Science based Integrated Coastal Zone Management: the Balearic Islands case

Understanding multidisciplinary processes and their interactions at different spatial and temporal scales as a basis for achieving sound and real sustainability as a response to global change

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

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change environment
2. The Balearic Islands case study
3. General frame, basic underlying principles and challenges. Sustainability. Yes, but ... hard or soft ?. And how ?
4. The new role of science in XXI century
5. ICZM: Integrated Coastal Zone Management
6. The ICZM Balearic Islands initiative (Government/IMEDEA)
7. The future: real and measurable science based Sustainability thought a new process of ICZM
8. Conclusions and suggestions

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change environment
2. The Balearic Islands case study: present, historical evolution, a privileged environment, unique habitats and well established tourist destination. Interest but limitations of habitat conservation approach. Need of a global perspective
3. General frame, basic underlying principles and challenges. Sustainability. Yes, but ... hard or soft ?. And how ?
4. The new role of science in XXI century, a new path for knowledge based decision making. IMEDEA: some examples of coastal research and technology/know how transfer
5. ICZM: a well established international process to reach multidisciplinary, knowledge based sustainability in the coastal zone. Specific case for islands: limited territory, carrying capacity issues (resources, pressures and infrastructures)
6. The ICZM Balearic Islands initiative (Government/IMEDEA): a starting point. Project goals and structure, 35 initiatives. One example: Indicators, science and society (CES)
7. The future: real and measurable science based Sustainability, trough a new process of ICZM, Coastal Observing and Forecasting Systems, Guidelines for sustainable tourism that need to be applicable, applied and enforced (preserve environment and residents culture, guarantee business competitiveness)
8. Conclusions and suggestions

www.costabalearsostenible.es

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

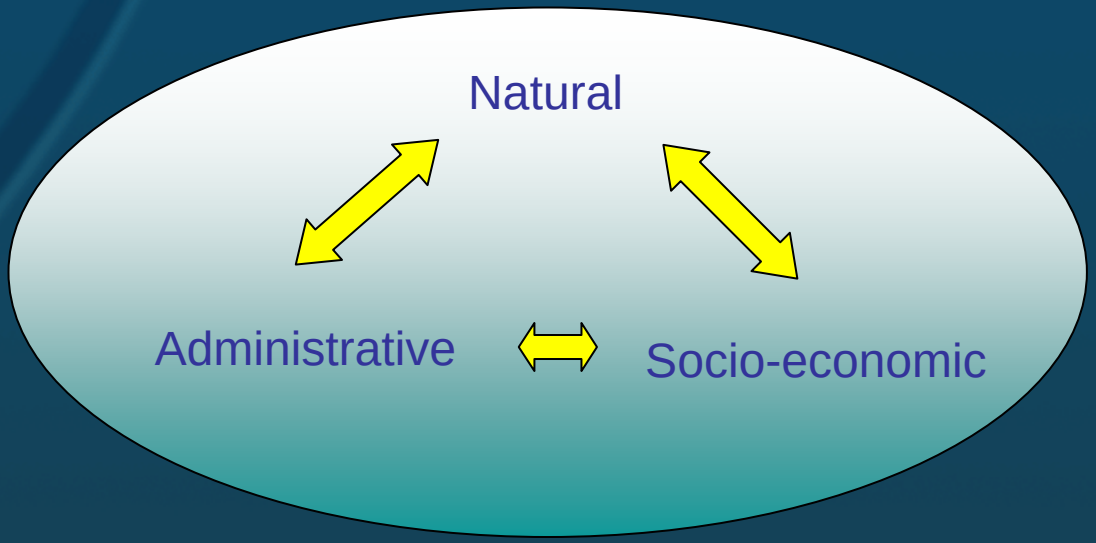
What do we understand by Coastal Zone

- 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.

www.costabalearsostenible.es

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

- Climate change, sea level rises, ecosystem variability
- More frequent extreme events
- Beach erosion
- Loss of coastal dunes
- Degradation of *Posidonia oceanica* meadows
- Proliferation of invasive species
- Coastal artificialization
- Degradation of water quality
- Red tides, HABS
- Loss of fisheries resources
- Proliferation of jellyfish
- Marine debris
- Accidental oil spills

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

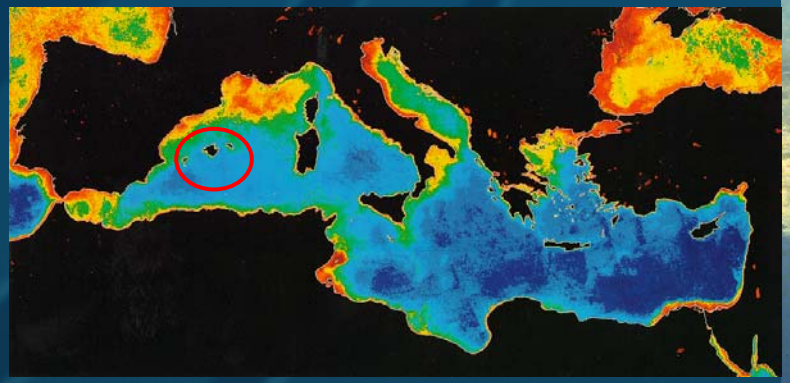
“The natural resource is not unlimited” (limitation concept)

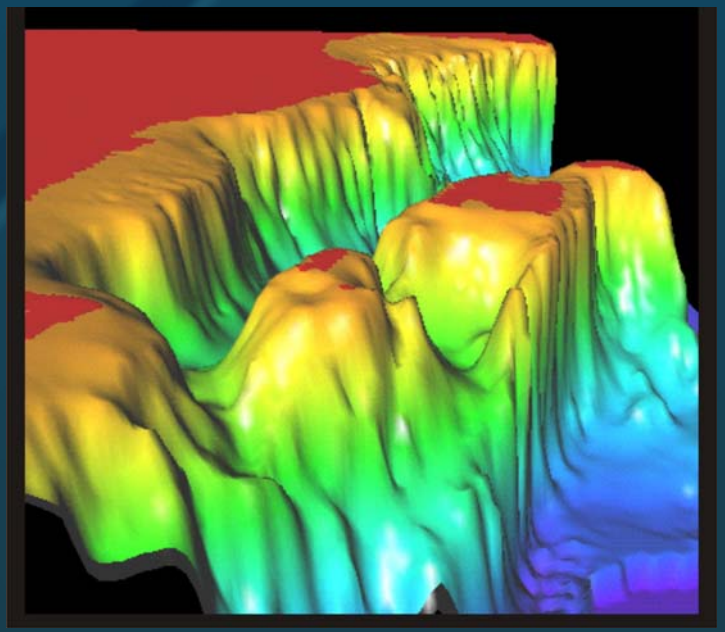
www.costabalearsostenible.es

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change scenario. Climate change is just one element of global change
2. The Balearic Islands case study: present, historical evolution, a privileged environment, unique habitats and well established tourist destination. Interest but limitations of habitat conservation approach. Need of a global perspective
3. General frame, basic underlying principles and challenges. Sustainability. Yes, but ... hard or soft ?. And how ?
4. The new role of science in XXI century, a new path for knowledge based decision making. IMEDEA: some examples of coastal research and technology/know how transfer
5. ICZM: a well established international process to reach multidisciplinary, knowledge based sustainability in the coastal zone. Specific case for islands: limited territory, carrying capacity issues (resources, pressures and infrastructures)
6. The ICZM Balearic Islands initiative (Government/IMEDEA): a starting point. Project goals and structure, 35 initiatives. One example Indicators, science and society (CES)
7. The future: real and measurable science based Sustainability, ICZM, Coastal Observing and Forecasting Systems, Guidelines for sustainable tourism that need to be applicable, applied and enforced (preserve environment and residents culture, guarantee business competitiveness)

The Balearic Islands





www.costabalearsostenible.es

Govern de les Illes Balears

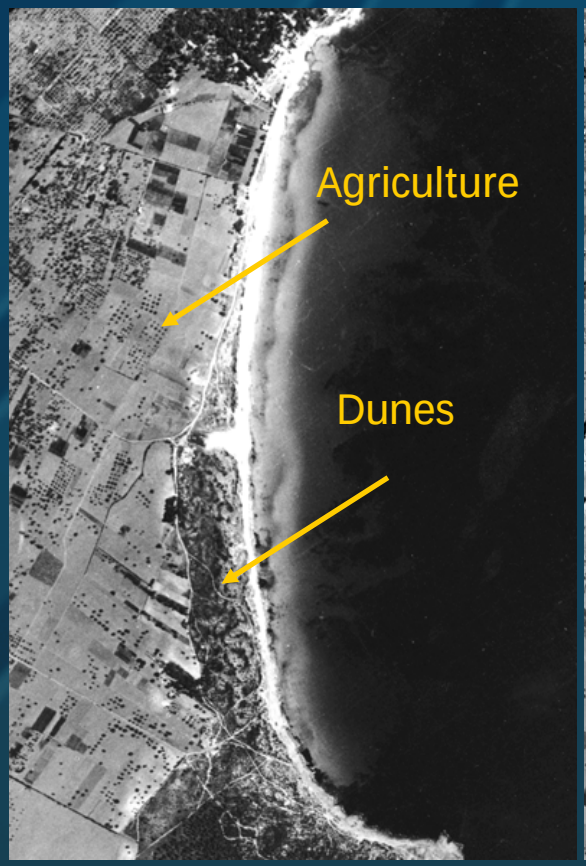
Investigació per a la sostenibilitat de la Zona Costanera de les Illes Balears

IMEDEA

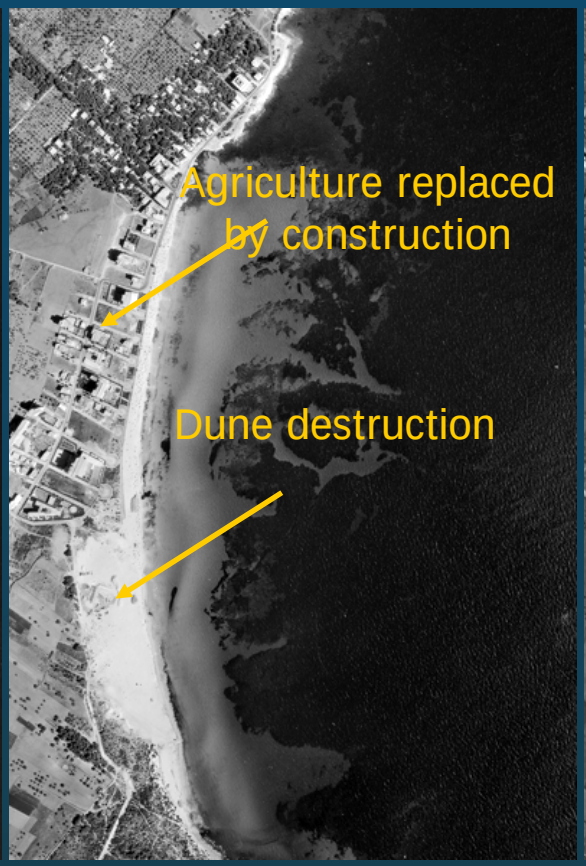
The Balearic Islands

- 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



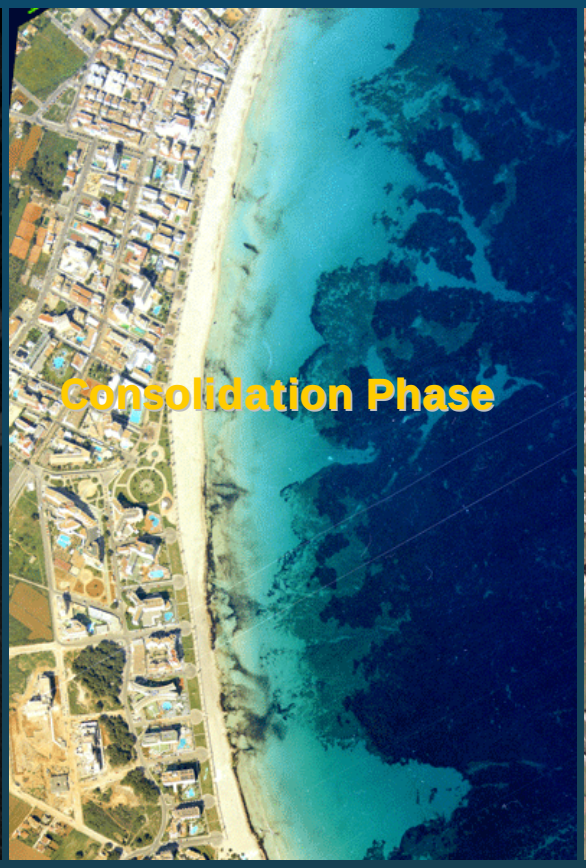
1968

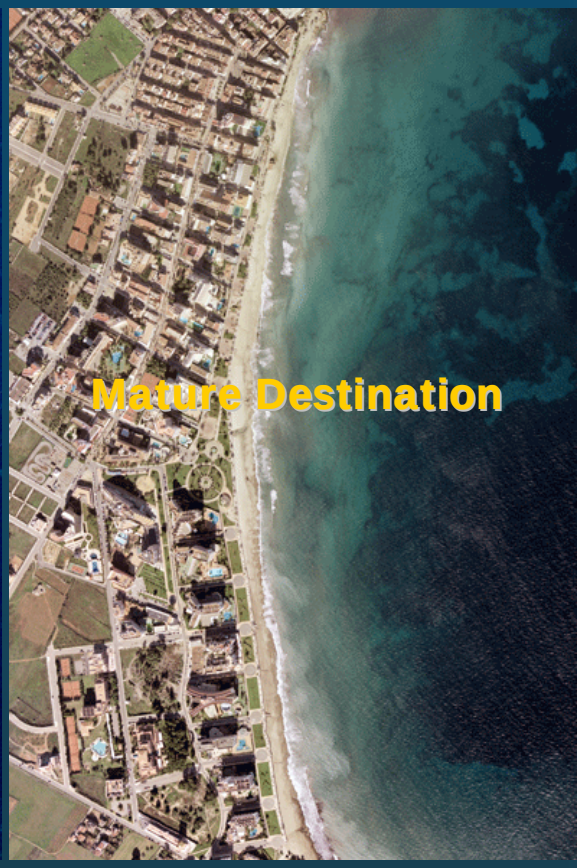
1973

Cala Millor, Mallorca

www.costabalearsostenible.es

The Balearic Islands





1979 1997 2002

Cala Millor, Mallorca

www.costabalearsostenible.es

Govern de les Illes Balears

Investigació per a la sostenibilitat de la Zona Costanera de les Illes Balears

IMEDEA

The Balearic Islands

The 1960s

Today

Cala Millor, Mallorca

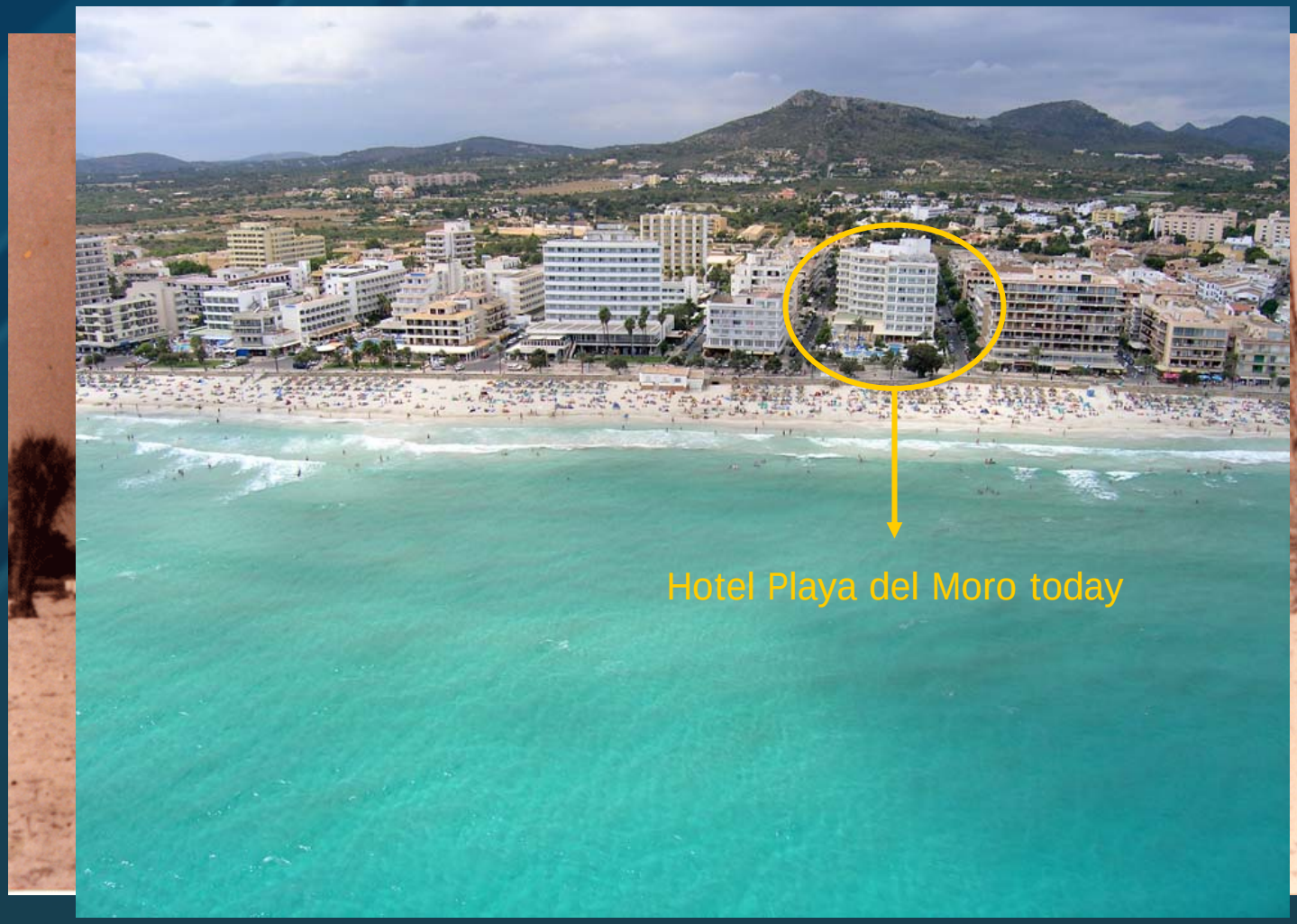
www.costabalearsostenible.es

Govern de les Illes Balears

Investigació per a la sostenibilitat de la Zona Costanera de les Illes Balears

IMEDEA

The Balearic Islands



Cala Millor, Mallorca

www.costabalearsostenible.es

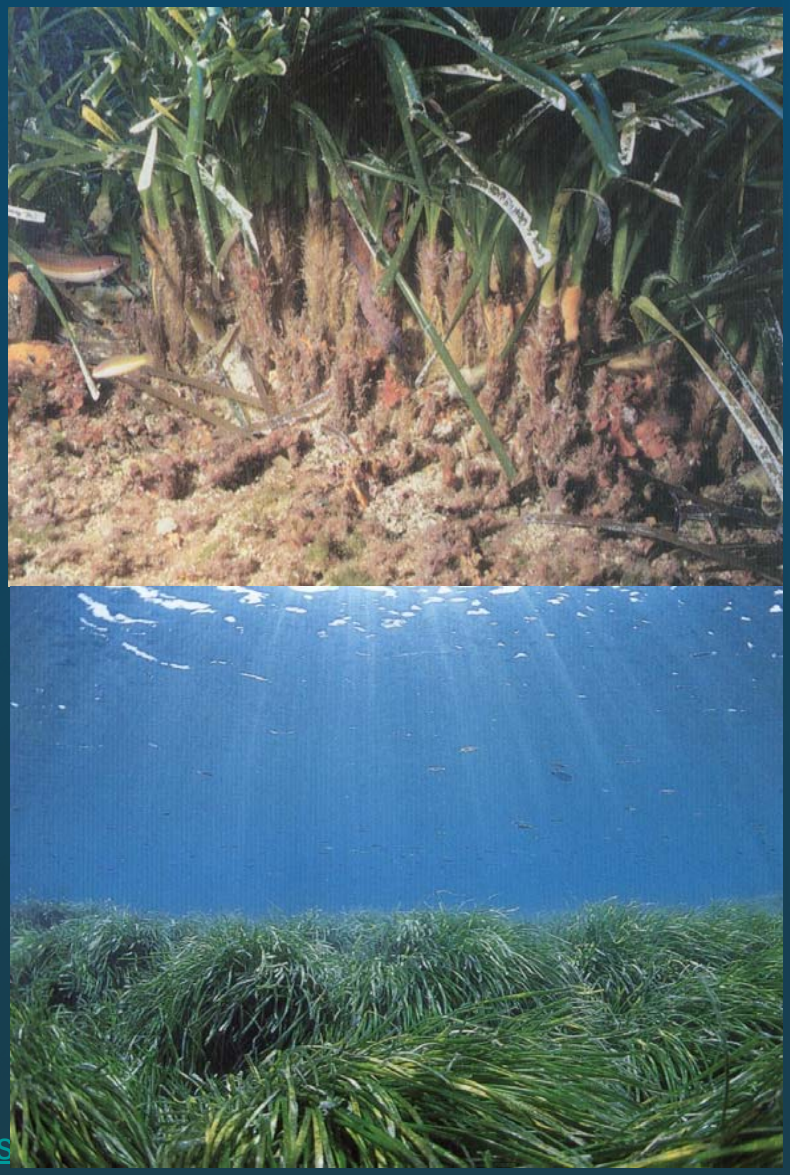
Coastal and Marine Habitats of the Balearic Islands

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



www.costabalearsostenible.es

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

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).

BUT THIS DOES NOT MEAN NO ACTION HAS TO BE TAKEN !!!!

Yes immediate action is needed!.

- 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.

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change scenario. Climate change is just one element of global change
2. The Balearic Islands case study: present, historical evolution, a privileged environment, unique habitats and well established tourist destination. Interest but limitations of habitat conservation approach. Need of a global perspective
3. General frame, basic underlying principles and challenges. Sustainability. Yes, but ... hard or soft ?. And how ?
4. The new role of science in XXI century, a new path for knowledge based decision making. IMEDEA: some examples of coastal research and technology/know how transfer
5. ICZM: a well established international process to reach multidisciplinary, knowledge based sustainability in the coastal zone. Specific case for islands: limited territory, carrying capacity issues (resources, pressures and infrastructures)
6. The ICZM Balearic Islands initiative (Government/IMEDEA): a starting point. Project goals and structure, 35 initiatives. One example Indicators, science and society (CES)
7. The future: real and measurable science based Sustainability, ICZM, Coastal Observing and Forecasting Systems, Guidelines for sustainable tourism that need to be applicable, applied and enforced (preserve environment and residents culture, guarantee business competitiveness)

www.costabalearsostenible.es

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).

www.costabalearsostenible.es

The new role of science in XXI's century society

"It is not an exaggeration to assert that without science there can be no sustainable development"

3ª Sesión de la Comisión de Desarrollo Sostenible UN, 1995

- Knowledge of the system is a key element to reach a true sustainable development. This implies high quality research, tools and instrumentation (data, indicators, thresholds, predictive capabilities, etc.)

A scientific approach should guarantee:

- A consensus by means of quantifications with reliable methodologies, reproducible and internationally established.
- A reliability of the data.
- A theoretical background internationally accepted.

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change scenario. Climate change is just one element of global change
2. The Balearic Islands case study: present, historical evolution, a privileged environment, unique habitats and well established tourist destination. Interest but limitations of habitat conservation approach. Need of a global perspective
3. General frame, basic underlying principles and challenges. Sustainability. Yes, but ... hard or soft ?. And how ?
4. The new role of science in XXI century, a new path for knowledge based decision making. IMEDEA: some examples of coastal research and technology/know how transfer
5. ICZM: a well established international process to reach multidisciplinary, knowledge based sustainability in the coastal zone. Specific case for islands: limited territory, carrying capacity issues (resources, pressures and infrastructures)
6. The ICZM Balearic Islands initiative (Government/IMEDEA): a starting point. Project goals and structure, 35 initiatives. One example Indicators, science and society (CES)
7. The future: real and measurable science based Sustainability, ICZM, Coastal Observing and Forecasting Systems, Guidelines for sustainable tourism that need to be applicable, applied and enforced (preserve environment and residents culture, guarantee business competitiveness)

www.costabalearsostenible.es

The new role of science in XXI's century society

- Science progresses in last 5 – 10 years: we know that a significant number of management actions in the coastal environment would now have to be made differently !-
- Importance of knowledge transfer
- Society is turning towards science (multidisciplinary)
  - Not only during crisis or catastrophic events (health, environment, food, energy, etc.)
  - As an element of the decision making process that guarantees independence and reliability due to the existence of an evaluation system internationally accepted.

'Strong science for wise decision'

Sustainability science

www.costabalearsostenible.es

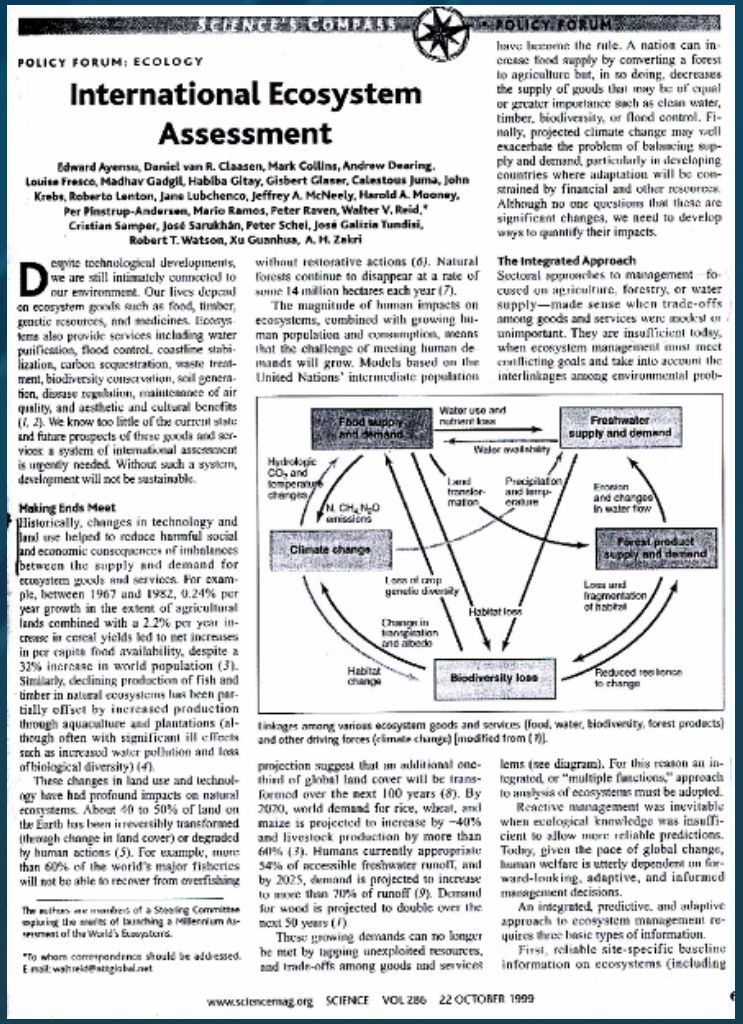
The new role of science in XXI's century society

It is not an exaggeration to assert that without science there can be no sustainable development"

3rd session of the UN Commission for sustainable development, 1995

- Allows for an objective view of the situation.
- Isolates cause-effect relationships so that problems may be addressed at their sources.
- Allows for the classification and evaluation of large amounts of information.
- Determines which data are relevant and the most appropriate method to analyze them.
- Finds existing data and evaluate their relevance and quality.
- Clearly defines and prioritizes areas that need to be managed and the interrelations between them.
- Identifies information gaps so that actions may be taken to remediate the lack of understanding.
- Allows for monitoring and evaluation of ongoing actions.
- Acts as a communication tool among scientists, stakeholders, the public and decision-makers.

The new role of science in XXI's century society



SCIENCE'S COMPASS — POLICY FORUM

POLICY FORUM: ECOLOGY

International Ecosystem Assessment

Edward Ayensu, Daniel van R. Claasen, Mark Collins, Andrew Dearing, Louise Fresco, Madhav Gadgil, Habiba Gitay, Gisbert Glaser, Calestous Juma, John Krebs, Roberto Lenton, Jane Lubchenco, Jeffrey A. McNeely, Harold A. Mooney, Per Pinstrup-Andersen, Mario Ramos, Peter Raven, Walter V. Reid,* Cristian Samper, José Sarukhán, Peter Schei, José Galizia Tundisi, Robert T. Watson, Xu Guanhua, A. H. Zakri

Despite technological developments, we are still intimately connected to our environment. Our lives depend on ecosystem goods such as food, timber, genetic resources, and medicines. Ecosystems also provide services including water purification, flood control, coastline stabilization, carbon sequestration, waste treatment, biodiversity conservation, soil generation, disease regulation, maintenance of air quality, and aesthetic and cultural benefits (*1*, *2*). We know too little of the current state and future prospects of these goods and services: a system of international assessment is urgently needed. Without such a system, development will not be sustainable.

Making Ends Meet

Historically, changes in technology and land use helped to reduce harmful social and economic consequences of imbalances between the supply and demand for ecosystem goods and services. For example, between 1967 and 1982, 0.24% per year growth in the extent of agricultural lands combined with a 2.2% per year increase in cereal yields led to net increases in per capita food availability, despite a 32% increase in world population (*3*). Similarly, declining production of fish and timber in natural ecosystems has been partially offset by increased production through aquaculture and plantations (although often with significant ill effects such as increased water pollution and loss of biological diversity) (*4*).

These changes in land use and technology have had profound impacts on natural ecosystems. About 40 to 50% of land on the Earth has been irreversibly transformed (through change in land cover) or degraded by human actions (*5*). For example, more than 60% of the world's major fisheries will not be able to recover from overfishing without restorative actions (*6*). Natural forests continue to disappear at a rate of some 14 million hectares each year (*7*).

The magnitude of human impacts on ecosystems, combined with growing human population and consumption, means that the challenge of meeting human demands will grow. Models based on the United Nations' intermediate population projection suggest that an additional one-third of global land cover will be transformed over the next 100 years (*8*). By 2020, world demand for rice, wheat, and maize is projected to increase by ~40% and livestock production by more than 60% (*3*). Humans currently appropriate 54% of accessible freshwater runoff, and by 2025, demand is projected to increase to more than 70% of runoff (*9*). Demand for wood is projected to double over the next 50 years (*1*).

These growing demands can no longer be met by tapping unexploited resources, and trade-offs among goods and services have become the rule. A nation can increase food supply by converting a forest to agriculture but, in so doing, decreases the supply of goods that may be of equal or greater importance such as clean water, timber, biodiversity, or flood control. Finally, projected climate change may well exacerbate the problem of balancing supply and demand, particularly in developing countries where adaptation will be constrained by financial and other resources. Although no one questions that these are significant changes, we need to develop ways to quantify their impacts.

The Integrated Approach

Sectoral approaches to management—focused on agriculture, forestry, or water supply—made sense when trade-offs among goods and services were modest or unimportant. They are insufficient today, when ecosystem management must meet conflicting goals and take into account the interlinkages among environmental problems (see diagram). For this reason an integrated, or "multiple functions," approach to analysis of ecosystems must be adopted.

Reactive management was inevitable when ecological knowledge was insufficient to allow more reliable predictions. Today, given the pace of global change, human welfare is utterly dependent on forward-looking, adaptive, and informed management decisions.

An integrated, predictive, and adaptive approach to ecosystem management requires three basic types of information.

First, reliable site-specific baseline information on ecosystems (including

Linkages among various ecosystem goods and services (food, water, biodiversity, forest products) and other driving forces (climate change) [modified from (*9*)].

The authors are members of a Steering Committee exploring the merits of launching a Millennium Assessment of the World's Ecosystems.

*To whom correspondence should be addressed. E-mail: walt.reid@attglobal.net

Peer reviewed papers that establish solid theoretical backgrounds

Independent system of evaluation

Science Citation Index

www.costabalearsostenible.es

The new role of science in XXI's century society

Scientific needs:

Ocean Commission, 2004

Box 25.1 Examples of Ocean and Coastal Science Needs

Fundamental knowledge about oceans and coasts is essential for assessing and predicting the status of marine resources, finding beneficial new uses of ocean resources, and implementing an ecosystem-based management approach. Greater understanding of these environments will enable policy makers and managers to make wise, science-based decisions at the national, regional, state, tribal, and local levels. However, to achieve this level of understanding, significantly more research will be needed as indicated throughout this report. The list below gives some idea of the range of topics to be covered, although it is by no means a comprehensive list of all needed research.

Aquaculture
- determination of the environmental impacts of marine aquaculture and the development of best management practices
- knowledge about the impacts of aquaculture feeds, species introductions, and the use of chemicals and pharmaceuticals in aquaculture practices

Biodiversity
- baseline measurements of marine biodiversity on different scales (i.e., communities, populations, and individuals)
- methods to mitigate human activities that adversely affect biodiversity and marine ecosystems

Climate Change
- better understanding of the ocean's role in global carbon and heat cycling
- predictive models of the effects of global warming, including sea-level rise and changes in global circulation

Coastal Habitat
- knowledge about the structure and functioning of coastal habitats and how human activities and natural events affect them
- effective habitat restoration techniques

Coral Reefs
- measurements of ocean temperature, currents, and other variables that affect changes in coral communities
- prediction of the impacts of global climate change and other natural and human-induced events on coral communities
- comprehension about the distribution and ecology of cold water corals

Fisheries
- better understanding of the relationship between fisheries and ecosystem dynamics, including the identification of essential habitat
- measures of the social science and economic aspects of fisheries

International Science
- international scientific partnerships to enhance long-term ocean science and management capacity in other nations

Invasive Species
- comprehension of how or why certain species become invasive
- understanding about why certain factors make an ecosystem more susceptible to invasions
- new techniques for invasive species identification and eradication
- new ballast water treatment and exchange techniques

Marine Debris
- knowledge about debris behavior in the marine environment and its ecological effects on organisms and ecosystems
- effective debris control measures
- identification of marine debris sources

Marine Mammals and Protected Species
- expanded understanding of basic biology and population status
- understanding of the effects of noise, coastal development, offshore oil and gas exploration, vessel traffic, military activities, and marine debris on these species
- methods to mitigate harmful impacts on these animals

Natural Hazards
- basic understanding and site-specific knowledge about a range of natural coastal hazards
- new methods for tracking and predicting hazards and assessing risks
- techniques to mitigate hazard events

Oceans and Human Health
- discovery of new marine bioproducts
- elucidation of the interrelations and causal effects of marine pollution, harmful algal blooms, ecosystem alteration, and emerging marine diseases in disease events
- new methods to monitor and mitigate threats to human health in marine and freshwater systems

Offshore Energy and Minerals
- understanding of cumulative, low-level, and chronic impacts of oil and gas activities on marine environments
- evaluation of the risks to the marine environment due to aging pipelines
- evaluation of the environmental effects of OCS mineral and sediment use

Regional Understanding
- regional-scale research programs to understand ecosystem processes
- integration of biological, physical, and chemical research on a regional, ecosystem basis

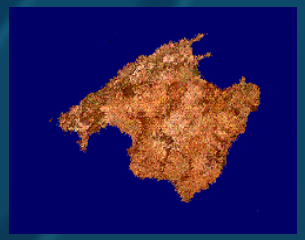
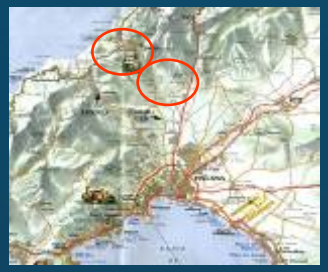
Sediment
- data on sediment processes in the marine environment on regional and national scales
- innovative techniques and technologies for managing marine sediment
- comprehensive information about the source, movement, volume, quality, and appropriate use or disposal of sediment—particularly contaminated sediment

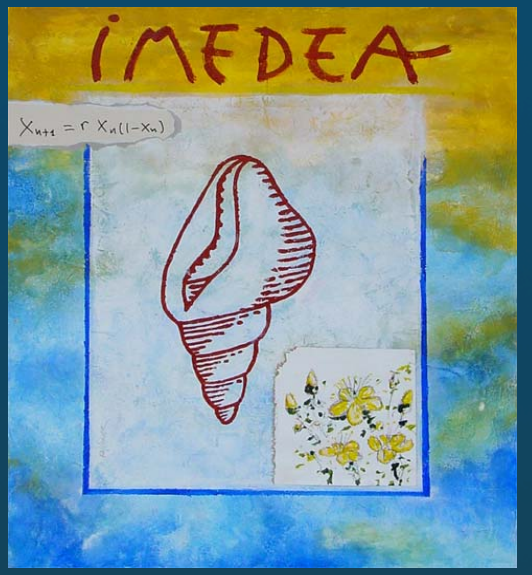
Socioeconomic Science
- operational data on the economic factors and human dimension affecting ocean and coastal areas and activities

Vessel Pollution
- understanding of cumulative impacts of commercial and recreational vessel pollution on ecologically sensitive areas
- knowledge of impacts of vessel air emissions, particularly in ports and inland
- disposal options for concentrated sludge resulting from advanced sewage treatment on large passenger vessels

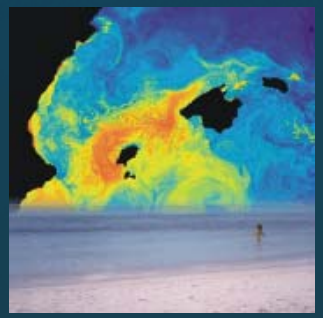
Water Pollution
- advanced treatment options for eliminating nitrogen, phosphorus, and other emerging contaminants, such as pharmaceuticals, from wastewater discharges
- new methods for removing nutrients and pathogens in coastal runoff
- new models and measures of atmospheric transport and deposition of pollutants

Examples of coastal and marine research at IMEDEA (CSIC-UIB)






Mallorca Island, Esporles http://www.imedea.csic.es

www.costabalearsostenible.es

Govern de les Illes Balears

Investigació per a la sostenibilitat de la Zona Costanera de les Illes Balears

IMEDEA

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

8,4 million Euros annual budget (40% obtained competitive basis)

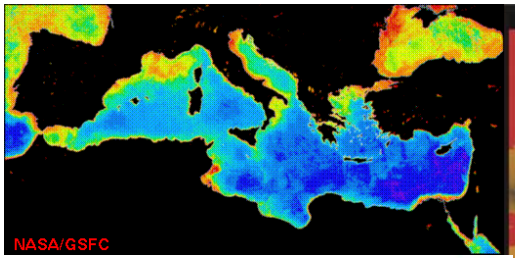
www.costabalearsostenible.es

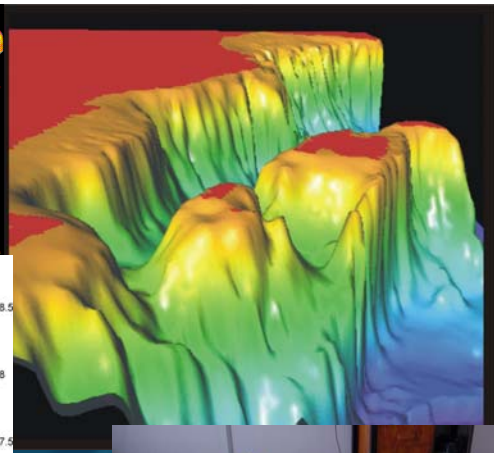
Some examples of IMEDEA know how transfer

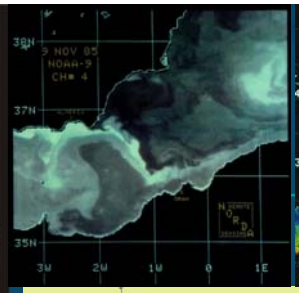
- Currents in the Balearic Sea for Search and Rescue Operations and oil spill response action
- Beach variability and relations to *Posidonia Oceanica*
- Beach erosion and response to extreme events
- Beach fill processes
- Harbor oscillations and impacts
- Residence time in harbors and bays, eutrofication
- Water quality and HABS
- Sustainable beaches
- Beach safety operational system, rip currents in beaches
- Technology transfer, coastal ocean monitoring, gliders, satellites

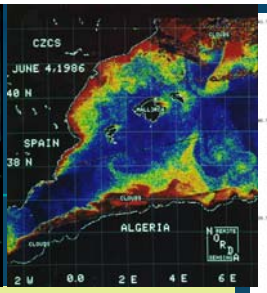
http://www.imedea.uib.es/ , www.costabalearsostenible.es

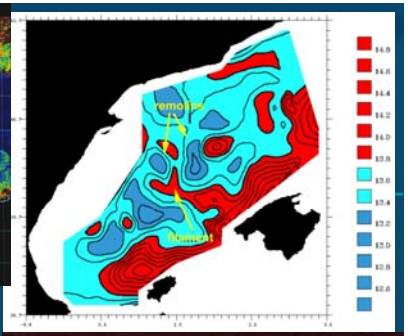
Mitigation and adaptation needs to be based on knowledge, on reliable observations, ...

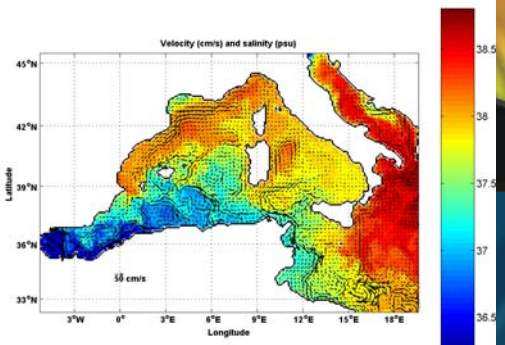


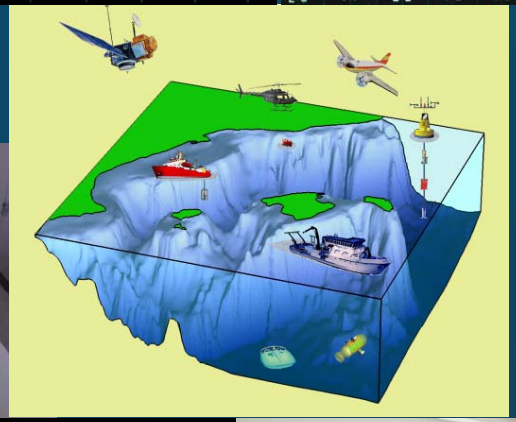


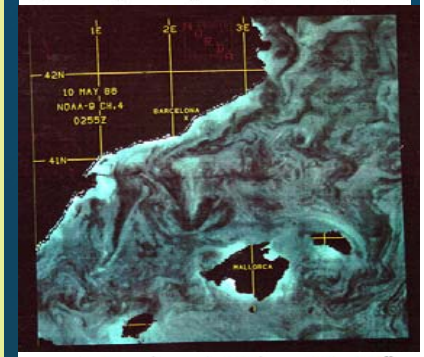


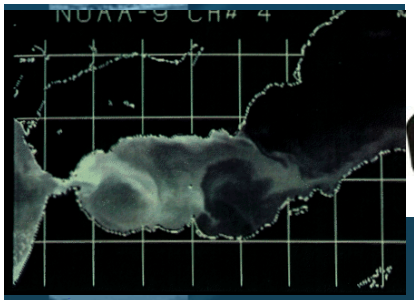


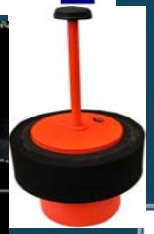


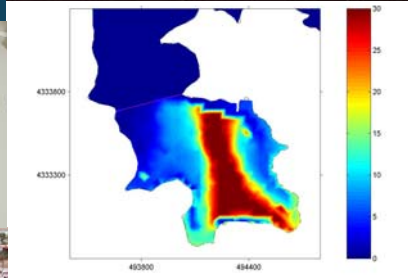


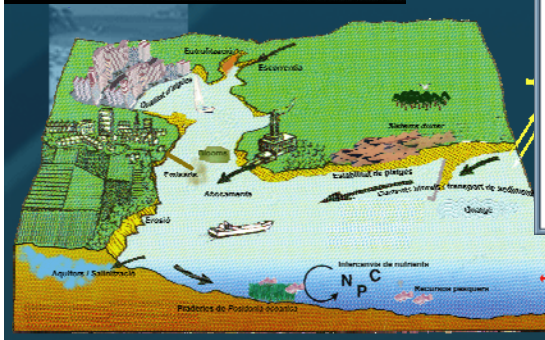


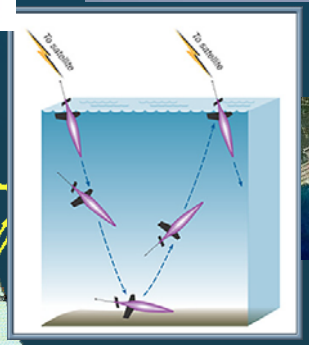


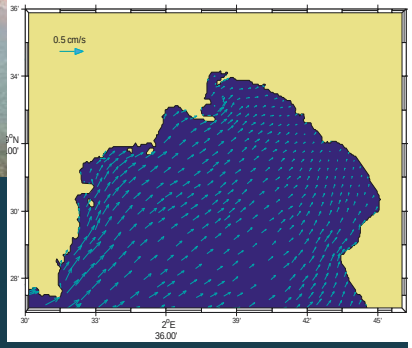


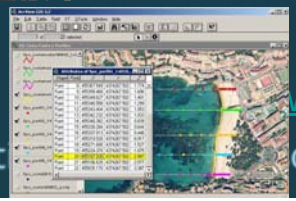












Govern de les Illes Balears

Invest [illegible] la Zona Cos

www.c[illegible]arsostenible.es

http://www.imedea.csic.es/natural/goi/goifis/

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.

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change scenario. Climate change is just one element of global change
2. The Balearic Islands case study: present, historical evolution, a privileged environment, unique habitats and well established tourist destination. Interest but limitations of habitat conservation approach. Need of a global perspective
3. General frame, basic underlying principles and challenges. Sustainability. Yes, but ... hard or soft ?. And how ?
4. The new role of science in XXI century, a new path for knowledge based decision making. IMEDEA: some examples of coastal research and technology/know how transfer
5. ICZM: a well established international process to reach multidisciplinary, knowledge based sustainability in the coastal zone. Specific case for islands: limited territory, carrying capacity issues (resources, pressures and infrastructures)
6. The ICZM Balearic Islands initiative (Government/IMEDEA): a starting point. Project goals and structure, 35 initiatives. One example Indicators, science and society (CES)
7. The future: real and measurable science based Sustainability, ICZM, Coastal Observing and Forecasting Systems, Guidelines for sustainable tourism that need to be applicable, applied and enforced (preserve environment and residents culture, guarantee business competitiveness)

ICZM: Integrated Coastal Zone Management

ICZM is “a continuous and dynamic process by which decisions are made for the sustainable use, development, and protection of coastal and marine resources” (Cicin-Sain and Knecht 1998).

ICZM is grounded in the concept that the management of coastal and ocean resources and space should be as fully integrated as are the ecosystems making up the coastal and ocean realms

ICZM: “The process is designed to overcome the fragmentation inherent in both the sectoral management approach and the splits in jurisdiction among levels of government at the land-water interface” (ibid).

Integrated Coastal Zone Management (ICZM)

- *ICZM (ICAM 2005)*

"A dynamic process of sustainable management and use of coastal zones taking into account at the same time the diversity of activities and users, the fragility of coastal ecosystems and their interaction"

- *ICZM*

Temporal and spatial scales of managing ?

- *ICZM: involve all parties concerned in the management process. (from the beginning)*

Think globally, act locally

Integrated Coastal Zone Management (ICZM)

Background in Europe:

- 70's 80's: Several coastal laws (Spain, USA...)
- 1987: World Commission on Environment and Development (WCED), "sustainable development"
- 1992: Agenda 21 ; Convention on Biological Diversity
- 1995: Global Program of Action for the Protection of the Marine Environment from Land based Activities
- 1996: European Commission, GIZC
- 2002: European Commission, Recommendation 413
- 2002: Plan of Implementation for the World Summit on Sustainable Development
- 2005: Protocol on Integrated Management of Mediterranean Coastal Zones, ICAM

Integrated Coastal Zone Management (ICZM)

Master plan for ICZM

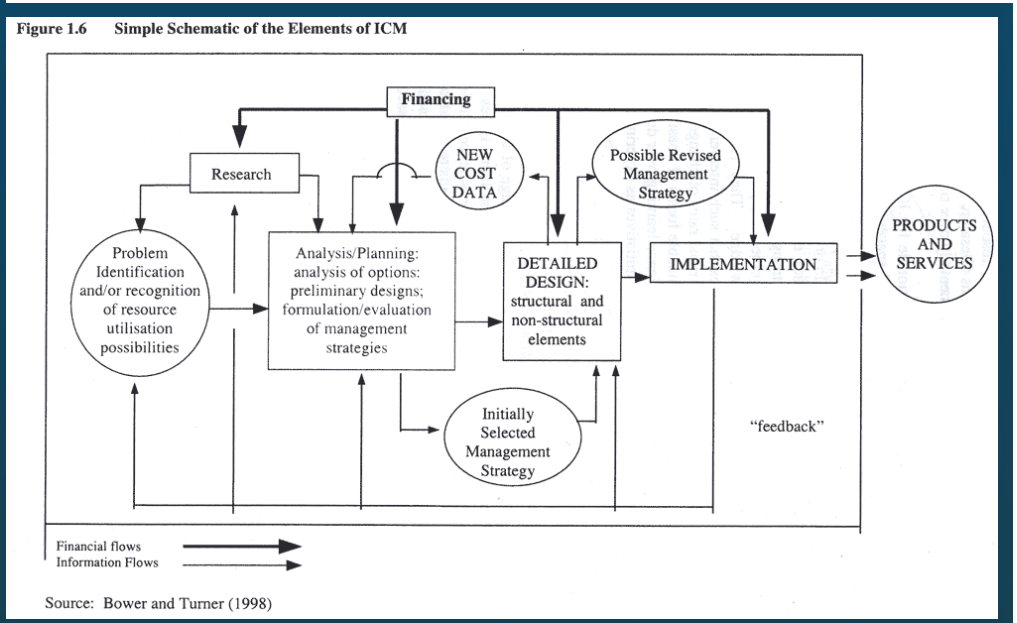
Four main steps

1) Start: problem identification, characterization and diagnostic of the coastal zone (natural, socioeconomic and administrative)

2) Planning phase: options, alternatives

3) Implementation

4) Monitoring and evaluation



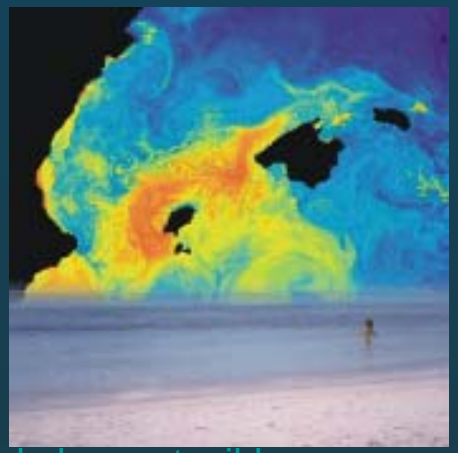
Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change scenario. Climate change is just one element of global change
2. The Balearic Islands case study: present, historical evolution, a privileged environment, unique habitats and well established tourist destination. Interest but limitations of habitat conservation approach. Need of a global perspective
3. General frame, basic underlying principles and challenges. Sustainability. Yes, but ... hard or soft ?. And how ?
4. The new role of science in XXI century, a new path for knowledge based decision making. IMEDEA: some examples of coastal research and technology/know how transfer
5. ICZM: a well established international process to reach multidisciplinary, knowledge based sustainability in the coastal zone. Specific case for islands: limited territory, carrying capacity issues (resources, pressures and infrastructures)
6. The ICZM Balearic Islands initiative (Government/IMEDEA): a starting point. Project goals and structure, 35 initiatives. One example: Indicators, science and society (CES)
7. The future: real and measurable science based Sustainability, ICZM, Coastal Observing and Forecasting Systems, Guidelines for sustainable tourism that need to be applicable, applied and enforced (preserve environment and residents culture, guarantee business competitiveness)

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.



www.costabalearsostenible.es

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 business competitiveness, 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.

The Balearic ICZM Project

- **Objective:**

to implement science-based ICZM in the Balearics with the overall goal of achieving sustainability in the coastal zone.

- **Project Structure:**

- Gaps in knowledge and research priorities needed for ICZM implementation
  . 30 ongoing specific research projects
- Multidisciplinary needs for ICZM implementation: horizontal projects, two ex:
  . Coastal Zone Characterization
  . Sustainability Indicators, 43 with CES.
- Identify and develop tools needed for ICZM implementation
  . GIS and database system
  . Coastal Observatory / Technological platform (data)
- To advance on transfer of knowledge (from science to society and from society to science, two sided)

Indicators: are essential for assessing and monitoring both

- the state and evolution of the coastal zone
- the progress of ICZM initiatives
- Study future scenarios

www.costabalearsostenible.es

RESEARCH → **TECHNOLOGICAL DEVELOPMENT** → **INNOVATION OF TECHNOLOGY AND SERVICES**

1.Disciplinary Research

1.1 Environment

1.2 Society, economy and culture

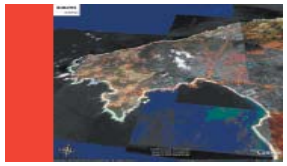
1.3 Governance

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

Indicators project: for Assessing and Monitoring ICZM

The objective of this project is to develop a proposal for a list of indicators to monitor and assess ICZM in the Balearic Islands.

- This has been achieved through
  - a full evaluation of international scientific standards and protocols for indicator development and methodologies
  - a participatory, cooperative process to tailor such standards to the environmental and socio-economic reality of the Balearic Islands though a 2 years project with CES Commissions (Environment and Social Council from Balearic Islands
  - A final recommendation *'Dictamen'* to the Balearic Government, unanimously approved on December 14, 2007.
  - Next step: action from the government to the parliament to enforce a new law and a regulation for sound ICZM indicators monitoring.

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change scenario. Climate change is just one element of global change
2. The Balearic Islands case study: present, historical evolution, a privileged environment, unique habitats and well established tourist destination. Interest but limitations of habitat conservation approach. Need of a global perspective
3. General frame, basic underlying principles and challenges. Sustainability. Yes, but ... hard or soft ?. And how ?
4. The new role of science in XXI century, a new path for knowledge based decision making. IMEDEA: some examples of coastal research and technology/know how transfer
5. ICZM: a well established international process to reach multidisciplinary, knowledge based sustainability in the coastal zone. Specific case for islands: limited territory, carrying capacity issues (resources, pressures and infrastructures)
6. The ICZM Balearic Islands initiative (Government/IMEDEA): a starting point. Project goals and structure, 35 initiatives. One example Indicators, science and society (CES)
7. The future: real and measurable science based Sustainability, ICZM, Coastal Observing and Forecasting Systems, Guidelines for sustainable tourism that need to be applicable, applied and enforced (preserve environment and residents culture, guarantee business competitiveness)

ICTS - SOCIB: Balearic Islands Coastal Observing and Forecasting System

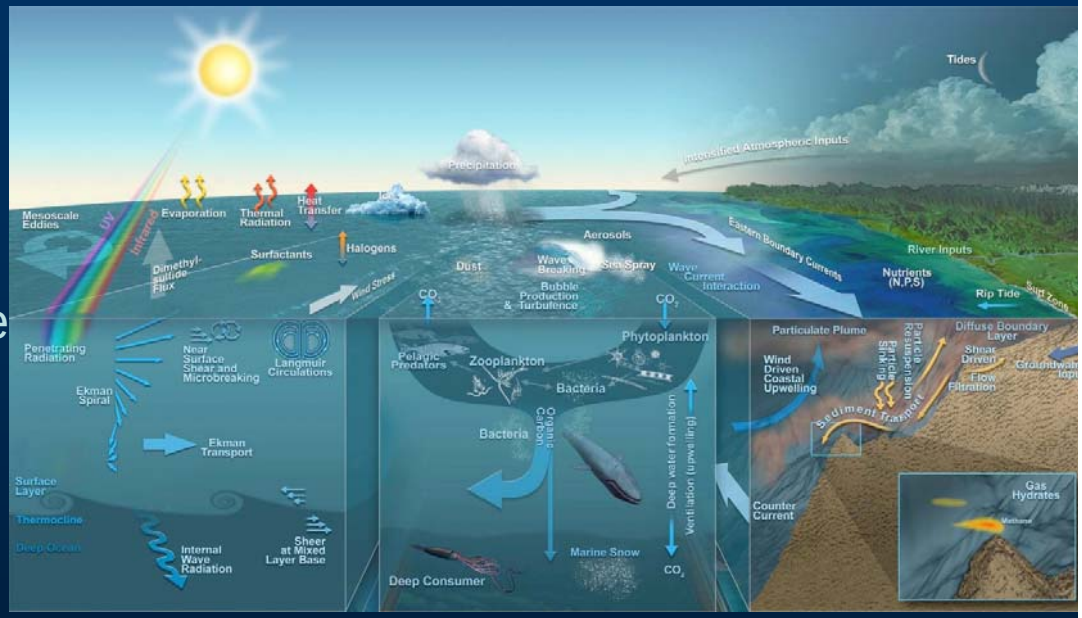
A New Approach to Marine and Coastal Research

New technologies, Three-dimensional observations in quasi real time, Forecasting numerical models and Data assimilation for ...

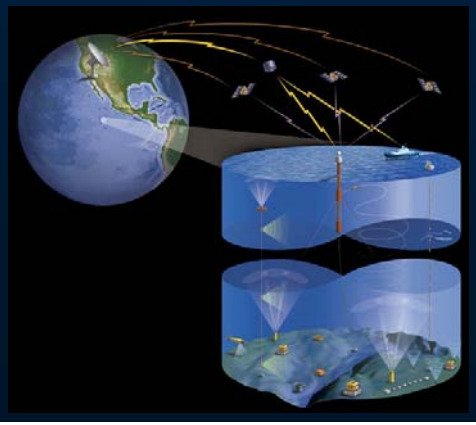
A quantitative major jump, advanceme of scientific knowledge and ...

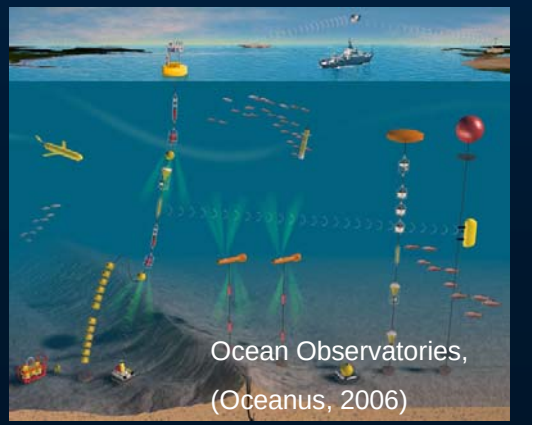
The development of a new form of Integrated Coastal Zone Management, based on recent scientific and technological achievements,

on a global change context (where climate change is one of the most important, but not the only one...), and following sustainability principles



OOI, Regional Scale Nodes (Delaney, 2008)





Ocean Observatories, (Oceanus, 2006)

ICTS - SOCIB: Balearic Islands Coastal Observing and Forecasting System

International Framework

Europe:

- Background: IFREMER, Liverpool Bay Marine Lab among other facilities, and projects such as: ESEOO, MOON, ICZM_Balearic Islands, MERSEA, ECOOP, SESAME
- Near future: GMES ESA-EU initiative, MyOCEAN project, etc.

EEUU

- OOI (NSF research) - http://www.joiscience.org/ocean_observing

  Collaborating to acquire research observing systems 10x what we have had. Requires making choices, consensus, priorities. Funding will go where the science interest is.
- IOOS (inter-agency operational)

  Creating an operational observing system. Research supporting operations. Will support OOI and all basic ocean research. IOOS provides larger scale, long-term setting for OOI observatories. OOI provides process based research in a region leading to better IOOS observing schemes. OOI provides new technology and test bed for IOOS. Coordination: http://www.ocean.us/

Specifically Balearic Islands:

- ICZM_Balearic Islands, start of PLATLIB/SOCIB: December 2005
- Pilot Observing and Forecasting System - 2007 http://www.imedea.uib.es/goifis/OPERACIONAL/

Balearic Islands Pilot Observing and Forecasting System - 2007

http://www.imedea.uib.es/goifis/OPERACIONAL/EN/

I·M·E·D·E·A Institut Mediterrani d'Estudis Avançats

RESEARCH & TECHNOLOGY FOR SICENCE BASED OPERATIONAL OCEANOGRAPHY

START | GOIFIS | PUBLICATIONS | PROJECTS | DISSEMINATION | WIKI | STAFF | LINKS

OPERATIONAL RESOURCES

Forecasting

- **Western Mediterranean**
  - Currents - ESEOO
  - Currents - MFS
- **Balearic Sea**
  - High Resolution Model
- **Long Waves**
  - Rissagues
- **Coasts and Beaches**
  - Waves and Currents
- **Oil Spill Forecasting**
  - Forecasting data(GNOME)
- **Genetic Algorithms**

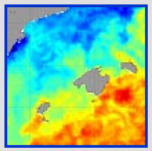
Observation

- **Satellites**
  - Sea Surface Temp. (SST)
  - Altimetry
- **Gliders**
  - Current Status
  - Mission Archive
- **Moorings**
  - Received Data
  - Location
- **Rapid Envir. Assessm.**
  - CTD Profiles
  - Cruises
- **Cameras - Beaches**
  - Data
  - Images

Data Management

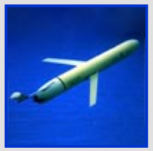
- **GIS + Database**
  - Cartographic Viewer
  - Metadata Search
  - Google Earth Data

Oceanographic Observation, Forecasting and Management

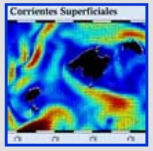

SATELLITES


MOORINGS


R.E.A


GLIDERS


CAMERAS



FORECASTING


OIL SPILLS


GIS

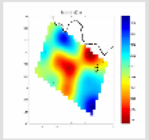
New Marine Technologies


AUV - CORMORAN
Autonomous underwater vehocle for small scale variability monitoring of coastal waters.


ROV - ALBATROS (Albatros Marine Technologies)
Simple, remotely operated underwater vehicle for underwater observation.


DRIFTER - ALBATROS
Lagrangian drift buoy that records its GPS position and transmits the filtered data via the GSM mobile phone network.

NEWS

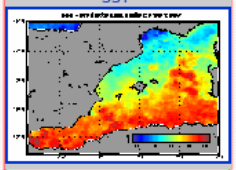


- European Gliding Observatory (EGO), 2nd Workshop (25-26 october 2007) and International Glider School (29 october, november 2nd) at IMEDEA/Calanova marine facilities, Mallorca (Spain).

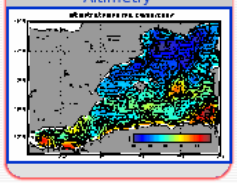
- The Status of European Coastal Observing and Forecasting Systems, International workshop organised and sponsored by NERC (UK), 22nd to 24th October 2007, Hotel Formentor, Mallorca (Spain)

REAL TIME DATA

SST



Altimetry



Enderrocat Mooring
Location

Air Temp.	:22.8ºC
Atm. Pres.	:1016.7hPa
Sea Temp.	:23.5ºC
Wind Dir.	:193.4º
Wind Speed	:4.2m/s
Wave Height	:0.4m

Date: 5/10/2007 15: 0
Connection via **WAP**

Glider MAYA
Location

Water Temp	:xx ºC
Salinity	:xx psu
Date	

ARGO Float IMEDEA
Location

ICTS - SOCIB: Balearic Islands Coastal Observing and Forecasting System

General objective: to develop an Observing and Forecasting System, a scientific and technological infrastructure which will be open to international access and collaboration (subject to peer review) to:

- Respond to the major scientific and technological challenges of the next decade as well as to the strategic needs of society related to new observing and forecasting operational oceanography capabilities in the coastal ocean in the context of global change.
- Consolidate, support and enhance excellence in research and technological development in operational oceanography in the Balearic Islands.
- Consolidate the position of the Balearic Islands as an internationally recognised centre of excellence for marine and coastal research for addressing sustainability challenges and progressing towards science based Integrated Coastal Zone Management

ICTS - SOCIB: Balearic Islands Coastal Observing and Forecasting System

To address this general objective, five different specific objectives have been identified:

1. Scientific objectives
2. Technological objectives
3. Strategic objectives (in response to society needs)
4. Outreach and Education
5. Training of scientist, students, engineers and technicians

ICTS - SOCIB: Balearic Islands Coastal Observing and Forecasting System

The basic components of SOCIB

1. **Observational sub-system**
   - in situ moored and drifting sensing systems
   - Coastal and offshore instrumented installations
   - Remote sensing from satellites
   - Shore-based remote sensing with radar

2. **Forecasting sub-system**
   - Ocean currents and wave at different scales
   - Ecosystem variability
   - Data assimilation and relevant analysis at overlapping spatial and temporal scales

3. **Data management and dissemination**
   - The latest in data server technology and internationally accepted protocols
   - Quality control
   - World Wide Web, open source
   - Effective data archiving, delivery and communication

4. **Outreach and education**
   - Focus on practical applications
   - Identify and assess needs and data preferences
   - Obtain user feedback
   - Targeting undergraduate and graduate student/teacher audience as end-users

Outline / Logical Framework

1. The coastal zone, complexity, problems and threats in a global change environment
2. The Balearic Islands case study
3. General frame, basic underlying principles and challenges. Sustainability. Yes, but ... hard or soft ?. And how ?
4. The new role of science in XXI century
5. ICZM: Integrated Coastal Zone Management
6. The ICZM Balearic Islands initiative (Government/IMEDEA)
7. The future: real and measurable science based Sustainability thought a new process of ICZM

Conclusions and Suggestions

- ICZM in the Balearic Islands. Ideal conditions. Know how and social society awareness. Take into consideration islands character, discuss limits to growth, thresholds for indicators, carrying capacity issues in a global change environment and accepting basic underlying principles such as sustainability, ecosystem based management, etc.

- Coastal observing and forecasting system – new technologies, monitoring and forecasting capabilities: baseline data, know how as a basis for ICZM.

- Science and society: using state of the art scientific results, involve stakeholders to guarantee real sustainability (in Ibiza, mostly, sustainable tourism). Establish differences between tourism growth and residential (2nd residences) construction growth.

- Science and ethical values “Science sans conscience n’est que ruine de l’ame” (Rabelais).

Conclusions and Suggestions

- Develop a methodological framework and model approach to habitat preservation that incorporates ecosystem-based, integrated management
- Develop common convergent strategies, definitions and legislation for habitat preservation and restoration
- Promote research, technological innovation and development for monitoring coastal habitats
- Take management plans beyond the “paper park” phase and into the implementation phases, combining top-down and bottom-up initiatives
- Incorporate long term financing and enforcement strategies into management plans
- Recognize the important role of sustainable tourism as a self-financing mechanism for habitat preservation
- Involve stakeholders and decision-makers at all stages of management
- Recognize that coastal habitat preservation 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 knowledge based ICZM in a global change environment.
- This implies a change in our present model of society.

Conclusions and Suggestions

- Are we all ready for that?
- Can we afford not to take immediate action?

Sustainable development:

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


Moltes gràcies