Bringing Public Perceptions in the Integrated Assessment of Coastal Systems

Case studies on beach tourism and coastal erosion in the Western Mediterranean

Doctorate Dissertation

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Agraïments

Estem a primers dels 2008. Abans de tancar aquesta etapa i proposar-me nous reptes no puc deixar de mirar enrera i recordar l'immens suport que he rebut de tantíssimes persones. Entre tots heu contribuit a donar forma a aquest projecte i aquestes línies volen fer-vos arribar el meu profund agraïment i la gran satisfacció em queda de què m'hagueu acompanyat durant aquesta llarga travessia.

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Abstract

Coasts are some of the most valuable ecosystems on Earth. However, not only coasts hold some of the most biodiverse and productive landscapes but at the same time they are some of the most coveted by humans. Current trends on demographic growth and urbanization indicate that in the near future the anthropic pressure in coastal areas is very likely to intensify. Climate change adds new risks and uncertainties to the dynamics of coastal systems and their management.

The management of most Mediterranean regions has been marked by strongly sectorial and fragmented management visions and practices, together with lack of coordination between the responsible administrations and very little public engagement. As a result, mismanagement practices have often derived in a number of ecosystem failures –such as the disappearance of precious beaches- as well as a number of social conflicts. Business as usual assessment methods have proved insufficient to deal with the persistent social-ecological problems of coastal management. This dissertation argues that this has been so because the predominant assumptions, tools and methods used so far have mostly been based on reductionist approaches which are too expert-knowledge dependent and are driven mostly or only by economic criteria. Furthermore, the assessment of problems and risks of coasts have mostly focused on the physical environment, thus avoiding an in-depth understanding of the whole social system dynamics, and leading to the implementation of engineering solutions.

The present dissertation applies complex system thinking and Integrated Assessment (IA) to the field of coastal management. It emphasises the social perspective and analyses the added value of integrating public perceptions into the processes of assessing coastal socio-ecological systems. It argues that the Integrated Assessment of coastal systems requires moving away from one-dimensional evaluation methods and to develop innovative assessment approaches capable to understand coasts in as highly complex, multidimensional dynamic systems and explicitly acknowledge their inherent degree of uncertainty.

Three case studies have been carried out regarding the assessment of beach quality and coastal erosion. The first one was developed in the area of “Costa Brava”, North-East Spain, a tourist hotspot. The case study addressed the lack of bottom-up approaches to assess beach quality. From this situation the case study set out to include beach-users’ perceptions in order to adapt beach management to local contexts. The methods, which were applied on six beaches, involved a survey of 700 beach-users and a set of in-depth interviews to local stakeholders. The results showed that urban beaches attract different types of beach users than semi-natural beaches, although both groups were highly satisfied with their recreational experience. The main factors influencing the selection of beaches are cleanliness and landscape in both cases and tranquillity is a key factor in semi-natural beaches. The preferences and perceptions appear to be not only influenced by the specific characteristics of each beach such as physical characteristics, environmental variables, facilities, services and landscape but also by the beach-user profile. Beach users’ more attached to the territory, like residents and Catalan people, tend to be more demanding with values that relate to the naturalness of beach, environmental degradation and the provision of facilities. Foreign tourism, however tend to be highly satisfied with urban beaches and do not feel much disturbed by overcrowding. These results point that public perception surveys can be useful tools for coastal managers. They can provide a systematic way to select priorities that are recognised by different segments of society, while at the same time they can help to enhance and protect the ecological functions and biodiversity of coastal systems. Coastal systems should be specifically managed in an adaptive fashion considering the particularities of each beach and avoiding homogenising practices. In this way, conservation strategies could be prioritised in natural environments with recognised natural values or with higher potential for ecological recovery. While in the other hand, ‘hard’ interventionist approaches oriented to enhance recreational beach uses could be pursued in those intensively used beaches, normally located along urban water fronts.

The second case deals with coastal erosion. It was carried out in Sitges (Catalonia, Spain) and analyzed a conflict that arose at the beginning of the year 2000 as a reaction to a proposal for

intervention to cope with coastal erosion. The research explored the elements that make it difficult to give integrated responses to coastal erosion. In this case, the research of public perception was based on in-depth interviews. Issues related to the very nature of the coastal systems – complexity and uncertainty of coastal erosion- were addressed. Furthermore, the work explored the drawbacks of the existing assessment approaches and the policy framework on coastal protection in Spain. The main conclusion point out that the Spanish institutional framework has traditionally entailed *rigidification* strategies that respond to a technocratic paradigm on which is based coastal Spanish policy. At the same time, these practices have sheltered the existing assessment methods that do not satisfy social needs and may create other environmental problems as they do not favour neither public participation nor interdisciplinarity in such assessment processes. The case study showed that the technical knowledge does not fit enough to find robust solutions that satisfy both social needs and technical requirements. The complexity of coastal erosion risks demands to move beyond the existing assessment frameworks where the role of the experts need to be reformulated. This process should open up the debate to other disciplines and knowledge which may bring more adaptive alternatives more in coherence with natural dynamics of coastal systems.

The third case was carried out in the Lido of Séte (France) and explored the suitability of applying participatory MultiCriteria Analysis (MCA) to assess different strategies to cope with coastal erosion risks. It aimed at improving the integration of diverse sources of knowledge and expertise as well as values so as to enhance the social-ecological robustness of the processes that lead to the definition of relevant policy options to deal with those risks. The methods used involved the Social Multicriteria Evaluation tool of Naiade combined with in-depths interviews and focus groups. Results showed that more adaptive alternatives such as “retreating the shoreline” were preferred by selected stakeholders to those corresponding to ”protecting the shoreline” and the Business as Usual proposals traditionally put forward by experts and policy makers on these matters. Participative MCA contributed to represent coastal multidimensionality, elicit and integrate different views and preferences, facilitated knowledge exchange, and allowed highlighting existing uncertainties.

The dissertation concludes by drawing a methodological proposal on how to bring social perspective into the assessment of coastal systems. A 3-step procedure is put forward which includes the following: i) a baseline analysis of the values and perceptions of the society under study; ii) institutional analysis and maping out the stakeholders’ relationships in order to identify barriers and opportunities to implementing integrated strategies and, iii) a public participation within the assessment process. We argue that all this in-depth knowledge on the functioning of the social system needs to be combined with an in-depth understanding of the dynamics of the ecological system under consideration.

New directions of future research should explore the opportunities and drawbacks to implement new institutional framework more adaptive to changing environments. Further research on strategic planning should be performed to provide cohesion to the existing but disconnected plans. Emerging socioeconomic models, such as new types of alternative tourism ought to be ex-ante evaluated in order to appraise their future implications and risks. Finally, innovative and creative management practices (e.g. deconstruction, managed realignment) should be more in-depth explored and tested.

Preface

I have had a highly intense relationship with the coast and the sea ever since a very young age: long stays at the seaside in Minorca led me to coexist alongside it in a natural and spontaneous manner; and I now live in the coastal city of Barcelona, which may be eminently urban, but has been historically influenced by its maritime tradition. Other than the Mediterranean Sea, I also had the opportunity to get to know the Mexican shores of the Pacific Ocean while I was studying for some time at Guadalajara University. Through these past experiences I have experienced the coast from the perspective of a sailor, a diver, a beach user, a resident, a tourist and as an environmental scientist. This background led me to orientate my Doctorate in Environmental Science taken at the Autonomous University of Barcelona towards the study of environmental problems affecting coastal areas and in particular looking at them from a highly social and integrative perspective.

From the very beginning, I have understood the thesis to be a learning process both in personal and professional terms, in order to enrich myself with the experiences of other people and to guide my professional career. I cannot deny that this provided me with a good opportunity to frequent my beloved coast. This work is therefore the culmination of an important stage of my life.

Generally speaking, my interest has been in dealing with the environmental complexities that societies have to cope with within the framework of social, economic and environmental sustainability. In my case, this concern is particularly intense when affecting coastal environments, especially considering the evolution that the Catalan coast has experienced in recent decades, and which I have witnessed through personal experience.

The opportunity to get things started was provided by the EU project EUROSION project in April 2002 and, afterwards, other projects have contributed to the thesis that I am presenting here.

This thesis is principally based on the results and insights obtained by the following projects: EUROSION (2002-2004), MESSINA (2004-2006) and MATISSE (2006-2008), all of which were carried out by the Institute of Environmental Science and Technology at the Autonomous University of Barcelona. In parallel, a close collaboration with the Laboratory of Social Studies for Civil Engineering at the Civil Engineering School of the Technical University of Catalonia gave me the opportunity to participate in the MEVAPLAYA (2005-2007) project, which also constituted an important contribution to this research.

I am aware that the scope of these projects covers a wide range of topics and diverse information. However, the encompassing and overaching theme is that of the integrated assessment and management of environmental risks and problems affecting coastal systems.

Elisabet Roca

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Acronyms

BMR Barcelona Metropolitan Region

DEFRA Department of Environmental, Food and Rural Affairs

EEA Environmental European Agency

EIA Environmental Impact Assessment

EMAS EU Eco-Management and Audit Scheme

FEEE Foundation for Environmental Education in Europe

GNP Gross National Product

IA Integrated Assessment

ICTE Instituto para la Calidad Turística Española

ICZM Integrated Coastal Zone Management

INRA Institut National de la Recherche Agronomique

IPCC Integov ernmental Panel of Climate Change

ISA Integrated Sustainability Assessment

MCA Multicriteria Analysis

PGOP Plan de Ordenación General de la Playa

PMTD Publi Maritime Terrestrial Domain

UAB Universitat Autònoma de Barcelona

UNEP (United Nations Environmental Programme

UPC Universitat Politècnica de Catalunya

WTO World Tourism Organisation

ZNIEFF Zone Naturelle d'Intérêt Ecologique, Floristique et Faunistique

Part I

Goals, theoretical framework and methods

Chapter 1
Introduction

1.1 The problem

Coasts are widely recognised as being some of the most valuable ecosystems on Earth in terms of biodiversity and productivity, but at the same time, it is one of the most coveted by humans (e.g. huge infrastructures, tourist resorts, residential areas, industries). The increasing urbanization that coastal areas have been experiencing in recent decades represents major pressure on the maintenance of their socio-ecological functions, such as protection, provision of biological and genetic resources, recreational, cultural and aesthetic values.

The most recent European report on the state of the coast warns about the increasing human pressure on coastal areas, which is particularly high in the Mediterranean basin. The population of the Mediterranean basin is increasing much faster than that of inland areas (EEA, 2006). According to the Blue plan (2005), under a baseline scenario, some 20 million additional urban dwellers and 130 million additional tourists are expected by 2025, the high concentration of roads, ports, airports, industrial and power facilities will intensify, half of the area will have some form of artificial land cover, and coastal pollution will continue to have a serious impact.

Furthermore, if we look to the future, according to the 4th IPCC assessment report (2007) with a high degree of likelihood it can be projected that coasts will be exposed to increasing risks such as coastal erosion due to climate change and the sea-level rise. This will add to the complexity, uncertainty, intensity and prevalence of coastal impacts in a variety of ways. Low-lying areas such as deltas, estuaries, coastal plains and barrier coasts are especially vulnerable to suffering the consequences of climate change (IPCC 2001, 2006; (Zhang, Douglas, & Leatherman, 2004).

These trends show that in the near future the pressure of uses in coastal areas is very likely to continue or even intensify, and this will require the development of assessment and management instruments capable of dealing with them. However, although there is a long history of coastal management policies, to

date these have not been implemented in an integrated manner (EEA, 2006). The management of most Mediterranean regions has been marked by a strongly sectorial and fragmented vision, a major lack of coordination between the responsible administrations and very little public participation. Moreover, policies based on "nature control" strategies have been implemented through measures for rigidifying and fixing the coastline. In 2001, about 7,600 kilometres "benefited" from coastal erosion protection schemes (performed by a wide range of hard and soft engineering techniques), and 80% of some schemes have been in place for more than 15 years (EC, 2004). In many cases, this has led to catastrophic consequences for the resilience capacity of coastlines to respond to the stresses and shocks of environmental change and perform their socio-ecological functions (Turner, 2000).

Given these circumstances, it is not fully known how the whole coastal system might evolve in the near future in response to the rise in sea level, extreme events and human demographic pressure, despite the fact that some 'expected surprises' may occur. Among those, the total disappearance of some famous beaches in the Mediterranean basin can be foreseen (Adger, 2005). All of these situations have become challenging concerns for the ICZM (Integrated Coastal Zone Management) approach which is seeking to reduce coastal vulnerability by increasing its resilience (EEA, 2006).

Within this context, the traditionally prevalent assessment methods used in coastal management, which mainly rely on reductionist approaches, are "expert"-knowledge dependent and mainly focus on the physical environment and the implementation of engineering solutions, have resulted inefficient (Turner, 2000; EC 2004, Tàbara *et al*. 2007, Hinkel *et al*. 2007).

This dissertation starts off with acknowledging this situation which requires to move away from single-issue methods and to launch innovative assessment approaches, tools and methods capable to understand coastal systems in its highly complexity, multidimensionality and significant degree of uncertainty. We propose the development and integration of a systemic perspective in coastal management in order to work with natural dynamics rather than against them. Such new methods and tools should be able to foster strategies more adaptive and resilient to changing environments rather than aiming at controlling nature with all the high economic, social and ecological costs that current policy implies. In particular, this work deals with perceptions and different kind of knowledge (scientific, popular, etc) that can be integrated in such assessment processes in order to help provide a more socially and ecologically robust

framing of the problems at stake, enrich the creative production of alternative and strategies and improve the transparency of coastal decision-making. Ultimately, this approach may increase the resilience of coastal systems and make it easier to cope with and adapt to existing or new pressures.

1.2 Objective and research questions

General Objective

This thesis aims to apply the complex system thinking and the Integrated Assessment (IA) approach to the field of coastal management in order to improve the processes related to the assessment and management of environmental problems generated by risks of coastal erosion and beach tourism. In this broad field of research, we particularly focus on the socials dimensions. Our assumption is that bringing together different sources of knowledge and appraising public perceptions can enrich the way these problems are framed in the scientific and policy arenas. Such integration and participation can contribute to make more creative and transparent processes of generating and evaluating alternative solutions to make coasts more adaptable and resilient to changing environments. Therefore, the objectives of the present study are not only of a substantial but especially of a methodological nature.

On this basis, the main objective is to **analyse the contributions and added value of integrating public perceptions into the processes of assessing complex environmental systems in coastal areas.** This objective stems from the core research questions of this thesis:

To what extent can the integration of public perceptions in the processes of assessing coastal systems improve their management?

The substantive and more specific objectives regarding the main research question are formulated on the basis of several case studies which are developed at local level. The first one, in the Costa Brava (Spain), deals with beach quality in high tourist environments. The other two cases address the topic of coastal erosion. One of them was carried out in the seafront of Sitges (Spain) and the other in the Lido de Séte (France). Next, we present the specific objective addressed through theses cases:

The case study of beach tourism in the Costa Brava

Most beach quality assessment tools either address single dimensions (e.g. health, water quality, safety issues etc) or, despite adopting a wider-scoped

approach, do not include aspects related to beach users' perceptions in their definition of the quality of beaches (Micallef *et al*. 2004; Nelson, 2002). Normally, they give poor consideration to the variability of beach systems and do not consider the beach itself hence applying the same quality standards to different types of beaches. Therefore, we aim to analyse:

How can public perceptions contribute to improve beach quality management and what are their managerial implications?

However, beach users' relationships with the environment are complex and their perceptions might be affected either by environmental quality and/or individual characteristics (Pendleton *et al*. 2001). It was therefore considered relevant for the analysis to investigate the variability of public perceptions concerning the type of beach (in terms of nature conservation/development) and concerning individual socio-economic characteristics. So, the following question was addressed:

What are the determinants that influence perceptions of beach users'?

The case study of coastal erosion in Sitges

Prevailing assessment methods to cope with coastal erosion have resulted in the predominance of reductionist, fragmented and technocratic engineering solutions to cope with a constantly changing system (Turner, 2000; EC 2004, Tàbara *et al*. 2007, Hinkel *et al*. 2007). As a result, mismanagement practices can be implemented which may entail social conflicts or create new and more environmental problems. Moreover, this situation is aggravated by different causes such as institutional fragmentation, the sector-by-sector approach, a lack of political will, a lack of cooperation, decentralized spatial planning, a lack of sea-land integration, fragmented scientific knowledge, deficient accessibility to shared information (see Cicin-sain, 1998).

Through the case of Sitges, the aim is to analyse a conflict related with coastal erosion in Spain. In particular, **it explores the main elements that contribute to the controversy and affect the decision-making process that seeks to deal with the problem of coastal erosion**. In order to reach this objective, the following questions are addressed:

What are the drawbacks and the potential for change and improvement of the main assessment methods used for the management of coastal erosion in Spain?

How does the Spanish institutional context conflicts with the process of creating and assessing robust alternatives to deal with coastal erosion?

The case study of coastal erosion in the Lido de Séte

Perceptions that understand coastal systems to be near equilibrium and static are less resilient than those that understand the continuous changes and uncertainties that characterise them (Berkes *et al*. 2003). Hence, coastal erosion is more likely to be tackled properly by approaches that deal with it from a dynamic understanding of human-nature relationships. Along these lines, the IPCC (2001) recognised that the diversity of strategies to cope with coastal erosion should open and consider, apart from "coastal protection", other alternatives such as "accommodation" and "retreatment", which are more dynamic in nature. From this starting assumption we understand that the inclusion of a wide variety of perceptions representing diverse worldviews through participation in the assessment process is likely to improve the sustainability of the strategies for the management of complex environmental coastal systems.

Through the case of Lido de Séte is aimed to **analyse the suitability of applying MultiCriteria Analysis (MCA) by means of a participatory process in order to assess different strategies to cope with coastal erosion risks** in a specific location on the Mediterranean coast.

Specifically, it is intended to shed some light on the way that the integration of diversity of perspectives and values in the assessment process – structured in a MCA fashion - by improving the framing of the problem, can enhance the representation of complexity and multidimensionality of the issues at stake and help in dealing with uncertainty.

In order to reach the objective, the following questions addressed:

How does the integration of social perceptions and values contribute to the representation of the complexity and multidimensionality and to the fine-tuning of the solutions to coastal erosion risks?

To what extent is the application of MCA combined with participation suitable for dealing with uncertainties of coastal erosion, especially when quantitative information is missing and decisions should be urgently taken?

Having established the main goals of the thesis, the following section offers a description of the structure and information included and the most relevant publications that have resulted from it.

1.3 Structure of the dissertation and related publications

This thesis is the result of a long process. It comes from the experience obtained from the participation in a set of research projects over 5 years at the Institute of Environmental Science and Technology (UAB) and in close cooperation with the School of Civil Engineering (UPC). In particular, my involvement in 3 European and 1 National project has generated a certain scientific production that is partly compiled in this monograph. Next, the main structure of the thesis is presented by highlighting the main publications sourced in each chapter.

The thesis is organised into 4 parts and divided into 9 chapters. The first, *goals, theoretical framework and methods*, provides an introduction to the problem we are dealing with and to the theoretical and methodological context that supports the study.

Specifically, the first chapter presents the objectives, research questions and a brief introduction to the scope of the work done.

The second chapter offers a definition of the coast in terms of the complex system paradigm as well as a description of its implicit characteristics. Moreover, an explanation is given of the functions and values that coastal systems provide. Finally, a brief historical background to the ICZM concept is provided, understood as the origin of an integrative discourse that has evolved over time.

The third chapter is mainly methodological. It begins by providing a review of the existing coastal management assessment frameworks. Based on the literature reviewed, the background, the definition and the desired characteristics and challenges of Integrated Assessment frameworks are explained. Part of the content of this chapter has been published in the following paper which was based on the experience gained by MATISSE[1] project.

[1] The MATISSE project, Methods and Tools for Integrated Sustainability Assessment (2006-2008) is intended to develop, advance and promote Integrated Sustainability Assessment (ISA) both conceptually and methodologically as a tool at the interface between policy, society and science with the (potential) capacity to integrate sustainability better in the policy process and support the emergence of sustainability-based governance (www.matisse-project.net)

Tàbara, J. D., Roca, E., Madrid, C., Valkering, P, Wallman,P, Weaver, P. (2007). Participatory Integrated Sustainability Assessment of Water Systems. Lessons from the Ebro River Basin. *International Journal of Sustainable Development. (in-press)*.

Finally, this chapter provides a description of the social dimension addressed by the thesis and the social science methods employed. However, it should be noted that detailed methodological descriptions are provided for each case study due to their diversity and autonomous nature.

Part II, *case study on beach tourism*, and *Part III*, *case studies on the coastal erosion risks*, present the three case studies on which this research is based. Both beach tourism and coastal erosion are two of the main sources of environmental problems faced by Western Mediterranean beaches. Specifically, *Part II* focuses on the case studies dealing with beach tourism and its impact on beach quality, while *Part III* addresses the problem of assessing the risks of coastal erosion. These case studies are based on different research projects: EUROSION, MESSINA and MEVAPLAYA. They are not presented in chronological order but in a way that shows how the research progressed.

In particular, Part II is organised into two chapters. Chapter 4 provides an introduction to the characteristics of so-called 3s tourism and its impacts on beach quality. Then, a review of the existing tools used to manage beach quality and the background to public perception studies for beach management are given. This presents the state of the art of the existing assessment process in relation to beach quality in areas such as those of the Mediterranean basin, characterised by a high presence of mass tourism. Chapter 5 is directly sourced by the MEVAPlaya Project[2]. This research is based on a very early phase of an integrated assessment framework as it principally aims to examine the social universe of the beach users in a specific tourist area (southern Costa Brava) and to analyse beach users' perceptions in terms of the elements that contribute to the quality of the beach in accordance with the type of beach and beach user's socioeconomic determinants. Some of the results of this chapter have been published in:

Roca, E. Villares, M. Public perception for evaluating beach quality in urban and semi-natural environments. Ocean & Coastal Management (in-press).

2 MeVaPlaya is project financed by the Ministry of Education and Science. It is aimed at developing a quality indicator and a valuation methodology to improve evaluation, management and monitoring of the quality of beaches located in popular tourist areas.

Roca, E. Villares, M. Satisfied vs. demanding. A Cluster Analysis of Beach users' perceptions in the Costa Brava (Spain). Tourism Management (sent).

The Part III includes cases that focus on coastal areas facing a serious risk of beach erosion with a consequent increase in the system's vulnerability. Chapter 6 provides an introduction to the topic of the phenomena of coastal erosion understood as a risk to human societies. Moreover, a classification of the main strategies used to cope with these risks is defined in order to clarify the concepts that are used in the following chapters. Part of this chapter is taken from the Eurosion[3] project and has been partly published in the following publications:

Serra, J., Roca, E. (2004) El litoral, naturalesa domada? In: *L'ordenació del litoral català. Revista Papers*. Núm. 41 Institut d'Estudis Regionals i Metropolitans. Barcelona. Pp.25-40

European Comission (2005) *Vivir con la erosión costera en Europa: Sedimentos y espacio para la sostenibilidad. Resultados del Estudio EUROSION.* Doody, P; Ferreira, M; Lombardo, S; Lucius, I; Midsorp, R; Niesing, H; Salman, A; Smallegange, M; Serra Raventós, J; Roca, E; Fernández Bautista, P; Pérez, C; (Eds.), 40 pag. European Commission. Luxembourg.

Chapter 7 analyses the case of Sitges, which also was developed as part of the EUROSION project. This case analyses the conflicts that arose due to a traditional assessment framework and an institutional context for coastal management in Spain. The outputs obtained were:

Villares, M; Roca, E; Serra, J; Montori, C; (2006). Social Perception as a Tool for Beach Planning: a Case Study on the Catalan Coast. *Journal of Coastal Research*. SI 48. pp. 118-123

Roca, E, Villares, M. Serra. J. Barriers and opportunities to Integrated Assessment of Coastal Erosion risks in Spain (in preparation)

Chapter 8 deals with a case study developed in the Lido de Séte (France) within the framework of the MESSINA[4] project. An academic exercise is made to show the advantages of an integrated evaluation methodology, the Multicriteria

[3] The EUROSION project, Coastal erosion-evaluation of the needs for action (2002-2004), commissioned by the Directorate-General for the Environment following an initiative by the European Parliament, set out to quantify the status, impact and trends of coastal erosion in Europe and assess needs for action on EU, Member State and regional levels. www.eurosion.org.

[4] MESSINA, Managing European Shoreline and Sharing Information on Nearshore Areas (2004-2006) aims to help bridge information gaps by breaking the "knowledge isolation" of some local authorities and institutions in Europe and by raising their managerial and technical capabilities through a mutualisation of the experience accumulated by each of them. More operationally, MESSINA is expected to review concrete examples of economic analysis methodologies applied to shoreline management inside and outside Europe.

Analysis combined with a participative process. The outputs generated from this research were:

Roca, E. Gamboa, G. Serra, J. Komen, A. (2004) Social multicriteria evaluation of alternative solutions for coastal erosion: the case of the Lido de Séte. Report Messina Project. Available at: http://www.interreg-messina.org/publications.htm

Roca, E., Gamboa, G., Tábara, J. D., Assessing the multidimensionality of coastal erosion risks. Public participation and Multicriteria Analysis (MCA) in a Mediterranean Coastal system. Risk Analysis (in-press).

The thesis concludes with Chapter 9, in which the research questions are recalled and contrasted with the results and discussions obtained by the case studies. Finally, a 3-step proposal to include public perception in the integrated assessment of coastal systems is given and the future research lines highlighted.

Chapter 2
Understanding coasts as complex systems

2.1 Providing a systemic definition

In this dissertation, the definition of coast goes beyond the disciplinary definitions based only on either administrative, geographical, biological or geomorphological criteria and understands coasts as something more than transitional areas with intrinsic, unique characteristics. (For an extended discussion on definitions see Barragán, 2004, Miralles, 1999).

Disciplinary definitions in legal texts, tend to conceive a coast as a relatively narrow strip on both sides of the shoreline, whereas the littoral is associated with wider areas, mainly heading inland. In the natural sciences there is not a consensus in the variability of this strip, it depends on the discipline that defines it. For instance, from a biological perspective the coast has a superior limit which is defined by the disappearance of certain terrestrial species and the appearance of maritime species or those which are adapted to the marine influence, and an inferior limit that coincides with the end of the continental platform and the beginning of the continental slope (Ros *et al*., 1996). From the geological perspective, the littoral comprises that area which is affected by a combination of maritime processes and continental influences with a domination of the former or the latter in a different way, alternatively or progressively over time (Serra *et al*., 2004).

In this work the need for providing a broader definition that integrates most of the disciplines and combines both social and ecological dimensions is required due to the holistic perspective on which the research rests. Along this line, one of the key references in Anglo-Saxon literature is Carter (1991) who defined c*oastal zon*e:

> *"as those spaces where territorial environments are influenced by maritime ones and vice-versa. The width of coastal zone is variable and can change in time. It is not possible to limit coastal zone and often, its boundaries are characterised by an environmental gradient or transition. Coastal zone can be characterised by physical, biological and cultural criteria".*

The author offered a multidimensional, flexible in time and adaptive to diverse types of processes.

More recently, Barragán (2003) defined the coast as "a system which is open, complex in structure, very much interrelated, with an extremely dynamic character, not always easy to understand and where the consequences of any human intervention are difficult to foresee". On the same line, the adopted definition for the dissertation is that provided by the Convention on Biological Diversity for defining ecosystems but applied to the coast:

> *"an interacting complex of living communities and the environment, functioning as a largely self sustaining unit, where humans are an integral and fundamental part of it".*

Above definitions are supported by the General System Theory (Von Bertalanffy, 1968) and the contributions of ecologists such as C.S. Holling, R. Margalef and the Odum's brothers. We believe that the systems paradigm applied to the coastal zones provides an holistic overview more adequate to treating environmental problems as it considers the interlinkages between two dimensions–social and ecological–which have been traditionally treated separately.

The ecological part of the coast is formed by what has usually been defined as an ecosystem that includes the abiotic environments and the living organisms sustained. The social dimension of the system can be understood as suggested by Cicin-sain *et al*. (1998) as a system of relationships among i) people who live, use or are otherwise concerned with coastal environment; ii) policy makers and managers whose decisions and actions affect the behaviour of coastal people and iii) the members of the scientific community.

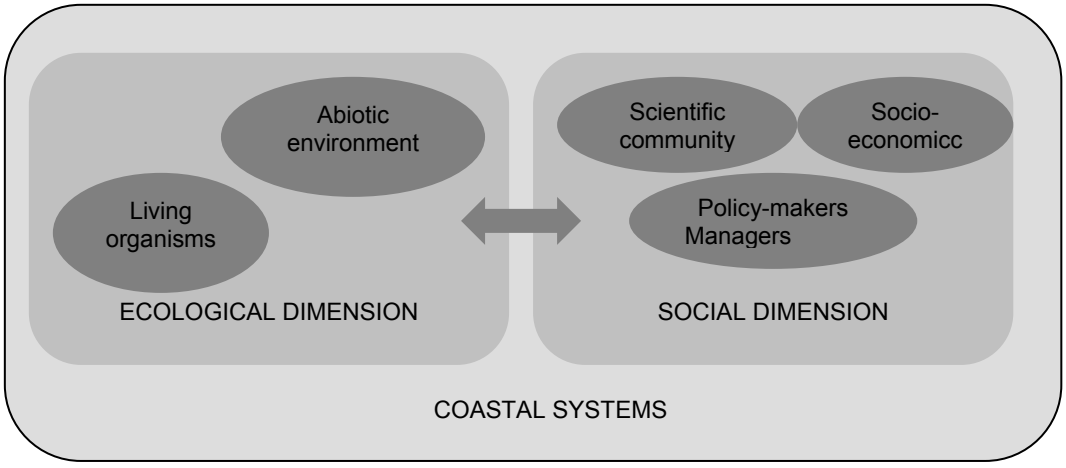

Figure 2.1 Conceptual diagram of coastal systems and their components.

In summary, the coast can be viewed as comprising interconnected systems, an ecological system and a socio-economic system (Woodroffe, 2007). Human and ecological sub-systems are in continuous, dynamic and complex relationship so driving forces that shape them are both biophysical and social. Hence, systemic perspectives will prevail throughout the present study.

In the next section, a detailed description of properties characterising coastal systems that the adopted definition implies is offered.

2.2 Properties of coastal systems

2.2.1 Complexity

General Systems Theory developed in 30s and 40s (Von Betarlanffy, 1968) is concerned with the exploration of whole and wholeness. This perspective has been applied to increasing areas of knowledge and, together with theories of complexity, chaos, catastrophe which have proportioned a set of concepts highly applicable to environmental systems, as is the case of the coast. Weaver (1948) described a complex system as that formed by a number of components, with some more intense relationships among sub-systems and which do not present a linear evolution. Complex systems are large aggregations of many smaller interacting parts, they are multidimensional which means that they are formed by hierarchical structures with different organisational levels which are interconnected and operate on a wide range temporal and spatial scale.

Complex differs from complicated in the fact that systems are not externally controlled. A car engine is complicated as it needs an engineer to manipulate it. On the other hand, the common characteristic of all complex systems is that they are organised without any external organizing principle being applied. They can learn from past history and modify their states accordingly. Complexity relies on the difficulty in understanding cause-effect relationships due to non-linear dynamics, future changes and emergent properties of the system and their capacity of self-organisation. All this implies different degrees of uncertainty when trying to assess and manage these systems (Kay, 1999),

2.2.2 Cross-scaling

The socio-ecological processes that operate in coastal dynamics can occur along multiple time and spatial scales both with regard to the drivers of change and of their effects. Ecosystems services are generated from range of ecological processes, and are supplied to stakeholders through a range of

institutional scales (Hein *et al*. 2006). Furthermore, ecological and human processes often do not fit in a harmonica way (MEA, 2003). In addition, the time dimension has been largely ignored in coastal management.

For example, Figure 2.2 shows different space-time scale of different human activities that cause erosion on the coast. Although the origin of erosion is mainly regional the effects are locals and persist over time. Socio-economic timescales are determined by the response times of humans and their institutions. The tourism is influenced by a geopolitical context at planetary level although its environmental impacts are at local or regional scale. Ecological systems in turn are influenced by geological or biological processes e.g. the lifespan of posidonia, sediment turnover, storm frequency, etc.

Another characteristic is that superior levels in the hierarchy are slower in changes which supply relative stability to the overall system, often based on the dynamic interactive processes on a lesser scale.

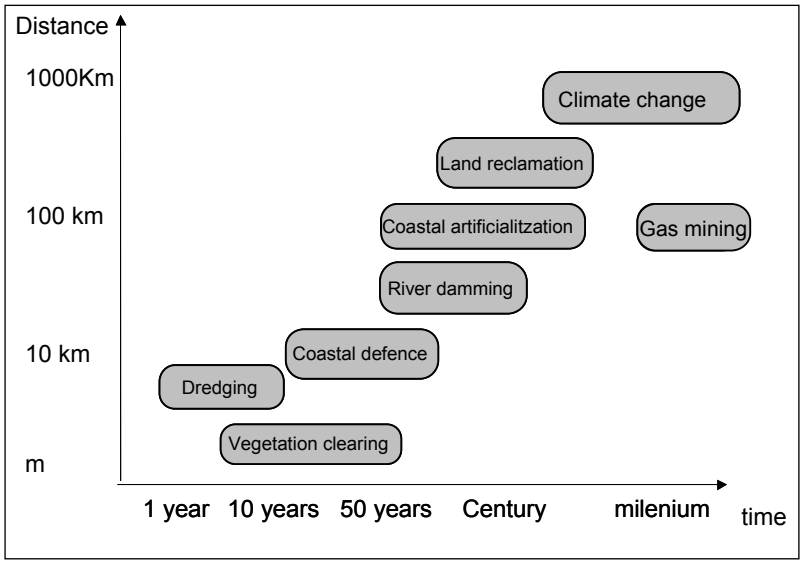

Figure 2.2. Temporal and spatial scale of impacts produced by diverse human activities on the coast. Source: EUROSION 2002.

Thus, many problems encountered by societies in managing natural resources arise because of a mismatch between the scale of management and the scales of the ecological processes being managed (Cumming *et al.*, 2006). Resolving the scale mismatches is a relevant issue in the assessment and management of these systems.

2.2.3 Dynamism and change

The concept of equilibrium has been widely used for defining the erosion/accretion dynamics of a beach (losing/gaining land) and establishes strategies to manage it. However, it is very difficult to talk about equilibrium in any sense of stability or permanence when we are dealing with coastal systems. According to Briggs *et al*. 1997 (in Haslett, 2000), we can identify three types of equilibrium (Figure 2.3):

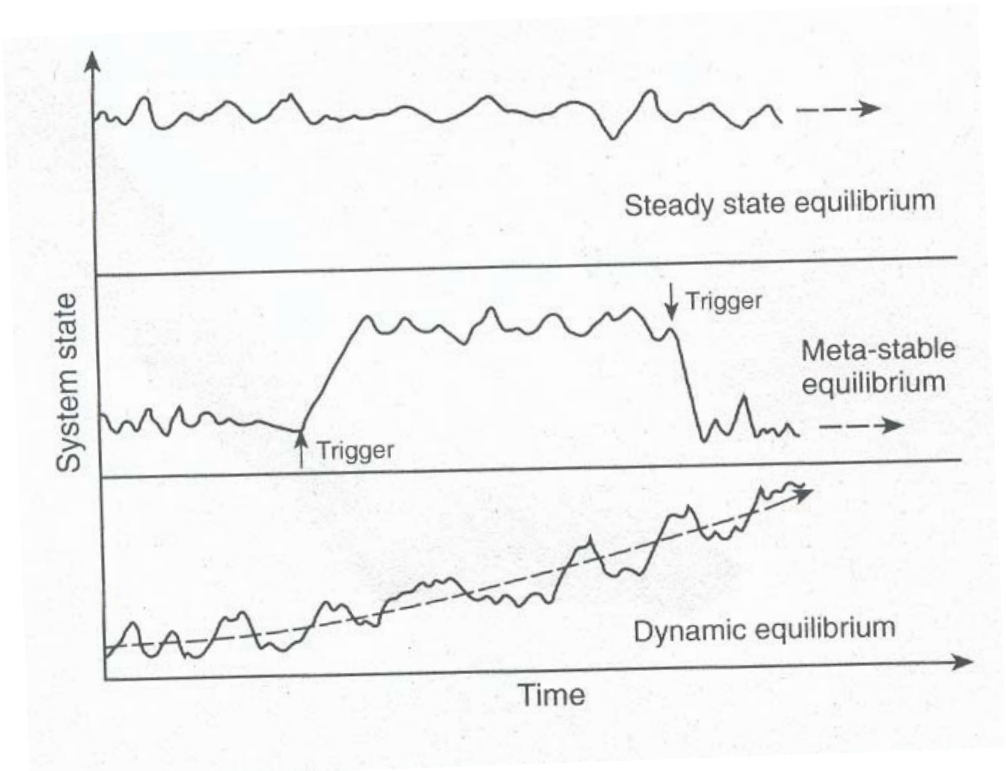

Figure 2.3 Types of equilibrium according to Briggs *et al*. 1997. Source: Haslett, 2000

→ **Stable equilibrium:** when variations in energy and their morphological responses do not vary significantly from the average in the long term.

→ **Meta-stable equilibrium:** when environmental conditions oscillate between two stable states of equilibrium. For example, this is the case of great energetic events such as sea storms or tsunamis which may provide or carry away large volumes of sediment.

→ **Dynamic equilibrium:** when there is a change in the conditions of equilibrium but a gradual one. The morphology of coastal system evolves constantly, therefore the coastline can be said to be affected by a succession of states in unstable equilibrium or, preferably dynamic equilibrium. As an example we can mention the responses of the coast to sea level rise or rather, the

constant state of change in coastal sedimentary systems where periods of accretion alternate with periods of erosion. Therefore, equilibrium becomes a balance between erosive phenomena (loss of sand) and accretion (increase of sand). A disturbance in this equilibrium therefore represents more intensity in one or the other phenomena.

Many conventional theories of environmental management have focussed on maintaining the stable situation of natural resources controlling their natural variability by using technologies. The coastal systems have been treated as something stable and the efforts have been oriented towards stabilizing them. A good example is the strategy of "holding the line" implemented by many governments to cope with coastal erosion.

However, coasts are highly mobile environments from both a biophysical and human perspective. For example, sand surface and distribution of beaches vary throughout the year. Urbanization and industry are constantly increasing in the coastal areas at a much higher rate than in inland areas. In fact, in the Mediterranean basin, demographic migrations towards coastal zones are very relevant (EEA, 2006).

Therefore, dynamism and changing environments should be acknowledged in the management strategies. For example, an understanding of the dynamic nature of the coast is a key factor in the management of coastal erosion.

2.2.4 Emerging properties

In these complex hierarchies, characteristics of larger units are not simple combinations of attributes of smaller units, but can show new collective behaviour (Gibson *et al*. 2000). It means that when components are combined to produce major functional units, new properties which were not present in the lower levels may appear or emerge (Odum 1995). These properties cannot be predicted

For example, the recreational value provided by a certain region (e.g. Costa Brava) emerges at the scale of the landscape, which is the result of natural elements, human transformations and historical processes. Socio-ecological resilience is another emergent property of a system that cannot be predicted or understood simply by examining the system's parts (Berkes et al. 2003) or what is the same "the whole is not the sum of the parts".

2.2.5 Uncertainty and surprises

Interactions in complex systems are rarely linear additive. Complexity, emerging properties, dynamism and the changing nature of coastal systems inherently brings irreducible uncertainties and surprises. This can be clearly exemplified though the risk of sea level rise. Although perspectives about sea level rise are increasingly accurate, their consequences such as impacts on coastal erosion rates and synergies with other processes like the regional change in storminess are still highly uncertain as many variables and relationships are difficult to understand.

The need for addressing uncertainties has been widely acknowledged. A variety of definitions of uncertainty has been provided in association with its different dimensions. For example, the classical typology made by Wynne (1992) distinguishes between: *risk* when the outcomes are known and their probabilities can be quantified; *uncertainty* if the outcomes are known but the distribution of probabilities cannot be identified; *ignorance* is defined as the situation where neither the probability of the potential outcome nor of the outcome itself is known, in other words, “we don’t know what we don’t know”; finally, *indeterminacy* regards the formulation of the problem to be decided, upon is in itself dynamic and subject to social, political or scientific redefinition. In the latter years, the term *ambiguity* has been added and understood as the quality resulting from the social processes of negotiation of different frames, interests and values. That is there are visions of the problem, different perspective which might be based in different values (Dewalf et al. 2004 in Cañellas, 2004).

Another typology is provided by Walker *et al*. (2003) which distinguishes three dimensions of uncertainty: the location of the uncertainty within the model; the level of uncertainty ranging from the deterministic knowledge to total ignorance; and the nature of uncertainty, if it is due to the imperfection of our knowledge which therefore can be improved by performing more research of if it is irreducible because is caused by the inherent variability of the phenomena described.

As underlined by Funtowicz *et al.* (1990, 1993, 1994) decisions on environmental issues are taken under conditions of uncertainty. Thus, exploring the different sources of uncertainties is essential in order to properly assess coastal systems (Janssen et al. 2005, Van der Sluijs, 2004).

2.2.6 Openness

Coastal environments are open, comprising continual, exchanging flows of mass, energy and information (Carter, 1991). Open systems are dissipative structures that self-organize themselves by incrementing the disorder or entropy of the surrounding environment (Terradas, 2001). On the other hand, in a closed system there are no flows that can perturb it and therefore classic physics can forecast its properties.

Changes in open systems are hence produced by the consumption and use of energy, material and information. These changes, which can be irreversible, are socially defined by environmental degradation or contamination (Tàbara, 2003).

2.2.7 Socio-ecological resilience

Another property of coastal systems is their socio-ecological resilience, which refers to the capacity to adapt and recover from shock as they learn from mistakes. It is then a key factor in enhancing their sustainability.

The term resilience comes from the ecology. Holling (1973, 1978) introduced this concept during the seventies in order to understand nonlinear dynamics, such as the process by which ecosystems maintain themselves in the face of perturbations and change. A holistic application of the concept to socio-ecological systems is provided by the Resilience Alliance (www.resalliance.org) (ICSU, 2002) which defines the resilience as:

→ The amount of disturbance a system can absorb and still remain within the same state or domain of attraction,

→ The degree to which the system is capable of self-organization,

→ The degree to which the system can build and increase the capacity for learning and adaptation.

Vulnerability is the other side of the coin to resilience: when a system loses resilience it becomes vulnerable to change that could previously be absorbed. Vulnerability is defined as the capacity of systems to suffer external stress and disturbance. It implies the combination of sensibility to exposure – by agents or elements composing the system- and the effectiveness of measures of adaptation to anticipate or reduce future damage (Kasperson *et al*., 1995). Vulnerability is therefore determined by the potential impact and the capacity to cope or/and prevent such impact.

In making this perspective of resilience operational, Berkes (2003: p.15) states that:

> *"sociecologic systems should be managed to maintain their diversity and variability, leaving some slack and flexibility, and not trying to optimize some parts of the system but maintaining redundancy. It also means learning how to maintain and enhance adaptability and understanding when and where it is possible to intervene in management. These soft management approaches are necessary because hard management approaches involving quantitative targets for resource production etc. often do not work. Linear models on which hard management depends tend to be incomplete or even misleading in the management of the ecosystems of the world. Equilibrium-base predictive models do not perform well with complex social-ecological systems".*

Resilience underlines the important elements that make a society adaptable to external changes and perturbation such as sea level rise. Socio-ecological resilience is synonymous with ecological, economic and social sustainability (Berkes *et al*., 2003). The greater the capacity of the institutions and societies to adapt to disturbances, the less vulnerable are the ecosystems.

This contrasts with the prevailing engineering perspectives. As Holling (1986) explains, the engineering view understands ecological systems close to a steady-state equilibrium, in contrast with socioecological resilience perspective which emphasizes conditions far from any stable steady-state where instability can flip a system into another behavioural regime.

There are many factors that contribute to increasing resilience. Traditionally, the concept of resilience has been applied in the natural sciences trying to measure the capacity of biophysical systems to deal with perturbations. A typical element of biophysical resilience is seen in dune systems as they provide protection against marine flooding, they are a source of sediment supply and they regulate freshwater (Carter, 1991).

Lastly, the concept of resilience has been applied to other fields of knowledge. For instance, Ostrom *et al*. (1999) has explored institutional resilience facing the development of new institutions and ways of communication to foster trust, cooperation and reciprocity to protect cultural diversity as well as complement and strengthen local institutions, which are fundamentally important when facing complex problems (Ostrom *et al*., 1999). On the other hand, socio-economic diversity is another factor that brings resilience to the systems (Matutinović,

2001) as the “acculturation” due to mass tourism or the monoculture due to expansion of tourism may deplete resilience of local communities.

Exploring the different elements of resilience is hence basic to enhance sustainability of coastal systems. One way to promote resilience is through a better understanding of public attitudes, expectations and values of the coasts which can help in matching public policies to what the public wants and will accept. (Tunstall *et al*., 1998).

2.2.8 Adaptation and learning

Intimate connected to the resilience, the adaptive capacity of a system is its ability to deal with changes and surprises and avoid shifts to undesirable stability domains (Hollings, 2001). Adaptive systems are those that acquire information from the environment and from their own relationships with the environment in order to be more adaptive to changing situations or surprises (Gell-Mann, 1994). Novelty or the ability to innovate, is an essential element of adaptability and hence resilience (Berkes *et al*., 2003).

In this sense, Berkes and Jolly (2002) and Folke *et al.* (2002) add that in order to cope with situations of rapid change without missing options for the future it is necessary that systems should be able to reconfigure themselves without significant declines in crucial functions, such as primary productivity, hydrological cycles, social cohesion and economic prosperity.

Adaptation of socio-ecological systems can be seen as a type of learning in which multiple processes interact. Thus, in order to make the system more adaptive, the design of specific mechanism to incorporate lessons learned from disturbances should be encouraged. In this sense, sustainability learning relates to learning to develop the capacity to manage options for the adaptation of human societies to the limits and changing conditions that are imposed by socio-ecological systems (Tàbara *et al.* 2007b).

2.2.9 Co-evolving

The historical vision on nature-society dichotomy was put into question by developing the paradigm of co-evolution by authors such as Norgaard (1994). This paradigm defends that humans and their environment change together. It denies attributing solely natural factors (Darwinism) or cultural events (technological development) to the process of evolution. This perspective understands changes in socioecological systems in a double-direction. The

changes produced in organisms by the environment in their adaptation process modify the environment, generating a constant cycle of interaction between the environment and the organism.

However, according to Aledo *et al.* (2001) the notion of co-evolution continues to reproduce the conceptual separation among nature and society. The author rejects the use of nature as an entity different from the social part. It can be considered as a differentiated subsystem in a wider conjunct which may be the socio-ecological system. Hence, from this perspective a deep change in the scientific way of understanding socio-ecological systems should be promoted in order to obtain a veritable integrated, systemic, holistic analysis.

2.2.10 Plurality of perceptions and conflicting interests

There are many different attitudes towards the environment and the understanding of the relationship between natural systems and society are present in the world. In short, an egocentrism perspective “everything in nature is connected”, believes that many events are, directly or indirectly, a consequence of human actions beyond human understanding (Marten, G.G. 2001). Whereas on the other extreme, anthropocentrism sees nature at the service of humans. These different ways of perceiving nature-society entail different strategies in managing coastal systems. Several authors (e.g. Anderson, 1996) have studied environmental management practices in belief systems different than those in occidental cultures. The wide diversity of existing spiritual and ethical traditions can give different “savoir faire” in managing the environment.

Another element which adds complexity to the management of coastal systems is the existence of multiple interest, often in conflict. Coastal systems attract a wide range of human activities to use or consume their natural resources. Some of them are navigation, communication, living marine resources, mineral and energy resources, tourism and recreation, infrastructure development, waste disposal and pollution prevention, beach and shoreline management, research, etc (Cicin-sain *et al*., 1998). Most of them are concentrated and interact in a reduced area. They often result in severe conflicts and depletion of the coastal system’s functionalities, with one use adversely affecting another. As an example the case of Mar Menor is shown where in the same system of reference a diverse presence of activities from all sectors is found.

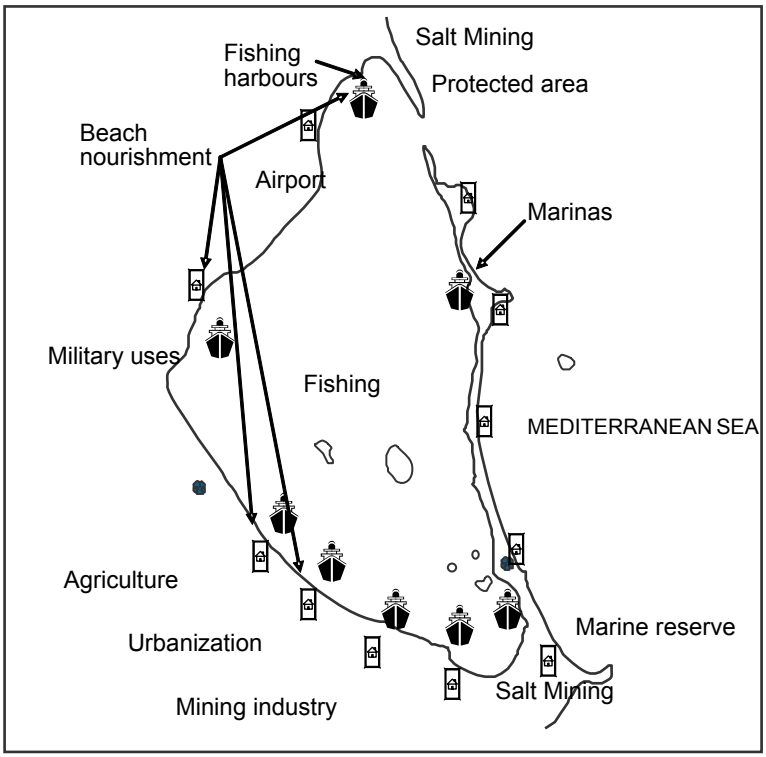

Figure 2.4 Main uses and activities developed in the Mar Menor area.
Source: Adapted from Pérez-Ruzafa, 1996

2.3 The functions and values of coastal systems

From an utilitarian perspective, coastal systems provide a set of ecosystem services that guarantee human development and wellbeing. Concepts such as ecosystem functions, services, goods, benefits, released by ecologists such some decades ago, are very helpful to explain the benefits that natural capital offers to human society and the need to value them holistically (Constanza, 1997; Daily, 1997; Daily *et al*. 2000, de Groot *et al*. 2002). Millennium Ecosystem Assessment (2003) defines Ecosystem services as the benefits people obtain from ecosystems. Some services provide value directly or indirectly from their current or potential use.

However, there are different ways in which services provision might be affected by human activities. For instance, marinas can represent a trap for sediments but also are a source of pollution and land speculation is indirectly promoted.

Ecological functions are understood by de Groot *et al*. (2002) as the capacity of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly. Next, the classification made by de Groot *et al*. (2002, 2006) is presented and exemplified in the field of coastal systems. From this classification, it is easy to identify a set of associated services and

goods that benefit human wellbeing directly or indirectly. Classification of ecological functions occurs in five main groups:

→ **Regulation:** capacity of the system to regulate essential ecological processes and life support systems through bio-geochemical cycles and other biospheric processes. For example, landforms bordering on the water's edge (sand dunes, mangroves, fringing coral reefs) play a key role in combating erosion and sea-level rise and contribute to long-term sustainability (Cicin-sain *et al*. 1998, Paskof 1993). Some rich ecosystems in coastal areas (e.g. coral reefs, mangroves) have an active role in CO_2 balance, hence in climate regulation. Therefore, these functions provides important services to maintain safety for human life and urbanisation in the coastline (de Groot *et al*. 2002)

→ **Habitat:** provision of living space for species in order to maintain biological and genetic diversity. Many deltas are refugee and nursery habitats for a great variety of species. The quality of wetlands in the Mediterranean basin is a key to guaranteeing the connection and survival of migratory species. Biodiversity and habitat complexity such us posidonia meadows provide crucial nursery habitats for many marine species.

→ **Production:** Biotic and abiotic natural resources are consumed by human society. Renewable rates constrain their uses. Marine ecosystems provide production goods such as seafood which are the main source of income of many local economies based on fishing. For example, a large number of fish species depend upon wetlands in one way or another (Turner *et al*. 1991), which is a significant part of protein intake in some countries.

→ **Information:** The aesthetic uses, human enjoyment and spiritual renewal that ecosystems can provide is included this group of functions. The recreational activities offered by coastal areas have become the source of many Mediterranean villages. The beauty, serenity and spiritual benefits resulting from the proximity of the sea and coastal landscapes have inspired many artists around the world and have attracted much sun and beach tourism. Logically, the main use of beaches in the summertime is to swim and sunbathe in vacation periods or weekends. However, this is not the only use. Beaches in some urban areas have the role of the urban parks. People walk along them to rest and disconnect from work time, with aesthetic recreation and a search for tranquillity and calmness.

→ **Carrier:** This function is concerned with the space or substrata to support infrastructure to develop human activities, such us transportation, urbanization, cultivation. Coastal areas highly concentrate many infrastructures especially industrial settlements linked to maritime activities and residential areas.

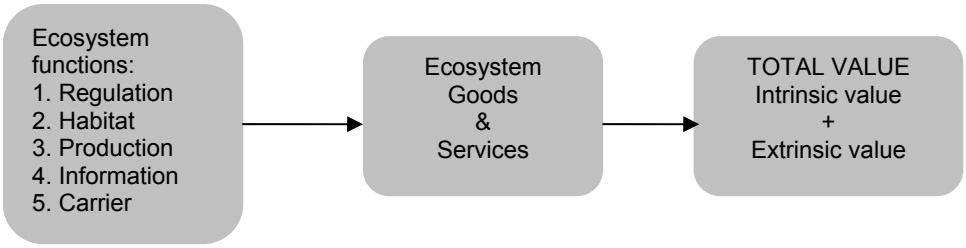

Figure 2.5 Functions, services and values of socio-ecological systems. Source: Adapted from de Groot (2002).

Described functions provide the goods and services that are valued by humans. Leaving aside utilitarian perspectives, coastal systems also yield for their non-use values (existence value). These are not derived from direct or indirect uses. Cicin–sain *et al*. (1998) also includes in the total value nonutilitarian values (the value of its mere existence and its value to future generations) and the aesthetic uses (the human enjoyment and spiritual renewal that proximity to the sea can provide) (Figure 2.5).

The competition for natural resources and space by various users have been resulting in severe conflicts and depletion of coastal system's functionalities, adversely affecting human activities. Over the last decades different debates have tackled this discussion. Above all the Integrated Coastal Zone Management (ICZM) paradigm has become increasingly recognised and introduced in the political agenda. The following section presents the state of the ICZM concept by doing a review of its evolution in the international political agenda and giving some definitions, principles and current challenges the concept should face.

2.4 Background on the Integrated Coastal Zone Management [5]

2.4.1 Evolution of ICZM in the political agenda

The discourse on ICZM appeared at the end of 80s as an alternative to the existing coastal management practices. It is aimed at improving life quality of human communities dependent on coastal resources, while maintaining biological and productive biodiversity of coastal ecosystems (GESAMP, 1996).

In fact, coastal problems were introduced in the political agenda in pioneer countries working on environmental planning and management such as USA, Australia and Sweden from the mid 1970s. Furthermore, although in 1975 the Mediterranean Action Plan of UNEP (United Nations Environmental Programme) already was approved, it was not until the end of the 80s that ICZM began to be developed. In the Earth Summit in Rio de Janeiro in 1992, the concept was reinforced when a entire chapter (No 17), was included in the final declaration of the conference. That chapter was completely dedicated to the "Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources". At a European level, that document coincided with the Resolution of the Ministry Council, 25th February 1992 related to the ICZM which motivated the Fifth EU Action Programme on the Environment (1993-2000). One of the main priority objectives of such programme was to develop sustainable coastal zones. Once the programme had started, a resolution related to "a communitarian strategy of ICZM" was enacted on 6th May 1994. As a response, the communication of the Commission on the ICZM (COM -95- 511) was brought in. There, the increasing degradation of many European coastal zones and the need to initiate an intervention at EU level was reported (CEC, 1995).

Accordingly, from 1996 to 1999, the Commission carried out a Demonstration Programme on Integrated Coastal Zone Management (ICZM) designed around a series of 35 demonstration projects and 6 thematic studies. This programme aimed to i) provide technical information about sustainable coastal zone management, and ii) stimulate a broad debate among the various actors involved in the planning, management or use of European coastal zones. The

[5] There are different terminologies used for name ICZM. In the Anglo-Saxon literature (north America and Australia) the terms *Integrated Coastal Management ICM* or I*ntegrated Coastal Area Management ICAM* are used while in the scientific literature others like *Integrated Coastal Planning o Coastal Zone Management ICZM*, etc. At European institutional level ICZM is the most commonly used.

lessons learned (CEC,1999a) and the principles (CEC,1999b) obtained from the experience of the Demonstration Programme were presented in two documents published in April 1999. Then, a series of consultation with the main stakeholders were called to review the documents and comment possible future actions at EU, national and local level.

In 2000, based on the experiences and outputs of the Demonstration Programme, the Commission adopted the document "Integrated Coastal Zone Management: a Strategy for Europe" a Communication from the Commission to the Council and the European Parliament (COM-00-547). Then ICZM was explicitly included in the European political agenda in 2000 with the Communication on Integrated Coastal Zone Management (EC, 2000). This process culminated in 2002 with the adoption of a recommendation from European Council of Ministers (COM, 2002) for the implementation of Integrated Coastal Zone Management, where sustainable coastal defence and transparent information management are key issues. Moreover, some authors (Sanz, 2004) have argued that it has been a limited and shy process and at the same time is too ambiguous because it does not establish capacities and pre-conditions to implement ICZM initiatives at national and local level.

During 2006 and the beginning of 2007 the Commission reviewed the experience with the implementation of the EU ICZM Recommendation. The Commission Communication of 7 June 2007 (COM-07-308) states that "*while the prevailing approach is still sectoral, the national strategies should provide a more strategic and integrated framework*". In this sense, several European countries have recently completed or at least drafted national ICZM strategies (e.g. UK, the Netherlands, etc.). Moreover, the EU Water framework directive is in continuous implementation and at EU level the Marine Strategy is under negotiation.

Although a lot has already been researched on it, there is a lot of room for exploring new approaches and developing integrated methods that can make this concept operational. the drawbacks in putting the concept into operation and the difficulties in implementing it at different policy levels, still leave room for a lot of discussion and experimentation.

2.4.2 Definitions and principles

The ICZM has been defined and characterised by many authors (Carter, 1991; Clark, 1992; Cicin-Sain *et al*., 1998) and by several international institutions working in these issues. In this section several definitions will be given from

both scientific and institutional literature[6].The following definitions have been chosen to reflect different key elements that constitute this concept:

"Dynamic and continuous process oriented to the sustainable development and protection of coastal zones. The ICZM requires the active and constant implication of the public and stakeholders with interests in coastal resources and the mediation of conflicts. The ICZM process provides with mechanisms to deal with questions arising at local, regional and national scale and to negotiate future trends. (GESAMP, 1996).

"Integrated coastal management can be defined as a continuous and dynamic process by which decisions are taken for the sustainable use, development, and protection of coastal and marine areas and resources. Integrated Coastal Management ICM acknowledges the interrelationships that exist among coastal and ocean uses and the environments they potentially affect, and is designed to overcome the fragmentation inherent in the sectoral management approach. ICM is multi-purpose oriented, it analyzes and addresses implications of development, conflicting uses, and interrelationships between physical processes and human activities, and it promotes linkages and harmonization among sectoral coastal and ocean activities" (Cicin-Sain et al., 1998).

"Integrated Coastal Area Management ICAM is a process that unites government and the community, science and management, sectoral and public interests in preparing and implementing an integrated plan for the protection and development of coastal ecosystems and resources" (UNESCO,2003, p.6)

"Governance process that offers a legal and institutional framework to guarantee that the development and management of coastal zone planning integrate environmental and socio-economic objectives with the overall participation of the affected parties. (Post and Lundin, 1996 in Lazarow, 2003).

"ICZM seeks, over the long-term, to balance the benefits from economic development and human uses of the coastal zone, the benefits from protecting, preserving, and restoring coastal zones, the benefits from minimizing loss of human life and property, and the benefits from public

[6] For an extended revision see Miralles (1999) and Barragan (2003).

access to and enjoyment of the coastal zone, all within the limits set by natural dynamics and carrying capacity" (EC, 1999)

ICZM can be viewed as a process of communication and governance, which helps in determining how to implement specific measures and define consensus oriented visions for the coast (Kannen at al. 2007)

In short, the concept of ICZM searches for vertical and horizontal integration of the stakeholders, spatial and temporal scales in the decision-making process . The concept defends the decentralization of responsibilities with strong mechanisms of collaboration and coordination. ICZM can be understood as an iterative cycle that is periodically reviewed and nourished with new information (reflexivity and adaptability) provided by a group of actors that is analysed from an interdisciplinary perspective so as it can be adapted to new changing circumstances of a complex and dynamic system such as the coast. Therefore, the process is as important as the results derived from it since it contributes to the creation of a social dynamic that confers adaptability to coastal systems and they become more resilient to changes and uncertainties that they have to face.

Furthermore, the process should be inspired in a set of principles constantly present (Clark 1992, UNEP 1995, Barragán 2003): precautionary, public participation, shared responsibility, self-evaluation and reflexivity, adaptability and learning, holistic and integrative framework. Normally ICZM is represented as a group of phases which can vary according the author. They should be understood as a logical succession of phases which might be modified, overlapped and adapted to the particular conditions of each case.

2.4.3 Future challenges of ICZM: the need for new assessment frameworks

New trends in coastal management aim at introducing news concepts to ICZM philosophy such as the principles of adaptive ecosystem management. This means building and enhancing capacities of the coastal system to deal with changing environments. This trend in environmental management toward more adaptive, community based and holistic perspectives requires new approaches to environmental evaluation (Norton *et al*., 2001). This is also claimed by the ICZM community, which demands not only the integration of objectives but also the instruments necessary to reach these objectives (EC, 2000).

The challenge, then, is to develop comprehensive assessment methods. Yet in 1996, the international group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) identified this as a priority emerging issue:

> *"…there is an urgent need for an accepted evaluation methodology for assessing the changes identified and implemented. When an evaluative framework is in place, it will be possible to document trends, identify their likely causes and objectively estimate the relative contributions of ICM programs to observed social and environmental change.*" (Olsen *et al*., 1997 p. 155).

As we will see in the next chapter, current assessment tools and methods are still not sufficiently developed both in scope as in process to integrate a comprehensive perspective of the coastal systems. When assessing alternatives or future options for a certain area, all these functionalities should be taken into account in a more holistic view. Our proposal aims at providing some on particular tools and methods to contribute to this debate.

Chapter 3
The assessment of coastal systems

3.1 Introduction

Persistent unsustainability problems are not problems that occur 'out there', independently of our individual, collective and daily multi-scale behaviours and interactions with the environment. Unsustainability is the cumulative result of the reproduction of a structural set of relations between natural and social systems that create a mounting number of unintended, negative and irreversible consequences both for humans and natural systems. In policy, persistent problems of unsustainability can be understood as those generated by the reiterative adoption of wrong solutions (usually of a non-systemic and short-term guise) to daily collective problems (Tàbara *et al*. 2007a).

Most current tools for the assessment and management of environmental problems tend to focus on one area of reality, or be based solely on one type of knowledge, and in this way they tend to suffer from a great deal of reductionism. The situation highlights the need for new approaches at the science-policy-society interface to deal with such problems and to facilitate transitional paths to more sustainable system futures. A more systemic and integrative view both in science and policy is essential.

In this chapter we begin to provide a critical review on the prevailing coastal assessment approaches to addressing our coastal systems. Furthermore, a review on the broader approaches developed in the last decades is provided in order to explore challenges for working with integrated assessment methodology in contrast to the existing procedures. In particular, this thesis focusses on the ways social sciences can contribute to integrating public perception and particular plural sources of knowledge in the overall process of assessing coastal systems. The final part of this chapter addresses some methodological remarks that have been applied in the development of the case studies.

3.2 Limitations and pitfalls of current practices in assessment of coastal systems

Most expert knowledge (scientific and technical) addresses environmental changes mainly by focussing on their final and separate effects – reductive, fragmented approaches – rather than dealing with the whole network of relationships between their ultimate causes and their systemic effects on the global socioecologic system (Tàbara *et al*. 2007a). In the coastal domain, research has been conducted mainly by geologists, ecologists and engineers, roughly as follows (Hinkel *et al*. 2007):

→ Engineers take a risk-based approach, assessing the probability of occurrence of storm surges and other extreme events that could jeopardise the integrity of the coast and the safety of coastal communities;

→ Geologists study coastal sedimentation patterns and the consequent dynamic processes of erosion and accretion over different spatial and temporal scales;

→ Ecologists study the occurrence, diversity and functioning of coastal flora and fauna from the species to the ecosystem level.

The conventional process of evaluation starts with a narrow definition of the problem and the identification of alternative solutions accordingly. The main baseline documentation required for intervening the coast often only includes quantitative information on the biophysical environment (e.g. maritime climate, sedimentary transport, evaluation of coastal biocenosis), an evaluation of alternative solutions based on cost-effectiveness criteria, technical description of the adopted solution (description of the works, execution time periods, budgets). Security and monitoring plans are also considered. However, it is rare to find social, environmental or cultural information, not to mention other types of knowledge aside from the technical-scientific arena. Within the Mediterranean context, the assessment of options to deal with coastal problems tends to include only expert, quantitative and technical judgements, therefore leaving little room for a more qualitative and plural perspectives, including other broader aesthetic and environmental sources of value (Roca *et al*. 2007, in-press).

Prevailing problem-solving routines tend to shape alternatives which not differ too much among them. A key issue in the process is the assessment of the relative impact of alternatives so as to guide final decision. As in other

environmental fields, some of related methods are based on using models to project developments to estimate the impacts of the options and draw conclusions about cost-effectiveness or the balance of cost and benefits (Weaver *et al.* 2007), implying a large degree of reductionism in various senses.

First, they are based on the compensability principle, which assumes that it is possible to compensate and quantify the trade-off existing between economic benefits and environmental costs. This involves the possibility of replacing natural capital with human capital. Measurements normally used consider a single unit (e.g. money) driven by "weak sustainability" principles (Martinez-Alier *et al.* 1998) involving a simplification of a complex reality. Consequently, simple cost-benefit analysis will often fail to provide adequate information to decision-makers (Gezelius, 2007)

Secondly, approaches and models used in conventional assessments assume simple cause-effect relationships and full knowledge of the reference system. Consequently, what is unknown or uncertain is not actively addressed in order to improve the robustness of the assessment, e.g. by including multiple perspectives via participation. (Roca *et al*. 2007 in-press).

Inherent uncertainty present in the data or model used is not normally communicated or explicitly expressed within the projects. From a survey performed within the EU project Eurosion (Serra *et al*., 2003), some drawbacks were identified in the systematic collection of data. On the on hand, data on maritime climate has only been registered since the nineties as the wave network is relatively recent. On the other, although there are only some sporadic photogrammetric monitoring, past records are missing. Therefore, studies on current dynamic processes are based on indirect, experimental data or information extrapolated from proximal areas, which become a source of uncertainty. Therefore, experts produce subjective estimations and judgements, which are not revealed in the reports or information produced. According to Arnell *et al* (2005) the communication of these judgements (i.e. their own worldviews or reliance on used models, data, etc.) can contribute to meaningful debate on criteria and priorities to assess policy agendas.

Last but not least, holistic and systemic perspectives are lacking in terms of considering other related components of the coastal system that might be affected. On this point, it can be argued that the Environmental Impact Assessment (EIA) precisely aimed at identifying and managing possible environmental impacts of the selected solution. However, since the beginning of

the implementation of the EIAs, these have received many critics due to their low efficiency, subjectivity and lack of interdisciplinarity[7]. Not to mention that they are written *a posteriori* to the project and do not really consider alternative solutions.

In conclusion, conventional assessment methods have resulted in the predominance of engineering solutions within a constantly changing system, which has in many cases reduced the resilience capacity of coastlines to respond adequately to the stresses and shocks of environmental change (Turner, 2000; EC, 2004). In general terms, the degradation and loss of sustainability in coastal systems are often due to a failure of the assessment methods to capture, represent and integrate the full values and beneficial functions provided by such systems. In conclusion, under our understanding of coastal systems the prevailing approaches to assess coastal problems do not fit in. There is an emerging consensus regarding the need to look for broader approaches and solutions, not only with resource and environmental issues but along a wide front of societal problems (Berkes *et al*. 2003). It is critical to perform feasible and consistent valuation processes that take into account different characteristics of those systems (Daily *et al*., 2000). In this sense, the next section explores new integrative approaches.

3.3 New integrated assessment frameworks

3.3.1 Background

New integrative paradigms have been developed during the last two decades to overcome the limitations of traditional approaches and to explicitly support policy making. These have been received many names but in general their purpose is to go beyond traditional ways or “normal science” to deal with urgent environmental complex problems with inherent uncertainties and diversity of knowledge and value judgement involved. It is worth to mention some of them: Science of Surprise (Holling, 1986), Post-normal science (Funtowicz *et al*., 1990; 1991), Civic Science (Lee, 1993), Mode II-science (Gibbons *et al*., 1994; Nowotny *et al*., 2003) and Sustainability science (Kasemir *et al*., 2003; Kates *et al*. 2001).

[7] For an extended revision of the critical aspects of the Environmental Impact Assessment see José Allende Landa, 1990, "La Evaluación de Impacto Ambiental. Marco de Referencia y Aspectos Relevantes a Debatir", Ciudad y Territorio, 83-1.

Integrated Assessment (IA) (Parson, 1995) framework arose from the realisation that existing methods aimed at dealing with socio-ecological systems needed to develop encompassing and interdisciplinary approaches. Parson (1995) stated that "*to make rational, informed social decisions on such complex, long-term, uncertain issues as global climate change, the capacity to integrate, reconcile, organize, and communicate knowledge across domains – to do integrated assessment – is essential."* Rotmans *et al*. (1996) defined IA as "an interdisciplinary and participatory process of combining, interpreting and communicating knowledge from diverse scientific disciplines to achieve a better understanding of complex phenomena". According to Schneider (1997), Toth and Hizsnyik (1998), Tol and Vellinga (1998), and Van der Sluijs, (1996), essential feature that characterize the practices of IA are:

→ that inter-disciplinary work provides an added and differentiated scientific value that cannot be obtained by simply adding knowledge produced by single disciplines;

→ environmental, social and economic aspects of the problem should be integrated.

→ the output of the assessment process should be oriented towards supporting policy-making.

Originally, quantitative and modelling tools predominated in the first developments of IA. Participatory and hybrid approaches to IA have then been increasingly used, leading to what is known as Participatory Integrated Assessment (Hisschemöller *et al*. 2001). In this regard, and in order to get insights into agents' behaviours, frame the problems at stake in a more relevant manner and enhance the social robustness of the assessments, modellers have increasingly opened the door to stakeholder participation.

Particularly since the 90s participation in the decision-making processes has been one of the characteristics of sustainable development. Its inclusion in sustainability assessments is justified on many grounds. While, a priori, it can be stated that it strengthens the democratization of the production of knowledge, a relevant key feature is that it can contribute to creating more socially robust knowledge for its context of application (Gibbons *et al*. 1994); Van den Hove (2000) argues that public participation ensures holistic thinking about the environment as complex environmental problems often cannot be solved through technology or scientific expertise alone. Ensuring that a wide variety of viewpoints are considered when defining the problem may assist

decision-makers in understanding complexities and fit-in solutions. Lynam *et al*. (2007) consider that a participatory tool must: support communication and learning between its users; be adaptable for implementation in different context; produce data and information that are useful and valid for decision-making. Furthermore, participation enhances transparency as conflicting claims and views becomes clearer which can increase public trust in the final outcome. Finally, it contributes to building an active civil society (Richards *et al*., 2007). It can promote higher levels of public acceptance of the decisions adopted, so it entails the legitimacy of public policy; it can contribute to better communication of uncertainties, and it can enhance processes of social learning and institutional change. Public participation functions as a quality control of established knowledge which is more socially robust.

Table 3.1 Comparative analysis between conventional and integrated assessment frameworks.

Elements	**CONVENTIONAL ASSESSMENT FRAMEWORKS**	**INTEGRATED ASSESSMENT FRAMEWORK**
Scope	Partial, fragmented	Integrative/holistic
problem framing	Single-dimensional	Interdisciplinary Multidimensional
Process	Linear	Cyclical
scale	Short-term, Single-level	Long term, Multiple scale
Trade off	weak sustainability	Strong sustainability
Treatment of uncertainties	Only facts and certainties	Uncertainty
Types of knowledge	Based on dominant worldviews	Diverse sources of knowledge, values, perceptions
Intention/goal	Predictive	Exploratory
Methodologies	Technical, model oriented	Participatory

Source: Adapted from Weaver et al. (2006a, 2006b)

A further development in this direction is the current Integrated Sustainability Assessment (ISA)[8]. In its participatory guise, the making of policy options in Integrated Assessment is not only considered as a result of a process of expert knowledge, hence neglecting other types of knowledge, worldviews, perceptions and values. More importantly, this is understood as a mutual learning experience, which arises from direct interactions with non-expert social agents in the definition of problems and options as well as the methods and tools to assess them. The use of knowledge only from the natural sciences is recognised as insufficient to fully grasp the complexities of unsustainability, and

[8] Carried out within the EU Matisse –Methods and Tools for Integrated Sustainability Assessment- 2005-2008 project and applied in the field of climate change in ADAM- Adaptation and Mitigation Strategies: Supporting European Climate Policy- 2006-2008.

in this sense, social sciences and participatory methods can play a crucial role in improving the relevance of the defined policy options and their implementation (Tàbara *et al*. 2003). ISA is also intended to enhance the transformative capacities of agents. Thus, ISA takes the issues of power and transition of resources regimes in the centre of its concerns (Weaver *et al.*, 2006b).

3.3.2 The Integrated Sustainability Assessment (ISA)

In order to make the concept operational, in the framework of European project called MATISSE, Integrated Environmental Assessment has been defined as:

> *"A cyclical, participatory and interdisciplinary process of scoping (problem identification and definition), envisioning (future scenarios or alternatives are drawn), appraising (the impacts and the trade-offs of each alternatives are analysed) and learning (the process is evaluated and the learned insights are introduced) through which a shared interpretation of sustainability for a specific context is developed and applied in an integrated way in order to explore solutions to persistent problems of unsustainable development. (Weaver et al. 2006a, p.284).*

ISA aims to help structuring the interfaces between science, policy and civic society. It also stresses that the IA participatory process should be transition-oriented, agent-based, anticipatory, holistic, cyclical, should foster social learning and should empower stakeholders. Altogether, participation in sustainability assessment allows the integration of different sources of knowledge and ways of framing, assessing and developing capacities to cope with complex issues in a socially and ecologically relevant manner in different scales of action (Weaver *et al*. 2007, Tàbara *et al*. 2007a).

From the operational perspective, the Integrated Assessment process such as ISA has been structured in different phases. In general, many authors agree that although the phases are conceptually different, they may not be successive and can overlap in time.

The Scoping stage: It aims at exploring in a participatory and qualitative way the definition of the unsustainability persistent problems of the system of reference, the main forcers driving such change and the different perceptions and definitions about them. It should be based on an accurate integrated system analysis at different scales and an a careful identification and identification of stakeholders capable to provide a socially and ecologically robust description of the context in which the ISA is to be applied.

Envisioning stage: It is aimed at the development of visions of sustainable futures in the context of application of the PAF by providing a common interpretation of sustainability. The 'problems' of unsustainability need to be transformed into challenges for action and specified in an empowering and engaging narrative. Scenario can be designed and the different pathways to attain to the different future need to be evaluated according to their social-ecological effects. This phase involves the formulation of policy options in close interaction with stakeholders implicitly or explicitly considered in the scenarios.

Experimenting stage: During this phase, a series testing and reflection activities are carried out by the systematic use of specific tools which allow participants to experience situations and alternatives of action that otherwise could not be able to experience unless under carried out controlled or simulated conditions. This may include the use of modelling, role gaming, and/and field experiments. In this stage, a series of ISA oriented experiments are selected, designed and evaluated on the basis of the previous two stages and sustainability visions and policy proposals are tested in terms of consistency, adequacy, robustness and feasibility. The impacts and the trade-offs for each transition pathway (scenarios) are explored.

Evaluation and learning: Finally, social learning is assessed both on content (e.g. what specific policy proposals) as of process (what tools and methods worked or not). The evaluation stages should provide inputs for the project team to adjust processes, tools, methods and assumptions in the next round. This stage include an evaluation of the stakeholder interaction as of the monitoring of the different stages, of the process and it is understood that a ISA process includes at least a full iteration of each of these four stages.

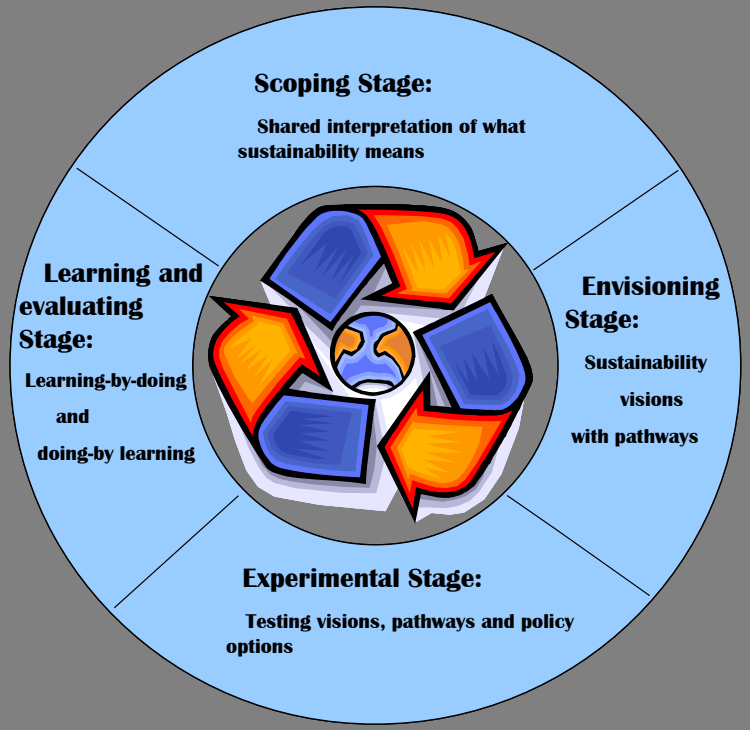

Figure 3.1 ISA process and phases. Sources: www.matisse-project.net

For example, Tol *et al*. (1998) distinguish between: problem structuration, analysis (by participative methods or modelling) and results communication to the stakeholders and public. In recent works such us in the MATISSE and ADAM projects four phases have been differentiated (i.e. scoping, envisioning, experimenting, learning) where participation has become a constant along the whole process and not only a complementary characteristic of the analysis phase (see Figure 3.1).

From the set of tools and methods provided by Integrated Assessment, we have focused on those that fall in the field of the social sciences: questionnaires, in-depth interviews and focus groups, which permit integration of different types of languages and provide a participatory context to our research. In the next section, we offer a review of justify the importance of public perception of value coastal systems and the methods available for that purpose.

3.4 Public perception in the assessment of coastal systems

3.4.1 The role of public perception

Relationships between socio-ecological systems are complex. We have seen how ecosystems provide society with goods and services and how humans deplete them. Human behaviour and attitudes are conditioned by their perception of nature. Hence, social values and perceptions play an important role in determining the importance of natural ecosystems and their functions in human society (de Groot, 2002). According to Daily (1997), environmental management needs to consider public perception. Identification of differences in attitudes of users may be effectively used in planning environmental management and sustainable tourism (Cihar *et al*., 2006).

Despite the fact that human culture and behaviour influences the way in which natural resources are accessed and utilized at all levels, from local to global scales (Alessa *et al*, 2003), knowledge, perceptions and human values are poorly examined in the research on environmental problems. Therefore, seeking a better understanding of how individuals perceive coastal impacts is very relevant for managers to develop strategies towards their integrated management.

Actors have different perceptions of reality, which are related to their different frames of reference or views of the world. Their perceptions are context-dependent and changing over time. This is why it is very important to involve all

stakeholders from the very beginning of the process of defining what the issues at stake are (Walker *et al*. 2003). Moreover, understanding perceptions and values of certain processes and effects makes easier to deal with them. Changes in social values, attitudes and human preferences can contribute to solve certain environmental problems (Ludevil, 1995).

Not everybody has the same perceptions about the environment. Public perception depends on human relationships with the environment. In part, it depends on the quality and quantity of information available and the capacity to interpret it. Therefore, scientific events and accessibility to accurate descriptions of cause-effects and processes affecting the environment can have a direct influence on the public representation of the problems (Tàbara, 1996).

Moreover, apart from personal experience, perceptions are influenced by the nature of the environmental processes themselves –personal proximity, temporal and spatial scales, degree of uncertainty, value and beliefs systems (García, 2004). Processes which changes are produced slowly or not very frequent (e.g. sea level rises) or with low intensity are undervalued and perceived to be far away from our personal influence. This is why attitudes related to these sort of processes are often very difficult to modify. In these cases, risk communication and education have a fundamental role to play in changing attitudes and perceptions in the long term. A clear example has been the mass media intervention regarding climate change during the last few years, which has been decisive in creating public opinion and establishing an political agenda on the issue.

Public perceptions are highly influenced by mass media. The selection and emphasis that mass media put on the publication of certain events, determines the definition of reality by society (Uzzell, 2000) and for that reason media can minimise or amplify the problems. The need for a brevity and impact entails a preference for the coverage of extreme events and the marginalisation of the long term and slow process, which in fact are often more relevant (Tàbara, 1996). Finally, at a local level, interpersonal communication mechanisms such as word of mouth also have a high relevance in the formation of perceptions (Ludevil, 1995)

In short, public perceptions on the environment are influenced not only by the environmental quality of natural systems but also by life experiences and the culture that conditions the worldview and the belief system (Figure 3.2).

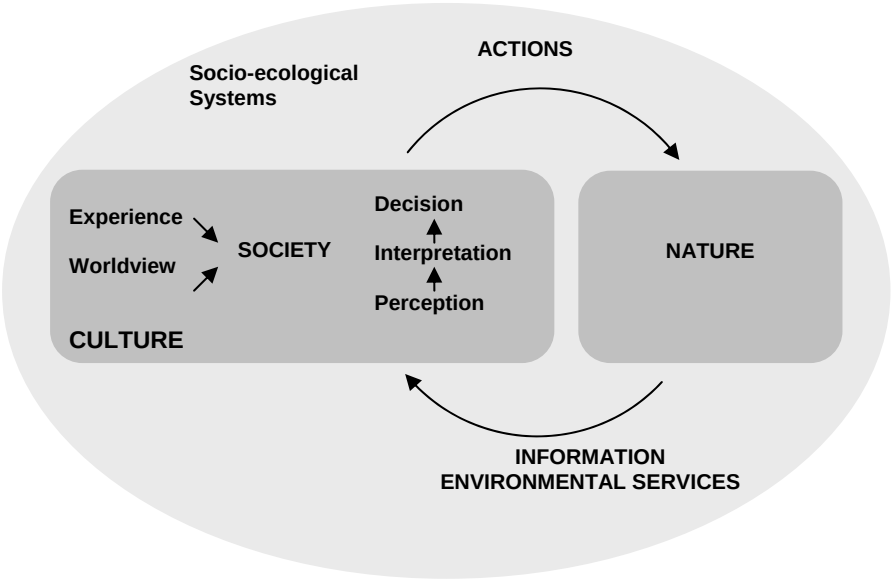

Figure 3.2 The relationships between nature and society and influences on public perception.

3.4.2 Some methodological remarks on the study of public perception

In relation to the specific social sciences techniques employed, next section provides some description of different methods used for collecting data. However, specific details on the methodology employed in each case study are given in the corresponding chapters to facilitate further reading and understanding of results obtained.

The quantitative-qualitative debate

In order to assess public perception, both quantitative and qualitative methods can be used. However, discussions between qualitative and quantitative methods have represented a split between disciplinary schools within the social sciences. Here we discuss some of the potential opportunities and limitations of each approach.

On the one hand, quantification can often help make our observations more explicit (Babbie, 2006). It also facilitates aggregation and comparison, in short, statistical analysis. It is based on the assumption that opinions, feelings, perceptions, beliefs, attitudes or behaviours can be expressed in meaningful numerical ways within a given context. However, they also carry the

disadvantage that numbers have, including a potential loss in richness of meaning. Quantitative approaches also look to clearly isolate causes and effects, to make theoretical relations properly operational, to measure and to quantify phenomena, to create research designs allowing the generalization of findings and to formulate general laws (Flick, 2006). This assumes that the system under study can be completely understood. However in the environmental problems where complexity and non-linearity are some of the features, most phenomena cannot be explained in isolation or as a single cause-effect process. Therefore, quantitative methods can only account for what can be quantified and thus provide only very partial insights in what usually is a very complex mass of uncertainties (Van der Sluijs *et al*., 2004).

On the other hand, qualitative approaches can address aspects that are difficult to quantify and that are under-represented using conventional assessments. They can be very helpful in explaining or assessing incommensurabilities and uncertainties. Some qualitative research methods take also into account different viewpoints and highlight it by showing the variety of perspectives on a specific issue giving it subjective and social meanings. However, the subjectivity of the researcher and of those being studied can be a drawback or a limitation. In this group of techniques, the process receives more attention as part of the findings and this is why some argue that is more linked with democracy (Flick, 2006) whereas quantitative techniques may obscure its correct interpretation by the public. Although we have to recognise that we live within a society where the crisp numbers tend to be more appreciated than semantic valuation.

Typically, qualitative research will provide in-depth information on fewer cases, whereas quantitative procedures will allow for more breadth of information across a large number of cases. A combination of both approaches offers future promise for environmental valuation (Ledoux *et al*. 2002).

However, the need of generate politically relevant information and communicate it to different stakeholders participating in the decision-making process makes both qualitative and quantitative frameworks useful. The first can contribute weight or importance whereas the second is more comprehensive in give coverage of variety of contexts found in the society.

As a consequence, current trends in qualitative research are oriented towards triangulation. It aims at overcoming limitations of a single method by combining several methods and giving them equal relevance. Triangulation links different qualitative or qualitative and quantitative methods becomes essential (Flick,

2006). According to Bryman (2001), the problem of generality can be solved for qualitative research by adding quantitative findings, whereas qualitative findings may facilitate the interpretation of relationships between variables in quantitative data sets. Integration contributes to further step, moving from triangulation to integration (Tàbara, 2003).

The following sections will give some details on different techniques employed within the study cases of this thesis.

Quantitative Methods: The questionnaire

The questionnaire is the instrument specifically designed to elicit information that will be useful for analysis (Babbie, 2006) in quantitative research within social science. Surveys are good techniques in collecting data to describe a population too large to observe directly. Self-administered questionnaires make large samples feasible and cheap. However, their standardization requirement implies superficiality in their coverage of complex topics and somehow inflexibility. They are weak on validity and strong on reliability.

In the case study of Costa Brava this technique in combination with in-depth interviews was used. Detailed description of the questionnaire, its administration and further data analysis is explicitly explained in the corresponding chapter.

Qualitative methods: In-depth interviews and focus groups

Qualitative interviewing involves present-time face-to-face (or sometimes telephone or e-mail) interaction, but the topic of the interview may be related to the past or future as well as the present. The general format of the interview is a dyad (one interviewer and one respondent), but there may be triadic interviews (one researcher and two respondents, for example, a married couple) or focus group interviews (one or two researchers and a group of respondents). They can have different degrees of structuration (structured, semi-structured or unstructured).

The strengths of this method are: the depth understanding of attitudes and behaviours that can be obtained; its flexibility as can be modified throughout the research, it is relatively inexpensive; and finally, it has more validity than surveys. On the other hand, the limitations are that they can not provide statistical descriptions and are less reliable as they are more influenced by the subjective perspective of the researcher. (Babbie, 2006)

The focus group method is based on structured, semi-structured or unstructured interviews. It allows the researcher to question several individuals systematically and simultaneously. A group of subjects are brought together in a room to engage in a guided discussion of some topics. It brings out aspects of the topic that would not have been anticipated by the researcher and would not have emerged from interviews with individuals. It can be said that the purpose is to explore rather than to explain. Some limitations are the difficulty of analysing data and it can generate the problem of group thinking, which is the tendency for some participants to conform with opinions of the most outspoken ones (Babbie, 2007)

The case study approach

This thesis is based on the case study approach which is a method within social science research. It gives holistic and meaningful characteristics of contemporary phenomena in real life situations in contrast with laboratory or experimental analysis.

They are developed at local level. Two of them are oriented towards coastal erosion problems and the case of Costa Brava deals with beach quality in high tourist environments.

Generally speaking, this approach allows multi- and interdisciplinarity as it starts with a document review from different sources and continues by exploring perceptions on relevant issues. Following the suggestion by Turner (2000), the starting point was to generate a baseline description of the particular coastal system under study. Furthermore, stakeholder analysis implied an identification of those groups who are affected by the policy results from the valuation as well as those who affect policy or influence the policy-making process.

Now, we move to present the case studies on which the thesis is based.

Part II

Case Study on beach tourism

Chapter 4 Introduction to coastal tourism and beach quality

4.1 Dynamics of 3s tourism[9] in the Western Mediterranean

Beaches are multidimensional systems where human and biophysical subsystems are in a continuous, dynamic and complex relationship. According to Costanza *et al*. (1997) such socio-ecological systems supply different services for the benefit of the society like erosion and flood protection, biological control and provision of recreational and cultural values. However, the coexistence of all these services can be conflictive and complex to manage, especially in the tourist areas where the anthropogenic pressure is very high.

The Mediterranean shoreline is a prime example of this situation, where although some traditional activities remain, tourism is the largest sector of the economy in many coastal zones. Western Mediterranean countries (Spain, France and Italy) receive around 175 millions of visitors per year (EEA, 2005) who mostly select the beaches as their main motivation. As a consequence of this, Mediterranean beaches have been converted into motors for local economy providing a significant part of the economic income and playing a key role in the regional and social development of the region in recent decades. As an example, the tourism contribution to the GNP in Catalonia was about 10% in 2001 and about 65 % of the foreign tourists chose to stay in coastal areas (Departament Indústria, 2002).

France, Spain and Italy have traditionally been the most popular destinations in terms of visitor numbers, most particularly since the tourist boom of the 1970s and beaches are a major tourist resource and attraction. In the Spanish Mediterranean coast after Balearic Island, Catalonia and Andalucia present an intensive coastal tourism, which has been the main socioecomic activity responsible of its environmental degradation (Barragán, 2004).

The importance of the Mediterranean basin as a major world tourist destination is largely based on its natural features, namely its beaches, weather and scenery. Its development begins afterwards the post-Second World War, in the

[9] Sand, sea, sun. Other two more “S” could be added: sex and sangria.

1950s, which involved the movement of thousands of tourists from United Kingdom to Spain, ultimately leading to the development of the western Mediterranean coastline for tourism in the process of democratisation of tourism. This gave a wide range of people the opportunity to spend their leisure time on an activity which had previously been mainly health-oriented and the exclusive domain of the aristocracy in the late 19th and early 20th centuries.

A part from specific factors in each country, the widespread ownership of the motor car and provision of good infrastructure of roads provided by governments; the development of the jet engine in the 1950s and the expansion of the tour-operating industry contributed to encourage travel around (Holden, 2000).

More recently, however, the globalisation of the tourist industry, the emergence of competition from the eastern Mediterranean region (the Adriatic states, Turkey, Malta, etc.) and North Africa, the degradation of natural resources and the out-dated tourism facilities have all led to an apparent crisis in the traditional tourism locations. Moreover, this promising activity for local economies has started to show signs of degrading the environment, which affects both ecological status and the recreational experience of tourists and thereby becomes counterproductive for host communities (Fullana, 2001; Priestley, 1998).

The core objective of mass tourism model is to increase continuously the number of visitors, prioritizing the economic benefits at short-term, creating a homogeneous and standardised offer with a scarce presence of local culture and traditions (Fullana, 2001) It is named fordist model and is characterised by an undifferentiated market (see Table 4.1). According to Coccossis (1996), the impacts derived from so-called “Mass tourism” are due to its space-time concentration, leading to a peak of demand and the overloading of local resources and infrastructures. Therefore it is the least sensitive to local resources due to the intensive type of tourist development associated with it – designed to lower the total cost of accommodation and services – and the behaviour of tourists and ho are attracted by the low-cost options, who are not very sensitive to environmental quality issues.

In sum, this monoculture tourism is “eroding” the capacity of the beaches to provide natural services which reciprocally has a detrimental effect on tourist activities. Not only the quality of natural resources has been affected but also tourism has become more demanding with their recreational experience. In

spite of that, coastal tourism still attracts the greatest percentage of tourism every year. For example, the WTO (World Tourism Organisation) estimated that with an average annual growth of 6,6% Mediterranean coastal region alone will receive 350 millions of visitors by 2020.

Table 4.1Characteristics and impacts of mass tourism.

Issue	Description
Strategy of development	Large scale (based on urbanization and infrastructure) Landscape modification High frequentation High Seasonality
Offer	Big tour operators (multinationals) Standardized and homogeneous offer Foreign investors
Demand	Passive tourist (motivation for sun and beach) Organized activities Lack of interest on local culture and environment
Impacts Economical:	Promotion of the economic development Employment creation (direct on the tourism facilities and indirect on the other economic sectors like construction) Increase of infrastructure demand and urban basic services (i.e. waste management, water supply) Increasing pressure on the financial capacity of municipal authorities. Cost of opportunity (loss of natural resources for alternative uses)
Socio-cultural:	Competition with activities with cultural impacts and loss of traditional activities) Restoration of historic buildings and arqueological heritage. Cultural ex-change between host and tourist (which can increase social problems). Revitalisation of folklore and local customs. “Acculturation”
Ecological:	soil erosion pollution (waste generation, water contamination, air pollution, etc) biodiversity loss Natural resources depletion (e.g. water, oil, etc.) Landscape degradation.

Source: Based on Fullana et Ayuso (2001).

In view of the fact that tourism is the world’s foremost economic activity and international bodies and experts widely acknowledge that tourism is and will continue be a fundamental aspect of our lives, it is important to design assessment procedures to evaluate and manage its subsequent impacts.

At the beginning tourism was considered the smokeless industry, but with the raise of environmental awareness in the seventies, this idea has been abandoned. Reconciling environmental quality and tourism development has been a target of much of the literature (Pearce, 1986; Holden, 2000).

Nowadays, it is well-known how sun-sand sea tourism development transforms original natural environments, modifying and building the source of attraction. It originally settled in a location with unspoilt and unexploited beaches, and as tourism increases the beaches and the hinterland become more overcrowded and the environment receive its consequences. Certain areas have suffered the consequences of a tourism-associated decline in environmental quality which has then been followed by a decline in tourism. For example, the massive use of beaches as recreational areas in a very limited space generates diverse conflicts: on the one hand among different type of users (sun-bathers, nautical sports, rentals…) and on the other degradation of natural beach services (e.g. protective effect and water and sand quality). This may imply a change in the experience in the user which may provoke his escape from the tourist area. Therefore, beach quality have become a concern for coastal managers since the mid of seventies. The next section reviews the instruments historically developed and applied to assess and manage beach quality.

4.2 The management of beach quality: a review of existing tools

There has been a lack of scientific interests in the field of beach management (Micallef *et al*., 2002), despite the fact there are plenty of coastal management books on other related subjects such us engineering, geomorphology, marine biology, and estuary/delta functionality. According to James (2000) beach management requires knowledge of human use of beaches, especially information on any pattern in human frequentation, spatial distribution of beach users, temporal use which are aspects of considerable importance in order to design management models.

In spite of the lack of research addressing beach management according to their recreational functions (Micallef *et al*. 2002), over the last few decades, certain quality labels have been implemented based on the inspection of certain pre-established indicators.

Next, a review of existing tools implementable in the Spanish beaches is going to be performed. They have been classified into normative and voluntary

instruments aiming to include regulatory framework that deals with beach management in Spain.

4.2.1 Normative instruments

The normative framework ranges from European to local level, including directive, state laws, regional programs and local plans:

→ **Bathing waters Directive (2006/7/EC):** It has been recently approved and substitutes the first directive from 1976. It establishes specific requirements in regards to methods and standards for assessing microbiological and water quality and other parameters (e.g. colour, transparency).

→ **Spanish Shore Act:** The shore act builds on the declaration in the Spanish Constitution that the coastal strip, beaches, territorial sea and the natural resources of the exclusive economic zone and continental shelf are State public property. It was intended to reassert State ownership over "coastal public property", which had increasingly become privatised, and to protect it from the effects of inappropriate development on adjoining land. This is the only clear, effective normative to avoid the occupation and degradation of shoreline (Breton *et al*., 1996). In relation to beach management, the law i) restrict the type of activity and facility that can be placed, ii) limit the maximum periods of concessions and, iii) establish an utilization canon. However, this law affects a very narrow stretch of coast and leaves the rest of the territory at the mercy of urban expansion.

→ **Programme for state, vigilance and information of beaches and interior bathing zones** under the responsibility of the Catalan Agency for Water in the Catalan Department of the Environment. It began in 1990 and was implanted in the summer season. It involves making almost daily inspections of beaches and weekly analyses of bathing waters to determine their health quality. The state information is eventually supplied to councils and citizens.

→ **Beach use plans**: At local level, the town councils are responsible for writing and implement beach use planning (i.e. beach uses, facilities, cleaning, information about the delimitations of coastal public domain). The application of planning measures to beach was a novelty of the Shore Act of 1969 which established the Plan de Ordenación General de la Playa (PGOP) for the permanent planning of beach services and facilities. Nowadays, such

plans are approved by the General Directorate of Coasts and they include the complete list of activities and uses permitted in the shoreline in each municipality. However, many times beach plans do not reflect the reality. The planning principally considers the demands of the concessionary services, forgetting the yearly variability of beach morphology or the social demands. Yepes (2002b) also pointed out that they lack emergency procedures and catastrophes plans.

4.2.2 Voluntary instruments

Most of beach management tools are based on the classification and rating of several parameters regarding the basic elements of the beach. However, according to Micallef *et al*. (2004) the majority of them are either addressing single dimensions (health, water quality, lifeguards and safety issues etc) or although adopting a wider-scoped approach, they do not include aspects related to beach users' perceptions in their beach quality definition. Normally, they give poor consideration to the variability of beach systems and one proof of that is that they do not have different values depending on the beach types.

In order to be more precise, in the case of Spain, Yepes (2002a) distinguish between:

→ **Product-oriented evaluation tools:** They are those Environmental Management System such us the Blue flag, Q de calidad from Tourism Secretary which are ecological labels as the focus is on the product and they are based on an objective reference catalogued as the desirable or good quality.

The most prestigious beach award in Europe is the Blue Flag was introduced in 1987 by the Foundation for Environmental Education in Europe (FEEE). It qualifies a beach on the basins of 26 pre-established indicators covering aspects of water quality, environmental management, safety and services, environmental education and information. Some are obligatory and others recommendable.

This sort of beach award schemes has gained many critics due to the fact that they do not consider the beach itself and apply the same quality standards for different types of beaches (Williams, 1993). Nelson *et al*. (2002) criticises that they are aimed at resort beaches, intensively managed to support tourism with little attention paid to more remote beaches. In addition, Duck *et al*. (2006)

argues that such specific tourist orientation focus on human parameters (e.g. provision of facilities) affects negatively on scenic values. The Generalitat de Catalunya (2007) adds that this label implies an evaluation of a set of photographies of the beach in a specific moment (during the inspection) and do not assess its evolution. Finally, James (2000) states that beach management has been traditionally orientated to the protection of geomorphologic hazards and to providing recreation, leaving ecological functions in a second place. Thus, there is a lack of recognition of beach type diversity within this sort of schemes, because they can not obtain blue flags those beaches located in natural areas difficult to access. Therefore, one of the more appreciated by users who associate this label to a good beach quality.

Another traditional problem has been that many of these management tools were single perspective-based, focussing only on water quality or safety or health-related aspects (Micallef *et al*. 2004).

→ **Process-oriented evaluation tools:** There are several environmental systems management [10] which are more oriented towards the quality of the process rather than in the final product itself (Yepes, 2002) and at the same time they are becoming wider in their scope since they include other criteria. It is a voluntary instrument oriented to those organisations with a need to assess the level of efficiency in their management and the level of environment improvements that this management implies (Generalitat de Catalunya, 2007).

The EU Eco-Management and Audit Scheme (EMAS)[11] and the ISO standards (14.001 International norm) or different national awards are the most common. For example in Spain there exist: Q de calidad, Sistema de gestión del uso público de playas del ICTE- Instituto para la Calidad Turística Española).

The implementation and running of EMAS/ISO certification were originally designed for managing environmental dimension in private companies. However, several pioneering municipalities were engaged in the certification of the environmental quality for their urban beaches. In Spain the first ones were Cadiz, San Sebastian and Cullera and in Catalonia Roses, Barcelona, Calafell, Tarragona and Calonge.

[10] It is based in the voluntary implantation of the european normative EMAS (Eco-Management and Audit Scheme) and the internacional environmental regulation ISO 14001.
[11] EMAS is a management tool for companies and other organisations to evaluate, report and improve their environmental performance. It has been open to all economic sectors including public and private services.

Even though the scope of process oriented tools is wider, since they include other quality criteria, they are disapproved due to their top-down approach (Nelson, 2002) and for the little or no importance given to the evaluation from the user's point of view. One of its main drawbacks is the difficulty to identify and to involve all relevant stakeholders link to beach systems (Generalitat de Catalunya, 2007). In spite of the fact that recreational uses are prioritised in many cases, patterns in beach user's behaviours and addressing their attitudes and perceptions are missing. In fact, there is not many literature on the beach users' preferences, though it has been acknowledge its importance.

What it seems a paradox is that beach management has focused on recreational function due to mass use of them while scientific research has been mainly oriented towards geomorphological hazards and biological studies. Therefore there is a clear evidence of a gap between management needs and scientific research.

Up to now, although a number of authors have considered the value of quality indicators for beaches, only a few studies have been carried out in the field of social perception applied to beach planning and management, these are going to be briefly reviewed in the next section.

4.3 Background on beach quality evaluation under beach user perspective

The need for considering beach user's preferences, opinions, concerns and demands is acknowledged by several authors (Morgan *et al*, 1996; Morgan, 1999a; Williams *et al*., 1993; Breton *et al*., 1996; Villares, 1999; Villares *et al*., 2006; Nelson *et al*, 2000; Tunstall *et al*., 1998; Priskin, 2003). A better understanding of public attitudes, expectations and values of the coasts, e.g. how they perceive environmental quality, is of value to coastal managers.

Beach user is defined as a person that goes to the beach to satisfy either professional or recreational needs (Generalitat de Catalunya, 2007). Identifying beach users' perceptions and priorities through questionnaire surveys was performed before by some authors. The following section will make a short review of the most relevant work realised in this field (for a detailed review see also Dahm, 2002).

The first studies on this field already highlighted the complexity of the topic. Their results indicated that no strong, systematic relationship could be

established between the perception of the environmental quality and the choice for a particular beach. Other aspects such us the accessibility, the presence of facilities, the sociodemographic characteristics appeared to play a role in beach selection (Hecock, 1970; Cutter *et al*. 1979).

On these bases, factors influencing beach users, which are very much context-dependent, can be grouped into:

→ **beach characteristics:** environmental quality, facilities, services…

→ **socio-economic determinants** of beach users: origin, age, race, gender…

One of the most interesting researches on the former group was performed in the University of Glamorgan (UK) by the team lead by Prof. A. William and Prof. R. Morgan. They have established a classification system developed on the basis of beach user preferences and priorities considering five groups of aspects: safety, water quality, facilities, beach surroundings, litter. Morgan (1999b) found that although there was a contrast between those users that prefer natural beaches and who preferred traditional beach resort, landscape was the most important single factor, followed by bathing safety, and a variety of factors associated with beach environmental quality (e.g. bathing water quality), whereas beach facilities were generally allocated a lower priority. Other perspective is given by De Ruyck (1995). In Kings beach in South Africa most important reasons for visiting it were its facilities, human activity and the accessibility of the beach due to its proximity to the city centre.

In the Mediterranean Basin, the study of Breton *et al*. (1996) in Metropolitan area of Barcelona is quite relevant. Beaches were seen as places where one can escape from everyday activities, but also have to be functional, comfortable, user-friendly and safe. However, the most important aspect for beach users was the cleanliness of sand and water and safety followed by basic amenities. People were, in general, more concerned about health and safety than about nature, aesthetic considerations or overcrowding.

In the work of Santos *et al* (2005) in southern Brazilian coastal zones, the presence of litter is observed as the main problem pointed out by the beach users. It concurs with other studies that highlight cleaning level as fundamental when people choose a beach for going to.

In Tudor *et al*. (2003) the beach users' values for recreation and beach characteristics revealed through their choice of which beach to visit. Cleanliness, recreational aspects and natural attributes were frequently mentioned in questionnaire responses concerning the important factors of a beach from a beach user perspective. These conclusions concur with the work done by Nordstrom *et al*. (2001).

The main focus of previous studies was to analyse beach users' preferences for choosing a beach and their perceptions regarding different aspects of the beach. In general all these authors asked to beach users to rank several criteria in order of what they considered to be the most important reasons for beach selection.

Another type of survey, developed by Tudor and Williams (2006) and Nelson (1999), aims to find out which is the level of public awareness of beach rating and award schemes. For example, Nelson (2000) did a survey in Wales to contrast beach awards with beach users' perceptions. He found that there was a need for beach awards to take proper account of the desires of beach users. Moreover, the author highlighted the need for more appropriate award which should consider undeveloped beaches, reducing the risk to add possible undesired facilities to pristine beaches.

Another group of factors that influences beach users' attitudes are their personal determinants. However, it is rarely to find studies focused on beach-going behaviour and its determinants. William *et al.* (1993) found that from socio-demographic factors influencing the choice of a beach to visit four were relevant: anxiety, gender, socioeconomic status and planed length of stay. Morgan *et al.* (1993) suggested that high socio-economic class tended to place lower priority on visitor facilities in general, although they were more critical of deficiencies in facilities such as shortage of toilets.

A broader perspective was provided by Wolch *et al*. (2004) which developed a conceptual model relating beach user rate and individual characteristics, geographical access, coastal knowledge, interaction with coastal environments and attitudes toward nature. The factors of the model (see Figure 4.1) are not completely independent, as demographic factors may shape environmental attitude and play a role in accessibility. A variable that hasn't been approached before is how differential environmental values or attitudes might influence beach recreational choice. Wolch *et al*. (2004) suggest that anthropocentric attitudes might be expected to be different from ecocentric ones, but there is a

lack on this kind of research. The first ones might be linked to consumptive recreation (deckchairs, restaurants…) and they would prefer a well-equipped beach and the ecocentric worldview prefers other activities (biodiversity observation, snorkelling, walking) and would choose unspoiled beaches.

Close to this perspective, Tunstall *et al*. (1998) conducted empirical research on the meanings that beach experiences have for them, and the values that they attach to them. Main results showed that beaches were linked to concepts of naturalness and their own personal experience in earlier years.

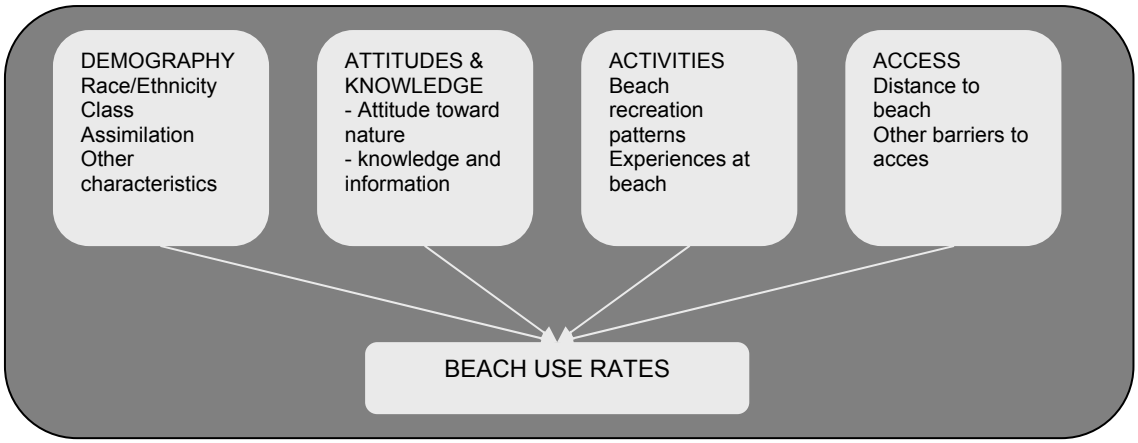

Figure 4.1 A model of beach use. Source: Adapted from Wolch *et al.* (2004).

Regarding, other relevant studies that investigated on other specific issues can be the study conducted by Martin *et al*. (2002) to explain perception on environmental quality and pollution-related risk associated with going to the beach. It was concluded that media and information on the beach were very important in influencing perceptions of risk.

Bonaiuto (1996) examined the importance of local and national identity processes in the perception and evaluation of beach pollution. It was found that subjects who were more attached to their town or their nation tended to perceive their local and national beaches as less polluted. Bonaiuto (1996) found that students who were more attached to their town tended to perceive their beaches as less polluted. It was interpreted as a reaction to physical assessments imposed by external groups which can be a threat to place identity.

Lastly, the work of Villares (1999) and Villares *et al.* (2006) focus on public perceptions in relation to beach erosion processes. Main findings recommended not to intervene and solve the problem by radical alteration of the scenery and

of the morphological characteristics of the former shoreline (sand texture, colour, slopes, and width). It was suggested that introducing public perception criteria in coastal protection projects regarding beach characteristics may facilitate consensus and acceptability on final solution. The methodology applied in Villares (1999) has been adapted to be applied in this case study.

Chapter 5 Public perceptions in the assessment of beach quality. A case study in the Costa Brava

5.1 Introduction: beach as icon of coastal tourism

Nowadays, beaches represent the main focus of global holiday tourism. They have become an icon of contemporary tourism (Holden, 2000). Moreover, tourism has been identified as one of the main factors affecting the quality of the coastal environment which in many cases result in coastal degradation (see e.g. Smith, 1991; Wong, 1998).

On trying to deal with this situation, a set of instruments have been developed to evaluate beach quality in order to manage both environmental degradation and recreational uses. In Europe, the first sign of this concern came in the mid 70's with the EC Bathing Water Directive (CEC, 1976) basically referring to water quality criteria. Afterwards, in 1987 the most prestigious and wide-known quality award scheme, the European Blue Flag was introduced. Since then, other types of norms are being used, such as the ISO standards.

In fine, recent years, the scope of beach management practices has broadened and a wide range of parameters regarding water quality, safety, public education, geomorphology, facilities and so on have been integrated in their evaluation processes. However, a complementary bottom-up perspective that considers beach users' preferences and demands is still missing (Roca *et al*. in press).

Public perceptions, needs and preferences are not yet fully understood. According to Daily (1997), environmental management needs to consider public perception. The criteria on which beach quality is assessed should be at least partly based on user opinion (Morgan, 1999a). A bottom-up perspective that considers beach users' preferences and demands would provide meaningful and relevant information in order to address their recreational needs and improve the quality of tourist beaches. In addition, the identification of differences in the attitudes of users may be effectively used in planning environmental management and developing sustainable tourism (Cihar *et al*.,

2006). Seeking a better understanding of how individuals perceive coastal impacts is very relevant in helping managers to engage a particular strategy towards the integrated management of coastal areas. Although this sort of analysis is almost non-existent in beach management, understanding visitors' attitudes, how they use resources, and how they perceive environmental quality is valuable to coastal managers (Priskin, 2003). Consequently, comprehensive information on user expectations and demands should be added to any assessment in order to produce a better-informed process.

Our proposal starts out from the presumption that each type of beach requires a different type of management that might be flexible and allow adaptation to a set of quality criteria locally specific, from both, the perspective of the users and the perspective of the different stakeholders involved. On this basis, the main goal of this case study is to analyse public perception and preferences of different aspects of beach quality in a context of highly tourist environment to draw policy implications in terms of beach management.

As we have explained in the previous chapter, beach users' relationships with the environment are complex. People's recreation behaviour is indirectly affected by environmental quality, via the individual's formulations of perceptions about their environment. Reciprocally, people the affect natural environment through individual behaviour, which may depend on people's perceptions of the environment (Pendleton *et al.*, 2001). On these bases, we have two main hypotheses. On the one hand, public perceptions can be affected by beach typology, which means that the conservation of the natural features and/or the recreational services offered influences their demands and their motivations for choosing a particular beach. On the other, beach users are very diverse from the socioeconomic perspective (age, nationality, income level) having different attitudes and relationships towards beaches and their management. Thus, our purpose is to highlight how public perceptions and attitudes vary depending on both the local context and the beach user profile.

The case study of is structured as follows: Firstly, the historical background and the local context of the case study are introduced; Secondly, a description is then provided of the methodology used; Next, the results are presented, largely in the form of a description of beach users profile and their motivations and their perception giving specific attention to the differences considering the type of beach and the type beach user. Finally, the discussion is oriented to

management purposes in order to argue which the implication of public perception surveys are.

5.2 Study area

5.2.1 Location

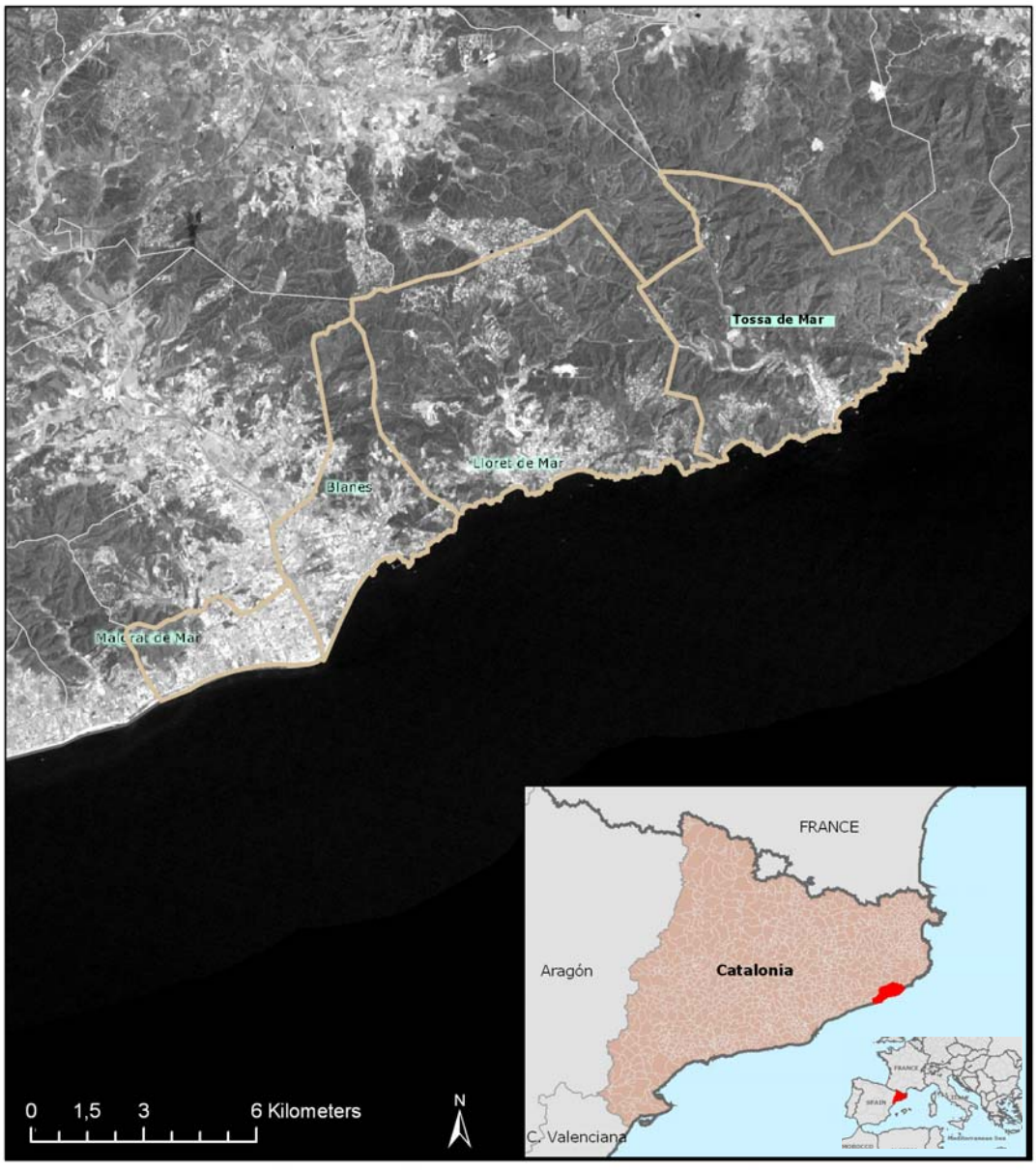

Figure 5.1 Location of study area. Source: European Commission - D.G. Research Joint Research Centre (2005) and European Topic Centre on Land Use and Spatial Information

The work has been conducted in the Costa Brava, a highly developed tourist area in the NE Spanish Mediterranean coast (Figure 5.1). This region has a long tradition of attracting international tourism, since the 60's. With the tourism

boom the growing pressure of a process of urbanization of second home residence, the social uses of these beaches has become more and more intensive.

Thus, it is an illustrative case of the sun and sand sprawl model experienced during the 60s and 70s in many tourist destinations of the Western Mediterranean basin. Due to the climatic, geomorphologic and socio-economic characteristics of the area, the approach and results can be extended and/or adapted to other Mediterranean areas and to zones with important coastal resorts.

5.2.2 Historical context: Sun-sea-and-sand tourism on the Costa Brava

The Costa Brava is a coastal region in northeast Spain where the beaches are a major tourist resource and attraction that has played a key role in the area's socio-economic development in recent decades.

The region's unique historical heritage and landscape, so different from the rest of the Spanish Mediterranean coastline, has since the 1950s provoked extremely intensive tourism development, which has focussed on the region's 'sun and sand' resources. Costa Brava tourist resorts are illustrative of a typical cycle of resort development identified by Butler (1980), where a destination area is promoted by an elite group, which leads to rapid unplanned tourism growth influenced by the political situation and market forces (Priestley, 1998). Under Franco dictatorship, the tourism industry in Spain was promoted with the aim of gaining political recognition (Holden, 2000). However, not all coastal areas were treated equally. In the case of the Costa Brava, little help was given. The provincial governments, chambers of commerce and private initiatives were relied upon to provide financial aid and investment in public services and infrastructures (Morris, 1996).

Tourism also had an important spin-off effect on other economic sectors. The availability of cheap land in Spain for hotel construction helped increase activity in the hotel and restaurant trades and consequently in the construction industry, which in turn attracted labour inflows from the rest of Catalonia and Spain. This development began to accelerate from 1980 and especially from 1990, at a time when local demand (both Catalan and Spanish) was massively incorporated into the consumer market and the tourist use of the coast, which led to a sharp increase in second-home construction for the region's city dwellers, especially those from Barcelona (Priestley, 1998). The magnitude of this process has

become a determining factor in the area, as Spanish families are now significantly more likely than other European families to own a second and even a third residence (Anton, 2004).

Seasonality is another characteristic of the tourism model found on the Costa Brava. The region's services (e.g. rubbish collection, transport infrastructures) alternate between periods of saturation and infra-utilisation. One of the chief ironies is that the peak occupancy period falls in the dry season, which increases the pressure on water resources.

In the end, the overexploitation of natural resources (water, energy, landscape, sea) is currently compromising the sustainability of the own activity. The major problem that this kind of destinations faces is the deterioration of the environment (natural and urban) which has dropped the price/quality ration.

The growing pressure brought about by the process of holiday-home development, combined with the area's long tradition of attracting international tourism has, since the 1960s, entailed increasingly intensive social uses of beaches in the area. In numbers it means that around 5.298 thousands de foreign tourists, 494 thousands from the rest of Spain and 1245 thousands from Catalonia visit the Costa Brava every year (Observatori del Turisme, 2007). In addition, more than 100.000 second residence which imply 1,8 second residence per main residence are found in the area (Sauló, 2005).

Regarding the origin of the visitors[12] that come to Costa Brava, Western Europeans have traditionally constituted the majority. French visitors, who arrive mainly by road in private cars and occupy campsites and private accommodation in preference to hotels, have always been the most numerous. Britons initially dominated the demand for short-stay hotel and apartment accommodation, but demand from the German market has gradually grown to such an extent that it now exceeds that of British nationals. The constant diversification of the market to include other European nationalities (Italy and Eastern European countries in particular) is the keynote of present trends (Priestley, 1998).

[12] According to World Tourism Organisation, a visitor is a person that travels between two or more countries or between two or more places in their country of origin, for a period less than 12 month and for whom the principal motivation of the travel is not exercise an activity that provides income in the visiting place.

Territorial expressions imply accommodation facilities for short-stay visitors and, consequently, international mass tourism demand, which is concentrated in a small number of large resorts (Platja d'Aro, Lloret de Mar and to a lesser extent, Roses, Tossa de Mar). Campsites are concentrated from Roses to Blanes, while second home development has mainly a disperse urbanisation model spread all along the coast and throughout its hinterland (Priestley 1996).

In fine, the dominating structure referring to the coastal environment has a residential base with construction and hotel development accompanied by products, in many cases, clearly tourist. Exceptionally there are some free or protected spaces that are still the object of new products for the tourist consumer. For instance, the development of the so called “sustainable tourism” associated with visits and activities carried out in natural parks found along the coast. In all these contexts, the beaches constitute the main tourist resource and their use during the summer (sun, sand and sea) is intense and fundamental.

Therefore, a diversity of “realities” lives together along the Costa Brava attracted by the presence of a unique shoreline. As a result, a variety of beach users now coexist on these beaches. First, there are the residents, who live there the whole year, pay taxes and vote. Second, there are regional visitors (from Catalonia), a floating and predictable population that stays mainly in second homes in sprawling urbanization. This type of family and seasonal tourism tends to stay for longer periods (1 month) at the tourist site. Finally, there are foreign tourists, who arrive on organised trips and stay for shorter periods in hotels, campsites or rented apartments, in a more intensive occupancy (higher-density buildings). This sort of tourism is more unstable and linked to global geopolitical factors such as international security and the emergence of competing areas.

5.2.3 Selected beaches in the southern Costa Brava

This study covers six beaches in four coastal municipalities: Malgrat, Blanes, Lloret de Mar and Tossa de Mar (See Figure 5.2). These coast towns rely almost exclusively on the tourism and property sectors. In addition to an important hotel trade, these towns have a high proportion of holiday homes, a fact which adds a large number of holiday and weekend residents to tourist numbers. Although a common origin, each municipality evolved in a different direction depending on intrinsic factors. For instance, Tossa de Mar is a paradigmatic location that resisted offers of large-scale tourist projects, although

through the film of Pandora in the early 1950 it became internationally famous. As a result Tossa remained largely unaltered while Lloret de Mar developed one of the major destinations for mass tourism on the coast (Priestley, 1996).

The difference in numbers between year-round and temporary residents is considerable. Malgrat has 17,500 inhabitants rising to 50,000 residents in the peak season. The population of Blanes goes from 37,000 to 100,000 inhabitants in the tourist season; Lloret de Mar experiences even more spectacular growth, with a population that goes from 28,000 to 200,000; finally, Tossa de Mar's population goes from 4,500 to 50,000 inhabitants[13].

Specifically, these are urban and semi-natural beaches located in the heart of these towns or in nearby built-up residential areas (consisting of holiday homes). A relatively variety of beach types are offered for a diverse social universe. The beaches studied are very popular for coastal tourism. They are highly demanded during the summer which is the peak season. All of them are sandy beaches without engineered interventions. Table 5.1 shows the main characteristics of the beaches studied including facilities and services provided to the users.

Table 5.1 Description and classification of study beaches.

Beach	Type of beach	Size (length/width)	Transport	Facilities	Disabled accesses	Blue Flag	Other schemes
Malgrat Nord	Semi-urban	2,270m/50m		Non-equipped	No	No	no
Blanes	Urban Beach.	3,100m/60m		Full-equipped			no
Sta. Cristina	Semi-urban	365m/30		Semi-equipped	No		no
Lloret	Urban Beach	1,300 m/40m		Full-equipped			Q-Quality ISO 14.001
Canyelles	Semi-urban	400m/40m		Semi-equipped	No	No	no
Tossa de Mar	Urban Beach	385m/50m		Full-equipped			no

Sources: Ministry of Environment, www.blueflag.org, www.lloret.org, www.ajmalgrat.org

 Public transport  Presence of cruises,  beach awarded by a blue flan.

[13] Data from IDESCAT. Catalan Census. Statistical Office of Catalonia.

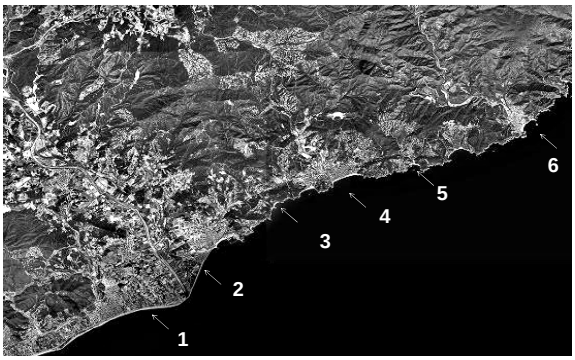

Figure 5.2 Location and aerial views of the studied beaches. Source: www.mma.es

From south to the north these beaches are (Figure 5.2):

→ **Malgrat North:** It is circumscribed to the coastal domain of the river Tordera delta. Morphologically, it is an open and extensive beach which is widely exposed to the wind. It is the least exploited beach of the whole group maintaining a certain natural setting and landscaping features, with few

services and hardly any facilities. These are covered by the proximity of the camping-sites, which surrounds the whole beach [14]

→ **S'abanell (Blanes):** It partly corresponds to a semi-urbanized beach oriented to recreational uses and its geology corresponds completely to a delta domain. In the immediate context we find the city sea front, a concentration of hotels, an area of local residents, an area of second homes, a large area occupied by the camping-sites and at the end of it, the free space taken up by the Delta of the Tordera river in its natural condition.

→ **Sta. Cristina (Lloret):** It is located in a less urbanized environment far away from the city centre. Its natural features provide it with a good environmental quality. It has few facilities. Although accessibility is rather complicated (it is accessed by a sharp path), its landscape quality entails high frequentation rates.

→ **Lloret beach (Lloret):** It is the typical tourist resort beach with a dense urbanisation behind the beach which is surrounded by a rigid promenade. It is a highly developed beach with all kind of facilities.

→ **Canyelles (Lloret):** It is 3km faraway from Lloret town but it is easy accessible by private car. It is a typical sheltered beach of this area with a high landscape quality and the presence of natural elements. In its immediate surroundings some disperse urbanizations are located and a camping is also found. The beach has few facilities and one small marina from the end of 70's.

→ **Platja Gran i Menuda (Tossa de Mar):** It is the smallest municipality with two central and overcrowded beaches which are not very extensive.

Beach types

The study area has a wide diversity of beaches in regard to the level of exploitation and its natural conservation, which point out two extremes depending on the predominating ecosystem function (conservation vs. recreational). Other authors have previously defined these situations and named them in different ways. For instance, Micallef *et al*. (2004) classifies beaches as resort/non resort beaches, Nelson *et al*. (2000) talks about

[14] During the high season they may house over 12,000 campers, mostly coming from the metropolitan area of Barcelona city – although a significant number are from a group of customers coming from other European countries; Dutch, English, French and German.

undeveloped and commercialised beaches. Although in our cases studies on a completely natural beach is not found, for analytical purposes, we distinguish between two categories of beaches:

→ **Urban**: these beaches that are found in front of dense urban areas with a variety of commercial services and tourist accommodation. They are normally surrounded by a rigid boulevard or a road. Being extensively developed with an intensive provision of facilities and services, the recreational value far exceeds that of conservation.

→ **Semi-natural**: This type of beach has a disperse urbanized area behind. They present reduced accessibility, only by private transport and this implies less frequent visits and reasonably preserved natural values. They provide a limited number of facilities for users.

In relation to this classification, the beach of S'Abanell in Blanes, the central beach of Lloret and the beach of Tossa are classified as urban beaches. In turn, the northern beach of Malgrat and Sta. Cristina and Canyelles beaches are semi-natural.

The whole situation provides us with an interesting opportunity of studying different beaches regarding its level of artificialised landscape, type of management (exploitation, service provision) and diverse beach users profiles, placed in the same geographical unit: the Costa Brava.

5.3 Methodology

The methodology designed implies two complementary approaches – quantitative and qualitative- which have been previously tested in Villares (1999) and Villares *et al.* (2006). The idea of linking different qualitative and quantitative methods is widely discussed in Flick (2006) and on our understanding it is becoming essential to deal with environmental issues. It aims at overcoming the limitations of a single technique by combining several methods and giving them equal relevance.

The first method consists in a massive survey of beach users' profile and perception by means of a questionnaire. Simultaneously, this was accompanied by the recording of beach characteristics during the survey to define the "objective beach". The second method was an in-depth semi-structured interview to main stakeholders. This technique is widely used in social sciences

to clarify and deal in depth those aspects that cannot be easily understood with just a quantitative survey (See Figure 5.3)

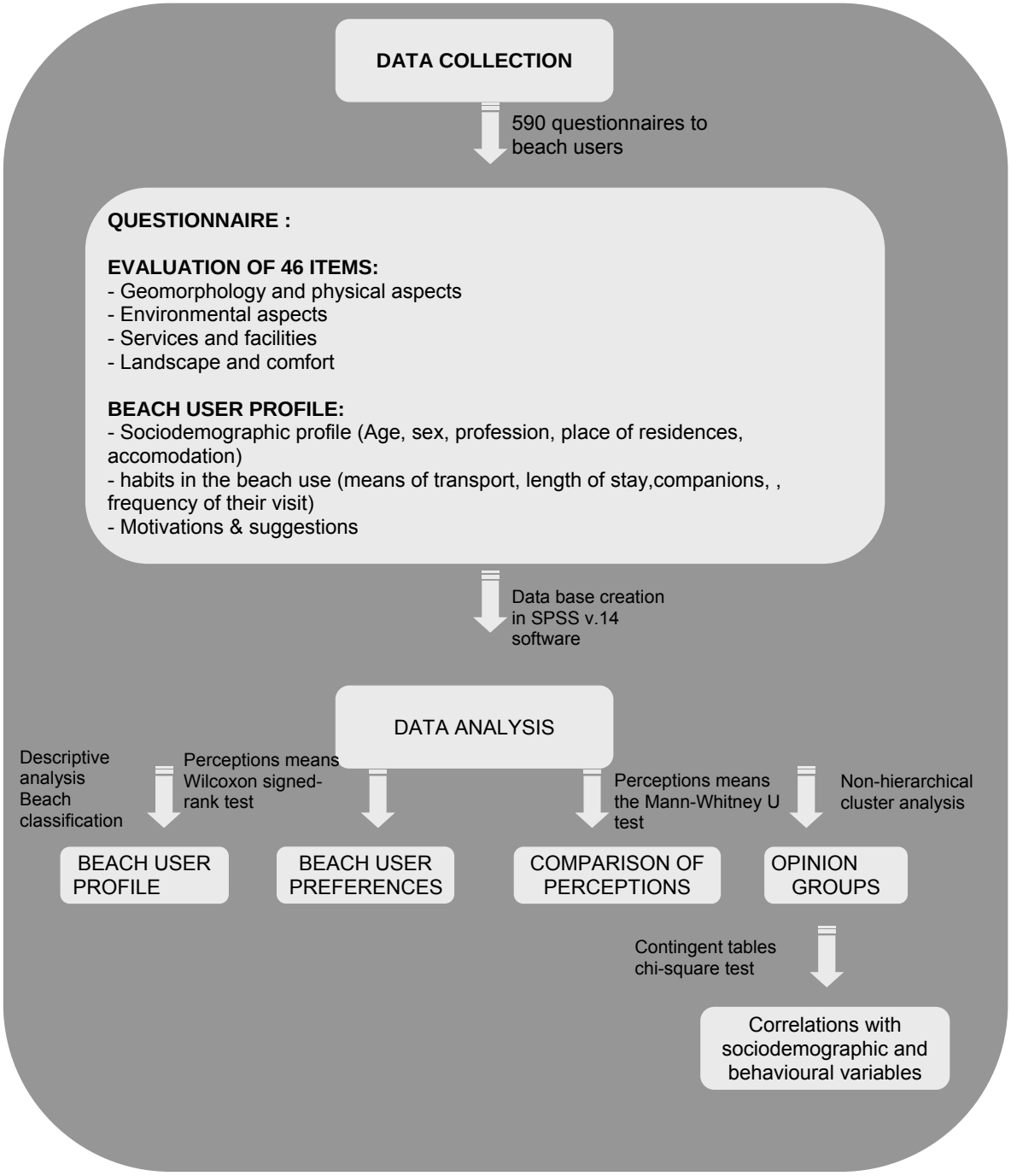

Figure 5.3 Diagram of the methodological pathway

Next, the set of instruments used for this research are presented. The section also describes in detail the context, sample and participants for the application of these methods and their analysis and interpretation.

Figure 5.4 Questionnaire

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STUDY ON SOCIAL PERCEPTION OF TOSSA DE MAR, LLORET DE MAR, BLANES AND MALGRAT DE MAR BEACHES. "*MEVAPLAYA PROJECT*"

INTERVIEWS WITH BEACH USERS

From the Technical University of Catalonia (UPC), we are carrying out a study on social perception in order to know the opinion and the valuation of this beach. We would appreciate if you could value the beach to help us establishing criteria for improving or correcting the situation in order to optimise its management.

We would ask you to evaluate different physical characteristics, environmental aspects and the services of the beaches. It is a matter of marking from 1 to 10. When answering please remember that 10 means maximum punctuation, what you value positively, and 1 means negatives punctuation, what you don't like. In case any aspect is not present, please mark "not present".

PHYSICAL AND MORPHOLOGICAL ASPECTS

Physical aspect and shape of the beach can change due to the effects of the storms, which limits sand extension. In order to evaluate the current situation of this beach, please, punctuate the following aspects:

The colour of the sand	1	2	3	4	5	6	7	8	9	10	Not present
The texture of the sand	1	2	3	4	5	6	7	8	9	10	Not present
Water temperature	1	2	3	4	5	6	7	8	9	10	Not present
beach Width	1	2	3	4	5	6	7	8	9	10	Not present
beach length	1	2	3	4	5	6	7	8	9	10	Not present
Slope of the beach	1	2	3	4	5	6	7	8	9	10	Not present
Slope into the water	1	2	3	4	5	6	7	8	9	10	Not present
Waves	1	2	3	4	5	6	7	8	9	10	Not present
Sand temperature	1	2	3	4	5	6	7	8	9	10	Not present
Wind	1	2	3	4	5	6	7	8	9	10	Not present
The presence of rocks	1	2	3	4	5	6	7	8	9	10	Not present
The presence of cliffs	1	2	3	4	5	6	7	8	9	10	Not present

Continue

ENVIRONMENTAL ASPECTS

Under this heading we would like you to evaluate the environmental quality of the water and the sand, and also the quality of the environment and the facilities. Please we ask you to punctuate such quality through the visible aspects as, for example, what you can see, smell, feel, perceive, etc.

Please remember that the minimum value is 1 and would represent a very serious environmental problem, whereas an optimum environment would be valued at 10.

Waste matter on the sand	1	2	3	4	5	6	7	8	9	10	Not present
Waste matter in the water	1	2	3	4	5	6	7	8	9	10	Not present
Toilet facilities	1	2	3	4	5	6	7	8	9	10	Not present
Shower facilities	1	2	3	4	5	6	7	8	9	10	Not present
Toilet maintenance	1	2	3	4	5	6	7	8	9	10	Not present
Shower maintenance	1	2	3	4	5	6	7	8	9	10	Not present
Installation of waste-baskets	1	2	3	4	5	6	7	8	9	10	Not present
Rain water run-offs	1	2	3	4	5	6	7	8	9	10	Not present
Presence of vegetation	1	2	3	4	5	6	7	8	9	10	Not present
Presence of fish	1	2	3	4	5	6	7	8	9	10	Not present
Presence of alive seaweed	1	2	3	4	5	6	7	8	9	10	Not present
Presence of dead seaweed	1	2	3	4	5	6	7	8	9	10	Not present
Presence of oil on the water	1	2	3	4	5	6	7	8	9	10	Not present
Presence of oil on the sand	1	2	3	4	5	6	7	8	9	10	Not present
Noise of engines	1	2	3	4	5	6	7	8	9	10	Not present
Noise of people	1	2	3	4	5	6	7	8	9	10	Not present
Presence of dogs	1	2	3	4	5	6	7	8	9	10	Not present

ASPECTS RELATED TO FACILITIES AND SERVICES

We would like you to punctuate the characteristics in the use and presence of facilities and services meant for the comfort and enjoyment of your stay on the beach. Please value from 1 to 10 the following aspects:

Stalls/booth	1	2	3	4	5	6	7	8	9	10	Not present
Rentals of deckchairs/sunshades	1	2	3	4	5	6	7	8	9	10	Not present
Surveillance	1	2	3	4	5	6	7	8	9	10	Not present
Life-saving	1	2	3	4	5	6	7	8	9	10	Not present
Walkway on the sand	1	2	3	4	5	6	7	8	9	10	Not present
Play/sport areas on the beach.	1	2	3	4	5	6	7	8	9	10	Not present
Areas for water activities	1	2	3	4	5	6	7	8	9	10	Not present
Rentals of jet skies, windsurf	1	2	3	4	5	6	7	8	9	10	Not present
Parking areas	1	2	3	4	5	6	7	8	9	10	Not present
Access to the beach	1	2	3	4	5	6	7	8	9	10	Not present
The waterfront/boulevard	1	2	3	4	5	6	7	8	9	10	Not present
Restaurants & bars	1	2	3	4	5	6	7	8	9	10	Not present

Continue

ASPECTS RELATED TO BEACH DESIGN, COMFORT AND GLOBAL VALUATION

This beach, that you have chosen to spend the day, has a determined landscape linked to its tourist development. How would you evaluate the following aspects? We also ask you to evaluate the beach on the whole thinking in terms of the aspects detailed above.

The landscape	1	2	3	4	5	6	7	8	9	10	Not present
The comfort of the beach	1	2	3	4	5	6	7	8	9	10	Not present
Quality/price ratio	1	2	3	4	5	6	7	8	9	10	Not present
The number of users	1	2	3	4	5	6	7	8	9	10	Not present

Global evaluation	1	2	3	4	5	6	7	8	9	10	Not present

Final suggestions: What do you think would improve this beach and its environment?

_____

_____

IN GENERAL, when you chose a beach (ANY BEACH), how important are the following aspects for you? 10 is the maximum importance and 1 the minimum.

Good facilities		Comfort and safety for bathing and swimming	
Clean water and sand		Good access and parking areas	
Attractive views and landscapes		Tranquility	

CLASSIFICATION DATA

Data:	**Time:**	**Normal place of residence (country)**
Age:	**Sex:**	**Profession:**

From which village/town have you arrived to the beach?
Why have you chosen this beach?

By which transport have you arrived to the beach today? (Mark only one box)

By foot		By bicycle		By car	
By urban bus		By train		By own boat	
By cruise		Others			

With whom have you come to the beach? (Mark only one box)

Alone		With the partner		With the family	
With a group of friends		Others			

How long (in hours) do you plan to stay on the beach? (Mark only one box)

Less than 1h		Between 1 and 3h		Between 3 and 5h		More than 5h	

Continue →

Where are you staying here?

Home (habitual residence)		Apartment		Swimming pool	yes / no
Home (holiday home)		Semi-detached house		With sea views	yes / no
Rented for the holiday		Detached house			
Home of friends/family					

Hotel / Hostel / Pension		Accommodation conditions	B&B	Half board	Full board
Camping					
Only spending the day					
On a yacht					
Others					

Please, indicate the name of the hotel or camping. In case you are in a house/apartment indicate the urbanization or the street.

How much do you spend per day in the beach? (€/pers) Please, consider restaurant, leisure, supermarket, beach services… (Mark only one box)

Less than 10 €		Between 11and 20 €		Between 21 and 40 €	
Between 41and 60 €		More than 60€			

How often do you come to this particular beach? (Mark only one box)

In summer:

Every day		Weekends		More than once a week	
More than once a month		Less than once a month		This is the first time	

Rest of the year:

Every day		Weekends		More than once a week	
More than once a month		Less than once a month		This is the first time	

Why are you on this beach today? (Mark only one box)

To swim and sunbathe		Enjoy the landscape and nature		Practice beach sports	
To walk and stroll		To play with the children		Practice water sports	

¿Where have you heard about this beach? (Mark only one box)

Travel agency		At the hotel, camping, etc		Information office	
Tourist guide		By recommendation		Others	

THANK YOU VERY MUCH FOR YOUR HELP!

5.3.1 Beach users' survey

Questionnaire design

The questionnaire included the following parts (Figure 5.4):

→ **Part A. Beach users' profile.** This part incorporated variables on socioeconomic and demographic profiles (age, sex, profession, place of residence), their habits using that particular beach (means of transport, length of stay, companions and types of activities undertaken on the beach) and information on their accommodation and frequency of their visits (in the peak season and in the off-season).

→ **Part B. Beach quality evaluation:** A set of 46 parameters were evaluated by beach users. The choice of parameters included in the questionnaire was ascertain on the results obtained in previous work (William 1993, Morgan,1996; Villares, 1999; Villares *et al*. 2006) and contrasted with the opinions provided by local stakeholders through a preliminary set of interviews conducted in the study area.

The respondents had to give a mark from 1 to 10 to each item depending on the level of satisfaction they provided. The set of parameters were split into 4 categories: physical and morphological aspects, environmental aspects, aspects related to equipment and services and, finally, design and comfort. The section on physical and morphological aspects evaluates the morphology of the beach: colour, texture and temperature of the sand, width, slope, entry into the water and the sea swell. These aspects determine beach shape and layout. The environmental characteristics focus on the evaluation of the most important biological aspects, such as the presence of fish, algae or vegetation, as well as public perception of the environmental quality of the most visible aspects, such as waste in the water or on the sand, maintenance and cleanliness, etc. It also deals with their appreciation of other kinds of pollution, such as noise or that arising from the rainwater drainage. Regarding the equipment and services, both the facilities and the efforts made to improve the quality, comfort and enjoyment of the users' stay on the beach are valued. The fact that there are lifeguards and items for hire (e.g. sunshades, deckchairs, tables, sail or motor boats etc.) enables the evaluation of the personal services. In addition, the public were asked to evaluate the planning of the area, including: recreational areas and activities, parking zones, access, the seafront etc. Finally, aspects related to design and comfort such as overall satisfaction and sensation, the

landscape, the level of comfort, peace and quiet, quality/price ratio are included. (Villares el al., 2006)

→ **C. Preferences, motivations and suggestions***:* In order not to lead respondents and to allow some degree of flexibility, two open-ended questions were included aiming at ascertaining i) what are beach users' main reasons for selecting that specific beach; ii) what propositions beach users have to improve the beach and its environment. In addition a closed question focused on the importance beach users give to each set of items (good facilities, comfort and safety for bathing and swimming, clean water and sand, good access and parking areas, attractive views and landscapes and peacefulness) when they choose a beach.

Table 5.2 List of items evaluated by beach users.

Physical/morphological features	Environmental aspects	Facilities and services	Beach design and comfort
The colour of the sand The texture of the sand Water temperature beach width beach length Slope of the beach Slope into the water Waves Sand temperature Wind The presence of rocks The presence of cliffs	Waste matter on the sand Waste matter in the water Toilet facilities Shower facilities Toilet maintenance Shower maintenance Installation of waste-baskets Rain water run-offs Presence of vegetation Presence of fish Presence of live seaweed Presence of dead seaweed Presence of oil on the water Presence of oil on the sand Noise of engines Noise of people Presence of dogs	Stalls/booths Rentals of deck chairs/sunshades Surveillance Life-saving Walkway on the sand Play/sport areas on the beach. Areas for water activities Rentals of water skis, windsurf boards Parking areas Access to the beach The waterfront/boulevard Restaurants & bars	The landscape The comfort of the beach Quality/price ratio The number of users Global evaluation

The checklist

The checklist is an extensive inventory list that must be filled in with the characteristics of the beaches under analysis by direct observation of the surroundings. It covers 50 aspects that are grouped into physical, biological, environmental, usage, service and equipment factors. The majority of these aspects logically correspond to the items that are integrated into the questionnaires. The checklist is completed at the time the questionnaire survey

was carried out and any particularity that occasionally or seasonally appears at the beach is highlighted.

Another component of the checklist is the photographic report that should be carried out ideally when the beach is deserted.

The sample

The sample is a group of individuals that represents the characteristics of a whole population's universe. Our target population is the beach users' universe in our study area, then the sample must be representative of it. Strictly speaking, the statistical population is the group of users that are in the beach in the moment of applying the questionnaire. In order to estimate the sample as representatively as possible, we based our calculation on the maximum data related to visits in the high season. Unfortunately there are few surveys related to visits in the area: the works of Alemany (1984) and Breton *et al* (1996) arrived to similar conclusions. According to Alemany (1984) our six beaches have a total peak visitation of 25,790 users. Subsequently, we decided to display 100 questionnaires per beach which sums 700 in total, which is a wide sample, representative of the total population.

The fact that the study area was frequented by a large number of international tourism was a relevant issue to consider because this implied that the beach users speak different languages. In order to guarantee the proportion of the different types of tourism in the sample and to avoid interviewer biases when selecting respondents, it was decided to stratify the sample according to the presence of each nationality. This information was taken from the local tourist office. Thus, the questionnaire was designed in 4 languages (Catalan, Spanish, English and French) and the fraction of each language was in coherence with composition of nationalities, taking into account that German and Dutch users could answer them in English and Italian could deal with the Spanish ones.

Survey administration

The sample used was a random group of people on each beach in a weekend of the peak season. Respondents were at least 16 years old. In total, 700 questionnaires were displayed over the last weekends of July during the bathing seasons in 2004 and 2005. The method of random sampling was based on a set itinerary which the interviewer followed in a zigzag fashion, trying to cover the whole beach.

Respondents were approached courteously and the purpose of the survey explained to them, together with the affiliation of the surveyors. Self-administered questionnaires were distributed in which respondents were asked to complete the questionnaire themselves. Each questionnaire took about 20 minutes to be completed. Simultaneously a total of 6 checklists were filled in to provide the objective reference.

In sum, around two-thirds of the sample was made up of young or middle-aged adults, accompanied by their partners and/or other family members, whose main interests were being outdoors and swimming. Over half (57%) of these were local users or visitors from other parts of Catalonia who had either taken up temporary residence on the coast or who had come as day visitors. Many came to the beach on a regular basis—33% daily and 19% every weekend. People from other parts of Spain and Europe (primarily from France, the Netherlands, Britain, Italy and Eastern Europe) accounted for 35% of the visitors. First-time visitors comprised 17%. Over half of the users spent lengthy periods on the beach: 38% remained on the beach for 3-5 hours and 15% spent more than 5 hours on the beach. Therefore, these holidaymakers clearly spent a significant proportion of their available time on the beach.

Variables classification

The socioeconomic variables have been organised in categories. Next, we present the variables and the categories in which have been grouped:

→ **Age** has three categories: youth (ages 16-30), adults (ages 30-60) and elderly (over age 60).

→ **The beach user's origin** is determined as being the place where he or she mostly resides. Three groups have been identified: locals (from the same municipality or neighbouring municipalities), Catalans (visitors from the same region, arriving mainly from Barcelona but also from other parts of Catalonia), and foreign tourists (visitors arriving from the rest of Spain or from foreign countries).

→ **Accommodation** is also divided into three groups: residents (whose main or second residence is in the study area), temporary residents (who are staying in hotels, campsites or rented apartments) and occasional visitors (who only spend the day on the beach).

→ **Transport**: most people go to the beach on foot or by private vehicle. Public transport is another category, which includes cruises (frequently used in the area by foreign tourists to visit more natural beaches).

→ **Company**: most people go to the beach accompanied by somebody (family, partner or friends). Only a few people participate in this recreational and social activity alone.

→ **Beach type**: According to their degree of development and natural conservation, we classified our study beaches in urban beaches (those directly adjacent to an urban centre, such as at S'Abanell, Lloret and Tossa) and semi-natural beaches (those with relatively well-conserved natural features despite some degree of development, such as at Malgrat, Santa Cristina and Canyelles).

→ The **reason** for choosing a particular beach was investigated through an open question, which received a wide variety of responses. The reasons were grouped as follows: proximity (the beach is close to the accommodation), tranquillity (the beach is quiet), family/friends (the beach user was invited by or visiting family/friends), landscape (the user was attracted by the landscape and/or local flavour), beach quality (clean water and sand), fidelity (familiarity, and tradition), prices, accommodation, weather and the recreation on offer.

→ The **suggestions** for improving the beach included the following categories: facilities, parking and accessibility, life-saving and security, beach morphology, beach planning, seafront and water quality. As it was an open question, the percentage of not answered (N) responses was treated as another category.

Data analysis

For the data analysis 42,000 responses to 590 questionnaires obtained were recorded using SPSS v. 14 statistic software. First the questionnaire was analyzed with a descriptive analysis: Mean and standard deviation for each parameter valuation grouped by beach type (urban and semi-natural). For comparative purposes, the arithmetic mean was calculated for each item to contrast perceptions.

It was expected that responses would differ between beach types and depending on beach user's profile. Therefore, the following analysis were performed:

→ **Comparing perceptions between beach types:** In order to test significant/not significant differences in the users' preferences and items perceptions the results were statistically treated with the Mann-Whitney U test, a non-parametric test for non-related samples as neither normality nor homogeneity of the samples could be proven. In statistics, the Mann-Whitney U test is a non-parametric test for assessing whether the medians between two samples of observations are the same. The null hypothesis is that the two samples are drawn from a single population, and therefore that the medians are equal. It requires the two samples to be independent, and the observations to be ordinal or continuous measurements, i.e. one can at least say, of any two observations, which is the greater (Pardo *et al*., 2002; Bryman, 2001) Results were considered significant at $P<0.05$. Non response cases were not considered in analysis.

→ **Comparing user's preferences when choosing a beach:** the differences between items in the same sample were considered important, as the aim of the question was to establish a prioritization in users' choice, so that the Wilcoxon signed-rank test was also applied. Results were considered significant at $P<0.05$. Non response cases were not considered in analysis (Pardo *et al*., 2002; Bryman, 2001).

→ **Comparing perceptions regarding beach user's profile**: A multivariate statistical analysis was carried out at a later stage. In order to reduce the number of items in the cluster analysis without losing representation, an *a priori* attempt to classify them using a principal component analysis was made (Peña, 2002; Krzanowsky, 1990; Anderson, 2003). However, it was not possible to reduce dimension to a relatively low number of factors. In the end, the cluster analysis was based on 30 pre-selected key and representative items.

Cluster analysis groups together individuals with similar patterns of scores on variables (Peña, 2002; Krzanowsky, 1990; Anderson, 2003). The objective is to group individuals according to their behaviour in a set of variables. Cluster analysis does not involve a cause-effect relationship. Instead, it attempts to describe the situation of some individuals within a population in relation to some specific phenomena by classifying them into homogenous groups. The resulting

groups should have high intra-group similarity but also relevant inter-group dissimilarity. Therefore, this sort of analysis allows the population, which is defined by certain variables, to be classified into a small number of groups not known *a priori*.

Basically, there are two clustering techniques: hierarchical and non-hierarchical clusters. A non-hierarchical approach was considered more appropriate for this survey, as it is better suited to bigger datasets and the solution is less influenced by outliers. One of its drawbacks is the need to establish the number of groups a priori. In this case study, several attempts were made, with the number of final groups varying each time. Finally, taking into account the complexity of results obtained with more than two-cluster solutions and aiming at offering relevant results for policy makers, a two-cluster solution was performed. This has permitted to facilitate further interpretative results and directly oriented to managerial purposes.

During post-hoc analysis, an ANOVA test detected statistically significant differences in how the members of the different clusters perceived beach quality.

In a further step, descriptive statistics (i.e. contingent tables) of both clusters were obtained to describe the beach-user profiles of the clusters. Correlations among clusters and several variables were tested by means of a chi-square test. Two sociodemographic variables (age and origin) and three behavioural variables (company, transport and accommodation) were selected to explore correlations. We also included beach type (urban or semi-natural), the users' reasons for visiting the beach in question, and the users' suggestions.

5.3.2 Qualitative approach

A quantitative technique as described above has to be complemented with qualitative information in order to acquire more in-depth information about answers given by beach users and to obtain a detailed and sectoral insight. Here it was decided to apply a motivation analysis which is a method of interviewing selected representatives, who provide the opinion of their organisations. The in-depth interview was designed and oriented to local stakeholders who had experience and knowledge of the beaches under study and who could provide technical details and also more strategic information. This type of methodology allowed us to investigate and understand the reasons

for certain perceptions. However, the results have to be treated carefully as interviewees are influenced by their personal situation and ideology.

Table 5.3 Lists of interviewees.

TYPE OF STAKEHOLDER	Municipality	Interviewees
PUBLIC ADMINISTRATION: Public interests	Malgrat	Regidoria Platges
		Regidoria Medi Ambient
		Regidoria Turisme
	Blanes	Regidoria Medi Ambient
		Regidoria Turisme
	Lloret	Regidor de platges
		Regidora de Turisme
		Regidoria Medi Ambient
		Lloreturisme
	Tossa	Regidora de Turismo
		Dir. Oficina Turisme
		Cap vigilància salvament
		Regidor medi ambient
Social arena: collective interests	Malgrat	Fundació Territori i Paisatge (espai dunar Malgrat)
	Blanes	Plataforma salvem Pinya de Rosa
		Creu Roja Platges
		Associació de Veïns els Pins
	Lloret	President de SOS Lloret
		Responsable vigilància de Platges
	Tossa	Pres assoc Amics de Tossa
Economic arena: private interests	Malgrat	Camping Pla de Mar
		Camping Tordera
	Blanes	Concessionari platja
		Associació de Campings
		Associació Hosteleria
		Restaurant Cal Tony
	Lloret	Concessionària Xiringuito. Platja Lloret
		Concessionari platja Sta. Cristina

		Concessionari patins. Platja Lloret
		Hotel Santa Marta.Platja de Sta. Cristina
		Concessionari Escola d' esquí i windsurf Platja de Canyelles
		Responsable Càmping Cala Canyelles
	Tossa	Concessionari Platja Gran
		Concessionari Platja Menuda
		Associació Hosteleria

In-depth interviews aimed at surveying people's perceptions on the problems and issues related to the quality of the beaches. We also wanted to assess management proposals and recommendations made for the studied beaches.

More than 40 in-depth interviews were carried out in the spring of 2004 and 2005 to local stakeholders who were concerned with coastal issues, ranging from local authorities, ecologist associations, tourism, to those who were directly involved in the beach management like people who clean them, rent sun-chairs or manage bars, lifeguards, police, Red Cross officers, etc. (see Table 5.3)

A content analysis of the in-depth interviews was performed to fully understand questionnaire results. Qualitative information plays an illustrative, explanatory part in the process of presenting and interpreting the results. Some statements extracted from the interviews are exposed in the results sections to contrast means and frequencies found in the questionnaire.

5.4 Results

The results are organised in three main sections: Firstly, some results on the main perceptions and concerns of the local stakeholder regarding the tourist model in the Costa Brava. Secondly, the beach user's profile which presents the information obtained from the classification data. Thirdly, preferences for choosing a particular beach are described. Finally, the perceptions obtained from the valuation given to the list of items and the opinions group formed according to the sociodemographic variables of beach users are presented.

5.4.1 Perceptions on tourist model from key stakeholders

There is undoubtedly a generalised perception of crisis and of having reached the end of an era. A process of renewal and a change in the tourism model are

both required to resolve this crisis. The perceived sensation of crisis is basically a consequence of unplanned and disorganised growth that responded to strong tourist demand and property speculation, which in turn led to imbalanced land use—in some areas verging on the disastrous (Roca *et al*. 2006).

In relation to the impact of beach users' behaviour on the local economy, it has been observed through the in-depth interviews that the Catalan tourist with a holiday home or with a temporary stay also seeks for other cultural interests (gastronomy, local festivals, historical heritage, etc) and spend more money in the municipality. This is in contrast to the huge amount of foreign tourists that get to the site through tour-operators. "They go from the hotel to the beach and from the beach to the hotel, afterwards they head to the disco and come back to the hotel..." as a local authority explained. This represents a lesser economic impact. Another aspect pointed out by Breton *et al.* (1996) was that some all-day users eat in the bar or restaurants nearby, but most of them bring their own picnic implying a low impact in local economies. This explains the efforts of the local communities to attract "a better quality tourism" represented by those segments prepared to pay more. In that respect, the business community, consisting mainly of hotels, restaurants, shop and beach-based business owners, acknowledge the need, on the one hand, to actively offer complementary cultural, sporting and entertainment activities that would reduce the high degree of seasonality attached to this kind of tourism. On the other hand, efforts should be made to improve the level of services and facilities provided not only on the beach but also in the surrounding areas.

The Costa Brava development model has been widely reproduced along the western Mediterranean coast in recent decades. This has led to explosive growth in sun-sea-and-sand tourism and a massive increase in the number of holiday homes. In neither case has there been adequate planning, and in both cases, the prime motivation has been short-term financial gain. However, the historical context and the results of this research point to the landscape quality and the natural features of the area studied as essential components of the system. The initial euphoria inspired by the mass-market tourism model has been replaced by a sense of crisis, motivated by exogenous and endogenous factors. Exogenous factors, which originated in the international context, lie beyond the scope of this research; endogenous factors—referring to deteriorating local natural features and tourist infrastructure quality— are discussed below in relation to the results of this local perception study conducted in Tossa del Mar, Lloret del Mar and Blanes.

To begin with, it is important to highlight that there is a general consensus consensus in relation to a vision of the crisis as a saturation of the carrying capacity of both the social and ecological systems. This saturation is reflected in landscape and ecological deterioration, mass-market tourism, the huge impact on water resources, and urban and inter-urban mobility problems—not to mention significant falls in benefits from the tourist activity itself. This perception of crisis is understood to represent a watershed. However, it has raised expectations and created opportunities towards the development of a new model that should be better adapted to changing circumstances and local needs. The question remains, however: what shape should this new model take?

In our local survey we compiled a series of proposals and recommendations that respond to specific sectoral issues. By general consensus at the local level, and leaving aside conservation issues, it is strongly argued that the highly seasonal nature of tourism in the area needs to be addressed, by prolonging the tourist season and/or by diversifying the offer to tourists. In this case, the issue of economic efficiency largely prevails above all other issues; the environment, nonetheless, is also perceived to merit concern as an important asset in this productive system (Roca *et al*. 2006).

5.4.2 Beach users' profile

This section aims to briefly describe the beach user profile most frequently found in each type of beach regarding their origin, age and accompanying people. In addition some details about their habits on accommodation and transport used to reach the beach are offered. Finally, the diversity of motivations for choosing each beach is highlighted in order to facilitate further interpretation of public perception.

All this information is offered for each beach but also aggregated by beach type (urban and seminatural).

Beach by beach

The results next presented are illustrated in the Table 5.4.

Malgrat Nord beach corresponds to a coastal environment visited by city dwellers. Almost half the users (about 48%) are from Barcelona city and its surrounding built-up areas. The majority of them stay in the camping-sites next to the beach. However, a significant number of users also come to this beach

from the town itself (Malgrat) or nearby villages due to its good communication with two inland towns. On the whole, therefore, we have a local population dotted with some foreigners accounting for scarcely 17% (British, French, Dutch and Italian) who mostly stay in the camping-sites.

It is a family beach with ¾ of the respondents enjoying a day out with the family or their partner. The great majority use the beach for swimming and sun-bathing which divides the activities between passive and active leisure, although a significant group say they use the beach as a meeting place for family contact and to play with their children. The main motivation for using this beach is the proximity of the camping-sites and the quietness that may be enjoyed in this area.

At S'Abanell beach mainly holidays users arrive, of which more than a half go to the beach every day. More than a quarter is European tourists (Dutch, English and French). However, the Catalans are the largest group, principally arriving from Barcelona and its Metropolitan Area (24%) and to a lesser extent from the rest of Catalonia (21%) and the same municipality (13%). The users are primarily hosted in the village in the hotels and camping areas (48%) or their second residence (28%) located just behind the beach.

The predominant tourism is family orientated as 74% of the respondents come "with my partner" or "with the family" with a strong prevalence of adults (53%). A high percentage (83%) gets to the beach "on foot". The main reason for choosing the beach is commonly the vicinity of their accommodation (35%), meaning house, hotel or camping areas. Other relevant causes include the landscape (23%) and family reasons (11%).

The main constraint at **Santa Cristina Beach** is the fact that its accessibility is linked to private transport. This favours users from nearby areas, 16% locals, and a larger proportion arrives from Barcelona Metropolitan Area (32%) and from the rest of Catalonia (14%).

It is a family beach as Table 5.4 illustrates with 73% of the users accompanied by their partner or their family. The majority access by private transport (80%), except for some tourists accommodated in the lonely hotel located in the hinterland (17%), who arrive on foot or those reaching the beach by cruise ship (8%). The beauty of the landscape appears clearly as the principal motive of users' choice.

Lloret is undoubtedly the touristiest beach. Thus, it is logical to find a clear dominance of foreigners (41%) and a minor proportion of users from Barcelona (13%) and the rest of Catalonia 6%. The beach is perceived as diverse, although the users are mostly young, more than 69% being less than 30 years-old. Only a few are accompanied by their families while more than half come with groups of friends. The beach is mainly accessed on foot as parking areas are rare and small and public transport is barely used (8%).

The tourists of this beach are primarily accommodated in hotels (60%) or in rented residences (11%). This is a low fidelity public, which although staying for the first time in the village go daily to the beach. On the contrary, in Sta Cristina and Canyelles in the same municipality, the public either local or from Barcelona and Catalonia and they visit repeatedly during the season and yearly.

In different proportion, the proximity to the hotel (29%), an attraction for the landscape (22%) and the recreational offer (16%) influence a choice for an eminent central and urban beach.

Although there is public transport at **Canyelles**, more than ¾ of the beach users arrive by car from the same municipality, or neighbour areas. The users come principally from Barcelona Metropolitan Area (40%) equally followed by locals and foreign tourists accounting for nearly 20% each. The holidaymakers are predominantly accommodated in second residences (27%).

This is a family beach as 73% come with their partner or the family. The landscape appeals together with the proximity of the second residences are the main reasons people gave for coming to this beach.

Tourism in **Tossa** is basically composed by families with a clear predominance of adults in 70 % of the respondents. This type of tourism is very quiet compared to Lloret described above. The users are mainly coming from Barcelona and Girona reaching 77 % for the Catalans, although the foreign tourism (western Europeans) represents a significant fifth of the total. The hotels are the most frequent accommodation 26 %, while second residence remains at 17%. An interesting statistic to highlight is that a quarter of the beach users choose this beach to spend only the day. Once again, the beauty of the landscape is what attracts the public to this beach and makes them loyal and repeat year after year.

Table 5.4. Beach user profile in each beach. Values in percentage.

	Ma	Bl	Ll	Sc	Ca	To		Ma	Bl	Ll	Sc	Ca	To
ORIGIN							ACCOMPANIED BY:						
Locals	22	13	16	16	21	8	Alone	5	5	9	0	9	4
Barcelona Metropolitan Area	48	27	13	32	40	31	With the family	57	42	14	45	46	34
Rest of Catalonia	13	21	6	14	17	29	With the couple	18	32	22	28	27	43
Rest of Spain	1	9	16	15	2	11	With friends	16	16	50	19	14	15
Foreign Tourism	17	29	49	23	20	22	Others	4	5	5	8	5	4
AGE							TRANSPORT						
Youth	34	39	69	45	25	26	on foot	50	83	70	10	21	39
Adults	61	53	28	51	69	70	private transport	49	17	22	80	79	61
Elderly	5	7	3	4	6	4	public transport	1	0	8	10	0	0
ACCOMODATION							MOTIVATION						
habitual residence	17	7	10	13	14	7	Vicinity	40	35	29	14	30	14
2nd Residence	5	28	4	14	27	17	Tranquillity	21	4	0	7	12	10
Rented for the holiday	1	4	11	12	9	9	Family/friends	5	11	8	2	11	6
Home of friends/family	4	6	7	5	14	8	Landscape	6	23	22	38	34	38
Hotel / Hostel / Pension	1	32	60	17	3	26	Beach quality	4	3	0	8	2	6
Camping	68	16	1	2	13	6	Fidelity	1	9	0	2	7	15
Only spending the day	3	4	6	28	19	24	accommodation facilities	17	5	4	1	0	1
Others	1	2	1	9	2	1	recreational offer	0	1	16	1	0	0
							others	6	9	22	26	4	10

Ma=Malgrat; Bl=S'abanell, Blanes; Ll=Lloret beach; Sc=Santa Cristina; Ca=Canyelles; To=Tossa

Trends according to the beach type

Table 5.5 shows beach users profile according to the beach type. In general, beaches of the Costa Brava attract more visitors than local residents (which are here defined as from the same municipality or neighbouring areas). The main groups are the city dwellers from Barcelona metropolitan area (BMA), followed by foreign tourists. Analysing separately by beach types, the semi-natural beaches are more frequented by visitors from BMA in 40% which altogether with locals and Catalans comes to 75% whereas in urban beaches this percentage decreases to 55%. The difference is accounted for by foreign

tourism in the urban environments which rise to more than 30% in urban that becomes the larger group.

Regarding accommodation, the biggest group is hosted in temporary residences like hotel/pension/hostel or camping. Locals are present not only in the habitual and residence category but also in "only spending the day" in the case of 1 day excursions to a neighbouring beach. Users of urban beaches frequently stay in tourist facilities such hotels, apartments or pensions in 40% which is partly linked with foreign tourism. The higher percentage of camping users, more than a quarter in semi-natural, is understandable if we take into account that most of these beaches in the study area usually have campsites in the hinterland.

Foreign tourists mostly arrive at the region by a tour-operator, which brings them directly from home to hotel. This makes difficult for this segment to reach the semi-natural beaches on their own as public transport is almost non-existent. The only opportunity is by cruise. Beaches with more natural settings, those categorised as semi-natural, are primarily accessed by private transport in 64 % of the cases facilitating the arrival of mainly locals and Catalans. On the other hand, the proximity of accommodation to the urban beaches together with the fact that parking areas are not nearly sufficient explains the high percentage, up to 64%, of beach users who reach the three urban beaches on foot. As a stakeholder pointed out: "*This is a completely tourist beach (..) as there are no parking areas or they are always full, the tourists who stay in hotels reach the beach on foot*". While in semi-naturals only a quarter gets to the beach on foot which may correspond to the residents from the closer hinterland. These results on accessibility concur with other work conducted on English beaches by Tunstall *et al*. (1998).

Beach recreational experience is a social occasion. As can be observed in the Table 5.5, groups (families, couples or groups of friends) are more frequent although solitary visits can also be found. In semi natural beaches, which are more peaceful, family tourism is more common while urban beaches concentrate large groups of youths as a result of a "night-party tourism" developed in some municipalities such us Lloret.

Table 5.5 User profiles in each beach type.

Variable	Urban	Semi-natural	**Variable**	Urban	Semi-natural
Age			**Transport**		
Youth (<30 years)	45%	35%	**On foot**	64%	26%
Adults (31-69) years	50%	60%	**By car**	31%	64%
Elderly (>60 years)	5%	5%	**By urban bus**	2%	1%
			By cruise/boat	0%	3%
Habitual place of residence			**By bicycle**	0%	1%
Locals	12%	20%	**By train**	0%	0%
Barcelona Metropolitan Area	24%	40%	**Others**	2%	5%
Rest of Catalonia	19%	15%	**Accompanying people**		
Rest of Spain	12%	6%	**Alone**	6%	5%
Foreign tourism	33%	20%	**With the family**	30%	49%
			With the couple	32%	24%
Motivation			**With friends**	27%	16%
Vicinity	21%	29%	**Others**	5%	6%
Tranquillity	4%	12%	**Accommodation**		
Family/friends	7%	5%	**habitual residence**	8%	15%
Landscape	22%	23%	**Holiday home**	16%	15%
Beach quality	2%	4%	**Rented for the holiday**	8%	7%
Fidelity	7%	3%	**Home of friends/family**	7%	8%
Prices	3%	0%	**Hotel / Hostel / Pension**	40%	7%
recreational offer	5%	0%	**Camping**	8%	27%
Others	11%	10%	**Only spending the day**	11%	17%
Don't answer	18%	13%	**Others**	1%	4%

Ma=Malgrat; Bl=S'abanell, Blanes; Ll=Lloret beach; Sc=Santa Cristina; Ca=Canyelles; To=Tossa

Finally, it is worth noting the motivation for choosing a particular beach. An important group of answers in both beach types, which is the vicinity – 21% for urban and 29 % in semi-natural – is due to the fact that the majority of users stay in the tourist infrastructures in the hinterland, mainly holiday homes, hotels or camp-sites. However, people do not go to a certain beach just because it is close, the data clarifies and provides more insights into knowing why people have arrived at a particular municipality. As can be observed from the

Table 5.5 scenery plays a key role. We must remember that the study beaches are on the Costa Brava where natural resources (scenery and beaches) make up an important part of the presented to tourism and the marketing strategy pursued by the local community is mainly based on the beautiful landscapes, clean waters, gastronomy and cultural events. Therefore, a priori, urban landscape would be expected to have a lower value but they receive the same percentage as semi-natural. However, some seafronts are perceived aesthetically attractive as it is the case of Tossa ancient village. In addition, Tunstall *et al.* (1998) suggests that even in the highly developed beaches the seemingly natural appearance of coastal landscape is highly appreciated and significant in guiding people's choice, which also includes the town behind the beach and the surroundings. The high percentage of questions unanswered is methodologically normal as the results come from an open-ended question.

A significant difference in motivations is found in the peacefulness and the beach quality which motivated 12% and 4% of beach users' for choosing semi-natural beaches, showing that these beaches do not receive massive amounts of people and are precisely valued for that reason. On the other hand, urban beaches receive a significant 5% of people who look for recreational activities.

To sum up, the beaches studied correspond to a typical tourist environment much more frequented by visitors than by local residents, mostly motivated by their landscapes even when they are urban. In the case of urban beaches the predominant profile is foreign tourism, groups of youths or accompanied by their families. They reach the beach mainly on foot as they are primarily hosted in temporary residences in the nearby hinterland. The semi-natural beaches are more frequented by locals or Catalan holiday-residents seeking for tranquillity and high quality beaches. The fact that beaches are linked to private transport dissuades foreigners to come.

5.4.3 General preferences for choosing a beach

As previous studies have shown people consider a variety of factors when choosing a beach, but some parameters are more important than others (Morgan, 1999b; Tudor *et al*. 2006). This is illustrated in Figure 5.5 that presents the results obtained from the generic question asking about the importance beach users give to each set of aspects. From this figure, it can be observed that the resultant ranking is apparently very similar in both types of beaches. Nevertheless some differences should be highlighted since the application of the Wilcoxon signed-rank test aiming at comparing statistically differences

between items in the same group. The resultant rankings are illustrated in the Figure 5.6.

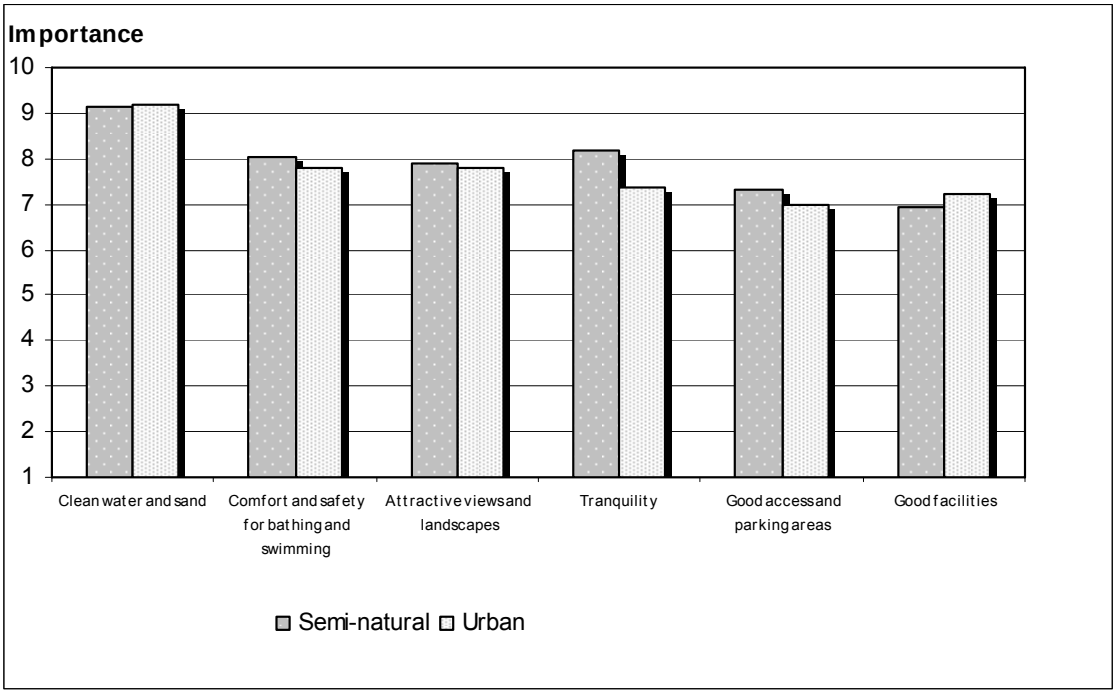


Figure 5.5 Importance given to each group of aspects on a 1-10 scale. (10=very important)

It is interesting to observe a common trend where cleanliness and hygienic conditions are the most desirable aspect when respondents select a beach since the item clean water and sand scored above 9 in both groups. This is also comparable with the work of the Metropolitan Beaches of Barcelona, where the main factors prioritised by beach users were those related to health and safety (Breton *et al*. 1996). Furthermore, it also concurs with similar studies conducted along Anglo-Saxon beaches (Tudor *et al*. 2006; Morgan *et al*., 1993) where clean litter-free sand and clean water are the most important criteria, followed by safety. However, this slightly differs from Nelson *et al*'s work (Nelson *et al*., 2000) who found that in 44 Welsh beaches by far, the highest priority was given to scenery followed by beach safety and water quality. This may be explained by the fact that in Wales meteorological conditions do not favour bathing uses as in the Mediterranean Sea, so beach users of the former are not in so close contact with sand and water as the latter. Therefore, Welsh beach users are more sensitive to aesthetical features rather than those concerning sand and water quality. What concurs with Nelson's work is the fact that facilities are given the lowest priority.

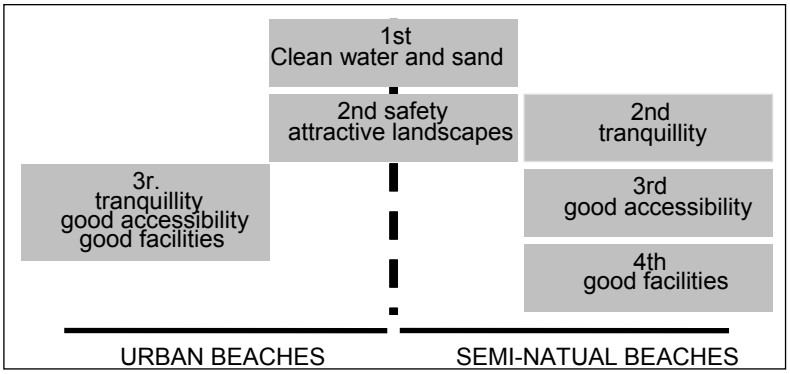


Figure 5.6 Ranking of beach users' preferences for choosing a beach.

It should be noted that the mean values among some items were not statistically different. This is the case of attractive views and landscapes, comfort and safety for bathing and swimming, which scored equally high. These aspects along with peacefulness are slightly more appreciated in semi-natural beaches, whereas in urban beaches peacefulness is not as important as in the former. Even though, one has to keep in mind that beach users, when they are lying on the sand, are spending leisure time looking for calmness and relaxing sensations, even in an overcrowded beach, which explains the 7.3 mark in "tranquillity". Good access and parking areas and good facilities are placed in the last position, which has been also found by Tudor and Williams (Tudor *et al*. 2006).

5.4.4 Beach user's perceptions

This section presents the results obtained in the second part of the questionnaire where respondents were asked to value a set of items, from 1 (minimum satisfaction) to 10 (maximum satisfaction) with 5 as the acceptable level. We have divided these items into 4 general groups of aspects (physical and morphological, environmental, facilities and services and, image and comfort) and compared between the urban and semi-natural beach types.

Physical and morphological aspects

In general, respondents are satisfied with physical and morphological features in both types of beaches and no item scores below the level of acceptance (Figure 5.7). However, physical variables and configuration are more satisfactory for those going to semi-natural beaches, which normally are less developed so users find the naturalness they are looking for in these kinds of

environment. They highly value the spaciousness of these beaches. The width and the length of sand extension are configurative elements which scored substantially higher than other factors. These features please users as they search for values like peacefulness, freedom and distance from strictly urban and developed sites.

Furthermore, from Figure 5.7 it can be observed that satisfaction with beach dimensions is statistically significantly different between both beach types. The lowest scores are found in urban beaches, which may indicate the sensation of a lack of space. In our case this perception is due to two reasons. On the one hand the overexploitation of the sandy area (rentals, boats placed on the sand, stalls, etc.) and on the other, some erosion problems in very central beaches (e.g. S'Abanell and Lloret). This results in a reduction in sand surface which does not favour the peaceful coexistence of multiple uses and increases the feeling of overcrowding (see e.g. Valdemoro and Jiménez, 2006).

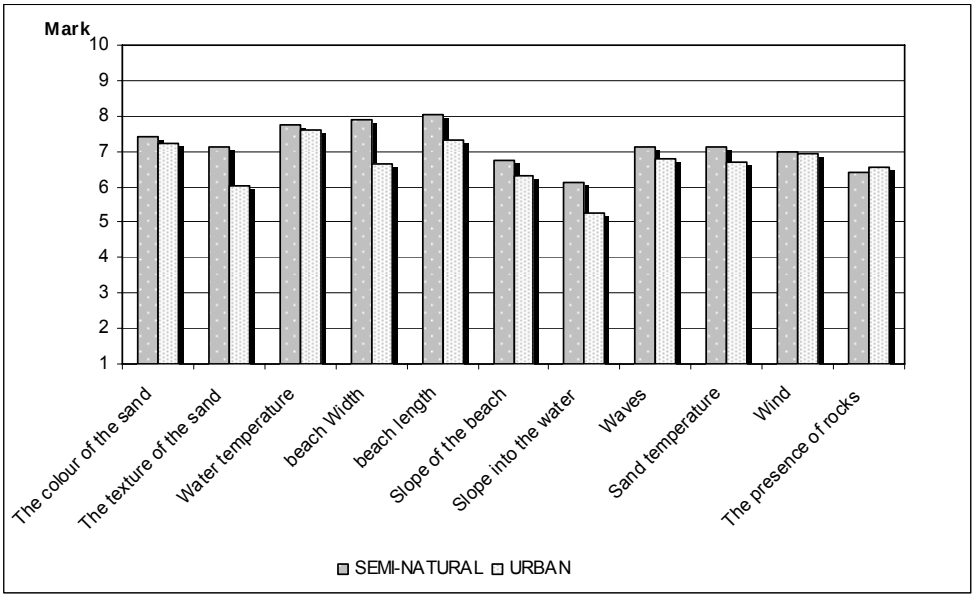


Figure 5.7 Physical and morphological aspects

The effect of climatic variables in several beaches is also perceived through the item of "beach width". Open beaches such us S'abanell and Lloret are quite exposed to eastern winds which are the most aggressive in the region and generate problems of erosion. "*The llevantades- eastern winds- create problems as they bring sand up to the boulevard and cut the street. This year, we hadn't even started recovering from the impact of a storm when a new one came*". (Neighbourhood Association in Blanes). A rental concessionary in Lloret stated that: "*Lloret has a high mobility, the sand moves from East to West,*

depending on the winter storms. Then the sand is piled up in one zone creating a high difference in the height, sometimes around 3,4 o 5 meters. As a result the slope is very noticeable and elderly people have problems to access sea water"

The case of Tossa has a low score of the width compared to the others which might be due to the overcrowding this beach – 5,15 m^2/user observed in the frequentation study performed by the University of Girona- creating the perception that it is smaller.

The slope into the sea, a factor linked with safety for swimming, has different perceptions for both beach types, but both were scored low, especially in urban environments where this item has received the lowest mark of the whole group. In these beaches, users desire a gentle morphology in coherence and adapted to the massive public use of this kind of beach. Whereas in more natural environments, the slope is not so penalised by users because they go there to experience nature more than to have a comfortable recreational experience. The following statement is provided by an interviewee: "*In Lloret, the beach has an irregular terrain which dissatisfies people specially the elderly facing greater difficulties*" (Town Hall Technician)

Sand characteristics -colour and texture- are important items that influence to a large extent the perception of the beach users. On the one hand, in the study area, its colour is very much appreciated for all the beaches. The golden colour is very typical of this region, which in contrast with the sea has become the international tourist image of the Costa Brava. Therefore this is what the tourist comes to find.

On the other hand, the sand texture provokes some controversy depending on the type of beach although it is the same size, medium thickness, in the whole study area. Considering the fact that the kind of sand texture is similar everywhere, the difference in the score average may be due to the differences in the beach user profile. In urban beaches, the discomfort linked to big grain size makes this item score low which corresponds to the higher presence of foreign tourists without previous knowledge about the local physical conditions (See next section). Their search for the stereotype of a comfortable, "easy" and safe beach is broken here. On the contrary, locals and holiday-residents appreciate this sand because it is an element that is a particular property of Costa Brava beaches differentiating them from other beaches on the Mediterranean coast of Spain. This interpretation was also suggested in the in-

depth interviews. Locals expressed that “this sand is good because it doesn’t stick to your skin and when the wind blows the sand stays” In contrast, the Tourism Council mentioned that “*tourists dislike this kind of sand as it hurts their feet*” and a foreign beach user claimed that “*my children can’t make sandcastles with this sand*”.

Other aspects related to climate and meteorology such us water and sand temperature, waves and wind are positively valued in almost all beaches although the wind, is underscored with less than a six in Malgrat as its orientation and openness makes it more affected by southern winds more frequent in summertime. Penalisation in the presence of rocks in Malgrat can be explained by the fact that the beach is part of the Tordera river mouth, which carries materials from inland and deposit them on the beach. This phenomenon does not occur in S’abanell beach, even though it is situated in the northern hemi-delta of the same river, due to the fact that the littoral drift circulates southwards.

Environmental aspects

Figure 5.8 shows the results obtained for the environmental aspects for each type of beach. In general, this group is less valued by beach users than the previous and differences between both groups are quite slight. This is understandable in the sense that the beaches belong to the geographical area known as Costa Brava (Brave Coast) precisely because of their singular geomorphologic and climatic features. Meanwhile, environmental aspects, services and facilities offered respond to local management implemented by each municipality.

Statistically significant divergences are observed in the cleanliness items which may have two parallel explanations. On the one hand, substantial cleaning efforts carried out by local authorities in urban environments are appreciated by their users.

On the other, beach users from semi-natural beaches are more sensitive to litter so that they express their demands by giving a low mark to those items. Particularly, in Malgrat the litter comes from the river. This is relevant for management implications since much more effort should be made by local managers in the mechanical cleaning of the sand which can represent a significant increase of the economic costs.

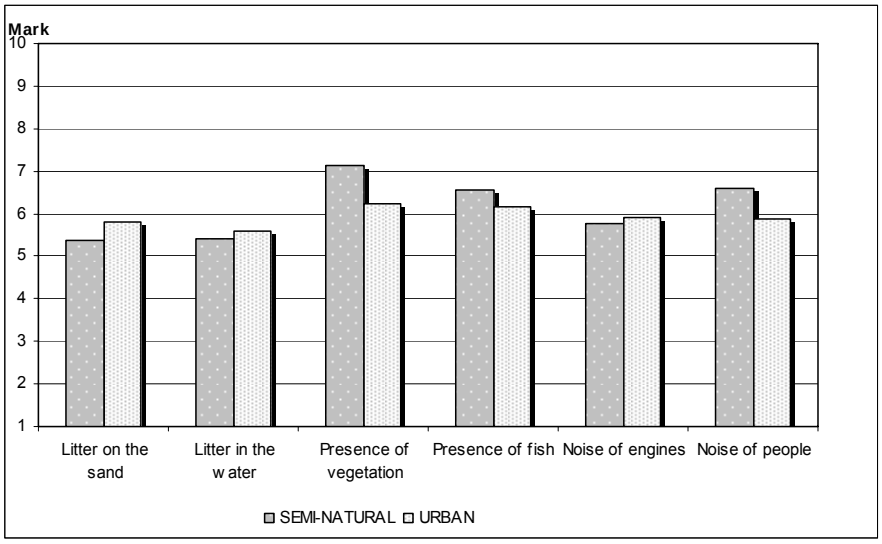


Figure 5.8 Environmental aspects

However in the case of urban beaches, these scores hide extremes. For example, in Lloret the cleanliness levels are below the accepted satisfaction while Tossa de Mar has obtained the highest score although its intensive use. This may be due not only to the local management, but also to characteristics beach user profile, which is mainly family and adults groups with more quiet behaviours compared with the big groups of young people in Lloret.

A general comment of all beach managers is that: although they work hard to maintain the beach clean, the collaboration of the beach users is essential. With this consideration in mind, location of litter bins is part of these cleaning tasks and it is positively valued except in Malgrat where the practical non-existence of them has implied a lower score. Moreover, from the manager's perspective what is difficult to control is the pollution coming from the sea, as a local technician mentioned: "*if a ship dumps something and it arrives to on beach, this won't leave a good image to the beach users. When faced with these kinds of episodes, we feel powerless as we can't control its origin*".

The users of more natural beaches show a high satisfaction for those aspects related to natural environmental quality such as the presence of vegetation or aquatic biodiversity. The presence of vegetation is an indicator of the nature conservation of each beach. In semi-natural beaches such us Canyelles and Sta.Cristina beach users are very pleased with that.

Noise on beaches is of human origin or other sources such as car or boats' engines. This can be considered an indicator of overcrowding. Hence, it would be expected, the noise from people is perceived stronger in urban beaches due to the huge agglomerations and the conditions of saturation in the peak season.

In spite of that, the score is above the limit of acceptance with 5.9. Users may expect overcrowding and that is why they might not feel completely dissatisfied.

In the case of the noise from engines we can find different situations. On the one hand, the case of urban beaches where the combination of cruises and the buzz of car engines from the streets may negatively influence user's perception. On the other, the case of semi-natural beaches such us Canyelles, which as a results of its natural and beautiful landscapes little boats are attracted to spend some time bothering beach users. Local authorities have recently reacted and have marked off with buoys the whole bathing area in order not to allow boats to anchor to close to the beach.

On the whole, environmental aspects represent the most penalised group in this questionnaire, whatever beach is evaluated. This demonstrates the high sensitivity of beach users for this kind of feature which concurs with the importance given to sand and sea cleanliness as explained in the previous section.

Facilities and services

In Figure 5.9, results obtained in the facilities and services items are represented. Even though differences are not so notable, urban and developed beaches have more positive perceptions in some aspects such us in the provision and maintenance of sanitary services (toilets, showers, litter-bins). The greatest difference, up to 1 point, is found in the toilet installations, which do not exist in semi-natural beaches and was the lowest scorer among all the factors, because in the case in Canyelles and Malgrat this service is lacking. Whereas in some urban beaches low score is due to either the presence of toilets are hardly noticed or their density is low regarding the high frequentation. For example, in Lloret, as local concessionary explained: "*This beach has 4 toilets per 1 km. of beach, this means 1 toilet for so many people*". In S'Abanell, the toilets available belong to the bars but in summer "*toilets are collapsed, and sometimes a cue of 20 people can be found*" clarified a local concessionary.

The situation of the shower facilities is slightly different, as the beaches under study are all of them well-equipped except for Malgrat which lacks showers and received a low score.

The presence of services such as stalls, rentals, etc. are always very well scored in urban beaches, but the difference from semi-natural is minimal. The latter are normally less valued due to the non-existence or certain lacks in these

kinds of facility, specially in the case of Malgrat. On the contrary, parking areas are the only item significantly more highly scored in semi-natural beaches as it is a very conflictive topic in urban areas where saturation and lack of space limits, or totally impedes, the possibility of parking close to the beach. In semi-natural beaches, this situation is faced with much less stress, except for Canyelles with a very reduced space for parking close to the beach which has scored ridiculously low mark because it doesn't cover the needs of visitors to this beach in the peak season.

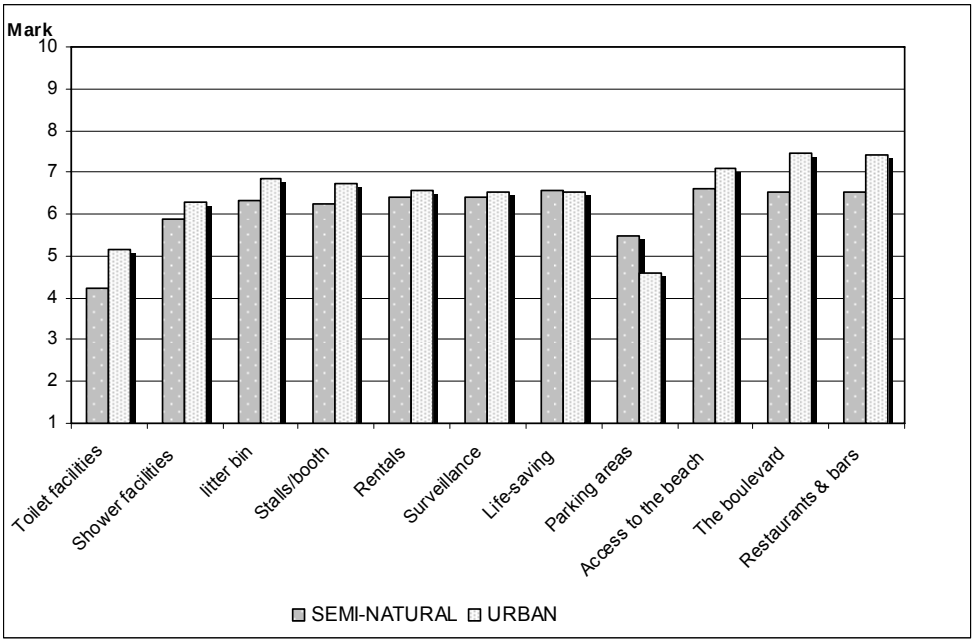


Figure 5.9 Facilities and services

The surveillance and life-saving meet the expectation of the majority of the beaches. Only Malgrat, which lacks this service has a lower score. Although it is not present in the figure, walkways on the sand for elderly and invalid users are becoming a service in creasing demand, in particular in urban and well-equipped beaches.

Accessibility, maritime boulevard and restaurant services offered close to the beach are greatly appreciated in urban beaches. They implicitly recognise the high value of transitional areas between sand and the corresponding urban area.

Landscape and comfort

Leaving aside beach frequentation, this group of items could be considered as the most subjective as it is difficult to have a quantitative reference to compare them.

Those aspects related to image and comfort are more highly scored in semi-natural beaches (Figure 5.10). Landscape has nearly the highest mark in both types of beaches which shows that both natural environment and urban villages on the Costa Brava are appreciated for their beautiful views. In all theses beaches, the beauty of their sceneries is one of the main motivations for the users, whereas in Malgrat users prefer tranquillity than the landscape. It is worth mentioning that Malgrat's views do not fit in with the typical image of the Costa Brava branded by golden sands, cliffs forested by pines and pocket beaches.

The rest of the aspects are slightly better scored in semi-natural environments, but what is significant is the degree of satisfaction due to the fact that these beaches are less overcrowded. Although Canyelles and Sta. Cristina beaches are objectively quite crowded with 12,6 and 11,3 m2/user respectively[15], their natural connotations and landscape and a quiet public contribute to increase the satisfaction of users considering the frequentation. On the other extreme, the most popular, touristy and overcrowded beaches have been more penalised, although this does not represent a real inconvenience for the users as the mark does not fall below 5. In these cases, the space taken by the concessionary services can also contribute to increase the perception of saturation. The local neighbourhood in Blanes claimed that "*here, people bring their own umbrellas, deckchairs. We don't think that concessionaries should occupy such a big part of the beach surface with their material since the early morning because it is under used*". Such conflicts for the space are critical in Tossa where several activities such us cruise disembarkation, divers crossing and boats beached have to coexist contributing to the sensation of overcrowding.

The quality/price ratio is quite equally evaluated everywhere. However, the slightly superior mark received by Canyelles and Sta. Cristina might be attributed to the high cost of the parking areas which almost any user arriving by car has to pay.

Finally, the similar global evaluation is only a bit higher in semi-natural beaches which are less accessible and more peripheral which consolidates the idea that the beach users feel satisfied with the recreational activity provided.

[15] Data provided by the prof. Rosa Fraguell and Claudia Riera from department of Geography, Girona University.

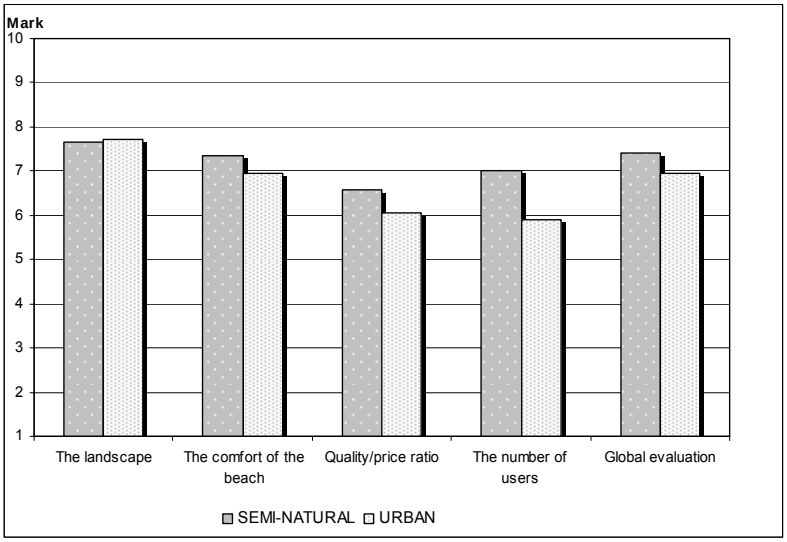


Figure 5.10 Aspects related to image and comfort

5.4.5 Cluster analysis: satisfied versus demanding beach users

The results obtained in the non-hierarchical cluster analysis formed two opinion groups which represent two different forms of evaluating beach quality. For the following analysis, it is important to consider the fact that the respondents were on the beach for recreational purposes. Therefore, their sensation, on average, is generally satisfactory, which explains the high marks obtained for most items (Figure 5.11).

The first group, the demanding beach users, shows some sort of dissatisfaction. The scores reflect a relatively low evaluation of the beach. Nearly 50% of the items are around the level of acceptability (5). In respect to the other items, only four (colour, width, length and landscape, i.e. the morphology of the beach) are closer to or above 7. These four items are difficult to modify from a management point of view. The lowest values reflect dissatisfaction with some services and facilities, such as the parking areas, which are normally insufficient at urban beaches or unsatisfactory at semi-natural ones due to their high prices. Furthermore, these users found the toilet facilities to be scarce, not clearly signposted or lacking in maintenance.

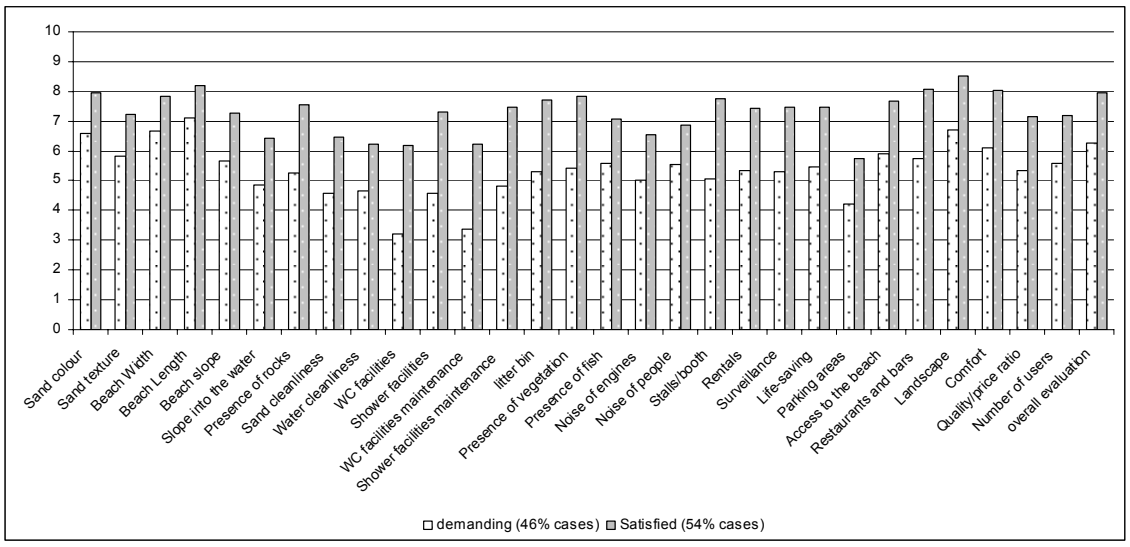


Figure 5.11 Scoring of items for each opinion group

Furthermore, in general these users only accepted environmental aspects to a limited degree. First, they perceived the sand and water as dirty, suggesting a lack of or minimal effort put into beach maintenance. Second, they perceived natural elements such as vegetation, algae and fish as scarce or non-existent. Finally, they considered the noise from people and engines annoying. On the other hand, this opinion group clearly manifests satisfaction with beach elements such as dimensions, colours and visual scenery.

The second group, the satisfied beach users, expresses a high degree of satisfaction throughout the whole set of items. The scores are above 7 in more than 80% of cases. These beach users are happy and satisfied to be on the beach. The best scores correspond to sets recording general sensations and global characteristics such as landscape, comfort, quality/price and quantity of users. These users also appreciate the physical and morphological characteristics, as well as the facilities and services offered (stalls, bars, restaurants, etc.). Like the other group, these users gave lower scores for aspects related to beach cleaning and toilet facilities. They also saw the parking areas as controversial, since the problem of providing sufficient parking is difficult to solve at such overcrowded beaches.

Comparatively speaking, the two opinion groups are relatively homogeneous in terms of the scores given, although they maintain a certain distance. In general, both are quite positive in their evaluations, only expressing dissatisfaction with beach cleanliness. For environmental items, the two groups' scores differed by two points, while their perceptions of the physical and morphological qualities of

the beaches were quite similar. Finally, the two groups were of nearly the same size: 54% were satisfied as opposed to 46% demanding.

Social profiles of the cluster

Table 5.6 shows the sociodemographic characteristics, behavioural variables, motivations and suggestions of the clusters. The two opinion groups, satisfied and demanding, present relatively different social profiles.

The clusters do not differ significantly in beach type, nor in the type of transport used to reach the beach nor in the company kept. Significant differences were observed for the beach users' origin, age, accommodation, motivations, suggestions and beach frequented.

The demanding group is made up of two groups of people: those from the same municipality as the beaches, and those from other parts of Catalonia who chose the Costa Brava for their summertime recreation. It is a group with a statistical significant presence of young people and a smaller influence of adults and elderly. Generally speaking, beach-going is a family activity. Most beach users have either their primary or second residence in the area, which means they have a strong attachment to the region. Therefore, the reasons that influence their choice of a beach at a specific village are the proximity of the residence—especially important when considering campsites located just behind the beach—and the level of peace and quiet.

The surveys conducted at Malgrat returned a greater number of demanding users than those conducted at the other beaches. The lack of any kind of tourist development or services at the beach entailed unsatisfactory perceptions.

The suggestions provided by this opinion group were along the lines of seeking to correct deficiencies and to improve the services and development of the beach, especially the facilities, parking areas and beach planning. What is more, this group was motivated to provide improvement suggestions for the beaches. An open question answered by 80% of the respondents of this cluster implies that they are demanding but at the same time motivated to suggest improvements.

Table 5.6. Correlations among social profile variables and cluster results

ORIGIN	Demanding	Satisfied	ACCOMODATION	Demanding	Satisfied
Locals	20,2	12,5	**Residents**	32,1	24,4
Catalans	53,6	43,9	**Temporary visitors**	56,3	58,6
Foreign Tourism	26,2	43,6	**Only spending the day**	11,6	16,9
	X2=18,879 df=2 ρ<0,001			X2=5,988 df=2 ρ=0,05	
AGE			**MOTIVATION**		
Youth	44,9	35,1	**Vicinity**	29,7	25,2
Adults	52,1	58,1	**Tranquillity**	10,5	8,1
Elderly	3,0	6,8	**Family/friends**	8,7	5,9
	X2=8,484 df=2 ρ=0,014		**Landscape**	23,1	29,6
TRANSPORT			**Beach quality**	3,5	4,1
on foot	46,1	44,6	**Fidelity**	4,8	6,3
private transport	50,6	52,2	**hotel price**	1,3	2,2
public transport	3,3	3,2	**accommodation facilities**	5,2	0,7
	X2=0,165 df=2 ρ=0,921		**climate**	0,0	0,7
BEACH			**recreational offer**	3,1	3,0
Malgrat de Mar	25,2	9,5	**others**	10,0	14,1
S'Abanell/Blanes	15,3	17,0		X2=18,426 df=10 ρ=0,048	
Santa Cristina	10,9	22,1	**(SUGGESTIONS) Improvement on:**		
Lloret	19,0	15,1	**Facilities**	26,5	15,8
Cala Canyelles	15,3	18,6	**Parking and accessibility**	7,4	3,9
Tossa	14,2	17,7	**Life-saving and vigilance**	4,4	3,3
	X2=35,989 df=5 ρ<0,001		**Beach morphology**	5,1	7,9
BEACH TYPOLOGY			**Beach planning**	18,4	11,8
Urban	51,5	50,2	**Maritime seafront**	0,0	0,7
Semi-urban	48,5	49,8	**Water quality**	14,7	15,8
	X2=0,100df=1 ρ=0,752		**others**	3,7	7,2
ACCOPANIED BY			**N**	19,9	33,6
Alone	6,7	4,5		X2=16,105 df=8 ρ=0,041	
with the family	39,4	41,0			
with the partner	26,8	30,6			
with friends	24,5	20,0			
Others	2,6	3,9			
	X2=4,119 df=4 ρ=0,390				

The second cluster is more satisfied and pleased with their choice and the use of these beaches. This group includes more foreign tourists, adults and elderly

people. Although they are mainly temporary residents who stay in hotels, campsites or rental apartments, a significant quantity of one-day beach users is also present in this cluster. In particular, they prefer the beaches at Santa Cristina, Canyelles or Tossa de Mar for their high scenic value. Not in vain, this group's reasons for choosing those villages and their beaches are implicit in their landscape appreciation and the quality of the beach. A third of these respondents did not show any interest in suggesting improvements. Those that did suggested improvements in beach facilities, quality and planning.

This research has shown that beach users' place of origin is a very significant determining factor in their evaluation of beach quality. Foreign users show a high degree of satisfaction, while locals and people who own second homes in the area are more critical and demanding. The latter group revealed its negative perceptions of environmental beach management by giving low scores for sand and water cleanliness. These users also expressed their dissatisfaction due to overcrowding through low scores for the parking areas, the number of users and noise. These opinions may be due to the greater knowledge that locals and loyal holidaymakers have of the original conditions of the natural beach. They can also compare the peak period with the rest of the year and are more likely to notice changes in the beaches over time. Criticisms and requests from groups that live in the area or traditionally spend their holidays there can be interpreted as a manifestation of their attachment to those beaches and villages, whereas foreign groups can be perceived as a threat to the place's identity.

5.5 Discussion

5.5.1 Management implications of public perceptions surveys

Our discussion approaches policy implication deduced from the public perception survey in our study cases in order to show the usefulness and relevance of this kind of studies. It is important to previously consider that one has to be careful when translating beach users' demands into management practices. As Breton *et al* (1996) also mentioned perceptions are cultural and mediated values so their interpretation and uses should be made with caution.

From the methodological side, this kind of survey is an efficient way to obtain public perception as the setting up is fairly easily done "in situ" and co-operation is obtained from interviewees who are enjoying a relaxing time on the beach

and do not mind sharing such activities with answering a questionnaire. Obtaining results from nearly 600 interviews having to visit homes or work places or along the street would have meant an enormous additional effort and the results would not have been so representative.

As we have showed, beach users' relationships with the environment are complex. People's recreational behaviour is indirectly affected by environmental quality, via the individual's formulations of their perception about their environment. At the same time, people approach natural areas in a different way and individual behaviour also depends on personal perception of the environment (Pendleton *et al*. 2001). The wide overview provided by the results provides us with a more comprehensive framework for discussing their policy implications both considering the influence of beach environment and the individual determinants, aiming to offer an adaptive approach for beach management.

Implications considering beach type

In the first part of the results we have concentrated on the preferences of beach users in relation to the characteristics of each specific beach in terms of recreation exploitation or conservation of the natural, from which management recommendations are discussed.

In relation to the physical aspects, which are largely very much appreciated, few items have been penalised because they can alter the sensation of comfort and safety. We refer to the size, the slope to the sea, the texture of the sand and the presence of rocks. However, modifying or "correcting" these aspects is very arguable as they are part of the natural characteristics of the beach system. In the case of some urban beaches, beach users have suggested flattening the beach profile and local authorities can invest a lot of money to re-address sand shifts every year. In the case of semi-natural beaches closer to river mouths, demands for an increase in cleaning efforts to remove organic material brought by the river are made. In those cases, policy recommendations may be considered with caution as functions of the natural environmental system should be guaranteed.

Micallef *et al*.(2002) stated that the conservation of nature is not compatible with the improvement of recreational activities for mass tourism. However, in our study cases, coastal managers have to deal with very popular, touristy sites where landscape and natural connotations are the prime motivation for beach

users. Moreover, this topic has been given the same importance to comfort and safety when users select a beach. Dealing with the complexity and multidimensionality of beach systems implies considering on the one hand, natural and physical conditions and on the other, the social uses which, we must not forget, are the basis of the local economies in the region. Principles of ecosystem management (Grumbine, 1994) should help to deal with this kind of situation, where coastal managers should prioritise ecological functions primarily and, as far as possible facilitate enjoyment of the public via activities in accordance with its recreational function (William *et al*, 1993).

In contrast, in the cases where the original, natural conditions have been modified to a large extent as in the case of those beaches along the front of very popular, tourist, urbanized areas that are very overcrowded, we suggest that in the peak season physical disturbances concerning beach profile, sand distribution and the presence of rocks can be addressed in order to increase safety, avoid accidents and facilitate accessibility and social use for the disabled, elderly people or children. A typical example of this kind of intervention could be the reshaping of the sub aerial beach profile to flatten it, especially in steep beaches with a high berm. Results of this action will persist for most of the season provided wave movements are low enough not to reshape the beach. Once the first storms come along, the beach will naturally recover its typical shape.

In relation to environmental quality, beach users have highlighted their preference for sand and sea cleanliness over other types of aspects in all the beaches. This determines their strong demands in related items ("litter in the sand" and "in the water"). Beach users prefer more efficient and frequent beach and water cleaning, although according to Tudor *et al*. (2006), users are able to tolerate and accept a certain level of beach litter. A point to note is that users perceive visual pollution (debris, oil, litter), while sewage-derived contaminants are not regularly recognised by the public.

Therefore, efforts to maintain hygienic conditions are very important. This implies several strategies: On the one hand, the focus on social awareness to promote proper attitudes and behaviours and, on the other, increased investment in cleaning and placing more bins on the sand, even though this may imply an aesthetic disturbance. However, we emphasise according with Santos *et al*. (2005) that concentration in proactive instead of reactive actions improving people awareness as a complement to cleaning task alone.

Keeping the beaches clean might implies a high cost in cleaning tasks and waste bins placed across sand area. The delicate balance between conservation and recreation arises here again. The risk of overexploitation in some natural sites is warned of by Roig *et al.* (2005) who defends soft-key management measures instead of providing answers to user demands that creates "accultural" models where the predominant function is recreational rather than the natural.

Thus, the provision of cleaning services should not be indiscriminate. On the one hand, efforts in urban beaches during the peak season must be guaranteed without interruption the whole day including mechanized as well as manually, which normally are local authorities' responsibility. In addition, it should be noted that these sort of beaches may be used for many other urban uses such us local festivities which should imply extraordinary cleaning campaigns. On the other hand, in semi-natural environments, the respect for scenic diversity and the natural surroundings of the beaches must be the main concern and the environmental information and communication should play a key role to raise the awareness of beach users.

Urban beaches, with huge overcrowding during the peak seasons due to their easy accessibility, are associated with a certain degree of comfort provided by facilities and services. However, this implies a wide diversity of uses (stalls, rentals of sun beds, umbrellas, pedal boats, toilets, shower, boat beaching areas) competing for a very limited space which may be the source of dissatisfaction or discomfort. Thus, an early beach planning considering beach users diversity is needed in order to rationalize an efficient management and to minimize conflicting situations between different social uses on the beach.

Another set of aspects in high demand are those related to safety and surveillance. Life-saving should be correlated with the quantity of users. Thus, in urban beaches the presence of life-savers must be more intensive and the location of first-aid points is highly recommended. As we have already pointed out, the safety conditions for bathing are related to beach morphology so that it is important to provide these beaches with elements (e.g. wooden walkways) that can ease the enjoyment of all kinds of public, in particular the elderly or disabled.

While in developed beaches the sensation of comfort is linked to the provision of services and equipment, in the semi-natural ones these feelings are associated to less people and the fact that they conserve natural features

(landscape, biodiversity) so that they can provide peace and contact with nature to their users. This is partly possible due to their limitations in accessibility and the lack of certain facilities which prevent a certain proportion of users from reaching and using them. Therefore, criticism regarding the lack of some facilities should be considered as secondary by coastal managers since investments made to increase recreational exploitation would imply the presence of more users.

The similar global evaluation and landscape scores puts forward the idea that perceptions are not only due to the different levels of conservation/development of beaches but also to the presence of variable beach user profiles that have different perceptions and interpretations of the environment.

Considering beach users' profile

Social diversity in outdoor recreation and leisure activities suggests that differences between social groups produce differential recreational patterns. For example, the work of Wolch *et al*. (2004) suggests that beach rate vary significantly by age, race/ethnicity, class and immigrant status, by distance between home and beach, and by beach recreational activity preference.

In this line, results have shown some signals that relates beach users' profiles and their perceptions. Emphasis has been put on examining separately two opinion group through a cluster analysis in order to find out which sociodemographic and behavioural determining factors influence beach users' perceptions.

This study has suggested that there are some differences in perception between residents and visitors. The results show that local residents and Catalan users are more concerned with natural beach values and environmental degradation and are more demanding about facilities and equipment. Foreign visitors coming for a short stay, however, are satisfied with all items and do not feel disturbed by overcrowding. We relate this finding with the different degree of fidelity according to beach users' origin. As explained above, the study area attracts local users who develops his quotidian life in the village so that knows very well beach evolution changes and along the year, second-residents who visit the beach year by year and tourist who come to the place for first time or occasionally. This concurs with some few studies carried out to face the relationship between beach perceptions and their socio-economic user's profile. According to Tunstall *et al*. (1998), local residents can

have special knowledge of the local seaside conditions, the tides, currents and pollution sources. It may be worthwhile to speculate that residents' bad perception of environmental aspects is due to everyday life in the area which make them more aware of impacts during the summertime. This also concurs with William and Nelson (n.d.) who found local people to be less tolerant to litter probably due to their understanding of debris origins (from visitors, tourism invasion). Moreover, Cihar *et al*. (2006) argues that there is a strong relationship to the territory by locals so that the level of tourism is perceived as an increasing disturbing factor for locals. This may explain that locals are more demanding with environmental quality such as noise, cleanliness, number of people while identity elements (landscape, sand colour, texture…) please them.

Another aspects that have not been sufficiently addressed, is the influence of each user worldview in their behaviour. According to (Wolch *et al*. 2004) anthropocentric worldviews might be linked to consumptive recreation (deckchairs, restaurants…) and they would prefer a well-equipped beach whereas the ecocentric worldview prefers other activities (biodiversity observation, snorkelling, walking) and would choose unspoiled beaches. This line of research is open to be more developed.

Concurring with Priskin (2003) we think that beach users' perceptions of recreational areas may be useful for implementing appropriate management strategies. However, we also acknowledge that this should be done preferable taking into account the variability in beach users' perceptions which is partly linked to the different sociodemographic factors. Attitudinal research could help to distinguish between beach users types which may contribute to the improvement of environmental management.

5.5.2 Recommendations on beach management

Our approach hereby presented has a managerial orientation. It allows working under a flexible and adaptive framework and can be used to assist coastal managers in selecting priority issues under a more participative context with an explicit consideration of the social and environmental diversity.

Therefore we want to finalize on the one hand by offering some practical recommendations for managing these study beaches and on the other by making a more generic recommendation on the suitable management model to implement in the whole system.

The practical recommendations are:

→ Having in mind that the model of sun and beach tourism is widely practised in the study areas and in the case of urban beaches, it is important to guarantee the security and comfort of certain groups of users (children, elderly and handicapped) by softening beach profile only in the peak season.

→ Beach planning should favour the coexistence of a wide diversity of activities. It implies a previous knowledge and a specific adaptation in coherence to particular beach characteristics and frequentation rates.

→ Improving the accessibility to all types of beaches should be done by prioritizing public transport instead of extending parking capacities. Seasonal public transportation combined with dissuasive mechanisms to park close to the beach should be promoted.

→ Water rationalization should be promoted by launching awareness campaigns and reduce showers.

→ In terms of cleanliness, local administration efforts should be oriented to both, the user and the management practices. For examples, in natural beaches, the frequency of cleaning services should be reduced and compensated by educational campaigns.

→ The provision of equipment and facilities should be dimensioned considering beach users' preference and beach prior functionality. In natural beaches, the ecological function should be prioritized in front of recreational one.

Dealing with beach systems and providing insights for management practices can have benefits for sustainability of such systems. However, management interventions in the natural systems can mean feedback loops with undesirable consequences for both ecological and social systems. For instance, a certain decision to improve beach accessibility can imply more frequentation so that a degradation in biophysical features. This may alter beach users' perceptions and satisfaction provided by the original system with a consequence changes in local economies when they are based on beach and sun tourism.

Moreover, as we have seen, many beach users perceive beaches as leisure areas more than natural systems, especially foreign tourism that come to spend their holidays in a urban beach. Therefore, they give priority to cleanliness, facilities, safety and comfort, although they have arrived to such municipality

due to landscape and natural characteristics of the area. However, there is a segment of beach users that are concerned with the quality and valuable natural resources. They looked for more natural or semi-natural beaches where tranquillity and environmental quality is better guaranteed.

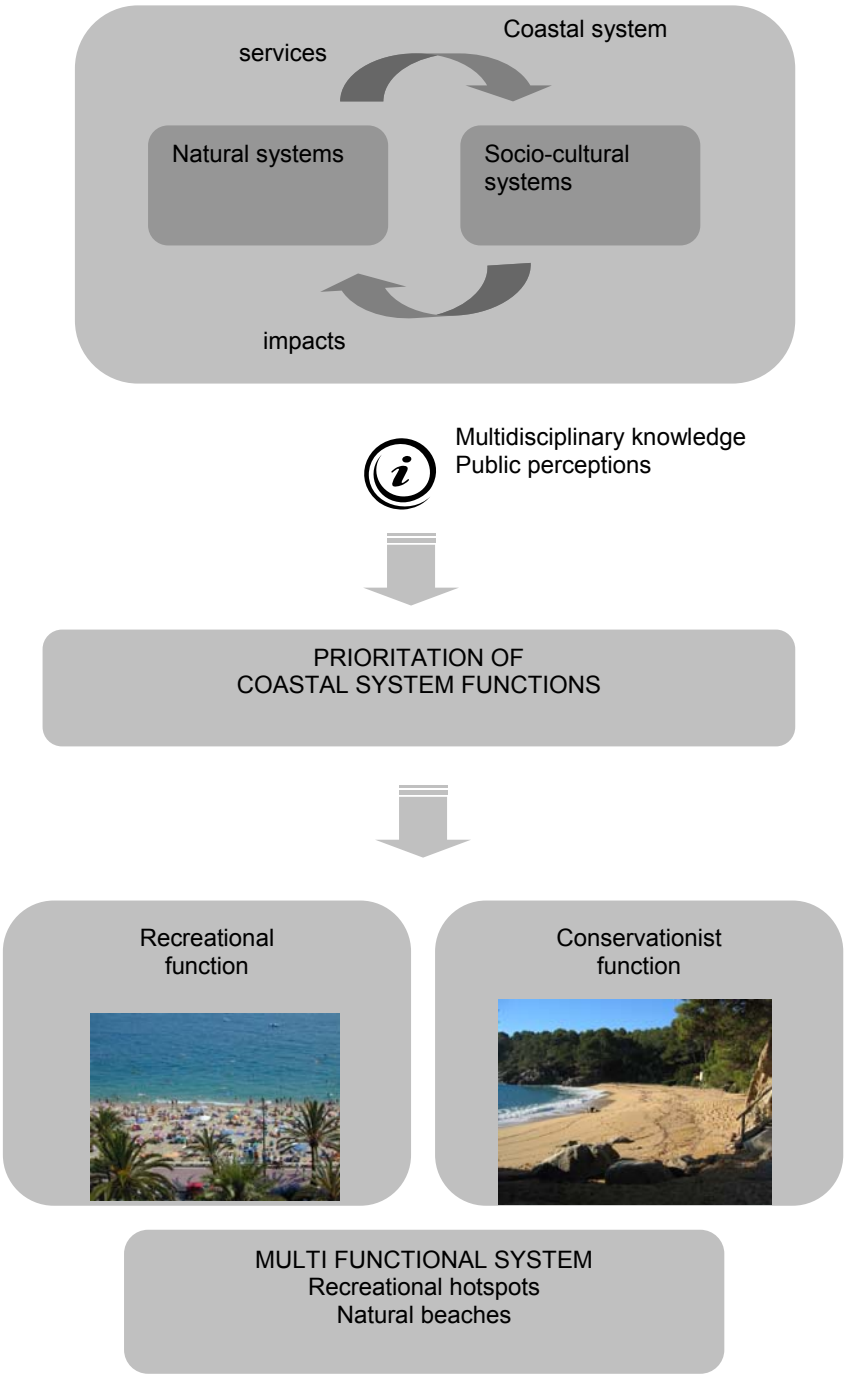


Figure 5.12 Managerial approach to facilitate the co-existence of different functions in a coastal system.

Hence, the question that may arise is how can both recreational and natural services co-exist? Our proposal is to launch an “adaptive model of beach management” understood as we next explain.

Under the theoretical framework defended in this dissertation, beaches are understood as being multifaceted and complex in nature, which hence need to be approached under a multidimensional analysis. At hierarchically higher level, the studied beaches pertains to the same coastal system, which can be named Southern Costa Brava. This system is formed by a set of exploited beaches which act as a recreational hotspots and attracts beach tourism while in the less developed and more natural beaches the conservationist criteria should be promoted and prioritized in front of other human uses. Subsequently as suggested by Ariza *et al*. (in-press a) the presence of different types of beaches should be explicitly reflected in the management approach and individually designed management policy should be implemented for each stretch of beach. This should be done within a integrated assessment framework where local stakeholders may participate and the main functionality (conservationist vs. recreationist) of each beach should be established (see Figure 5.12)

Therefore, efforts towards interventionist management approaches should be encourage in recreational-oriented beaches where mechanical cleaning tasks, diversity of uses (e.g. facilities, equipment, activities), control of physical variables could be implemented in order to guarantee a satisfactory experience of the beach user. Whereas, efforts towards conservationist strategies such us discouraging the presence of beach users and protecting natural values should be placed in order to guarantee natural services. In the former beaches, the perceptions of beach users should be taken directly into account while in the natural ones, only conservationist values should be integrated. In the middle, hybrid beaches bringing together human used and natural conservation projects can be promoted as educational tool and as example of sustainability. In this sense, the coexistence of recreational and natural services could be guaranteed in the whole system, understood as a multifunctional system, in spite of being mixed in the same beach which is often incompatible, at least in the Mediterranean where the frequentation rates are extremely high in the peak season.

Part III

Case studies on coastal erosion

Chapter 6 Introduction to coastal erosion risks

6.1 Issues at stake

Coastal erosion is becoming one of the growing environmental concerns faced by coastal communities, aggravated by the prospect of accelerated sea level rises due to climate change (Nicholls *et al*. 1999, IPCC 2007) and the accumulated, negative effects of mismanagement practices (Carter, 1991; EC, 2004). Over the past 100 years, about 70% of the world's sandy shorelines have been retreating (IPCC, 2001) and currently around 20% of the EU coastline is eroding (EC, 2004). Coastal erosion affects both economic and social development, making some activities unfeasible, and it also jeopardizes the capacity of the coastal ecosystems to supply other biophysical and non-monetary services, such us inland protection, natural resource provision, biodiversity conservation or landscape integration, which cannot be substituted by human capital (Costanza *et al*., 1997; Daily, 1997; Daily *et al*., 2000; de Groot *et al*. 2002).

Urban sprawl, tourism-induced land-use changes, the proliferation of marinas, as well as other inland processes such as deforestation and sediment retention, have profoundly altered coastal system's dynamics, increasing the potential of what would be a natural phenomenon of change to become a large-scale risk requiring urgent action. While coastal landscapes have always been evolving naturally in a dynamic way, it is now clear that converging human and natural forces are making these areas very vulnerable and a number of diverse, negative social, economic and environmental change effects are likely to be concentrated there.

In coastal erosion management, predominant 'hard' technological-based responses such as building larger protection barriers or carrying out large sand beach 'restoration' plans – involving sea bed destruction – are still the predominant strategies aimed at dealing with coastal erosion. Research carried

out in the EU[16] has shown that many responses in this area tend to 'solve' erosion locally and very temporarily which have often exacerbated coastal erosion problems in other locations (EC, 2004). Short-term strategies to deal with shoreline retreat and the disappearance of beaches which are key for the economic activity of local populations frequently increase the intensity and scale of the problem elsewhere and generate new environmental or economic impacts, which are then even more difficult to deal with.

Climate change and sea level rise adds to the complexity, uncertainty and intensity and prevalence of coastal risk impacts in a variety of ways. Low-lying areas like deltas, estuaries, coastal plains and barrier coasts are especially vulnerable to suffering the consequences (IPCC 2001, 2006; Zhang *et al*., 2004; Adger, 2005). Under these circumstances, it is not known how the whole coastal system might evolve in the near future as a response to sea level rise and extreme events, despite the fact that some 'expected surprises', such the total disappearance of renowned beaches around the Mediterranean basin, can be foreseen.

The Intergovernmental Panel for Climate Change (IPCC, 2001) also recognizes that a multiplicity of open strategies need to be developed and considered, beyond the traditional 'hard' paradigm of coast control or coastal protection, to allow for more dynamic and socio-ecologically resilient alternatives, such as coastal accommodation and retreat.

This situation highlights a need for new approaches and tools for assessing and managing coastal erosion, which should take a holistic perspective that integrates the diversity of values and social perceptions into the decision-making processes. These case studies on erosion risk will discuss this issue. But before, this chapter briefly present the phenomenon of coastal erosion (e.g. origin, causes, and dynamics) as a risk for our society and provides a generic classification of coastal management strategies in order to set some concepts as a basin for a clearer understanding of the case studies.

6.2 From natural phenomenon to human risk

Modification of the natural conditions of coastal systems has led to a loss of resilience to cope with different types of environmental stresses (e.g. extreme

[16] EUROSION project: Coastal erosion – evaluation of the needs for action (2002-2004). www.eurosion.org

storms, sea level rise, etc.) increasing their vulnerability, which has therefore transformed natural phenomena into risks for human development. Such is the case of coastal erosion.

Below we outline the duality of a phenomenon, coastal erosion. It has played a fundamental role in the formation and modelling of our coasts, but at the same time, in recent decades, with the growing overexploitation of these systems, it has become one of the most important problems facing coastal policy in the EU, not only due to the financial cost generated, but also due to the complexity involved in the search for solutions.

Erosion is defined as a form of mechanical degradation which manifests itself in the coastline recession and the disappearance of those formations which characterise it. It is present in all areas and timelines, and is the expression of morpho-dynamic processes which affect the land/sea/atmosphere interface (CIESM, 2002).

Both the processes of erosion and accretion have always existed and have contributed over time to the modelling of the great diversity of coastal landscapes. Erosion is a natural phenomenon which is the result of the action of modelling agents which affect coasts from time to time, when a storm impacts on a beach, or chronically when the equilibrium has a constant deficit of sediment, i.e. when deposits of sediment are less than losses. Unfortunately, the acute anthrophisation suffered by the coastline in recent years has multiplied and converted the natural phenomenon of erosion into a problem for man.

Erosion of most coastlines is a cumulative result of numerous interacting variables (Figure 6.1). On a geological timescale, the coastline is the result of a balance between sea forces, continental forces and climatic factors (Ros *et al*. 1996). Therefore, the nature of erosion is determined by the type of coast which is eroded and the form of erosion depends on the structure and resistance of the material. Low sandy coastlines, or those with a sedimentary relief, are not very resilient and therefore are more vulnerable than coasts formed by more resistant rocky material (EUROSION, 2002). Moreover, the dominant climatic conditions determine the meteorological variables of the zone (temperature, rainfall, etc.) as well as the dynamic atmospheric and hydrospheric agents (Serra et. al, 2004). Finally, man may alter all these patterns and accelerate processes of accretion or erosion which in the end may be counterproductive

for the development of man's own activities, transforming natural phenomena into risks.

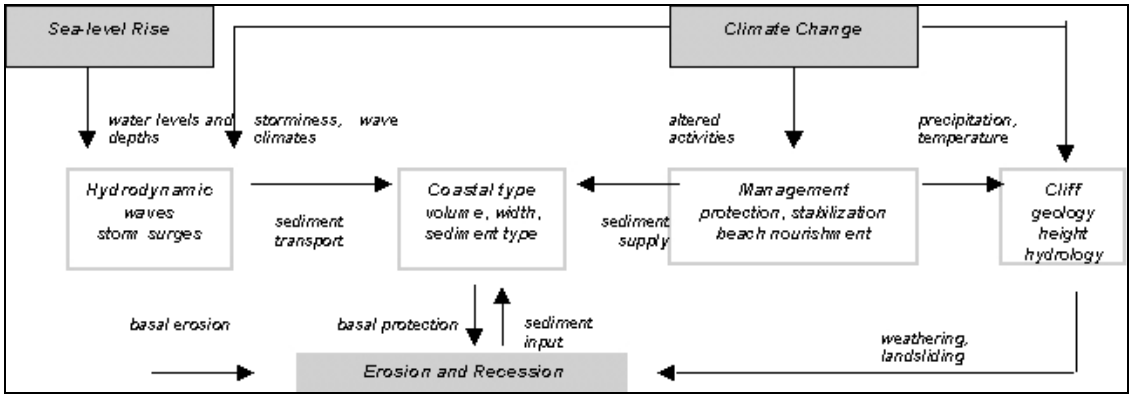


Figure 6.1 Factors that influence coastal erosion. Source: Eurosion (2002)

The factors involved in coastal balance and which lead to such dynamism may be classified into three groups: the nourishment system or reservoir of sedimentary material, the dynamic system of distribution of detritus material and lastly, the factor of climate change which acts in the long term modifying the sea level and marine climate.

→ **The nourishment system** includes those elements which directly or indirectly supply the detritus material which forms the beaches. The origin of this material may be marine (when the system of surface drainage is not sufficiently developed) or continental. In most cases, sediment comes from the continental drainage network. When it arrives to the coast forms a coastal sedimentary cell[17]. In the case of the Catalan coastline, various compartments or cells are delimited by or have their origin in the main rivers or in the structural units which compartmentalise the coast, for example we may cite the case of the Maresme which begins in la Tordera and ends in Llobregat (before the port of Barcelona and other more recent interventions were undertaken).

→ **The dynamic system** is governed by coastal modelling agents: waves, tides and various spatial-temporal events which occur from time to time and which add dynamic characteristics to the coastal system. These forces are responsible for transporting and distributing sediment in two directions: along the coast (a trajectory defined by the sedimentary cells) and transversally,

[17] Unit identified on an extensive sandy coastline which includes: the source of the sediment, its transport and the deposit area of the material. (CIESM., 2002)

across the coast (characterised by the beach profile: backbeach, beach and submerged beach).

→ **Changes in sea level** are caused by subsidence and elevation of the emerged part with respect to the sea. On the one hand, this may provoke retrocession of the sea in relation to the land (regression) when the sea level falls and, on the other, the land surface is flooded (transgression) when there is a rise (Haslett, 2000). The response of each coastal system depends on its intrinsic characteristics and the components which make up its resilience. The impact will be of varying degree depending on whether the zone is low-lying such as a delta, where a rise of a few centimetres may lead to extensive flooding of coastal areas, whilst at the other physiographic extreme represented by cliff zones, the retrocession of the coastline is minimal. In this section we should not forget to mention the threat of global warming and the sea level rise in sea levels, the consequences of which are characterised by a great uncertainty. The scenarios which are put forward, offer possible sea level rises between 0.2 – 0.7m approximately according to the scenario IS92 from the IPCC (2001) (See figure 3.3), but we still do not know which effects will provoke on marine climatology (virulence and frequency of storms). What is certain is that the uncertainty on the sea level is greater than on the atmosphere and, the oceanic responses to these changes are slower than those of the atmosphere.

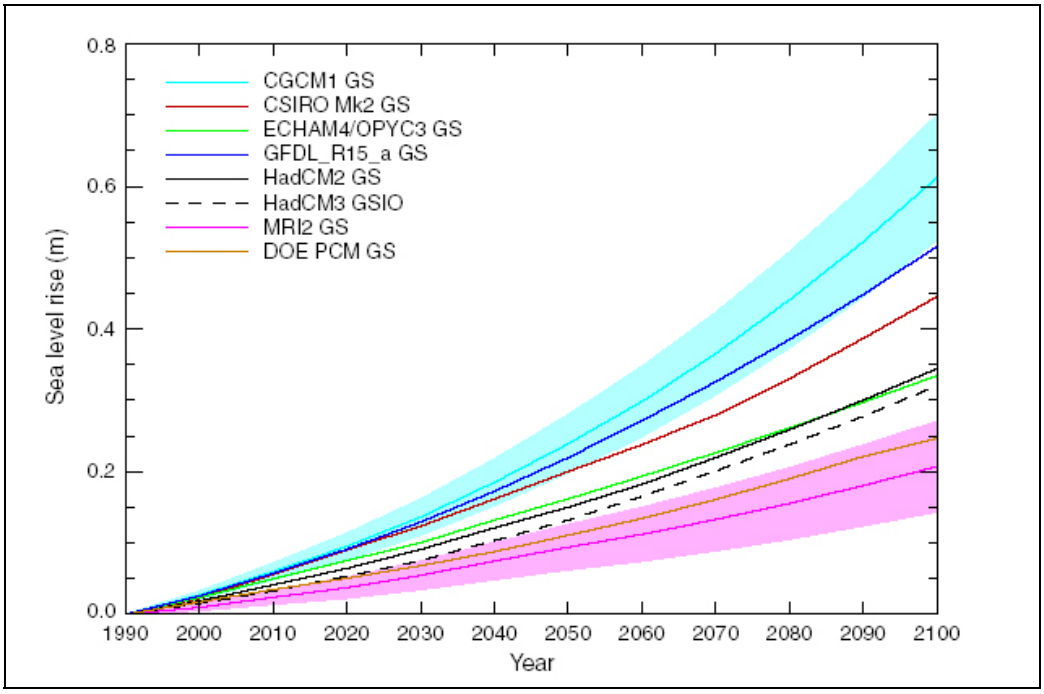


Figure 6.2- Global mean of sea level rise from 1900 to 2100, described by the scenario IS92. Source: IPCC, 2001.

Erosion is influenced by naturals and anthropogenic factors which vary according to the timescale or space-scale and which are of diverse nature: continuous, incidental, reversible or irreversible. In most cases, erosion is the accumulative result of various forces which interact (EUROSION, 2002) and it is usually very difficult to point to a single cause. Causal mechanism includes sea-level rise, tectonic instability and subsidence, climatic change, plus numerous man-made causes (see Table 6.1). Diverse works in the river basin (e.g. construction of dams) and changes in land use (e.g. urbanization and deforestation) have retained sediment on its route to the sea and have made them impermeable. In addition, the construction of ports, marinas, breakwaters and other transversal sea defences on the coastline have caused the interruption and diversion of coastal currents and a change in the regime of deposits. On the Mediterranean coastline, the inefficient interventions of the past followed by continuous pressures from urbanization and tourism, along with the effects of local geodynamics such as subsidence, are the main causes of erosion.

Table 6.1 Human causes of coastal erosion.

On the sediment supply (nourishment system):
Mismanagement of river basin
Dams
Reforestation and rural land abandon
Sand extraction (from dunes, river, beach, marine bottoms)
On the littoral dynamics:
Urbanization and tourism
Works
Ports installations
Pollution and destruction of Posidonia Oceanica
On the sea level rise:
Climate change
Subsidence

Source: Own elaboration based on CIESM (2002)

6.3 Strategies to coastal erosion: control vs. adaptation

The review of the main processes involved in the formation and evolution of coastal systems has highlighted problems such as the loss of certain habitats (beaches, dunes, marshlands, underwater submarine meadows) and of the environmental functions and services which they offer for the development of

human activity. Coping against such natural phenomena goes back to historic times when the Phoenicians, Greeks and Romans constructed ports and coastal defences to protect themselves from storms or changes in sea level. However, since the second half of the 20th century, trends have accelerated the vulnerability of coastal systems, making the management of coastal erosion an urgent necessity for human development.

The results of the EUROSION study (EC, 2004) showed that, although protection is possible, at present coastal defences can be breached by extreme events and it is not known how the situation will evolve in the future due to the sea level rises and meteorological virulence associated with climate change. Uncertainties, in the long term, about population safety, the development of a large number of activities, and coastal biodiversity lead us to rethink some strategies such as maintaining the coastline artificially with engineering works of rigidification or massive regeneration.

In order to describe the strategies of erosion management, we have used the typology established by the Department of Environmental, Food and Rural Affairs (DEFRA) in the UK, which has been adopted in the Eurosion project (EUROSION, 2002). The main aim is to develop a long term and sustainable strategic policy of coastal defence and land use within a sedimentary cell (DEFRA, 2001). Figure 6.3 shows the generic policies which DEFRA has typified.

→ The most extreme case corresponds to the policy known as ***move seaward***, where man takes advantage of his power and wins ground from the sea and humid areas. This is the case of the Dutch polders or the cruel and uncontrolled drying up of wetlands which has affected our coastline over recent decades.

→ The policy of ***holding the line*****,** widely applied along the Spanish coasts, includes those situations where defence works are undertaken to improve or maintain the standard of protection provided by an existing line of defence, such as the regeneration of beaches, the construction of defensive structures such as breakwaters. In this group of policies maintenance activity on current defensive systems is included.

→ By means of the policy of ***managed realignment*****,** the sea gains ground in the emerged zone in a managed way. It consists of identifying a new coastline further inland and establishing new defences. Along our coasts we still

do not have any example of this type of policy, but since the beginning of the nineties this new vision of erosion management has been applied in areas of the UK and France where erosion was severe. This is the case of the Essex estuaries (UK) and the cliffs of the Isle of Wight (UK) and Criel-Sur-Mer (Fr). Normally this coincides with areas of great ecological value where action more in line with natural dynamics is valued, or in those situations where erosion is very difficult to control and the costs are very high.

→ We speak of ***limited intervention*** when man work jointly with natural processes in order to reduce risk, while at the same time allowing a natural change in the coastline. This means maintaining the natural standard of defence and incorporating a range of measures to slow down erosion, such as the construction of a beach below an unprotected cliff, or the management of dunes, as well as measures aimed at public safety such as warning systems against flooding or the risk of landslides.

→ Finally the option of ***doing nothing*** which implies not implementing any coastal management interventions. It happens when no investment is made in actions or coastal defences, letting nature take its course.

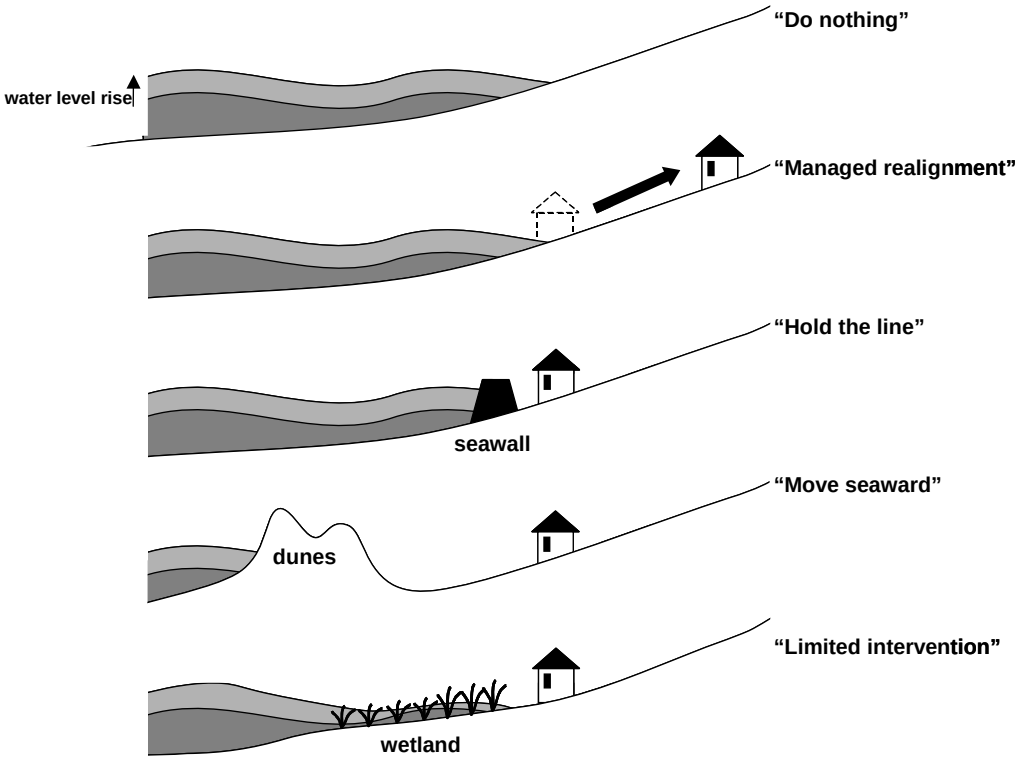


Figure 6.3 Management strategies to cope with coastal erosion, defined by DEFRA, 2001. Source: Eurosion, 2002.

Another classification more simplified but also useful is done by Bijlsma *et al* (1996) used in IPCC (2001) which identified three possible coastal response options (IPCC, 2001, p. 367):

→ ***Protect***, which aims to hold the line by constructing hard or soft technical coastal defences (e.g. seawalls, groins, beach replenishment)

→ ***Accommodate***, which implements some adjustments so that people can continue occupying the land (e.g. elevating buildings, salt-tolerant crops)

→ ***Retreat***, which works with natural dynamics and leaves more space for water and sediment. Infrastructures are removed and land uses can be abandoned.

In both classifications, there is a gradient of alternatives that ranges from those technocratic that aim at controlling coastal systems and those more adaptive that aim to adjust to natural dynamics.

Chapter 7 Barriers and opportunities to the Integrated Assessment of coastal erosion in Spain. A case study in Sitges.

7.1 Introduction

Sitges has been experiencing chronic beach erosion for decades. The history of the intervention along the Sitges coastline provides an illustration of the inefficiency of much of its traditional coastal management. The latest proposal of the Ministry for the Environment to deal with coastal erosion in Sitges was categorically rejected by the public. The project proposed was a huge plan to redesign the seafront of the town, which is currently a symbol of local identity. Various socio-cultural and ecological associations from the municipality protested. The main arguments of these stakeholders were that the project entailed a radical change to the coastal front of Sitges, uncertain environmental impacts, a questionable distribution of uses along the beach. The project also modify and reduce one of the town's most identifying features: the boulevard, an element highly valued by the public. (Serra *et al*, 2003; Roca 2005).

This case is an example of how coastal erosion risks and uncertainties made many coastal areas very vulnerable and how, at the time beach surface reduces, the intensity of social uses increases, which can lead to the generation social conflicts as a result of different values and interests at stake. This is a significant concern in a country as Spain where the major part of its economy relies on the tourism sector specially based on coastal resources. Sitges therefore can be very representative for analysing which are the main elements that feed this kind of conflicts.

Our starting point parts from the presumption that prevailing assessment processes for coastal erosion are reduced and only focus on the physical environment. On the other hand, the existing institutional system which is very centralised and with a top-down decision-making approach, makes difficult communication and participation of the local community.

In this sense, our aim is to analyse a conflict related with coastal erosion and explore the outstanding elements that contribute to feed the controversy and interfere in the decision-making process to cope with erosion problem.

Specifically, the research follows the next steps:

→ Analysing current coastal policy-making process.

→ Identifying the main stakeholders and their interactions in the institutional system of Sitges

→ Framing the problem by understanding social needs, identities and perceptions present in local society in relation to the physical problem, the solutions and the impact.

→ Making proposals and recommend actions and intervention criteria consistent with public expectations.

→ Analysing and discussing the elements that have arisen or contributed to the conflict in Sitges.

7.2 Area of study

The municipality of Sitges (Garraf) is located 36 km southwest of the city of Barcelona. With a coastline of 17 Km. the municipality has the longest coastline in the metropolitan region. Although it is of great extent (4.387 ha) less than a third is built up, given that most of the surface area belongs to the *Garraf* massif natural park, a karstic morphological massif. The main urban centre, the town of Sitges is located in a quaternary basin which is protected from the North winds by this massif, which gives it a mild climate all year round.

Apart from the municipal centre, Sitges has other urban developments such as Garraf or Les Botigues, but the beaches under study are those directly in front of the town of Sitges (Figure 7.1). In total, this urban coastline represents 2 km of sand along with breakwaters or other defensive works making up 10 beaches of the 18 which belong to the municipality. The space between one breakwater and another has a particular name and acquires certain uses and social peculiarities. In summary, they are urban beaches, highly visited during the summer period and appreciated by locals, visitors and tourists.

Figure 7.1 Location and aerial view of the town of Sitges. Source: European Topic Centre on Land Use and Spatial Information

7.3 Methodology [18]

7.3.1 Data collection

The method adopted to fulfil the objectives is next presented. It involves two complementary processes. The first one is a more static analysis that involves a multidisciplinary research to frame the main issues at stake (Framing the issues). The second, mainly qualitative, focus on the stakeholders' perceptions to perform an institutional analysis and to appraise different perspective on several faces of the problem at hand (Institutional analysis and public perception) (see Figure 7.2).

Framing the issues

The first approach gives a wider description of the case provided from the bibliographic sources related to theoretical and empirical knowledge. A broad range of elements has been covered: the coastal physical dynamics, socio-economical characteristics and human activities, engineering interventions developed on the environment and the political context governing the area under study. This part has a multidisciplinary approach as the information supplied comes mainly from different scientific disciplines (geosciences, natural sciences, economy, history, politics…). Here press and local documents were reviewed, especially to re-construct the background on the conflict.

The study of these contents characterizes a frame of reference for further analysis. In order to put all this knowledge into movement and to generate dynamic results in terms of social perception and stakeholders' relationships a study based on an in-depth interview to know the social perception of the problem of erosion currently affecting the coast was set up.

[18] This methodology was applied simultaneously in 11 case studies throughout Europe in the frame of Eurosion project. It was publicated in Serra *et al* . (2002). The methodology set to make the assessment was based on an in-depth study of eleven pilot sites, spread around the coastal area of the member states and accessing countries. The analysis covered different aspects, such as type and dynamics of the coast, policies implemented in coastal area, the socio-economic characteristics, measures to protect the coast, social perception of the problem and the management of information.
The methodology was in accordance with EUROSION project, which worked on the basis of a conceptual framework consisting of several assessment levels: policy level, physical level, socio-economic level, technical level, social perception level and information and communication level. The first four levels correspond to the classic fields of research, which derive from the static analysis mentioned above and provide the basis to understand the social perception level and information and communication level.

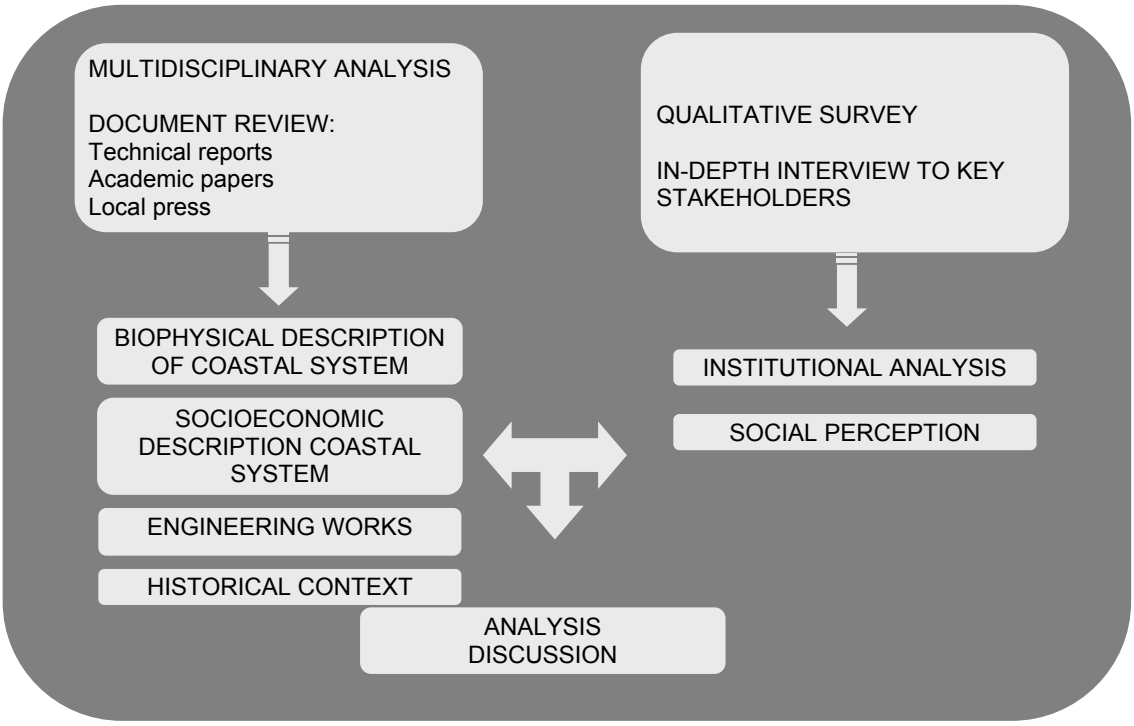


Figure 7.2 Diagram of the methodology

Institutional analysis and public perceptions

The other approach was faced with a qualitative technique that provides a detailed, sectoral vision. It was decided to apply a motivation analysis, which is a method of interviewing selected stakeholders who can freely express their opinion on the topics addressed. This is common in the social sciences as it is a way of clarifying difficult aspects that are not assessed within a large-scale quantitative survey.

With the aim of learning more and understanding the richness and complexity of the social reality of Sitges we opted for a qualitative method: the in-depth interview. Although the social sciences provide a range of quantitative methods such as mass surveys which cover a larger and more representative sample, these do not allow such depth of study, even if they can be useful to quantify certain information or know the views of those surveyed on various different aspects[19] .Moreover, although there are other qualitative techniques which allow us to cover all the social universe of Sitges more widely (e.g. discussion groups), we chose the in-depth interview of key stakeholders given the time limitations set by the demands of the EUROSION project.

[19] In July 2002 a survey to the Sitges' beach users was carried out as part of the work on the Eurosion project. The results can be found in some publications by the work group as Villares *et al* (2004).

This research method allows to study in depth the different aspects of the case and may also give rise to unexpected concepts or the more hidden areas of the conflict. In this way the responses represent a partial understanding of the subject in question which has a high value as it aids in interpreting different aspects of the problem and their possible solutions. The interviewee represents the opinion of a stakeholder who is influenced by their own personal situation. Therefore we need to take this into account when generalising certain demands and validate them with other opinions. It could be criticised that the stakeholders selected for the interviews represent those organisations which are organised with common aims but there is a lack of general public opinion.

Design of in-depth interviews

Two types of interviews were designed. One oriented to local stakeholders who have experienced and known the beaches for a long time. This group of interviewees formed part of the political, technical, social and economic arena in the site. Leaving aside local level, in order to enrich the analysis other interviews were considered so as they could provide scientific- technical details and amplify and offer a more strategic knowledge. This group of interviews included regional and national administration, technicians and researchers.

In the local area we looked to investigate the nature and size of the problem, along with the perception of each stakeholder over time and how they understood the causes of the problem (question 1). We also wanted to know their perception of a future change in the current physiognomy of the coast, whether there was a risk of losing the beach and therefore a need to act (question 2). The responsibility of protecting and managing the coast and the current system of competences was also investigated (question 3). We wanted to know the opinion of the interviewees on the actions taken in the past by the government on the coastline and its efficiency (question 4). We also aimed to know the action taken by the stakeholder interviewed and his perception of actions undertaken by other institutions to maintain the state of the beaches (question 5).

Once this part of the interview was concluded, we went on to study in depth the ins and outs of the conflict, beginning with an identification of the most controversial aspects in the opinion of the interviewee and their evaluation of the degree of acceptance on the part of the general public (question 6). We asked them to evaluate possible environmental changes, of use, design, landscape, comfort, safety, due to an intervention such as that proposed by the

Ministry (question 7). However we also asked about the effects on the local economy strongly linked to tourism (question 8) and on the economic activities carried out next to the beach and the sea (question 9). Finally, another important aspect was citizens' participation and the relationships established between the stakeholders, the degree of communication and how information circulated (question 10).

Leaving aside local perception, other interviews were carried out that aimed at amplifying and reporting on specific aspects of the conflict. We interviewed those in charge in the regional and national administration (politicians and technicians) and experts from specific scientific fields (e.g. marine biology, geomorphology, marine engineering). Firstly we tried to look at the legal aspects (regulations, plans and tools for implementing coastal protection) and to know the type of data or information used in the studies they carried out (question 1). We also wanted to get more information about the relationships between stakeholders, how they communicated or how information was exchanged (question 2). As they were well aware of the network of competences, they were asked to evaluate them (question 3). They were also asked to give their opinions as experts on whether there was a risk of losing the beach and therefore of a need to act (question 4). Continuing on, with regards to the technical evaluation, we centred on the project proposed by the Ministry, asking about the suitability of the proposed solution and its main effects on the physical environment from their field of expertise and on the socio-economic aspects (question 5). The next part of the interview looked at the social conflict generated. On the one hand, we asked about those elements of the project which had caused rejection (question 6) and on the other, how public participation should be handled in this kind of interventions (question 7). At the end, we asked about the improvements fostered by the project (question 8), an evaluation of landscape changes (question 9) and, finally, we wanted to know if the interviewee had any suggestion or proposal of any alternative action (question 10).

Stakeholders identification

According to Beatley (1994), in coastal management the stakeholders are those interest groups who seek to influence or who are influenced by the location of coastal resources. The process of identifying stakeholders began with a set of preliminary contacts and interviews with a number of stakeholders (government technicians, the anti-project platform) who cooperated in the configuration of a final list of interviewees based on a database of entities provided by the town

council. Interviews were mainly carried out with representatives of those entities which responded as such and not on an individual basis. Moreover, we also included some people of the general public, who due to their links with the coast or due to personal interest wanted to respond to the interview on an individual basis without representing any particular group.

Given the politico-economic complexity of the social network, it was thought prudent and appropriate to carry out about thirty in-depth interviews with local stakeholders and experts.

The in-depth interviews carried out geographically were addressed towards politics and socio-economic interests groups. In the first place, opinion was sought from the leading politicians and officers of the municipality. Secondly, social leaders, representatives of organisations established in the town with strong links to the position and the situation of the coast were interviewed. Thirdly, opinion was sought from economic representatives; those who at a level of business or institutional responsibility are connected with the financial resources which, directly or indirectly, come from the coast.

With a total of 30 in-depth interviews, the social and local perception of the conflict was outlined in qualitative form.

As already mentioned, beyond this local perception other expert opinions connected with the problem were surveyed. This opened another direction in the field of work, that of seeking the opinions of experts and institutional leaders. In this case, the perceptions of various leaders of the administration were sought and, at the same time, those of experts and scientific/technical consultants. (See Table 7.1).

Application of in-depth interviews

The in-depth interviews were carried out following a prearranged script, but, as necessary, interest was directed to specific questions depending on the background of each interviewee. Before starting, the person interviewed was informed of the anonymous character of the interview and the results and informed that it would be recorded. Nearly 30 in-depth interviews, which lasted between 45 and 90 minutes, were carried out in a short period, centred on the

high season on the beaches, from 5 to 24 July 2002[20]. Afterwards, they were transcript and the written text analysed with content analysis.

Table 7.1 List of stakeholders interviewed.

TYPE OF STAKEHOLDER	STAKEHOLDER	INTERVIEWED PERSON
PUBLIC ADMINISTRATION: Public interests	National administration (Ministry of Environment)	Territorial head of Catalan Office
		General Deputy-director
	Regional administration Territorial Planning department (Generalitat de Catalunya)	Direcció General de Ports i Transports
		Direcció d'Acció Territorial
	Province administration (Diputació de Barcelona)	the Head of the Environmental Service
		Director of Centre d'Estudis del Mar
	Local administration (Political arena)	The mayor
		The urban planning Councillor
		The Environment and Beaches Councillor
		Patronat de Turisme
	Local administration (Technical arena)	A municipal architect
		An environmental officer
Social arena: collective interests	the oldest residents' association in Sitges	The chairman
	The Platform against the project	Spokesman
	La Falconera-Local ecologist group	The leader
	Red Cross	The head of beach lifeguards
	Local expert	Individual
Economic arena: private interests	Club Nautic	The chairman
	Club de Mar	The chairman
	Beach Concession Holders	The chairman
	Hotel and Restaurant Association	The chairman
	the Aiguadolç Marina	The director
	the Builders' Association	The chairman
	the Commecials' Association	The chairman
	Fishing Botherhood	The chairman
EXPERTS: disciplinary knowledge on certain aspects of the project	Department of Ecology. University of Barcelona	a biologist, expert in the posidonia oceanica
	BCN Regional (the projects office of the Barcelona Metropolitan Area)	an environmental officer
	Department of Maritime Engineering. Technical university of Catalonia	professor of marine engineering
	Private Consultancy	A civil engineer

[20] These dates coincided with the sand nourishment carried out by the Environment Ministry on Terramar, Barra and Riera Xica beaches, with materials coming from the marine deposits sited next to Port Ginesta (see section 7.4.2 on the origins of the conflict).

7.3.2 Data analysis

The results exploitation is based in two information resources. On the one hand, the technical documents and literature review contributed to characterised the coastal system and, on the other, in-depth interviews provided information on the conflict.

As a result, an identification and description of stakeholder systems was drawn up by using a matrix to show the relative power and influence of each of them. In addition, an actor map was used to show linkages and flows of information between them. Finally, the description on social perception issues was performed through a content analysis of transcribed interviews.

7.4 Results

7.4.1 The context

The maritime urban front of Sitges town

Although the beaches of Sitges have never been very extensive, they are the scene of several activities which contribute to give them a recreational use. The division by breakwaters has promoted a certain degree of social specialisation in terms of use, as different types of activities are carried out in each beach, such as swimming, sunbathing, water sports (sailing) and beach sports (beach volleyball, football...), shows, etc.

The nearest beaches to the promontory crowned by the church, the Punta, are the most frequently visited beaches. They, called the Fragata and the Ribera, are closer to the old quarter of the town and the train station and give rise to a number of uses specially during the summer months. The Sailing Club and its stretch of beach occupied by small boats are located there. There are also sports areas, show areas, etc. relatively extensive, which, during the season, are used for beach volley ball and beach football competitions etc, attracting a good number of spectators. There are also areas where sand sculptors create their creations.

Northerly, the compartmentalised beaches begin to suffer serious problems of erosion, but are also used intensively. In this direction we find the Bassa Rodona, the Estanyol and the Barra beaches. They are topologically encased between breakwaters which run perpendicular to the coast and the latter beach is also delimited by small islands of concrete. The beach of the Bassa Rodona

is frequented by gay tourists and by young people of both sexes (this is the beach of the “beautiful” people). The next, the Estanyol, is visited by all types of people, but it is said that mostly locals and the tourists who have been going there all their lives prefer to go swimming. Older people predominate. Finally the last beach, the Barra, is a beach with all types of visitors but out-of-town visitors are more frequent. Mainly beach users from the inland towns and villages are attracted because this beach is well communicated with the roads that link this coastline with the inland districts of the region (the C-15 road, the Diagonal axis which links el Garraf with Penedès, l’Anoia, el Bages).

Figure 7.3, 7.4, 7.5 and 7.6 Images of the seafront of Sitges and its boulevard.

The promenade has its origins in a road which ran from the town to the sanctuary of *el Vinyet al*ong the sea front. In 1919, the first project was approved. During the second half of the century a number of town planning projects gave it its current configuration with a length of over 2.5 km and a diverse transversal section. The boulevard is a two kilometre-long route in a

neoclassical style that gives a strong scenic and architectural personality with views of the beach. It is surrounded by many colonial-style houses built by those who returned from Cuba towards the end of the 19th century and constructed them inspired by their stays in the Caribbean. It is as widely used and visited as the beach itself, especially in winter when temperatures tend to push visitors away from the seashore. It is used for various purposes during the local carnivals and cinema and theatre festivals and it has a range of facilities for recreational activities and sports. Its value lies in the image it gives to the town: a long gardened promenade, above a beach split by breakwaters, with the promontory of la Punta with the church at the top in the background. Currently, the promenade has a social function as a leisure area for walking and meeting, fomenting collective life and contributing to a general improvement in the quality of life in Sitges. Additionally it is a lookout point from the town to enjoy the landscape of the coast, and integrates the beach with the urban centre (Miralles, 1997). The promenade is one of the essential elements of the economic promotion of the municipality and a very important tourist attraction, which has led in recent years to a sharp increase in the price of land and housing. However, it is also one of the causes of the erosions problem affecting these beaches. (See Figures 7.3, 7.4, 7.5, 7.6)

Coastal dynamics

The Sitges municipality coastline is basically rocky calcareous with a few little sandy beaches to the NE and SW of the town (See Figure 7.6). The section under study focuses on the beaches which are just in front of the town. They are made up of a sandy area divided by breakwaters and other coastal defence works, as a result of a coastal protection policy that started in the 1930s.

These beaches have a yearly variable width which none of them exceeds the 40m. The nearshore seabed has a slight regular gradient slope, between 0º and 5º. However the presence of breakwaters in front of Sitges has modified the original contour lines and joined them. Beach and bottom sediments are of siliciclasthic origin and have a light gold colour which is very appreciated by beach users. The sand grain size is fine to medium, changing depending on the beach and along the beach profile.

In front of the coasts of Garraf there is a marine ecosystem, which despite its high degree of degradation, plays a role in the system that cannot be ignored. This is due to the presence of *Posidonia oceanica* meadows. This seagrass is an endemic plant of the Mediterranean ecosystems. Its importance lies in the

fact that its presence triples the biological production of organic material available to trophic networks. Another ecologic function is the capture of particles and the stabilisation of sediment as it gives rise to the formation of solid structures. Its growth over time may arrive to form authentic shields barrier, thus protecting the coast (Ros, 2001). Leaving aside fishing and anchorage, the main causes of its degradation are sand extraction or being buried by the transfer of sediment.

The factors which govern the **coastline dynamics** in Sitges are:

→ **Nourishment system:** The major input of sediment to Sitges' beaches comes from the River Llobregat. The characteristic longshore drift of Catalan coast carries the sediment from the River Llobregat to the SW. The input sediment in the Llobregat Delta has been calculated in 100.000 m^3/any (Acebillo, 2000), from which only a small quantity arrives to Sitges due to several obstacles encountered such us 4 ports[21] and the Garraf Massif.

The watercourse of Ribes, downdrif of the beaches under study, also contributes but to a considerably lesser extent, to the replenishment of sediment (limestone) when it is active, normally in spring and autumn. We do not have specific data on this replenishment.

→ The **dynamic system of distribution of sediment material** is formed by a predominant current along Catalan coast which flows to the SW, related to the general Western Mediterranean nearshore circulation path. It is responsible for transporting the sediments from the Llobregat Delta to Sitges coastline. The approximate mean transport of longshore drift in this coastal sector of Sitges is around 60,000m^3/yr (Acebillo, 2000).

[21] These marinas have a serious problem with sediment silting up their harbour entrances (see Photo 3.1), with continuous dredging operations necessary. The last dredging works at Port Ginesta marina were carried out for the renourishment of the Sitges beaches in July 2002.

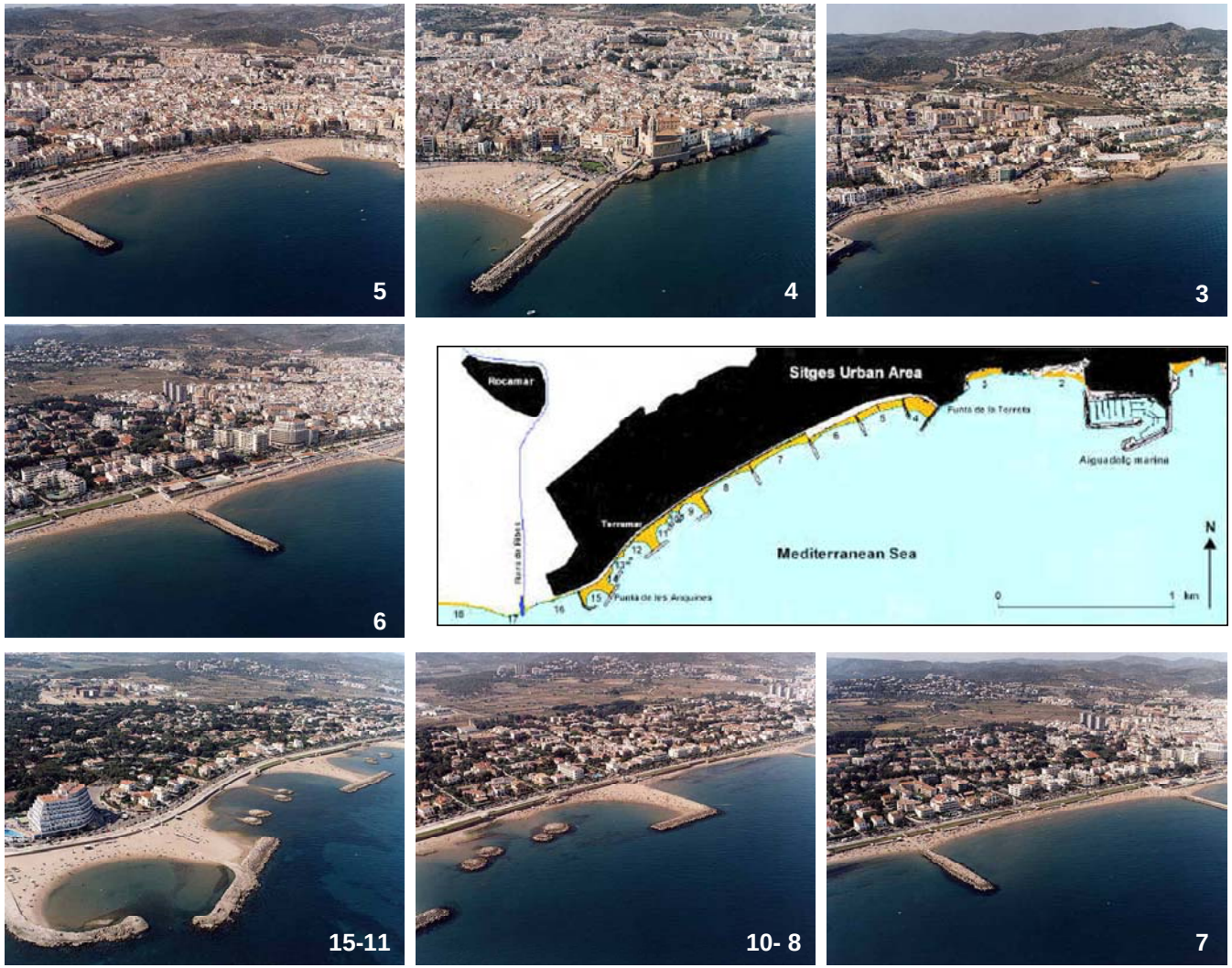


Figure 7.7 Aerial view of urban beaches in the town of Sitges. Source: Ministry of Environment.

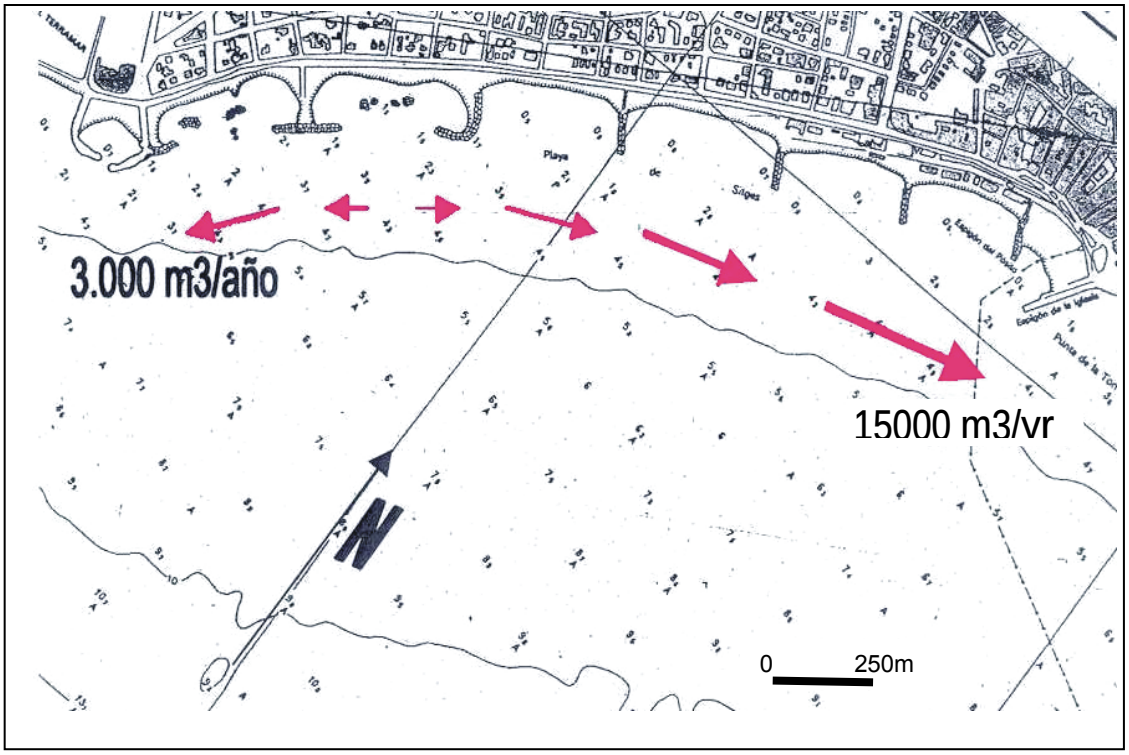


Figure 7.8 Model of coastal dynamics in the urban front of Sitges. Source: ALATEC, 1999.

However, these dynamics can be altered by local characteristics such as the morphology of the coast, winds and human infrastructures like harbours and groynes- The nearshore currents on the coast at Sitges have the same flow direction as the longshore drift, but an inverse current can be observed between Riera Xica and Fragata beaches because of the variability of wind and wave climate (see Figure 7.8). In a normal situation, the main wind directions are NE generating a NE to SW current, but in several situations the SW winds are dominant and generate an inverse NE current . This corresponds to a numerical model calculated by ALATEC (1999). Sediment transport rates calculated by this model are 3,000m^3/yr to WSW and 15,000 m^3/yr to ENE.

The transverse offshore transport (that contributes to the loss of sediment from the beach) must be explained by rip currents, favoured by the present shape with short cells. This type of current is generated when wave trains approach at a semi-perpendicular angle to the coastline and the whole water mass cannot be evacuated by nearshore currents. In front of the coast at Sitges, these rip currents are focused more because of the presence of many groynes that mark out the cell boundaries.

The main transport agents which impact on the sedimentary balance in Sitges are the wind and the waves. The main wind directions are NE, SE and SW. The most persistent winds are from the SW with a high frequency, but the strongest winds on the Garraf coast are from the E and NE and are associated with storms which are popularly called *llevantades*.

The wave climate of Sitges coast can be divided into SEA (waves associated with wind), SWELL (Condition of the surface caused by a distant wind system.) and TOTAL (the resultant of summing sea+swell). Predominant SEA directions are similar to those described for the wind. Whereas SWELL main directions NE to SE are associated with the fetch.

Finally, considering the coast's orientation (S60W-N30E), which prevents northern waves, the most frequent directions of waves are NE, SE and SW.

Higher intensities can be observed in winter and spring, when easterly waves are generated in the Mediterranean sea, while intensities are lower in summer. A low number of calms in spring and a high number in summer. Seasonally, winter and spring present the highest intensity, related to east wind storms.

→ The **climate change** is considered a factor that affects at long term. The trend of sea level rise can be assumed of the same rate for the whole NW Mediterranean coast, at an average of 2-6mm/yr. Changes in weather trends (storm frequency and virulence) cannot be foreseen. Therefore it is a factor with a high intrinsic degree of uncertainty.

Having described the coastal dynamics, we have to bear in mind that the equilibrium that the system keeps with the conditioning factors is extremely fragile. As we explain below, the presence of man and his action on the Sitges coastline have affected this initial situation of equilibrium converting the phenomenon of erosion into a problem for man.

Socio-economic system

Sitges boasts an intense tourist and cultural life which have consolidated the town as the main attraction pole on the south coast of the BMR (Barcelona Metropolitan Region).

Its vocation as a tourist destination dates back a long way. In the 19th century, with the arrival of the railway in 1881, Sitges became a tourist centre for the bourgeoisie from Barcelona and a cultural centre for intellectuals and modernist

artists of the age, mainly painters, sculptors and writers such as Santiago Rossinyol, Ramon Casas, Mingote, Pere Pruna, etc. Currently, the town still preserves its past history in its old quarter, which is full of artistic expressions such us its three museums and a high number of galleries and antique shops.

The development of tourism reached a peak in the boom of the 60s. This phenomenon attracted millions of tourists in the search of the so-called 3s tourism which implied a massive exploitation of the coastline. From the decade of the nineties to the present, this model has been opening up to new sectors by diversifying the offer towards a more cultural and conference types of tourism. Additionally the affluence generated by tourism, which was initially concentrated in the summer season, has been extended over the whole year, but is especially high at weekends, bank holidays and the hotter months. At present the town has 4,000 hotel beds, half of which are four star, showing the focus on quality in infrastructure and becoming a member of a select club of cities: the Jewel of European Tourism. Moreover, the construction of new hotel complexes has allowed it to become a major centre for conventions, conferences and festivals.

At the same time it displays its more playful nature through bars, discothèques and a spectacular and well-known carnival. Sitges is also a meeting point for gays coming from around the world.

Last but not least, over the last 10 years, it has become part of the BMR. With the construction of the motorway A-16 in 1986 communications with Barcelona improved to an extraordinary extent, as it is now within less than 30 minutes of Barcelona by car, only a few minutes away from the international airport of El Prat-BCN and only between 27 and 35 minutes by any one of the many daily commuter trains that run between Sitges and Barcelona-Sants. This has turned it into a suburb of the metropolitan area and consequently a target of the urbanization market. Hence, urban and urbanized areas have extremely increased in value out of all proportion.

All these tourist-urban specialisations are linked to the sun and beach resources that are complemented by attractive urban landscapes and a pleasant microclimate. The two kilometres of beach in front of the town centre are frequented all year round, and not just during the summer months.

As a result, Sitges has experienced a constant demographic growth, firstly because of the boom in second homes since the 70's and secondly due to the construction of the motorway of el Garraf, which has provoked a growth of 50% reaching, in 2006, a population of 25.642 inhabitants. Although the density is not apparently very high (558 inhab./km^2 in 2006), we should take into account that a large area of the municipality is a protected area (the Natural Park of Garraf) and most of the population is concentrated on the sea front.

Figure 7.9 View of the beach in the peak season.

Figure 7.10 Aerial view of beaches of Sitges.

On the other hand good communications with Barcelona and the airport, along with the good climate and a pleasant quality of life mean that around 8 % of its residents are foreigners. Annually current demographic growth in Sitges of around 4% corresponds to the positive migratory movement of its population[22].

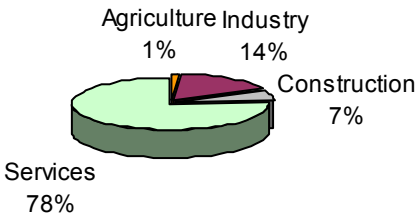


Figure 7.11 Distribution of the population among the economic activities in the municipality of Sitges. Source: IDESCAT, 2001.

From an economic point of view, tourism and industry represent the most important sectors (Figure 7.11). In the past Sitges had been an agricultural town

[22] Data from IDESCAT (Catalan Institute for Statistics)

dominated by vineyards, fruit orchards and dry-land crops and also had a small fishing activity. This lasted up to the 19th century when the phenomenon of industrialisation arrived and textile mills were established, although they only lasted until the end of the century when the current trend of second home construction began. This has caused a process of tertiarization of the economy towards a strong tourist industry and construction. Additionally we should not ignore that along the coasts of Garraf, especially in the town of Vallcarca, there are many quarries and a cement factory. There is also an industrial estate called Mas Alba that has allowed for the installation of new industries and facilities needed for a town of the size of Sitges.

This economic boom can be seen in the economic data available in IDESCAT which shows that Sitges is the municipality with the highest level of income in the district of el Garraf and the eighth highest in Catalonia. The index for the Average Gross Household Disposable Income in Catalonia is 100, Sitges stands at 117,4. However these figures also hide a picture of uncontrolled urban speculation, which has led to a sharp increase in the cost of housing, leading in turn to the emigration of people from Sitges to other municipalities in the region. The average profile of the new residents is of young people, especially between the ages of 30-45 with a medium to high level of income.

In urban terms Sitges is intensely occupied mainly by residential housing, tourist infrastructure and roads and railways. *Els Colls Miralpeix* is the only one that remains non-urbanized to the west, although it comprises 2 camping sites, a golf course and an area of farmland which is separated from the urban centre by the Riera de Ribes. Parallel to the coast various roads and railways cross the territory. The railway crosses the municipality 600 m from the coast, although in some stretches it passes very close to the sea. The C-246 road also passes very close to the sea although when it arrives to the port of Aiguadolç it goes inland to go round the town centre. Finally the A-16 motorway runs inland, crossing the Garraf Massif by some controversial tunnels.

During the period in which the survey was carried out in Sitges the General Urban Planning of the Town was being reviewed. The Council was preparing a Plan which contemplated a new ceiling of 40,000 inhabitants, which would mean almost doubling the population in 10 years and implied strong urban growth in the municipality. It was widespread rejected by the inhabitants of Sitges.

Background on Spanish coastal policy

In order to understand the conflict some information on the political *savoir faire* in Spain should be provided. The historical evolution of coastal management in Catalonia is closely linked to the regulations in force and the circumstances which have conditioned, from time to time, the type of planning and actions carried out to defend the coastline.

Since the middle of the 20th century the model of territorial occupation of the coastal fringe has been marked by the tourist boom of the sixties, which affected almost all the Mediterranean basin converting it in the main tourist destination in the world with 30% of all international tourism. This global circumstance led to a spectacular agglomeration of urban and industrial uses in a very reduced territorial fringe. In Catalonia, just like the rest of the State, this process of occupation was developed without any type of planning, or regulation and was the cause of many of the problems and conflicts which affect our coasts at present.

During the 60's and 70's the only priority of the state policy in coastal management was tourism and the economic benefits it brought with it. In this period there was no coastal policy, and sectorial policies intervened only in a fragmented way and without any coordination. However, the government's actions were backed up by the Shore Act 1969, which consisted of a legal text with serious structural deficiencies. It impeded the most minimal protection and management of the PMTD (Public Maritime-Terrestrial Domain) and as it has been showed, such law was unable to stop the intense transformation suffered by the Spanish coastline (Barragán, 2003).

The policy of coastal protection was dedicated exclusively to the protection with hard works (breakwaters, dikes, groins etc.) and no strategic planning. This only responded to the economic interests of the local administrations related to urban expansion and tourism, with the occupation of public space. They embarked upon the construction of seafront promenades, marinas and the drying up of wetlands and other areas of great ecological value. The delimitation of the PMTD in the aforementioned Act of 69 had the same extension as that contemplated in the current law on coasts, but permanent occupation was allowed. In the mid 70´s the General Directorate of Coast and Ports of the

Ministry of Public Works started to work on the so-called Plan for Coastal Use[23] which would be the first attempt at territorial planning of the coastline but which was not binding in nature and was merely a declaration of good intentions.

In spite of the arrival of democracy in 1977, there was no perceptible advance in coastal policy until the Socialist Party took the power in1982. The pressure of tourism which had started to show certain risks, environmental pressure and the inefficiency of some of the defensive works led to the drafting of the Coasts Act of 1988[24], which marked a crucial moment in state coastal protection.

This law provided a legal framework and the tools necessary to carry out actions to defend the coastline, to protect the PMTD and to control future developments. The enactment of this law was accompanied by a political willingness to recover public coastal space, although this contrasted with the policy linked to large scale regeneration of beaches, the construction of seafront promenades and coastal civil engineering projects (Barragán, 2004).

Unfortunately, although this law was quite efficient in certain Spanish regions, we cannot say the same for Catalonia where with political, urbanising and tourism pressures that have prevailed until nowadays. The main criticism such law received is that it has taken so long in coming. If it had been instated 40 years ago it would have been a highly powerful instrument for the protection of beaches (Basora, 2001). But this law affects a very narrow stretch of coast and leaves the rest of the territory at the mercy of urban expansion.

Independently of this legislation, the coastal area is regulated by other local sectorial regulations. Here we need to mention legislation regarding the territorial and town planning, ports, the environment, natural spaces, tourism, roads, waters, cleaning, urbanism, fishing and navigation, both on a state and autonomous level.

Along with the new coastal law, the General Infrastructure Plan 1993-2007 was drawn up. It has been the only coastal plan that has ever existed in the Spanish

[23] PIDU, Plan Indicativo de Usos del dominio público litoral.
[24] The Spanish Shore Act 22/1988 of 28 July. BOE nª181) stipulates that the coast corresponds administratively to the maritime-terrestrial zone. The law determines four landward zones (easement of protection, easement of passage, easement of free public access to the sea and influence zone) adjacent to the Public Maritime-terrestrial domain and imposes restrictions on development of certain land uses, urbanization and the exercise of private property rights within them.

State. This plan was articulated around 3 programmes (MOPTMA, 1994), the improvement and regeneration of beaches and other coastal areas, the recovery of the coastline and its defence and, lastly a guarantee of accessibility for the general public to this space which was so desired and appreciated from a social point of view. The lack of success of the solutions adopted in the sixties and seventies which responded to the concept of "total rigidification" based on the series of groins developed in the US and the UK lead to the introduction of soft-protective measures (e.g. beach regeneration) and mixed solutions combining rigid structures such as breakwaters with large scale regeneration of sandy beaches.

The change of the government in 1996, along with ecologists' pressures protesting against the environmental impacts of beach regenerations froze the coastal plan, which contained an investment of around 900 million €. This reduced the interventions in coastal protection only to the emergency actions, which were undertaken from time to time and were not coordinated under any national strategic plan.

Very recently, some lights on Spanish and Catalan Policy have emerged. Following the EU Recommendation on ICZM, the Director Plan for Sustainable Development[25] as a tool for implementing ICZM at national level is now currently being drawn up. At regional context, the Catalan government has also carried out two important initiatives. On the one hand, the Strategic Plan for Integrated Management of Coastal Zones in Catalonia[26] launched prior to the national initiative, which deals with different aspects (sediments dynamics, biodiversity, water quality, land use planning…) and seeks to enhance cooperation and responsibility between experts and actors (Ariza, 2007). On the other, the development of the Director Plan of the Coastal System[27] which is specifically aimed at protecting areas that have not yet been urbanised. Although the effectiveness of the first two plans are still to be tested, on behave of the latter is received as a very important initiative for protecting the hinterland which has not yet been transformed.

As a consequence of this process, at present there is a certain ambiguity. On the one hand the policy of "maintaining the coastline" with large-sale

[25] Plan Director para el Desarrollo Sostenible de la Costa (PDDSC)
[26] Pla Estratègic per la Gestió Integrada de les Zones Costaneres a Catalunya (PEGIZC)
[27] Pla Director Urbanístic del Sistema Costaner (PDUSC)

regeneration like those from the 80s and early 90 has come to a standstill. On the other, there is no a clear political position to adopt a “do nothing” or “living with nature” options. In the words of Barragán (2004) national coastal policy is in state of transition, of change. A period in which we can see a dialectic between traditional management formulas and innovations which may anticipate change.

7.4.2 Background on the coastal erosion conflict

Once, the contextual factors have been described from various perspectives: the physical, socioeconomic environment and the political aspects, we will go to chronologically narrate how erosion becomes a problem for the beaches of Sitges, what is the strategy that has been followed to address the issue, how social conflict has arisen due to a proposal by the Ministry of the Environment to remodel the town sea front and regenerate the beaches. The main documental sources used in this section have been the press and the technical projects published by the Ministry of the Environment.

The physical problem and the long history of engineering interventions

Over the last 50 years, a number of manmade influences have changed the layout of this coastal area and led to a lack of sediment. The main cause has been the internal management of the Llobregat river (e.g. dams, urbanisation, deforestation, etc). Secondly, the construction of perpendicular barriers along the coast (4 ports are placed in the same municipality[28]) has represented a tramp in the longshore sediment transport. Finally, the construction of the boulevard on the old dune system at the beginning of the twentieth century decreased its physical resilience hence, reducing its capacity to recover from critical erosive events.

During the twentieth century several actions were carried out on the Sitges coastline to combat this problem and slow down the effects of erosion. This process began with the construction of two breakwaters in front of the Terramar Hotel in 1930 and continued until the eighties following a “hold the line” strategy based on “hard engineering” actions. As a result, several breakwaters,

[28] These marinas have a serious problem with sediment silting up their harbour entrances, with continuous dredging operations necessary. The last dredging works at Port Ginesta marina were carried out for the renourishment of the Sitges beaches in July 2002.

detached breakwaters, seawalls and artificial islands were implemented (See Figure 7.14).

The latest steps were taken during the 1990s with a “soft engineering” approach based on occasional beach nourishments when it was really needed. The most recent of these took place in June, 2002.

Finally the successive interventions constructed along the coastline of Sitges in the last century in order to address these problems haven’t turned out very effective. They do not have achieved their goal, to stop erosion. Even more, in some cases the modification of the coastline has created other problems such as stagnant water reducing the quality of the Terramar and the Barra beaches.

Erosion does not affect all the beaches in Sitges in the same way, the different protection structures and their location, as well as the orientation of the beaches and their situation with respect to the municipal ports condition their erosion rates. Besides, we can see some beaches affected by accretion due to a change in the sedimentary dynamics caused by the installation of these structures.

In general we can see a tendency towards a reduction in the extent of the beach to the south-west and therefore the beaches worst affected by this phenomenon are the Riera Xica, the Barra and the Terramar. However we should specify the particularities of each section according to the factors that intervene (ALATEC, 1999):

→ **Fragata** beach has a stable situation because of the protection groin oriented to the SW.

→ On **Ribera** and **Bassa Rodona** beaches, a general trend of sediment loss can be observed. The mean annual beach surface loss is estimated at 280m^2 for Ribera and 130m^2 for Bassa Rodona. The backward movement of the shoreline is 1.1m/yr and 0.45m/yr, respectively.

→ **The Estanyol** beach gained in beach width since groin construction in 1970, but the continuing process of erosion and the sediment deficit reduced its width from 30m (approx.) in 1975 to 25m in 1999.

→ **The Riera Xica** beach presents an eroding profile since 1966 related to the sedimentary deficit. Recent storms significantly affected the

beach, reducing its width from 12 (July 1999) to 2m (Nov 2001). (See Figures 7.11 and 7.12)

→ **The Barra** and **the Terramar** beaches have shown unusual behaviour since the construction of detached breakwaters and artificial islands, which produced a very important increase of beach surface. The remodelling of this beaches in 1984 led to a gain in beach surface, but from 1995 until today the trend has been inverted. The erosion process has not stopped yet. In Nov. 2001, storms significantly affected these beaches, reducing both to 8m wide.

However, no complete studies of the erosion trends and rates have been made on the Sitges coast. If there is an exceptionally stormy year (like 2001-2002), the beach profile can be seriously eroded and this effect will be reflected in the data. The chronic erosion of this coastal sector is mainly due to the sedimentary deficit of these beaches, related to an alteration of longshore drift transport.

Figure 7.12, 7.13 Views of the eroded beach of Riera Xica in July 1999.

The origin of the conflict: the latest proposal from the Ministry

As has been described above, the present configuration of the sea front in Sitges is the result of a long history of interventions which has modified its original landscape and turned it into what we can see today: a compartmentalised beach in eight areas separated by breakwaters which are limited by a sea front promenade of 2 kms long. Despite these civil engineering works the sedimentary balance continues to be negative.

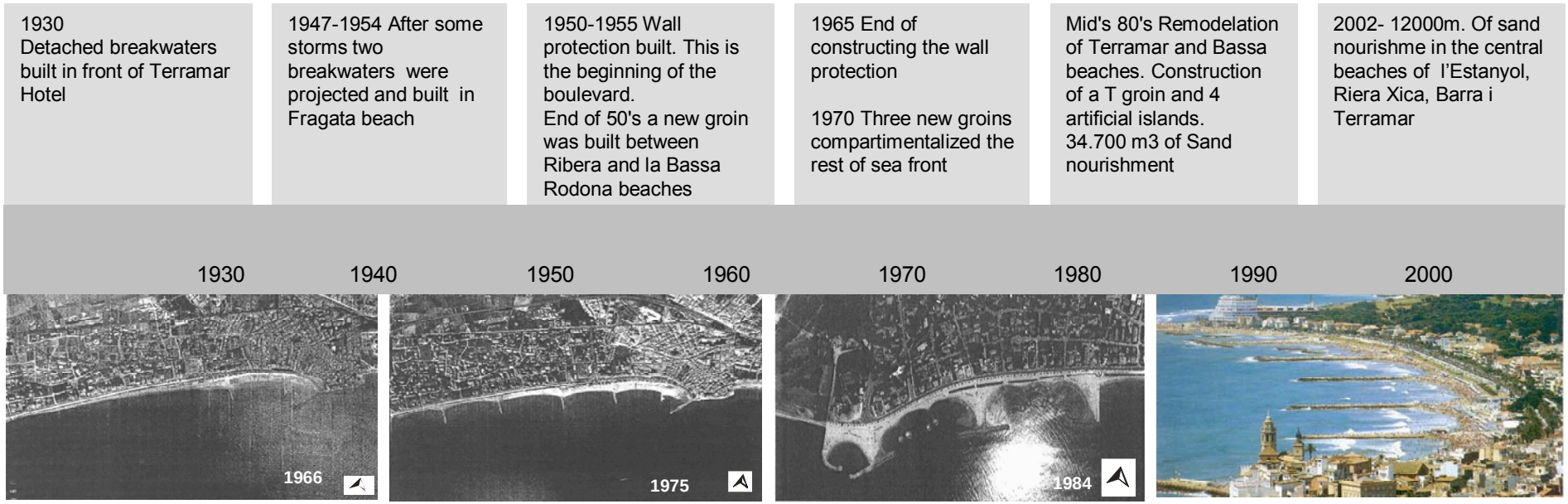


Figure 7.14 Timeline of engineering interventions along the twentieth century in Sitges.

A decade ago, a proposal was put forward to artificially nourish these beaches (INTECSA, 1994), within the framework of the *Plan de Costas* then in force and under the auspices of the former MOPTMA (*Ministerio de Obras Públicas, Transporte y Medio Ambiente*). The magnitude and scale of the projected beach produced a reaction of rejection on the part of neighbours and opposition politicians. This social opposition and political indecision led to the project being dropped in 1994. Five years later, in 1999, the *Ministerio de Medio Ambiente* promoted a new intervention under the name of *Proyecto de acondicionamiento de la fachada marítima de Sitges* (ALATEC, 1999), which although it was planned by another company was very similar to the initiative of 94.

The Ministry of the Environment's project anticipated a renovation of the whole sea front of the town, a fact which led to widespread social opposition. After decades of chronic erosion and periodic actions which had not solved the problem, central government had drawn up a large scale project where the solution proposed to combat erosion did not please the public of Sitges given its environmental impact. The origin of the project can be found in "the need to stabilize and improve the condition of the beach in Sitges and protect the sea front promenade from the action of storms, taking into account necessary protection of the environment". The project anticipated, among other actions, reducing a large part of the sea front promenade and dismantling the concessions: the Club de Mar, Bar Kansas and Picnic given that they occupied part of what was public space, the so-called PMTD[29].

The project considered three alternatives very similar in concept and with only very small modifications between them. It had a budget of 1around 12 M€, and proposed four different actions, three in the maritime area and one on the urban sea front which together would modify the current design of the sea front of the town from the Church point to the hotel Terramar:

→ Reducing the elevation of the four perpendicular breakwaters until +1m and eliminating the detached breakwaters and artificial islands of the Barra and Terramar beaches.

[29] The coastal act does not allow building in the PMTD. Under this principle many examples of infrastructure which were located in this zone were demolished at the end of the 80s and the 90s, such as the emblematic case of the "xiringuitos" or beach bars of la Barceloneta.

→ Constructing a dike in front of the Terramar hotel until draught of –5.5m, which implied a length of 300 m.

→ Remodelling the sea front and the promenade. This implied reducing the surface area of the promenade by 30% from the Sofia Avenue to Terramar and dismantling the facilities, buildings and installations (the Club de Mar, Bar Kansas and Picnic) that take up part of the PMTD.

→ The massive nourishment of sand which would be extracted from a bank located in front of the Premià de Mar and Vilassar de Mar coasts. The type of sand would be darker and would have a larger grain than the original sand. This regeneration would supply the central beaches which run from the Sailing Club to the eastern breakwater the Anquines beach.

The final design of the beach would consist of an area of 2,100 m in length losing the old compartmentalisation that the breakwaters provided. The sand nourishment and the reduction in the elevation of the breakwaters would mean that these would be buried and would only surface out at sea.

The proposed solution was based on a massive initial regeneration, but also over time there would be a need to make periodic supplies as the project did not, in principle, guarantee the stabilization of the sand.

The project landed in the mayor's office around March 2000. However, the information was not circulated to all the council and the public until October 2000 and then, indirectly through the press. On 25 November of that year, the ecological group la Falconera held a public meeting in the Santiago Rusiñol Library, where they put forward the ideas of various local experts and academics to inform the public of the ecological impacts as a result of an intervention such as that proposed by the Ministry (Figure 7.15). In the same meeting, the leader of the Socialist and ERC opposition promised to request an extraordinary council session which would take place in January 2001. The mayor agreed to designate a Commission to monitor the situation. This commission would be made up of political representatives, public entities and interest groups to study and debate the problem in depth. In the end, the commission was only made up of political parties with an unclear position and over time became inoperative and didn't facilitate the process.

Figure 7.15 Hand out to inform about an event organized by the ecologist group la Falconera the 30 June 2000.

These facts led to, in the spring of 2001, the articulation of a social movement opposed to the development of the Ministry's proposal. This was a protest platform, "La Plataforma per una Regeneració Alternativa", formed by various socio-cultural and ecologist entities in the town. During that year it was very active and collected up to 6,000 signatures against the project. Although dialogue with the Council was absent, the mayor and then councillor for the Environment went to Madrid to meet with the Minister for the Environment. According to them the minister had promised not to undertake any project without the consensus of the local community.

In this context, at the end of November 2001 and during spring 2002, there were a series of storms which seriously affected the beaches and their facilities. The magnitude of the storm along the Catalan coast led the Minister for the Environment to visit the affected area before the summer season and to repeat what he had said in Madrid. An emergency solution was put forward to save the season. A sand nourishment by dredging with sand from underwater deposits near the port of Ginesta (in the municipality of Sitges) was performed. The first and second weeks of July this was carried out with an investment of 500,000 € on the part of the *Ministerio de Medio Ambiente*. The sand improved the situation of the beaches of the Terramar, the Barra and to a lesser extent, the Riera Xica. On the other hand the state of the Bassa Rodona at the end of the summer was of extreme loss of sand.

Figure 7.16, 7.17, 7.18 and 7.19 Set of photographies made during the beach nourishment during the July 2002.

Meanwhile the Council made excuses for its passivity saying that the project was under an evaluation stage and undergoing the Environmental Impact Study. The project was shelved[30] and that summer (July 2002) a wide range of stakeholders was interviewed (See Figures 7.16, 7.17, 7.18, 7.19).

This dialectic lasted for more than a year and a half. In that time, there was little advance about how to act. In summer 2002 there was an inflexible stance from the Environment Ministry's Coastal Division and the Town Council began to seek technical advice to try to present alternatives to the Ministry. On the other hand, the Platform, going further than holding informative rallies and collecting signatures, sought alternative solutions for the most negative aspects of the scheme. They sought expert advice in the university and project experts and now they were waiting for a joint meeting with the Town Council and a committee for monitoring the project, which until there was inoperative.

[30] At present given the change in government in June 2003 it seems that a stage of dialogue has been opened in order to find a solution. A commission has been created to which all the stakeholders have been invited and which meets from time to time in order to try to reach a consensus.

7.4.3 Institutional analysis

In this section we offer a vision of the institutional context in which different types of relationships (e.g. information, communication, consultation, participation) take place between the stakeholders in the case under study. The information sources for these results come from: reviewed documents, in-depth interviews and a press data base.

A snapshot of the institutional context is illustrated in the Table 7.2 and the Figure 7.20 which responds to a static representation of the situation in the summer of 2002 when the survey was undertaken.

In the table, a description and characterisation of each of the stakeholders in the conflict are given. The aim is to identify which are the most active stakeholders (i.e. those who intervened most actively during the period under study) by characterizing their type of participation (formal or informal) and their efficiency in influencing the final decision (Very high, high, medium, low). Moreover, relationship among stakeholders has been presented. More details on the relationships are offered through the Figure 7.20 we have made a graphic representation of the relationships and information flows between the main stakeholders.

The system has two different parts. On the one hand the public administration, which is more rigid, formed by a political-administrative sub-system and its technical body which has traditionally managed the coast. On the other hand, a more flexible group, which depends on and is characterized by the presence of to a more or less intense degree, social and economic pressure groups, who are trying to get involved in the coastal management (Serra *et al*. 2003).

The public administration is represented with four levels (national, regional, supra-local and local) often with different political positions and conflicting interests, and they maintain, in the specific case of decision-making on beach protection, largely inflexible postures which make any degree of consensus or concerted actions difficult.

The institutional context emerging from the Spanish Coastal Law concentrates the maximum responsibilities to the Ministry of Environment. In addition, the apparent decentralization of the central government in territorial demarcations masks a system in which power is concentrated in the hands of central administration.

Table 7.2 Description of stakeholders and their role and active participation in the decision-making process within the case of coastal erosion protection.

Stakeholder type		Actor	Description (Formal mandate and Role)	Scale of intervention	Type of participation in the decision (FORMAL/INFORMAL)	Efficiency of stakeholders' participation	Relationship with other stakeholders
PUBLIC ADMINISTRATION	**National administration**	**Ministry for the Environment General Directorate of the Coasts**	It is territorially represented by the Catalan Coastal Division It defines the main lines of activity, principles and objectives in coastal matters. Management of the Coastal Public Domain (CPM) which includes operations for the protection, defence and conservation. It is also in charge of performance, supervision and control of studies, projects and defence protection work especially those related to the creation, nourishment and recuperation of beaches.	From national to local.	FOR MAL. The promoter of the project in Sitges and the main and only party responsible for taking the final decision.	VERY HIGH	Cooperation with other administration restricted consultation phase. Informal meetings with local authorities. Informing those directly affected by the project.
	Regional Administration	**Department of Territorial Policy and Public works.**	Authorization the use of easement protection. Definition of the uses of CPD. Guardianship and policing of protection easement. Ports not classified as of general interest. Controlling Port Plans. Definitive approval of beach planning.	From regional to local	FORMAL in the project consultation phase.	LOW	Due to political affinity: Periodic meetings with national administration Little contact with local authorities
	Supra-local Administration	**Province administration (Diputació de Barcelona)**	Environmental parameter control of beaches. Management of natural areas. The Sea Studies Centre which is an institution based in Sitges for publicity and education about the environment that reports to the Barcelona Provincial (supra-municipal) Government.	local	FORMAL in the project consultation phase. INFORMAL through lobbying of the Sea Studies Centre.	LOW	Institutional co-operation restricted to consultation phase and specific initiatives.
	Local administration	**Sitges Town Council**	Exploitation of season, beach services (under control of the central administration) Beach cleaning and equipment Use of performance plan Coastguards and life-saving. Urban planning Authorization of protection easement. Informing of the delimitation of DPMT, reservation requests, inscriptions, authorization and concessions.	Local	FORMAL in the project consultation phase. Two councillors (Environment and urban planning) are especially involved in the planning, management and taking decisions concerning beaches).	MEDIUM (Their role was not clear, they should have taken a mediating role between local groups and the Ministry).	Informing the local population and stakeholders through mass media. No availability to hold meetings with social groups (platform and ecologists)

SOCIAL GROUPS		**The Platform against the project**	It is made up of various organizations, groups and activists concerned by coastal defence and the public action it gives rise to. It is led by the La Falconera ecology group, with ecological activists supporting the classical interests of the green movement, but with a particular position on the action they want on the coast at Sitges. The Platform is made up of a group of organisations, some new and others deeply rooted in local society, who are fighting and acting to achieve respectful action in the urban coastal area.	Local	INFORMAL though lobbying (protest actions e.g. signatures collection and informative events). FORMAL through project public information phase.	HIGH – Protest actions stopped the project	Informing the local through the organisation of public events. Consultation of technical and scientific experts. Lack of direct communication with local authorities. Mass media used as a communication channel
		Leisure and sports Associations	Aiguadolç Port, Club Nàutic and Club de Mar represent very different social classes. They look after the interests of nautical sports and leisure activities related to the sea.	Local	INFORMAL though lobbying. FORMAL through project public information phase	LOW	Club Nautic which is directly affected by the project was directly informed by town hall. The rest are informed through mass media.
		Neighbourhood associations of Poble Sec	the most active residents' association in the municipality. It represents a good part of the native population, of popular origin.	Local	INFORMAL though lobbying. FORMAL through project public information phase and Agenda 21 participatory process.	LOW	They are informed by mass media.
SOCIO-ECONOMIC GROUPS	**Tourist sector**	**Hotel and Restaurant Association**	Economic stakeholders made up of companies with primary interest, direct or indirect link with coastal tourism. All of them do business thanks to the resources of sun and sand.	Local	INFORMAL though lobbying. FORMAL through project public information phase	MEDIUM	Informed by Town council, mass media and social groups.
		Beach Tourism association	It is made up of 44 concessionaries of the beaches. They offer services to the beach users and keep their beach area clean.	Local	INFORMAL though lobbying. FORMAL through project public information phase	MEDIUM	Good and periodic communication with government and civic organization. Daily contact with the public.

	Fishing sector	**Brotherhood of Fishermen of Sitges.**	Small association with 24 boats, 23 for minor fishing and 1 for the deep-sea fishing. The fishing has never played an important role in the town's economy.	Local	INFORMAL though lobbying. FORMAL through project public information phase	LOW	Informed by Town council, mass media and social groups.
	Others	**the Commercial Association**	They represent the commercial activities carried out in Sitges.	Local	INFORMAL though lobbying. FORMAL through project public information phase	LOW	Informed by Town council, mass media and social groups.
		the Builders' Association	They represent building industry which is important in Sitges.	Local	INFORMAL though lobbying. FORMAL through project public information phase	MEDIUM	Informed by Town council, mass media and social groups.
EXPERTS		**University Consultancy**	Experts from different disciplines (biology, engineering) that can offer their perspective on certain knowledge area.	National to local	INFORMAL providing knowledge and information.	LOW	Contacted by social groups to seek for technical assessment

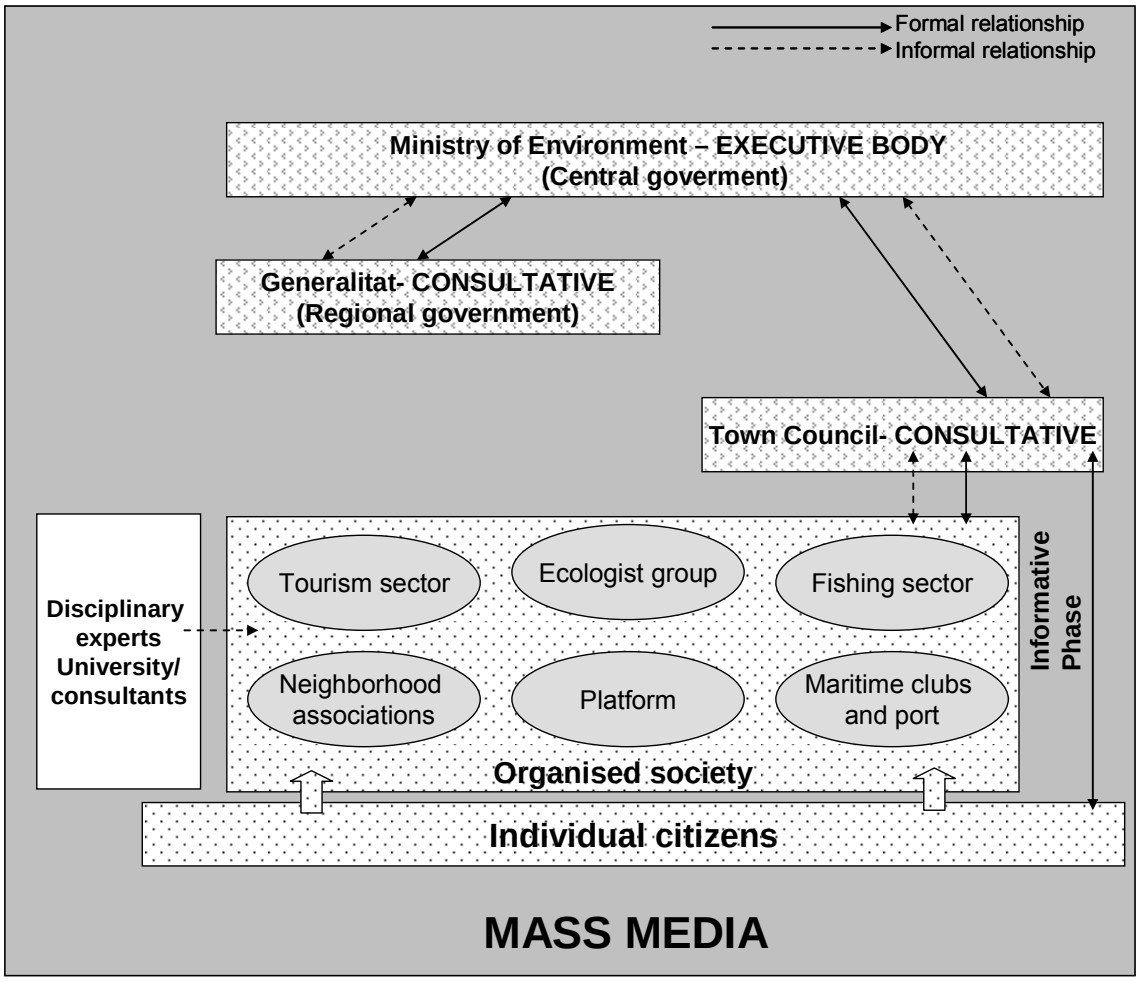


Figure 7.20 Actor's system and relationships.

In Sitges case, this politico-administrative subsystem has two principal agents: on one hand the preponderant action of the Ministry and on the other, the passive position of the Town Council. The same project has been reported on and questioned by the Department of Territorial Policy and Public Works (Regional Government) and by the Provincial (supra-municipal) Government of Barcelona, with very fragmented responsibilities and a low capacity to influence. In general, relationship between central administration and the rest are subscribed to consultative phase legally stipulated concerning to coastal protection. Therefore, regional and local administrations are merely consultative bodies (Serra *et al*. 2003).

When decision-making is centralized within the central administration, local stakeholders can be very active, but their ability to influence is uncertain. These socio-economic stakeholders have no formal and regulated elements in order to participate in the process of decision-making in an effective form. Their

participation is carried out in an informal way, some by the use of economic lobbying strategies and the others by protest activities to increase awareness of their position and if they can, to influence the final decision. In the case of Sitges, the Platform represents the most extreme position against the Project. Since spring 2001 they have made up the most active group on the stage, but they have not achieved a point of contact of have organised informative events and collected multitudes of signatures (more than 6.000 signatures).

A part from the ecologist movement that leads the platform, other stakeholders from social and economic local arena are also worried by the effects of the project on their activities. This is the case of Club de Mar – affected by the recuperation of PMTD- and Aiguadoç Port – affected by a possible silting up with sediments from the massive regeneration the project proposes. Therefore, the Platform brings together a group of very diverse interests which even includes some private ones. This has led the Ministry to claim that it is a manipulated stakeholder.

On the other hand, we should point out the role of the concessionaries, *a priori* directly affected by erosion, which have not joined the platform and have supported the Council because of two reasons. First, the council grants their concessions and, secondly, the beaches of great extension proposed by the project favour, directly, their economic incomes.

Regarding the economic stakeholders, the Fishermen's Association is worried about how fishing banks would be affected by the marine works. Although this stakeholder had little influence, they could be the worst affected. The other interest groups such us the tourism sector, construction and trade did not seem too much worried and maintained good relationships with all levels of the government.

Although the size of the municipality and the scale of the problem has allowed information to flow mainly informally between the social and economic stakeholders, we should also point out the important role played by mass media in informing and communicating. For example, the Platform used the media as a channel to express their interests, call meetings and demand dialogue with the Council which at that time was reticent to have any contact with them.

Lastly, the role of experts as advisors both to the administration and to the social stakeholders conditioned the awareness about the environmental

impacts, the uncertainties that affected it and the alternative options that should be taken into account in decision-making. Additionally, we should highlight the role of certain local personalities, who due to their relevant knowledge, their experience and their particular connections with the local community have represented another important source of expertise.

7.4.4 Public perceptions

Once we have described the make up of stakeholder groups, the research interest lies in analysing the specific social perceptions and needs on different aspects of the conflict. The reflections derived from local opinion, together with the knowledge and opinions expressed by the experts and those who have administrative responsibility, serve to understand how some of the erosion problems are perceived, the intervention requirements, who is the responsible to act, which is the role of public participation and finally, which changes and impacts in the local economy and environment are expected. This section is structured by each item, although a detailed overview on each stakeholder perception can be obtained from Table 7.3.

Which is the problem:the lack of sand or the proposed solution?

From the interviews, a wide concern on the erosion problem affecting beaches and their recreational activities can be outlined. However, at the time to dimensionate the problem some differences have arisen. At one extreme, there is some opinion arguing that, aside from the latest storms, there has always been little sand at Sitges and the situation can be maintained like that. At the other, there are a very few who believe that an action at the scale proposed by the Ministry is necessary. In the middle, almost everyone believes that the problem must be ameliorated, but few have the intention to accept much changes.

The erosion issue is perceived as a problem of sediment deficit. Logically, the lack of contribution from the stream beds, the size of the urban area itself, the presence of the four ports that have been built and the barrier they cause are all put forward as arguments. But an interesting observation is that from the local perspective the very inefficiency of the breakwaters that have been built is also pointed out.

Table 7.3 Stakeholders' perceptions

Stakeholder	What is the problem?	How to act? Intervention requirements	Impacts and effects Fears and uncertainties	Who is responsible to act and what is the role of public participation
General Directorate of the coast Ministry of the Environment	The problem in Sitges is seen more as a conflict of use than a lack of sand. Chronic erosion is very low compared to other Catalan beaches. However, high occupation during the peak season means a demand for more beach. A correlation between beach area and economic benefits is observed.	Its objective is clearly to make beaches more profitable. The proposed solution is the most appropriate from a technical point of view, although it is acknowledged that the problem will not be completely solved.	The larger the beach extension, the higher the economic benefits. The impact on the landscape is understood but will be compensated by the economic benefits People will get used to landscape changes.	The Ministry supports broad technical participation (from the ministerial body) in the design process to guarantee the efficiency of the final solution. However, it supports only a minimum expression of public participation because it would imply more resources to arrive at the same solution. The conflict is understood as private interests who are manipulating the majority.
	Comments: "Sitges beach loses sand but only a few. The key issue is a problem of occupation of the beach" "a definitive solution to the erosion does not exist " " The improvements that the project provides are: more surface of sand and more stability. This represents a major public use of the beach, more income and ecological advantages, since a pebble beach turns into a more natural beach ". "At technical level, the more technicians and experts the better discussion about problem (...) At political level, integrating more people in the discussions is worse. "It is possible that the variation of the beach profile causes social rejection, but only during the first year. Afterwards, they get used and completely forget the topic when already they have their beach assured" "a generalized rejection against the boulevard does not exist. It is an individual opinion under an exaggerated demagoguery (...) The mobilization has been lead by individual interests".			
Sitges Town Council	The problem of erosion is seen as a sum of several factors (dams, ports, engineering works). This is the main body interested in solving the problem.	Action is urgently required, but additional scientific information is needed to decide how to do so. Their position has softened whilst the dimensions of the social conflict have increased.	Not too large an extension of sand is desired. Sand should be golden and fine, very characteristic in this area. They accept lowering the groins height in order to improve the aesthetics and to facilitate cleaning and maintenance tasks.	They insist on the fact that the problem is not their responsibility. Ambiguous position regarding public participation. Town council openly expresses their support for local citizens to take the final decision. However they do not give the opportunity to open a public debate or dialogue with the platform.

Table 7.3 Stakeholders' perceptions

Stakeholder	What is the problem?	How to act? Intervention requirements	Impacts and effects Fears and uncertainties	Who is responsible to act and what is the role of public participation
	Comments: "The history of the Sitges' beaches is the history of the civil servants of the General Directorate of Coasts. During the last 15 years I have lived three interventions based on three different criteria from three different policies " "Basically the project has an error of concept, that is not sensitive to the jewel of Sitges: its promenade" " a suitable solution should be found as quick as possible, but this is not in our hands". "We do not want a beach of 200 m. width (...) we do not like the sand of the Costa Brava, we want it finer" "If the technicians say that we can save only the two first groins, we will have to accept it. If the rest have to be submerged, even the sea front physiognomy changes, we will have to accept it. "Sitges is tourist and therefore there has to be sand"			
The platform	They understand the problem of beach erosion and the fact that the promenade is one of the main causes. However, this does not justify the project because the current sea front is a symbol of identity for the Sitges landscape.	Although they do not know what is the right solution, they are clear that the boulevard is untouchable. They defend a coherent intervention from a social and environmental perspective: Beach width should not exceed 20-50m, rejecting massive regenerations.	Low consideration of local idiosyncrasies and needs. Loss of local identity. Beach overuse and overcrowding. Loss of aesthetic sand quality and morphological dimensions (width, slope). Impacts on the marine bottoms (e.g. posidonia ecosystems) Impacts on fishing activities.	Ministry is the body responsible for CMD protection. However the solution should be a consensus among all involved. They call for a more active role on the part of the Town Council as a mediator. Town Council has a passive attitude in disseminating information and facilitating dialogue.
	Comments: "everybody is a very sensitized with what could happen to the beach, because we have had a bad technical experience during the last seventy years (...) It is absurd that for seventy or eighty years any technician has not been able to solve the problem" "the people of Sitges do not want strange sand as happened in Calafell" "The perception that we now have of a beach with its soft profile and this colour, would disappear..." "The problem is also aggravated with the prospect of urban growth of Sitges. "The attitude of the town council has not been collaborative at all" "Altering a maritime promenade with a hundred years of history is a very heavy" "Apart from the technicians of the Ministry, an external advice to the Local Administration has missed (...)			

Table 7.3 Stakeholders' perceptions

Stakeholder	What is the problem?	How to act? Intervention requirements	Impacts and effects Fears and uncertainties	Who is responsible to act and what is the role of public participation
Neighbours' Association	These people are much more worried by the negative impact of the urban and population growth of the municipality rather than the precarious position of its beaches or the management of its coast.	They do not want large sand extensions which can lead to overcrowding, more parking areas, more beach services.	Overcrowding is correlated with more public expenses, which they do not want to fund.	More public participation is demanded for the problem of beach erosion but also for the future of the urban plan.
	"Historically the sea arrived until the houses" "There is a significant lack of infrastructures in Sitges" "What we want is a sustainable growth, we do not want overcrowdings, neither in the village nor on the beach"			
Regional and supra-local administration	They do not have direct responsibilities on the shoreline, therefore the erosion problem is administratively far-removed. It is not perceived as an important issue.	They question the transfer of sand and the efficiency of the proposed solution.	High economic and social costs	The municipalities should be listened to. The lack of efficient mechanisms of public participation is highlighted and the town council is not efficiently promoting them.
	"The worst of everything is the segmentation of the legislations concerning the coast, and therefore the responsibilities". "The town councils, constitutionally and practically, should be the first ones to say what they want and what they do not want in their villages" "We do not have to consider the problem as important, the erosion of beaches is something natural" "We have to be aware of the economic and ecological costs that could imply giving social satisfaction in all beaches" "there should be a forum to make a common planning of coastal areas"			
Nautical activities and Port	They want to preserve their use and do not accept significant changes to the beaches, and still less to the promenade. Port involvement in the problem is minimum.	The solution should not modify the boulevard or remove the concessions on it (Club de Mar is one of the directly affected activities)	An extra dimension of sand area could imply a lack of services and more investment in cleaning and maintenance. Large-scale nourishment could provoke silting problems for the port of Aiguadolç.	More public participation is demanded.

Table 7.3 Stakeholders' perceptions

Stakeholder	What is the problem?	How to act? Intervention requirements	Impacts and effects Fears and uncertainties	Who is responsible to act and what is the role of public participation
	" I would prefer these small regenerations to a huge one, but something has to be made". "The beaches do not have sand for many years, always temporary solutions have been searched. "I have not received any information neither from the MOPU nor from the Town Council nor from the Generalitat in all this period..." "We do not want a Castelldefels. Sitges has an identity and has to be respected" "Sitges is changing its tourist offer. Before, Sitges offered only sun and beach but nowadays there are more things".			
Tourist sector	Understanding of the problem of beach erosion and its origins.	They are resistant to great change in landscape. Their ideal is to maintain the current small beaches and, above all, the promenade;. Maintenance of beach quality	Local economy is not threatened because it is not only based on sea and sand. Culture, gastronomy and conference tourism is also offered.	They understand that the main institution responsible is the Ministry. However a consensus should be reached by technicians and the local population. In this process, the Town Council should work as a mediator or link between affected agents.
	"Initially when there were not groynes in Sitges, there was sand protected with a pinewood and vegetation. In the winters the beach decreased and with the storms of spring there was sand again". we do not want beaches where one has to make an excursion for arriving at the water". "if the information circulates on time, rumours of groundless news would be so problematic" "Nobody has informed us" "Any debate previous to any intervention is much better than a posteriori". "The beach of Sitges has an identity card which cannot be changed"			
Concession holders	Understanding of a lack of sand due to different causes: river dams, engineering works.	Maintaining the image of the town is more important than retaining the sand. However, they acknowledge that their activity is dependent on this resource.	A disproportionate intervention could affect the local economy as Sitges depends on its seafront both in winter and summer.	The solution should come from deliberation among those involved. The solution should be satisfactory for the town's citizens without compromising the local economy.

Table 7.3 Stakeholders' perceptions

Stakeholder	What is the problem?	How to act? Intervention requirements	Impacts and effects Fears and uncertainties	Who is responsible to act and what is the role of public participation
	"The Association always supports who is in the power, because we depend on the town council" "We do not oppose to the regeneration of beaches, what we want is sand." "We want beaches clean, nice, not very overcrowded and well-planned".			
Fishermen	Coastal erosion is perceived as a natural phenomenon.	They suggest re-orientating the groins as the original ones did not provide the expected results. Large-scale nourishment is not desired.	They are aware that extraction/replenishment of a great quantity of sand can threaten their activity. Impact on the marine bottom due to massive sediment movement if large-scale nourishment is performed	They want to be consulted on decision taking.
	"That the sand leaves has always happened, it is not new. "If they take the sand from where we are fishing, we will be very much affected"			
Experts	They understand the physical problem.	They question the effectiveness of the intervention as it does not guarantee beach stability, and periodic nourishment might be necessary in the future. This entails a problem of sand reservoirs and causes environmental impact	Dredging sand is seen as a controversial method due to its impact on the marine bottoms, especially where there is *Posidionia Oceanica*, and on the fishing activities.	

For local opinion, the aware and organised citizens, and also the economic agents who are themselves affected, the main problem is based on the loss of the current promenade. The attraction of Sitges is rooted in its image (the long promenade with gardens raised above the beach divided by breakwaters and, in the background, the promontory of La Punta with the church on top).

Outside the local sphere, the administrations at regional or supra-municipal level do not have direct powers to intervene on the coast and therefore they have the erosion problem at an administrative distance, which allows them to be relative. At the end, national administration arrived at a Manichean situation: that of deciding “do you want beach or promenade”? With this inflexible position the problem has become worse.

Almost everyone perceives that, paradoxically, the nub of the problem is the possible solution (change) and not so much the situation giving rise to the problem (lack of sand).

Impacts, uncertainties and fears of the proposed solution

In general, there was the perception that the technical solutions carried out up to then were not the right ones; only on the Fragata and the Ribera beaches they have been effective. As a consequence, some wonder, why these new project would work now? It is understandable, therefore, that proposed scheme also created mistrust and rejection from local community. The arguments were the following:

First, the great reticence to the reduction of promenade area is pointed out. There is a general opinion, reiterated over the course of this analysis: the fear of changing an image, the loss of a well-loved and highly valued land/seascape. Apart from the aesthetic and image arguments there is the loss of public use. The central part, the widest, is the one the current project intends to reduce. At the moment it provides physical and scenic support to different uses by the people, specially the multiple uses for a pedestrian area (walking, cycling, covering a route of architectonic and artistic interest, area of hedonistic exhibitionism, etc.). To limit all these uses to less than 10 meters in width and, in some places to 4 meters, represents a change that cannot be accepted from a local vision that perceives the increased intensity of use caused by the growth in population, the success of yearly events (festivals, local holidays and so on),

cultural, patrimonial and landscape values, etc. The sea front is perceived as a content and container of the local attraction.

In addition, this impact implies the disappearance of some businesses such as restaurants and a social club which provide necessary services to the tourist and visitor.

Secondly, the new layout of the beach was questioned. The large scale sand nourishment which was proposed by the project concerned the public due to the enlargement of the current beach extension which was directly related with a future massive occupation of this space. Some local stakeholders such as the Neighbours' associations linked the project with the also much-criticised review of the POUM (General Urban Plan) which proposed doubling the ceiling of inhabitants to 40,000 in a decade. Additionally the reduction of the breakwaters represented a unification of space which was at present zoned in various uses and types of users.

In general terms and concurring with a survey to beach-users (Villares *et al*. 2006), the evaluation of that beach is very positive especially concerning those aspects that configure its physical and morphological condition. Characteristics such as the colour and texture of the sand are very much appreciated, not in vain after the tourist boom Sitges was called the golden beach (Villares *et al*., 2004). Therefore, based on this study, we can highlight the fear of a change in the sand grain and colour which would occur as a result of the massive nourishment with sand from Maresme as proposed by the Ministry. Additionally other works (Villares 1999) has showed that in regenerated beaches a change in the grain leads to a more pronounced profile to enter to the sea, something that users are not keen on. Frequently, the example of Calafell, a beach located only few kilometres southwards[31], is cited as an example of what is not wanted for Sitges. Thirdly, the groins are another formal aspect that may change with the project and, from the local viewpoint, the changes to these structures raise all sorts of opinions. In the opinion expressed by politicians and technicians working for the Council, there is a tendency to pragmatism and tolerance with the solution of submerging the breakwater. This would facilitate the task of beach cleaning and the entrance of machinery. The construction of a large, 300

[31] In 1993, 200,000 m^3 of sand to each lineal km of shoreline were brought to Calafell creating a 80 m width of new beach.

meter groin at the Terramar beach constitutes another tricky part of the plan because of the negative effect it could have on the land/seascape. The fear is that from the western beaches the sea horizon will be blinded and this will drastically change the view from the beaches.

More specifically, the main group protesting the changes is the Platform that, with the aid of an expert opinion, has published the reasons for their campaign of rejection. They doubt that the change along the sea-front is positive, especially the loss of 30% of the promenade, with a final image of the pedestrian walk 10 metres wide and the beach 80 metres wide. They also question the change in the size of the sand colour and texture, from the aesthetics point of view as well as the repercussion on comfort and safety. The new beach profile will be five times more steeper than the old one and they fear that children and older people, as well as those who need to walk along the beach for therapeutic reasons, will find it difficult.

Within the Council various sensitivities have been expressed which are the result of the differences in the political colours. Overall, there is a coming together over what can and cannot be accepted or agreed (widths, breakwaters, promenade…) when faced with the radical change of the proposed action.

The beach concessionaires are the most directly affected as some areas are so eroded that they have had to close down their business due to the lack of space. They ask for the recuperation of the beach width, but they are concerned about the negative effect a radical change may have on the tourist environment. They argue the uselessness of large spaces since they know that the user will not go any further than 20 to 30 meters from the water and the cost of maintaining and cleaning such wide areas of sand that are not used is high. On the other hand, other businesses and hotel owners are worried about the loss of sand since their business cannot be divorced from the beach. They know there is a strict relationship even though the local tourist business has many other attractions.

Finally, the sailing port of Aiguadolç is very worried about the effects the plan may have in the port. Bringing in such huge quantities of sand to the towns' beaches could block the port entrance in the short term.

The opinion raised in the scientific/technical sphere, from experts, from the administration, universities and consultants, is practically unanimous: the

project is based on accurate, baseline studies which they do not question. What they do question is the proposed solution. The most delicate aspects are related to the provision of sand from an area between Premià and Vilassar on the Maresme coast. These considerations are based on the impact caused to the ecosystem of the extraction zone and, on the impact caused to the regenerated beach, as it will noticeably change the profiles and slopes of the current beach.

Once we have identified and described how the problem of erosion and its impact are perceived we go on to point out aspects to be taken into account when proposing new solutions.

The need to act and the intervention requirements

In general the need to act is clearly seen, although to make the beaches grow enormously is not desired. The system is understood as dynamic and changes can be observed year after year or depending on the season, but in any case, local society would accept 50 m. of width. In addition, as it has been shown, what provokes more opposition is the intervention that damages the promenade. Action is accepted as a necessary remedy, but against this need is posed the desire to safeguard and not to alter the image – the current landscape.

The arguments given by technical staff of the Ministry have put forward the population and urban growth is experiencing the municipality, which justify the need to create and maintain a greater area of sand. The argument “more beach, more business” is raised in large numbers of opinions. However, from the economic interests (shopkeepers, hoteliers, builders…) action that respects the widths and, above all the quality of the native sand is highly supported. Therefore, in case of beach nourishment the sand should come from the same sedimentary cell to guarantee the maintenance of the sand characteristics.

Another important aspect is the maintenance of the zonification of social uses developed on the beach, which is a priority in the local opinion. In any case other solutions could be sought to maintain this spatial division which is currently provided by the existing breakwaters, rather than having the function (i.e. capturing sediment) for which they were designed.

Finally the stability of the beach is an aspect which concerns most of the stakeholders and is the “life-motive” of the project. The complexity of the

problem comes up again, when we need to add the preferences of the stakeholders described above, the desire for a stable beach in the long term.

Who is responsible to act and which is the role of public participation

In parallel, the process of intervention and the evolution of the conflict has given rise to other problems especially raised by social stakeholders (the Platform, La Falconera, Sailing club, Neighbours' associations, etc.): they feel a lack of communication with the Council. They know that who can intervene to mitigate or ameliorate the loss of sand and to conserve the beaches is the Ministry of Environment. But at the same time, they are aware that the Town Council is the only possible mediator between them and those who will finally decide.

Once the conflict started, one of the main barriers encountered were the lack of information provided and the lack of dialogue established with the closest administration i.e. the Council. The lack of participation in the project has been one of the main complaints of many stakeholders headed by the platform. What is clearest in this local scenario is that, for the moment, there is no kind of communication between the Town Council and the Platform. There have only been discussions with the economic agents. In the other hand, a period of political crisis and changes in the council town has not helped in stimulating the dialog.

The Platform hopes that a dialogue will be initiated with the municipal politicians and it feels the results of their last campaign are viable: expert information collection for providing an alternative to the project of 1999. Up to now, the most relevant task of the Platform, apart from the initial mobilisation in the spring-summer of 2001, was to seek expert opinions from the universities and public and private consultants in order to provide a viable and alternate solution to the 1999 project.

From the beginning of 2001 the Platform has carried out actions with a will to participate but logically with a reivindicative spirit. Therefore their part in respect of the problem of erosion and future action has been in the phase of studying the problem and seeking solutions.

In this way, the Platform's action demands an integration in a process of public participation since the beginning, in the phase of evaluating the problem and looking for alternative solutions. At that phase, technicians and scientists

should present the problem and explain advantages and disadvantages of each alternative in an information process that should be done before participation.

There has been a strong mobilisation in Sitges as in other coastal towns that is the fruit of general discontent of the people caused by a lack of information. The social-economic players understand that there has been a continuous process of disinformation that has its origin in the Ministry with a partial, bad transmission of the information. In this way, rumours and false news have been created and fed during several months. During that time, neither the Town Hall nor the Ministry have provided any type of public, direct information on the project or its consequences. From what we understand of local perception, the passing months has not reduced the intensity of feeling. When any action is brought up again, the need to be more pedagogic in approaching the problem of erosion and the proposals or alternative solutions will be raised once more.

7.5 Discussion: conflictive elements

When trying to identify the elements involved in the Sitges case we have to distinguish on the one hand those related to the own nature of the problem, characterised by its complexity and the uncertainty surrounding the search for a long term sustainable solution. On the other, those factors which are more procedural. It means, those elements concerning the existing assessment methods, the institutional system and the decision-making process.

7.5.1 Elements related to the nature of coastal problems

The case under study faces us with a complex environmental problem: coastal erosion, where the lineal cause-effect relationships are not easily detectable, nor predictable, due to the high level of complexity of the coastal system, given that components of various types are interrelated (i.e. social, ecological and economic), hierarchically and multi-scaled. For example, it is difficult to establish in which proportion each cause (e.g. dams, sports ports, sea front promenade and breakwaters) contributes to the lack of sediment and consequently to erosion. Predicting how the system will evolve over the long term and its response to future anthropogenic action and climate change are also difficult. Therefore, quantifying future erosive trends is problematic but even worse is to calculate the (ir)reversibility of their effects and the (in)efficiency of the strategies implemented. This implies that any technical solution comprises a series of uncertainties linked to the very dynamism of this

coastal system. Although the opinion of the experts and technicians interviewed does not question the studies in which the project is based on, in general we can see that the solution proposed by the Ministry does not guarantee a complete efficiency. Hence, what is true is that there is no an optimal solution to stop erosion and from the diverse disciplines (geology, biology, engineering) several different solutions are proposed. Such proposals are either more or less aggressive from an environmental point of view, or more expensive, and with differences in their durability and effectiveness. However there is a certain degree of consensus of the problem in pointing out that the main cause of the problem is a lack of sediment which makes difficult to reach a new equilibrium of this system.

As we have seen, the strong opposition to this kind of interventions cannot be understood unless we recognize the intrinsic value that the sea front of the town of Sitges represents for its citizens. The sea front promenade contributes relevantly to the use of the coast as a leisure area which, over time, has become consolidated as a sign of local identity. We should emphasise that, in general, the public do not question technical solutions per se, but rather wish to solve the problem of erosion without causing other problems. The experience of coastal defence over recent decades in many areas of the Mediterranean shows how collateral impact has been caused due to engineering works (EC, 2004). Therefore, a problem as complex as erosion cannot be evaluated in an isolated manner without taking into account the whole reference system because new negative and irreversible impacts may emerge as a consequence.

In order to cope with this situation we have to admit that conventional (or normal) science is not enough. Therefore, the management of erosion should not be the exclusive competence of experts and technicians from the government, but has to be addressed from a diversity of perspectives which make up the socio-ecological system under study. This means opening up the assessment frameworks and integrate other legitimate values and knowledge as those present within the local society, as we next explain.

7.5.2 Elements related to the prevalent evaluation frameworks

The controversial project presented in Sitges was born from a conventional evaluation assessment model based on engineering technology and characterised by being uni-disciplinary (or at maximum bi-disciplinary), in any case without considering local needs and preferences. During the last decades,

the main goal has sought to command and control these processes in an attempt to stabilize the systems in the short term (Folke *et al*. 2003).

Expert based assessment as happened in Sitges provokes a misconsidering of local idiosyncrasies. The definition of a particular environmental problem should be multiple and should represent a wide range of ontological entities which exist within the society. In the case of Sitges, landscape changes, local identity, sense of place are some empirical evidences of the way natural systems fulfil immaterial human needs and of the many intangible values. They should be taken into account in the assessment procedures. It is, therefore, essential to assess their values and communicate them to policy makers, so that it can be better accounted for (Chiesura, 2003).

The conflict under study is in part due to the lack of consideration of the local identity of its inhabitants. The evaluation process used does not incorporate other information inputs in the coastal assessment process apart from those directly concerning its own discipline. This is the result of public policies and a regulatory framework based on expert processes of evaluation with a sectorialised and fragmented vision of the various components of the coastal system. Coastal policy is fractured between a series of institutions at various administrative levels and often with conflicting objectives. This sectorialisation of policies and the legal division between land and sea hinders a transversal integration of coastal management.

As we have mentioned, there is not sufficient scientific knowledge about how to find solutions and we have to take into account that complex environmental problems do not have an optimal solution, neither from a technical point of view nor from a social point of view. One of the pieces of evidence that shows that decisions in this field can not be based on a rational analysis on the part of experts are the contradictory interpretations and recommendations of the various experts (Davos, 1998). In Sitges, from the interviews carried out with government experts and technicians we can see a range of varied opinions: from experts who question engineering solutions to others who do not approve the source of the sediment (Premià) for the nourishment, etc.

The case is representative of one environmental problem characterised by a low level of political consensus and low technical certainty. It is, according to Funtowicz *et al.* (1991,1992) a typical case of post-normal science where “the facts are uncertain, there are values in dispute, a plurality of legitimate

perspectives, the stakes are high and the decisions to be taken are urgent". The knowledge base used to take decisions is incomplete, and can be found on a spectrum between deterministic knowledge and total ignorance (Janssen *et al*. 2005). That means, we have to take decisions before having scientific evidence, but the environmental costs of mistakes are also high. This has direct implications on the assessment system used to generate management strategies as they should cope the complexity and multi-dimensional nature of the system.

This leads us to reconsider the role of the so-called "expert" in the processes of assessment given that at times their opinions may feed the conflict and hinder cooperation between stakeholders. In other cases their paternalistic decisions (Davos, 1998) ignore other relevant elements at a local level or questions outside their area of knowledge as happens with the position of the Ministry in Sitges. In fact, these institutional stakeholders who operate at a central level have a presence much more based on their technical and/or administrative capacities, and end up leveraging the technical complexity of the solutions. (Subirats, 1999). Therefore, the technocratic monopoly which predominates in the assessment of environmental problems should give way to an interdisciplinary approach orchestrated by a technical assessor who has a capacity for analysis and the management of information from diverse sources and languages. According to Barragán (2004) the type of knowledge needed by a planner-manager to work is multidisciplinary. Furthermore, they also need the intellectual skills and technical abilities to relate to organised groups and people.

7.5.3 Elements related to the institutional context

Our study has ended up being paradigmatic example because of the intensity of the mobilisation of the townspeople. The opposition movement, which was articulated at a local level through the Anti-project Platform, was aimed at a withdrawal of that project and a search for a proposal more in tune with the local environment. Although is advised by academic experts, this stakeholder is characterised by a low level of professionalization. It takes an unregulated, flexible and very variable form. These types of social movements are characterised by collective action under common interests and act outside established institutions (A.Giddens in Nel·lo 2003). They are different from traditional hierarchical mass movements, they group together forming networks

that tend to have the form of amoeba, with fluctuating borders and without a differentiated centre. In any manifestation there are a great variety of postures (on demands and actions). We have found a very active society which reacts to the transformations that environmental systems suffer. These new social movements arise in order to fight against these situations and demand that their opinions be heard and included as another piece of information to be taken into account when taking decisions.

This situation is marked by a crisis of confidence in the institutional channels (Nel·lo, 2004). Perceptions about the uncertainties of the project and opposition to the changes are influenced by various aspects. Firstly, a past history of misguided solutions has generated a lack of confidence in those in charge of the project. We are dealing with a level of government which is far away from local reality and which at the same time has been the promoter of all the measures implemented to date and which have not delivered the effectiveness expected of them. Additionally, strong centralisation of competences in the area of coastal protection, the rigidity of the coastal law and the distribution of competences described makes it very difficult to establish positives synergies with other institutional stakeholders at a lower hierarchical level. Furthermore, there is a great lack of mechanisms of coordination and liaising between levels of government and, finally, participation is relegated to the consultative phases. According to Adger *et al*. (2005) cross-scale and cross-level dynamics should be promoted because shared responsibility for management of resources creates positive incentives for sustainable use and overcomes problems of legitimacy from traditional resource management.

The importance of the institutional context and of building social capital to cope with external perturbations has been widely acknowledged in the existing literature. As argued by several authors (Adger, 2005; Berkes *et al*. 2002; Folke *et al*. 2002; Olson, 2004), the existence and creation of new institutions and collaborative networks of action and social capital can be of crucial importance to provide resilience to social ecological systems.

However, institutional and political decentralisation does not automatically imply a greater degree of participation. But, if a willingness to protect the environment arises, if it can be developed and if a consensus can be reached on a more decentralised situation, closer to the case, then initiatives are potentially better received and integrated (Subirats, 1999). Furthermore, in the model where decision-making also depends on local institutions, such us those present in the

northern countries, the role played by the socio-economic stakeholders becomes more influential and determinant. Whereas, when the power is centralized within the state, the local stakeholders can be very active, but their ability to influence is uncertain. Theoretically, greater control and transparency are produced when stakeholders act. With appropriate governance structure for sharing rights and responsibilities for management, there are more direct linkages between stakeholders, while information and learning processes flow between them. On the other extreme, there is the situation when the management of erosion is only decided on the local level. There, local authorities may lack the long-term vision and may do not think enough in the regional context.

Therefore and as shown in Sitges, when a project comes from outside without any implication on the part of local stakeholders it tends to generate conflict. In part the inhabitants of Sitges feel that “projects for their hometown” should be legitimised by the local scene. Moreover, although local level is the main “receivers” of erosion-induced problems, actions to solve or counteract them are designed and executed at national level. As a consequence, in many cases there is a time lag between the identification of the problems and the execution of the measures. (Ariza, in press b).

On the other side, Sitges can be seen as a success of a society with a great social capital. Social cohesion within Sitges has strength their capacities to deal with external proposal and the scope of their mobilisations could manage to stop the project. Therefore, this could be an example of how social capital can provide better means to cope with changes, uncertainties and hence improve the resilience of local populations (Olson, 2004 and Adger, 2003).

7.5.4 Elements related to the information management and participation

Apart from the mistrust that the intervention of a far away government body provoked, the management of the information and the communication flows that were established during the process also contributed in a relevant manner to this conflict. There is a need for more transparent decision-making, not only in the institutional arena but also with the local community. What is most remarkable about this local scenario is that there wasn’t any type of communication between the Council and the Platform. Hence the information flows which predominated were informal, a fact that consolidates a growing mistrust in government, both local and national.

We have seen that in the case of Sitges local perceptions were not considered in the search for solutions, given that at no time was any participative mechanism set up in the design stages of the search for alternatives. This has generated a proposal far away from local expectations and therefore, a solution which aimed at avoiding the loss of sand on the beaches of Sitges, transported the problem to another dimension, “eroding” the local identity of that community by trying to modify the town sea front.

In Spain, the system of formal public participation is a symbolic exercise to minimise the effects of the decision. There are no formal mechanisms to assess local needs a priori. The institutionalised channels to participate in decision making are restricted to the public information stage of the project which consists of a limited period to raise objections once a selection of alternatives has been made and the project has been designed. This restricts public participation to the final stage of the process and giving very few opportunities to modify projects.

Knowledge is a key resource in the exercises of power (Adger *et al*. 2005). The local community can provide very valuable knowledge as a result of their experience, observations, their local press, anecdotes or local history, which should feed the process in the same way as technical knowledge coming from various scientific disciplines does. Popular knowledge yet explained that in Sitges there is a coastal current which runs in the opposite direction to the N-S current which dominates the Catalan coastline, and this is the reason that the present breakwaters’ orientation is not effective. This only supports once more the need to foster dialogue and avoid unidirectional information flows.

Some experiences (Myatt, *et al*, 2003 and Roca, 2005) show that when a project of this type is bring to public debate, acceptance is much higher, which helps to reduce tension. In Sitges the precarious nature of the dialogue and public debate caused a delay in the search for solutions and extraordinarily high costs (given that on the one hand the problem of erosion persists, 2 projects have already been paid for and a satisfactory solution has still not been found).

In general terms, to improve the quality of participation and improve the acceptance of projects we should include various factors: initiation of participation from the very first stages of the process, ongoing participation and reciprocal responsibility (Cicin-Sain, 1998).

The need to increase public participation is linked to an improvement in the management of environmental information. Unfortunately, in Spain the cost of obtaining and accessing information depends largely on institutional and personal relationships (Serra *et al*. 2003). Information exchange is not sufficiently promoted. Normally, information is dispersed and the involvement of many departments without explicit cooperation mechanism do not facilitate communication flows. A great demand for bridging the gap among stakeholders is highlighted so new mechanisms for dialogue and communication must be created. Furthermore, this is more important when the information is oriented to the non-specialised public. According to Doody *et al*. (1998), "the key on-going problem in relation to the nature of information required for coastal zone management lies not so much in the provision or the content of information itself, but in the way it is presented to those who implement policy and take management decisions". Thus translation of information between researchers, scientists and practitioners is a requirement that should be enhanced.

7.5.5 Final remarks

We have seen how the complexity and uncertainties of the erosion problem, the drawbacks characterising traditional assessment procedures, the centralised system of Spanish coastal policy, the lack of information and coordination among stakeholders, the weak system of public participation are some of the main problems facing coastal erosion management in Spain. As a result these may generate territorial conflicts relating to place identity, quality of life, tourism income and beach regeneration.

In this scenario, the wide range of stakeholders needs to be taken into consideration more when assessing any strategy that may affect the coastal systems. Thus, new tools and mechanisms are required to meet the social needs and interests. The next chapter is going to offer an exercise that illustrates the advantages of working in a more integrative framework such as Multicriteria Analysis combined with participatory methods in order to overcome drawback discussed in this chapter.

Chapter 8 Public participation and Multicriteria Analysis (MCA) for dealing with multidimensional coastal risks. A case study in the Lido de Séte

8.1 Introduction

An important conclusion from the previous case study is that within the Mediterranean context, the assessment of options to deal with coastal erosion risks tends to include only expert, quantitative and technical judgements, therefore leaving little room for a more qualitative and plural perspectives, including other broader aesthetic and environmental sources of value. In coastal erosion risk management, such assessment methods have resulted in the predominance of engineering 'solutions' (e.g. for resource exploitation, sea defence and coastal protection) within a constantly changing dynamic system. In many cases, this has led to catastrophic consequences for the resilience capacity of coastlines to respond to the stresses and shocks of environmental change and perform their socio-ecological functions (Turner, 2000).

Therefore, in order to address coastal erosion problems which are complex and multidimensional, it is necessary to move away from the assessment methods that have traditionally predominated in coastal management. An appropriate interface among experts, decision-makers and society should be worked out in order to provide a participatory assessment framework that entails a sustainable management of erosion problems.

As we have discussed in Chapter 3, among new approaches, and mostly during the last decade, *Integrated Assessment* (IA) (Parson, 1995, Rotmans *et al*. 1996, Tàbara 2003) has emerged as an applied field of science for policy

research, with a number of new tools and methods[32] which can be used for deal with environmental problems in coastal areas, enriching problems' framing and becoming more creative in finding solutions to be make coasts more adaptable and resilient to changing environments. In particular, integrating different types of knowledge sources, from expert to non-expert, qualitative and quantitative, as well as different interests, values, and perceptions with expert tools (e.g. computer models) in the assessment is seen as an basic condition of a robust assessment (Stagl, 2006).

Few approaches are specifically designed to incorporate multiple stakeholder perspectives and knowledge, or competing value systems, in the evaluation of complex system dynamics such as those of coastal erosion risks. One exception, however, is provided by Multi-criteria Analysis (MCA), which can be an adequate tool for dealing with a multiplicity of dimensions, ways of framing the problem, and uncertainties, in order to engage stakeholders to contribute to the alternative creation of rich narratives that are relevant for policy (Banville *et al*. 1998; Facheux *et al*., 2003; Stirling, 2006; van den Hove, 2006; Linkov *et al*., 2006). In MCA, a set of alternatives is compared under an explicit set of evaluation criteria, which can include both quantitative and qualitative data in the same framework of analysis.

Participatory MCA applications have been carried out in a few number of environmental problems in the domains of energy (See e.g. Stagl, 2006; Gamboa, 2006; Gamboa *et al*., 2007), freshwater (see e.g. De Marchi *et al*. 2000; Messner *et al*. 2006) and Protected Marine Areas (see e.g. Brown *et al*., 2001). However, so far MCA has not yet been applied in a participatory way to dealing with coastal erosion risks. As part of the European MESSINA *Managing European Shoreline and Nearshore Areas* (2004-2006) project, such an approach was applied to a case study at Lido de Séte, on the Southern French Mediterranean coast. This area is characterized by rapid economic growth mainly fostered by coastal tourism and services. The type of development model and human activities and infrastructures which are at risk of coastal erosion are very representative of many other Mediterranean sites. Lessons learned from this experience may help with understanding and better designing

[32] For a recent inventory of Tools and Methods for Sustainability Assessment resulting from the EU project Sustainability A-test visit www.sustainabilityA-test.net.

new tools and methods to help other areas, such as delta systems, cope with similar erosion problems and economic uses.

On this basis, the combination of analytical tools and participatory methods are explored in this case study. The main objective is to analyse the suitability of applying MultiCriteria Analysis (MCA) by means of a participatory process in order to assess different strategies to cope with coastal erosion risks in a specific location on the Mediterranean coast. Specifically, it is intended to shed some light on the way that the integration of diversity of perspectives and values in the assessment process – structured in a MCA fashion - by improving the framing of the problem, can enhance the representation of complexity and multidimensionality of the issues at stake and help in dealing with uncertainty.

8.2 Area of study

8.2.1 Location and description

The research was applied to a case study located on the French Mediterranean coast, in the Thau lagoon (Figure 8.1). The Thau lagoon is the largest of about thirty costal lagoons in the Languedoc-Roussillon region (Southern France), 15km long, 5km wide and, on average, 4m deep. The narrow strip of land that closes off the lagoon from the Mediterranean Sea is the Lido de Séte, a 12-kilometre band of dunes and sand that separates the municipalities of Marseillan and Séte.

The permanent population of Thau's catchment area is 80,000 inhabitants, of whom half are from the municipality of Séte. Tourism and shellfish farming are the main economic activities carried on in this area. In summer, because of tourist resorts, the population of coastal towns - Marseillan, Balaruc-the-Baths, Séte and Agde - increases to 130,000 inhabitants, which can represent 8 times the number of local residents in Marseillan and 1.2 in Séte. Accommodation capacity moved from 43,560 beds in 1968 to 75,115 beds in 1999. Shellfish farming, established since 1880 in Séte, is the dominant activity in the villages located around the lagoon itself. Annual production of around 13,000 tonnes of oysters and 2,500 tonnes of mussels is the largest in the Mediterranean and represents 10% of national production (La Jeunesse, 2001).

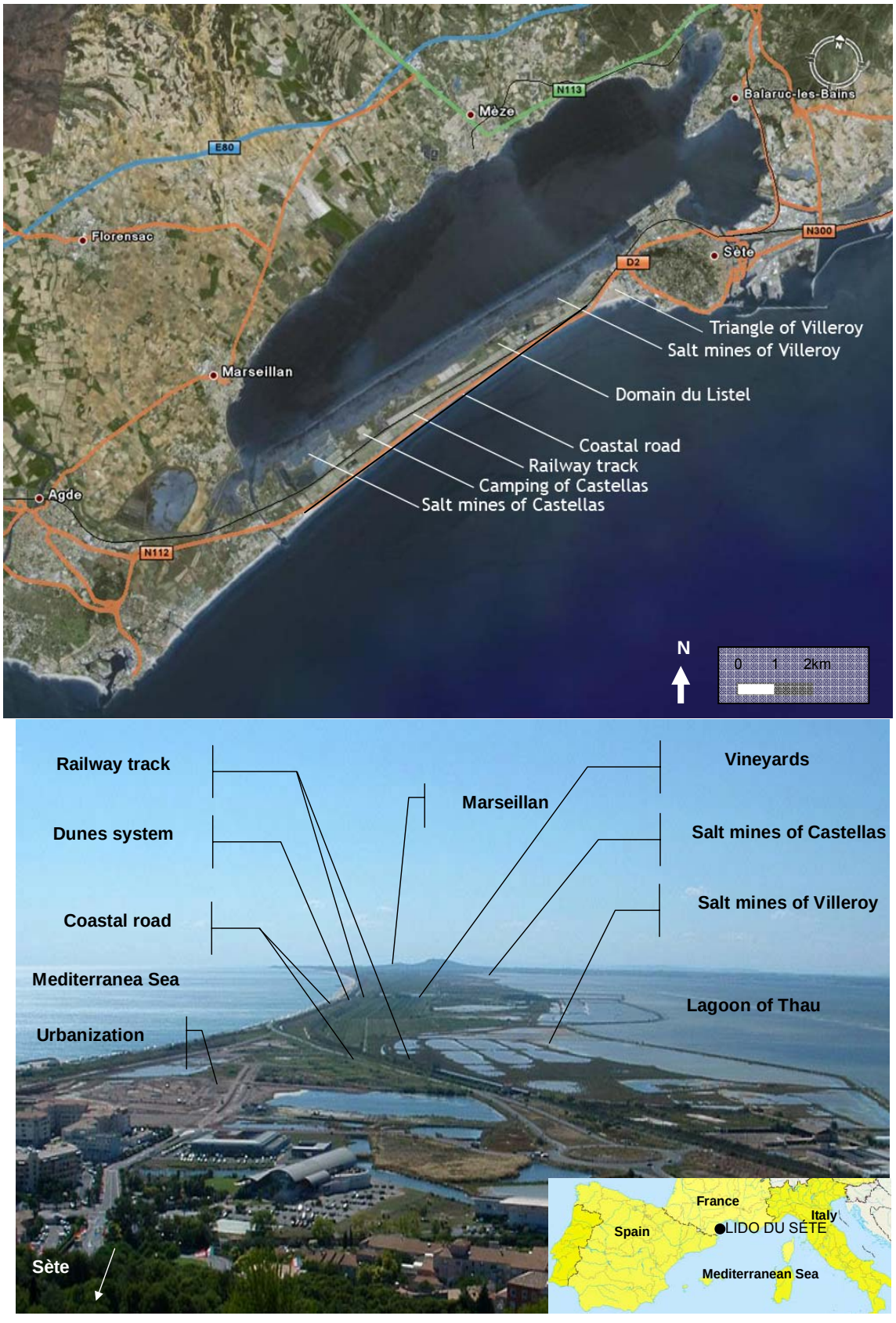


Figure 8.1 Location and land uses in the Lido de Séte, France.

The study is particularly focussed in the Lido of Séte which, morphologically speaking, is a typical Mediterranean sedimentary coastal system formed by long sandy beaches surrounded by a dune system protecting the inland area from winter coastal storms. Although since the saltmining exploitation finished in 1968 and land abandon partly degraded the surroundings, the area has been saved from urban development. Some natural sites have been conserved conserved (e.g. brackish marshes designated as a Zone Naturelle d'Intérêt Ecologique, Floristique et Faunistique (ZNIEFF) and two woodlands with important flora and fauna with some rare and protected migratory birds). However, it is a high humanized environment. Intensive human presence can be observed through several land uses, such as wine-producing, camping facilities, saltminings and, especially during summer time, a very busy beach. Moreover, several infrastructures run along the lido (See Figure 8.1).

The vineyards, one of the main activities in the lido as well (also in the region), covers near to 60% of the lido surface which is around 645 ha including vines, dunes, salt mines and wetlands. In this area the private company of Domain de Listel owns 270 ha for cultivation, from which 111 ha are located between the road and the railway (Figure 8.2). Its high production of vine entails an important traffic of heavy lorries, estimated between 20 and 25 per day, and the direct sales attract an average of 7.000 visitors annually. Another viticultor in the area is l'*Institut National de la Recherche Agronomique*[33] (INRA) which is renting 28 ha to the Domain de Listel where a wide representation of different of vines from around the world (more than 2200) are cultivated.

At 8 kilometres from Séte, between the Domain de Listel and the coast road the Camping of Castellas is located. This is the only tourist lodge in the lido with 1.000 sites -200 for mobile caravan and 800 for caravans and tents- which is placed in 24 ha of land and it has almost direct access to the beach.

The coast road, parallel to the beach and partly built on the old dune system, which is the main transport connection between both sides of the barrier spit. It is commonly used as a parking area by beach users and motor caravans. Finally, there is the railway which runs parallel to it between the road and the lagoon, representing another element of Lido's landscape fragmentation (Figure 8.3).

[33] French National Institute for Agricultural Research

Figure 8.2 View of the railway and the Domain de Listel background.

Figure 8.3 Aerial view of abandoned saltmines in the north-western part of the Lido.

8.2.2 Coastal erosion phenomena as a problem

Several studies (Barusseau, 1996, Certain, 2002, BCEOM, 2000) reveal that there is a clear deficit in the sedimentary balance in the Lido de Séte. From 1954 to 2000 the Lido lost a total area of 45 ha of beaches, an average of 1 ha per year (BCEOM, 2001).

A deeper analysis shows that situations are different depending on the coastal sector (See Figure 8.4):

→ Almost 48% of the shoreline between Séte and Cap d'Agde, presents a state more o less in equilibrium or a light increase of the wideness of coastal profile.

→ The northern sector of camping du Castellas, which corresponds with the zone of weak wave energy, is stable and accompanied by low dune system degradation in comparison with eroded sectors.

→ Erosion sectors which extends to 9 km of shoreline distributed in 3 homogeneous areas:

a) From PK 30 to PK 32.8: From the beach in front of the Triangle of Villeroy to the winery. In this sector, erosion has been revealed very active, where maximum shoreline retreat (50m in 50yrs) is observed.

b) From PK 34.2 to 37: From southwards of the winery to the northern limit of the camping.

c) From 42.1 to 45.1: From the Marseillan port to the Ambonne Port. The southern sector suffers strong erosion, with a maximum retreat of 30 m. in 50 yrs southwards of Marseillan Plage.

These sections have similar characteristics: affected by high-energy waves, backward movements of the shoreline and diminution of the beach surface, degradation of the dune system and infrastructure in the high beach.

Coastal sedimentary systems like the Lido de Séte are characterized their high level of dynamism. They are driven by two main dynamic factors: south-easterly storms and the inland winds, and, less importantly, the tide-generated currents and the sea level rise. The first pushes the sediments hold in the submerged system onto the backshore (or conversely, depending on the capacity of energy absorption of the beach), and the second returns the sediments to the beach, hence restoring the shoreline.

The wind is an essential morphodynamic factor of the Mediterranean coastlines, responsible of the dunes' formation. In the area of the Thau lagoon, the most important wind directions are NNW (36%), NE (15%.), SE (15%). The mean eolian transport in the site of Séte (BCEOM, 2000) is about 250m^3/m/yr, based upon observations made in the period from 1978 to 1983.

In addition, climate change and sea level rise may add other possible effects, although these are highly uncertain. Data from tide gauges and satellite observations show that the mean sea level has risen by 15cm since the beginning of the 20th century, at a mean speed of 1.5mm/yr. However, the specific consequences of the rise in sea level and pattern of storms in the future and their contribution to changing coastal dynamics in the Lido de Séte are still, for the most part, unknown.

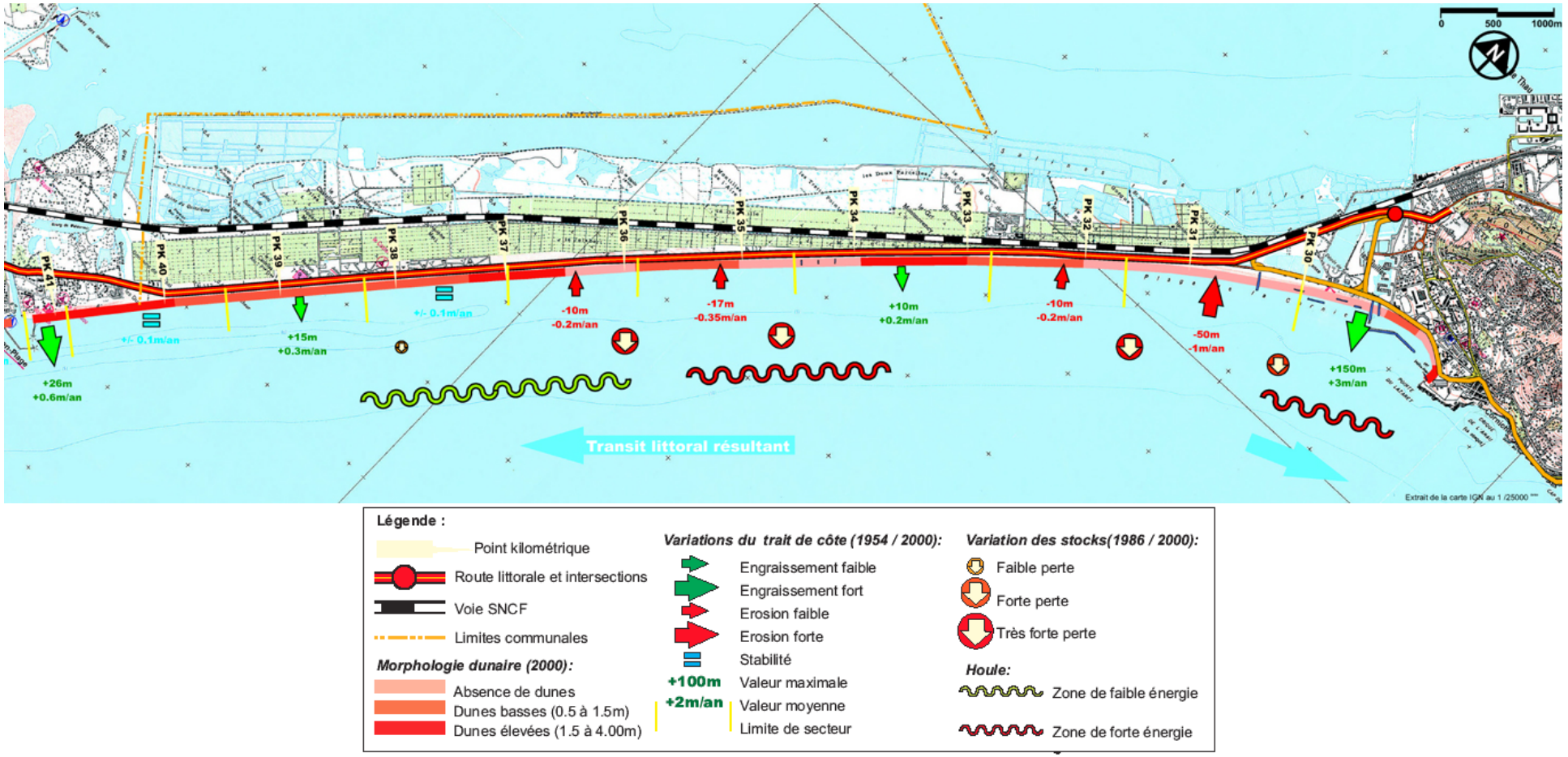


Figure 8.4. Coastal erosion map. Source: BCEOM, 2001

The origin of coastal erosion is a combination of several causes. The difficulty in measuring each individual contribution to the problem offers another symptom of the complexity. At river basin level, the interruption of the sediments supplied by River Rhone due to the presence of several dams is one of the main causes. At a local level, the coast road, built at the beginning of the twentieth century on the high part of the beach, reduces the natural and protective service provided by the dune system, increasing the mobilization of sediments, with the consequent erosion of the backshore and the dunes. This reduces the lifespan of the road and represents high financial costs for the local municipality in repair works after the storms. In addition, past interventions, mainly hard-engineering oriented (e.g. groins and detached breakwaters), near the marinas have built a set of perpendicular barriers, modifying the original sand distribution and exacerbating impacts on the adjacent downdrift areas (BCOEM, 2001).

At the time this research was carried out, in the north-eastern sector of the Lido, the popularly called Triangle du Villeroy was being urbanized. The construction of housing, an urban park and a boulevard was projected (see Figure 8.5 and Figure 8.6). As a compensation measure, the Conservatoire du Littoral[34] bought part of the old salt mines located behind the new urbanizations aiming at restoring them. But according to experts, this zone would become one of the most vulnerable area to coastal erosion in the lido.

Figure 8.5 Illustration of the project of urbanization in the Triangle du Villeroy

Figure 8.6 Illustration of the boulevard projected in front of the new urbanisation in the Triangle du Villeroy.

[34] The "Coastal protection agency" is a public administrative body with the responsibility of conducting appropriate land-use policies for the protection of threatened natural areas. www.conservatoire-du-littoral.fr/

8.2.3 Historical search for solutions

Basically four important activities would be affected by the erosion; Tourism, housing, vine cultures and fisheries. Moreover a unique and patrimonial ecosystem of marshes and dunes would disappear. This is not new. The awareness and actions towards coastal erosion date back from several decades ago. The first needs for protection appeared in 1953 on the north end of the camping *Le Castellas* (south-end of the lido), where the construction of three groins was needed to protect a 400m stretch of the coastal road and the camping facilities (see Figure 8.7). These groins contributed to maintain the shoreline position and the dune ridge.

Figure 8.7 Groin northwards of the camping Le Castellas.

After 1954 a groin was built in the Lazaret beach, which contributed to block an important mass of sediments and then, helped to increase the beach surface (more than 50m). However it affected negatively the beach southwards.

Detached breakwaters have protected the tourist area of the lido, i.e. from La Corniche to the Villeroy triangle, in the period 1987-1993. In this sector the breakwaters assured a continuous maintenance of the sedimentary stock and of the present shoreline, tombolos were created behind these structures and the beach has gained more than 150m. (see Figure 8.8)

Figure 8.8 View of the coastal defences in the Lazaret beach and the marina of “Quille’s” mouth.

However, the effectiveness of these coastal protection measures has been questioned because of their negative impacts downdrift of the last breakwater, showing a high erosive trend, especially intensive in the section where the coastal road is close to the beach. (See Figure 8.9)

Figure 8.9. Wall protection for road.

The population became aware of the vulnerability of the Lido with the impact of several important storms, which caused diverse damages and high costs specially for repairing the coastal road. The following dates are the main storms:

→ November 1982 storm, which destroyed the restaurants installed on the beach and public equipments. (Figure 8.10)

→ December 1992 storm, which involved the closure of the coastal road.

→ December 2002 storm, the cost to repair its damages was estimated at 1 million francs.

Currently the costs of reparations from coastal storms represents approximately 250.000 euros for the municipality every year; most of them are dedicated to the coastal road.

Complementing all these hard protection schemes, different soft measures like wind-fences have been placed to maintain and consolidate the dune ridges. Until today, three generations of wind-fences have been performed between 1987 and 1990. As well as soft measures, some innovative techniques have been experienced, like wooden stakes planted on the beach berm (north of the three groins). These stakes, which reappear periodically, are intended to help the sediment transfer perpendicularly to the shoreline. Other measures were the permeably submerged structures placed in the mid part of the lido's coast, which seemed not to produce accretion but at least to maintain the sedimentary stock of the beach; and a few sediment recharges in several sites of the municipalities of between Agde and Séte.

Figure 8.10 Illustration of the effects caused by a coastal storm in 1982. Source: Urbanis (2004).

Historically, the need for *giving space* to the coastal system to ensure its dynamic balance has been discussed in the area. One example of this was the compulsory purchase, at the beginning of seventies, of a strip of land alongside to railway in order to move the road backwards and restore the dune system. However, this proposal did not succeed. At the end of the 90s, the local administration once again began a process to solve the problem, seeking a long-term solution.

8.3 Methods

During its history, the application of multi-criteria methods has been guided by different methodological principles. First, Multi-criteria Decision Making (MCDM)

was aimed at obtaining the best alternative based on the subjective preferences of a mythical decision-maker and the application of more or less sophisticated algorithms to a well-structured mathematical decision problem. Afterwards, it has appeared the concept of Multi-criteria Decision Aid (MCDA), which stresses the importance of the process of creation and learning so as to make a decision. In this last approach, a MCA is seen as a tool that helps in decision-making process rather than obtaining the best course of action. Further theoretical developments stress the importance of including public participation in MCDA. Having this differentiation in mind, the present work uses a Multi-Criteria Analysis (MCA) structure with a wider MCDA framework and an explicit emphasis in the participatory process.

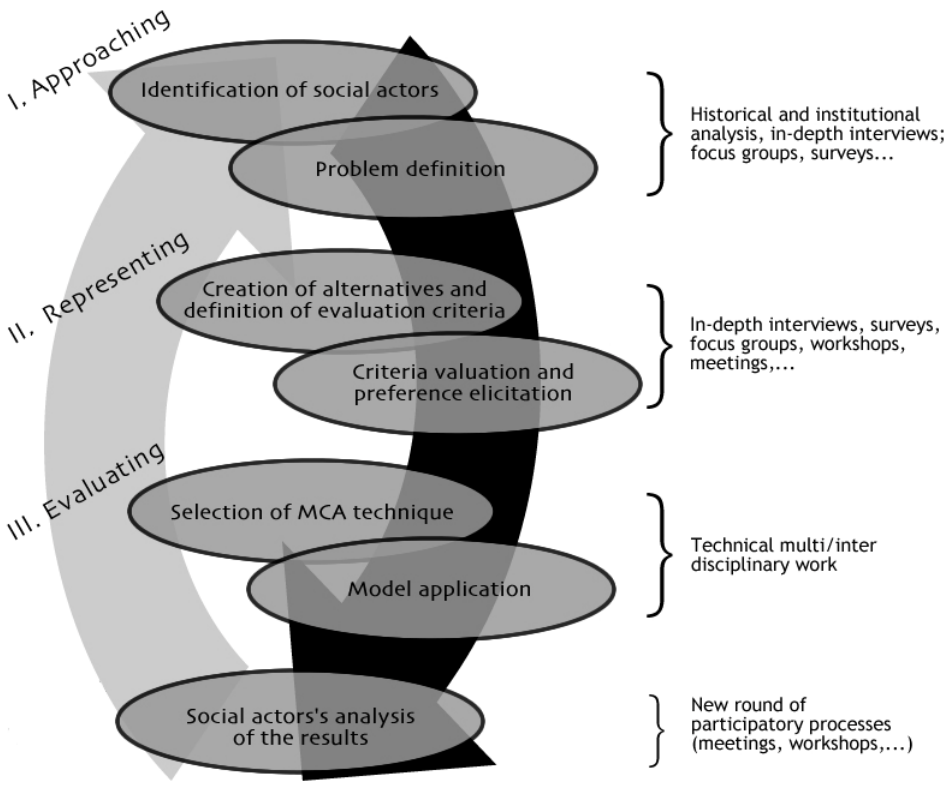


Figure 8.11Phases of a MCA process and techniques used. (Adapted from Gamboa, 2006)

The MCA approach used in our research is based on the framework called Social Multi-criteria Evaluation (SMCE) developed by (Munda *et al*. 1995), which is aimed to: *i)* perceive the values and aims of the involved social actors by means of participatory approaches and technical advice; *ii)* to represent the decision space in the decision-making process through a multi-criteria structure and, *iii)* to evaluate the different options. Its application should be largely understood as a process combining different techniques rather than a single

tool. Although it is drawn in a linear structure to make it easier to understand, in real cases some of the steps may overlap one other, and a cyclical and reflexive procedure is advisable (See Figure 8.11)

The first step, the framing phase, consisted of a wide understanding of the situation regarding the conflict from the full range of social perspectives. This was done through a review of existing documents and an institutional analysis to identify agents, discourses, values and interests present in the system of reference. In social science, qualitative methods, like in-depth interviews, are useful for identify the underlying values and aims (O'Neil, 2001). Our goal is to consider the diversity and quality of information present in society, including groups that are under-represented or not represented at all as social equity is a desirable characteristic of these methods.

The process of identifying stakeholders began with a set of preliminary local contacts actively involved in dealing with coastal erosion (local authorities and researchers from the University of Perpignan) who cooperated in the configuration of a final list of interviewees based on a geographical criteria, the type of knowledge (lay/scientific/technical) and the diversity of socioeconomic interests presents in the area (social/ecological/economic). From this process, similar to a snow-ball procedure, we eventually selected a total of fourteen stakeholders. People perspectives were recorded, transcribed and its content analysed following an inductive way, hence constructing categories and criteria in a bottom up and sequential fashion. These categories about the issues at stake, options and assessment criteria were then used in the meetings.

With a total of 14 in-depth interviews, the social and local perception was outlined in qualitative form. The interviewees came from different economic sectors (fishermen, shellfish farmers, wine-growing, tourism), social groups (environmental, civic and leisure associations), research institutions and administrative authorities (local and regional administrations) (see Table 8.1). The in-depth interviews included questions that addressed the general perspectives on the region's development and expectations for the future. Interviewees were also asked to identify the main problems in the Lido area. Several questions focussed on a set of alternatives for solving the problems previously recognized. At the same time, the questionnaire was left open enough to allow for exploratory insights not anticipated by the researchers.

Table 8.1 List of interviewed stakeholders

Type of stakeholder	Stakeholder
ADMINISTRATION	Local Administration: Comunité d'Aglomeration du Basin du Séte Tourism Office
ECONOMICAL SECTORS	Viticulture sector: Cooperative Marseillan, Domaine du Listel Sellfish farming : Syndicat Ostreicole Mytilicole du Bassin de Thau SA.THO.AN (Société Coopérative Maritime des Pêcheurs de Sète-Môle) Camping du Castellas
SOCIAL AND CULTURAL ASSOCIATIONS	GRIVE (Groupe de Recherche et d'Information sur les Vertébrés et leur Environnement) Ecologistes d'Euzière Association of defence of the inhabitants of Marseillan plage (DHMP) ADENA (Association of Denfence of the Environement and Nature of Agde) Association of amateur fishermen Sailing School of Barrou Association of maritime hunt
SCIENTIFICS	University of Perpignan University of Naples University of Barcelona

In the representation phase, the problems previously identified were organised in a multicriteria structure. In this phase the criteria and alternative were defined. Basically, alternatives were created based on the work done by BCEOM (2000, 2001) – a consultancy firm contracted by the local authorities to develop the alternatives.

The definition of criteria involved a multi/inter-disciplinary task of translating social preferences and values into a representative number of indicators, following a participatory approach. Although the main criteria were first elucidated from the interviews transcriptions, two meetings were organized to check and improve the internal validity of the results. or correct them giving internal robustness the MCA process and minimizing the effects of the researchers biases. Representatives from environmental associations, tourism

sector, wine-growers, local authorities and scientists attended, and their views were used to evaluate and to discuss on individual impacts of each alternative.

In the evaluation phase, the appropriate MCA technique was selected. This part represents the most technical and what is, in a way, the least participative stage of the whole process. According to the characteristics of the problem at hand and the requirements of our assessment framework aimed at representing complexity, dealing with mixed information – both quantitative and qualitative - controlling compensability, including the presence of uncertainties, the aggregation method selected was NAIADE (Munda *et al*.1995). This tool gives the possibility of managing different type of data, takes into account indifference and preference thresholds, and allows the use of weightings. After its application, performing a sensitivity analysis to assess the robustness of the assessment is very important. It should be noted that we also did an evaluation with REGIME model, which is an ordinal method that uses weights as important coefficients in order to test the reliability of the results.

Finally, in order to test and validate procedural coherence of the methodology and the robustness of the results obtained, a final meeting was hold with the partners of the Messina project which was formed by a group of 11 institutions from France, The Netherlands, Poland, UK, Spain, Sweden and Italy.

Figures 8.12, 8.13 Pictures of the meetings held during the MCA process.

8.4 Results

8.4.1 Framing phase

Different conceptions of the current situation were approached through the in-depth interviews, which provided a wider description of the main conflictive issues at stake and of their demands and expectations on the reference system. Firstly, it was assumed in advance that coastal erosion was a key issue for all the stakeholders. . A quote given by a resident of Séte shows that the problem of erosion is present in people's minds: "A few years ago the sand burnt your feet while crossing the beach to reach the sea. Today this no longer happens." This perception concurs with the scientific and technical studies that provide objective data on erosion patterns and rates (e.g. BCEOM, 2001). Coastal erosion is perceived as major problem, not only for the administration, which has been spending €250,000/year on repairing the coast road, but also for the tourism sector. The reduction of the beach area also affects beach users' comfort and satisfaction. In the long term, it can represent a serious risk for a recreational activity that partly depends on shoreline dynamics (Valdemoro & Jimenez, 2006).

Figure 8.14 Image of cars and caravans parked along the road.

Figure 8.15 Example of waste in the dune area.

However, erosion was not the only concern expressed by interviewees. Impacts generated by "sand and sea" tourism and overcrowding in the Lido were a very widespread concern. Specifically, the high concentration of cars, vans and caravans parked along the road, which can rise to a peak of 5.000 vehicles in the high season, generated problems of mobility, road security and parking difficulties in an area lacking public transport. The occupation of the seaside road by caravans annoyed locals and tourism representatives due to its

negative aesthetic effect and the fact that they do not leave any significant income in the local economy (See Figure 8.14). Moreover, the open and easy accessibility of the dunes and natural areas encourages over-frequentation, not only on foot but also by quad bikes or motorcycles (Figure 8.15). It provokes the destruction of this fragile ecosystem and affects the biophysical resilience capacity to cope with extreme storm events and restore sediments in shortage periods.

Table 8.2 collects some of the perception and opinions given by interviewed stakeholders. Our research found a rather general consensus on the main problems of that area, mostly that coastal risk erosion is a real problem and that it is becoming increasingly difficult to tackle. However some differences

Table 8.2 . Social actors' opinions collected

Sec-tor	Group/Activity	Observations
Administration	Municipality of Séte	The municipality has been spending large amounts of money in repairing the coastal road after strong storms. They need and want to stop this situation. They also see the need of creating an integrated land uses frame for the Lido of Séte, which facilitates the coexistence of several activities.
	Communauté d'Agglomération du Bassin de Thau	They have been looking for soft solutions (dune restoration) instead of hard ones (breakwaters). It has to be a long-term solution with acceptable and reasonable maintaining costs. Recovering the dunes, stop the erosion and solving the problem of over-frequentation are the aims of the Agglo. But they have to find the funds for implementing such a project, which is the main worry.
	Mission Littoral	This is an administration entity dealing with coastal problems at a regional scale. They look for long-term solutions considering the interrelations between local zones and regional phenomenon.
Tourism sector	Tourism office	"It is important to combine tourism activities and environmental protection" because the characteristics of the lido are essential for tourism development. Another priority is controlling the massive frequentation and diversify the tourism offer ("beaches for all tastes" and "opening new spaces for soft activities (kite, cycling), like the zones behind the railroad track")
	Camping du Castellas	The current location of the road doesn't disturb them. They are worry about their future situation (access to the camping, possible isolation and so on). The think the camping caravans that park along the road nowadays are an esthetical problem and not a financial one.
Other socio-economic activities	Domaine du Listel	The activity of wine production relies upon the lido's characteristics and uses. They see the camping caravans as a source of pollution. Mainly because of the lack of services to enable the releasing of tourists' wastes (which many times end in Listels' lands). It is important for them to put special attention in the security of the access to the parking and to their installations, due to the big amount of trucks going to the wine cellars. Also for security reasons they are against allowing people to go behind the railroad track. The water management is a very important point for them. The water flows equilibrium has to be controlled and maintained to avoid an excessive flow of salty water going up to the vineyard lands.

emerged in the process of generating alternatives.

Social movements	GRIVE	The problem is inserted in the whole regional coastal dynamics. It has to be faced regionally and not only locally as it is done today. "It is not a problem of construction, it is a problem of frequentation". They see as a big problem the lack of management of the natural zones behind the road. They think the access to these zones has to be forbidden between April and July (to protect birds during their reproduction period). The frequentation of the natural zones behind the railroad track should be controlled during the rest of the year. Some lines of vineyards may be sacrificed in order to recover the dune chains. And the access to the dunes has to be forbidden.
	Ecologistes de l'Euzières	"The road is dangerous and the noise of the road is disagreeable". The access to the central part of the beach has to be difficult for the people. It is needed a long-term approach, to avoid future damages and catastrophes. The breakwaters are very anaesthetic. So, the best is to build as less as possible and to put more effort in recovering the dune chains. The new road shouldn't promote the access to natural spaces.
	A.D.E.N.A.	The erosion problem has to be solved, the road has to be moved, and the dunes and beach have to be protected, because they have a very important ecological value. It is important to organise all type of information for the inhabitants, and tourists. It is a good idea to eventually guide the people through the natural spaces.
	Association of defence of the inhabitants of Marseillan plage	The dune regeneration is the best solution, the inhabitants of Marseillan plage are really threatened by this erosion problem. The road has to pass outside Marseillan, (in the North option) for security reasons for the inhabitants of Marseillan Plage, and to improve the access to Marseillan village. It is important to stop the erosion, but also to link the Plan of Management with Marseillan, and think globally
	Association of amateur fisherman and sailors	a good solution either. They think nothing will stop the erosion. The law says the camping cars, are forbidden, but they tolerate the camping cars on the road. It is a problem. The fishing department prohibited anchoring for amateur fishermen in most of the zones of the lagoon, since it represents concurrence to the professional fishermen. There should be an urgency way on the road, because it is obvious there will be accidents, it is better to have lots o small car parks and not two big ones.
	Association of maritime hunt	They agree with the moving of the road, they think it is very interesting to be able to restore the dunes, because it is a very important ecosystem, which is linked to the Lagoon. They protect the ducks, because if they disappear their hobby disappears The brake waters are the best solution for the erosion, but it is too expensive. They prefer the dunes, they think it is good for the visitors to walk to the beach through a nice dune Landscape. All the changes will have consequences on the fauna. They think it is wonderful to try and recreate what they used to see when they were young for the future generations. They have lost three month of hunt (March, February, and August have been taken away), because it is the reproduction period.
	French Sailing School of Barrou	They are not sure something can stop the erosion, the road of course has to be moved to leave the nature restore itself and form a unit... They think it is a middle-term solution, it improves the natural spaces. They think a lot of people will appreciate to be on a quiet beach far from the road. For their activity it will bring no changes because they don't sail in front of the Lido, they stay in front of the canal des Quilles, and on the lagoon., The breakwaters can be positive for the kitesurf activity because they generate waves. There has been lot of retention of sand in front of the big dike, they even have to take the sand away, every year otherwise the entrance of the marina is blocked. The problem about brake waters is that they are ugly and that there are lots of rats in them. So it is also a sanitary problem.

Table 8.3 shows a scheme listing the main issues that emerged during the interviews and the suggested alternatives or proposals for dealing with them.

Table 8.3 Summary of the issues at stake in the Lido and the proposals for defining alternatives.

Issues at stake and trends	Expectations/ needs for the alternative creations
Coastal erosion: Reduction of beach area Damage to coastal infrastructures Uncertainties and risks linked to sea level rise and extreme storm events.	Implementing long-term solutions. Stopping coastal erosion, stabilizing rates. Avoiding future catastrophes Reducing the economic costs of recovery after a storm. Alternatives ranging from: engineered interventions to environmental- friendly approaches, work with nature processes Re-establishing coastal natural dynamics. Preventing larger scale effects or transferring erosion effects to adjacent areas.
Ecological quality and landscape: Degradation of dune system Loss of biophysical resilience of the Lido. Over frequentation Pollution of natural areas	Recovering natural features of the Lido Protecting the dune system from over–frequentation. Restoring the dune system, extending its surface and removing the coast road, in order to increase biophysical resilience.
Mobility and planning conflicts: Increase in road accidents Accessibility of central areas of the lido. Anti-aesthetic presence of caravans.	Dealing with road safety Several positions concerning road placement: moving it backward, keeping it on its current site. Planning parking areas: along the road or in specifically designed areas. Regulating caravans. Promoting public transport Tracing a cycling track Improving and planning accessibility and safety for accessing the beach on foot

8.4.2 Representation Phase

A MCA structure is conceived as a set of policy alternatives which are assessed against a collection of criteria. The alternatives were sourced mainly from technical documents commissioned by the local administration to BCEOM (2001) but also the qualitative information provided by the in-depth interviews (see table II). As a result, four main strategic alternatives were established:

→ **A- BUSINESS AS USUAL:** This alternative is necessary to identify what would happen if nothing new other than what has been done so far was carried out. In practice this means continuing to repair road damage as storm events occur.

→ **B- HARD-ENGINEERING**: This alternative would implement coastal engineering defences along the coast, through the construction of a set of detached breakwaters parallel to the lido. No intervention is proposed inland.

→ **C- MEDIUM-DISPLACEMENT OF THE ROAD**: This proposal would move the road backward to the western limit of the ancient dunes and restore dune system.

→ **D- BACKWARD DISPLACEMENT OF THE ROAD**: This solution would move the road backward adjacent to the railway and fully restore dune system.

These alternatives represent different coastal responses to cope with the sea level rise and coastal erosion that can be typified according to the classification done by Biljsma *et al* (1996) used in IPCC (2001). Strategies A and B are protective alternatives and C and D are retreats.

In order to integrate other concerns, some of the strategies were sub-classified into different sub-alternatives depending on several varying elements (parking areas, mobility and accessibility to the beach). In total, 9 sub-alternatives Table 8.4 were created, which became more related to an integrated land use planning than to a single shoreline strategy.

Table 8.4 Description of alternatives.

POLICY OPTION	ALTERNATIVES	SUB-ALTERNATIVE
COASTLINE PROTECTION	**A BUSINESS AS USUAL** Maintaining the current situation. No changes. Repairing storm damage after extreme events	
	B HARD ENGINEERING	
	Keeping the road in its current position and restoring the dune system where the road doesn't interfere	B1 Unilateral parking along the sea side of the road.
	Sitting detached breakwaters (+1m) along the whole lido with periodic beach replenishment.	B2 Concentration of parking in two areas.

POLICY OPTION	ALTERNATIVES	SUB-ALTERNATIVE
COASTLINE RETREAT	**C MEDIUM-DISPLACEMENT OF THE ROAD** The coast road is moved back right up to the western limit of the dune system. A set of detached breakwaters is built only in front of the urbanized area A cycling track is placed parallel to the road on the seaward side.	C1 Delimitation of parking areas from where a track accesses the beach. C2 Parking is permitted along the road. Accesses to the beach are planned every 100m.
	D BACKWARD MOVEMENT OF THE ROAD The road is moved backwards close to the railway. A set of detached breakwaters is built only in front of the urbanized area	D1.1 Delimitation of parking areas from which a track accesses the beach. Cycling track is placed at the western limit of the dune system D1.2 Delimitation of parking areas from where a track accesses the beach. Cycling track parallel to the road. D.2.2.Parking is permitted along the road. Accesses to the beach are planned every 100m. A cycling track is placed at the western limit of the dune system D.2.3 Parking is permitted along the road. Accesses to the beach are planned each 100m. A cycle track is placed parallel to the road.

As explained above, the content analysis of the in-depth interviews and the stakeholders' meetings elicit and validate the set of criteria shown in Table 8.5.

Table 8.5: Evaluation criteria

Criteria	Index (direction)
Road safety	Qualitative, based on: Amount of access to the road for vehicles (to minimize) Ease of access to the beach for pedestrian (to minimize)
Long term effectiveness to control coastal erosion	Qualitative , based on: Extension of the dune system, from the sea to the road. (to minimize) Number of detached breakwaters (to minimize)
Costs of the works	Quantitative Unit: € (to minimize)
Costs of management and maintenance	Quantitative Unit: €/year (to minimize)
Visual impact	Qualitative, based on: Degree of interference between an observer on the road and the horizon line (to minimize).
Impact on the sea bed environment	Qualitative, based on: Number of constructions into the sea (to minimize) Level of intervention in the sea in the future (minimize)
Dune Fragmentation	Qualitative, based on: Longitudinal fragmentation: Amount of longitudinal cuts in the dune system (to minimize) Transversal fragmentation: Amount of access to the beach (to minimize)
Regional Impact- Effects on downdrift areas.	Qualitative, based on: Number of elements interfering with sediment transport and affecting currents (to minimize).

From the seven criteria elucidated, quantitative evaluation in monetary units has only been possible for the economic criteria. This was thanks to the available information on the costs of works and their future maintenance. New interventions or replacement costs were not considered, as the lifespan of the infrastructure is longer than the period of evaluation.

The rest criteria have been qualitatively evaluated. The road security addresses the rate of accidents. Although some studies exist, it is almost impossible to forecast the impact of the different alternatives in the future, but in a qualitative way based on the degree of accessibility for the pedestrians and the vehicles to the road.

The long term effectiveness of the solution is another concern of the local society. Taking into account that the dunes acts as sand reservoirs and improve stability of the system against erosion, the extension of the dune system increases the value of this criterion. Moreover, the number of detached breakwaters also contributes to provide protection against storm and to trap sediments transported by marine currents.

The ecologic quality of the dune system is another important factor that affects beach stability. In this respect, fragmentation of this natural system caused by lineal infrastructures and beach users' frequentation need to be assessed. Hence, longitudinal fragmentation due to the road, the railway and transversal fragmentation due to the accesses from the road to the beach have been qualitatively evaluated.

Another aim of recovering the beach and the natural ecosystem is to benefit tourism development. Therefore, visual impact becomes an important criterion. As pointed out by the stakeholders, the main nuisances for their aesthetic recreation are the effect produced by artificial objects placed between an observer and the sea horizon line. This refers to the amount of camping cars and the number of detached breakwaters which have been used as qualitative indicators to evaluate this criterion.

The impact on the sea bed environment caused by dredging activities and sand transportation was an specific worry of the fishing sector. Its evaluation was related to the construction of infrastructures in the sea (e.g. detached breakwaters and nourishment) and the works for their future maintenance.

Finally, the influence of coastal management practice in adjacent areas is widely recognised. Therefore, assessing the impact of each alternative solution in the nearby beaches as well as at the regional level have been considered relevant. This has been performed by taken into account the hard infrastructures affecting the marine currents.

8.4.3 Evaluation phase

The MCA continues with the filling of the impact matrix, presenting the scoring of each alternative under the selected criteria (see Figure 8.17).

In Séte, historical solutions to solve coastal erosion problems have showed a wide range of effectiveness and a high degree of uncertainty in their

successfulness which means that some indexes cannot be evaluated with crisp numbers. Quantitative analysis often assumes that the system's behaviour can be fully grasped or satisfactorily simplified with a single figure, but in this case this is very difficult if not impossible for many criteria (i.e. how can a numerical relationship be established between the dune system area and its effectiveness in protecting the beach?). On these bases, some of these criteria were constructed in a qualitative way (e.g. very good/good/moderate/bad/very bad). In order to conduct the evaluation in a transparent way and facilitate stakeholder understanding, graphic evaluations, based on the acquired scientific knowledge during the participatory phase, have been used (see Figure 8.16 for an example). Using these graphics it is possible to conduct an evaluation with partial compensation between sub-criteria, as they are qualitative in nature.

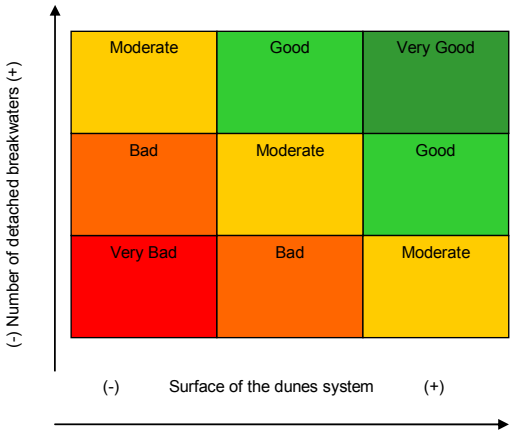


Figure 8.16 Graphic for evaluating the longevity of the Lido de Séte

The information contained in the impact matrix is aggregated in order to obtain a ranking of alternatives.

Matrix type: Impact Case Study: Sète

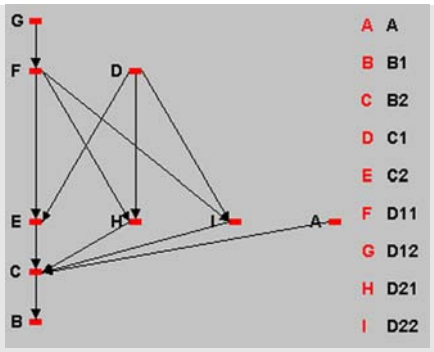
Criteria \ Alternatives	A	B1	B2	C1	C2	D1.1	D1.2	D2.1	D2.2
Security	+ or - Low	+ or - Low	High	+ or - High	Low	High	+ or - High	+ or - Low	Low
Long-term effectiveness	Very Bad	Good	Good	Moderate	Moderate	Very Good	Very Good	Very Good	Very Good
Investment costs	0	~ 48	~ 46.5	~ 38.9	~ 36.3	~ 44.3	~ 44.3	~ 45.3	~ 45.3
Maintenance costs	~ 500	~ 1.500	~ 1.500	~ 800	~ 800	~ 800	~ 800	~ 800	~ 800
Visual impact	High	Very High	High	Moderate	+ or - High	Moderate	Moderate	+ or - High	+ or - High
Impact over marine environment	Moderate	Very High	Very High	Low	Low	Low	Low	Low	Low
Fragmentation	Very High	Very High	Very High	Moderate	+ or - High	+ or - Low	Low	Moderate	+ or - Low
Regional impact	Moderate	Very Bad	Very Bad	Bad	Bad	Bad	Bad	Bad	Bad

Figure 8.17 Impact matrix

Several evaluations were carried out with the Naiade method introducing various degrees of compensability to test the sensitivity of the model results. Figure 5 shows in the right side the result obtained from the Naiade software which has been translated into a ranking as illustrated in the left side of the same figure. The outcome ranking indicates the alternatives that best meet the technical requirements (see Figure 8.18).

Outcomes with different compensation degrees were quite stable in all the cases, with the alternatives D1.1, D1.2 and C1 ranked in the top positions. These possible actions had medium-high investment and maintenance costs, but they presented good scoring in the environmental and social criteria. Whereas, alternatives B1 and B2 scored in the last positions due to their poor performances under all kind of criteria, except for the long-term effectiveness criterion.

Ranking position	***Alternative***
First	D12
Second	D11 C1
Third	C2 D21 D22 A
Fourth	B2
Fifth	B1



Graphic representation given by NAIADE

Figure 8.18. Results of NAIADE

In conclusion, the alternatives corresponding to the group of policy options “retreating the shoreline” (i.e. Medium-displacement of the Road and Backward-displacement of the road) were mostly preferred to those corresponding to the “protecting the shoreline” group (i.e. Business as Usual and Hard engineering). It is important to highlight that the main results of this study are coherent with the decision made by the authorities of Séte. A reason which might explain this concern is the fact that the project of restoring the “natural” landscape of the lido has historically been under social debate for 4 decades. Moreover, the fact that in the seventies the local administration had already bought land for the relocation of the road facilitated the acceptance of the plan, as expressed by most of the participants during the empirical work. Therefore, with time and

public debate, the criteria and the definition of the problems in the Lido have moved closer together.

Although during 2006 a political agreement was held on retreating the road and implementing a plan similar to the alternatives D1.1 and D1.2, some uncertainties on the vulnerability of the Lido to coastal erosion remain unsolved. In order to deal with them, decision makers decided to increase the number of detached breakwater in front of the Triangle of Villeroy, a hot spot regarding coastal erosion risk.

8.5 Discussion

This paper has described the combination of participatory approaches and MCA to assess alternative responses to coastal erosion risks. This has involved running an analytical framework, the MCA, as a tool to structure and assess an environmental problem in a participative way to encourage deliberation and the integration of various perspectives and knowledge. Now, we want to discuss the contribution of this approach to helping to integrate complexity, multiple values and uncertainty in order to improving coping with erosion risks.

Actors have different perceptions of reality related to their different frames of reference or worldviews. Stakeholders' involvement in the framing phase was very helpful in providing a broader definition of key issues, as it allowed the integration of the plurality of values and concerns in the process, minimizing future conflicts. As a result, other issues (e.g. the invasion of caravans, dune degradation, etc.) were also considered, contrasting with those coming from purely technocratic perspectives that reduce the problem to the lack of sand or the annual rate of land retreat.

Another consequence of opening up the scope was that it allowed obtaining much richer and more creative policy alternatives. In our case study, the strategies that potentially increase resilience, like realignment and working together with the natural dynamics, were considered and went beyond those solely based on engineering judgements. Such alternatives represent world views which are also present in society, although frequently omitted in coastal erosion management. Thus, in the technocratic world view, a static and dominant misunderstanding of the society-nature relationship prevails, promoting a "Hold the line" strategy. Bringing in the plurality and the diversity of social values allowed the inclusion in the evaluation process of innovative, more

adaptive and resilient options under changing circumstances for the dynamics of the system, such as moving sea-front infrastructures backwards. Although managed retreat is always controversial, especially in heavily populated areas, a few examples in the UK have been successfully implemented after long deliberation processes (Myatt, 2003). These have been able to overcome some difficult pitfalls related to institutional arrangements, lack of technical knowledge and resources, and lack of sufficient financial compensation (Ledoux *et al*. 2005).

Moreover, embedding a different set of criteria corresponding to social (e.g. road security, aesthetic impact), economic (e.g. economic costs) and ecological dimensions (e.g. dune fragmentation, impact on the marine sea bed) of the problem through consultation with stakeholders helped in representing complex reality and with an analysis of trade-offs among multiple dimensions and social values within the problem. The use of Naiade method allows managing the degree of compensation but does not use weights. Weighting each dimension involves a subjective value judgement that cannot be avoided. However, making them explicit, through a sensitivity analysis, allows that stakeholder can examine information on criteria and impacts and explore the outcomes of the decisions made, and then, modify the values given to each criterion accordingly (Brown *et al*. 2001) .

The desired features of a multi-criteria method depend on the framework in which it is applied (Jansen *et al*.1999; Munda, 2004). Within the public policy domain, the multi-criteria model should be as simple as possible so as to guaranty transparency. However, it should be stressed here that different multi-criteria models could give different results. Although not showed in this paper, the results obtained by REGIME (Hinloopen *et al*., 1983) were quite similar to those coming from NAIADE, which is a signal of robustness of the results. In fact, such robustness may be provided by the participatory process which has acted as a control and manager of researcher subjectivity.

Another potential advantage of our chosen method was its capacity to deal with uncertainties as part of the relevant information considered for the evaluation process. In this respect, the key dimensions of uncertainty in the knowledge base of complex environmental problems can be classified into technical (inexactness), methodological (unreliability) and epistemological (ignorance) (Funtowicz *et al.* 1990) In relation to the first type MCA may be more appropriate than other methods such as cost/benefit analysis (Munda, 2006) In

our case it has allowed to manage the lack of technical information by ranking the effects for each alternative under qualitative criteria. For example, although we could not establish the exact effectiveness of protection measures, the evaluation could be performed by using an index in qualitative terms with a semantic variable (long term effectiveness), which is more transparent than assigning only numbers or monetized impacts and implicitly deals with the uncertainty.

Uncertainties associated to the methodology are solved with the participatory process. It is very important to recognise that the final results of MCA are determined by the problem structure and the tool used. This is why is important to emphasize the significant value of bringing in and foster a transparent public participation which is the key element in providing robustness and validity to the whole process.

Finally, a last source of uncertainty concerns the fact that we are in the field of environmental risks where complexity and non-linearity make impossible to achieve complete deterministic knowledge of cause-effect relationships in coastal systems. Under these circumstances, adaptive management is seen as the most appropriate strategic option. In this sense, we agree with recent publication (Linkov *et al*. 2006) that suggests that MCA couples with adaptive management as it provides flexibility and dynamism allowing for a framing-reframing process according to the characteristics of complex environmental risks at hand.

8.5.1 Final remarks

We have seen how MCA facilitated the integration of information from different scientific fields and from society and the capture of the different dimensions of the problem, allowing the combination of qualitative and quantitative information. Compensability and uncertainty management and trade-off analysis are another added values.

However, validity of such bunch of methodologies strongly rely on the participation process as they provide social robustness and may engage stakeholders in assuming responsibilities, risks and uncertainties. The participation helped in extending the framing of the reference system and to open it up for new alternatives beyond expert ones in order to devise a more adaptive and resilient future for the use of coastal systems.

While we have shown its potential, this approach is not without limitations. Normally, timeframe, human and financial resources are considered to be drawbacks of this methodology. Flexibility of the tool can also be a double-edged sword, as it can promote ambiguities which yield weak, policy-relevant results (Lynam *et al*., 2007). Nonetheless, it brings a good opportunity to address a problem of interest conflict involving "social control" of the outcome and generating a wide variety of knowledge to inform decision-making process in a socially robust manner (de Marchi, 2000). More research should be done on evaluating feedback and the learning process, which are very important to fine-tuning the representation of the problem and to ensuring acceptance of the final solution.

Part IV

Conclusions

Chapter 9 Conclusions and new directions of future research

9.1 Beyond uni-dimensional assessments: The value of integrating of social diversity to assess coastal systems

This thesis started with the hypothesis that many of the environmental problems affecting coasts are intensified and made worse due to the use and application of appraisal concepts and methods that do not consider the complexity and multidimensionality of coastal systems. These approaches, which have prevailed during the past decades, are characterised by a strong technocratic stance that excessively reduce the system of reference for policy-making and leads to the implementation of inefficient solutions both from the technical and the social point of view. This results in the emergence of new environmental problems and the generation of social conflicts.

More specifically, in tourist beach contexts, the predominant recreational function of the beach has induced homogeneous service-oriented management instead of providing an adaptive approach considering intrinsic beach characteristics and users demands. In dealing with coastal erosion, engineering perspectives that search to maintain a static equilibrium of the coastline have promoted end-of-pipe hard and soft-engineered solutions that have often resulted ineffective and/or have caused larger impacts in other parts of the coastal system.

Against this background, we have argued that coastal areas should be better understood from the perspective of complex socio-ecological systems. Our case studies have helped us to analyse the adequacy of the theoretical proposition set out in the Part I. Issues regarding, complexity, multidimensionality and multiple scales have been evident both in the case of beach quality and the cases of coastal erosion. Furthermore, the cause-effect relationships have been highlighted to be difficult to fully know. As a consequence, dynamism and constant change of coastal systems imply an irreducible degree of uncertainty which is likely to increase with climate change perspectives.

In this context, our research has corroborated that most of the existing assessment frameworks are uni-dimensional which mean that concern with a single or a few criteria. They lack of systemic perspective and understand nature as something controllable which do not couple with the actual characteristics of the Mediterranean coastal systems. It is therefore urgent to develop assessment tools, methods and processes that are better adjusted to this perspective. Along this line, Integrated Assessment, which has been developed during the past decades, becomes an approach that is suitable for addressing these situations, both theoretically and methodologically. Through this thesis we have taken a further step in bringing Integrated Assessment with social science. In particular, we have looked at how the analysis of public perceptions can contribute to a better grounded IA of coastal systems. Thus a main objective has been to examine the added value of integrating public perceptions into the process of assessing complex environmental problems in coastal areas. This objective is eminently methodological, although some substantive conclusions have been produced through the case studies.

Next, in the forthcoming lines we first present the conclusions obtained specifically in each case study. The conclusions extracted from the methodological experience have allowed us to offer some guidelines to introduce public perceptions in the process of assessing coastal systems. In the final section, we look at possible criteria that could be considered in order to improve the current practices in the assessment and management of coastal systems and we suggest new lines of future research.

9.2 Recognising social and environmental diversity for beach quality management. Conclusions on the case study of beach tourism .

The first case study concerned with the mass tourism affecting Costa Brava in Spain. It centred its attention on the quality of the beaches as a key element of that type of tourism. We studied the public perceptions of 6 beaches in the popular, tourist centre in the Costa Brava Region. The beaches examined corresponded to typical tourist environments which are much more frequented by visitors than by local residents, mostly motivated by their landscapes even when these are urban spaces. As we have described, the current mechanisms of beach assessment and management are not very flexible in terms of beach diversity and variability. The same quality standards are applied for different

types of beaches. There are only a few experiences where the evaluation takes into account users' and local stakeholders' interests and needs to define beach quality. Given this situation, the objective was to discuss how public perceptions could contribute to the process of beach quality assessment.

The starting point was that in order to evaluate beach quality it is necessary to integrate information from the people who are actually using the beach and what they think. Moreover, the diversity of beaches regarding its degree of development and nature conservation and the different beach users profiles enjoying these areas made relevant to know how these variety (social and ecological) influences their perceptions. Hence, analysing variability in terms of beach type (i.e. urban and semi-natural environments) and beach-users determinants was performed. The main conclusions of that study are the following:

→ **Different user profiles enjoy different types of beach environments.** The study has shown that in the case of urban beaches the predominant profile is foreign tourism, groups of young people or those accompanied by their families. They reach the beach mainly on foot as they are primarily hosted in temporary residences in the nearby hinterland. The semi-natural beaches are more frequented by locals or Catalan holiday-residents seeking tranquillity and high quality beaches. The fact that beaches are linked to private transport dissuades foreigners from coming to these ones. Therefore, the study showed that in the same region different beach users' profiles frequent different type of beaches.

→ **The main factors influencing the selection of beaches are cleanliness and landscape.** People consider a variety of factors when choosing a beach, but some are more important than others. Cleanliness and conditions of hygiene are the most desirable aspects when respondents select a beach whereas accessibility, parking areas and good beach facilities are placed in last position. Tranquillity is a more important factor for those using semi-natural than urban beaches.

→ **Beach users show a high degree of satisfaction both in urban and semi-natural environment.** In general beach users are satisfied with their recreational experience, especially as regards biophysical and landscape characteristics. High satisfaction is showed even in urban and overcrowded beaches with high provision of services. This suggests that public perception is

not only influenced by the specific characteristics of each beach but also depends on the beach user profiles as we next explain.

→ **The relationship of beach users to the territory influences their degree of satisfaction.** The cluster analysis showed two types of opinion which represent two different forms of evaluating beach quality: the demanding and the satisfied beach users. The results show that local residents and Catalan users are more concerned with natural beach values and environmental degradation and are more demanding about facilities and equipment. Foreign visitors coming for a short stay, however, are satisfied with all items and do not feel disturbed by overcrowding. We suggest that residents' bad perception of environmental aspects is due to everyday life in the area which makes them more aware of impacts during the summertime. Moreover, their strong relationship to the territory leads to the level of tourism being perceived as an increasingly disturbing factor for locals.

→ **Public perception survey can be a useful tool and provide valuable information to coastal managers.** The results obtained from the application of this methodology, in combination with top-down quality awards currently used, can contribute to provide a more adaptive approach to beach management not only taking into consideration beach users' expectations of the recreational values but also offering insights to addressing public attitudes in order to conserve beaches' ecological functions.

Public perception surveys can act as a preliminary mechanism within a wider participatory process in order to assess the social expectations in advance of designing beach management schemes. They are hence a first step in a long process to legitimate decision-making and to democratise beach management.

In particular, integrating beach users' perspective into the assessment and management of beach is a systematic way that can help coastal managers select priority issues recognising social and ecological diversity in beach environments. When we examine the use of urban versus semi-natural beaches, it is clear that we are not only faced with two different types of beaches but also with two very different users. Hence, the message to the managers is very clear: they have to manage not only two different types of ecological systems but also two different types of users.

→ **Ecological and social diversity should be explicitly considered in beach management.** This research showed that there is an ecological and social diversity which should be explicitly considered in the formulation of new management strategies for the beach. On this basis, the first step to managing the beach is to establish objectives and priorities, which means defining whether the management will be oriented either to conservation or to tourist uses. In our understanding, conservation strategies should be prioritised in coastal environments with recognised natural values (e.g. existing biodiversity or potential for re-naturalization). On the other hand, interventionist approaches oriented to enhance recreational beach functions should be pursued only in intensively used beaches, normally located along urban water fronts. Even though, reduced natural values in urban environments should be preserved or restored. Apart from their naturalist value, this sort of conservationist projects in such antropicized zones can have a very important educational function for those beach users with low environmental awareness.

→ **Co-existence of recreational and natural functions is possible in the same coastal system.** Beaches studied should not be seen from a narrow perspective. If they are regarded from a hierarchically higher scale, this group of beaches corresponds to the same coastal system, which can be defined as the Southern Costa Brava. From this perspective, the system is formed by a set of exploited beaches which act as recreational hotspots and attracts beach tourism while in the less developed and more natural beaches the conservationist criteria can be promoted and prioritized before other human uses. Therefore, those policies oriented to promote intensive use by tourism can be restricted to a handful especially recreational-oriented beaches. In these beaches, mechanical cleaning can be carried out together while at the same time promoting a diversity of uses (e.g. facilities, equipment, activities). In these beaches, control of physical variables (e.g. slope, beach width) could be implemented in order to maximise the satisfaction and the security of the beach user.

On the other hand, efforts towards conservationist strategies such as discouraging access to beach users and protecting natural values can be put into place in order to guarantee the long term provision of natural services. In the middle, hybrid beaches bringing together human used and natural conservation projects can be promoted as educational tool and as example of sustainability.

This perspective would require a strategic management plan on a coastal system scale with a common management body. In this plan each coastal section should be establish a prioritization of social and ecological coastal system functions.

9.3 Barriers and opportunities to the Integrated Assessment of coastal erosion in Spain. Conclusions on the case study of Sitges.

The first case on coastal erosion in Sitges analyzed a conflict that arose at the beginning el the 2000 as a reaction to a proposal for intervention to deal with coastal erosion. The research carried out during and *ex-post* the conflict analysed the elements that difficult to give or impede giving integrated responses to coastal erosion. Through public perception research, issues related to the very nature of the problem – complexity and uncertainty of coastal erosion- and aspects regarding assessment approaches and Spanish institutional decision-making framework have been investigated. Furthermore, although this study was not explicitly framed within the Integrated Assessment approach, it made an extensive diagnosis of the issues at stake. It also points out some possible ways of advancing towards acceptable solution both from the social and technical perspective, providing detailed information on possible alternatives.

The main conclusions of the case are:

→ **The complex nature of coastal erosion and the non-existence of optimal technical solutions demand to move beyond the existing assessment framework.** This case has put into evidence that the nature of the erosion problem is highly complex and characterised by a high degree of uncertainty. This implies that any technical solution comprises a series of uncertainties linked to the very dynamism of this coastal system. The diversity of opinions regarding the potential alternatives in the same field of expertise, civil engineering, is a sign that optimal solutions do not exist. Moreover, the case has also shown how some of the alternatives might have social and environmental costs that are too high to be accepted.

Therefore, a problem as complex as coastal erosion cannot be assessed in an isolated manner without taking into account the dynamics of whole reference system, because new negative and irreversible impacts may emerge as a

consequence. As a result, the existing assessment frameworks are not fit for purpose in managing environmental problems and satisfy social needs. The reductionist vision of the Sitges coastal erosion problem as a beach rather than a broader coastal system problem left out the framing many important elements for the local society and the environment. As a consequence, those interventions with significant perceptive impacts (e.g. texture, sand colour, slope, beach extension) that can modify the littoral landscape can be rejected by the society. For example, the Sitges' maritime boulevard was highly modified in the proposed intervention without considering that it was an important symbol of the local identity, a very representative and valuable landscape.

→ **The role of the experts should be reformulated within the assessment process.** The management of erosion can not be the exclusive competence of experts, although has to include a diversity of perspectives that conforms the socio-ecological system under study. Notwithstanding, experts have a relevant and indispensable role. Their role within the integrated assessment processes should be rethought. As we have seen in the Sitges case, they can act as advisors both to the administration and to the social stakeholders, explaining and warning about the environmental impacts, the uncertainties that affect the projects and the alternative options that could be taken into account in decision-making processes. This role is essential if it is performed with high scientific rigour and in a transparent way, highlighting the uncertainties present for each alternative.

→ **Interdisciplinarity entails opening up alternative creation and developing socially and ecologically robust strategies.** Until now, Spanish as on coastal protection has been characterised by primarily using technical knowledge from civil engineering and the geosciences. This fact has considerably reduced the consideration of other types of knowledge sources and dismissed other ways to develop and implement long-term sustainable, efficient and equitable alternatives. These expert approaches have prioritized strategies of holding the line instead of those more involved with integrating natural dynamics of coastal systems in spatial and economic planning such as restoring dune systems or returning land to the sea. Neither those alternative that deal with the origin of the problem such as dismantling dams, ports or deconstructing buildings placed on the ancient dunes or wetlands have not been considered. Integrating other disciplines in the evaluation of coastal problems, such as sociology, biology, urbanism and environmental science

could facilitate and enrich the process of generating and implementing more sustainable alternatives. Interdisciplinarity is therefore a required condition to advance towards integrated assessment of coasts.

→ **Rigidification strategies in coastal environments respond to a technocratic paradigm which is characteristic of the Spanish Policy Framework.** As we have seen, the hegemonic technocratic paradigm of a controlling nature does not consider surprises or changes which increases the vulnerability of coastal systems making them more unprotected and less prepared in the face of sudden changes, such as those that can arise as a result of climate change. Policies of rigidification and artificialisation implemented over recent decades have brought the concept of stability to a ridiculous, extreme situation, with a misconceived static conservationist goal. This perspective is fully in conflict with the own coastal system nature which is highly dynamic, especially when it comes to sedimentary systems.

→ **The current Spanish institutional framework does not favour public participation and integration in the coastal assessment and management.** Traditional assessment processes are sheltered by the current regulatory and institutional framework. The case of Sitges has proved that the current institutional configuration and the existing mechanisms of decision-making processes are barriers to promoting the processes in line with the IA principles and especially with regards to the consideration of public perception and local knowledge. Firstly, Spanish coastal policy is split between multiple institutions at various administrative levels, often with conflicting objectives which hinders the transversal integration of coastal management. Secondly, strong centralisation of competencies in the area of coastal protection and the rigidity of coastal law makes very difficult to establish positive synergies with other institutional stakeholders at lower hierarchical levels. Thirdly, and as a consequence of this, there is a great lack of coordination and liaising mechanisms among the different levels of government. Finally, participation is still merely relegated to the consultative phases.

Therefore, the current institutional framework does not favour efficient participation of social and economic stakeholders in the assessment process. Formal public participation is restricted to the final stage of the process which gives very few opportunities to modify projects. There are no formal mechanisms to assess local needs *a priori*. Dialogue and public debate from the

very first stages of the process would be an initial step to integrating other legitimate values and perceptions such as those present within the local society.

→ **Social capital influences the capacity to deal with sustainability issues.** As we have seen, in this institutional context, social demands are mostly transmitted through informal channels. This conditions the influence and the capacities and resources of the leading social groups (social cohesion and capacity for organization and mobilization) instead of providing systematic and transparent participation through institutional channels. The case of Sitges is an example of how strong social capital entailed a powerful collective action which helped to firmly react against an external project.

→ **The challenge to address institutional issues in order to enhance future sustainability of coastal systems is a critical aspect in Spain.** With an appropriate structure of governance for distributing and sharing rights and responsibilities for management, it is likely that more direct links would be formed between stakeholders, while information would more easily flow between them and learning processes would likely to occur. Enhancing institutional resilience is the key element for dealing with changing environmental systems in the long term.

9.4 Contributions from participation and MultiCriteria Analysis (MCA) to deal with multidimensional coastal erosion risks. Conclusions on the Lido de Séte Case study.

The case study of the Lido de Séte provides an illustration of the inefficiency of most of the practices coastal management until the present, based on conventional one-dimensional assessment processes and short-term perspectives, mainly engineering-oriented. The aim of this study was to explore the feasibility of combining participation with an MCA tool that facilitates the structuring of environmental problems within a flexible and context-adaptable framework.

The main conclusions can be summarised as follows:

→ **MCA helps to structure and facilitate the integration of diverse sources of relevant information.** We have seen how MCA enabled the integration of information from different scientific fields and from society. It allowed to capture the different dimensions of the problem, enabling the

combination of qualitative and quantitative information as well as the use of different languages coming from a variety of disciplines and stakeholders.

→ **Participation can open up alternative creation and implementation of integrated adaptive responses to coastal erosion management.** The case study of Séte illustrates how the participation helped in extending the problem framing of the reference system and in opening it up for new alternatives beyond the expert ones in order to devise a more adaptable and resilient future for the use of coastal systems.

Apart from the intrinsic dynamics of coastal systems, climate changes offer a new argument to reconsider the "whatever the cost" protection policies and to move towards more adaptive policies which accept the dynamic nature of the coast, such as managed realignment. In this sense, one of the most outstanding contributions of making the assessment process participative since its beginning has been the inclusion of other perspectives (or even cosmovisions) in the problem and alternative definitions. Apart from "hold-the-line" strategies which are mainly from a technocratic perspective, trying to control and dominate coastal dynamics, other more adaptable and resilient alternatives have been considered. In the case of Séte, "Managed re-treatment" and the restoration of natural elements such us the dune system was incorporated in the evaluation process.

Managing qualitative information facilitated the treatment of uncertainty and facilitates communication. The use of qualitative information helped in managing and showing uncertainty as well as facilitating communication and dialogue among stakeholders. However, we are aware that the evaluation of qualitative research is always a conflictive issue. In order to overcome this drawback, participation is very helpful to provide validity and robustness. Participation acts as a controller and validates the process, minimising the effects of the researchers' biases.

→ **Participation is required to provide socio-ecological robustness to assess risks with high degree of uncertainties.** However, the validity and credibility of such a set of methodologies strongly relies on how participation has been carried out all along the research process and how they provide opportunities for social robustness and for engaging stakeholders in assuming responsibilities, risks and uncertainties.

The flexibility of the participation combined with MCA can also be a double-edged sword, as it can yield ambiguities and weak, policy-irrelevant results. Nonetheless, it offers good opportunities to address a problem of conflicting interests involving "social control" of the outcome and generating a wide variety of knowledge sources to inform the decision-making process in a more socio-ecological robust manner. Furthermore, by constructing categories in a bottom-up fashion it is possible to some extent, minimise biases derived from using categories and criteria defined *ex-ante* by researchers themselves, thus improving the quality of the outputs in terms of enhancing social robustness and external validity.

→ **Participation within MCA allows to include perspectives, criteria and modes of reasoning by groups that are usually under-represented or not represented at all in political and risk assessment discussions of coastal system management.** Such an approach can enhance the procedural equity of the research process by promoting the integration of the "low" voices.

9.5 A 3-step procedure for bringing social perspective into the assessment of coastal systems

The three case studies presented in this dissertation are relatively different regarding the problems addressed, and also in regard to their methodological approaches. However, these methodological perspectives are complementary as they aim at integrating social perspectives in the process of assessment of beach quality and coastal erosion risks. The three cases have produced relevant insights that have been progressively integrated in the generation and evaluation of policy alternatives.

In the framework of the Integrated Assessment (IA) of coastal system, we propose the following methodological sequence, where each step might be deepened with greater or lesser intensity depending on the objective and conditions of the process itself.

→ **Baseline analysis of the values and perceptions of society.** This first step implies recognising the initial situation. Through the study of public perception a radiography of the interests, values and perceptions present in society in relation to the addressed topic (such us the case of beach quality in tourist areas) is undertaken.

In this stage, different methodological perspectives, quantitative and qualitative, complement each other. Qualitative methods play a more illustrative part in the process; statements in the open interviews are then tested and explained by their confirmation and frequency in a quantitative survey. It is conceived as the complementary compensation of the weaknesses and blind spots of each individual method.

This step principally generates descriptive results on the social dimension, although their contributions can be very relevant to set the baseline for the assessment process. Firstly, it can produce information on social behaviour, socio-demographic factors and trends on the use and degradation of natural resources. Secondly, it can contribute to understanding how society interprets environmental problems affecting the coasts and evaluates the level of information and environmental awareness. Thirdly, it allows the analysis of the degree of acceptance that future management proposals can have. Finally, it can be an evaluation tool to assess needs and opportunities in environmental education and formation, offering guidelines to the public administration to orientate and readdress their communications and awareness campaigns. This is the first step to giving a bottom-up perspective to the management of coastal systems.

→ **Mapping stakeholders' relationships to identify barriers and opportunities to implementing integrated strategies.** This step implies carrying out an institutional analysis that might be accompanied by conflict-mapping or a study of the relationships (i.e. types of relationship and information and communication flows).

In this step qualitative methods (e.g. in-depth interviews, group interviews and focus groups) are preferred because it is mainly a search for contents and discourses analysis.

Furthermore, this sort of analysis allows information on several issues to be gathered. First, identifying stakeholders' interests, reasons for their positions and areas of agreement and disagreement; Second, contributing to provide a holistic frame of the problems at stake; Third, this approach might foster or help to emerge new strategies or alternatives for problem resolution. Finally, it can identify those elements that might be opportunities or barriers in the process of integrated assessment.

Up to this point, a complete and broad understanding of the social environment and its performance is given. With this information we move to the culminant process of evaluation.

→ **Public participation mechanisms in the Integrated Assessment.** This stage implies accompanying the evaluation with public participation. Apart from the argument on legitimating, the use of participative and deliberative methods combined with the tools to aid decision-making such as MCA permits the generation of more sustainable alternatives. In coastal systems, understood as dynamics and in constant change, participation becomes a mechanism to make the treatment of the complexity, uncertainty and the use of different languages more transparent.

Furthermore, this type of exercise has a double social function. On the one hand, they are mechanisms to produce environmental awareness as a result of the social learning they imply. On the other, they can be tools give society co-responsibility for the risks that certain alternatives involve.

9.6 Some recommendations and future for research in the IA of coastal systems.

As I mentioned in the preface, this thesis is a reflection on my personal learning process in the research. Therefore, I would like to finish my thesis giving some recommendations regarding the research related to the integrated assessment of coastal problems in order to improve drawbacks and pitfalls that I have experienced during this process. I finally finalize suggesting some new questions to address in future investigations.

The recommendations on the research are:

→ **Enhancing a cooperative research.** One contribution of this thesis is to provide some relevant insights regarding how to work under interdisciplinary conditions. It has been shown that combining social science with natural and geo sciences to address coastal systems characterised by complex problems without optimal solutions is very useful. Notwithstanding, there is still a lot to do in the field of real practical interdisciplinary research. There are great potential for transforming current practices regarding the assessment and management of coastal system from a single, top-down, technical orientation to a more integrated, participatory approach. However,

there is a lack of culture on interdisciplinary research in Spain. Most of so-called interdisciplinary studies are done by teams with a poor diversity of disciplines. Interdisciplinary means working and developing processes with different fields of expertise from disciplinary to lay knowledge but generating and integrating new information is not just the sum of disciplines. In order to do this, many attitudinal skills should be promoted such us ability to listen and communicate, to encourage mutual learning, collaboration, team working, empathy and respect towards other disciplines. Moreover, integrative methods should also be used. Finally, an interdisciplinary approach deals therefore with cooperation in research instead of competition.

→ **The creation of a new expert.** The conventional scientific expert in a specific discipline, as we have seen in the case of Sitges, could ignore other relevant elements or questions outside their area of knowledge. For that reason, it is important to create in these IA processes the expert position of integrator who should have good skills of analysis, information management and knowledge of different languages. The integrator should be responsible for facilitating and coordinating the process and guarantee the generation of interdisciplinary knowledge.

→ **Bringing integrative science to coastal managers**. It is important to work in close cooperation with actors and managers in order to fine-tune research with social demands. Coordination mechanisms within research should be created so as respond to problems faced by coastal managers. In this sense, Integrated Assessment could be an appropriate framework to establish an interface among science, policy and society as it can facilitate the process of bringing together different sources of knowledge.

There is a lot of literature on ICZM, many of the studies diagnosing and characterising the problems; now is the moment to look to the future and to be more propositive and merely critical. In the light of this statement, future research lines are:

→ ***Ex-post*** **analysis of potentially resilient institutional frameworks should be carried out.** Identifying outstanding elements, drawbacks and opportunities of successful initiatives should be performed in order to assess the feasibility of them implementing in new places.

For example, it would be interesting to evaluate the applicability of creating a partnership for the Catalan coast in the style of the Anglo-Saxon forums (e.g. Standing Conference On Problems Associated with Coastline, Initiative of Essex Estuaries) in order to improve the legitimacy of local proposals and decisions and to assure that projects are adjusted to social needs. Moreover, operative mechanisms of cooperation and collaboration should be investigated in order to improve the transversal and vertical integration of the administrations and their responsibilities.

→ **New strategies of coastal planning should be launched.** Based on a depth analysis of the current panorama of the coastal planning (e.g. *Directrices Nacionales de Gestión Integrada, Pla Director Urbanístic del Litoral, Pla Metropolità del Litoral de Barcelona*) it is necessary to arbitrate a logical and coherent take-off that provides cohesion between existing and disconnected plans. This should be expressed through research with a systematic and sustainable perspective, based on the accountability principle and providing coordination in management. The result could be in a form of strategic planning.

→ **New development models and their impacts should be *ex-ante* assessed.** In a panorama in which the current socioeconomic model is called into a question, new proposals emerge which should be previously evaluated. For example, more research should address innovative alternatives to beach tourism and investigate the environmental implications of more extensive models or so-called “quality tourism”. This should be developed through the construction of future scenarios and the use of indicators in order to appraise their implications and risks from the ecological, social and economic perspectives.

→ **Innovative and creative practices should be developed.** The complexity of coastal systems demands imagination and creativity in finding and testing new alternatives.

For example, investigations should be carried out on how strategies such as managed realignment of the coastline - by deconstructing and recovering the natural dynamics- should be addressed from a wide range of perspectives i.e. legal, juridical, social, technical and economical implications.

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