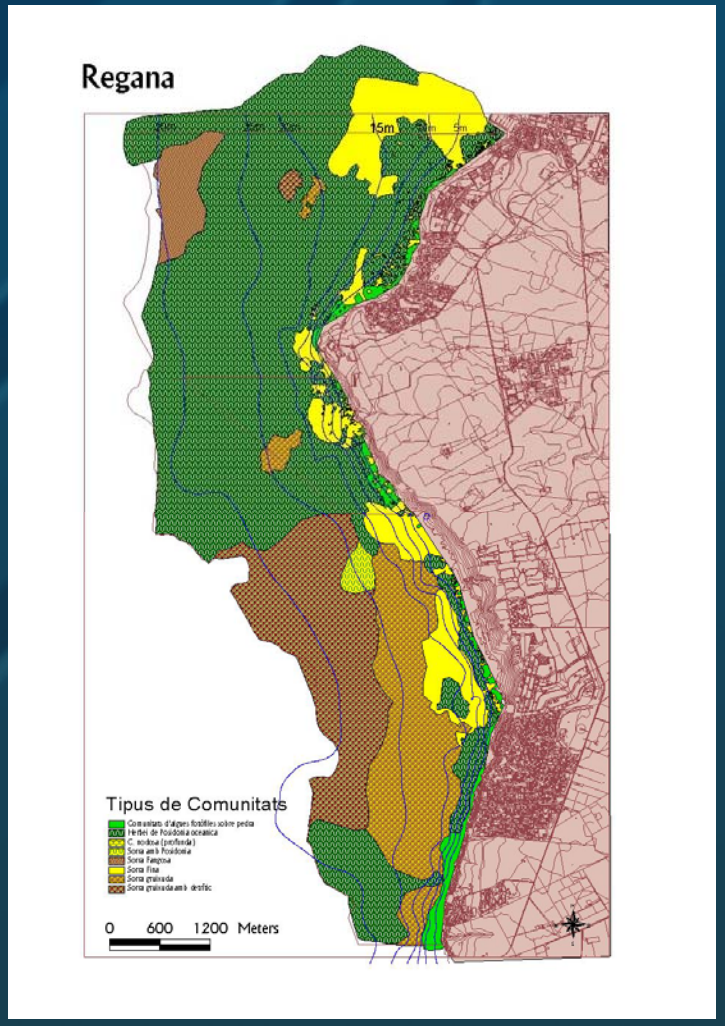


Life Posidonia: Biological studies



65% *Posidonia oceanica*

Understanding the Ecosystem (Ballesteros et al. 2006)

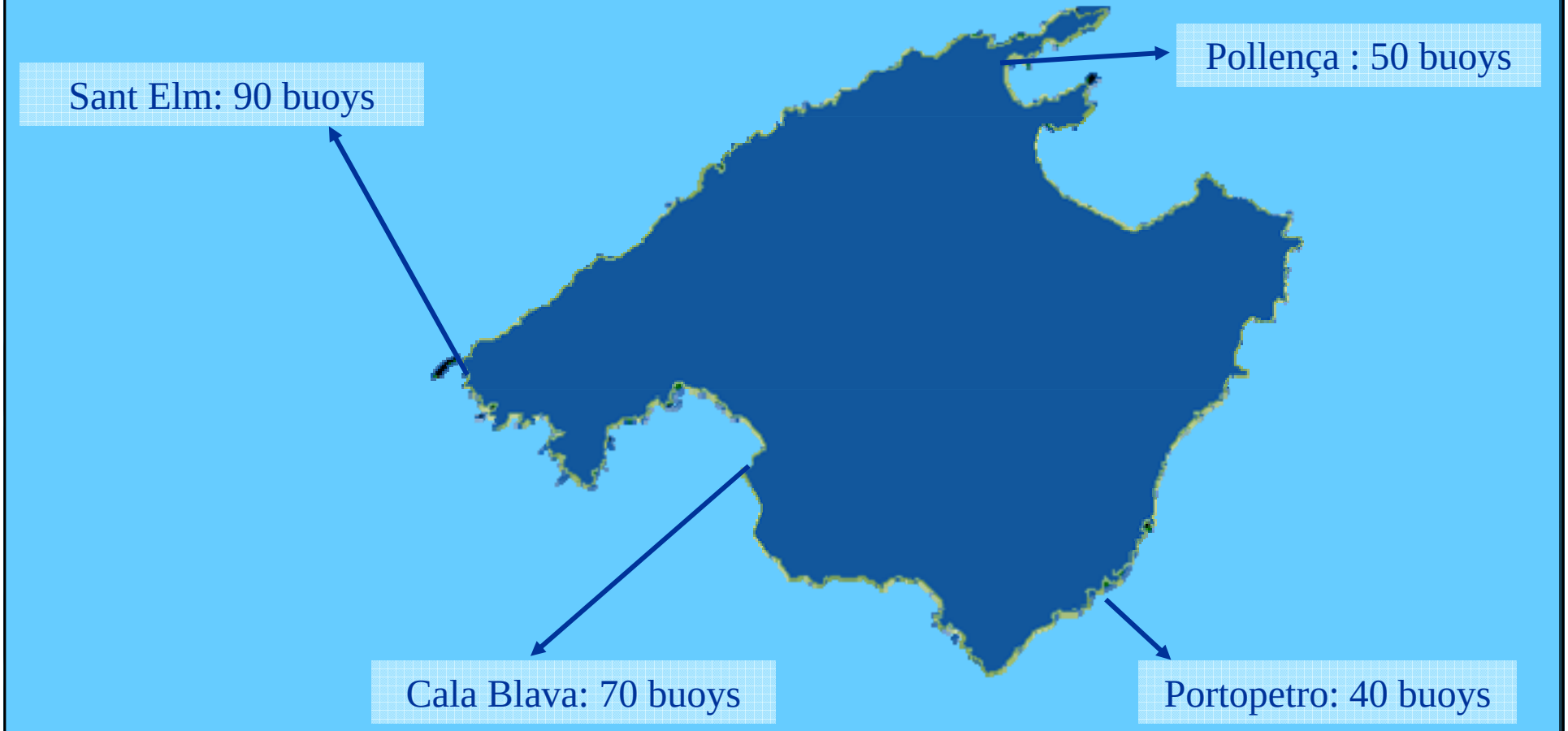


24 Communities

Reduced area
Depth range: de 0 a 32 meters

Type of community	Area (ha)
Comunitat d'algues fotòfiles	92,15
Herbei de *Posidonia oceanica*	1430,45
Cymodocea nodosa profunda	1,81
Sorra fina amb *Posidonia oceanica*	17,22
Sorres fines ben calibrades	304,54
Sorres gruixudes	334,35
Sorra fangosa	70,91
Sorra gruixuda amb detrític	354,51
	2605,94

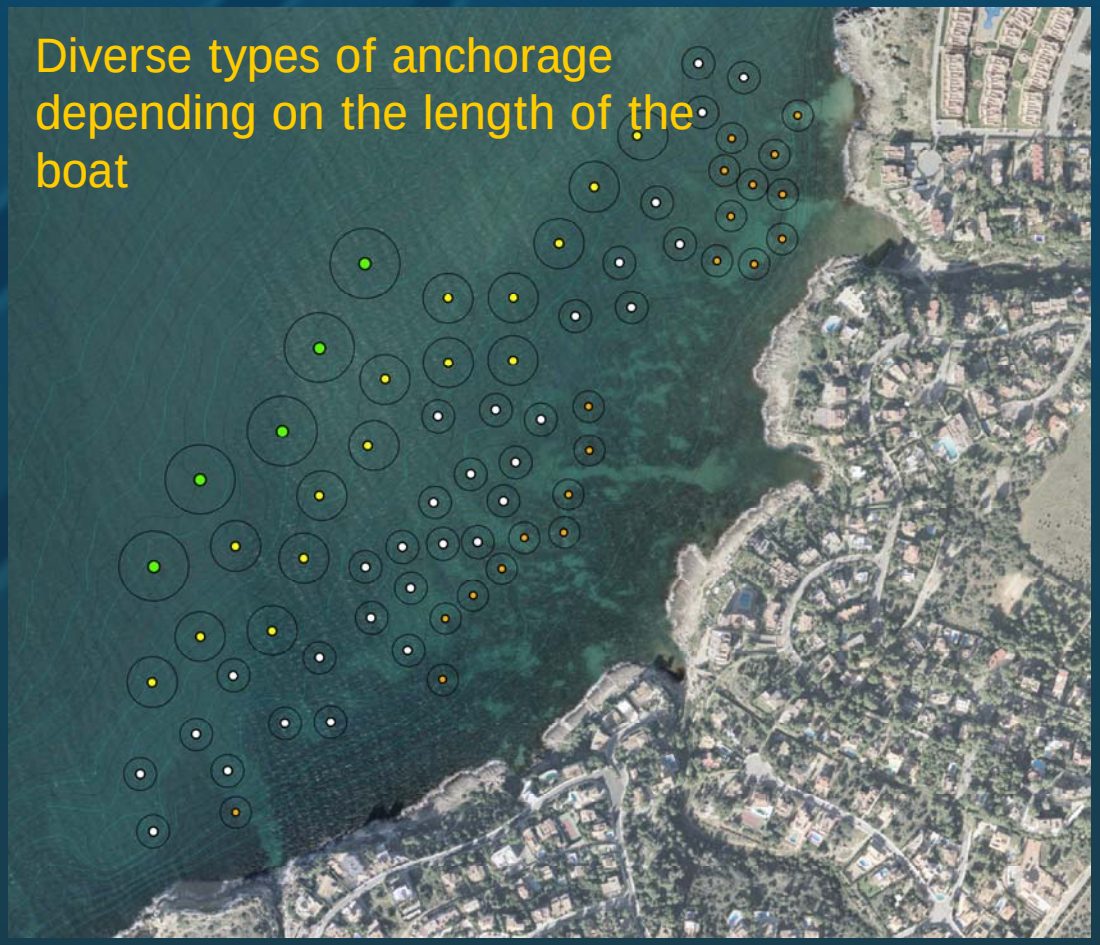
Life Posidonia: Mitigating Anthropogenic Impacts in Mallorca

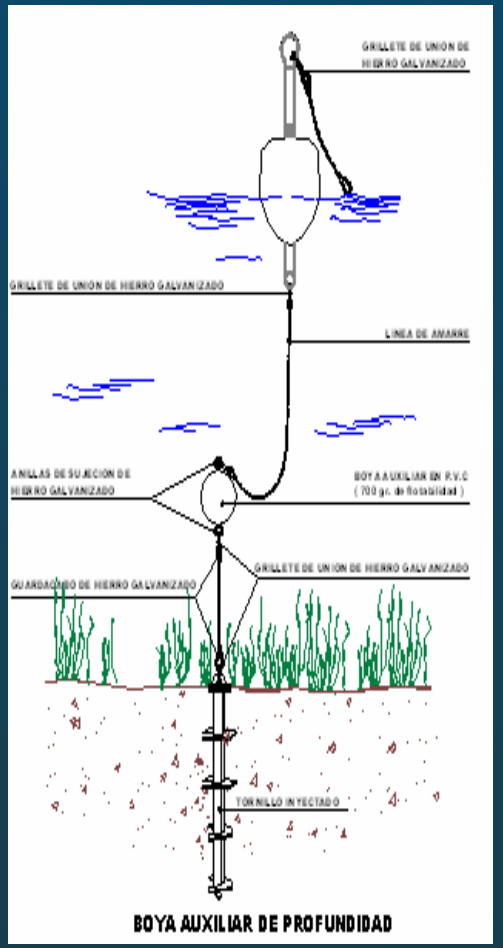


Govern de les Illes Balears
Conselleria de Medi Ambient

Life Posidonia: Location of Moorings in Cala Blava, Mallorca

Diverse types of anchorage depending on the length of the boat





LIFE-POSIDONIA project summary

- Interesting approach - monitoring and characterization - but need for more ecosystem based functioning studies
- Marine reserves have been designated, but are only based on a specific habitat Posidonia (and not on whole ecosystem functioning)
- NEDD data, monitoring strategies to be defined and implemented
- Interesting project that has also addressed the project the anthropogenic effects and proposed specific actions for conservation

Limitations to Habitat Conservation: A Global Perspective

- Limited understanding of ecosystems and of how to implement ecosystem-based management.
- Limited baseline data (spatial and statistical).
- Lack of an integrated approach – habitat conservation is just one of the elements that is necessary to achieve the overall goal of sustainability.
- Limited understanding of interactions among the environmental, socio-economic-cultural, and governance systems.
- Lack of communication and coordination among scientists and decision-makers.
- Inefficient and insufficient governance system for managing natural resources.

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General frame, basic principles and challenges: sustainability

The concept

- Sustainable development:

"...the development that satisfies the needs from the present without compromising the capacities of future generations to fulfil their own needs"

Comisión Mundial del Medio Ambiente y Desarrollo, 1987, informe *Brundtland*

- Also:

"Sustainable development implies an increase in quality of life within the limits of the ecosystems"

Programa de Medio Ambiente de las Naciones Unidas y Fondo Mundial de la Naturaleza, 1991

Sustainability

The sustainability principle requires the sustainable management of environmental resources, whether in their pristine state or through sympathetic utilisation, to ensure that the legacy of our current activity does not impose excessive burden on future generations (Turner et al. 2001).

Cited from Ecological economics and coastal zone ecosystems' values: an overview. Turner, R. K., Bateman, I.J., Adger, W.N., Kluwer Academic Publications, Studies in Ecological Economics. ISBN 0-7923-6504-6, 2001.

Sustainability

The concept of sustainability has been roughly partitioned into two approaches: weak sustainability and strong sustainability.

Weak sustainability requires that the total stock of capital, whether man made or natural, be maintained and rests upon the assumption of substitutability between these two types of capital (Pearce et al. 1989 and Turner 1993 in Turner et al. 2001).

Economic theory suggests that decreasing supplies of natural resources will tend to increase their price, encouraging more efficient use, substitution with other goods, and technological advancement. However, complete substitution will not always be possible due to availability of substitution opportunities (Turner et al. 2001).

Sustainability

There is also the question whether man made capital is able to fully compensate for all functions provided by complex ecosystems and the existence of 'critical' natural capital and thresholds beyond which reversal is not possible. Hence, the more stringent interpretation of:

Strong sustainability requires that the total stock of natural capital be non-declining. Natural and man-made capital, rather than regarded as substitutes, can be interpreted as complements (Daly 1995 in Turner et al. 2001).

Sustainability

On the basis of strong sustainability criterion, projects considered in isolation are likely to be rejected since most development projects impinge to some degree on the environment.

In practical terms, application of such a sustainability constraint could involve investments to reduce as much as possible the overall net environmental damage, and adopting suitable projects which generate net environmental benefits as part of the portfolio of investments (Barbier et al. 1990 in Turner et al. 2001).

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change scenario
2. The Balearic Islands: present, historical evolution, a privileged environment and unique habitats
3. General frame, basic principles and challenges: sustainability
4. The new role of science. IMEDEA: some examples of coastal research
5. The ICZM Balearic Islands project (2005-2007): a starting point
6. The future: recommendations for ICZM, Coastal Observatories and guidelines for sustainable tourism

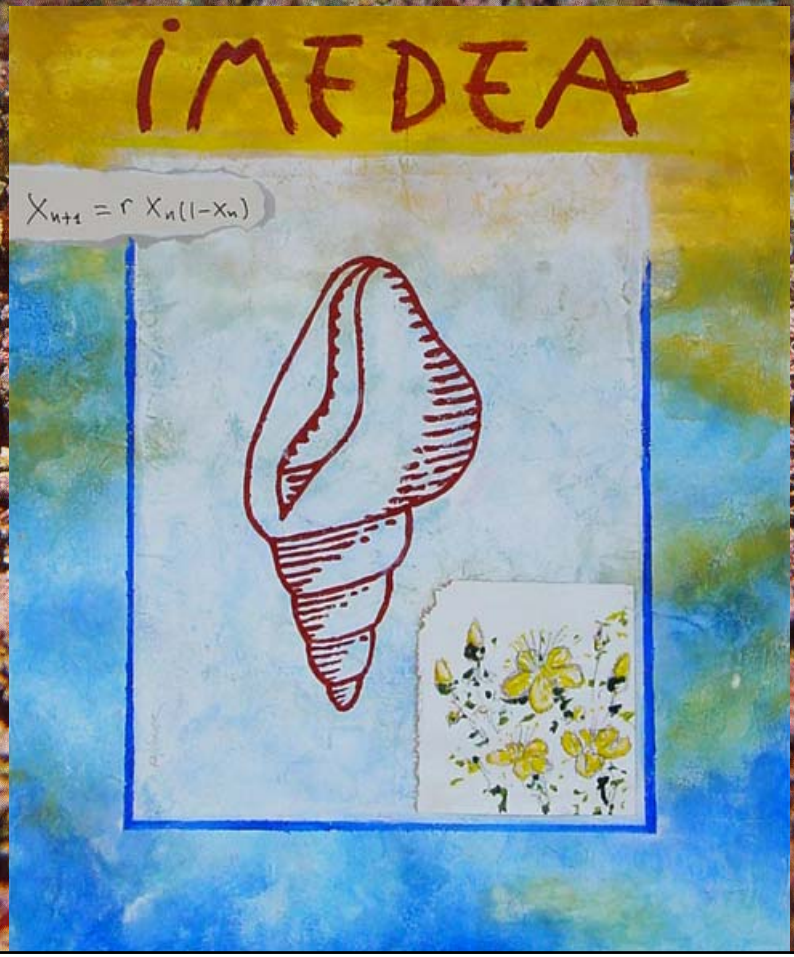
The new role of science in XXI's century society

- Society is turning towards science.
- Not only during crisis or catastrophic events (health, environment, food, energy, etc.)
- As an element of the decision making proocess that guarantees independence and reliability due to the existence of an evaluation system internationally accepted.

'Strong science for wise decision'.

What can we do as scientists to address these limitations?

Examples and experiences from the Balearic ICZM Project



IMEDEA: The Mediterranean Institute for Advanced Studies

Mission

- To generate the scientific basis that allows for better understanding and prediction of responses of insular, coastal and marine systems to anthropogenic pressures and global change in order to advance the capacity to respond and manage these systems in a sustainable manner and inspire adaptive response strategies from society.
- This mission will be achieved through conducting interdisciplinary research of the highest quality and through demonstrating the ability to respond to concrete problems.

Vision

- To become a center of reference not only for the scientific community, but also for environmental managers.
- To identify and clarify the consequences of the threats associated with anthropogenic pressure and global change on insular, coastal and marine systems.
- To formulate an approach that is proactive, integrated, and adaptive in response to the prevention and mitigation of these impacts.

IMEDEA: The Mediterranean Institute of Advanced Studies

Strategic Objective of IMEDEA in relation to society

IMEDEA is a research institute for which one of the objectives is to transfer knowledge and technology to society.

We work to find synergies among researchers and coastal zone decision-makers in the Balearic Islands.

We work to create working groups among researchers and coastal zone decision-makers, using the most recent knowledge available.

We establish common objectives that address complex problems, like environmental quality in the coastal zone, and generate specific recommendations for improvement.

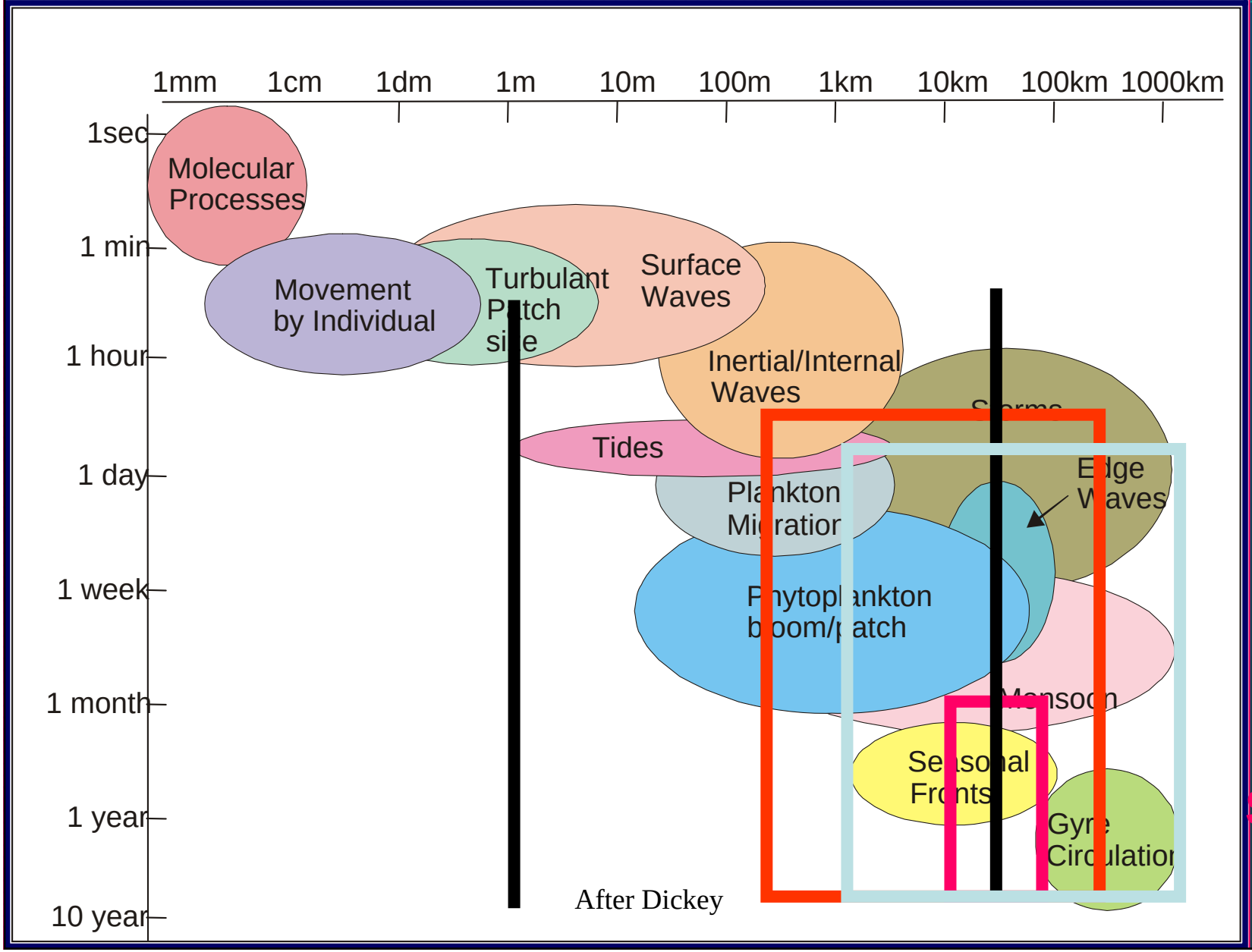
150 persons, 40 permanent researchers

100 ongoing research projects

120 peer reviewed papers

7 million Euros annual budget (40% obtained competitive basis)

Space and Time Scales



Time series

Satellites

Ferry

Spatial survey

Research lines

1. Science based Operational Oceanography in the Mediterranean

- *Circulation and dynamics, scale interactions, basin, sub-basin and local*
  - Basin scale circulation and climatic effects
  - Sub-basin scale, mesoscale effects and interactions, shelf/slope exchanges
  - Local scale, interactions and residence time
- *Coastal zone variability and beach morphodynamics*
  - Beach erosion and sediment transport
  - Beach safety: longshore currents and rip currents
  - Tsunami forecasting
- *Physical-biological interactions at sub-basin and local scale: water quality*
  - Harmful Algal Blooms (HABS) in harbors, bays and beaches
  - Debris and floating material characterization and drift forecasting for recovery
  - Interactions between currents, waves, water quality and Posidonea oceanica extension
- *New tools for non linear systems forecasting: evolutionary computation*
  - Darwin Genetic algorithm (reg) : applications to ocean currents forecasting, solar spots, wave heights, precipitation, etc

Research lines

2. Marine Technologies: development of new low cost (in collaboration with Albatros Marine Technologies, spin-off)

- *Development of new platforms: Rov's, AUV's, gliders, buoys*
- *Integration of sensors and platforms for sound sampling of the coastal zone*

3. Operational Systems "to be" implemented at IMEDEA

- *Sub-basin and local scale currents circulation, interactions at different scales: Balearic Sea*
- *Rip currents in beaches: pilot study off northeast of Mallorca Island: Cala Millor*

4. Science based Sustainable Integrated Management in Coastal Zone

- *Scientific achievements, Science based management and Sustainability principles*
- *New Observational networks, GIS tools and modeling predictive capabilities*
- *Innovation in services in the coastal zone, environmental innovation and sustainable tourism*

Research lines

Scientific examples (observations and modelling)

from basin to beach scale.

Basin scale (10→5 km), since 1995 (*)**:** *large scale circulation, role of bottom topography, specific features, transport in detailed sections*

Sub-Basin regional scale (5→1 km), since 1992: *mesoscale/mean flow interactions, blocking basin scale circulation in specific sub-basins, circulation Alboran and Balearic Seas, etc.*

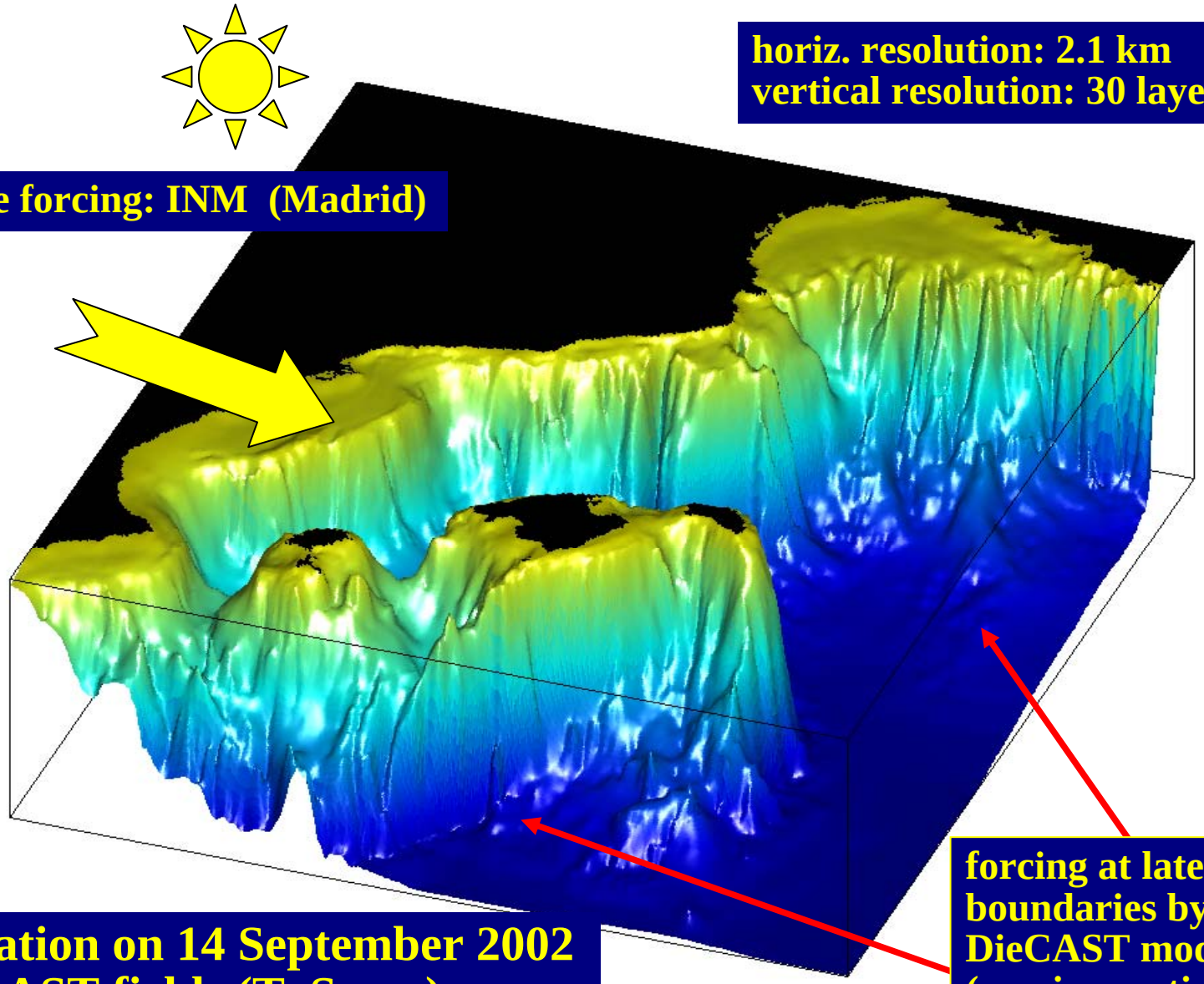
Local (1 km→500m), since 1993: *sub-basin-local interaction through canyons, shelf/slope exchanges, circulation in bays, residence times and water quality, etc.*

Towards… beach (500→10m), since 2004: *fine sediment resuspension by waves and recirculation and sediment transport by wind induced coastal currents in bays and beaches, (only still with PE non hydrostatic models and towards integration with wave models).*

The coastal ocean forecasting model: domain setup

horiz. resolution: 2.1 km
vertical resolution: 30 layers

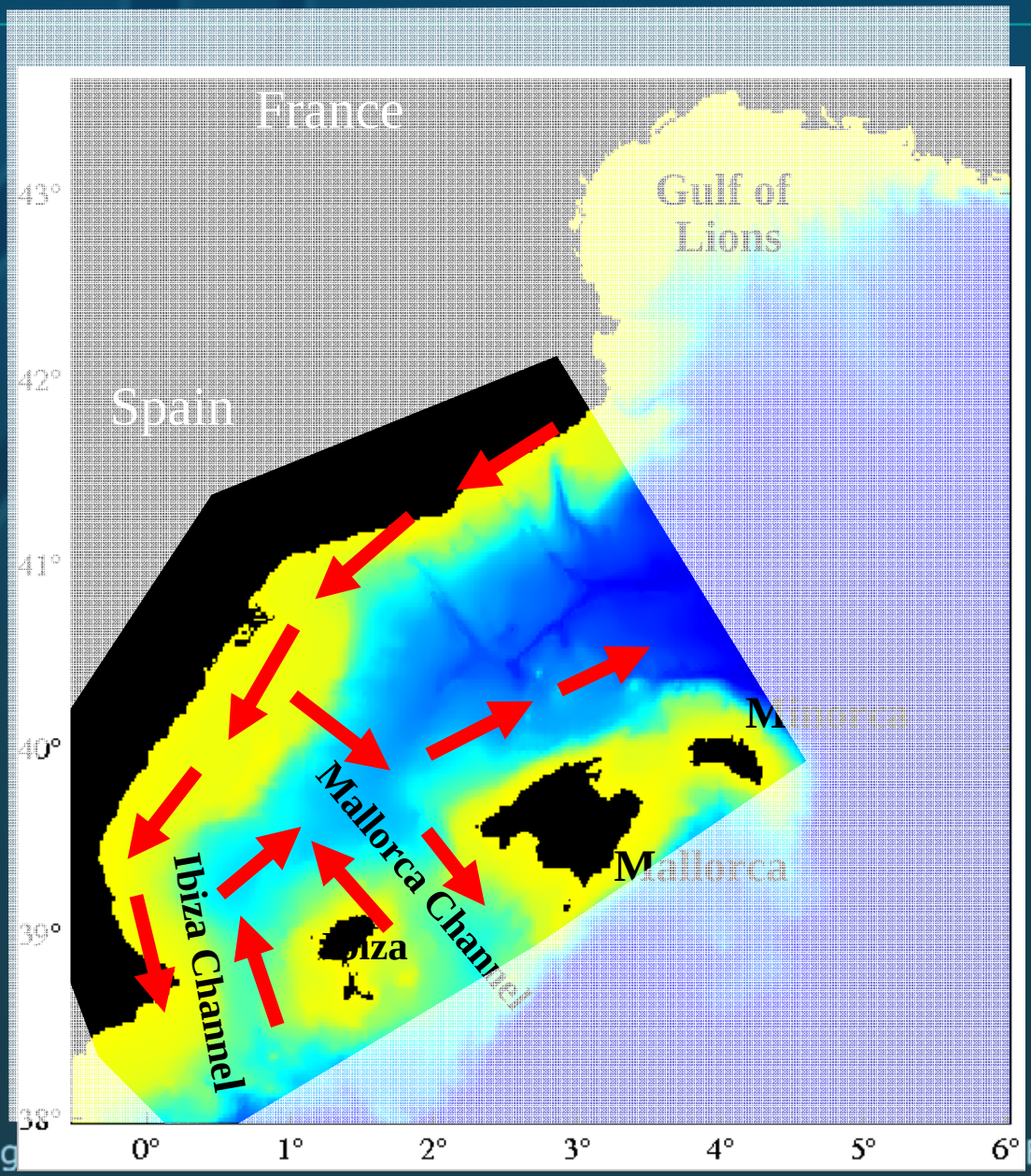
surface forcing: INM (Madrid)



forcing at lateral boundaries by DieCAST model (passive nesting)

- initialisation on 14 September 2002 by DieCAST fields (T, S, u,v)
- integration through 10 October

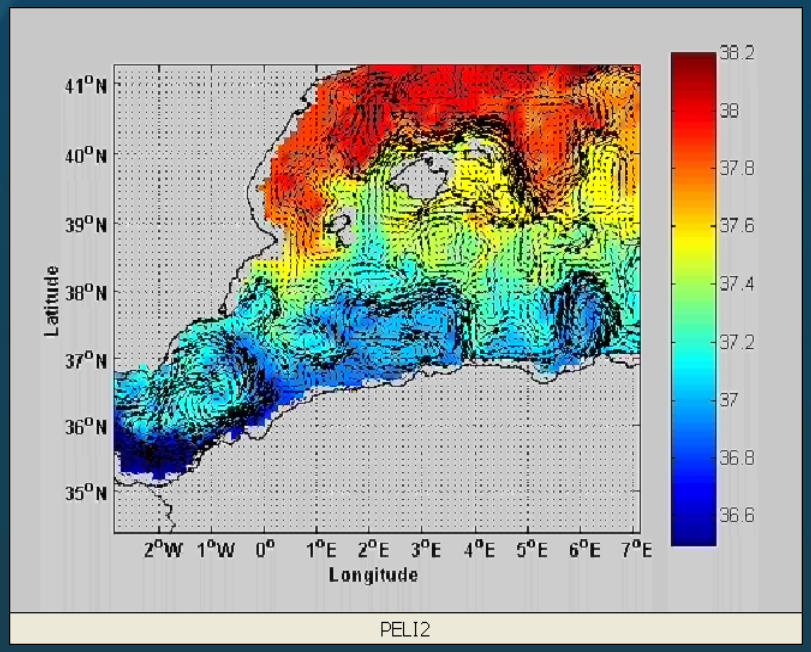
The Balearic Sea and its general circulation



Results at basin-sub-basin scale

Circulation and dynamics. Scale interactions: basin, sub-basin and local scales

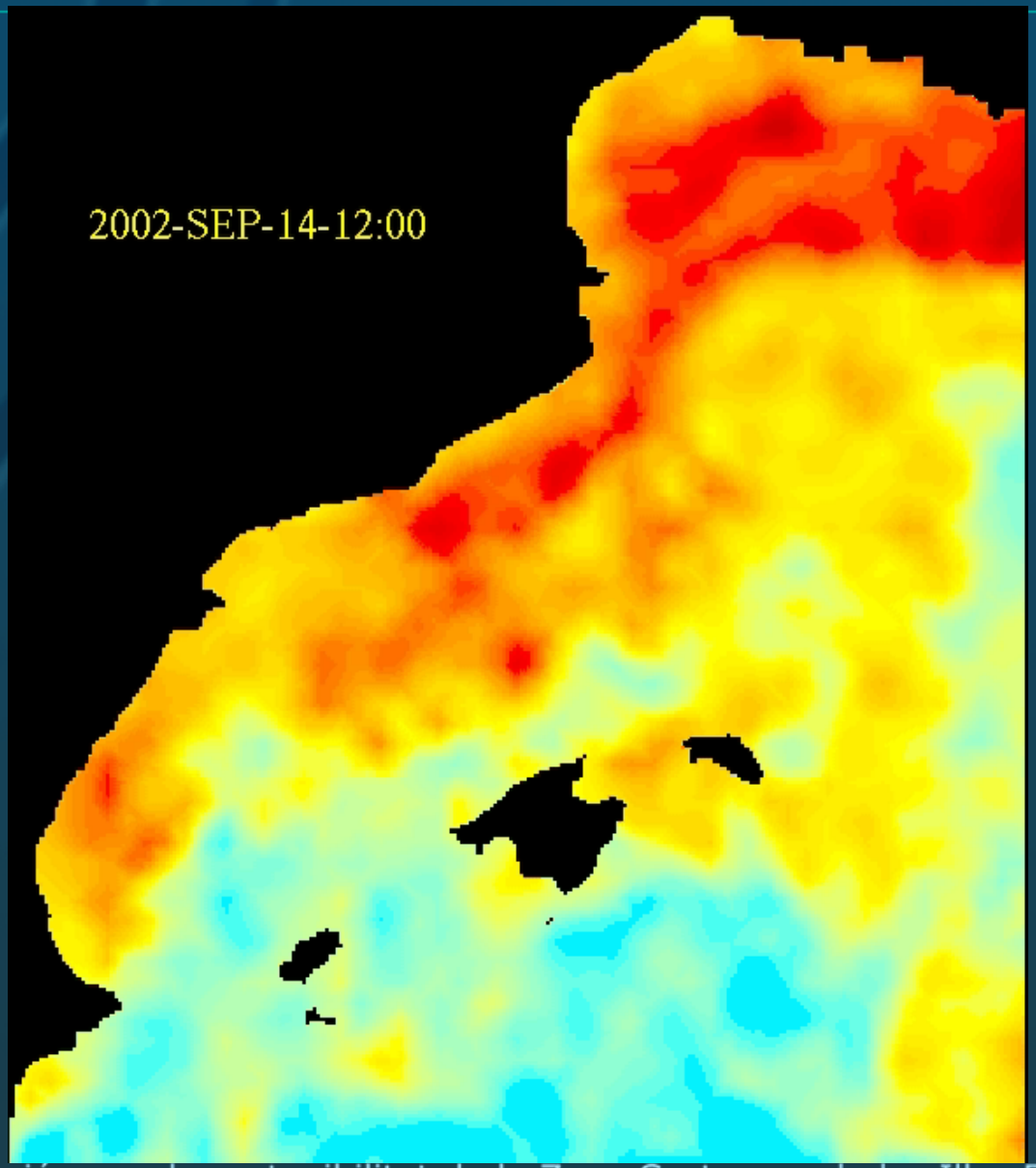
- Basin scale circulation and climatic effects
- Sub-basin scale, mesoscale effects and interactions, shelf/slope exchanges
- Local scale, interactions and residence time



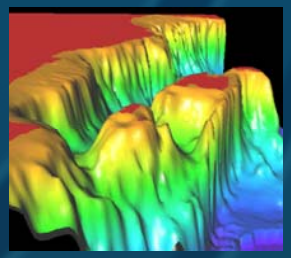
Fernández, D. E. Dietrich, R. L. Haney, J. Tintoré. *Progress in Oceanography*. 2005

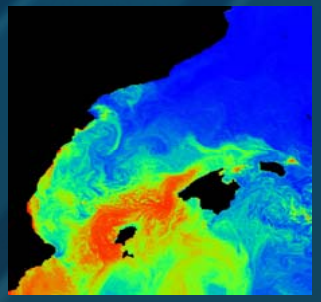
Main result: importance of general circulation and sub-basin interactions

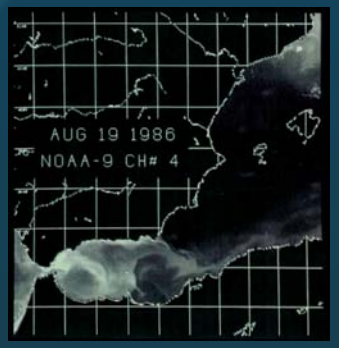
Result: Sea surface salinity
14 September – 10 October 2002

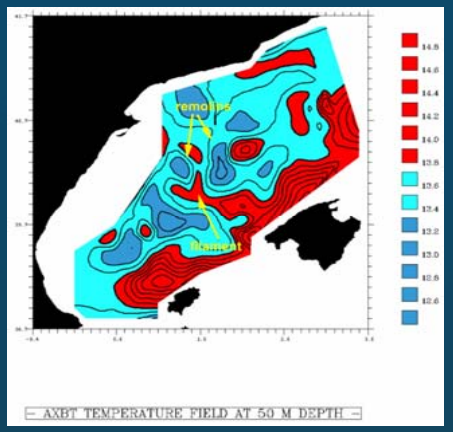


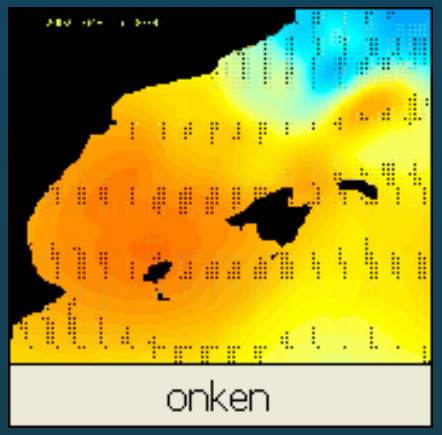
Results at sub-basin scale

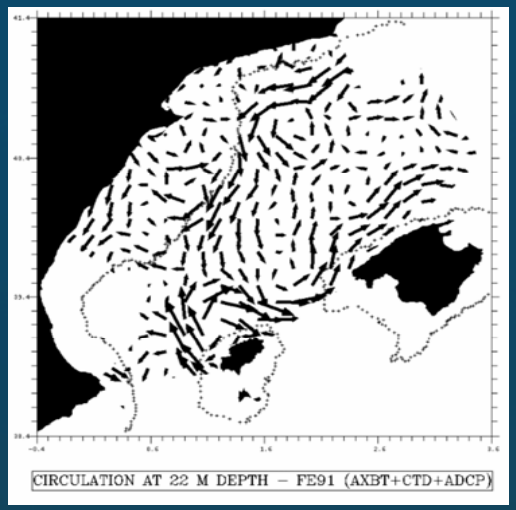


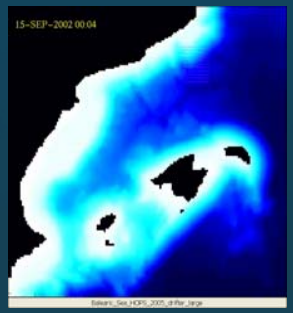








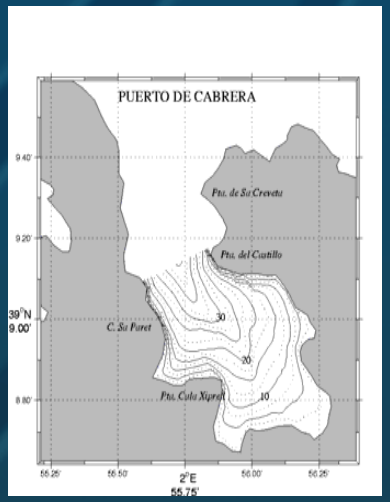


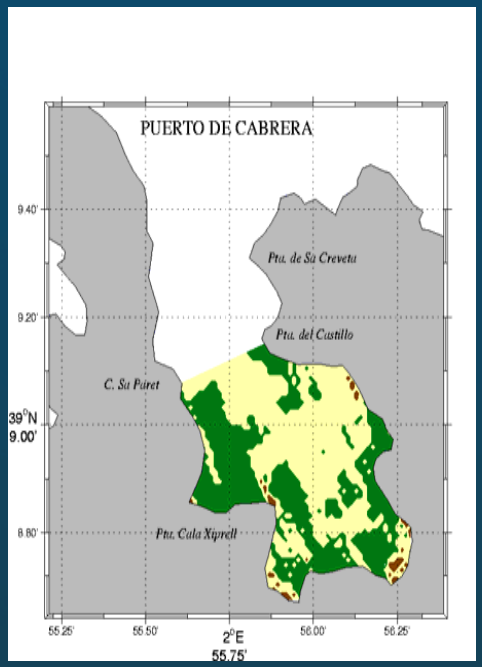


Main result: importance of mesoscale structures.

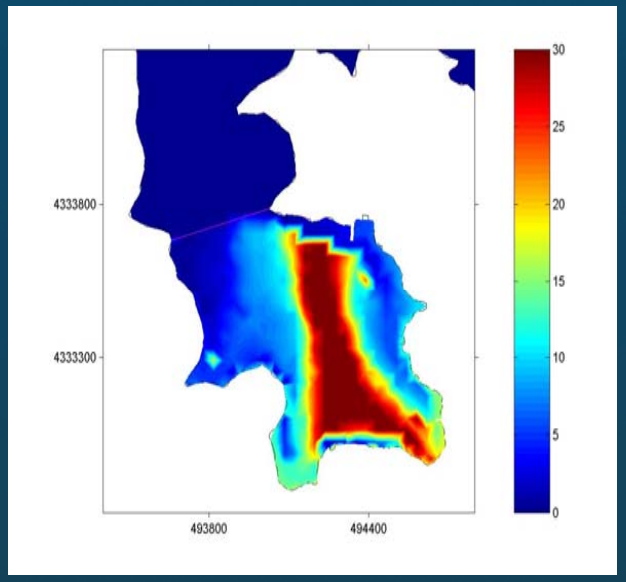
More than 30 papers in peer reviewed journal since 1988, mostly in Balearic and Alboran sub-basins

Results at local scale





Cobertura de Posidonia oceanica



Tiempo de residencia (en días) cerca del fondo. z

Main result: residence time and eutrofication. Water quality and relation with Posidonia Oceanica seagrass coverage in Cabrera Harbour.

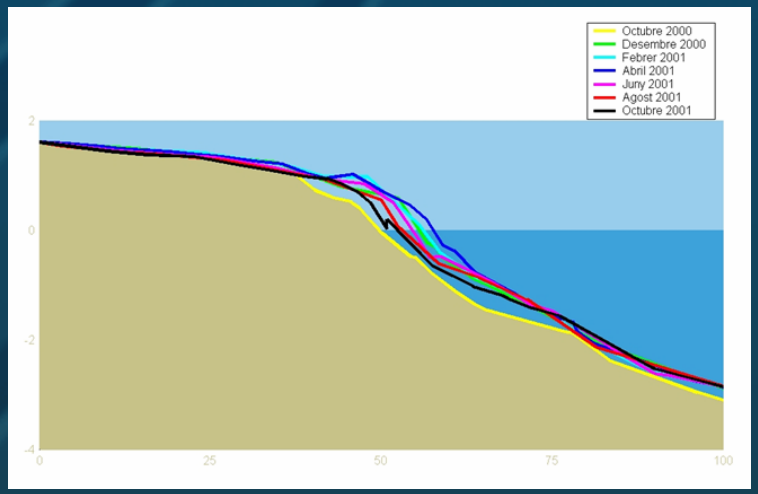
Implications for number of boats allowed in the moorings.

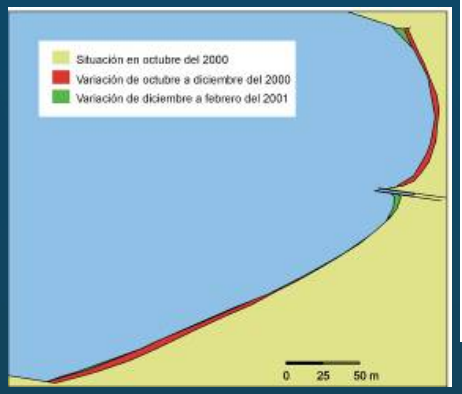
Orfila et al., Contin. Shelf Res., 2004

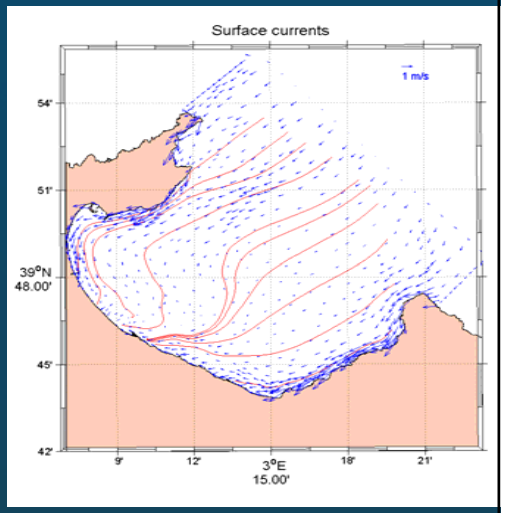
Results at local scale

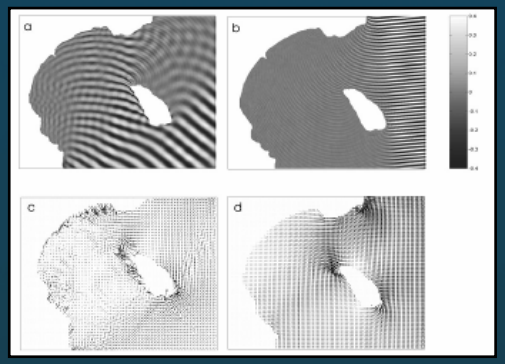
Coastal morphodynamics

Beach erosion and sediment transport







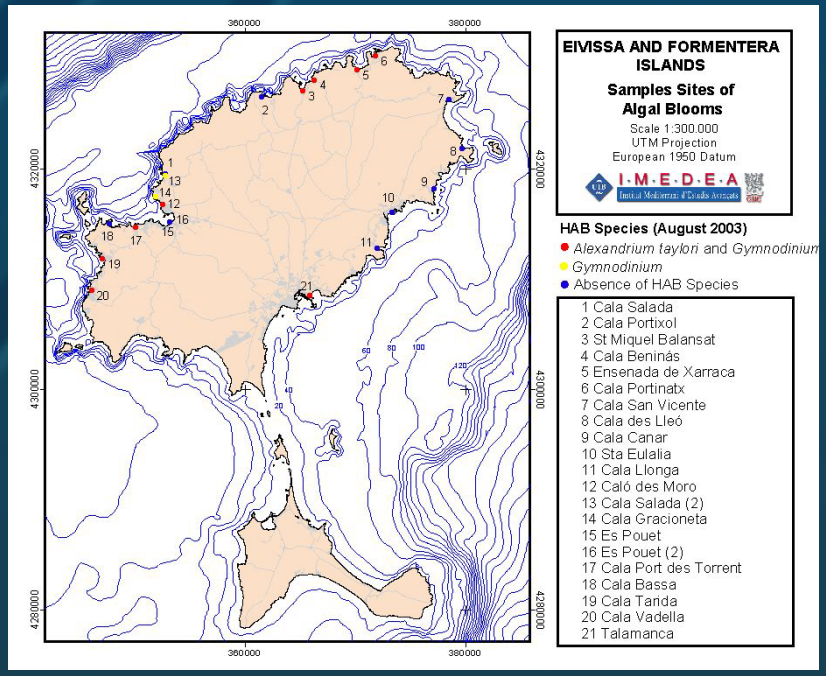


Main results: adjustment after extreme events, fine sediment resuspension by wind

Basterretxea et al., J. Coastal Res., 2004

Results at local scale

Water Quality: HABS proliferation



Playa de Palmira (Calvià)

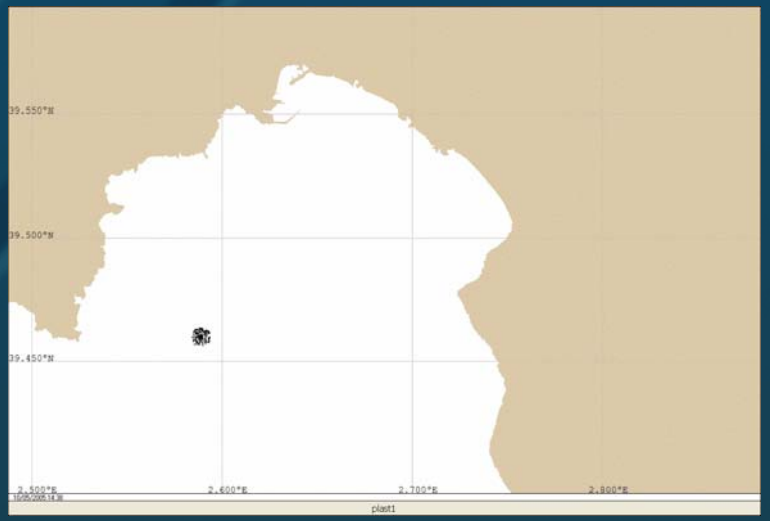
Water quality, eutrofication: massive proliferation of micro-alguae.

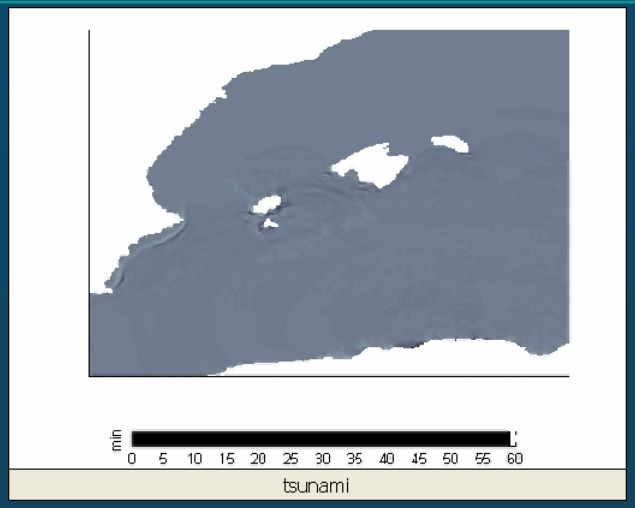
Ec reserach projects.

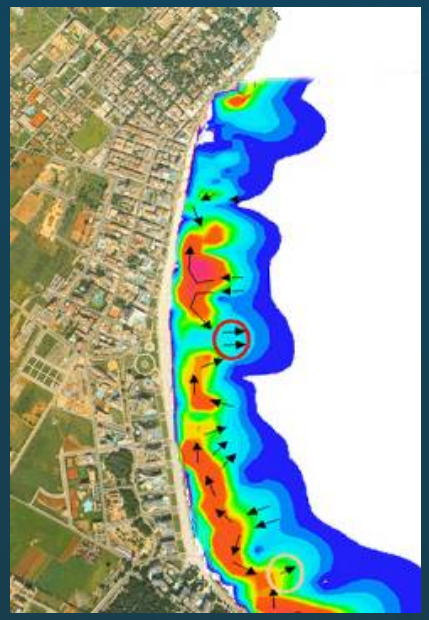
Basterretxea et al., Estuarine Coast. Shelf Science., 2004

Operational systems being implemented

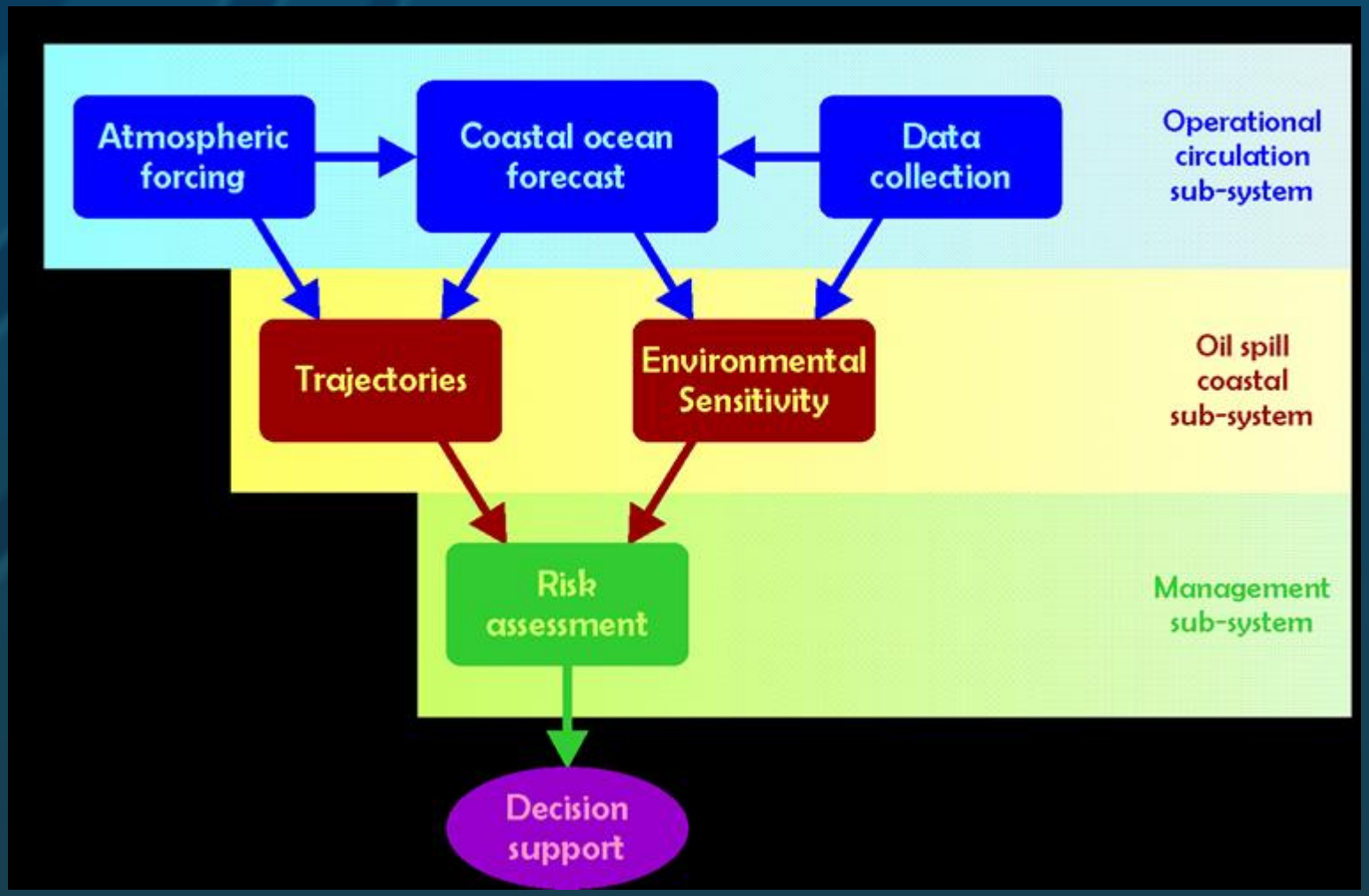
- Oil-spill mapping
- Land vulnerability
- Security in beaches – rip currents
- Prediction of trajectories from Tsunamis.





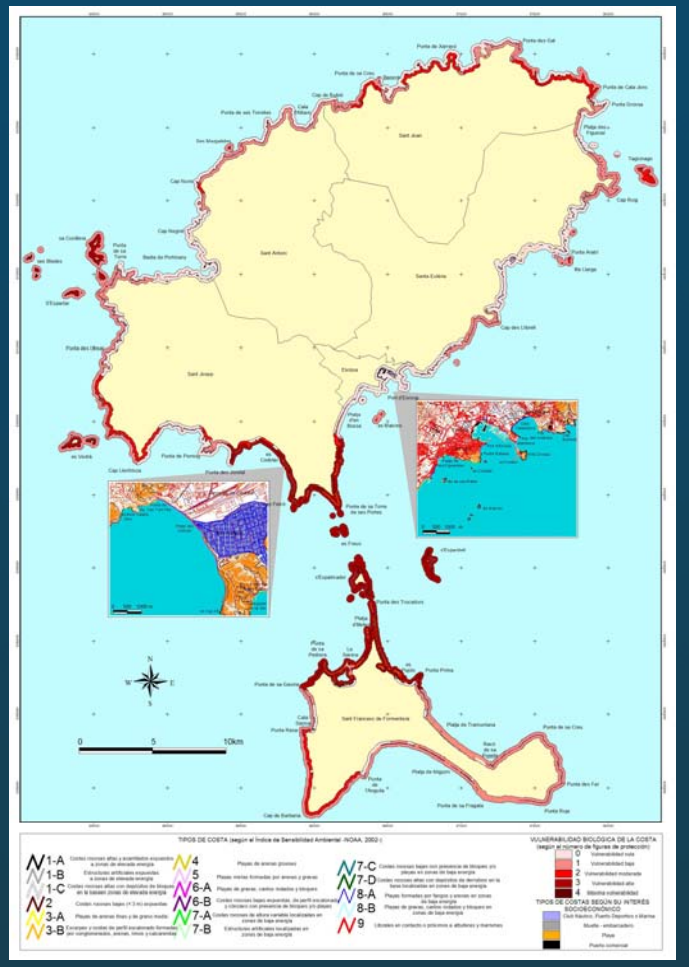


Operational systems being implemented



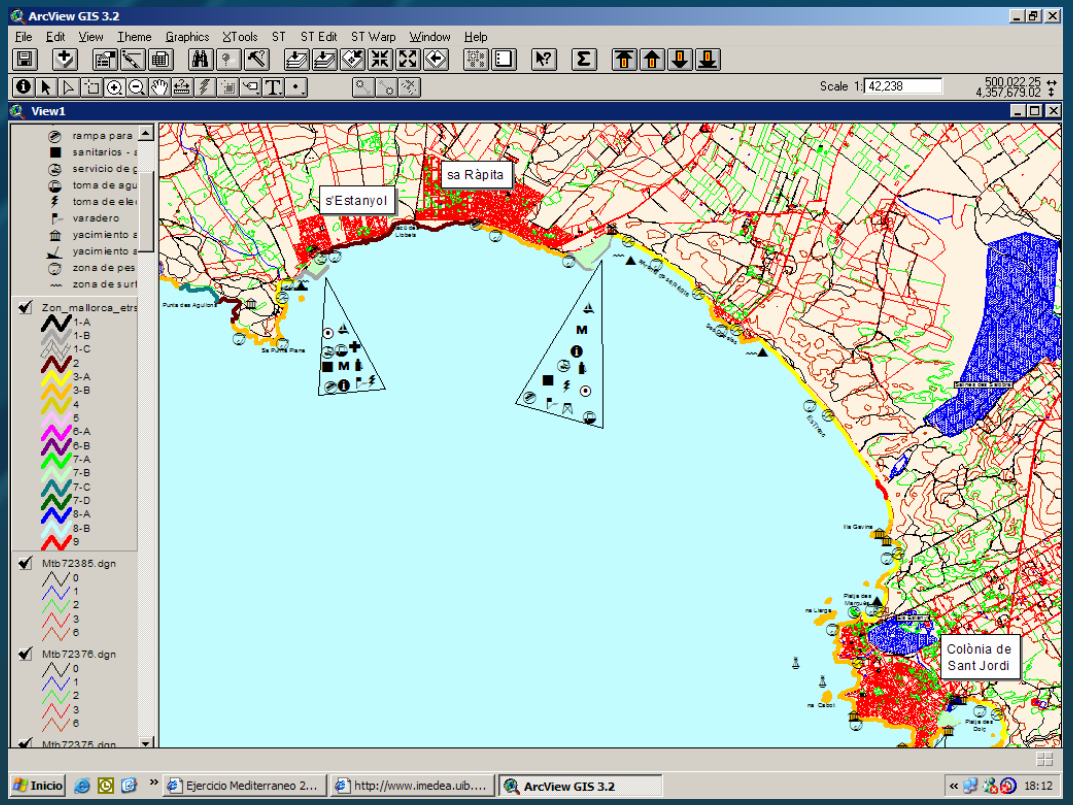
Operational systems being implemented

Characterization of the different types of coast: vulnerability and ESI.



Operational systems being implemented

Management sub-system

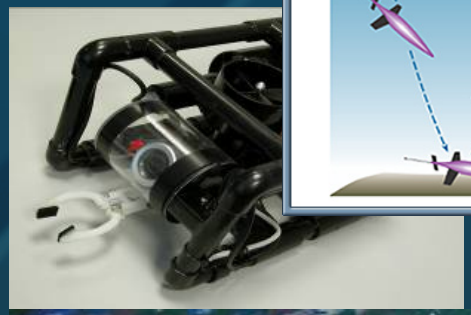


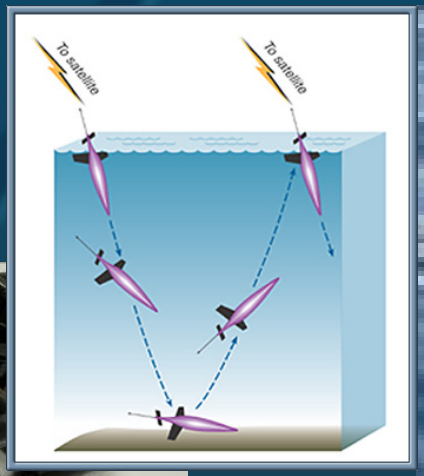
It is based on a Geographical Information System (GIS) for oil spill crisis management.

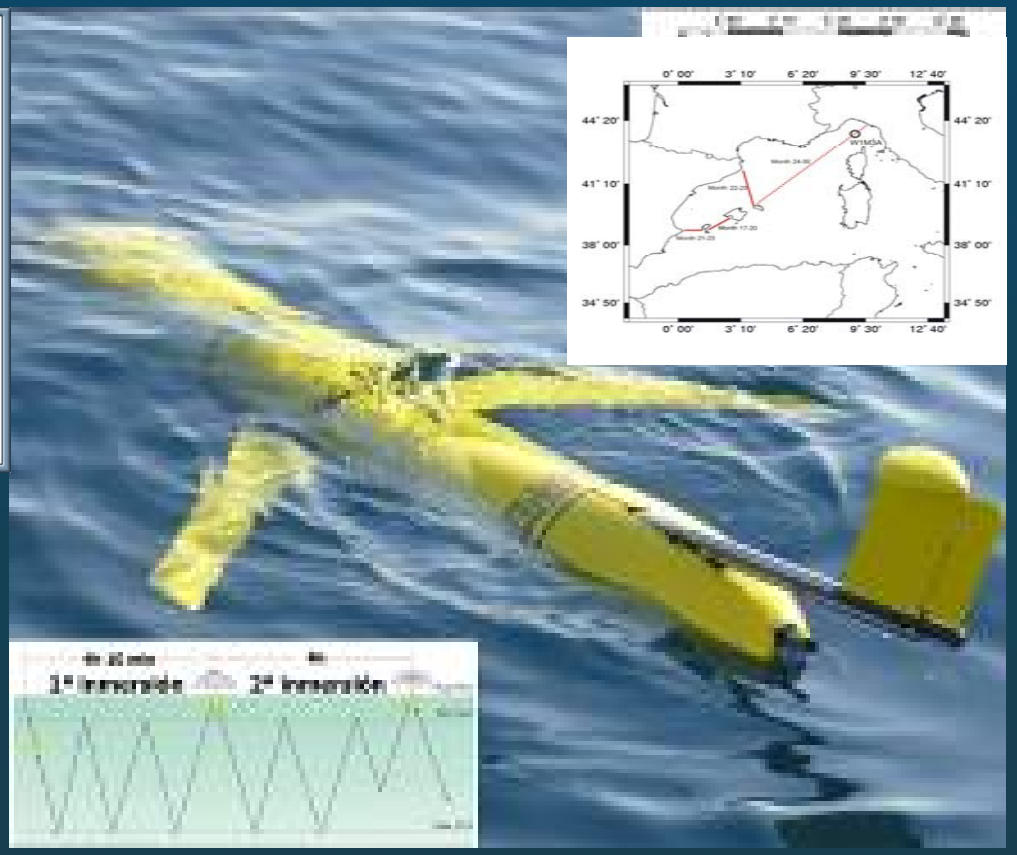
It incorporates all the available information, identifies resources at risk, establishes protection priorities and appropriate response.

Technology development

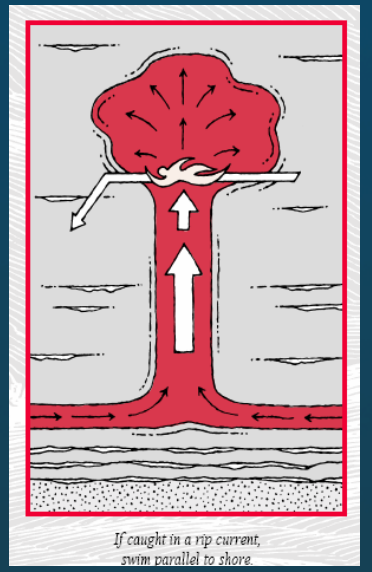
- Cormoran (CICYT). *ROV's, AUV's, boyas*
- Mersea (EU). *Gliders*







Technology development



Beach monitoring using cameras, breakers, rips, bathymetry changes, etc.

Summary examples of IMEDEA know how

- Currents in the Balearic Sea for Search and Rescue Operations.
- Beach variability and relations to *Posidonia Oceanica* (Magaluff)
- Beach erosion (Magaluff, Santa Ponsa, Bahía Alcudia, Cala Millor, Cala San Vicente
- Beach fill processes (Cala San Vicente, Cala Millor, Bahía de Alcudia)
- Harbour oscillations (Puerto de Calanova, Ciutadella, La Rápita)
- Support to Olympic candidate (Palma-Madrid, 2012) and America's Cup candidate (Palma)
- Residence time in harbours and bays (Parque Nacional de Cabrera)
- Water quality and HABS (Paguera, Eivissa)
- Sustainable beaches (Calvià)
- Operational systems for currents and waves in beaches (being implemented)

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6. The future: recommendations for ICZM, Coastal Observatories and guidelines for sustainable tourism

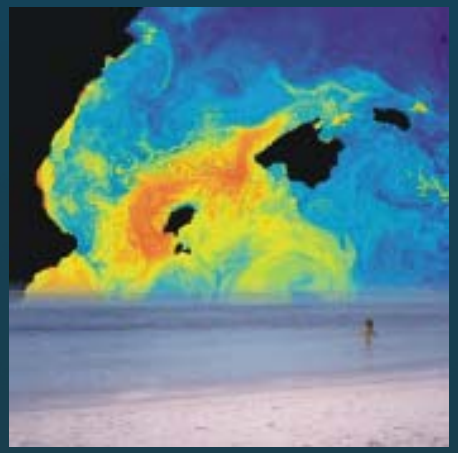
The Balearic Islands: an ideal location for ICZM

- Insular environment – conceptually simpler in spatial terms and easier to understand inputs and outputs.
- There exists the need (social, economic and environmental).
- There exists understanding, demand from civil society and awareness among politicians. Unlike many other parts of Europe, the socio-political system favours preservation.
- There exists the know how capability.
- With these elements in mind, IMEDEA is leading an initiative to implement ICZM in the Balearic islands, based on clear understanding, following international standards in such a way that the islands Balearics become a global reference of sustainable development in the coastal zone.

The Balearic ICZM Project

Objectives

- To use a multidisciplinary approach to generate scientific knowledge to facilitate and inform the implementation of ICZM in the Balearic Islands.
- To develop new methods, tools and instruments for both science and management and establish the bases and strategies necessary to achieve sustainability in the coastal zone of the Balearic Islands.
- To re-enforce the role of scientific research as a critical basis for future decision-making in ICZM at an international level.



The Balearic ICZM Project

Fundamental Principles

1. Development has economic, social and environmental dimensions and can only be sustainable if a balance is attained between these distinct factors, all of which have a profound influence on the quality of life of coastal residents.
2. Finding this balance needs to be based on the highest quality, internationally accepted scientific understanding available at any given time.
3. Moving towards sustainability principles requires that sustainability be treated as a quantifiable process.
4. Advancing towards sustainability is a positive change. The strategies represent a positive change with respect to employment and the quality of life of coastal residents.
5. Recognizing that there may be initial costs of adjustment in the short-term, sustainable development represents a clear medium to long-term strategic opportunity.
6. Institutional commitment and social consensus are key elements in the process of advancing towards sustainability.


Thematic Structure of the Balearic ICZM Project

RESEARCH → TECHNOLOGICAL DEVELOPMENT → INNOVATION OF TECHNOLOGY AND SERVICES

1.Disciplinary Research

1.1 Environment

1.2 Society, economy and culture

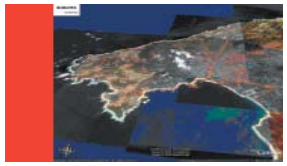
1.3 Governance

2. Multidisciplinary research

The horizontal projects respond to cross-cutting research needs requiring an interdisciplinary approach

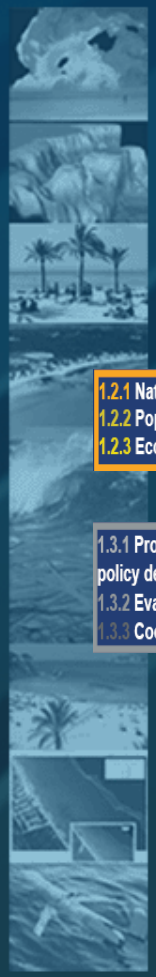
3. Research aimed at tecnological developemet

Responds to the need for new scientific tools and technologies that support ICZM in the Balearics



4. Transfer of knowledge

Thematic Structure of the Balearic ICZM Project



RESEARCH → TECHNOLOGICAL DEVELOPMENT → INNOVATION OF TECHNOLOGY AND SERVICES

1.1.1 Coastal variability and global change
1.1.2 Biodiversity and global change
1.1.3 Water quality end public safety in the coastal zone
1.1.4 Operational oceanographyand marine technology

ry Research

1.1 Environment

1.2.1 Natural and cultural heritage
1.2.2 Population, territory and landuses
1.2.3 Economy, employment and tourism

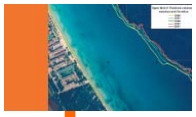
1.2 Society, economy and culture

1.3.1 Provision of information to help generate and guide policy developemet
1.3.2 Evaluation of the governance system
1.3.3 Cooperation and coordination

1.3 Governance

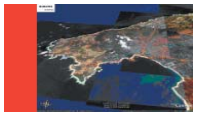
2. Multidisciplinary research

The horizontal projects respond to cross-cutting research needs requiring an interdisciplinary approach



3. Research aimed at tecnological developemet

Responds to the need for new scientific tools and technologies that support ICZM in the Balearics



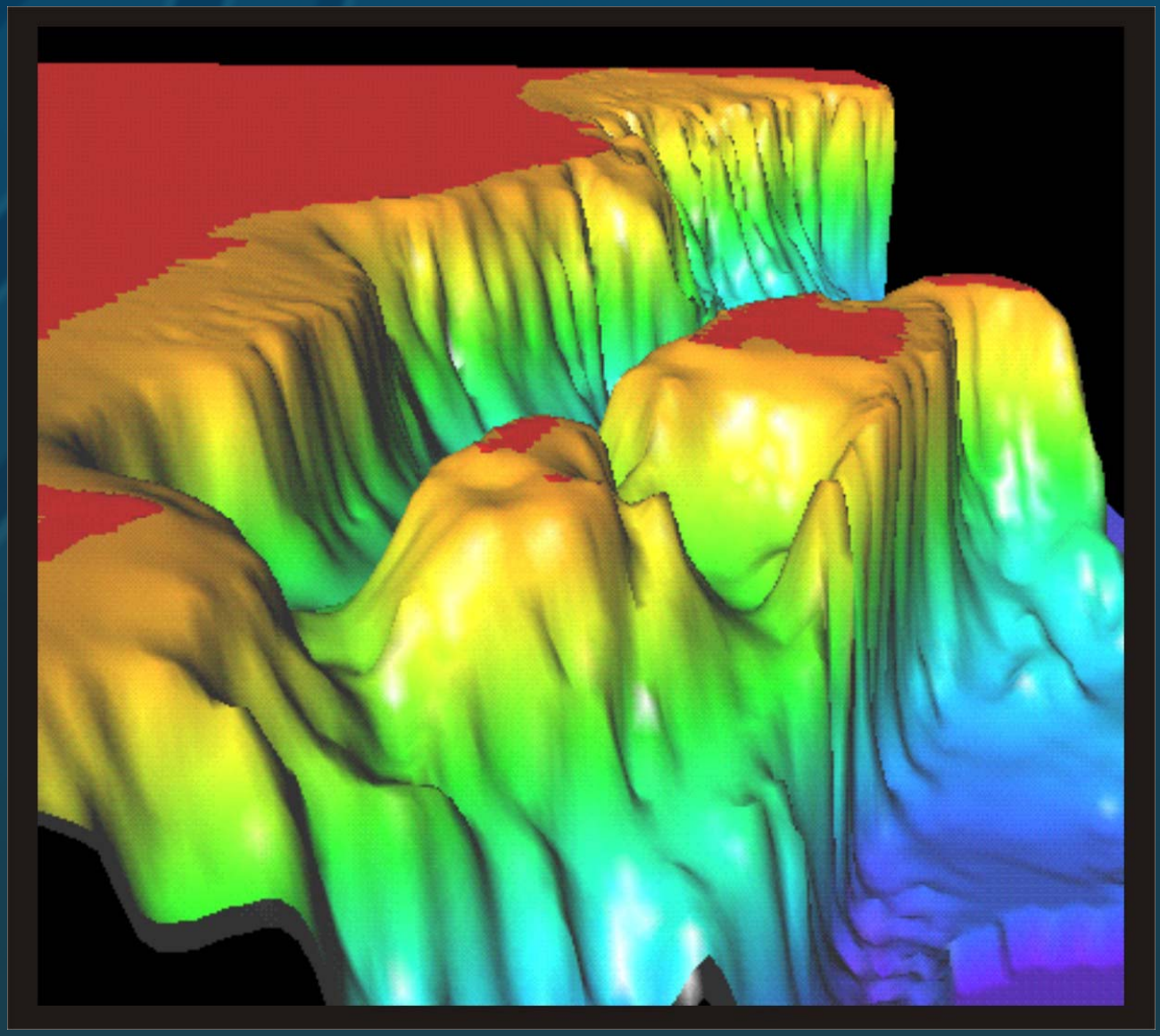
3.1 GIS Database
3.2 Proposal for technological developement

2.1 Zoning criteria for implementing ICZM
2.2 Literature review
2.3 Development of a system of indicators for ICZM

4. Transfer of knowledge

4.1 Strategy for dissemination of results, stakeholder participation and tranfer of knowledge

Examples of Research Projects



Methodological Approach to Boundary Delimitation for ICZM

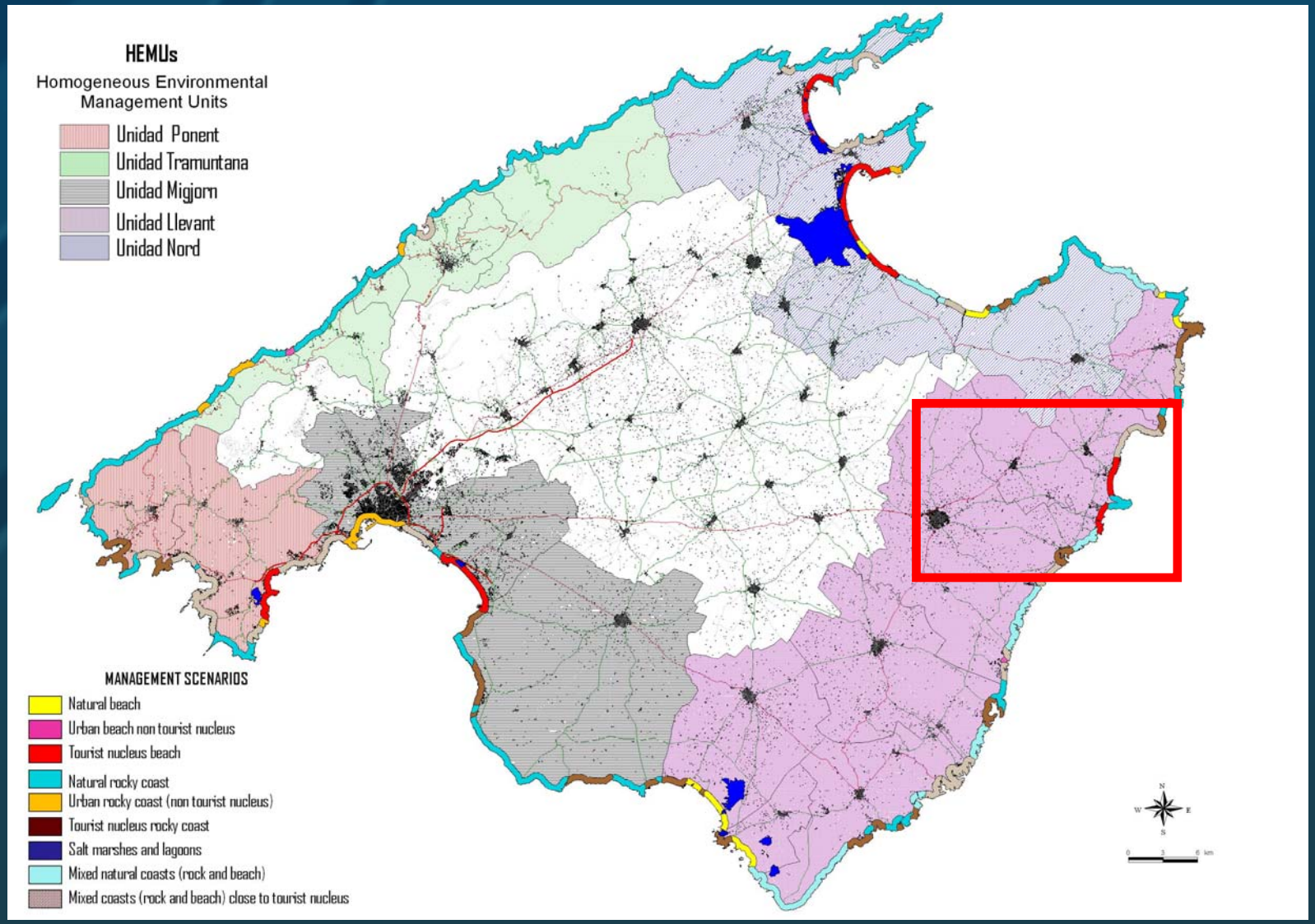
Objective

To generate a methodology for boundary delimitation for ICZM initiatives, taking into account the interactions among the geophysical, environmental, societal, and jurisdictional dimensions.

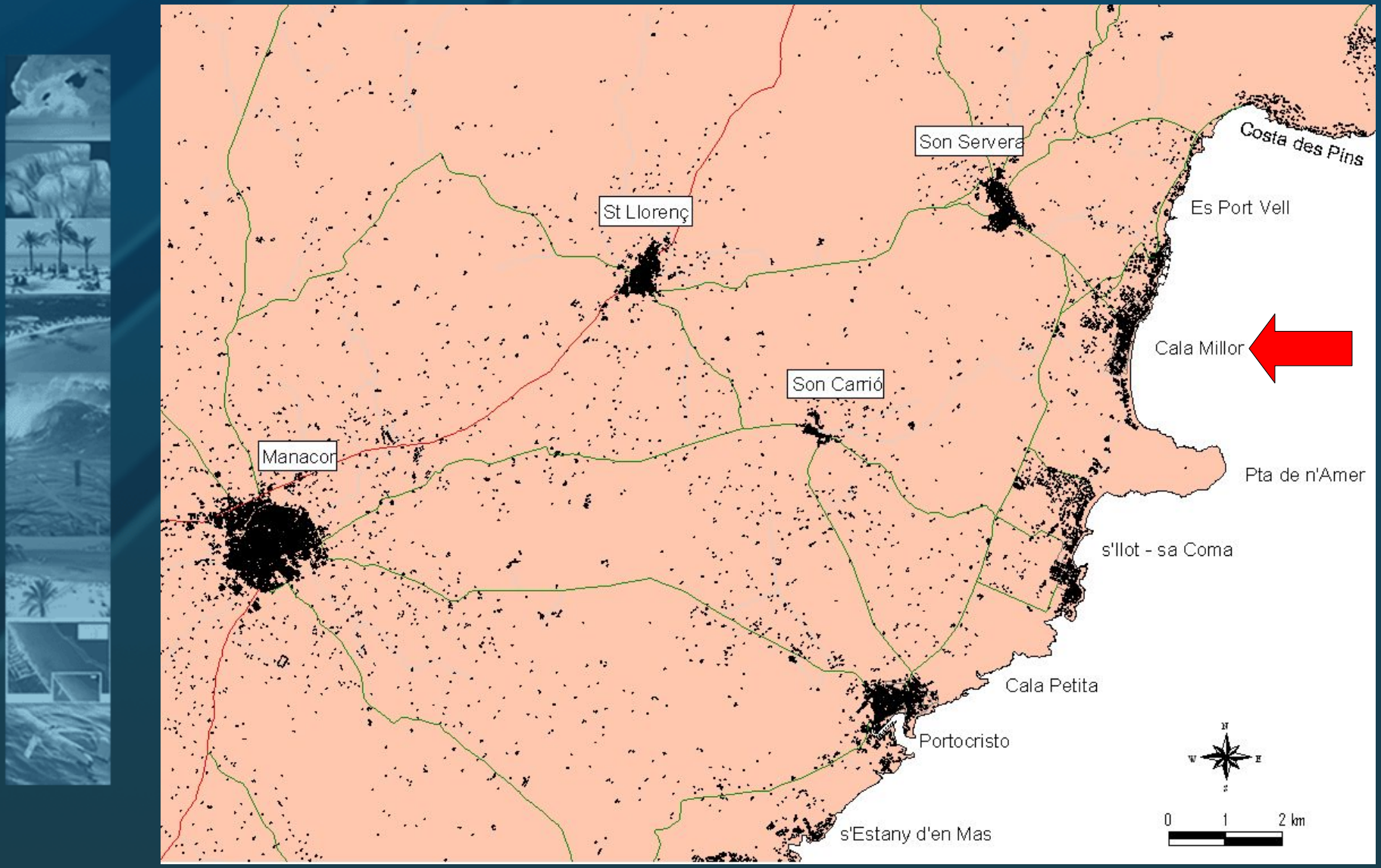
Justification

Defining the boundary of an ICZM initiative is a challenge for coastal decision-makers. This is especially true in an island environment where one could invariably end up selecting the entire island which may not be realistic in management terms. This methodology allows for a pro-active, realistic approach to determining the boundaries of management initiatives.

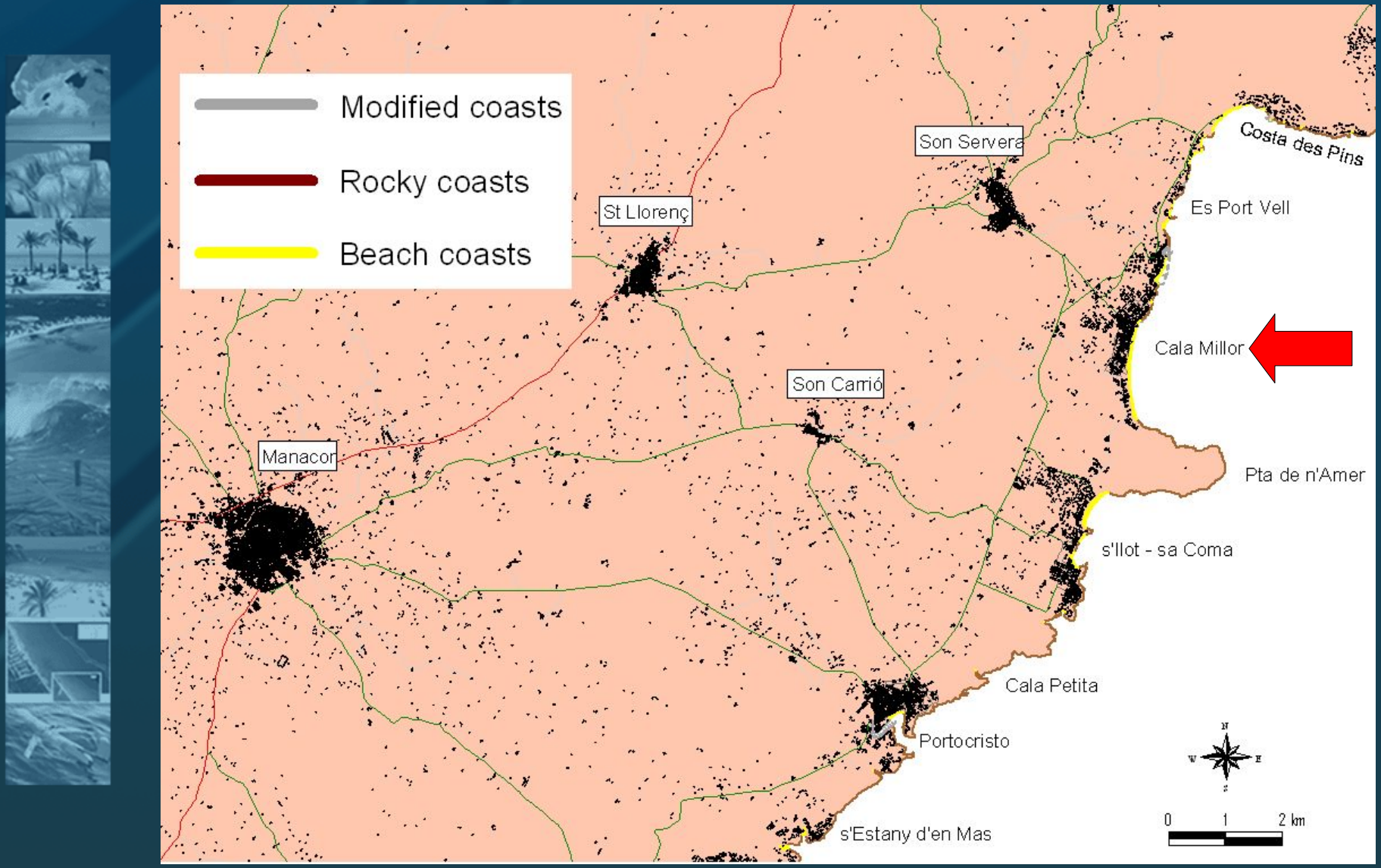
Methodological Approach to Boundary Delimitation for ICZM



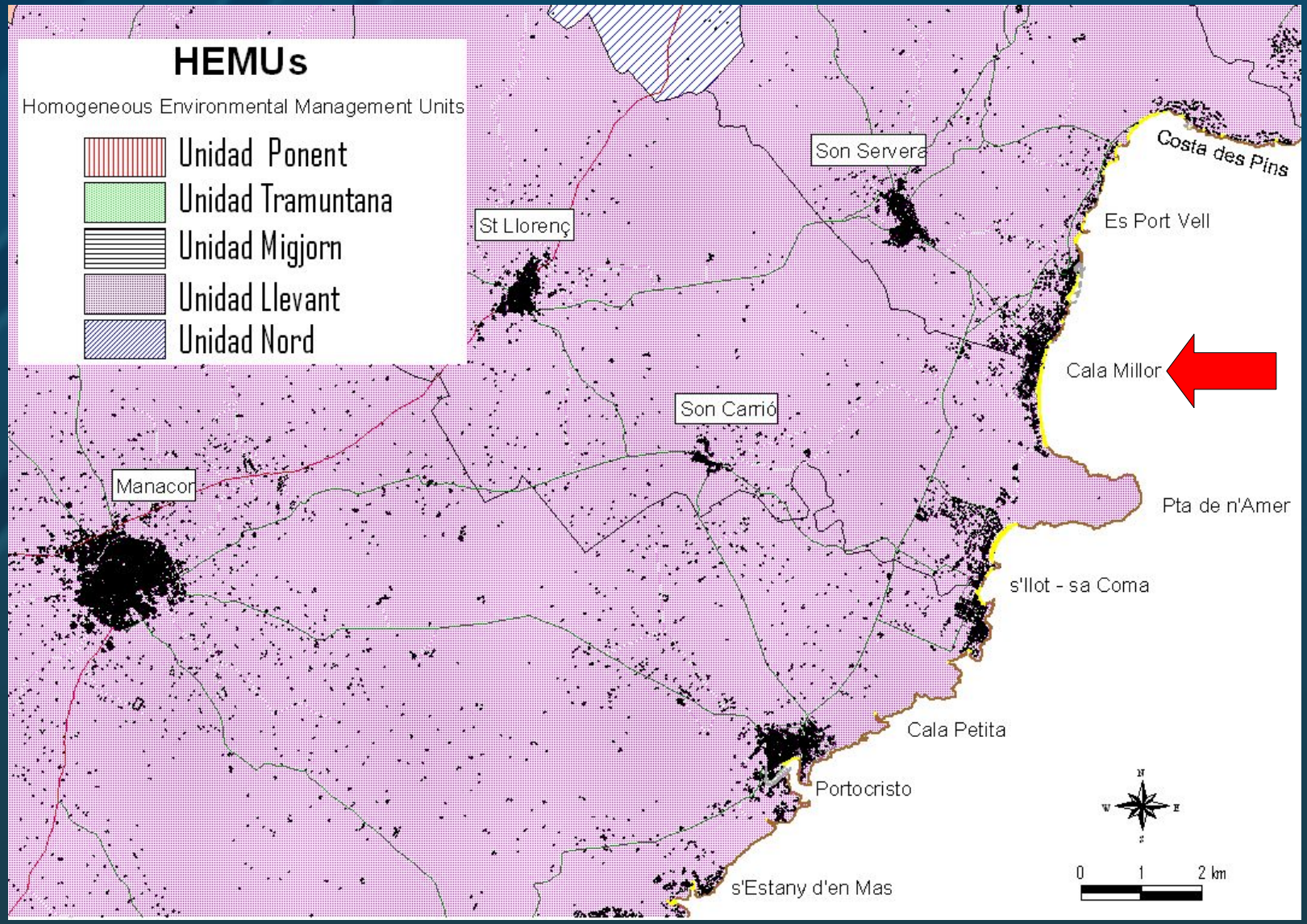
Methodological Approach to Boundary Delimitation for ICZM



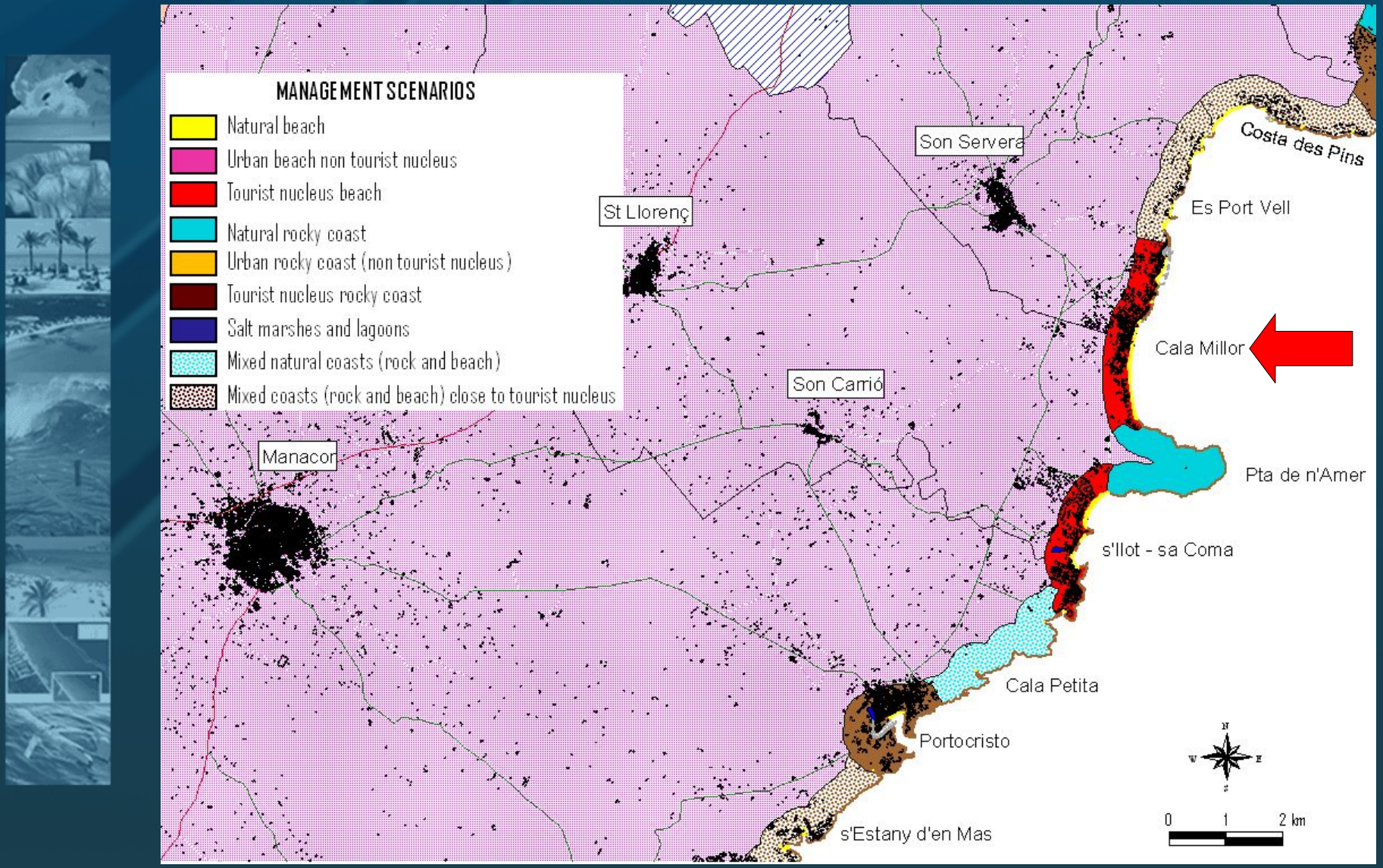
Methodological Approach to Boundary Delimitation for ICZM



Methodological Approach to Boundary Delimitation for ICZM



Methodological Approach to Boundary Delimitation for ICZM



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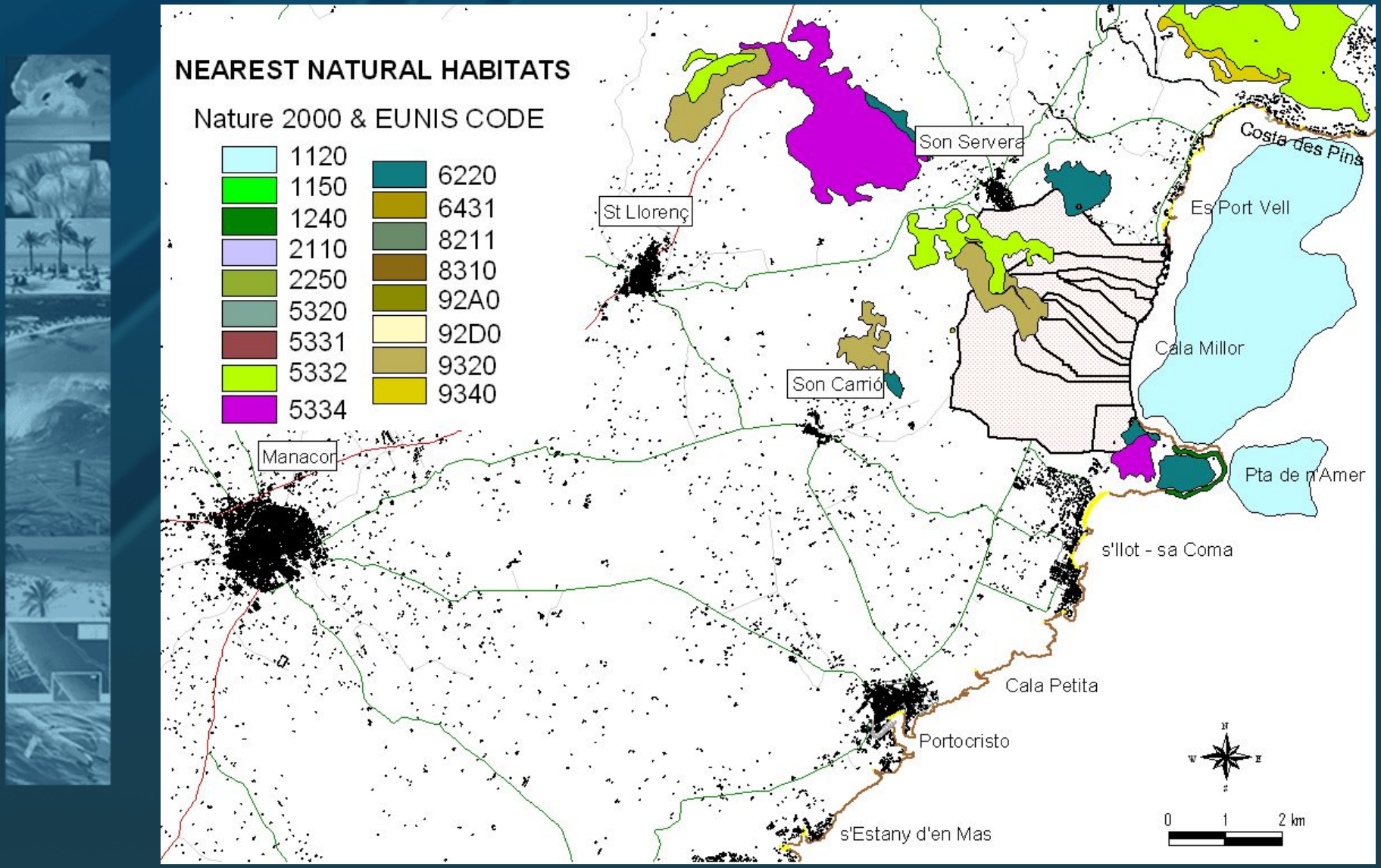

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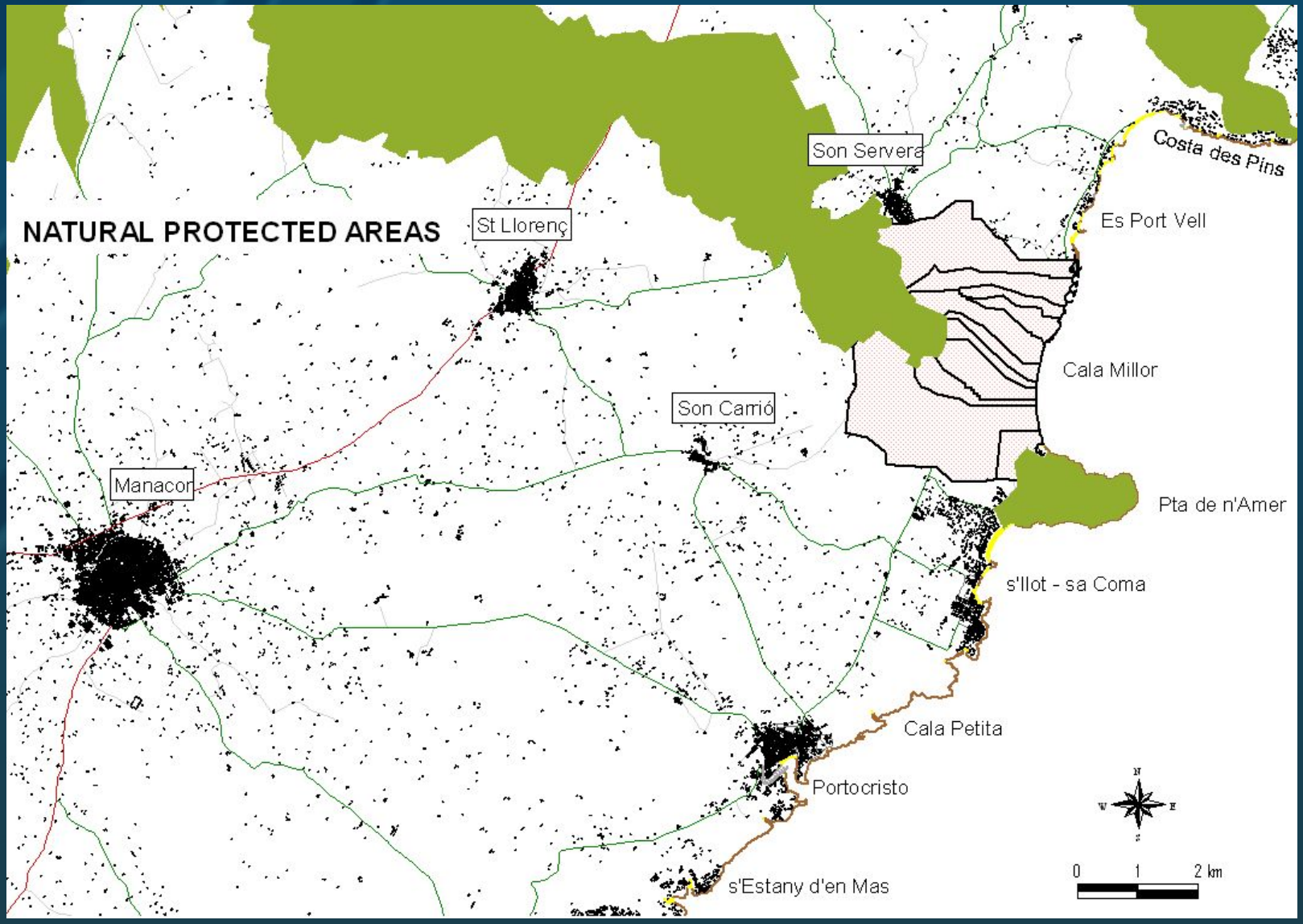
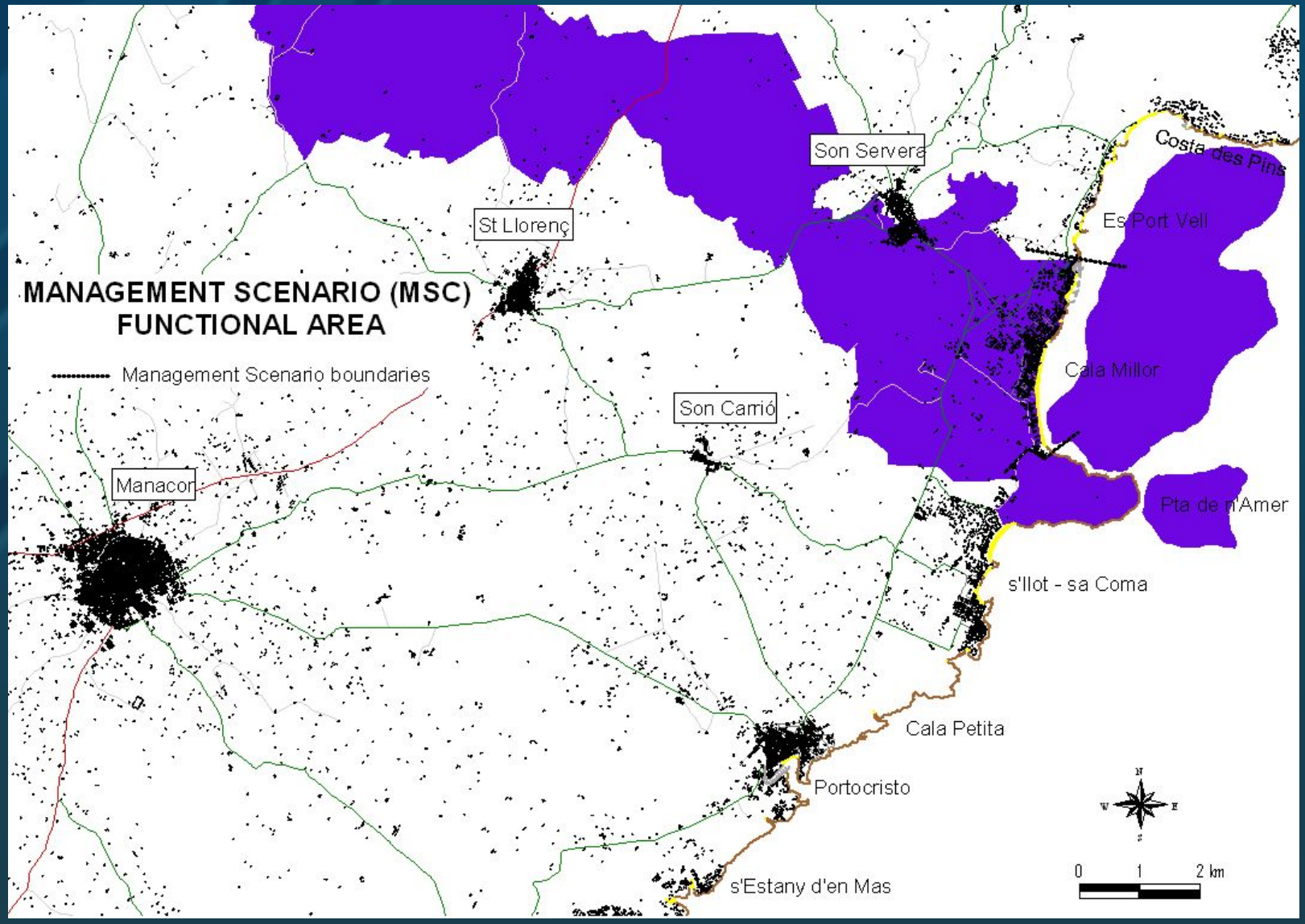


Methodological Approach to Boundary Delimitation for ICZM



Comparative Study of Urban Development in the Coastal Zone of the Balearic Islands

Objective

To conduct a spatial analysis of the effects of urban settlements and urbanization in the coastal zone of the Balearic Islands.

Justification

Urban development is a primary cause of habitat destruction in the coastal zone and also has significant impacts on marine habitats. Understanding the process from a spatial perspective is an essential decision-making tool related to ICZM and the achievement of sustainability in the coastal zone.

Land Categories

1 - Transformed land (developable or developed)

2 - Developable, non-transformed land

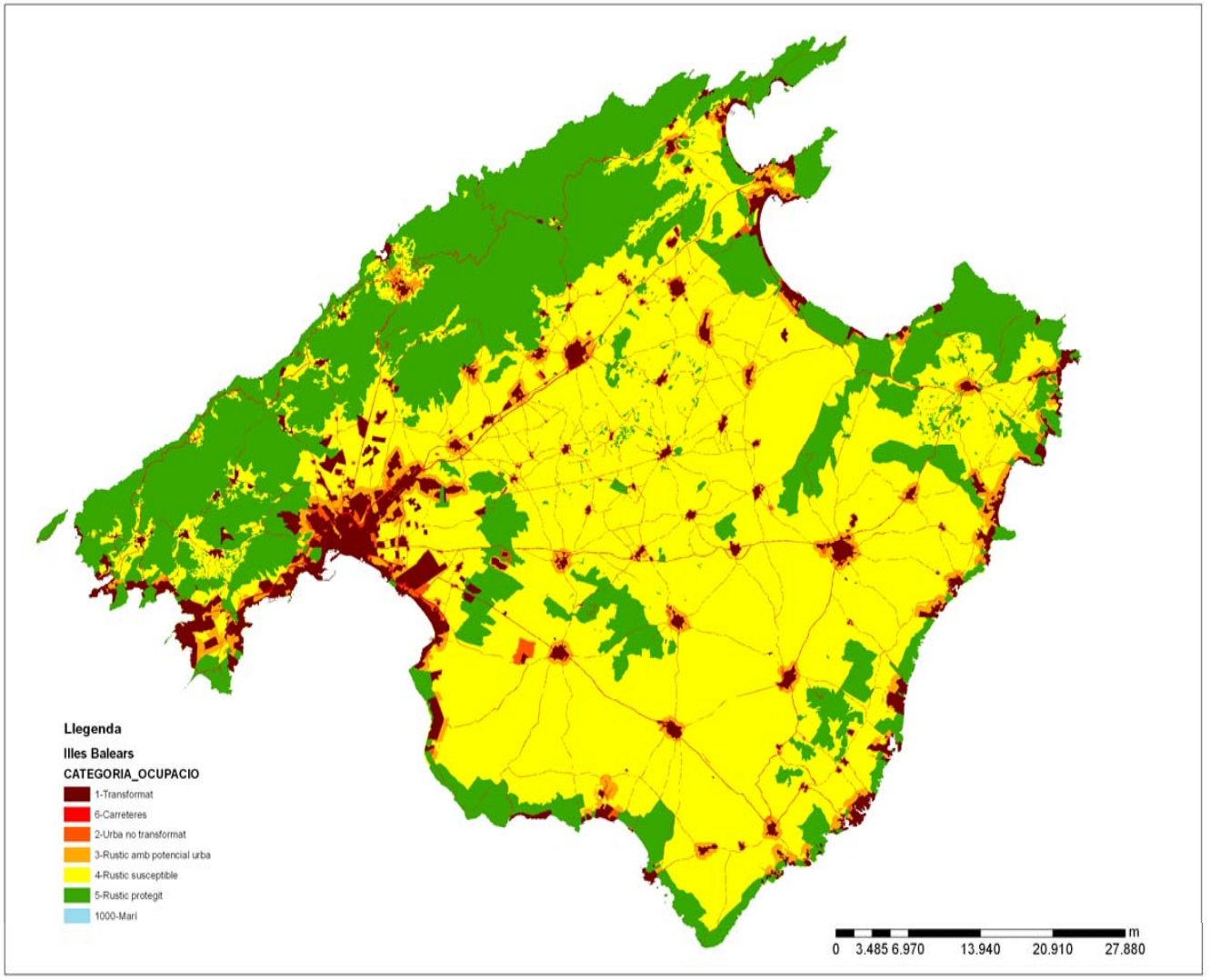
3 – Rustic land, potentially urbane

4 - Rustic land, potentially constructible

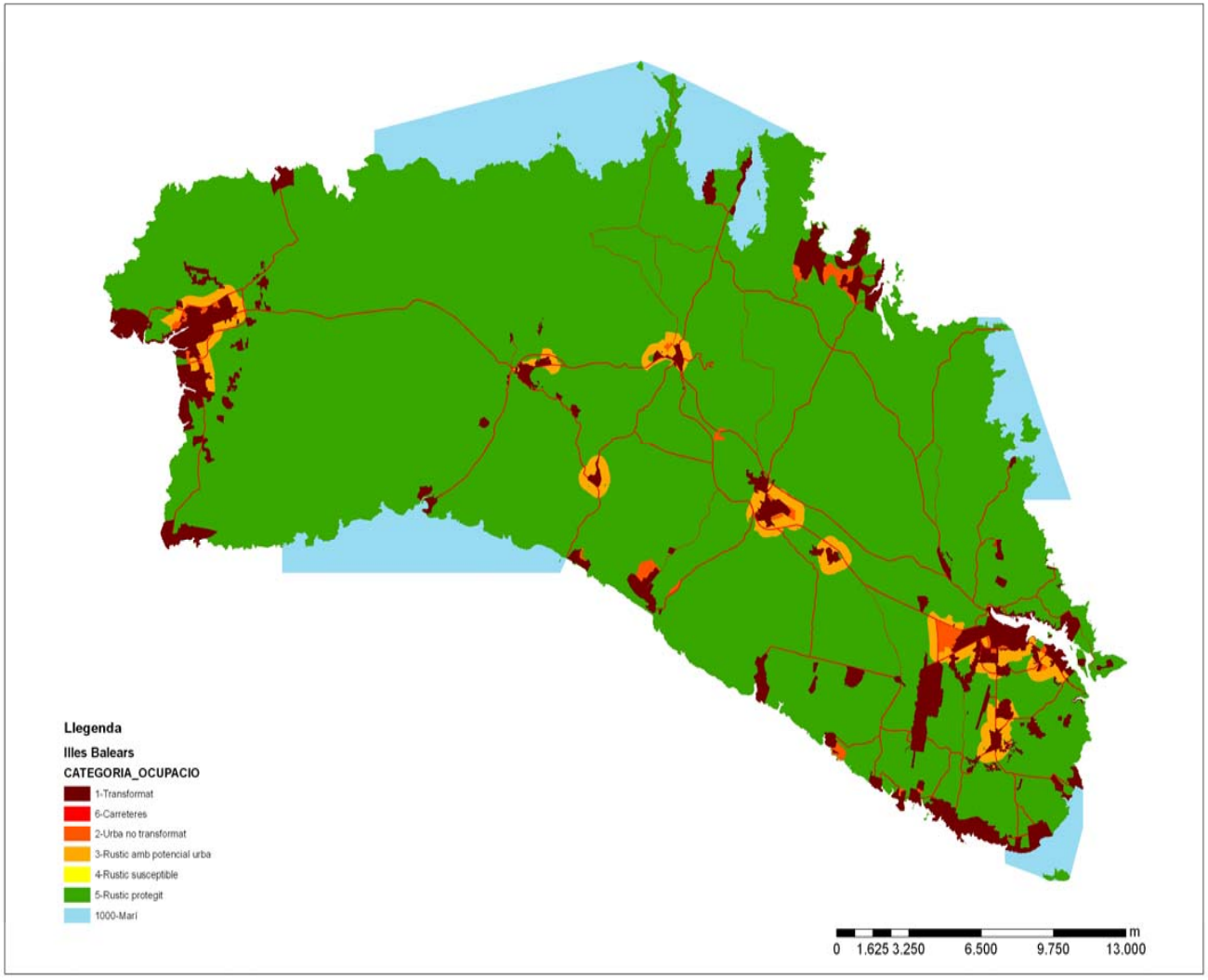
5 - Protected rustic land

6 - Road infrastructures

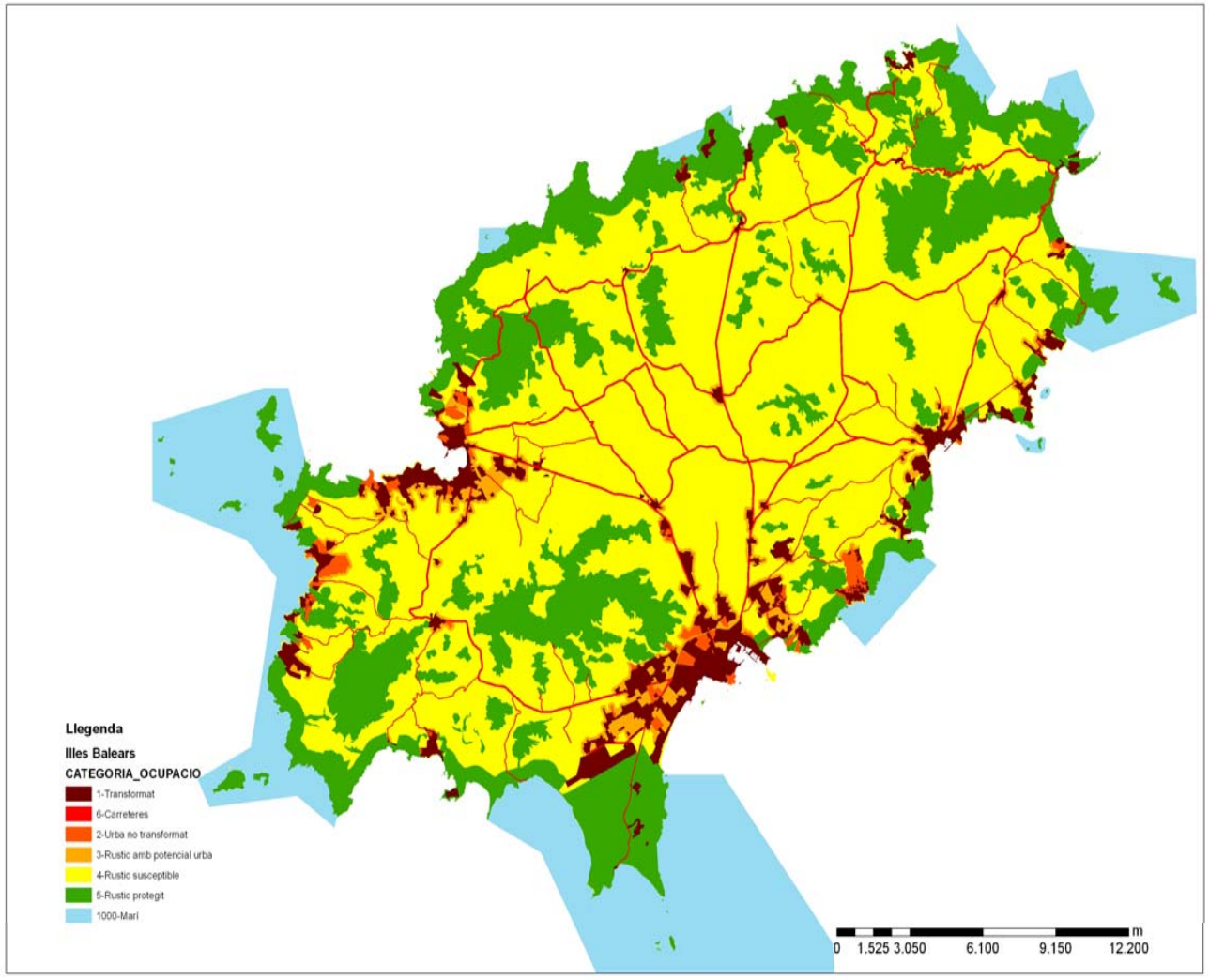
Results: Mallorca



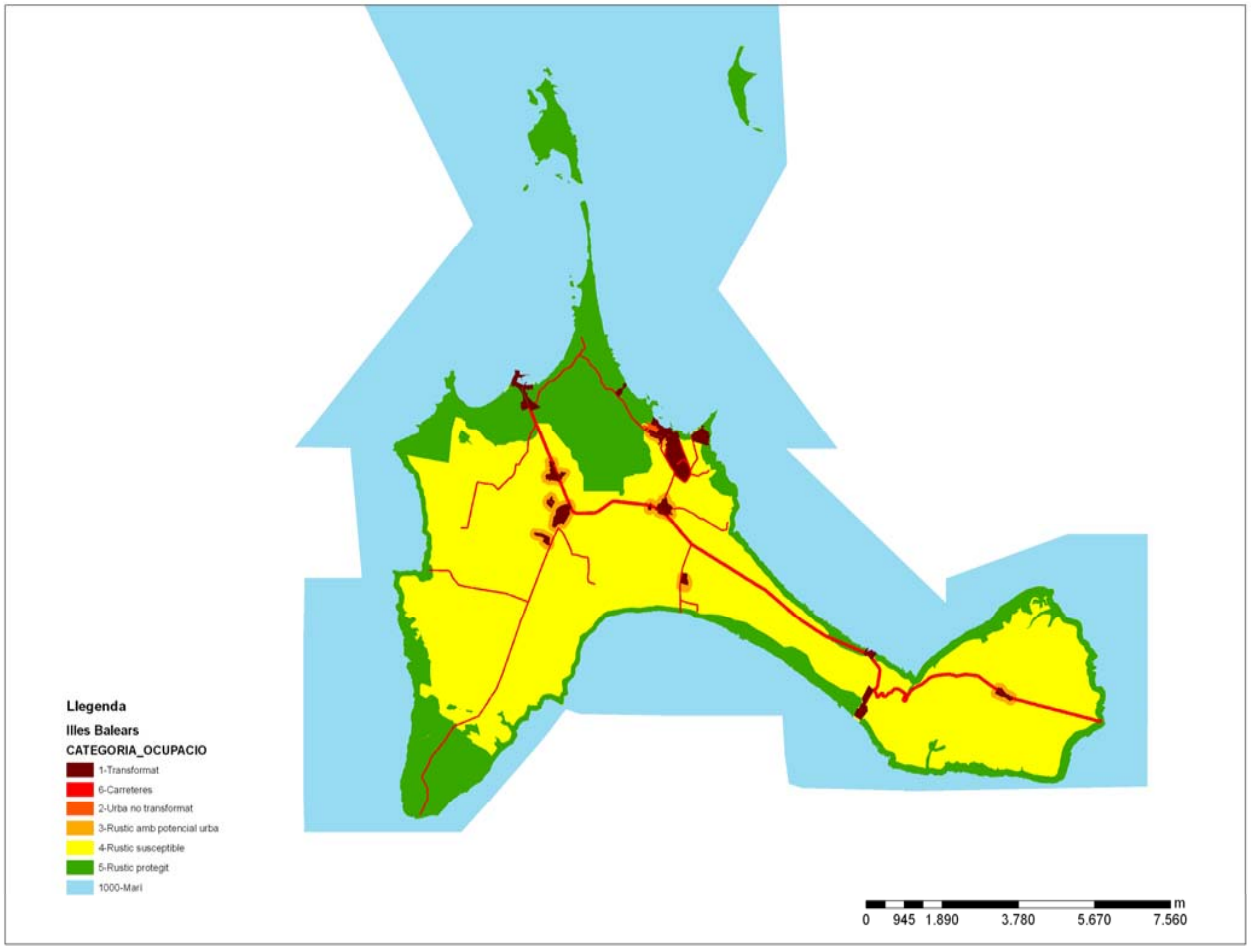
Results: Menorca



Results: Eivissa



Results: Formentera



Level of Satisfaction and Perceptions of Resident and Tourist Beach Users on the Island of Mallorca

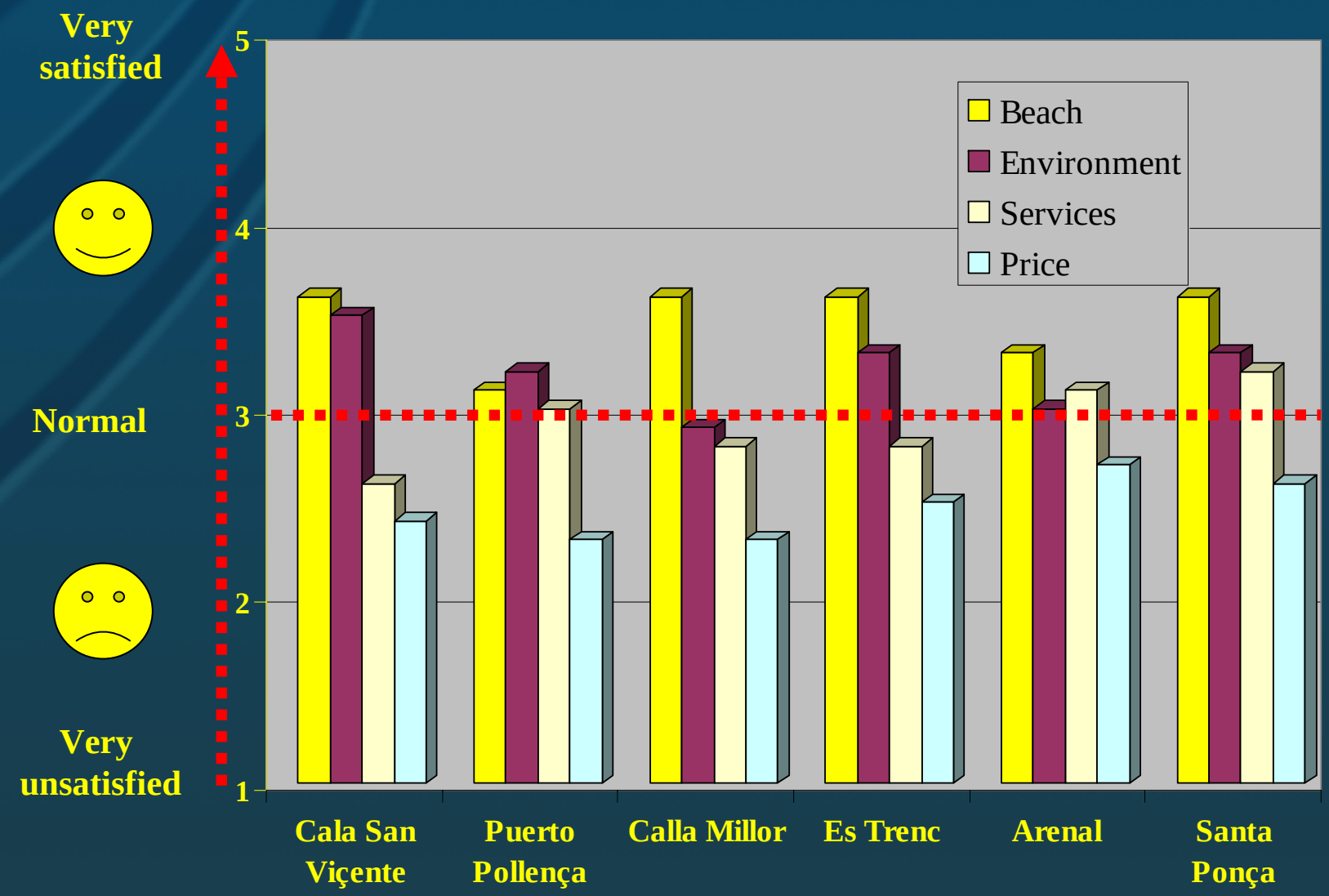
Objective

To assess the level of satisfaction (environment, services, prices, beach quality) and perceptions of resident and tourist beach users in six pilot sites in Mallorca.

Justification

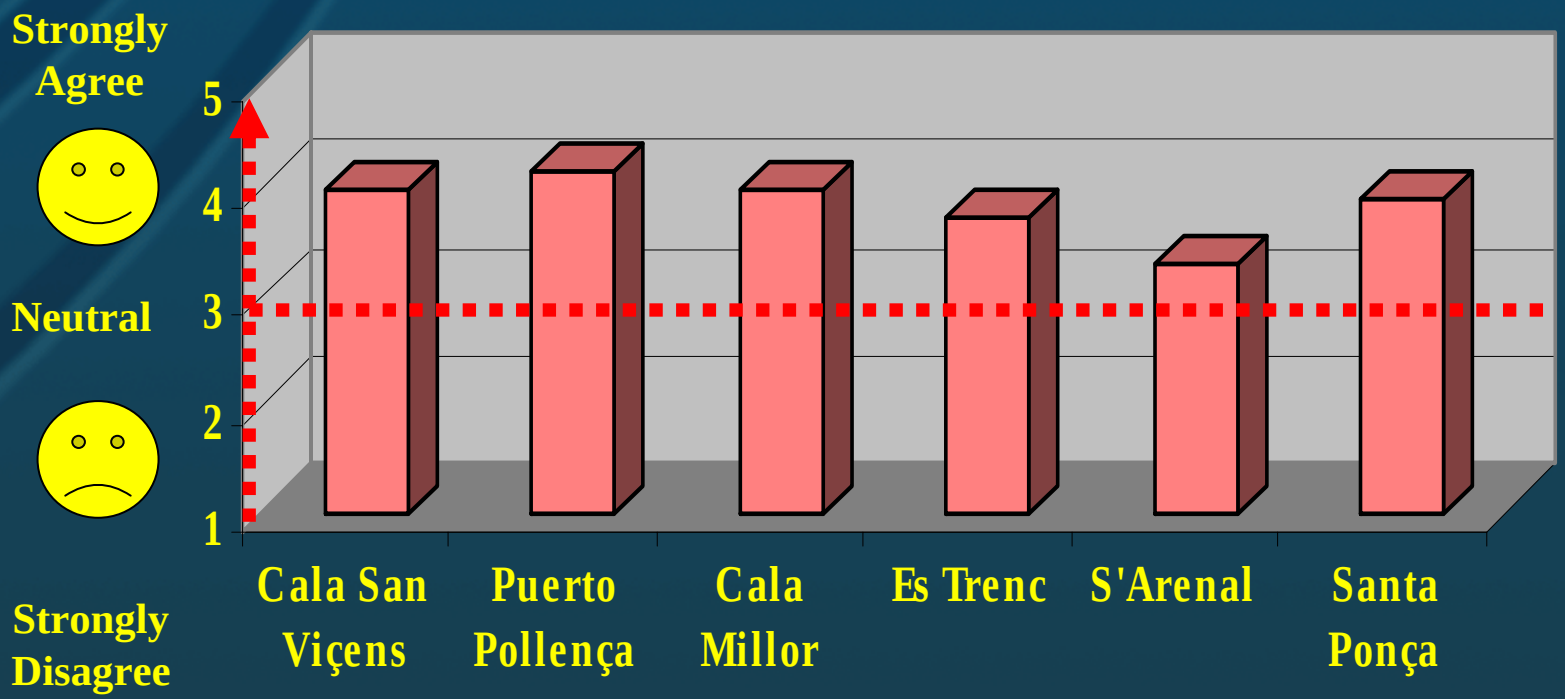
Satisfied tourists and residents and healthy communities are essential elements of sustainable tourism. Sustainable tourism is an integral element for achieving ICZM and the overall goal of sustainability in the coastal zone.

Satisfaction Levels of Resident Beach Users in Six Pilot Sites on the Island of Mallorca (N = 645)



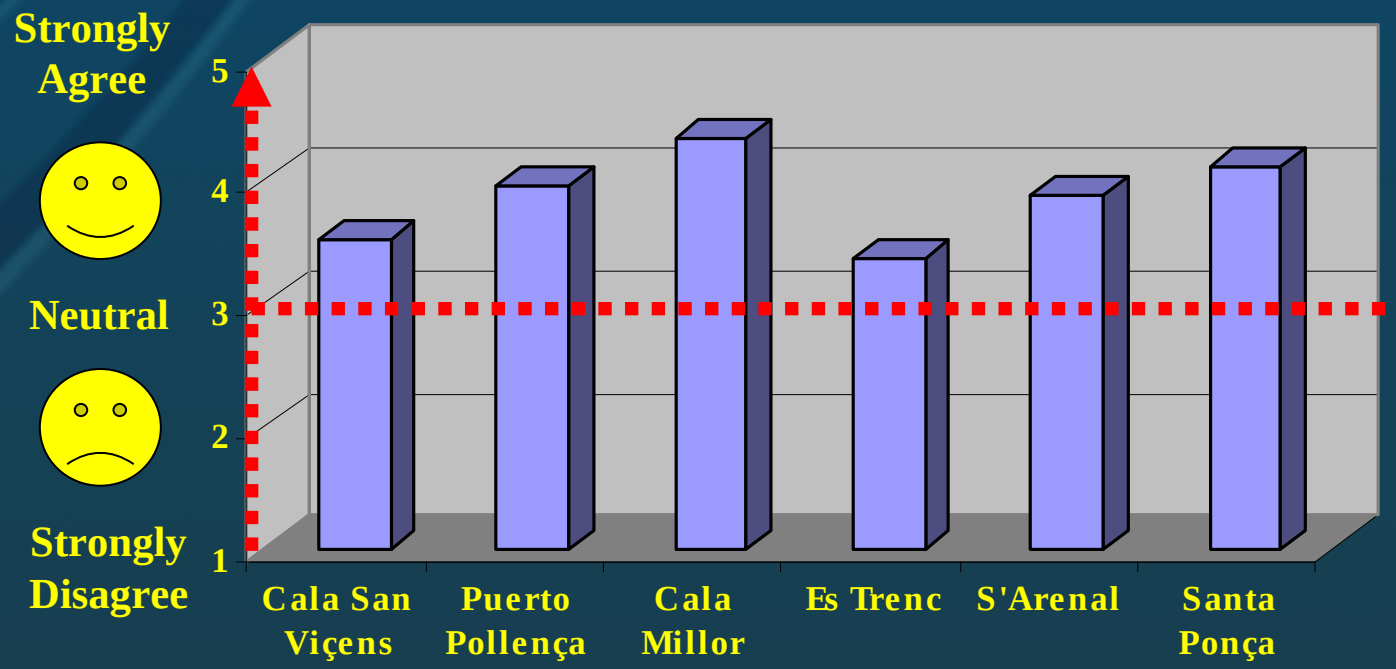
Resident's Perceptions of the Tourism Destination (N = 645)

This Area is a good Tourism Destination...

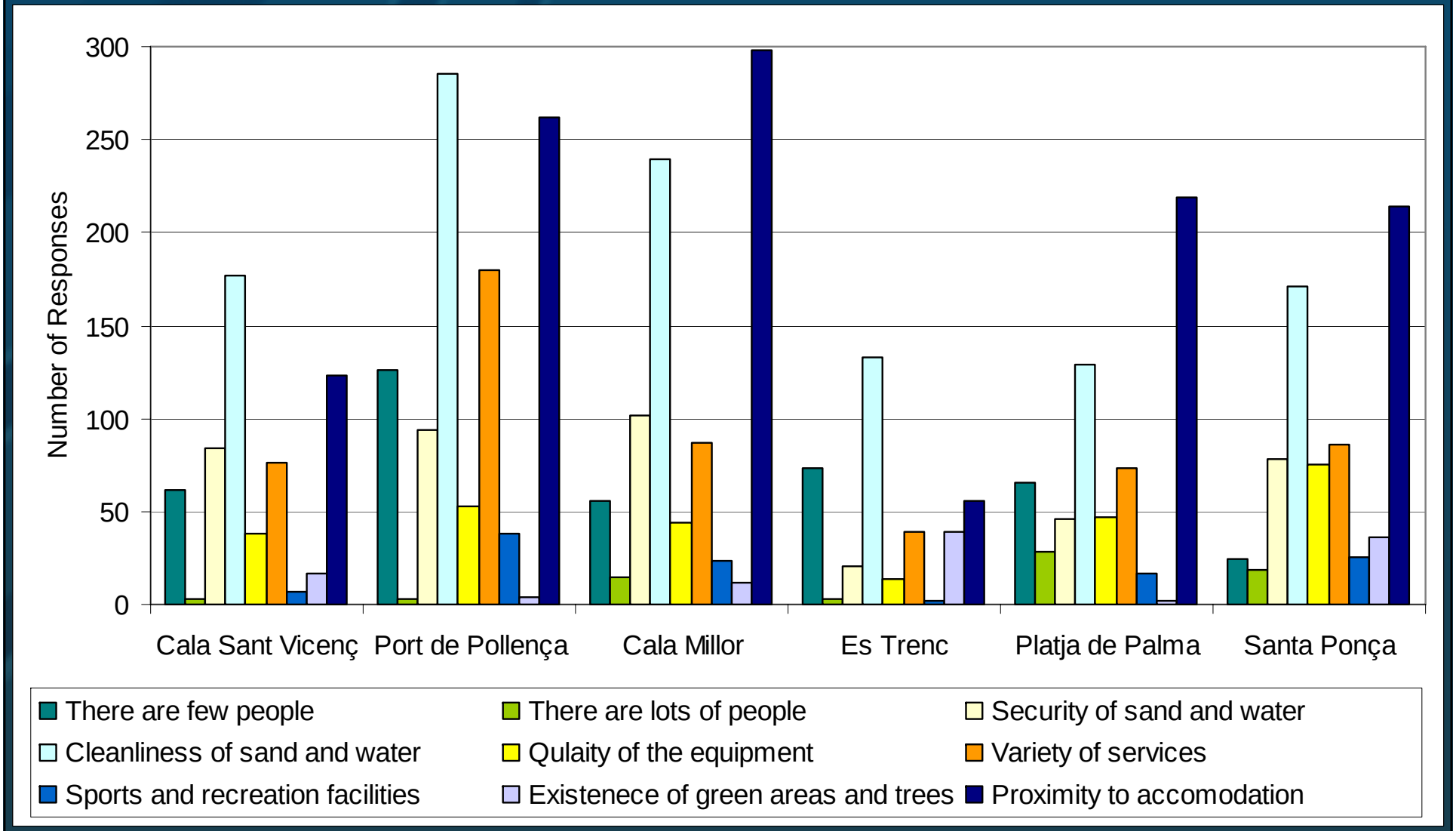


Resident's Perceptions of Benefits from Tourism (N = 645)

Tourism is Beneficial for the Residents of this Zone ....



Primary Reasons of Tourists for Beach Selection



Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change scenario
2. The Balearic Islands: present, historical evolution, a privileged environment and unique habitats
3. General frame, basic principles and challenges: sustainability
4. IMEDEA: some examples of coastal research
5. The ICZM Balearic Islands project (2005-2007): a starting point
6. The future: recommendations for ICZM, Coastal Observatories and guidelines for sustainable tourism

Conclusions and Recommendations

- Science for ICZM in the Balearic Islands. Ideal conditions. Know how and social society awareness
- ICZM Balearic Islands recommendations (e.g., US – Ocean Commission)
- Coastal observatory – new technologies, monitoring and forecasting capabilities
- Science and society: using state of the art scientific results, involve stakeholders to guarantee real sustainability (in our case, mostly, sustainable tourism).
- Science and ethical values “Science sans conscience n’est que ruine de l’ame” (Rabelais).

Conclusions and Recommendations

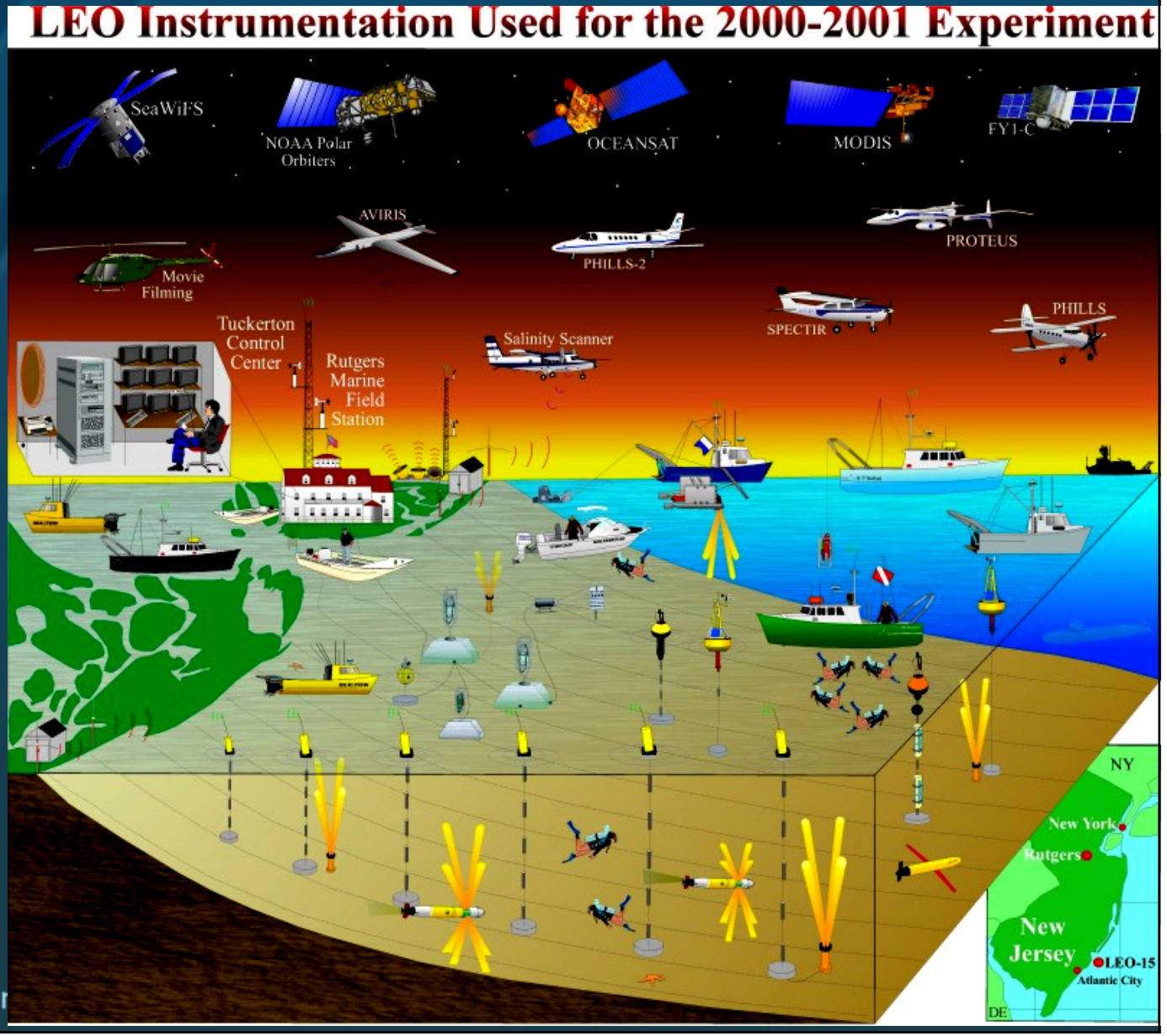
- Develop a methodological framework and model approach to habitat conservation that incorporates ecosystem-based, integrated management.
- Develop common convergent strategies, definitions and legislation for habitat conservation at an international level.
- Promote technological innovation and development for monitoring coastal habitats.
- Take management plans beyond the “paper park” phase and into the implementation phases.
- Incorporate long term financing and enforcement strategies into management plans.
- Recognize the important role of sustainable tourism as a self-financing mechanism for habitat conservation.
- Involve stakeholders and decision-makers at all stages of management.
- Recognize that coastal habitat conservation is just one small piece of the puzzle that leads to sustainability – the real challenge is piecing together all of the elements through the process of ICZM.

The future: coastal observatory, monitoring, new technologies, forecasting

LEO -15

Rutgers

Scott Glenn



All this is made possible by... :

Dr. Amy Diedrich
Dr. Alberto Álvarez
Dr. Alejandro Orfila
Dr. Gotzón Basterretxea
Dr. Pau Ballester
Dr. Lluis Gomez Pujol
Benjamín Casas
Guillermo Vizoso
Mauricio Ruiz
Marta Fuster
Dr. Vicente Fernández (now at INGV, Italy)
Dr. Pedro Vélez (now at IEO, Canarias)
Antonia Fornés (now at Cmallorca)
Rosario Ferrer
Dr Reiner Onken (GKSS)
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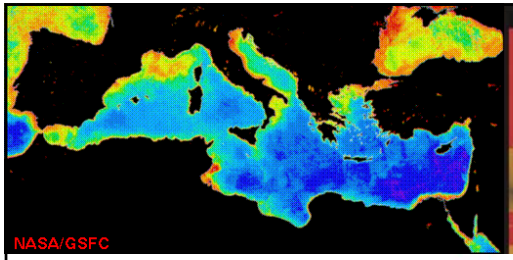
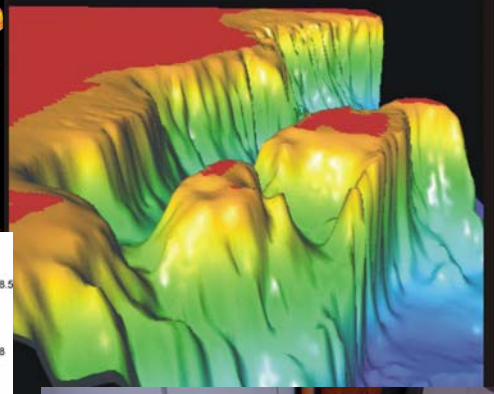
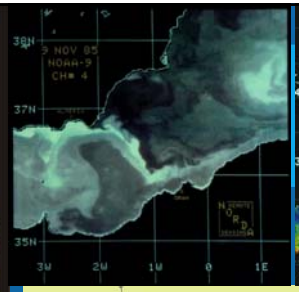
Amaya Alvarez
Tomeu Cañelles
Saül Pitarch
Carlos Castilla
Pep Homar

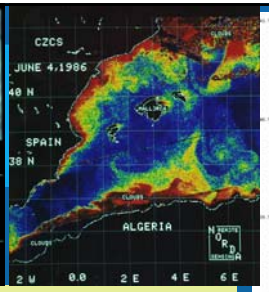
And all the ICZM project team
(more than 50 reserachers)

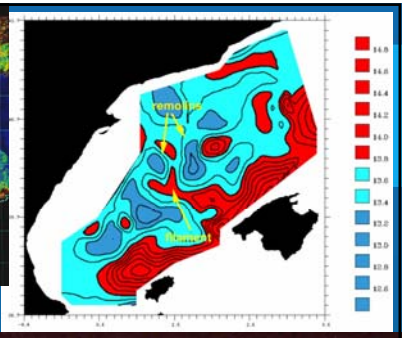
Thank you for your attention

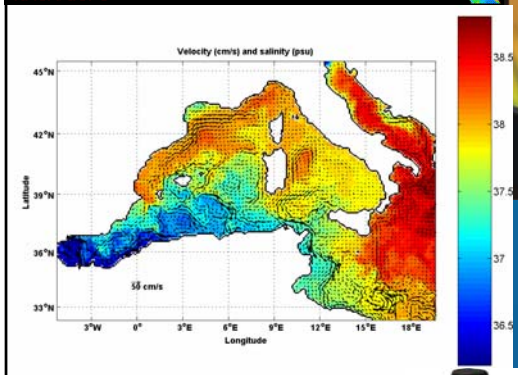


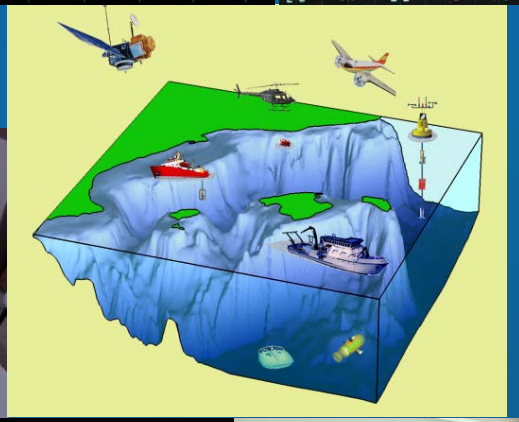


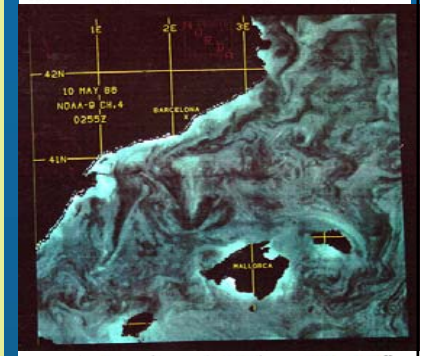


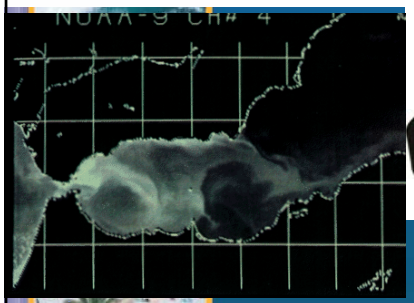


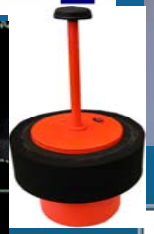


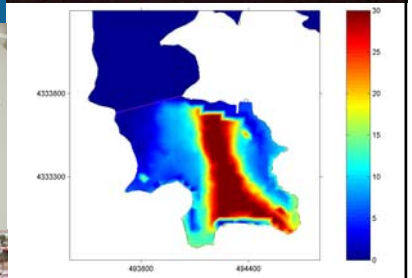


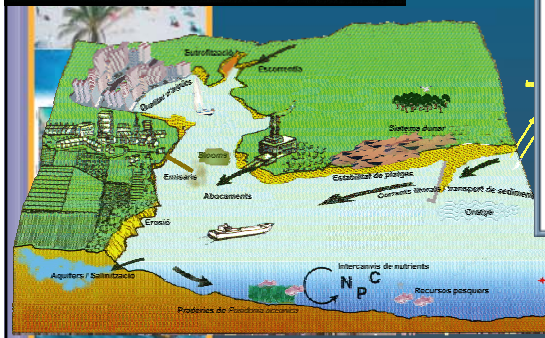


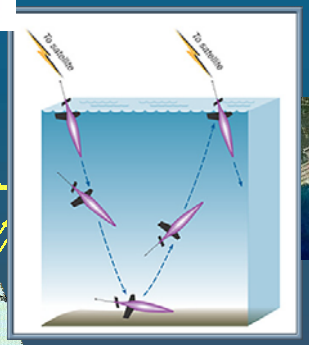


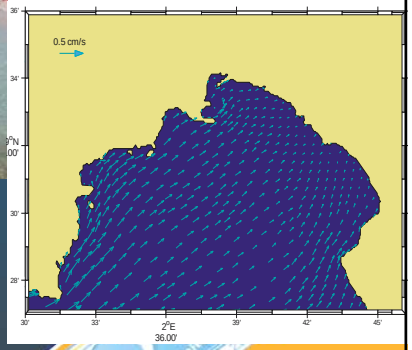


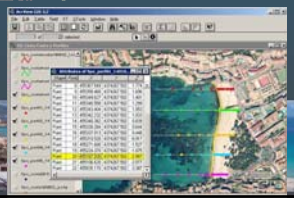












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