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Multi-risk assessment and users' perception: a further step towards ecosystem-based beach management

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by

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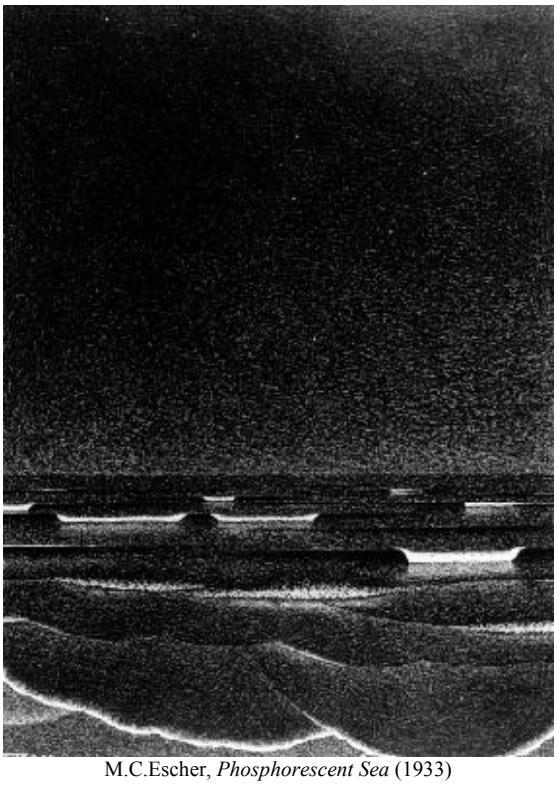

M.C.Escher, *Phosphorescent Sea* (1933)

Diego *no conocía la mar. El padre, Santiago Kovadloff, lo llevó a descubrirla.*

Viajaron al sur.

Ella, la mar, estaba más allá de los altos ***médanos****, esperando.*

Cuando ***el niño y su padre*** *alcanzaron por fin aquellas cumbres de arena, después de mucho caminar,* ***la mar*** *estalló ante sus ojos. Y fue tanta la inmensidad de la mar, y tanto su fulgor, que el niño quedó* ***mudo de hermosura****.*

Y cuando por fin consiguió hablar, temblando, tartamudeando, pidió a su padre:

- ***¡Ayúdame a mirar****!*

Eduardo Galeano
El Libro de los Abrazos

Quiero agradecer…

A **Cate** por su permanente e incondicional apoyo, su paciencia y su fortaleza, su iniciativa y su perseverancia, su crítica y su comprensión, su alegría y su rabia…mi imprescindible compañera en esta aventura. A **Tomás** y **Lucas** por sus reclamos y sus risas, sus peleas y sus caprichos, sus preguntas y sus besos, sus teorías y sus abrazos…son lo más grande y maravilloso que me ha pasado jamás.

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Resumen

Esta tesis doctoral trata sobre las estructuras de gestión de las playas, y específicamente sobre la necesidad de mejorar la integración del paradigma socio-ecológico en los dichos sistemas. Esta tesis se basa en la hipótesis de que para lograr un uso sostenible de las playas dentro del actual paradigma socio-ecológico resulta crucial que la gestión de estos sistemas avance hacia una visión holística y verdaderamente integrada basada en los ecosistemas. Sin embargo, la escasez de herramientas y sistemas para la gestión de estos sistemas socio-ecológicos de manera holística ha sido identificada como uno de los principales obstáculos para hacer frente a esta necesidad. El objetivo de esta tesis es aplicar y desarrollar un conjunto de herramientas y metodologías basadas en la introducción de los principios del enfoque ecosistémico en la gestión de playas. En nuestro caso, dicha gestión debe lidiar con un doble objetivo, que implica el cuidado de los sistemas socio-ecológicos pero también incluye los intereses humanos para obtener beneficios. El estudio se ha desarrollado a lo largo de la Costa Brava (Mediterráneo noroccidental), un buen ejemplo de una zona costera claramente afectada por el turismo, que alterna playas urbanas, semi-urbanas y naturales.

Como una mise en scène este trabajo comienza con una breve descripción de la evolución de los principales paradigmas de la gestión ambiental, con especial énfasis en la gestión de costas y playas. Se analiza la situación actual de la gestión de playas en España, así como las diferencias entre los sistemas actuales y la mayoría de las políticas internacionales y europeas en materia de gestión costera y marina. Los resultados confirman la necesidad de una gestión holística e integrada de las playas, basada en las "fuentes" y no sólo en los "recursos", así como la urgencia de desarrollar nuevas herramientas y metodologías que puedan ser realmente implementadas.

En este contexto, y como su principal contribución, esta tesis propone un marco metodológico basado en la evaluación de riesgos por múltiples eventos como una herramienta para mejorar la gestión de las playas. Esta metodología permite a los administradores identificar y priorizar las principales amenazas, que potencialmente perturbarían la playa y afectarían a los servicios ambientales brindados por el sistemas. Como resultado, los administradores serían capaces de adaptar sus estrategias de gestión de acuerdo con sus prioridades, sus visiones del sistema, y su disponibilidad económica. Esta metodología fue validada en la playa de S´Abanell, donde siete eventos de riesgo y seis servicios ambientales proporcionados por la playa fueron identificados. Si bien algunos de ellos podrían ser específicos de este sitio, la mayoría pueden ser considerados como comunes a muchas playas del Mediterráneo. Esta metodología formaría parte del Pilar de Gestión del Ecosystem Based Management System (EBMS), un novedoso sistema formal de gestión de bienes públicos desarrollado para entornos costeros y marinos.

En esta tesis las playas son analizadas como sistemas socio-ecológicos, donde los factores sociales pueden generar impactos ambientales significativos. En este sentido, se pretende la incorporación de las motivaciones, percepciones y comportamientos

humanos en los procesos de gestión. En esta disertación las percepciones y opiniones de los usuarios han sido analizadas como posible retroalimentación de las medidas de gestión. Aprendiendo a partir de actuaciones previas, esta evaluación permite priorizar futuras medidas, a partir de la realidad percibida por los usuarios. Las percepciones de los usuarios se han evaluado de forma comparativa en dos escenarios antagónicos: una la playa urbana (S´Abanell) y una playa natural protegida (Sant Pere Pescador). Aunque las percepciones de los usuarios parecieron muy similares, los atributos naturales fueron considerados una prioridad en el escenario protegido. Si bien existieron diferencias significativas, estas no fue tan importante como se hubiera asumido a priori. En cuanto a Sant Pere Pescador, esto podría deberse a una combinación de la reducida información brindada a los usuarios, de una gestión que no destaca como debería los atributos naturales de la playa, y una fuerte influencia del entorno condicionado por una gran tradición de turismo de masas. La participación pública en los procesos de gestión debe facilitar la corrección (e.g. revalorizar los atributos naturales de la playa de Sant Pere Pescador) y mejora (e.g. intensificar la recolección de residuos marinos en la playa S´Abanell) de las actuaciones anteriores, con el objetivo de mejorar la gestión de las playas. La participación del público formaría parte del Pilar de Participación del EBMS.

Por último, la implementación real de estos enfoques integrados de gestión de playas también ha sido destacada como una necesidad esencial. En este sentido, este estudio ha abordado un componente clave de esta dificultad, identificando las autoridades y oficinas a cargo de la gestión de playas a través de un análisis institucional. Para ocho playas de la Costa Brava esta evaluación identificó las duplicaciones y las ausencias en la gestión de los procesos clave que sustentan las principales funciones de playa. Asimismo, mostró la gran diversidad y complejidad de las estructuras actuales de gestión de playas de esta zona del Mediterráneo español. Los resultados obtenidos confirmaron el particular énfasis que la gestión actual da a la función recreativa de las playas. Estos resultados establecen además con claridad que la gestión de playas está activa principalmente durante el verano, y especialmente en la temporada de baño (de Junio a Setiembre). En cuanto a las estructuras de gestión, si bien las tres principales órbitas jurídicas involucradas en la gestión de las playas en España fueron claramente reconocidas (i.e. Gobierno del Estado Español, Gobiernos de las Comunidades Autónomas y Gobiernos Municipales-Ayuntamientos), una infinidad de diseños han sido identificados para los distintos Ayuntamientos analizados. El actual modelo se basa en la gestión de responsabilidades, con medidas de gestión altamente fragmentadas. Diversas cualidades socio-ecológicas del sistema son consideradas por separado y en solitario, por diferentes administradores con disímiles objetivos y responsabilidades. La eventual aplicación de nuevos planes de gestión se ve obstaculizada por esta complejidad y los potencialmente conflictivos objetivos estratégicos de los distintos niveles, “brazos” y oficinas de gobierno presentes en una determinada área geográfica.

Las metodologías presentadas en esta tesis doctoral contribuyen al desarrollo de una vía que permita pasar de un modelo de gestión de las playas basado en competencias a un modelo integrado basado en resultados. Esto está fundado en la aplicación del enfoque ecosistémico en la gestión sostenible del sistemas socio-ecológico playa.

Abstract

This dissertation is about beach management frameworks, specifically about the need for a better integration of the social-ecological paradigm into present beach management schemes. This dissertation is based on the hypothesis that for a sustainable use of beaches within the present *social-ecological paradigm*, it is crucial to move towards a holistic and truly integrated ecosystem-based management system applied to beaches. The scarcity of tools and frameworks to manage these social-ecological systems in such a holistic manner has been identified as one of the main constraints to address this need. The goal of this thesis is to develop and apply a set of tools and methodologies based on the introduction of the Ecosystem Approach principles to beach management. In our case, beach management needs to deal with a double objective: to care about the social-ecological systems and to consider human interests for making profits. The study has been developed along the Costa Brava (Northwestern Mediterranean), a good example of a coastal area highly affected by tourism that alternates urban, urbanized and natural beaches.

As a *mise en scène* the work starts providing a brief description of the evolution of major paradigms of environmental management, with special emphasis on coastal and beach management. It analyzes the present situation of beach management in Spain, as well as the gap between the beach systems currently used and most of the International and European policies on coastal and marine management. Results confirm the need of an integrated and holistic beach management based on "sources" and not only on "resources", as well as the urgency of developing new tools and methodologies that could be really implemented.

In this context, and as its main contribution, this dissertation proposes a methodological framework based on multi-hazards risk assessment as a tool to improve beach management. This methodology allows managers to identify and prioritize the main hazards potentially disturbing the beach and affecting existing ecosystem services. As a result of this, managers should be able to adapt their management strategies according to their priorities, visions of the system and availability of economic resources. This framework was applied in S´Abanell beach, where seven main hazards and six ecosystem services provided by the beach were identified. Although some of them could be cited as site-specific, most can be considered as common in many Mediterranean beaches. This methodology would be part of the Managerial Pillar of the Ecosystem Based Management System (EBMS), a novel formal system of public good management developed for coastal and marine environments.

In this thesis, beaches are analyzed as social-ecological systems, taking into consideration the idea that social drivers can produce significant environmental impacts. Therefore, motivations, perceptions and human behaviors should be incorporated into management plans. In this dissertation the assessment of users' perceptions has been used as feedback for management measures. Learning from previous actions, this assessment allows prioritizing future measures based on the reality perceived by users. Users' perceptions have been assessed in a comparative manner to two antagonistic settings: an urban beach (S´Abanell) and a natural beach (Sant Pere Pescador). Although users' perceptions seemed quite similar, natural attributes have been considered a priority in the protected setting. However, this difference was not as important as would be expected a priori. As far as Sant Pere Pescador is concerned, this could be due to a combination of the reduced information provided to users, a management framework that does not properly highlight beach natural attributes, and a strong influence of the surroundings with a great tradition of mass tourism. Public participation in management processes should allow the correction (e.g. revaluate the natural attributes of Sant Pere Pescador beach) or the enhancement

(e.g. intensify sea waste harvest in S´Abanell beach) of previous actions, in order to improve beach management. Public participation would be part of the Participatory Pillar of the EBMS.

Finally, the real implementation of beach integrated management approaches has also been highlighted as a critical need. In this sense, this study has addressed another key component for the assessment by means of an institutional analysis, identifying responsible authorities and key officers in charge of beach management. For eight Costa Brava beaches our assessment identified duplications and absences in the management of key processes underlying main beach functions. Likewise, it showed the great diversity and complexity of the current beach management structures of this zone of the Spanish Mediterranean. The obtained results confirmed the particular emphasis that current management practices are given to the recreational function of the beach. They also make clear that beach management is active mainly during summer and especially during the bathing season. Concerning management structures, even if the three major legal scales involved in the Spanish beach management (i.e. Government of the Spanish State, Government of Spain Autonomous Communities, and Municipalities) were clearly recognized, a *myriad* of layouts have been identified within the Municipalities. The actual model is based on managing responsibilities, where highly fragmented management practices are common. Different social-ecological qualities are considered separately by different actors having different objectives and responsibilities. Further implementation of potential new management plans is hampered by the complexity and potentially conflicting jurisdictional policy objectives of various levels and arms of government and offices in a given geographical area.

The methodologies presented in this dissertation contribute to the development of a pathway in order to move away from a competence-based model of beach management to an integrated beach management model based on results. This is based on the application of the ecosystem approach to the sustainable management of beach social-ecological systems.

CONTENTS

Chapter 1
Introduction

1.1- Background and motivation

Beaches are social-ecological systems where physical, ecological, social and economic dimensions interact. Beaches improve human well-being to a significant extent, providing several environmental goods and services such as disturbance regulation, leisure and recreation, habitat, cultural heritage and identity, nutrient cycling, , gas and climate regulation (de Groot, 1992; Costanza et al., 1997; Farber et al., 2006; Brenner et al., 2010). Three main functions can be recognized: *1) Natural function* providing natural sceneries and ecological reservoirs, including physical supports for ecosystems; *2) Recreational function* which considers the beaches as an area of leisure and free time for the users; and *3) Protection function* which concerns the beaches capacity to absorb the wave's energy during the impact of coastal storms, protecting the hinterland's infrastructures during and after the storm (Ariza *et al*, 2008b).

Beaches are one of the most important coastline units requiring management, but, as in other coastal areas, they have been traditionally managed by sectorial approaches dealing with specific resources in isolation, even if these managed resources (or activities) belong to a web of ecological processes and human interactions (Hildebrand and Norrena, 1992). Thus, in spite of beaches provide different functions, in most coastal areas, and especially in regions where tourism is one of the main economic drivers (e.g. NW Mediterranean), managers tend to prioritize the recreational function. Accordingly, beach management is primarily aimed at ensuring quality standards, fulfilling user expectations, and optimizing this commercially-oriented function without taking other values or characteristics into consideration (James, 2000; Roca and Villares, 2008; Ariza et al., 2008b, 2010).

The great importance of beach tourism industry for the Spanish economy has been largely documented (Breton et al., 1996; UNWTO, 1999; Sardá and Fluvia, 1999; Suárez de Vivero and Rodríguez-Mateos, 2005; Valdemoro and Jiménez, 2006; Ariza et al., 2008; Roca et al., 2008). Around 10% of the Gross Domestic Product (GDP) of Spain is linked directly or indirectly to beaches (mass tourism of "sun and sand model", Aguiló et al., 2005), which are one of the most marketed products. This percentage can go up to extremely high values (around 50%) like in the Balearic island when an economic monoculture has been created around these coastline units. In the Mediterranean Spanish coastal area, beaches are, then, a major attraction and probably the main asset to be managed. For years, beach units have been treated just as tourism products ready to be used as a deliver of potential earnings for a whole industry behind. However, due to this sectoral approach, this promising industry has already started to decimate the environment (Sardá and Fluviá, 1999; Suárez de Vivero and Rodríguez-Mateos, 2005) and thereby the recreational experience of tourists (Roca et al., 2009).

Nowadays, it is recognized that human activities and the ecosystems in which they occur should be managed as a whole (*human-in-nature* concept, Berkes and Folke, 1998). This is the fundamental basis for the Ecosystem Approach and has resulted in the emergence of the concept of social-ecological systems, reflecting the inextricable link between society and ecology. In this sense, the vast majority of European and national policies of environmental management are currently based on the principles of Ecosystem Approach (EA) and promote an ecosystem-based management (EBM) as the pathway towards the sustainable use of resources (e.g. IPPC, WFD, MSFD). In synchrony with this evolution of management, but in a slightly higher scale to which is addressed in this thesis, the Integrated Coastal Management (ICM) has been identified as a possible outline for attaining the sustainable development for coastal areas, including beaches. This would be possible by *i)* maintaining the functional integrity of the coastal systems, *ii)* reducing resource-use conflicts, *iii)* maintaining the health of the environment, and *iv)* facilitating the progress of multisectoral development (Chua, 1993). Based on a holistic view of these systems, the ICM is carried out through an iterative cycle of policy formulation and implementation (e.g. Olsen et al., 1998), allowing for learning and adaptation within the process.

Nevertheless, despite the great development that ICM has had during the 1990s, and its recent revitalization within the actual *social-ecological paradigm*, there still exist an implementation gap between rhetoric and practical reality. As Glavovic (2008) points out, "even when commitments to pursue sustainable coastal development through integrated coastal management are translated into policy and law, unsustainable practices persist" (in Kannen and Burkhard, 2009).

Beach coastal units are clear examples about this implementation gap between rethoric and practical reality. Although today's beach social-ecological systems are mostly considered in terms of the recreational opportunities they provide and other ecosystem services offered are undervalued and/or not considered in decision-making processes, we need to develop new frameworks to introduce the social-ecological paradigm in their management. The concept of a tourist beach as a tourist product ready to be offered to mass tourism has gain relevance for decades and it has open a complete dedication of beach manager to servitization activities. We have seen the development of innovative ideas of beach managerial organization's capabilities to increase the value and to better sell the complete product (beach)-service package, exactly as we have seen in many manufacturing companies (Neely, 2008). As a consequence of these processes an entire bunch of standard systems, certification procedures were created to audit the quality of such servitization activities. However, these coastal units are something else than mere tourist products. They should be considered as social-ecological systems providing multiple functions not just to people but also to other organisms dependent on these physical environments. To date, the modern environmental management associated to beaches should be able to recognize these issues. There is clear evidence that under the above premises, beach management must be holistic, integrated, well coordinated and based on interdisciplinary approaches (Ariza et al., 2008a; Cheong, 2008; Forst, 2009; Sardá et al., in press).

1.2- Objectives of the thesis

Within this general context, the ***general objective*** of the thesis is to develop and apply a set of tools and methodologies based on the introduction of the Ecosystem Approach

principles for the improvement of beach management frameworks. In order to do that, we took use of the innovative introduction of a new formal system of public good management for coastal and marine environments, the Ecosystem-Based Management System (EBMS) (Sardá et al., 2010a; 2010b) to start to check its possible utilization in beach management frameworks. The EBMS was designed to combine classical Environmental Management and Risk Management Systems (EMS, RMS) theory with the Ecosystem Approach principles. For beaches, where performance standards are usually met, the use of the EBMS could allows us to take a further step, not only to "do things right" but also to "do the right things". In this way, we could introduce sustainable principles in the management of beaches, we could improve eco-effectiveness in its management and, depending of the reality of the situation of each single beach, we could work with the entire beach social-ecological systems under a general framework.

To achieve the general objective, three ***partial objectives*** have been considered:

- To develop a framework to incorporate Risk Analysis into planning for beach management, in order to assist decision-making prioritizing issues and focusing efforts in response to risks threatening beach ecosystem services.

In order to promote the integration of the social dimension of the beach in its management tow components of this dimension have been considered in this thesis:

- To analyze beach users' perceptions as a component of an integrated and ecosystem-based beach management.

- To analyze the institutional framework behind the current beach management.

1.3- Structure of the thesis

This thesis has been developed in order to fulfil the three objectives defined in the previous section, and thus this document is organized as follows. Chapter two provides

the conceptual framework for the work developed in the thesis. It briefly presents the evolution of major paradigms of environmental management, with special emphasis on coastal and beach management. It analyzes the present situation of beach management, as well as its challenges facing a sustainable use of these systems.

Taking into account the formal framework where this work fits in, and making use of existing management methodologies, the third chapter presents the development and application of a methodological framework for multi-risk assessment in beaches. In the second section of this chapter, the framework is applied to S´Abanell beach (Costa Brava, Girona, Spain).

The fourth chapter presents the analysis of beach users' perceptions, which can be considered as some kind of management auditing. The first section details the analysis of users' perceptions in Sant Pere Pescador, one of the last natural and protected beaches of the Costa Brava, while the second section presents the differences in perceptions between users of an urban beach (S'Abanell, already described in the previous chapter) and a natural beach (i.e. Sant Pere Pescador).

The fifth chapter deals with the second aspect considered in this thesis related to beaches social dimension: the analysis of the institutional structure for beach management. This chapter presents the results of an institutional analysis performed to eight beaches along the Costa Brava, including those treated in the past chapters (i.e. S´Abanell and Sant Pere Pescador). The analysis of *Institutions* has already been identified in Chapter 2 as a key component to improve the performance of natural resource management.

The sixth chapter presents the general conclusions of the dissertation, including all conclusions of the five previous chapters. In an integrated way, this chapter analyzes in which way the risk analysis framework, the users' perceptions and the institutional analysis contribute to accomplish the general objective of the thesis.

The seventh chapter lists the references cited throughout the dissertation and complementary materials are provided in annexes.

Chapter 2
Theoretical framework

Nowadays, when human actions are having serious consequences on the well-being of people, and especially on the capacity of landscapes and seascapes to generate essential ecosystem services, manage the environment in a sustainable manner is still a major challenge (Boyd and Folke, 2012). The urgent need for solutions to increasingly complex environmental problems has led to an upsurge in interdisciplinary work. This new perspective broke historical boundaries, and promoted synergies between disciplines (e.g. natural and social sciences) and actors (e.g. academics and practitioners) (Cheong, 2008). That increase in cooperation and combination between different branches of science has encouraged the growth of "merged-topics" such as sustainability science, ecosystem-based management, and social-ecological resilience. Although these approaches have extended in several thematic areas (e.g. agriculture, forestry, or urban environment), to date its application in coastal management has been limited (Cheong, 2008).

The present chapter presents the theoretical framework in which is framed this thesis. Through a historical perspective, this chapter describes the evolution of main guidelines of environmental management, beginning on a global scale (Section 2.1), downscaling to coastal zone management (Section 2.2) and finally focusing on beach management (Section 2.3), the scale on which this thesis has been focused. This chapter is intended to provide context and insight needed to understand both the current state of beach management and its challenges facing a sustainable use of these systems. Section 2.1 briefly describes the evolution of main paradigms of environmental management, and details some of the most important concepts which are mentioned in the following chapters of the thesis (i.e. *Ecosystem Approach* - *Ecosystem Based Management*, *Social-Ecological systems* and *Ecosystem Services*). Section 2.2 briefly describes the Integrated Coastal Management approach, as a particular case for coastal areas of these new integrated and holistic approaches described in Section 2.1. Section 2.3 describes

certain management frameworks and methodologies that will be mentioned and used in subsequent chapters of the thesis. Returning to the historical perspective used in the first section, Section 2.4 presents the evolution of beach management in Spain, as one of the most developed beach management strategies, mainly due to the great tradition of beach tourism.

2.1- Environmental management

Since 1990, world population has tripled, world economy has expanded 20 times (Speth, 1989), and world human ecological footprint has increased sharply (humankind alone consumed yearly 40% of all terrestrial primary productivity, Vitousek et al., 1986). These exponential growths put drastic pressures on the biosphere (our basic environment) asking for a better management of all of its delicate components.

2.1.1. An Inexhaustible Environment

Until the late 1960s a dominant social paradigm was leading our relationship with the environment (Figure 2.1), "the economy became disembodied from nature, in theory and in practice" (Colby, 1991). At that time, "environment" was considered as infinite, and hence it did not enter into economic thinking, since both neoclassical and Marxist economics were mainly concerned of scarce resources (allocation and distribution, respectively) (CITAS2). Nature was considered as an infinite supply of physical resources (i.e. raw materials, energy, water, soil, air) to be used for human benefit, and resource management science was geared for the efficient utilization of these resources (Colby, 1991; Berkes and Folke, 1998). Natural resources were seen as existing for man's instrumental benefit, to be explored, exploited, and manipulated to improve the material quality of human life. However, the main flaw of this paradigm was not to be truly aware of the great dependence of the human economic model on both physical and biological resources, which in turn depends on the delicate balance of interdependent ecological services (Colby, 1991).

2.1.2. Environmental Protection

At the beginning of the 1970s, the Club of Rome published "The Limits to Growth", a stunning report concluding that the world could go out of resources to sustain human populations by the end of the 20th Century. These worries in practice became a bad joke; instead of shortages, the last two decades of the 20th Century were marked by a fast acceleration in natural resource consumption and further environmental degradation. The world ended up enjoying significant declines in almost all commodity prices. Technology and efficiency won and the Club of Rome simply was ignored. However, "The limits to Growth", as well as other important authors as Paul Ehrlich created a kind of "neo-malthusian" activism to just bring into the table the idea of environmental protection.

Since the 1970s, management science has sought to repair the environmental and social problems due to mismanagement and reduction of natural resources (Berkes and Folke, 1998). This was based in a new environmental paradigm (Figure 2.1). Several new approaches emerged, some were closer to this model of resource based management and others less so (e.g. Deep-ecology, Colby, 1991; Berkes and Folke, 1998). Facing the disjunctive between conservation and economic growth, the "environmental protection" and the need of tradeoffs between "development" and "conservation" were highlighted as essentials. Independent Environmental Protection Agencies were created and Environmental Impacts Statements were institutionalized as a rational means for assessing costs and benefits of human activities before they began. However, even if this could be seen as a further step towards sustainable development, in environmental politics and management this was called the "negative agenda" (Colby, 1991).

Rather than focussing on ways to improve both development actions and ecological resilience, this approach institutionalized the focus of damage control (i.e. repairing and setting limits to harmful activity). Moreover, those Environmental Agencies were not responsible for planning more sustainable development activities (e.g. avoiding polluting, protecting and/or facilitating ecological functions), but just for setting the limits, or cleaning up after those limits were exceeded. "Optimal pollution levels" were defined to satisfy short-term economic interest (i.e. politics) rather than to maintain or improve ecosystem resilience (Colby, 1991).

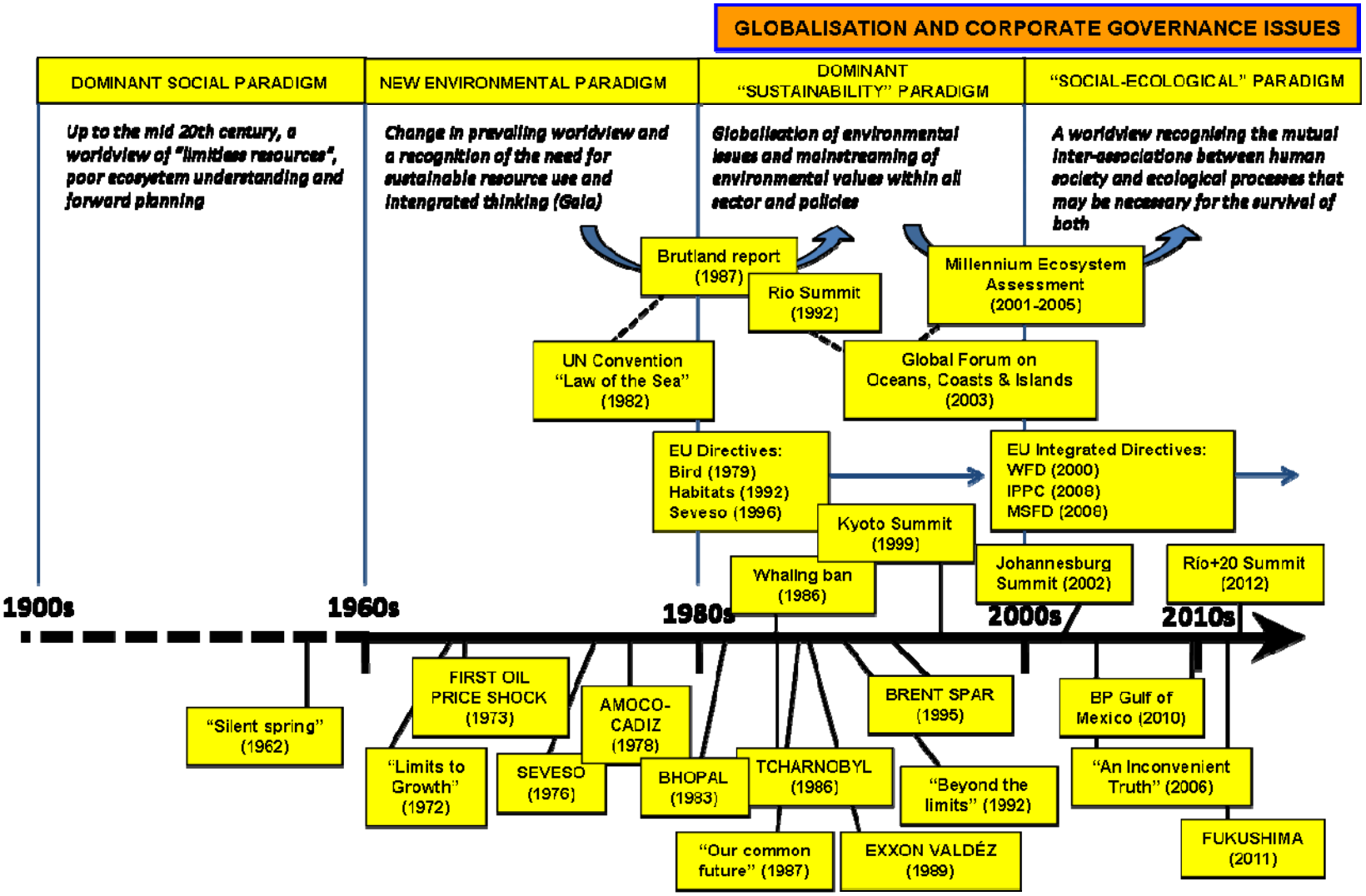


Figure 2.1- A story line of the main paradigms dominating environmental management trough recent decades with some accidents, thoughts and facts (adapted from A. Kannen and R. Sardá pers. comm.).

As within the classical model, the prescription of new technological solutions to mitigate pollution problems has become a key issue of this strategy (Colby, 1991). Furthermore, development balances remained only based on monetary data, which were extremely difficult to obtain for environmental benefits. Therefore environmental management showed more costs than benefits, and governments often have seen environmental concerns (e.g. pollution, wildlife protection) as contrary to their needs, and as the interests of an elite class of rich countries (Colby, 1991).

2.1.3. Resources Management

Despite these policies of control and environmental protection, predictions remained disappointing with a future of "doom and gloom". Within this context "resource management" began to be a major topic (Colby, 1991). The main idea of this approach was to incorporate all types of capitals and resources (i.e. biophysical, human, infrastructural, and monetary) into calculations of national accounts, productivity, and policies for development and investment planning. Thus, although economic growth remained the main objective of development, sustainability was seen as a necessary constraint to growth. The interdependence of resources (i.e. system approach) and their multiplicity of values have been also deemed as fundamental aspects to be managed (e.g. climate and process regulating it) (Colby, 1991).

Around these days, the United Nations Conference on Environment and Development (UNCED) took place in Rio de Janeiro (the Rio Summit, 1992). Solutions to global issues (e.g. war, poverty, gap between industrialized and developing countries) were under discussion, as how to relieve global environmental system through the introduction to the paradigm of sustainable development (Figure 2.1). It emphasizes that economic and social progress depends critically on the preservation of the natural resource, stressing the need for effective measures to prevent environmental degradation. The Rio Summit certified a new deal with the Earth and its environmental management.

In order to achieve that sustainable development within the system approach, a set of new frameworks analyzing links between society and environment have been emerged. The system approach refers to a holistic view of the components of a system and the

interrelationship among them (Berkes and Folke, 1998). One of the great improvements of these approaches was to reconcile the views of both natural and social sciences about the environment. Historically, for natural scientist human actions were just considered as disturbance to the ecosystem, and humans were seldom considered as part of the system. The human dimension of the ecosystems was just referred to political aspects. On the other hand, social scientist usually overlooked the results of natural science. This reconciliation seeks to reverse these partial views that usually cause misinterpretation of results by politicians and laypeople, moving us away from sustainable development (Cheong, 2008).

In the mid 1990s there has been a consensus on the need for a holistic management based on structures, processes and ecosystem functions, to achieve sustainability of natural resources. Yet, in order to understand the nature of sustainability it was necessary to understand how ecosystems and economies were regulated, as well as their relations. While the formers are regulated by natural limitations (e.g. predator/prey relationship, herbivory/plant toxin production), the economic systems are generally limited by supply and demand, and are relatively free of constraints related with carrying capacity (Forst, 2009). As a consequence, natural resource policies should not be based on goods and services demand or arbitrarily set harvests, but on ecosystem functions and processes that generate and guarantee goods and services. Policies should also use specific indicators of ecosystem's health and productivity (e.g. Resilience, see Box 1) as a barometer to guide economic systems (Forst, 2009).

At the turn of Century, the United Nations (UN) called to develop a huge environmental report, the so-called Millennium Ecosystem Assessment (MEA) (MEA, 2005). The objectives of the MEA were to assess the consequences of ecosystem change for human well-being, and to establish the scientific basis for actions needed to enhance conservation and sustainable use of ecosystems. The MEA provides a scientific appraisal of the condition and trends in the world's ecosystems and the services they provide, as well as the scientific basis for action to conserve and use them sustainably. The MEA introduced a new framework for analyzing Earth systems, in which social and ecological parts interact and are considered together (social-ecological systems), which has had wide influence in policy and scientific communities. Studies after the MEA are taking up new challenges in the basic science needed to assess, project, and

manage flows of ecosystem services and effects on human well-being (Carpenter et al., 2009). The MEA gave pass to another paradigm, the social-ecological paradigm (Figure 2.1), in which we are right now and who has introduced a bunch of new ideas, concepts, and approaches.

Box 1- "*Science of surprise"*

Resilience is the buffer capacity or the ability of a system to absorb perturbations, the magnitude of disturbance that can be absorbed before a system changes its structure by changing the variables and processes that control behaviour (Holling et al., 1995). In 1986 Holling notices the existence of a generalized pattern of unexpected changes and resource crisis. That was the beginning of the "science of surprise". This matches the period in which resource management emphasized shifts to improving the efficiency of the methods of resource utilization, in order to supply markets and meet production targets and economic objectives. In this sense resource management tries to control a target resource by reducing its variability, in order to improve its exploitation efficiency. The management policy is successful in the short term, but that causes inadvertent changes in the functioning of the ecosystem, favoring that "surprises" occurs. "This general pattern of unforeseen effects and nasty surprises is thought to occur through a mechanism involving the loss of ecological resilience (Berkes and Folke, 1998)". The effective short term management "freezes" the ecosystem at a certain stage of natural change, actively blocking its environmental variability and feedbacks that are fundamental to govern change. Reducing variability, management does not allow minor alterations to act on the system, and these can add up. As a result, there may be larger and less predictable feedbacks that could affect the functionality of the system and thus the resources and services it provides (Berkes and Folke, 1998).

At this point, some of these relevant concepts and approaches of this human-environment research need to be better explained; concepts such as *Ecosystem Approach - Ecosystem Based Management*, *Social-Ecological systems* and *Ecosystem Services* are taking special relevance and should be described in more detail.

Ecosystem Approach - Ecosystem Based Management

The Ecosystem Approach - Ecosystem (Based) Management (EA, EM or EBM) has been one of the approaches growing consistently within the last decades (Curtin and Prellezo, 2010). Although since the early 1930s the ecosystems were recognized as key issues (in addition to particular species) in several programs for nature conservancy, it was not until the late 1970s that ecosystem-based management really caught the attention (e.g. Craighead, 1979). In this line, in the late 1980s an ecosystem approach to land management was widely supported by both scientists and managers, and since the

mid 1990s most US Federal Agencies with resources responsibilities have officially adopted EM as its new management model (Grumbine, 1994;1997).

The MEA reinforced the concept of the Ecosystem Approach (EA). Nevertheless, the starting point for conceptualization of the EA was the UN Convention on Biological Diversity. The Convention formally sets out a decision on the description of the EA (see its Annex 3 for more details), and worked out a definition: "*The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Application of the ecosystem approach will help to reach a balance of the three objectives of the Convention. It is based on the application of appropriate scientific methodologies focused on levels of biological organization which encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems.*"

The EA is an important concept that has been used in almost all global legal documents to setup the current environmental management. In Europe, and especially in its Marine Environment, it is a principle underlying the Marine Strategy Framework Directive (MSFD), the Common Fisheries Policy reform, or the Mediterranean Action Plan. Recently during the course of the FP/European Union Porject KnowSeas, a new workable definition, coming from its use in Canada, has been introduced. "*An integrated resource planning and management approach that recognizes the connections between land, air and water and all living things, including people, their activities and institutions*". This is the one that will be used throughout this document.

The Ecosystem-Based Management (EBM) was defined as an innovative management approach to address the challenges associated with the emergence of the EA concept: "*an integrated approach to management that considers entire ecosystems, including humans*". The objective of the EBM is "*to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need*" (COMPASS, 2005). However, EA and EBM are difficult to differentiate in practice and should be considered as parallels. In both cases, they are based on considering the whole ecosystem, including humans and the environment, rather than managing one issue or resource in isolation, which represents a clear move from the

more traditional resource management approach. However, they remain based on principles rather than management systems and their application is variable on a case by case basis (Sardá et al., 2009).

The EA-EBM arose as "a response to today's deepening biodiversity crisis" (Grumbine, 1994) and to the widespread feeling that traditional approaches of natural resource management have failed (Curtin and Prellezo, 2010). As opposed to traditional management, the focus within the EA-EBM is on the connections between the elements of the ecosystem and the processes that link them, taking into account the interconnectedness and interdependent nature of its components (Curtin and Prellezo, 2010). Managers' goals are also different, and in this sense, it is useful to distinguish between "resources" and "sources" (Grumbine, 1997). Traditional management has focused on "resources" (i.e. computable wealth gained from nature), and has been mainly concerned about "management production outputs" (i.e. goods and services for humans). Although EA-EBM is also concerned about these outputs, it holds that "sources" (i.e. ecosystem that provides resources) must be protected, and therefore the ecosystem health (e.g. maintain native biodiversity, ecosystem structure and function) is a condition *sine qua non* (Grumbine, 1997). Therefore, "sustainability must be a precondition for management rather than an afterthought (Christensen et al., 1996, in Grumbine, 1997)".

EA-EBM considers all drivers and impacts in relation to their effects on ecosystems structure and functioning that are essential in providing services to human societies (Curtin and Prellezo, 2010). Due to the inherent uncertainty in the knowledge of these impacts and their consequences, the ecosystem is seen as complex adaptive system. Nevertheless, this lack of knowledge should not be used as an excuse. The utilization of the precautionary approach as part of the adaptive management has been identified as essential for the implementation of the EA-EBM (Curtin and Prellezo, 2010).

Adaptive management has been defined as a scientific management approach that explicitly emphasizes the importance of feedback from the environment in shaping policy. Dealing with the unpredictable interactions between people and ecosystems (evolving together), this iterative process is feedback and learning-based (Berkes and Folke, 1998). Management should be considered as a learning process or a continuous

experiment, and managers must remain flexible and adapt to uncertainty in contrast to the rigid structure of traditional management model. Since scientific knowledge is provisional and investigating process is ongoing, management must be also capable of incorporating new knowledge as it becomes available (Grumbine, 1994; Curtin and Prellezo, 2010).

The precautionary principle has often been used in medicine and public health ('better safe than sorry'), but its application to environmental hazards and their uncertainties only began to emerge in the 1970s (EEA, 2001). Since then, it has risen rapidly up the political agenda, and has been incorporated into many international agreements (particularly in marine environments). This principle is a general rule of public policy action to be used in situations where potentially serious and irreversible effects should be prevented, without disproportionate costs (i.e. taking into account the likely costs and benefits of action and inaction) and before there is strong proof of harm (EEA, 2001). It is a general consensus that levels of precaution should be proportional to the amount of information available (Curtin and Prellezo, 2010). This principle helps policy-makers and politicians in circumstances in which waiting for very strong evidence of harm before taking precautionary action may seriously compromise public health, the environment, or both (EEA, 2001).

Another frequently mentioned goal of EA-EBM is the implementation of subsidiarity, trying to manage resources at the appropriate scales. The concept of subsidiarity holds that decisions should be taken at the most appropriate level of government and establishes a presumption that this level will be the lowest available (Golub, 1996). As was proposed by Berkes and Folke (1998), institutions and property right regimes become key elements for improving the management of resources. Institutions were defined as the "humanly devised constraints (formal and informal) that structure human interaction", while property rights were "the rights and obligations of individuals or groups to use the resource base" (Berkes and Folke, 1998). The importance of these factors for resource management arises in the context of the "tragedy of the commons" (Hardin, 1968), which has traditionally been seen as the inexorably destiny of the use of common resources. However, several examples showed that this was not the case when the resources were not open-access but used under communal property rights arrangements. Hardin's tragedy often occurs, not due to any inherent failure of common

property, but from institutional failure to control access to the resource, and to make and enforce internal decision for collective use. Berkes and Folke (1998) suggest that the analysis of jurisdiction and the respective roles of local groups and government agencies should be included in the analysis. In this sense, EA-EBM requires that all stakeholders were involved throughout the process, giving the right holder a sense of belonging and responsibility. The inclusion of their opinions and knowledge improves learning of ecosystem processes, but also ensures more participation and hence less enforcement and monitoring, and gives more legitimacy to the management process (Berkes and Folke, 1998; Curtin and Prellezo, 2010).

Social-Ecological Systems

Today, it has become almost impossible to understand how nature works without society, and society without nature, making useful to categorize the concept of social-ecological systems. Recent ideas as the one of Crutzen and Stoermer (2000) suggesting we are in a new geological epoch that they call *Anthropocene* (see also http://www.anthropocene.info), goes in the direction to analyze earth systems under the perspective of interrelated social-ecological systems. Consistent with many traditional societies, Berkes and Folke (1998) emphasized an ecosystem perspective which explicitly includes the social system in the analysis. Based on the view that "social and ecological systems are linked, and that the delineation between them is artificial and arbitrary", the authors coined the term *social-ecological system*, emphasizing the integrated concept of "humans-in-nature" (Berkes and Folke, 1998).

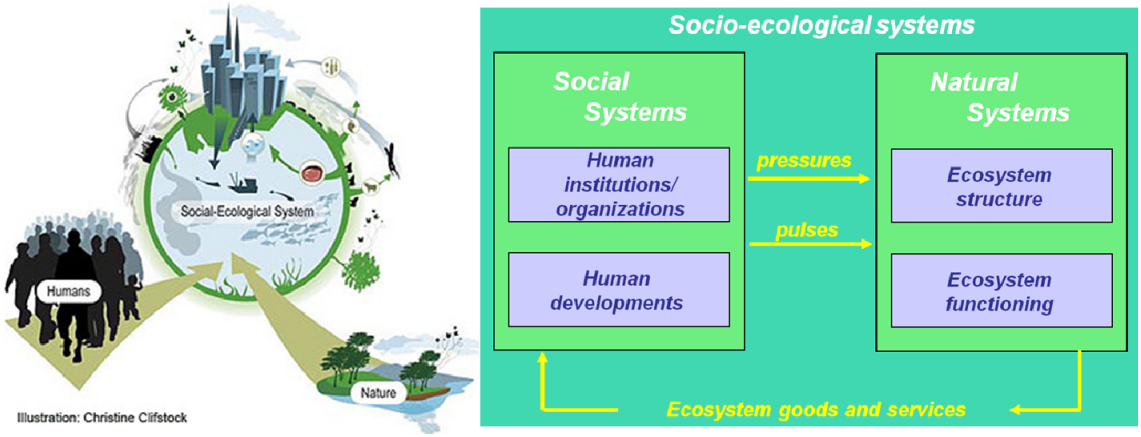


Figure 2.2- Schematic diagram of components of a social-ecological system.

Glaser et al. (2008) have provided a working definition of social-ecological systems: "*A social-ecological system consists of a bio-geo-physical unit and its associated social actors and institutions. Social-ecological systems are complex and adaptive and delimited by spatial or functional boundaries surrounding particular ecosystems and their problem context*." What they have in common is that social-ecological systems are understood to be concrete units in the real world of spatial-temporal phenomena.

Ecosystem services

In the beginning of the 2000s and following the ecosystem approach, the MEA was, as described before, another landmark in the "evolution" of the environmental and resources management. In line with the "humans-in-nature" concept, the results of this assessment were the consensus view of the largest body of social and natural scientists ever assembled to assess knowledge in this area. While scientists and environmentalists have discussed ecosystem services for decades (e.g. Ehrlich and Mooney, 1983; Odum, 1989; De Groot, 1992), one of the most significant contribution of the MEA has been the definition and the introduction of ecosystem services in the global agenda (see Box 2 and Table 2.1). The focus on the environment through the framework of ecosystem services, and their link to human well-being and development needs, has been pioneering in environmental research. From this approach it becomes much easier to identify how changes in ecosystems influence human well-being. Besides, this approach provides information in a way that decision-makers can weigh alongside other social and economic information (MEA, 2005).

Several ecosystem services categorizations have been developed concerning biodiversity conservation, integral environmental assessments and economic valuation (e.g. De Groot, 1992; Costanza et al., 1997; De Groot et al., 2002; MEA, 2003; Farber et al., 2006; Beaumont et al., 2007; Wallace, 2007; Costanza, 2008; Wallace, 2008). In this study, it was used the one published by Fraber et al (2006), based on the original proposal of MEA (2005) (Table 2.1).

Within this characterization, services were aggregated into four major classes: a) *Supportive structures and functions* are ecological structures and functions which are essential for the delivery of ecosystem services, b) *Regulation services* are services which assure the maintenance of essential ecological processes and life support systems

for human well-being, c) *Provisioning services* are natural products and raw materials obtained from the ecosystems and, d) *Cultural services* are the nonmaterial benefits people obtain from ecosystems, enhancing emotional, psychological, and cognitive well-being. Within these categories, several ecosystem services have been described for coastal ecosystems and beaches (e.g. nutrient cycling, habitat, climate regulation, disturbance regulation, water supply, or recreation) (see ecosystem services highlighted in Table 2.1).

Table 2.1- Categorization of Ecosystem Services based on the one proposed by Farber et al (2006). The ecosystem services described for beaches are highlighted based on the results of Brenner (2007). These will be used in Chapter 3 of this thesis.

CATEGORY	SERVICE	EXAMPLES
Supportive structures and functions	Nutrient cycling	Nitrogen cycle, Phosphorus cycle
	Net primary production	Plant growth
	Pollination & seed dispersal	Insect pollination; Seed or larvae dispersal (water, wind, or animals)
	Habitat	Spawning and nursery grounds, refuge for species;
	Hydrological cycle	Stream runoff, groundwater retention, evapotransporation
Regulation services	Climate regulation	Influence on temperature, precipitation, wind and humidity
	Gas regulation	Biotic sequestration of CO_2 and release of O_2
	Biological regulation	Control of pests and diseases
	Disturbance regulation	Storm surge and flood protection
	Water regulation	Modulation of the drought-flood cycle, water purification
	Soil retention	Prevention of soil loss (wind, runoff)
	Nutrient regulation	Prevention of premature eutrophication in lakes, maintenance of soil fertility
	Waste regulation	Pollution detoxification
Provisioning services	Water supply	Provision of fresh water (drinking, transportation, irrigation)
	Genetic resources	Genes to improve crop resistance to pathogens and pests
	Medical resources	Quinine, Pacific yew, echinacea
	Ornamental resources	Shells used as jewelry
	Food	Bivalve fisheries; small scale subsistence aquaculture
	Raw materials	Fuel energy; mining industry
Cultural services	Recreation	Ecotourism, bird-watching, outdoor sports
	Aesthetic	Open spaces, scenery
	Science & education	Natural field laboratory and reference area
	Spiritual & historic	Nature as national symbols, landscapes with religious values

Box 2- *Ecosystem services and human well-being*

The Millennium Ecosystem Assessment (MEA) defines ecosystem services as benefits people obtain from ecosystems, and distinguishes four categories of ecosystem services: *Provisioning services*, *Regulating services*, *Cultural services*, and *Supporting services*. The human species, while buffered against environmental changes by culture and technology, is fundamentally dependent on the flow of ecosystem services (MEA, 2005).

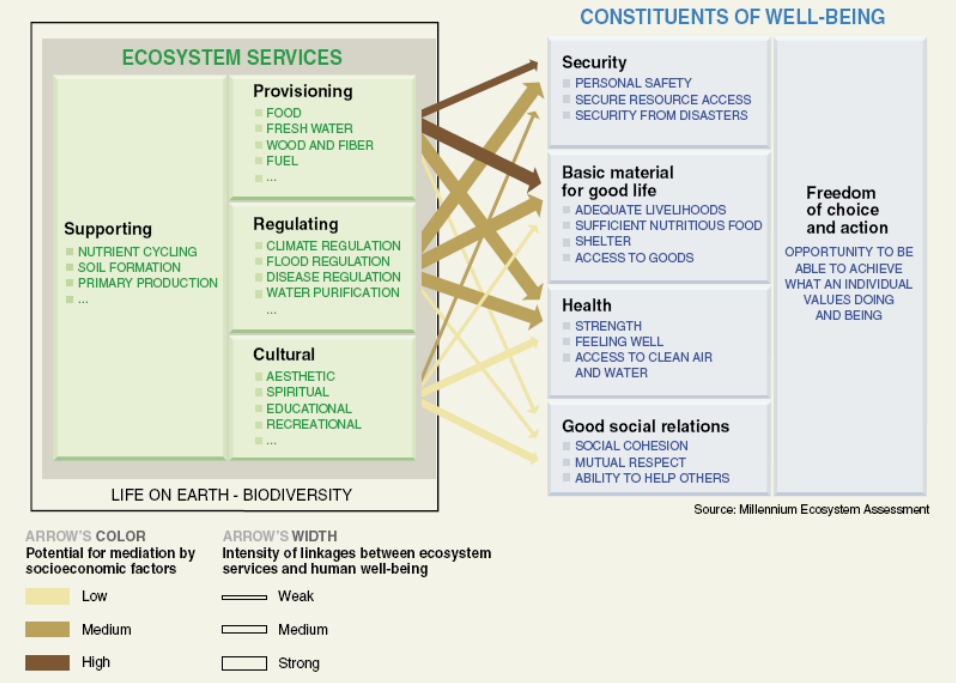
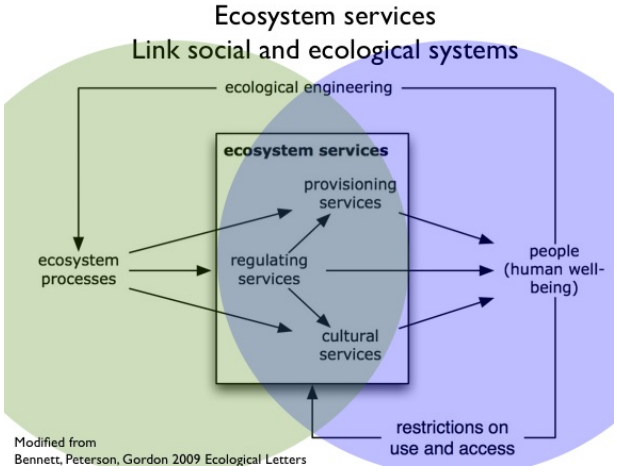


Figure from Millennium Ecosystem Assessment http://www.maweb.org/en/Index.aspx

The conceptual framework for the MA posits that people are integral parts of ecosystems and that a dynamic interaction exists between them and other parts of ecosystems, with the changing human condition driving, both directly and indirectly, changes in ecosystems and thereby causing changes in human well-being. At the same time, social, economic, and cultural factors unrelated to ecosystems alter the human condition, and many natural forces influence ecosystems (MEA, 2005).



2.2- Coastal zone management

As a particular case of environmental management, coastal zone management also showed an "evolution" in their approaches and methodologies, following the general trend presented in Section 2.1. Conventional sectoral management neither was effective in addressing such a complex system. In the coastal area the processes based on interactions between land and sea are most intense, and physical, ecological and social interactions are very strong (Hildebrand and Norrena, 1992). Coastal zones are of great economic, social and environmental significance in most coastal nations. These countries depend on the outputs from coastal activities such as the oil and shipping industries, coastal tourism and some primary industries. Moreover, these zones are extremely attractive areas for human settlement and use (e.g. preferred site for urbanisation) due to their wealth of natural resources and amenities (e.g. fisheries, productive wetlands and beaches). Yet it is this very attraction that has led to intense pressures being placed on the diverse and valuable resources, pressures which are likely to increase. These resources are limited and therefore must be conserved on both sides of this frontier between land and sea (Hildebrand and Norrena, 1992; Chua, 1993; Clark, 1997).

Despite best efforts in many cases, natural coastal systems continue to degrade, resource use conflicts are growing, and the social and economic benefits which could be derived from natural resources are being lost. The complexity of this system, where issues are often cross-sectoral in nature wherein the activity of one sector affects negatively the development of others, added even more difficulty to its sustainable management (GESAMP, 1990; Hildebrand and Norrena, 1992; Chua, 1993). In this context, and due to the increasing importance of the coastal zone, the amount and diversity of uses, and the implications of its management, a more integrated, multidisciplinary and well coordinated approach was required in order to move towards a truly sustainable management (Hildebrand and Norrena, 1992; Vallega, 1993).

In the early 1970s an integrated management approach to coastal resource utilisation has been attempted in the US (Coastal Zone Management Act, CZMA 1972). The concept of coastal zone management began to be part of coastal management policies (Chua,

1993). The UNCED *Agenda 21* (Chapter 17), represented a paradigm shift from sectoral, multiple-use framework to an integrated approach to managing the coastal area. Integrated costal management (ICM) had a prominently place in this meaningful document produced by the 1992 Rio Summit. Thereafter, ICM (or Integrated Coastal Zone Management, ICZM) was recognized as an inherent and necessary component of sustainable development (and vice versa). As well, this approach has been considered a viable alternative to conventional sectoral management (Chua, 1993; Vallega, 1993; Cicin-Sain et al., 1995).

Towards this integrated approach for coastal management, the attention had to move from the conventional structuralism background toward the general systems theory based approach. Within this theory, to investigate coastal changes has been a key element, considered more important than to assess the structure of the system in detail (Vallega, 1993). The international Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) defined ICM as "*a continuous and dynamic 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*" (GESAMP, 1996 in Olsen et al., 1997). In order to find a sustainable balance between human societies and the quality of coastal environments, the major goal of ICM is therefore "*to improve the quality of life of human communities who depend on coastal resources while maintaining the biological diversity and productivity of coastal ecosystems*" (GESAMP, 1996 in Olsen et al., 1997). Hence, ICM is first and foremost about people and attempting to define a dynamic balance between people and the qualities of our coastal environments (Olsen et al., 1997). A major purpose of ICM is to coordinate the initiatives of the various coastal economic sectors toward long term optimal socio-economic outcomes, including resolution of use conflicts and beneficial trade-offs. This coordination implies a complex task in terms of the number of stakeholders. Therefore a major function of ICM is to provide a framework for coordination of a wide array of interests. In order to accomplish these objectives, its main tools are governmental regulations which protect biodiversity and control the harvest and use of natural resources, and the environmental assessments which can predict the impacts of various economic development schemes (Clark, 1997).

Achieving ICM is especially complex because of the superposition of many human activities along coastlines, and the many dimensions of integration that need to be addressed (Olsen et al., 1997). Yet ICM ensures an appropriate shift from single sectoral and self-centered concerns to a collective agenda, where all parties will be better prepared to be addressed. In this context, coastal management programmes are designed to handle such complexities, being mainly built on two essential elements: integration and coordination (Clark, 1997). These elements ensure not only internal consistency but also linkages between the process of planning and implementation. They provide a broader and cohesive perspective of the entire ICM program, which enable to focus efforts on sustainable development goals (Chua, 1993). These mechanisms imply better understanding and cooperation among various stakeholders in addressing a wide range of coastal development and management issues (Chua, 1993). Three broad categories of integration/coordination have been defined:

System integration considers both spatial and temporal dimensions of the coastal resource systems, in terms of environmental physical changes (e.g. seasonality), resource-use patterns, and socioeconomic setting. *Spatial integration*, which considers both land uses affecting coastal waters and coastal marine area affecting the coastal land area (Cicin-Sain et al., 1995), would fall under this type of integration.

Functional integration refers to links between different management actions (e.g. program or project), ensuring they are consistent with the goals and objectives. This integration is encouraged among relevant sectoral bodies to promote complementarities and avoiding duplication. *Horizontal integration*, whereby all the disparate private and governmental sectors are brought into a single lateral framework for management (Cicin-Sain et al., 1995; Clark, 1997) would be included in this type of integration.

Policy integration is essential to ensure internal consistency of the ICM program in terms of national and local government policies and management actions. This integration pretends to improve coordination, and to ensure complementarities and rationalism between programs and projects as well as among concerned public agencies (Chua, 1993). This integration has also been called *Vertical integration* (e.g. Cicin-Sain et al., 1995; Clark, 1997).

Since the final aim is to integrate ICM programs into national or local economic development plans, it is essential that coastal policy and management strategies be

consistent with national economic development goals, responding to the challenges of change in the coastal zone. Therefore, it is necessary to involve strong political will and commitment right at the beginning of any ICM programs (Chua, 1993). Yet "*the problem is that the coastal zone is the shared responsibility of many agencies (at all levels of government) and interests, but the sole responsibility of none*" having a clear problem of leadership (Hildebrand and Norrena, 1992). In this sense, the institutional framework of ICM is not sectorally oriented, and differs from the usual government line agency type of organization. At least two ways have been proposed to address this multiplicity of institutional arrangements in order to improve the performance of resource management systems. The first one proposes to develop new planning and management techniques within their current legal and organizational frameworks, while the second suggests redesigning the system, changing laws, structures, and responsibilities of management agencies (Hildebrand and Norrena, 1992). In this sense, even if ICM operates by governments at the local/regional level with central government assistance, the implementation of these programs has been generally recommended through an "overlay" agency, a coordinating and consultative unit supported by the enforcement capabilities of one or more line agencies (Chua, 1993; Clarke, 1997).

Since its definition, the ICM concept has been interpreted and operationalized in several efforts, in order to develop guidelines which would allow its formulation and implementation (Cicin-Sain et al., 1995). However, there is general agreement that an ICM programme should have the following five attributes: 1) be a dynamic ongoing process over a considerable period of time, with continual updates and amendments; 2) be geographically defined, with clear boundaries and a specified extent; 3) have a management arrangement to establish the policies and process for making allocation decisions; 4) assure that this arrangement uses defined strategies to rationalize and structure the allocation decisions; and 5) management should be based on a systems perspective, considering associations between coastal resources and processes (Hildebrand and Norrena, 1992).

Several descriptions and conceptual framework have been developed to explain the phases or steps of integrated coastal management (ICM) initiatives (e.g. Chua and Scura, 1992; GESAMP, 1996; Cicin-Sain and Knecht, 1998; UNEP, 1995 in Olsen,

2001). The GESAMP offered a version of the public policy cycle as a framework for grouping the activities related to the five phases (one generation) of coastal management (Figure 2.3). The ICM Policy Cycle starts with the definition of the context (*Step 1*), analysing the issues of the coastal zone in question, indentifying the existing conditions and consulting key stakeholders. The *Step 2* is about planning, setting objectives and preparing a plan of policies and action. The *Step 3* involves the institutional acceptance and funding of the ICM plan. It concerns the adoption of a formal management plan and securing adequate funding for implementation of first actions. After that, in *Step 4* the planned procedures and actions are implemented. This may include public meetings, enforcement procedures, and conflict resolution as well as construction of infrastructure, strengthening of institutions and the dissemination of appropriate forms of resource use. In the last step (*Step 5*), the results of the whole process are evaluated and compared with the desired outcomes (i.e. audits) and adjustments to the governance process are selected (i.e. feedback) (Olsen et al., 1997; Olsen, 2001; 2002).

The time frame required for the implementation of an initial cycle of this program (i.e. a 5-steps generation) is typically between 8 and 15 years. Mature ICM programs clearly demonstrate the need for a sustained effort, measured in decades and involving different generations of a particular program, to achieve a tangible outcome at a significant scale (Olsen et al., 1997; Olsen, 2001; 2002). These time requirements highlight the importance of identifying intermediate outcomes (1^{st}, 2^{nd} and 3^{rd} order intermediate outcomes, see Figure 1b). If a program is strategic, it will define in general terms an end goal (i.e. vision) and then carefully and pragmatically define its intermediate objectives for a given generation of the ICM policy cycle. The importance of clear, specific, objectives that are amenable to objective analysis cannot be overstated, and therefore underlying project objectives should be stated explicitly (Olsen et al., 1997; Olsen, 2001; 2002).

ICM has been identified as a possible outline for attaining the goals and objectives of sustainable development by *i)* maintaining the functional integrity of the coastal systems, *ii)* reducing resource-use conflicts, *iii)* maintaining the health of the environment, and *iv)* facilitating the progress of multisectoral development (Chua, 1993).

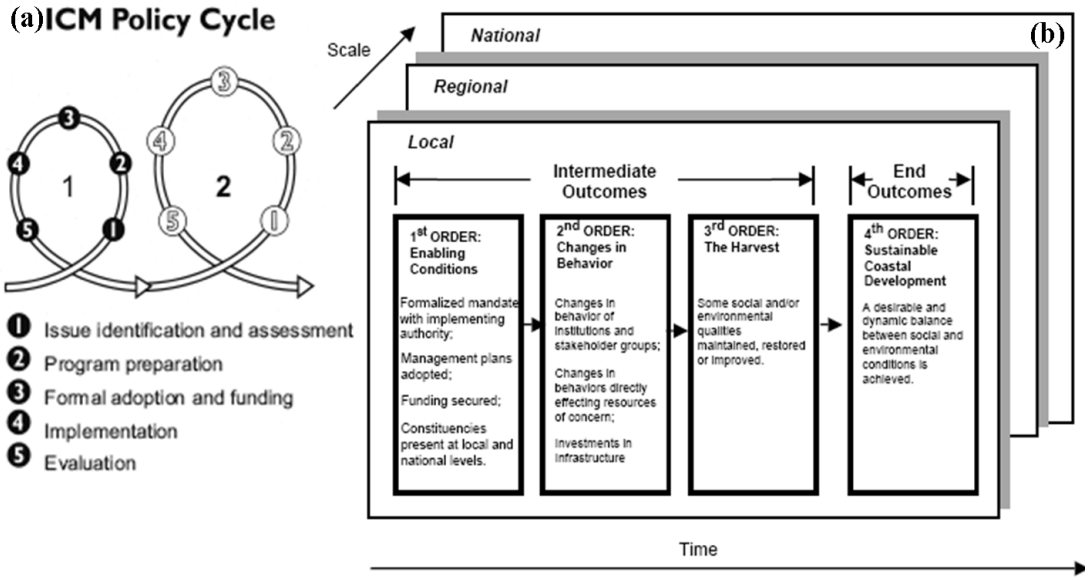


Figure 2.3- the five steps of one "generation" of the ICM Policy Cycle are presented, as well as (b) the sequence of 1st, 2nd and 3rd order intermediate outcomes of the process (from Olsen et al., 1997).

However, despite the great development that ICM has had during the 1990s, and the large amount of money invested in supporting and developing this policy, in most coastal areas natural habitats are still declining and exploited resources are still diminishing (e.g. Beach, 2002; Lotze et al., 2006; Roberts, 2007; Ochipinti-Ambrogi, 2007; Diaz and Rosemberg, 2008 in Mee, 2012). Some authors have recently questioned whether or not ICM is appropriate and effective as a way to achieve sustainability in coastal areas, while recognizing that in certain cases ICM clearly seems to work (Mee, 2012).

The ICM is a holistic approach since its creation, and this is demonstrated by the different integration requirements that support this framework (e.g. intersectoral or *horizontal*, intergovernmental or *vertical*, spatial, temporal, international, sciences-management) (Chua, 1993; Cicin-Sain et al., 1995; Clark, 1997; Cicin-Sain and Belfiore, 2005). However, some authors noted that the primary function of ICM has become to arbitrate and overcome conflicts of resource use between stakeholders in this common property natural environment. Furthermore, the environmental impact statement, originally formulated to assess the effects of development, has been adopted as one of the main tools to execute ICM master plans (Forst, 2009). Faced with the immediacy of conflict, ICM practitioners usually accelerate the application of "any tool at hand" that used alone represents an oversimplified response to the complexity of the natural system. Unwittingly, this misapplication could become an instrument of

mismanagement (Forst, 2009). This situation recalls the previously explained for environmental management on the "negative agenda" (see Colby, 1991). The holistic dimension of the ICM is not really taken into account, and management is merely monitoring use licenses in order to meet government regulations that do not always consider the general interests of the community (Forst, 2009).

Other criticisms argue that the focus of ICM has mainly been on obtaining a good governance system (i.e. *horizontal* and *vertical* integration), and seldom on a strong integration for example between marine science and coastal management (Cheong, 2008; Forst, 2009). This despite that scientific knowledge has been highlighted as a critical factor for managing coastal zones, as well as combining natural and social sciences insights for managing marine environments (Smith, 2002; Cheong, 2008). But this is probably due to the traditional barriers between both natural and social sciences, and scientists and policymakers (Cheong, 2008).

By mid 1990, scientists started to play a leading role, especially concerning their opinions on prevention, reduction and control of marine environmental degradation. In this sense, the involvement of science in management processes as ICM was a premise for sustainable management of complex ecosystems (Forst, 2009). This “revaluation of science” in management programs concurred with the enthusiasm for the ecosystem-based management (EBM), which generated a widespread effort to improve the operational framework under the ecosystem approach (Forst, 2009).

The EA-EBM paradigm was taking shape and relevance, far from the old strategies that failed to meet the objectives. For example, within this new approach, adaptive management allows to adjust and change management strategies in light of new priorities that may arise. This has been seen as a possible alternative to address one of the main criticisms of ICM: the difficulties of scaling up ICM projects to a national scale (Lau, 2005 in Mee, 2012). Within the EA-EBM, the focus was changing from individuals to ecosystems, from exclusively small spatial scales to multiple spatial scales, from short-term to long-term expectations, from humanity outside the ecosystem to “human-in-nature”, from managing commodities to sustaining the production potential for ecosystem goods and services. There was also a shift away from a management detached from scientific research, to one that recognizes and adapts to

scientific discovery (Forst, 2009). This new perspective inevitably broke historical boundaries, led to cross-disciplinary contributions, and promoted synergies between disciplines and actors (Cheong, 2008; Forst, 2009).

2.3- General frameworks

Pursuing this integration between science and management, integrative efforts to combine them in marine and coastal sciences, have led to the development of several frameworks such as Driver-Pressure-State-Impact-Response (DPSIR) now moving to Driver-Pressure-State-Welfare-Response (DPSWR), Risk Analysis and Management (RA), or the Ecosystem Based Management System (EBMS).

2.3.1. The DPSIR (DPSWR) Framework

The DPSIR framework (Driving Forces-Pressures-State-Impacts-Responses) has been originally developed by the Organization for Economic Cooperation ands Development (OECD) and the United Nations Division for Sustainable Development in order to achieve, in a holistic way, the connection between different parts of scientific information for the benefit of policy formulation (Cheong, 2008). The DPSIR is a general framework used to assess and manage environmental problems, organizing and defining information about the state of the environment and the human uses of it (Figure 2.4). This framework has been also used for organizing systems of indicators in the context of environmental health and sustainable development (GIWA, 2001 in UNEP, 2012).

Driving Forces *(Drivers)* are considered as the social, cultural, economic and regulatory forces that drive human activities in the ecosystem and which contribute pressures on the environment such as population, marine transportation, and agricultural production, fisheries or tourism. ***Pressures*** are considered as the number or load of physical, chemical or biological products discharged or produced by the *Drivers* such as wastewater, sediment and fertilizer runoff, fish catches or aggregate extraction. ***State*** of the environmental effects are considered in terms of water quality in rivers, quality of

eelgrass in estuaries, concentration of contaminants, fish stock status, coastal erosion, level of non-indigenous species invasion or marine letter. Generally, the state of the environmental effects would establish the level of disruptions, alterations or degradation in terms of contaminants, sediments, nutrients or hydrographical regimes as well as habitat or biota integrity. ***Impacts*** to ecosystem components and processes are considered equally to impacts to environmental services such as social, cultural and economic goods and services. Considered as effects of environmental degradation, examples may include algal blooms or macro-algae changes, water-related human health problems, changes in species distribution and abundance, flooding, seabed destruction, loss in habitats, genetic disturbances. ***Responses*** are considered as the management measures implemented via regulations, policies, best management practices, standards, stewardship or education strategies. Developed and implemented to achieve ecosystem management objectives these may have international, national or regional applications (Maxim et al., 2009; GIWA, 2001 in UNEP, 2012; Cormier et al., in press).

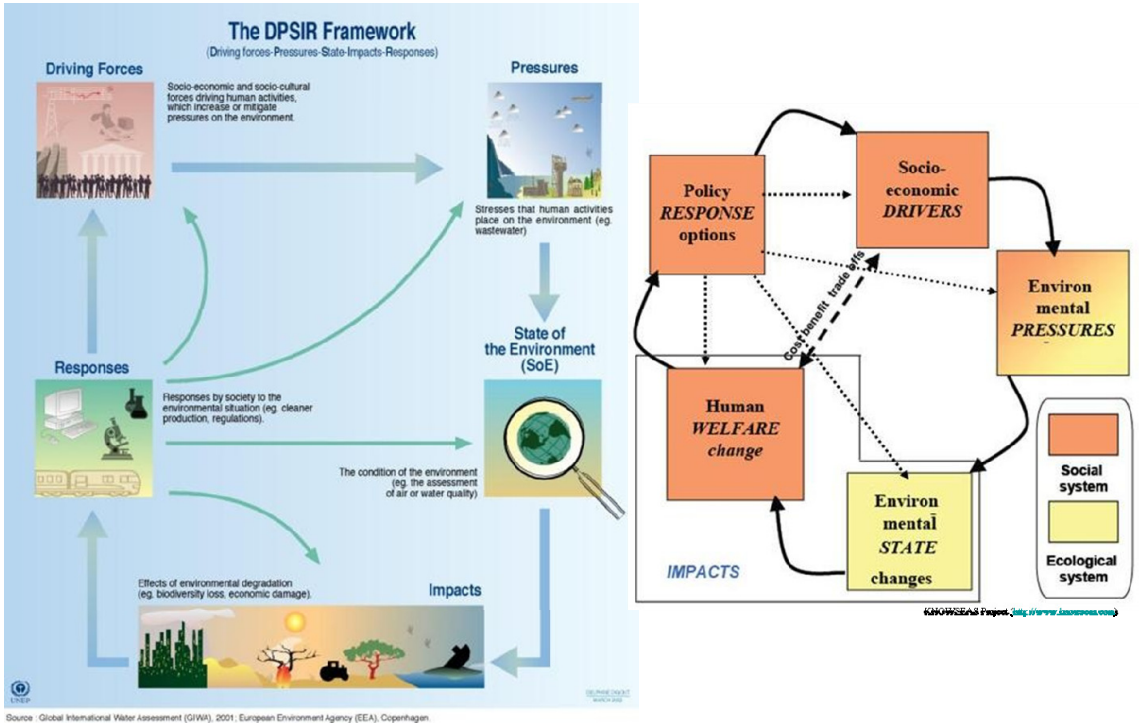


Figure 2.4- Explanation of the DPSIR process (GIWA, 2001 in UNEP, 2012), and the DPSWR framework (KNOWSEAS Project).

This model identifies cause/effect pathway relationships between interacting components of ecological, social and economic systems with environmental effects

events, and hence it has been included in several broader environmental management frameworks (e.g. risk analysis such as the EBRM described bellow, or even the EBMS, among others). Recently, there have been some criticisms about some of the items included in the DPSIR framework, especially the one related to impacts, as well as the separation between human and ecosystem categories. An evolving framework has been categorized under the Driver-Pressure-State-Welfare-Response framework (DPSWR) (Cooper, 2012). In modifying DPSIR to address conceptual limitations, two guiding principles were adopted: a) aligning categories with either human or ecosystems as far as possible so as to support commensurability between categories of information relating to human systems, and b) avoiding the introduction of new categories so as to keep the overall number to the minimum possible. The DPSWR categorizes the five items as described in Figure 2.5 (Cooper, 2012).

2.3.2. Risk Analysis and Management (RA)

Risk Analysis (RA) has been internationally recognized as a framework intended to assist decision making, providing an objective, repeatable and documented assessment of the risks posed by a particular course of action. It represents a systematic way of gathering, evaluating, recording and disseminating information leading to recommendations for a position or action in response to an identified risk (MacDiarmid, 1997). A risk-based approach helps managers to compare and prioritize issues and focus on limiting the activities which are considered to have the greatest potential impact.

Regardless of the organization that is using the tool, number of steps, or terminology, the process of RA, comprises four general components (Figure 2.6) (EFSA, 2002; Sardá et al., 2010a; 2010b; Gormley et al., 2011; Cormier et al., in press):

- *Hazard Identification* that involves specifying the adverse event which is of concern,
- *Risk Assessment* that takes into account the probability (the actual likelihood and not just the possibility) of the hazard occurring, the consequences of that hazard occurring, and the degree of uncertainty involved,
- *Risk Management* that involves identifying and implementing the best option for reducing or eliminating the likelihood of the hazard occurring, and
- *Risk Communication* that implies the open exchange of explanatory information and opinions that leads to better understanding and decisions.

Information Category	Definition	Commentary
Driver	An activity or process intended to enhance human welfare.	▪ Human welfare has a broad economic meaning so that the category covers anything done that is intended to be for the benefit of at least one person. ▪ Activities may be organised according to economic sectors.[a] ▪ Where necessary the category can be split between: - Immediate Drivers: activities proximal to at least one Pressure. - Underlying Driver: population, economic, social and technological factors that influence the level/nature of Immediate Drivers.
Pressure	A means by which at least one Driver causes or contributes to a change in State.	Thus a pressure is a link between a Driver and a change in environmental State, effectively therefore the agent of change. Generally, it is a by-product or an unintended consequence of the Driver activity/process. It may be a human activity, although one not intended of itself to enhance welfare, e.g. the type of gear used in fishing, but may more often be a change in natural systems, e.g. the concentration of chemical pollutants .
State (change)	An attribute or set of attributes of the natural environment that reflect its condition as regards a specified issue (or change therein).	This definition allows flexibility so that the information or measure used can be tailored to the precise circumstances that are relevant. However, often the most useful information will: ▪ relate to the extent to which a system has been subject to disturbance, particularly in terms of ecosystem functionality, and ▪ reflect changes in State over time. Natural (i.e. non-anthropogenic) variability may influence the effect of Pressures on State or change in State.
Welfare	A change in human welfare attributable to a change in State.	▪ "Change" allows for enhancement but generally we are concerned with diminution in welfare. ▪ Welfare is not only affected by changes in use values; it can be affected by changes in nonuse values that people hold (e.g. in respect of general ecosystem functionality or the viability of particular species).
Response	An initiative intended to reduce at least one Impact (State or Welfare change).	In this sense "initiative" is an action that would not have been taken in the absence of an Impact or set of Impacts. It may operate through influencing any of the above but with the intention to ultimately reduce Impact.

Figure 2.5- The DPSWR framework (extracted from Cooper, 2012).

Risk Analysis (RA) has been a fundamental framework which is used worldwide in diverse management fields such as human health, international trade, food safety, public security, or civil and mechanical engineering (e.g. World Health Organization, World Trade Organization, Food and Agriculture Organization, Sanitary and Phytosanitary agreement, Hazard Analysis and Critical Control Point, and many Governmental National Agencies in Australia, Canada, or US). Even recently, two ISO standards on risk management and risk assessment techniques have been published by the International Standards Organization (ISO) (i.e. ISO 31000:2009, ISO/IEC 31010:2009) (Hardy and Cormier, 2008; Sardá et al., 2010b; Cormier et al., in press).

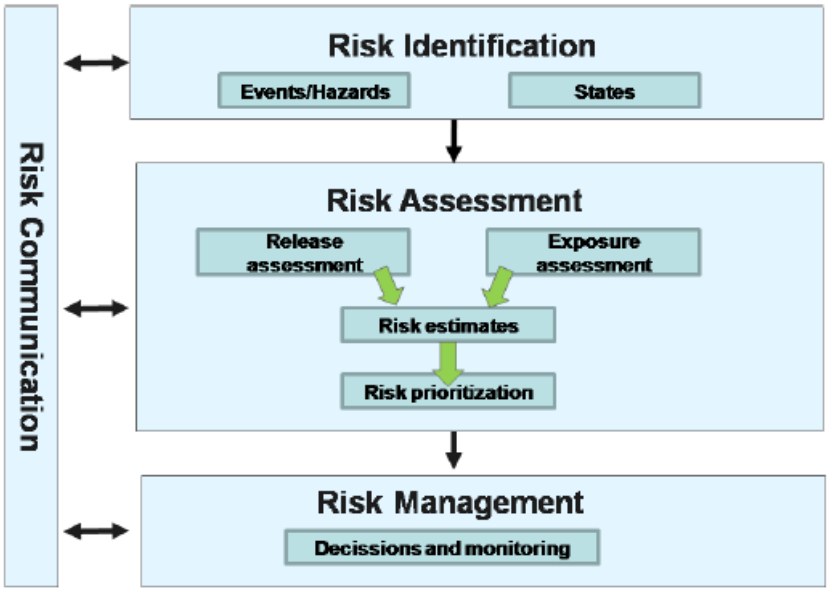


Figure 2.6- Basic design of a Risk Analysis (RA) framework (Sardá et al., 2010b).

This framework has received a lot of attention in the environmental field as a way to integrate science, policy and management. In environmental management, the application of such risk approaches provides assurance that management measures adequately protects the sustainability of the most vulnerable ecosystems and environmental services. Using the concept of risk as a central element to decision-making allows for the use of the best available information, both qualitative and quantitative data, and produces an estimate of the probability of negative impacts occurring in response to a variety of situations (USEPA, 1992; 1998; EFSA, 2002; Gormley et al., 2011; USEPA, 2011; Cormier et al., in press). Although there are a myriad of models and methodologies based on Risk Analysis and Management, in this case I will mention briefly only two: the Ecological Risk Assessment (ERA), which is probably the first one to formalize this approach in environmental issues; and the Ecosystem-Based Risk Management (EBRM), which has recently been developed.

Ecological Risk Assessment (ERA)

Ecological Risk Assessment (ERA) has evolved from human health-based risk assessment to include evaluations of impacts to the environment. During the 1980s, risk assessment emerged as a prominent regulatory issue and consideration of ecological impacts began to influence regulatory and policy decisions. The use of ecological information for decision-making expanded slowly through the 1980s, and in 1992 the U.S. Environmental Protection Agency (USEPA) published the "Framework for

Ecological Risk Assessment" as the first statement of principles for ERAs. In 1998, the USEPA published the "Guidelines for Ecological Risk Assessment", which supersedes the 1992 guidance. These documents describe methods for conducting conventional single-species, chemical-based risk assessments, and techniques for assessing risk to ecosystems from multiple exposures (or stressors) and multiple effects (or endpoints) (USEPA, 2011).

ERA has been defined as "*a process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors*" (USEPA, 1992). This framework includes three phases: *Problem formulation*: where information is gathered to help determine what, in terms of plants and animals, is at risk and what needs to be protected; *Analysis*: which is the determination of what plants and animals are exposed and to what degree they are exposed, and if that level of exposure is likely or not to cause harmful ecological effects; and *Risk characterization*: that includes two major components: *risk estimation* and *risk description*. The former combines exposure profiles and exposure-effects, while the latter provides information important for interpreting the risk results and identifies a level for harmful effects on the plants and animals of concern (Figure 2.7) (USEPA, 1998).

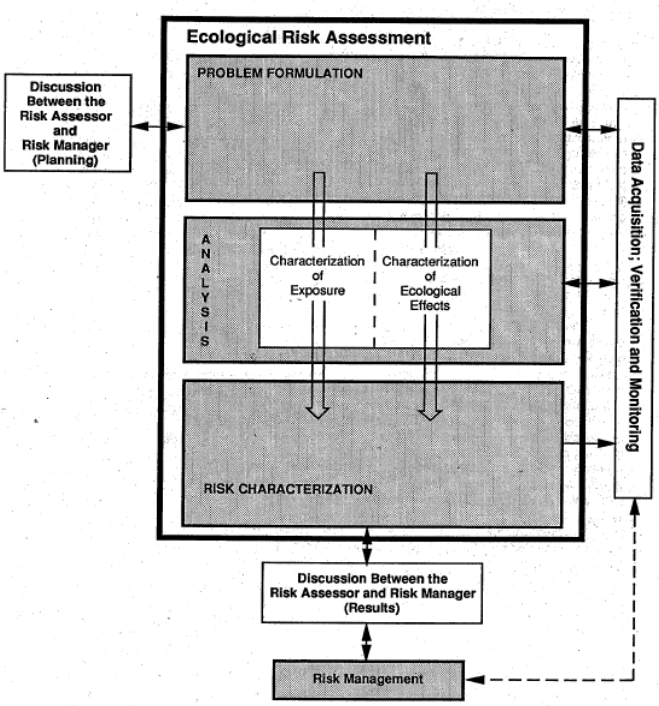


Figure 2.7- Ecological Risk Assessment (ERA) Framework (USEPA, 1992).

An ERA evaluates the potential adverse effects that human activities have on the living organisms that make up ecosystems. The risk assessment process provides a way to develop, organize and present scientific information so that it is relevant to environmental decisions. There are four main goals of an ERA: 1) determine whether harmful effects are likely for wild animals or plants exposed to site related hazardous chemicals (i.e. significant risk); 2) if there is significant risk, to calculate a protective cleanup level that would reduce the risk to wild animals or plants; 3) determine the potential impact of cleanup activities on the habitats, plants, or animals; and 4) provide information that can be used as a baseline for long-term biological monitoring programs to determine if the cleanup is effective. ERA results provide a basis for comparing different management options, enabling decision-makers and the public to make better informed decisions about the management of ecological resources (USEPA, 2011).

Ecosytem-Based Risk Management (EBRM)

From an EBM perspective, development coupled with natural variations in ecosystem processes introduces uncertainties when considering ecosystem sustainability objectives. Using EBRM, environmental risks are managed through the identification, analysis and evaluation of environmental factors to determine whether management strategies are meeting the risk criteria pre-established in the EBM context.

For this approach the ISO/IEC 31010:2009 standard for risk management and risk assessment techniques has been used as the basis. Considered as "events", environmental effects are at the centre of this process where the consequences can alter, disrupt or even degrade the ecosystems. This model bridges the ISO 31010 risk management framework with environmental assessment, integrated coastal and oceans management, marine spatial planning practices, and ecosystem-based management (Cormier et al., in press).

The EBRM process is subdivided into three main components: *Establishing the context*, *Risk Assessment* and *Risk Treatment*. It also includes two supporting function namely *Communication and Consultation* as well as *Monitoring and Review*. In addition, Risk Assessment is subdivided into *risk identification*, *risk analysis* and *risk evaluation* (Figure 2.8). Such a process not only assesses ecosystem risks, it aims at implementing management measures and deploying resources to priorities of the highest ecosystem,

social, cultural, economic and policy risks. A key benefit of risk management frameworks and processes is also the identification and implementation of the most effective and efficient management measures based on existing scientific knowledge, legislation and technologies (Cormier et al., in press).

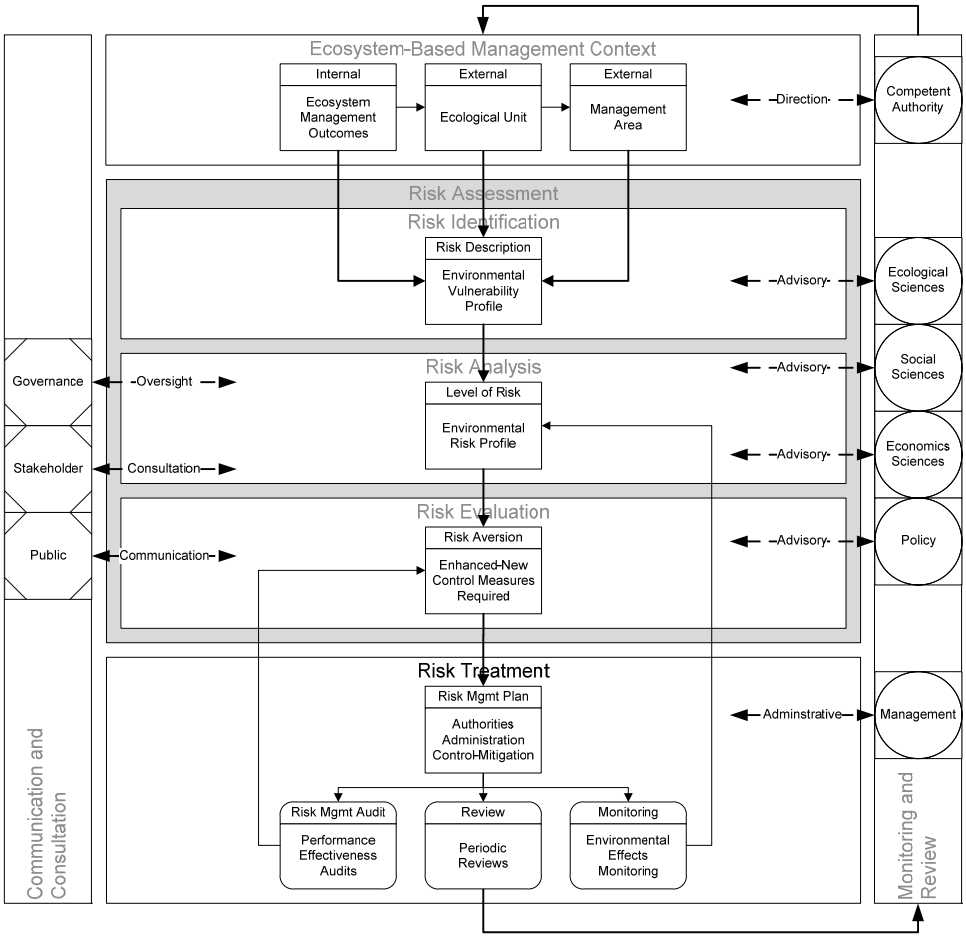


Figure 2.8- Ecosystem-Based Risk Management Process (EBRM) (Cormier et al., in press).

2.3.3. The Ecosystem-Based Management System (EBMS)

The Ecosystem-Based Management System (EBMS) framework has been designed to combine classical Environmental Management System (EMS) theory with the EBM principles. The formers (EMS) are useful frameworks through which organizations can reduce their environmental impact, improve their environmental performance, and provide relevant information to the public and other interested parties. While the EBM represents a policy framework for the application of the Ecosystem Approach (EA) concept (see definitions above in this chapter). The EBMS is intended then to provide a

systematic approach for the principles of the EA by introducing them into a clear, familiar, managerial framework (Sardá et al., 2010a; 2010b).

The marine policy of the European Union (i.e. the Marine Strategy Framework Directive (MSFD) and the Integrated Maritime Policy (IMP)) responds to the introduction of the concept of sustainable development into the management of marine and coastal environments. Bearing in mind the fact that the MSFD defines the overall objective of Good Environmental Status (GEnS) in largely ecological terms, and that the IMP is more focused on human aspects of marine management, the EA has been identified as a valuable concept that draws together the objectives of both policies (Sardá et al., 2011). In order to implement this approach, moving from disharmonious, sector-oriented managerial approaches to a more holistic process-oriented management system, it becomes necessary to develop new comprehensive, science-based practical guidelines and tools. In this context the EBMS has been developed (Sardá et al., 2011).

The basic design of the EBMS can be divided into three components: the *Managerial Pillar* which is the basis of the system (resembles a formal EMS), and the *Information Pillar* and the *Participatory Pillar*, which provide necessary inputs for the functioning and performance of the managerial one. The latter also facilitate a wider use of sustainable development principles such as integration, adaptability, transparency or participation (Figure 2.9 and 2.10) (Sardá et al., 2010a; 2010b).

The conceptual thinking underpinning the *Managerial Pillar* is the policy cycle assessment developed interalia by the GESAMP (1996). This cycle follows the classical Plan-Do-Check-Act (PDCA) managerial scheme, a continuous quality improvement model consisting of a sequence of four repetitive steps that uses an iterative logic for the continuous improvement and adaptation of the systems under management. The *Information Pillar* is designed to assist the managerial pillar with user-friendly tools than can facilitate the flow of information into the decision making process, while the *Participatory Pillar* should seek to enhance communication with stakeholders and to service needs for capacity building (Sardá et al., 2010a; 2010b).

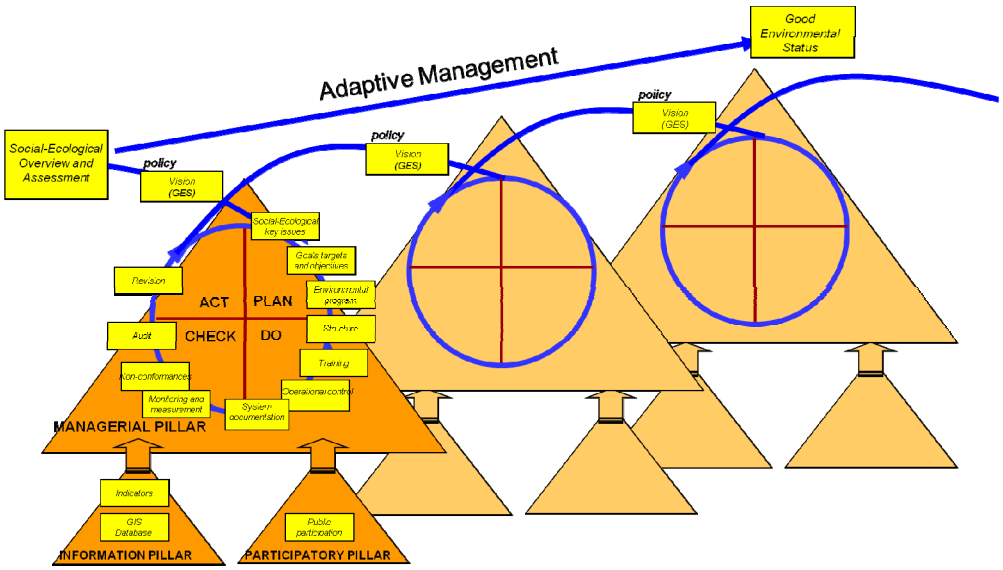


Figure 2.9- Ecosystem-Based Management System (EBMS) structure (Sardá et al., 2010a; 2010b).

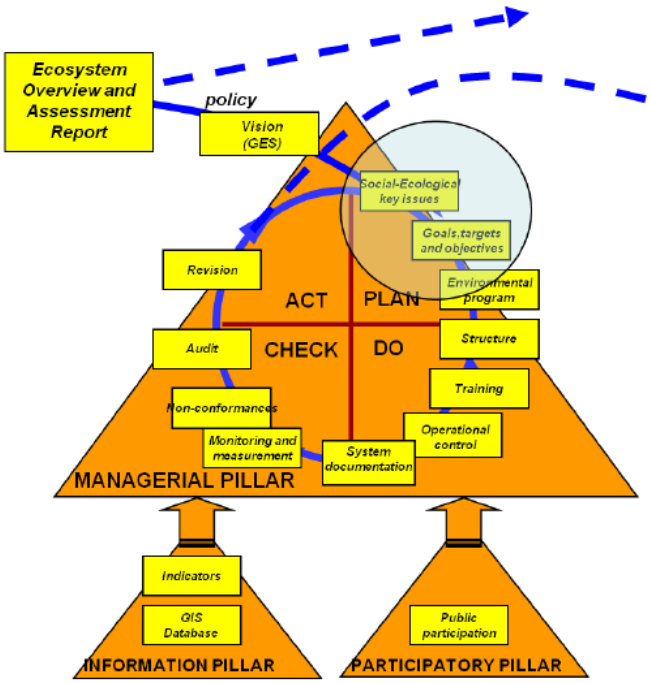


Figure 2.10- Detail of different stages in each one of the three pillars of the EBMS (Sardá et al., 2009).

2.4- Beach management in Spain

Beaches are complex social-ecological systems that contribute to the welfare of human society in several aspects that could be grouped in three main functions: protection, natural and recreational. However, in coastal areas which were traditionally dedicated to

coastal tourism, beach management has focused almost exclusively on the recreational function. The Spanish Mediterranean coast is an example, where beaches have been identified as the main attraction and the main asset to be managed due to its economic significance (i.e. 10% of the GDP of Spain is directly or indirectly linked to beaches in Yepes, 2003; Ariza et al., 2008b; 2012). Hence, the focus has been on services offered to users, rather than on biological and physical processes that were normally seen as complementary.

Human use of beaches in Spain had its boom in the second half of the 20th century. In this sense, the main management initiatives and directives have been developed and implemented in the second half of that century (Figure 2.11). The initial development of beach management processes began in 1960s, since previously beaches were considered natural resources without economic interest. The Shores Act of 1969 was the first planning measures for the beaches, with the establishment of the Plan for the General Zoning of the Beach (PGOP) for the permanent planning of beach services and facilities. Following that, in 1970 the first guidelines with concrete standards for managing urban beaches have been published (Ariza, 2010). In the mid 1970s, the Ministry of Public Works and Urban Planning carried out the "Indicative Plan of the Uses of the Public Domain" (Plan Indicativo de Usos del Dominio Público, PIDU). This project provided guidelines for the development of the coastal areas in the coastal provinces of Spain, analyzing sediment dynamics, parking characteristics, licenses, uses, and beach use and urbanization density (Ariza, 2010).

In 1978, the Spanish Constitution included the beaches in the public domain and established that they should be regulated according to more specific laws. This regulation came into place in 1988 with the new Shores Act (Ley 22/88 de Costas) and its Regulation 1471/89 (Ariza, 2010). This law significantly changed beach management practices, and the focus of beach management. Abolishing the PGOP, and assigning the responsibility of land use planning, urbanism, and other issues to the Government of Spain Autonomous Communities. It also established the competencies and responsibilities of the different governmental bodies and agencies (Ariza, 2010). The Shores Act 22/1988 establishes the legal requirements for managing the Maritime Terrestrial Public Domain (DPMT), which includes beaches, and, to a lesser extent, the adjacent area. Under such general framework central, regional, and local (municipal)

coastal managers addresses different managerial aspects related to beach environments. However, managerial practices become even more problematic due to this division of competencies between different administrative offices of the different governmental agencies (Ariza et al., in press). A detailed analysis of legal responsibilities in the Costa Brava is presented in Chapter 5 of this dissertation. In addition to an overview of coastal and beach management in Spain, there is presented a detailed institutional analysis assessing this administrative complexity.

In this context, the decision-making options of beach managers are determined by the socioeconomic characteristics of these areas, in which tourism is the main economic sector and most municipalities rely solely on this activity. Beach management process are traditionally restricted to water and sand quality control and seasonal beach use planning. Therefore, beaches are being managed in accordance with the concepts of service management and the vision of beach managers is rarely integrated (Ariza et al., in press). In addition two main general problems have been detected: there are large obstacles to coordinate the interventions of the different organizations managing beach environments, and there is a clear absence of proactive planning in its management. The main tool used in the management of beaches is the development of the Beach Use Plans, but these plans are mostly active at most for six months of the year, with little variation form year to year, and covering only the bathing season. Normally these Plans are excluded from long-term programmes and do not incorporate proactive planning. Therefore, the type of beach management that emerges from the analysis is usually a short-term service-oriented management where Beach Use Plans become its main management tool, and visitor preferences are the main factor to establish its desired qualities (Ariza et al., in press).

Satisfying beach user needs is the main existing goal in beach management processes. Following quality criteria in the service economy, this idea has introduced the need to certify the quality of these environments. Quality is guaranteed by means of performance standards and performance rating systems, which were introduced at the end of the 1980s, forced by the continuous demand of tourist for certain environmental conditions and quality (Ariza et al., 2008b). In order to guarantee the required environmental conditions, several standards (e.g. Blue Flag, UK Seaside Award) and rating systems (e.g. ACA, CEDEX, Cantabria indexes) have been developed and used

by beach managers (Figure 2.11). However, under such schemes, when good scores are reached, management should not be improved any further, and a certain state of complacency is observed (Ariza et al., 2008b).

At the turn of the Century, the principles of the EA were included within the recommended guidelines for ICM (World Summit on Sustainable Development, Johannesburg, 2002). From this point, management should consider beach ecosystems instead of just beach faces, recognising its recreational, protective and natural functions, as well as the extreme variability of coastal conditions. Managerial activities should be enhanced by developing proactive planning and establishing responsibilities instead of introducing reactive measures when problems are detected. The organizations in charge should examine all the aspects of its operations and how these actions have an effect on the main beach functions and on the sustainable use of such coastal resources. Planning must evolve so that it can be better adapted to the true conditions associated with different beaches, and considering the objectives of beach management at various levels (Micallef & Williams, 2002). To be successful, the environmental program should have the support of the senior coastal manager that promotes the integration of different stakeholders. This support is made tangible through a vision statement (policy) that summarizes the key points that should follow above ideas. If beaches are to be managed as the complex systems they are, the managerial challenge is to ensure their sustainable use rather than the achievement of a standard (Ariza et al., 2008a).

In this sense, the Environmental Management Systems applied for Beaches (EMSBs) have begun to be used in Spain since 2000 (Figure 2.11). From the three most used (i.e. ISO 14001, Eco-Management and Audit Scheme (EMAS), and Q of Quality of beaches), the ISO 14001 is probably the most internationally recognized EMS (Ariza et al., 2008a). As noted in the previous section of this chapter, the EMS are useful frameworks through which organizations can reduce their environmental impact, improve their environmental performance, and provide relevant information to the public and other interested parties. EMSBs are flexible tools based on commitment to an environmental policy, to the compliance with legal and other regulations, and to the continuous improvement. These systems can be integrated with other management requirements and can work under the ICM principles (Ariza et al., in press).

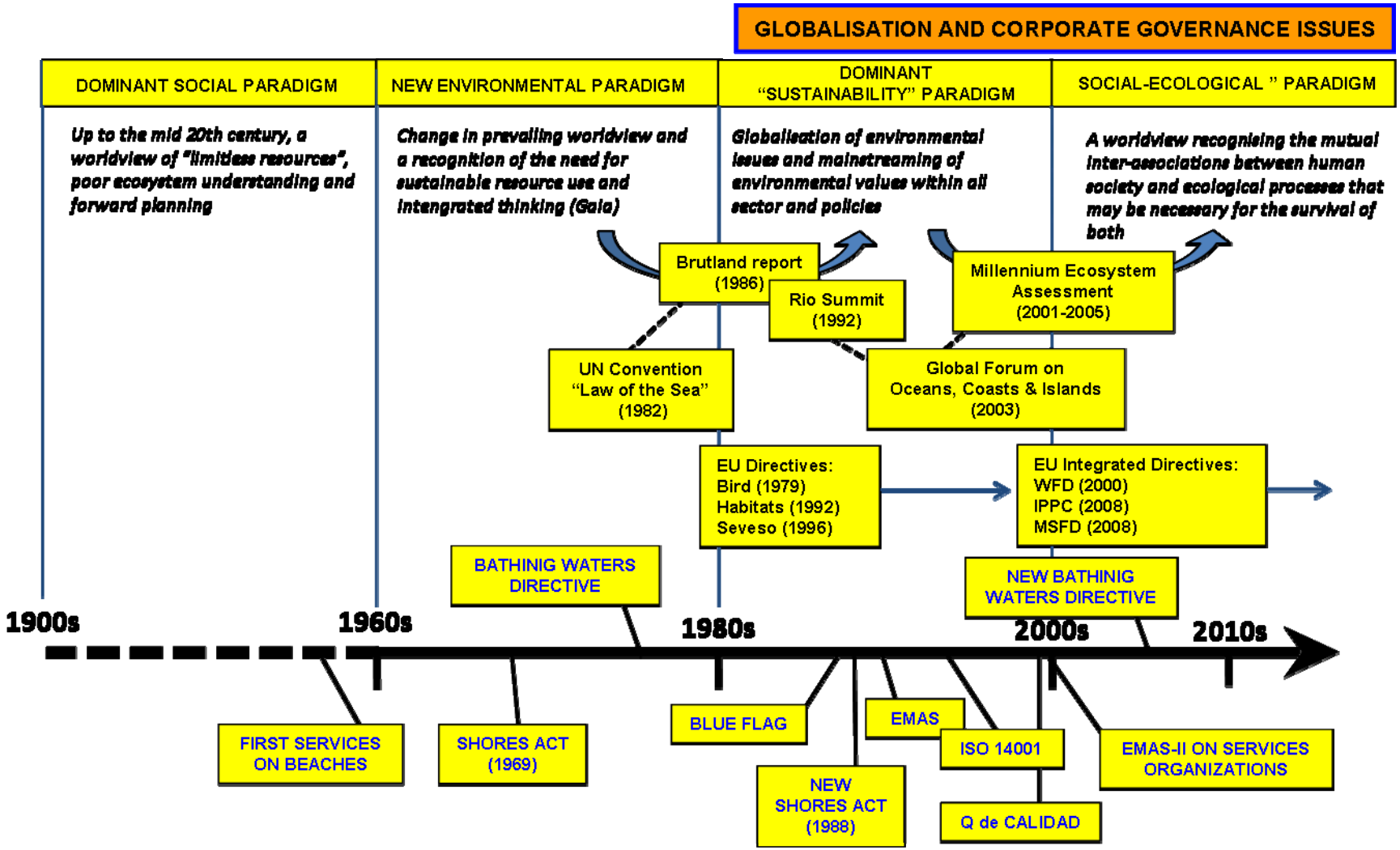


Figure 2.11- A story line of the main paradigms dominating beach management trough recent decades with some accidents, thoughts and facts (adapted from A. Kannen and R. Sardá pers. comm.).

EMSBs present large advantages over traditional beach management schemes. EMSBs are valid for use in both urbanised and pristine beaches and could serve to integrate all available information in a single conceptual framework. The use of EMSBs allows different visions to be used together according to the reality of each individual beach under management and its respective "status quo", while nevertheless managing all of them from within a similar, understandable, and acceptable framework. These systems are capable of integrating specific defined functions for beaches and of assigning resources and responsibilities that allow for temporal proactive planning. Introduced in the three main organizations with coastal responsibilities, the EMSBs provide a common language that could facilitate the integration of its needed activities, and solve problems derived of necessary organizational change.

Guidelines established for beach management, such as local management directives, conservation programmes, or the development of design and valuation tools (Simm et al., 1995; Micallef & Williams, 2002) are in perfect accordance with EMSBs. Finally EMSBs introduce in the management of beaches the permanent planning approach and allow managerial goals to be implemented. Once the first priorities have been achieved, others can be considered and monitored. This would permit a diversification of management actions and the introduction of the continuous improvement principle (Ariza et al., 2010).

Although the use of EMSBs is still in its infancy, the potential for improvement that it offers is clear. In this sense, in this Doctoral thesis we start to check the possible utilization in beach management, of the Ecosystem-Based Management System (EBMS) a new formal system of public good management developed for coastal and marine environments, which has already been described in this chapter. Through this thesis some steps are presented in order to use the EBMS in beaches social-ecological systems as a new framework for managing these complex environments.

Chapter 3
A methodological framework for multi-hazard risk assessment in beaches

This chapter presents a methodological framework based on risk analysis, an approach that, as has been mentioned in Chapter 2, is widely used in different management processes to assist decision-making. In this case it was developed as a tool to improve beach management within the principles of the ecosystem approach, incorporating among its main components the main ecosystem services provided by these social-ecological systems.

3.1- Introduction

Natural hazards are recurrent events, which can produce such economic damage and the loss of so many human lives, that commonly they become disasters (Pérez-Maqueo et al., 2007). Caused by natural factors or induced by human activities, natural disasters should be understood as the outcome of a development process whereby human societies have generated vulnerabilities and risks (Taubenböck et al., 2008). They could be seen as a function of a specific natural process and human activity, leading to strong impacts on societies (i.e. economic damages, loss of human lives) (Dao and Peduzzi, 2004; Raschky, 2008; WEF, 2009). However, though they are common features that have long concerned the international community (e.g. International Decade for Natural Disaster Reduction), humans have yet to fully learn how to cope with them (Pérez-Maqueo et al., 2007). The number of natural hazards has increased by a factor of 2.2 within the last decade as compared to the 1960s, whereas the economic losses have been increasing by a factor of 6.7 (Raschky, 2008). Damages from natural hazards have been increasing exponentially over the last decades (MEA, 2005), and the IPCC suggests that

those losses are growing all over the world and this trend is not going to stop in the near future (Pérez-Maqueo et al., 2007).

Coastal environments are transitional areas where intense physical, ecological and social interaction occurs (Hildebrand and Norrena, 1992). They are exposed to multiple aquatic and terrestrial hazards, whose impacts are often exacerbated by the fact that they occur in areas with high economic and social vulnerabilities (Fleischhauer et al., 2005). In coastal zones, damage due to natural hazards has been significant, mainly because of the high concentration of population and the amount of infrastructure susceptible to being damaged (Costanza and Farley, 2007; Crowell et al., 2007; Martínez et al., 2007). Global warming and rising sea levels could also increase the severity and frequency of coastal storms and add to the intensity of coastal risk impacts (Raschky, 2008; Roca et al., 2008a). However, the design and placement of infrastructure without planning to safeguard ecosystem services and protect natural capital resources is probably the most important cause of damage (Costanza and Farley, 2007).

Since 1995, concern about the state of European coastlines has led to the development of several EU initiatives based on the concept of integrated coastal zone management (ICZM) (EEA, 2006a; Douvere and Ehler, 2009). ICZM is a strategy for an integrated approach to planning and management, considering all interests (i.e. policies, sectors, individuals) and all coastal stakeholders in a participative way, in the full range of temporal and spatial scales. It attempts to balance development needs with the protection of the resources that sustain coastal economics, addressing the three dimensions of sustainability (i.e. socio-cultural, economic and environmental) with good communication between authorities (EEA, 2006a). Recognizing this urgent need, the Council of the EU recently approved the signing of the Protocol on ICZM in the Mediterranean by the signatories to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (2009/89/EC).

Due to the extreme variability of coastal areas, the highly diverse nature of these systems and their social-ecological value, appropriate study units need to be selected from the very beginning to guide ICZM initiatives (Balaguer et al., 2008). Beaches are one of the most important shoreline units requiring management, and, as in other coastal areas, they have been traditionally managed by sectorial approaches dealing with

specific resources in isolation, even if these managed resources (or activities) belong to a web of ecological processes and human interactions (Hildebrand and Norrena, 1992).

Beach management has traditionally concentrated on geomorphic hazards and the recreational human use of beaches but has largely ignored their ecological and broader environmental values (James, 2000). Beaches are usually viewed as natural places supporting hedonic socio-cultural activities. However, they are very complex social-ecological systems that have many other functions (e.g. Regulation, Habitat, Production and Information; de Groot, 1992). A broader conception of beaches must be incorporated, recognizing these ecosystems as multidimensional environmental systems rather than one-dimensional physical or recreational sites (James, 2000). Beach management must be integrated, well-coordinated and based on interdisciplinary approaches (Ariza et al., 2008a; Forst, 2009). The growing need for solutions to complex environmental problems has led to an upsurge in interdisciplinary work, encouraging synergies between academics and practitioners and blurring boundaries between social and natural sciences (Cheong, 2008; Roca et al., 2008b; Hills et al., 2009; Zou and Wei, 2010; Innocenti and Albrito, 2011). Natural ecosystems and the services they provide for human well-being have occasionally been considered in coastal management, hazards mitigation and risk reduction programmes (de Groot, 2006; Costanza and Farley, 2007; Stanturf et al., 2007; Costanza et al., 2008). However, the usual practice of risk analysis overlooks the other functions of beaches and mainly deals with damages to assets, which means that risk management frequently only manages a part of the total risk (Meyer et al., 2009).

Risk analysis is internationally recognized as an approach to assist decision-making. It is a systematic way of gathering, evaluating, and disseminating information leading to recommendations in response to an identified risk. It is a tool intended to provide decision-makers with an objective, repeatable and documented assessment of the risks posed by a particular action. A risk-based approach also helps managers to prioritize issues and focus efforts when they are regulating the activities that are considered to have the greatest potential impact (Hardy and Cormier, 2008).

Considering the entire beach as a social-ecological system, the objective of this chapter is to propose a new framework for beach multi-hazard risk assessment in which the

consequences of the existing hazards are assessed according to their effects on the environmental services provided by the beach. The main objectives of this methodology are hazard prioritization and risk valuation, based on hazard intensities and, economic valuation and exposure of the affected ecosystem services. From the risk analysis perspective, the proposed framework intended to suggest the best decision in the subsequent steps of the risk analysis (i.e. risk management and risk communication), helping managers make responsible decisions as part of an integrated beach management process.

3.2- Methodological framework for multi-hazard risk assessment in beaches [1]

3.2.1- General characteristics

The proposed methodology goes through two phases: *Risk profile* and *Risk assessment* (Figure 1). The main objective of the *Risk profile* is to define the *Beach Pathways of Effects* (*Beach PoE*), in which links between main hazards and principal ecosystem services provided by the beach are identified and formalized. Pathways of Effects (PoE) conceptual models were defined as a "visual representation of relationships between human activities (drivers), the pressures they generate (aquatic ecosystem hazards) and their impacts on ecosystem components (endpoints)" (Hardy and Cormier, 2008).

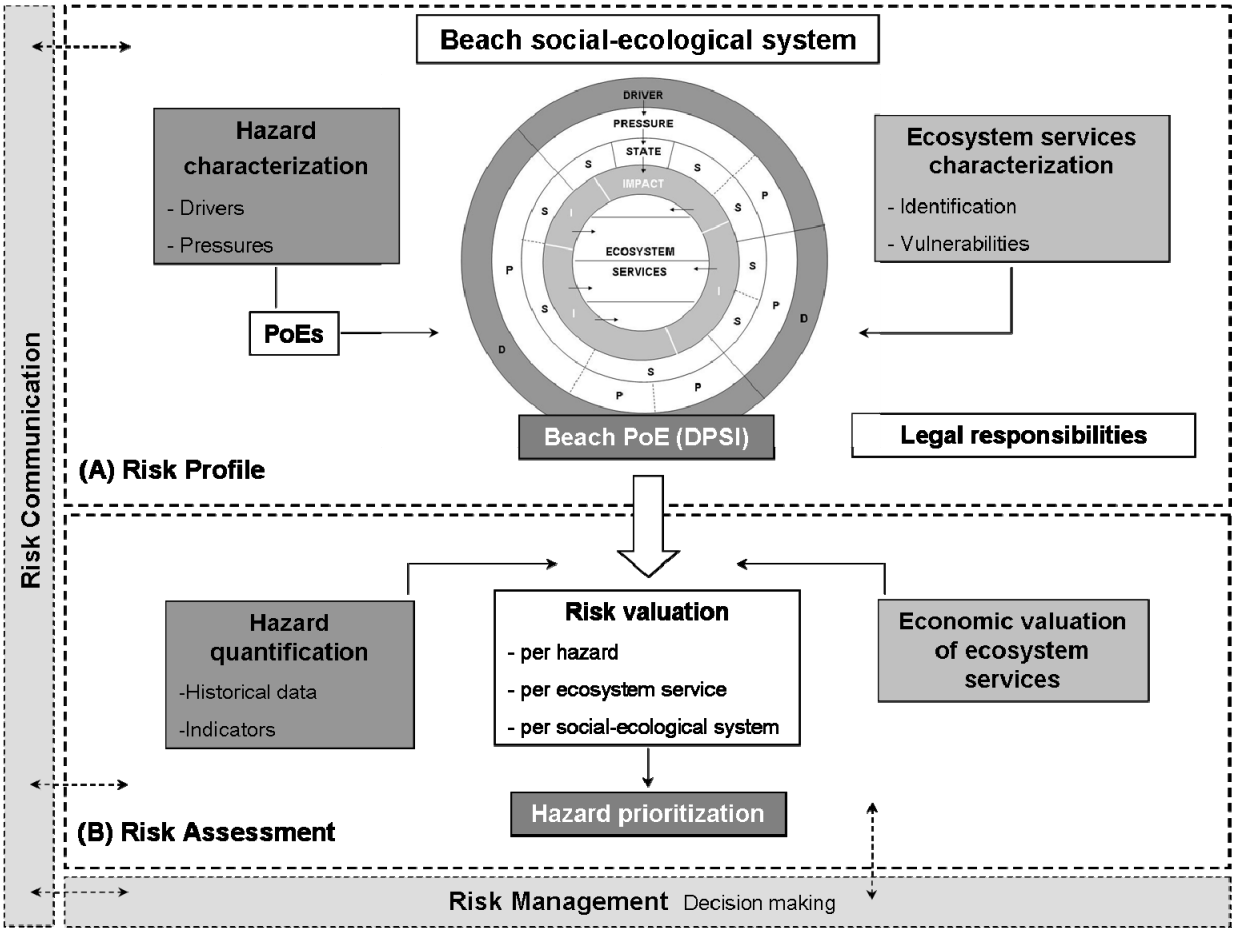


Figure 3.1- Diagram of the multi-hazard risk assessment of the beach, presenting the main steps of the proposed methodology.

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[1] Edited version of *A Methodological Framework for Multi-hazard Risk Assessment in Beaches (2011) by JP Lozoya, R Sardá & JA Jiménez. Environmental Science & Policy, 14: 685-696.*

PoE models follow the Driver-Pressure-State-Impact-Response approach (DPSIR), described as a "causal framework for describing the interactions between society and the environment" (EEA, 2006b). Within this frame, social and economic developments (Drivers, D) generate Pressures (P) on the environment, and modify its State (S), leading to Impacts (I) on ecosystems, human health, and society (i.e. *Welfare* sensu the developed made by Cooper (2012) and explained in Chapter 2 of this thesis). Related to decision making, Responses (R) feeds back on Drivers, on State or on Impacts through mitigation, adaptation or curative actions (Maxim et al., 2009). In the PoE, the focus is limited to the Driver-Pressure-State-Impact portions of the model. Knowing the links between hazards and ecosystem services provided by the beach, the main objective of the *Risk assessment* are risk valuation and hazard prioritization, based on hazard intensities and, economic valuation and exposure of the affected ecosystem services (Figure 3.1).

3.2.2- Risk Profile

In order to obtain the *Beach PoE*, the first phase of the proposed methodology starts with the identification and characterization of both major hazards and main ecosystem services.

Hazards characterization

Hazards were classified in two main groups of coastal Drivers (*sensu* DPSIR approach): *Natural & Climate related DRIVERS* and *Anthropogenic DRIVERS*. The former includes hazards affecting the physical environment (physical hazards e.g. coastal storms, erosion) and those involving organisms and their effects (biological hazards e.g. dangerous marine life). The second group includes hazards resulting from human activities and policies, whether specific events (e.g. major accidents), spread processes (e.g. pollution, land use, tourism overuse), and legal aspects (land reclamation) (see Table 3.1 for examples).

Once main hazards were identified and classified, a PoE for each one of them was obtained in order to understand links between hazards and beach ecosystem services delivered by the beach under study (see Figure 3.2 as an example).

Table 3.1- Potential hazards in coastal areas and beaches. Some descriptors that can be used to characterize these risk events are also proposed.

HAZARDS	DESCRIPTORS
Natural & Climate related DRIVERS	
Dangerous shore breaks [1,2, 6]	Accidents during the bathing season
High surf [1, 2, 6]	Accidents during the bathing season
Strong currents [1, 2, 6, 7]	Accidents during the bathing season
Wave on ledge [1, 2]	Accidents during the bathing season
Dangerous marine life (*e.g.* sharks, jellyfish, sharp corals, algal blooms)[1, 2]	Presence, concentration, or accidents during the bathing season
Tsunamis, Hurricanes, Cyclones [3, 4]	Probability of occurrence
Sea level rise	Models, Predictions
Storm surges [3]	Probability of occurrence
Coastal erosion [4, 5]	Erosion rate
River floods [3,4]	Probability of occurrence
Anthropogenic DRIVERS	
Pollution [1]	Water quality indexes
Land use	% of land urbanization
Major accidents (*e.g.* chemical/nuclear power plants, refineries, oil transportation) [3]	Number of pipes, distance from industrial plants, oil transport route
Uncivil behaviours (e.g. thefts)	Incidents during the bathing season

(1) The Dangerous Beaches Mapping Project: http://oldweb.geog.berkeley.edu/ProjectsResources/DangerousBeaches/; (2) Lifeguards' guide to Oahu's popular guarded beaches; (3) Schmidt-Thomé (2005); (4) FLOODSite-Consortium: http://www.floodsite.net/; (5) Valdemoro and Jiménez (2006); (6) Australian Coastal Safety Resource: http://www.surfrescue.com.au/; (7) Short (2007).

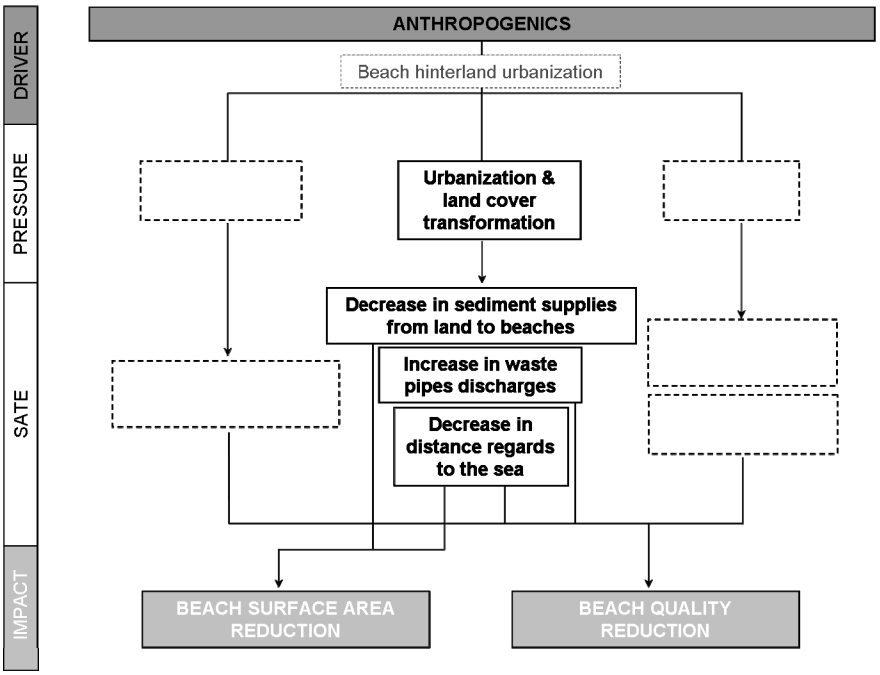

Figure 3.2- Example of a Pathway of Effects (PoEs) obtained for the hazard "Beach hinterland urbanization". This hazard, classified as an *Anthropogenic Driver*, generates one *Pressure* (i.e. Urbanization & land cover transformation), which modify in three ways the *State* of the environment (i.e. Decrease in sediment supplies from land to beach; Increase of waste pipes discharge; Decrease of distance regards to the sea), leading to two general *Impacts* (i.e. Beach surface reduction and Beach quality reduction).

Ecosystem services characterization

As described in Chapter 2, several ecosystem functions and services categorizations have been developed. But, since the objective of this chapter is to apply this framework in beach management, based on the classification proposed by Farber et al 2006, the characterization was focused only on the services identified and described for beaches by Brenner (2007). These services are presented in Table 3.2, as they were outlined above in Table 2.1 (Chapter 2 of this thesis).

Table 3.2- Categorization of goods and services provided by beaches (after Wilson et al., 2002 in Brenner, 2007).

CATEGORY	SERVICE	EXAMPLES
Supportive structures and functions	Habitat	Spawning and nursery grounds, refuge for species;
Regulation services	Disturbance regulation	Storm surge and flood protection
	Soil retention	Prevention of soil loss (wind, runoff)
Cultural services	Recreation	Ecotourism, bird-watching, outdoor sports
	Aesthetic	Open spaces, scenery
	Spiritual & historic	Nature as national symbols, landscapes with religious values

However, ecosystem services must be characterized by considering the features of the region under study and their main activities (Turner, 2000). For example, in the coastal zone *Disturbance regulation* will be mainly determinate by the amount of settles or infrastructures built in the hinterland, while *Habitat* will be greater depending on land covers, the existence of rivers, wetlands or estuaries that could be for example a reproductive zone for endemic species. In this sense, existence of raw materials, foods, freshwater, medical or genetic resources will determine the *Provisioning services* of the ecosystem, and *Cultural services* will be affected by the presence of historical and spiritual constructions, or zones with high aesthetic or recreational value (de Groot et al., 2002; Farber et al., 2006). Accordingly, vulnerabilities of these services, defined as an "inherent susceptibilities of an ecosystem component in relation to the potential impacts of a hazard which can cause adverse effects" (Hardy and Cormier, 2008), were also included in this characterization. The identification of vulnerabilities improves the understanding of the types of risks which could have a significant impact on identified ecosystem services.

Construction of Beach Pathway of Effect

The aim of this step, and the main result of the *Risk profile* is to obtain the *Beach PoE* (Figure 3.3), based on the PoEs obtained in the hazard characterization (see section 2.2.1 of this Chapter), and the vulnerabilities identified in the ecosystem services characterization (see section 2.2.2 of this Chapter). Following the D-P-S-I portions of the DPSIR model, Figure 3.3 illustrates for the main Drivers (D), their main Pressures (P), the corresponding States (S) and the Impacts (I). Since the vulnerability of beach ecosystem services were already characterized, links between impacts and ecosystem services can be established for the beach under study. Construction of Beach PoE is crucial for the next phase of the proposed methodology (i.e. Risk Assessment) since risk valuation and hazards prioritization will be mainly based on links obtained in this step.

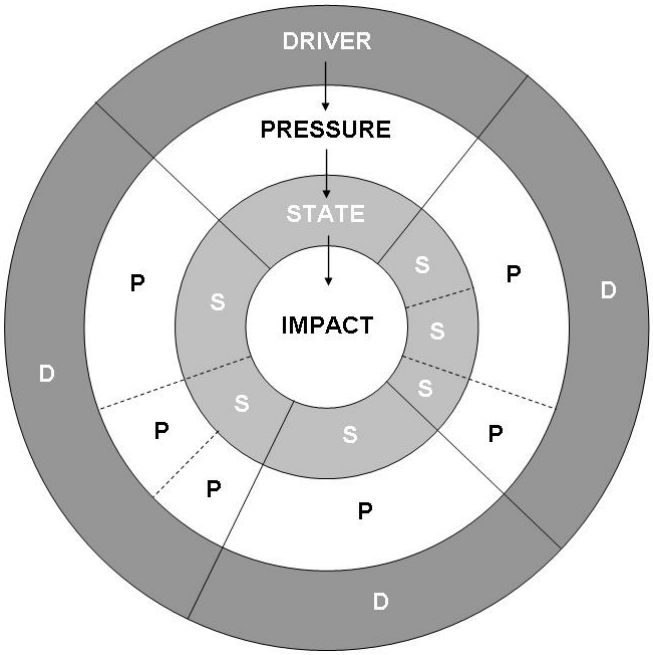

Figure 3.3- General diagram of a *Beach PoE*, showing for the main Drivers (D) identified in the beach, their main Pressures (P), the corresponding States (S) and the Impacts (I).

Legal responsibilities

Within the context of ecosystem-based management practices (e.g. integrated management, marine spatial planning or environmental assessments), risk management initiatives need to establish the management basis for managing risks (Cormier et al., in press). Competent authorities, that will lead the process in terms of legislative, policy and mandate related to sustainability and ecosystem management outcomes must be identified.

A competent authority is a person within an organization that has the legally delegated authority to set ecosystem sustainability policies and outcomes. This person also has the authority to oversee the development and implementation of management strategies, in collaboration with other authorities and stakeholders. Monitoring should also be reported by the competent authority. Legislation may authorize an organization to establish preventive controls (e.g. best management practices, standard operating procedures, or management targets) or to establish mitigation controls (e.g. environmental quality standards, spatial planning, integrated management, or sustainability objectives). The legislation may also authorize the competent authority to facilitate or lead the development of such strategies in collaboration with other authorities and stakeholders. The legislation sets the boundaries of the organization's ecosystem sustainability policies and programs, which provides direction as to the ecosystem management outcomes (Cormier et al., in press).

In this step, an overview of key legal responsibilities related to the hazards and the ecosystem services provided by the beach helps to identify the appropriate jurisdictions which may be affected in subsequent risk management initiatives. In this sense, the following questions may serve as a guide: Who are the organizations that have legislations, policies or programs that complement the competent authority mandate in managing drivers within the management area?; who are the stakeholders of the drivers that will be managed?

3.2.3- Risk Assessment

Hazards are events directly caused by pressures released by drivers that interfere with the environment's ability to provide valued services. Such events can have multiple impacts in terms of social, cultural, economic and policy repercussions. Linked directly to specific pressures, the risk criteria are expressed in terms of the potential changes in the event that a hazard manifests itself. The risk criteria classify and rank the risks in terms of the possible consequences or repercussions. These could express losses in terms of ecosystem components and environmental services, as well as regulatory and policy repercussions. The criteria also reflect the values of the regulators, stakeholders and the public describing the severity of a hazardous event such as being for example

minor, significant, major or catastrophic. The risk criteria results a benchmark throughout the entire risk management process (Cormier et al., in press).

The main objectives of this phase are risk valuation and hazards prioritization. The latter was performed according to the risk valuation, estimated based on the intensities of the hazards and the eventual losses of the affected ecosystem services. In this sense the intensity of the events were quantified (and normalized) and the environmental services were valued economically. Although the consequences of the ecosystem services losses could be assessed, and even at different levels (e.g. managers, users, management process, stakeholders), in this case the analysis was not so detailed. Likewise, differences in exposure of different services along the beach were not taken into account either. That level of detail would undoubtedly be a significant improvement for the framework, and therefore it will be considered in future developments. In this sense, the prioritizations obtained with this framework should be interpreted as "hazard A is riskier than hazard B" instead of "hazard A has a level of risk unacceptable (red), negligible (green), or medium (yellow)."

Hazard quantification

Using indicators derived from proposed descriptors (see Table 1), hazards were quantified based on their intensities. The latter were obtained using risk matrices based on frequency of the hazards (e.g. extreme probability distributions) and their consequences with regard to current conditions (e.g. reduction in beach width, erosion rate), according to a return period or temporal scale previously defined. The tolerable maximum intensities of each event (i.e. where the manager does not consider any action: relative intensity=0) were prefixed and the relative intensities were assigned to each case of the risk matrices. Considering the heterogeneity of hazards, an ordinal scale of relative intensities (i.e. 0 to 1) was applied in order to normalize these intensities and assure their integration in the risk evaluation (see *Risk valuation and prioritization*).

Concerning the temporal scale, the episodic events identified (i.e. storm-induced erosion, storm-induced floods and river floods) were analyzed in probabilistic terms through a probability of occurrence expressed as a return period (*Tr*). These hazards were considered in the analysis as *frequent* and their *Tr* were 50 years, based on the

European Flood Risk Directive (2007/60/EC-FRD). Other events not associated with extreme conditions were quantified based on a probability distribution obtained from historical local data. For these hazards, which present a defined time trend, a temporal scale of 5 years was used in order to ensure enough time for managers to consider risk assessment, policy and decision-making, and implementation.

Economic valuation of ecosystem services

Economic valuation is one of the critical steps. Although it is a criticized methodology, it enables the estimation of monetary values of ecosystem services related to human welfare, giving a more complete picture of their economic importance, allowing their comparison, and demonstrating the high costs associated with their possible degradation (Brenner, 2007; Brenner et al., 2010).

In the proposed methodology, we applied the transfer method in order to obtain estimates of ecosystem services values (ESV) at the beach under study. "Ecosystem service value (ESV) is the process of assessing the contribution of ecosystem services to achieve a particular goal" (Daly, 1992), which has traditionally been efficient allocation, but could also be the assessment of the sustainability of the scale or magnitude of human activities (Brenner, 2007). In this sense, ESV helps managers make responsible decisions, improving their abilities to evaluate and chose from different management alternatives (Costanza and Folke, 1997 in Brenner, 2007). The value transfer method constitutes the application of values and other data empirically obtained from the original study site, to the present site under study (Loomis 1992, Brenner et al., 2010). Despite known limitations (i.e. biophysical and socio-economic sensitivity) (Troy and Wilson, 2006; Brenner, 2007; Brenner et al. 2010), this method has become very useful when primary data collection is limited (Moran, 1999; Kreuter et al., 2001 in Brenner, 2007), and has been widely used to inform management decisions by public agencies (Downing and Ozuna 1996; Eade and Moran 1996, Kirchoff et al., 1997 in Brenner, 2007), providing a credible basis for policy decisions involving sites other than the one for which the values were originally estimated. This is particularly significant because resources that were not evaluated for the site under study are generally negligible (zero value) because they have simply been ignored in the existing markets, and hence they will not be considered in management processes (Brenner, 2007; Brenner et al., 2010). By estimating the economic value of ecosystem services, social and environmental costs

or benefits that usually were not considered, are now available to be included in the analysis, helping managers to make more accurate decisions in an integrated beach management process.

Risk valuation and prioritization

Risk valuation was based on the definition proposed by Morrow (2009), in which risk was defined as the product of hazard, exposure and consequence or a combination of probability and severity of consequences. The exposure of all ecosystem services along the beach was assumed to be maximum and constant, and the risk was calculated as the product of hazard intensities (H) and ecosystem services values (ESV), according to the links defined in the beach PoE.

Considering subsequent interactions with risk managers and stakeholders, the proposed methodology allows three different risk valuations:

- Risk caused by each hazard (R_{Hx}), considering the intensity of the hazard (H_x) and the economic valuation of all the ecosystem services affected by this hazard (ESV_A):

$$R_{Hx} = \sum_{A=1}^{A=n} (H_x \times ESV_A)$$

- Risk affecting each ecosystem service (R_{ESy}), considering all the hazards (H_a) affecting this ecosystem service and the economic valuation of this ecosystem service (ESV_y):

$$R_{ESy} = \sum_{a=1}^{a=n} (H_a \times ESV_y)$$

- Risk for the entire social-ecological system (*TR)*, considering the risk of all the hazards or the risk affecting all the ecosystem services considered in the assessment:

$$TR = \Sigma R_H = \Sigma R_{ES}$$

In order to improve visualization of the riskiest hazards and the most affected ecosystem services and thereby ameliorate risk communication and management, both hazards and ecosystem services were prioritized in a Risk Matrix. Coastal hazards were prioritized according to their intensities and the severity of their consequences (i.e. affected ESV),

while ecosystem services were prioritized based on their values (ESV) and the supported pressure due to affecting hazards (Undergoing pressure) (Figure 3.4).

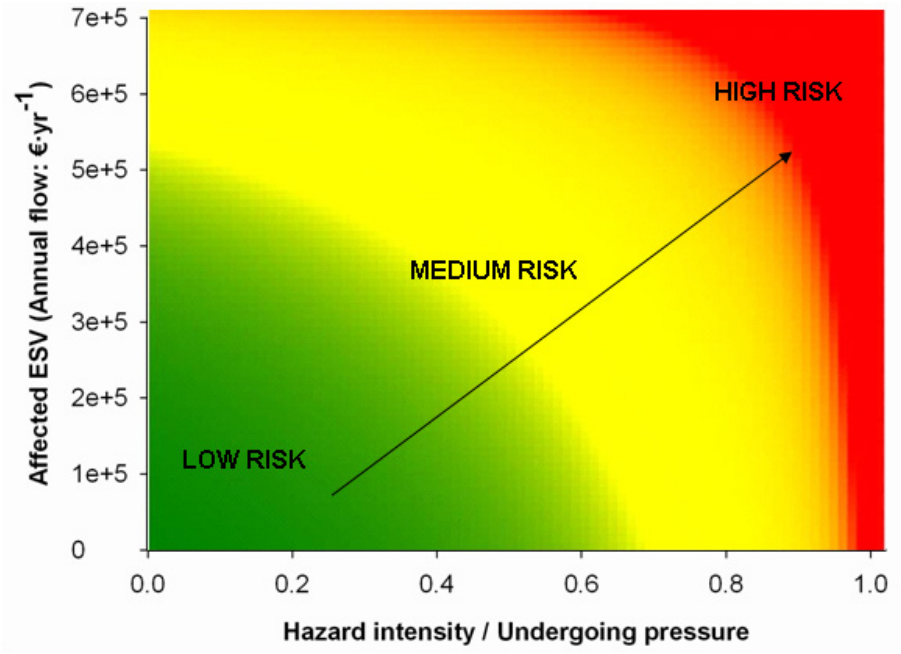

Figure 3.4- Risk Matrix where hazards and ecosystem services were prioritized based on their intensities and the severity of their consequences (i.e. affected ESV), and their values (ESV) and the supported pressure due to affecting hazards (i.e. Undergoing pressure), respectively.

3.3- Validation of the methodological framework for multi-hazard risk assessment in beaches [2]

3.3.1- Study site

The methodology presented was validated at S´Abanell beach (41º40'N, 2º47'E), located in the Bay of Blanes (NW Mediterranean Catalan coast, Spain) (Figure 3.5). S´Abanell is an urban and touristic beach that is intensively used during the bathing season and managed so as to guarantee this industry. Tourism represents almost 10% of the Catalan GNP and is the main economic activity in the area (Valdemoro and Jiménez, 2006; Ariza et al., 2008a). However, this beach is subject to increasing pressure due to intensive development, already identified as one of the main factors inducing coastal degradation (Sardá and Fluvià, 1999; Barragán, 2003).

In the last decade S´Abanell beach has suffered significant erosive processes that have accelerated its retreat (Valdemoro and Jiménez, 2006). This trend has been associated with a drastic decrease in sediment supplies from the Tordera River, caused by increasing urbanization in its watershed, major dredging operations on the river bed and decreasing river liquid discharge due to intensive human use (Martí and Pintó, 2004). This retreat has contributed to the failure of S´Abanell beach as a supplier of several ecosystem services, especially disturbance regulation and recreation & aesthetic. In 2008, Blanes endured several coastal storms causing considerable damage to the sea front (e.g. parks, access, parking, vessels), resulting in the failure of S´Abanell beach and thus compromising protection and tourism activities. Three nourishment processes were necessary to guarantee these services, but by 2009 S´Abanell almost failed again.

Valdemoro and Jiménez (2006) identified two different zones in S´Abanell beach in terms of frequentation, beach use, hinterland, morpho-dynamics and management. The southern part (900 m from the river mouth) is not intensively used, even during the bathing season, and has natural areas, camping sites and crop lands in its hinterland.

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[2] Edited version of *Beach Multi-Risk Assessment in the Costa Brava (2011) by JP Lozoya, R Sardá & JA Jiménez. Journal of Coastal Research, SI61: 408-414.*

In the north, the beach hinterland is urban and beach frequentation is clearly greater, especially during the bathing season. Differences were also observed in both hazards (occurrences, intensities and consequences) and ecosystem services (existence and degree of delivery), which made this beach more interesting to study and increased the potential of this methodology for generalization.

Figure 3.5- Picture of S'Abanell beach (Google Earth ™ 2007) showing the northern and the southern zones, including the effects of beach nourishment carried out in 2007 in the southern zone.

3.3.2- Risk Profile

Hazards characterisation

Six hazards were identified and classified as the most important stressors affecting S´Abanell beach. We found three physical hazards (*coastal storms*, *long-term erosion* and *river floods*) and one biological hazard (*jellyfish*). Among anthropogenic hazards we identified *pollution* and *human uses*, the latter combining the two main human drivers of change at S´Abanell: *tourism overuse* and *hinterland urbanization*. Based on these hazards, we identified two PoE with two main drivers (*anthropogenic* and *natural & climate–related*) and two main impacts (*surface area reduction* and *quality reduction*) (Figure 3.6 and 3.7).

As for anthropogenic activities, *alteration of natural land-sea fluxes* was one of the negative pressures, causing the increase in litter and waste discharges (state), with the corresponding reduction in beach quality (impact). *Urbanization and land cover transformation* was also a negative pressure, causing a decrease in sediment supply from land to sea, an increase in waste pipe discharge and a reduction in the distance between infrastructure and the sea (states). All of these activities reduce both beach quality and beach surface area (impacts). *Tourist population increase* was the third negative pressure identified, causing higher litter and waste discharges and increased beach crowding (states), both of which reduce beach quality (impact) (Figure 3.6).

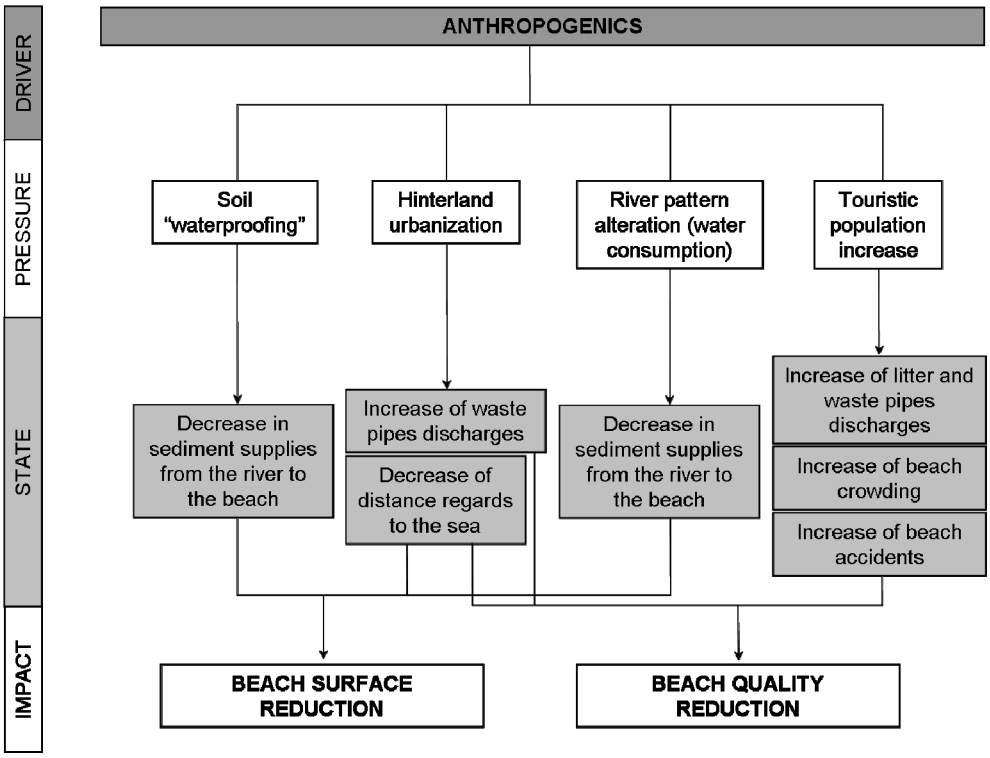

Figure 3.6- Pathways of Effect (PoE) of the anthropogenic driver in S´Abanell beach. The main hazards are also suggested.

The main negative pressures identified for the second driver (natural & climate–related) were alteration of natural beach sand transport, alteration of sea level, alteration of river bed and natural water transport patterns and alteration of species distribution patterns. The first implies a decrease in beach sediment supply, while the second also causes an increase in sea level. Alteration of river bed and natural water transport patterns increases the river level (state), while alteration of species distribution patterns increases the occurrence of dangerous marine life (state). The latter was the only pressure which

causes a reduction in beach quality, while the other three only reduce beach surface area (Figure 3.7).

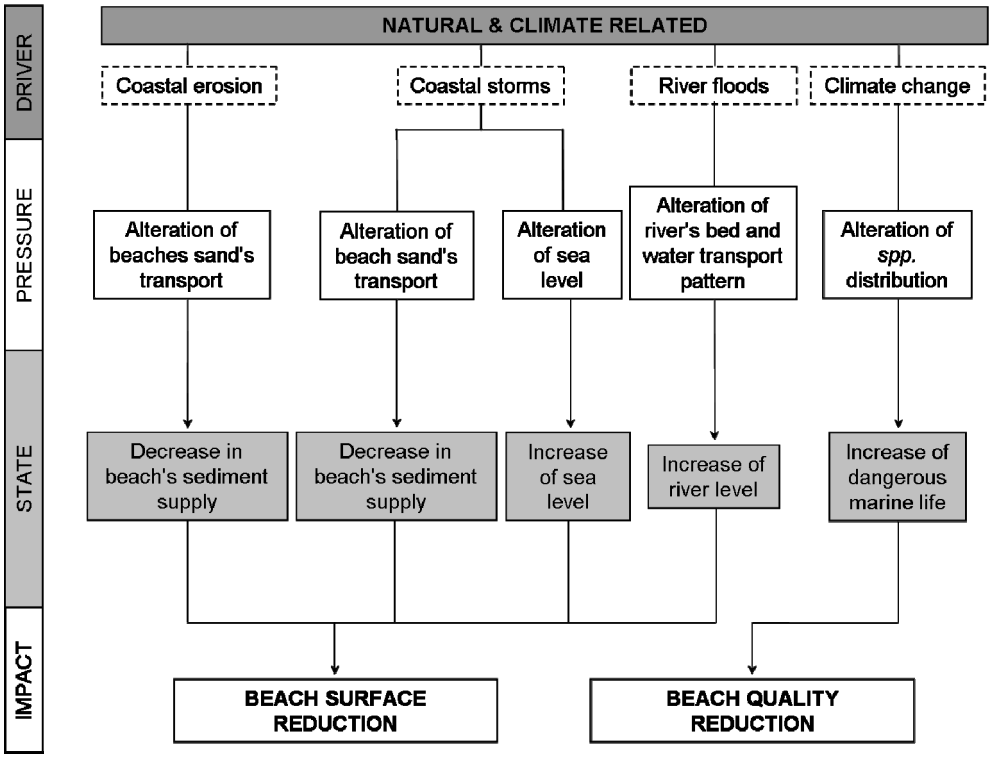

Figure 3.7- Pathways of Effect (PoE) of the natural & climate related driver in S´Abanell beach. The main hazards are also suggested.

Ecosystem services characterization

Considering the characteristic of S´Abanell beach and its main activities, six ecosystem services were examined in this assessment: *Habitat*, *Disturbance regulation*, *Water supply*, *Recreation*, *Aesthetic*, and *Spiritual and historic*. It is noteworthy that *Water supply* was added to the list presented in Table 3.2 (services provided by beaches identified in the literature) due to its importance in S´Abanell beach.

Habitat: defined as the physical place where organisms reside and the habitat that they provide. At S´Abanell beach, this service is primarily linked to the Tordera river delta which is included in the Natura 2000 network, an EU network of nature protection areas which is the centrepiece of the EU nature and biodiversity policy (Council Directive 92/43/EEC). Any non-natural event causing the loss of surface or an environmental perturbation directly (e.g. beach surface losses, pollution) or indirectly (e.g. reducing sediment supply) could be affecting this service.

Disturbance regulation: with a valuable role in the defence of coastal regions, this service is mainly determined by hinterland infrastructures and concerns the dampening of environmental fluctuations. It is probably one of the most important services provided by S´Abanell beach, and it will be affected by any direct (e.g. erosion) or indirect (e.g. sediment supply) beach reduction.

Water supply: defined as the retention, filtering and storage of fresh water, including fresh water for drinking, irrigation or transportation. In this case, the southern zone of S´Abanell beach supports a water pump from a desalinization plant (Catalan Water Agency, ACA), which provides drinking water for several towns along the coast. Any reduction in beach width that could affect these infrastructures or any considerable reduction in water quality could affect this service.

Recreation: defined as the opportunities for rest, refreshment and stimulation of the human body and mind based on ecosystems. This service is one of the most important at S´Abanell beach. Reductions in beach surface area and beach quality are the main vulnerabilities of this service.

Aesthetic: the attractive landscape features based on the sensory enjoyment of functioning ecological systems. Although S´Abanell is an urban beach, its aesthetic value is not negligible because of the beauty of the Costa Brava landscape. As in the previous case, reductions in beach surface area and beach quality are the main vulnerabilities of this service.

Spiritual & Historic: defined as spiritual or historic information provided by natural features of the ecosystem, this value is intimately associated with the beach itself and the fishing history of Blanes town. Reductions in both beach quality and surface are also the main vulnerabilities.

Because of the aforementioned differences between the two zones of the beach, not all ecosystem services were considered equally. The southern zone offered all the services described above, while the northern zone simply offered *disturbance regulation*, *recreation*, *aesthetic*, and *spiritual & historic services*. *Water supply* was strictly related to the infrastructures of the desalinization plant, and *habitat* was linked to the Tordera River, both in the southern zone. In order to improve risk assessment, and particularly regarding the economic valuation, *recreational* and *aesthetic services* were considered as one service (i.e. *recreational & aesthetic*).

Construction of Beach Pathway of Effect

Based on the PoEs obtained in the hazard characterization (see section 3.2.1 of this Chapter) and the vulnerabilities identified in the ecosystem services characterization (see above in this Chapter) we obtained the main result of the *Risk profile*: the Beach PoE for S´Abanell beach (Figure 3.8). In this way, we fulfilled the main objective of this step, representing main drivers and affected environmental services, and detailing the links between them on the beach under study.

Legal responsibilities

In Spain, several public administrations are responsible for coastal management. With several laws and regulations, they are spread over three administrative levels: the central government of the Spanish State, the Autonomous Governments (in the case of S´Abanell beach the one of Catalonia), and the Municipalities.

A detailed analysis of legal responsibilities is presented in Chap 5 of this thesis. There, in addition to describing the general structure of coastal and beach management in Spain, it was performed a detailed institutional analysis for eight Municipalities along the Costa Brava (including Blanes and hence S´Abanell beach), identifying the different agencies responsible for management. Maintaining the ecosystem perspective, this work was done based on the analysis of processes underlying each of the three main functions of beaches before described (i.e. Natural, Recreational, and Protection). This analysis represents another key component to improve beach management, since *Institutions* (see Berkes and Folke, 1998) have been mentioned as an essential component to improve the performance of natural resource. As regards S´Abanell beach, any mitigation or reduction measures proposed in a risk management process will entail coordination

between departments and agencies at the three administrative levels: the Spanish government, the Autonomous Government of Catalonia and the Municipality of Blanes.

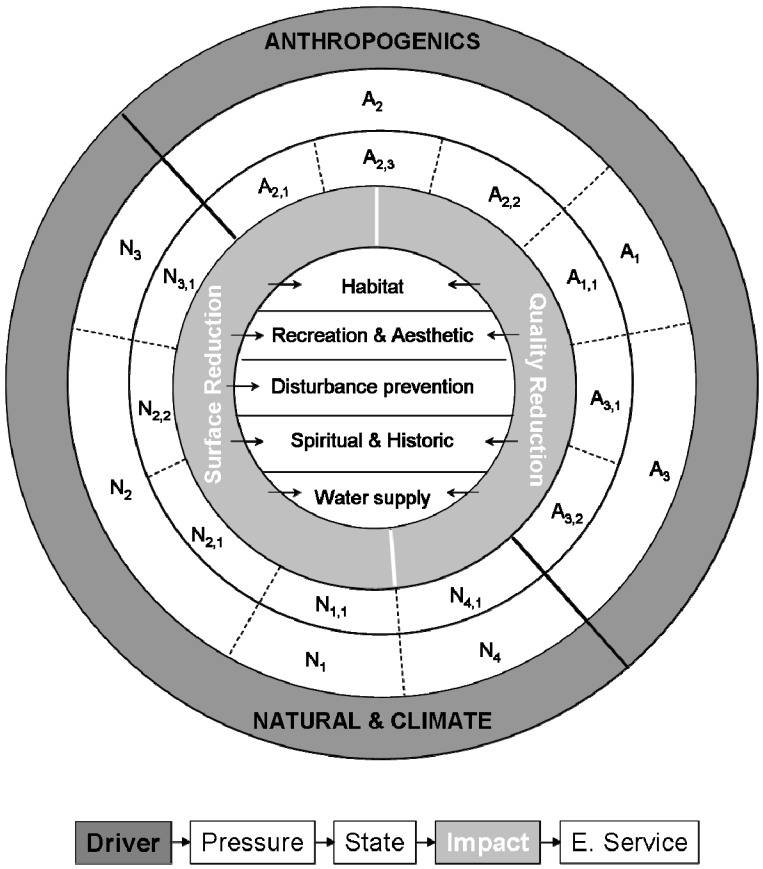

Figure 3.8- PoE obtained for S´Abanell beach, showing the two main Drivers, their main Pressures, and the corresponding States and Impacts (see codes in Figures 3.6 and 3.7). Link between Impacts and ecosystem services considered for S´Abanell beach are also presented.

3.3.3- Risk Assessment

Hazards quantification

The six hazards identified at S´Abanell beach were quantified as follows:

Coastal storms cause two processes that were quantified independently as follows.

Storm-induced erosion: due to the stochastic nature of this process, quantification was based on the extreme probability distribution of beach induced retreats (Δx). This distribution was built through a numerical model based on local beach geomorphology and wave climate, which calculates the expected shoreline retreats for a given probability. With this distribution, the intensity of this hazard (0 to 1) was calculated following Jiménez et al (2011) from the ratio between the actual beach width (BW), the

beach retreat (Δx) associated with the target return period (Tr=50 yr) and the minimum beach width necessary for any recuperation activity (MBW):

$$\beta = \frac{1}{(BW - \Delta x)/MBW} \quad (4)$$

The relative intensities for the northern and southern zones of S´Abanell beach were 0 and 1, respectively (Table 3.3).

Table 3.3- Relative intensity of *Storm-induced erosion* for both the northern and the southern zones of S´Abanell beach.

STORM-INDUCED EROSION					
cale					
β	>0.83	>0.90	>0.99	>1.24	>1.66
Intensity	0.2	0.4	0.6	0.8	1
Data Analysis					
Tr (yr)	5	10	25	50	100
Δx (m)	10	12	15	16	21
	North			South	
MBW (m)	5			5	
BW (m)	27			19	
β	0.45			1.67	
Intensity	0			1	

Storm-induced flood: this quantification was also based on extreme probability distribution, using the expected water level increase (run-up). The intensity was determined from the ratio between the expected run-up and the sea front height (SFH) of the beach, where the run-up was calculated according to Stockdon et al (2006). The relative intensities (Tr=50 years) were 0.8 and 1 for the northern and southern zones, respectively (Table 3.4).

Table 3.4- Relative intensity of *Storm-induced flood* for both the northern and the southern zones of S´Abanell beach.

STORM-INDUCED FLOOD					
Scale					
Run up/SFH (%)	>80%	>90%	>100%	>120%	>150%
Intensity	0.2	0.4	0.6	0.8	1
Data Analysis					
Tr (yr)	5	10	25	50	100
Run up (m)	3.4	3.7	4.1	4.4	4.7
	North			South	
SFH (m)	3			2	
Run up/SFH (%)	147%			220%	
Intensity	0.8			1	

Long-term erosion: this quantification was achieved from an erosion rate for a period of 5 years, calculated with historical data and assuming that the system remains constant (Jiménez et al., 2011). The erosion rates (Δx) were -0.8 for the northern and -2.2 for the southern zones, and the relative intensity calculated with Eq. 4 was 0 for both zones (Table 3.5).

Table 3.5- Relative intensity of *Long-term erosion* for both the northern and the southern zones of S´Abanell beach.

LONG TERM EROSION					
Scale					
β	>0.83	>0.90	>0.99	>1.24	>1.66
Intensity	0.2	0.4	0.6	0.8	1
Data Analysis					
Δx (m/yr)	*North*: **0.8**			*South*: **2.2**	
	North			South	
MBW (m)	5			5	
BW (m)	27			19	
β	0.22			0.63	
Intensity	0			0	

River floods: an extreme probability distribution of Tordera river floods was used in this quantification, comparing the water level increase and the topography (Generalitat de Catalunya, 2010a). Fixing the return period at Tr=50 years, we analyzed the expected percentage of flood surface against total beach surface. For both zones the relative intensity was 1 (Table 3.6).

Table 3.6- Relative intensity of *River flood* for both the northern and the southern zones of S´Abanell beach.

RIVER FLOOD					
Scale					
In flood/BS (%)	>40%	>50%	>60%	>70%	>80%
Intensity	0.2	0.4	0.6	0.8	1
Data Analysis					
Tr (yr)	10	50	100	500	
In flood/BS (%)	>80%	>80%	>80%	>80%	
	North			South	
In flood/BS	>80%			>80%	
Intensity	1			1	

Jellyfish: this biological hazard was quantified based on historical organism concentration data from the Catalan Water Agency (ACA) monitoring programme (2000-2009). The intensities were calculated from the frequency (% of weeks) of *low concentration* (<1 ind·10 m^{-2}, ACA) during the bathing season. The relative intensities were 0 and 0.2 for the northern and southern zones, respectively (Table 3.7).

Table 3.7- Relative intensity of *Jellyfish* for both the northern and the southern zones of S´Abanell beach.

JELLYFISH					
Scale					
Frequency (% weeks)	>10%	>20%	>30%	>40%	>50%
Intensity	0.2	0.4	0.6	0.8	1
Data Analysis					
	North			South	
Low concentration (*) frequency (% weeks)	6%			19%	
Intensity	0			0.2	

Pollution: this quantification was based on water quality history (ACA monitoring programme, 2000-2009), and the intensities were calculated from the frequency (% of weeks) of *good water quality* (Generalitat de Catalunya, 2010c) during the bathing season. The relative intensities were 0.2 and 0 for the northern and southern zones, respectively (Table 3.8).

Table 3.8- Relative intensity of *Pollution* for both the northern and the southern zones of S´Abanell beach.

POLLUTION					
Scale					
Frequency (% weeks)	>10%	>20%	>30%	>40%	>50%
Intensity	0.2	0.4	0.6	0.8	1
Data Analysis					
	North			South	
Good quality (**) frequency (% weeks)	12%			5%	
Intensity	0.2			0	

Human uses: this hazard was quantified by combining *tourism overuse* and *hinterland urbanization*:

Tourism overuse was estimated using beach crowding data (i.e. sand availability per user, S) obtained from MevaPlaya project, applying four scores: '3' if $S < 4.5 m^2 \cdot user^{-1}$; '2' if $4.5\ m^2 \cdot user^{-1} < S < 9\ m^2 \cdot user^{-1}$, '1' if $9\ m^2 \cdot user^{-1} < S < 18\ m^2 \cdot user^{-1}$ and '0' if $S > 18\ m^2 \cdot user^{-1}$.

Hinterland urbanization was estimated using Geographic Information Systems (GIS) and aerial photographs, applying scores to four categories of hinterland urbanization in a 500 m buffer zone from shoreline: natural (0), crop land (1), camping (2) and urban (3). This sub-indicator was quantified by applying the corresponding score to the percentage (from 0 to 1) of each category in the buffer zone, which gave an urbanization score from 0 to 3 in each zone of the beach.

Assuming equal relative importance, *human uses* intensity (from 0 to 1) was obtained adding both sub-indicators, being 0.8 in the north and 0.2 in the south zone (Table 3.9).

Table 3.9- Relative intensity of *Human uses* for both the northern and the southern zones of S´Abanell beach.

HUMAN USES					
Scale					
Hinterland urbanization	Natural	Crop	Camping	Urban	
Scores	0	1	2	3	
Data Analysis					
Surface (0 to 1)					Scores
North	0	0.09	0.18	0.73	3
South	0.18	0.52	0.29	0.01	1
Scale					
Beach crowding (m^2/user)	>18	<18	<9	<4.5	
Scores	0	1	2	3	
Data Analysis					
	North			South	
Scores	**1** (15m^2/user)			**0** (74m^2/user)	
Intensity	0.6			0.2	

Storm-induced erosion, *storm-induced floods* and *river floods* were the most intense hazards in the south, while in the north *river floods* showed the highest intensity.

Economic valuation of Ecosystem services

Annual estimates of ecosystem services values (ESV) for S´Abanell beach were obtained from scientific literature review, updating the values obtained by Brenner et al. (2010) (Table 10). These results are the statistical mean of individual estimates for each ESV, standardized to the average 2009 euro (€) equivalents per hectare and per year. Values were standardized using the annual Consumer Price Index variation for Catalonia and the annual mean fixed exchange rate (http://www.ine.es; http://www.bde.es). *Disturbance regulation* and *recreation & aesthetic* were the most valuable services, while *Habitat* and *spiritual & historic* were the least valuable, with two and three orders of magnitude less.

Nevertheless, the differences described above between the two zones of S´Abanell beach were considered in the economic valuation. A different number of ecosystem services were delivered by each zone, and *disturbance regulation* and *recreation & aesthetic* services were not equally delivered. A percentage of supplied service was defined for each service in each zone, and the ESVs obtained were corrected according to these percentages. *Disturbance regulation* is mainly determined by hinterland

infrastructures, and the northern zone has a higher concentration of settlement than the southern one (18% of natural hinterland). Based on this, the ESV for this service in the south was reduced by 18% (€ 78,035/ha·yr). Mean recreational use during summer in the south (568users/day) was 85% lower than in the north (3,753users/day). The ESV of the *recreation & aesthetic* services was thus reduced by 85% in the southern zone (€10,436/ha·yr). Considering the whole beach, the total annual flow of ecosystem services delivered to citizens was € 1,003,043/yr, of which almost 50% corresponded to *disturbance regulation* (Table 3.10).

Risk valuation and prioritization

For S´Abanell beach, the northern zone involved a greater risk than the southern one (TR_N= 1,638,048 and TRs=1,174,987, respectively) (Table 3.11). Among hazards, *a river flood was* the most risky event in the north, followed by *storm-induced floods* and *human uses*. In the southern zone the riskiest events were *storms (erosion* and *floods)*, and *river flood* (Table 3.11 and Figure 3.10). Concerning the ecosystem services offered by the beach, in both zones *disturbance regulation* was the most affected service, followed by *recreation & aesthetic* in the north and by *water supply* in the south (Table and Figure 3.11).

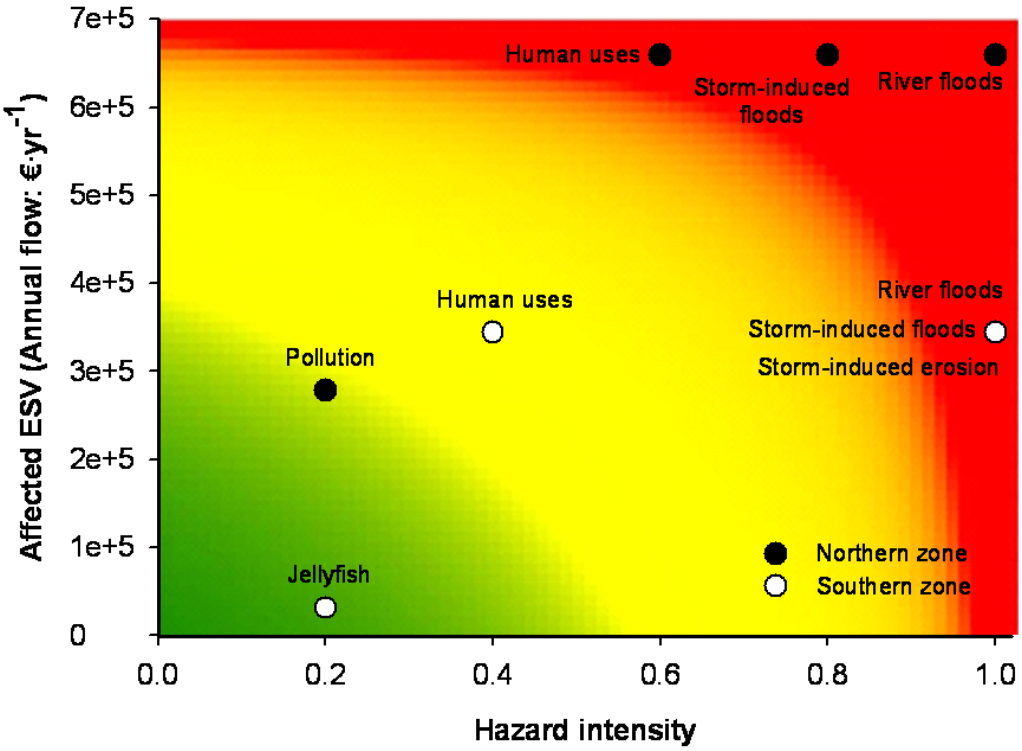

Figure 3.10- Hazard prioritization based on their intensities (0 to 1) and the affected ecosystem services (ESV: annual flow in €·yr^{-1}) for both northern and southern zones of S´Abanell beach.

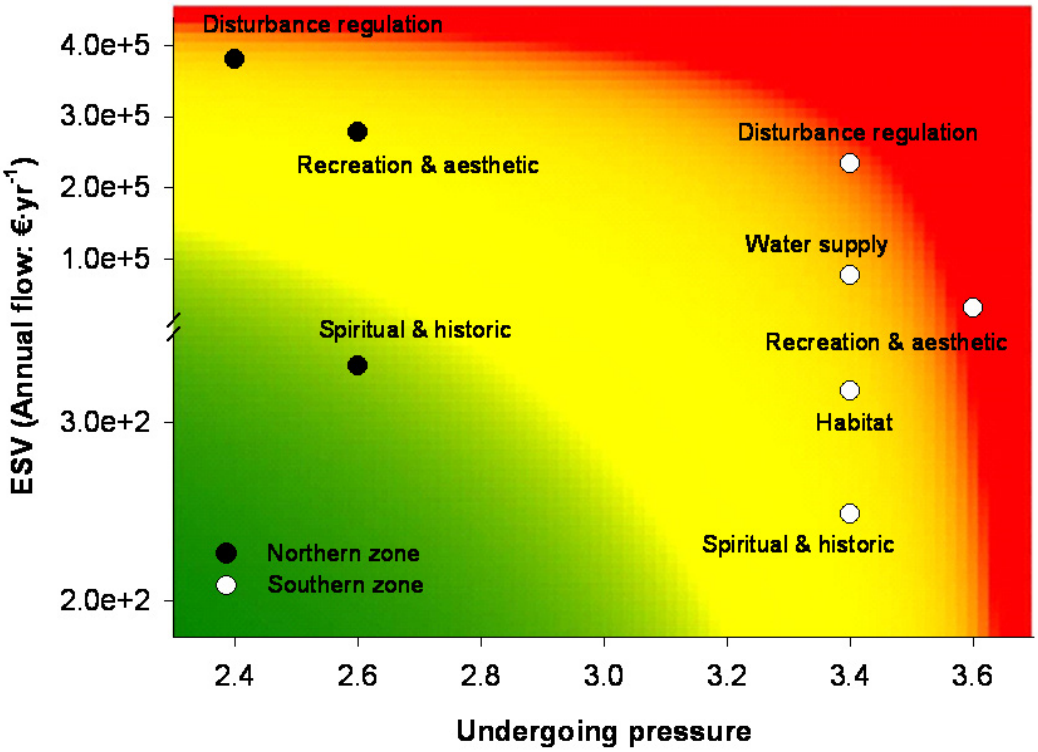

Figure 3.11- Ecosystem services prioritization based on their value (ESV: annual flow in €·yr^{-1}) and the suffered intensity (undergoing pressure) for both northern and southern zones of S´Abanell beach.

Table 3.10- Non-market values (ESV: €•ha-1•yr-1 in 2009) of the ecosystem services considered in the validation case. These estimations were obtained based on values calculated by Brenner et al (2010), Rabadán and Suárez (2008), Machado and Mourato (2002), Leeworthy and Bowker (1997), and Falk et al (1994). Annual flow of non-market values (€•yr-1 in 2009) of each ecosystem service, in both northern and southern zones and the entire beach, and their contribution (%) to the total value of S´Abanell beach are also shown.

ECOSYSTEM SERVICES	ESV ($€\cdot ha^{-1}\cdot yr^{-1}$)	Annual flow North ($€\cdot yr^{-1}$)	Annual flow South ($€\cdot yr^{-1}$)	Annual flow S´Abanell ($€\cdot yr^{-1}$)	Annual flow (%)
Habitat	106	-	318	318	0.06
Disturbance regulation	95,165	380,660	234,106	614,766	49.86
Water supply	25,920	-	77,760	77,760	13.58
Recreation & Aesthetic	69,577	278,308	31,310	309,618	36.46
Spiritual & Historic	83	332	249	581	0.04
Total	190,851	659,300	343,743	1,003,043	100

Table 3.11- Results of risk valuation at S´Abanell beach. Risk values per hazard (TRH) and per ecosystem service (TRES), and Risk Scores for each ecosystem service were calculated for both the northern and southern zones of S´Abanell beach.

HAZARDS	ECOSYSTEM SERVICES					RISK VALUES
NORTHERN ZONE	Disturbance regulation		Recreation & Aesthetic	Spiritual & Historic		TR_H
Storm-induced erosion	0		0	0		0
Storm-induced flood	304,528		222,646	266		527,440
Long term erosion	0		0	0		0
River flood	380,660		278,308	332		659,300
Jellyfish	-		0	-		0
Pollution	-		55,662	66		55,728
Human uses	228,396		166,985	199		395,580
TR_{ES}	913,584		723,601	863		1,638,048
Score	2.4		2.6	2.6		2.5
SOUTHERN ZONE	Habitat	Disturbance regulation	Water supply	Recreation & Aesthetic	Spiritual & Historic	TR_H
Storm-induced erosion	318	234,106	77,760	31,310	249	343,743
Storm-induced flood	318	234,106	77,760	31,310	249	343,743
Long term erosion	0	0	0	0	0	0
River flood	318	234,106	77,760	31,310	249	343,743
Jellyfish	-	-	-	6,262	-	6,262
Pollution	0	-	0	0	0	0
Human uses	127	93,642	31,104	12,524	100	137,497
TR_{ES}	1,081	795,960	264,384	112,715	847	1,174,987
Score	3.4	3.4	3.4	3.6	3.4	3.4

3.4- Discussion and Conclusions

This chapter proposes a multi-hazard risk assessment for beaches in order to assist policy and decision-making in the framework of integrated beach management processes. The need for holistic approaches is undeniable in environmental policies as well as for beach management (Hildebrand and Norrena, 1992; Ariza et al., 2008a; Forst, 2009). Moreover, risk reduction processes require a systemic vision, integrating natural and socioeconomic variables (Pérez-Maqueo et al., 2007). Since the concept of ecosystem services could improve this integration, the methodology proposed combines coastal hazards and beach ecosystem services in a risk analysis framework. The identification and prioritization of the highest risk hazards and the most affected ecosystem services allows ad hoc managers' plans and actions, improving risk and coastal management.

Based on the methodology proposed, the riskiest hazards at S´Abanell beach were river floods, storm-induced floods and storm-induced erosion in the south, and river floods, storm-induced floods and human uses in the north (in decreasing order). This prioritization is in accordance with the RISKCAT program (Natural Risks in Catalonia), which describes this area as a high river flood risk area, and a high danger zone related to coastal erosion and coastal flooding (Generalitat de Catalunya, 2008, 2010a).

For ecosystem services, the proposed risk assessment reveals that disturbance regulation and recreation & aesthetic (especially in the northern zone) were the service more affected, barely ahead of water supply, habitat and spiritual & historic. S´Abanell beach brings at least €1,003,043 each year (in 2009) to Blanes citizens, from which disturbance regulation (€95,165/ha·yr) and recreation & aesthetic (€69,577/ha·yr) were the most valuable services, though habitat and spiritual & historic services seem to be undervalued due to the limited availability and reliability of the literature. Considering the total risk scores, the northern zone of S´Abanell involved a greater risk than the southern one, mainly due to the great importance of disturbance regulation and recreation & aesthetic services. This risk-based prioritization is critical for beach management at S´Abanell because it is an important tourist destination, which is mainly managed to guarantee this industry (Valdemoro and Jiménez, 2006).

Any risk reduction or mitigation measure at S´Abanell beach in an integrated management process should be part of a risk management plan based on effective communication, coordination and cooperation between at least three administrative levels: the Directorate General for Coasts of the Spanish Ministry of the Environment (national government), the Ministry of Environment and Housing and the Ministry of Town and Country Planning and Public Works of the Catalan Autonomous Government (Generalitat de Catalunya) and the Department of Environment of the Municipality of Blanes (local government). However, although new beach management approaches have been introduced, beach management in Spain is still carried out by various private and public organisms, which lack an organized, regular flow of information, and clear, shared mid-term policies. Responsibilities are widely dispersed and beach management lacks proactive management tools that allow coordination between the different authorities, thus hindering the effective implementation of an integrated beach management process (Barragán, 2003; Ariza et al., 2008a; Doménech et al., 2009).

New beach management tools as well as a critical assessment of actual models are needed to ensure an efficient and equitable use of ecological services, minimizing the environmental impacts exerted by human activities (i.e. the ecosystem approach). The methodology proposed could contribute to the development of a pathway in order to move away from a competence-based model to integrated management based on processes, applying the ecosystem approach to the sustainable management of beach social-ecological systems. Additional work at other beaches is required for comparative purposes in order to check consistency and to confirm the potential of this approach for generalization. Despite these limitations this methodology should provide a procedure for systemic and spatially explicit coastal risk assessment, thereby improving risk analysis and helping managers make responsible decisions as part of an integrated beach management process.

Chapter 4
Users´ perceptions: a key factor for sustainable beach management

This chapter analyzes the users' perceptions in two beaches along the Costa Brava, as a significant factor in the assessment and feedback of beach management. After a general introduction (Section 4.1), the Section 4.2 analyzes a beach other than the one studied in the previous chapter, which is one of the last natural protected beaches of the NE Mediterranean coast of Spain (i.e. Sant Pere Pescador beach). The next section (Section 3) compares users' perceptions in the two beaches studied until now in the thesis, contrasting them as "antagonistic": a natural beach located in a protected setting (Sant Pere Pescador) vs. an urban beach in unprotected setting (S´Abanell). As mentioned in Chapter 2 both the consideration of social dimension as part of the system, and the engagement as many stakeholders linked to the beach as possible, are some of the main pillars on which are based on the ICM and the EBM.

4.1- Introduction

Beaches are social-ecological systems where physical, ecological, social and economic dimensions interact, providing several functions and services leading to improved human well-being (de Groot, 1992; Costanza et al., 1997; Farber et al., 2006; Ariza et al., 2008a; 2012). However, this increase in human welfare should be based on a sustainable use of these functions, "using its environment and its resources to meet the needs of the present without compromising the ability of future generations to meet their own needs" (Berkes et al., 2003). To properly manage these systems, a need for integration is crucial at this time to address the complexities of the diverse interests and perspectives, leading to a more transparent and fair decision-making process (Marin et al., 2009; McFadden et al., 2009). Dealing with so many interests, objectives/visions, players and even jargons, beach management requires consideration and integration of all these dimensions, looking for solutions that are at the

same time ecologically sustainable, socially equitable and economically efficient, ensuring sustainable use of these systems (James, 2000; Ariza et al., 2008b; Tett et al., 2011).

Although beaches can provide several protective, recreational and natural functions (Ariza et al., 2008a), in regions where coastal tourism is one of the main economic drivers, such as the NW Mediterranean, only recreation has been traditionally prioritized by coastal managers (e.g. Sardá and Fluviá, 1999; Yepes, 2005; Valdemoro and Jiménez, 2006; Ariza et al., 2008a). Accordingly, these social-ecological systems are basically managed to fulfill user expectations, optimizing this commercially-oriented function without taking other values or characteristics into consideration (Roca and Villares, 2008; Ariza et al., 2008a; 2008b; 2010). The aspiration of many coastal municipalities in these regions is addressed to offer more facilities and tourist services, thus attracting more and more tourists in order to obtain the greatest economic return as quickly as possible. However, in this eagerness to achieve economic development, managerial standards mainly designed for tourist beaches, such as ISO 14001 or EMAS, or certifications such as the Blue Flag, among others, have been sought coveted and applied in a uniform manner by municipalities, forcing them to adopt measures in order to fulfill the criteria required by the issuers of these beach quality awards (Ariza et al., 2008b).

While this standardization might be acceptable for recreationally-oriented beaches (beaches located inside urban and/or urbanized environments), those located on preserved natural environments should be managed in a differentiated manner, emphasizing their natural singularities as priorities in their management used frameworks. Management should strongly promote and assure the protection of natural values for these environments, which make these beaches special and even give good justification for their inclusion in conservation or protection programs. Nevertheless, in Spain and especially in the Costa Brava, these natural values are usually not considered to be such issues of great import to be managed by local beach managers, even if they recognize that their beaches have sensitive natural communities (see Ariza et al., 2008b). Since these beach management plans are mainly focused on recreational uses during the bathing season, beaches that are located in more isolated natural environments (sometimes even legally protected by regulatory figures), are usually not subjects of special attention (with some few exceptions, e.g., Menorca Island). If they are given such attention, their unique profile is usually not considered.

Furthermore, although beach quality criteria should be based at least partly on user opinions, under commercially-driven beach management models, users' expectations are only sporadically taken into account (Morgan, 1999; Ariza et al., 2008b; Roca and Villares, 2008). That is still occurring despite the fact that since the 1990s the need of a bottom-up approach in coastal management has been highlighted as an essential component of the Integrated Coastal Zone Management (ICZM) process (Morgan et al, 1993; De Ruyk et al, 1995; Breton et al, 1996; Pereira da Silva, 2004; Marin et al, 2009; Roca et al., 2009; Ernoul, 2010; Ariza, 2011). This bottom-up approach requires the use of different methodologies that encourage the participation and cooperation between the different stakeholders. The former could be seen as more than a democratic right of affected user-groups, because it assures a more equitable and transparent process but often leads to conflict mitigation (Marin et al, 2009). On the other hand, cooperation is an important condition for successful management, because it usually avoids or reduces the gap between decision-makers and affected communities, and thereby the failure of regulatory and planning measures (Jentoft, 2000). However, these bottom-up approaches should be based on good knowledge and education about the inherent attributes of these systems, especially those that can be classified as natural. In addition, these approaches imply a shift in the philosophy of management, and the overcome of several constraints inherent in our sectorally-oriented and top-down system of coastal governance (Ellsworth et al, 1997; Hildebrand, 1997).

Although beach management in Spain is largely focused at the local (municipal) level, which in theory should enhance the ability to recognize and manage the peculiarities of each system, when those municipalities have both urban/urbanized beaches and natural ones, the entire process usually results in a large homogenization of management practices (Nelson and Botterill, 2002; Ariza et al., 2008b). This partial management, which is largely standardized and poorly adapted to beach characteristics, beach settings and beach users, could lead to critical policy errors and an important oversight: managing different potential beaches with different users with the same strategies (Vaz et al., 2009), and overlooking a potentially important target market consisting of natural beach users.

This reasoning introduces an interesting question into the debate of beach management: are managers using the right strategies/management models adapted to the beach characteristics (especially its setting) and its visitors, and particularly, are visitors aware or educated about

the special characteristics of beaches when they visit these different social-ecological systems?

It is worth noting that when we refer to the bottom-up approach (or community consultation) we are aware that not only beach users but all the actors involved should be considered in the analysis. However, in the following two sections of this chapter only beach users' expectation and perceptions were considered.

4.2- Management's priorities and users' expectations in an environmentally protected spot within a tourist-intensive area: are we aware of its value? [1]

Within this context the objective of this section was to assess users' expectations and real management's priorities for one of the most pristine and protected beaches of the Costa Brava. The goal was to evaluate if they correlate with the expected main objectives and overarching goals for a beach of these characteristics (i.e. protected natural setting). The fact that this beach was located in a highly anthropized traditional touristic destination was not overlooked, and the surrounding influences were considered in the discussion of the results.

4.2.1. Methods

Study area

The assessment was carried out for the Sant Pere Pescador beach, (Costa Brava, Northwestern Mediterranean coast, Spain) (Figure 1). This is a 3.7km-long, 60m-wide open beach, East oriented, with fine sands (i.e. D50=0.23mm) and a steep slope. Presently, the beach is suffering a mean erosion rate of -3.5 $m \cdot yr^{-1}$ (CIIRC, 2010). This beach is located inside the Els Aiguamolls de l'Empordà Natural Park (PNAE), created in 1983 (Act 21/1983) (Figure 1). The park was formed to counteract the developing practices that were carried out mainly during the 1970s and 1980s in this coastal zone when new construction was encouraged (e.g. housing, hotels, and campsites). This development increased the occupation of the territory, modifying the landscape and causing important environmental impacts (Martí, 2005). The Natural Park was created with a dual objective: a) to preserve, improve and promote its natural ecosystems, and b) to make conservation compatible with sustainable economic development for the region (Generalitat de Catalunya, 2009a).

Nevertheless, during the summer season, the Sant Pere Pescador Municipality multiplies its population by 2-3 times due to tourism, and beaches within the PNAE receive up to 23,000 users per day during the peak of the bathing season (Generalitat de Catalunya, 2009b).

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[1] Edited version of *Management's priorities and users' expectations in an environmentally protected spot within a tourist-intensive area: are we aware of its value? by JP Lozoya, R Sardá & JA Jiménez, submitted to Journal of Environmental Management.*

Campsites are very popular in the Costa Brava (over 884,000 guests·yr^{-1}, Generalitat de Catalunya, 2009b), and each summer Sant Pere Pescador offers shelter and services for over 15,000 guests in the hinterland of the beach (see Figure 1).

In 1992 the Catalan government approved the law *Pla d'espais d'interès natural* (PEIN, Decret 328/1992) (Plan of Preserved Natural Spaces), and included the PNAE as one of its highlighted areas. At the same time, the EU approved the "Habitats Directive" (Council Directive 92/43/EEC) with its popular Natura 2000 network, an EU network of protected natural areas which at this time is the centerpiece of the EU nature and biodiversity policy.

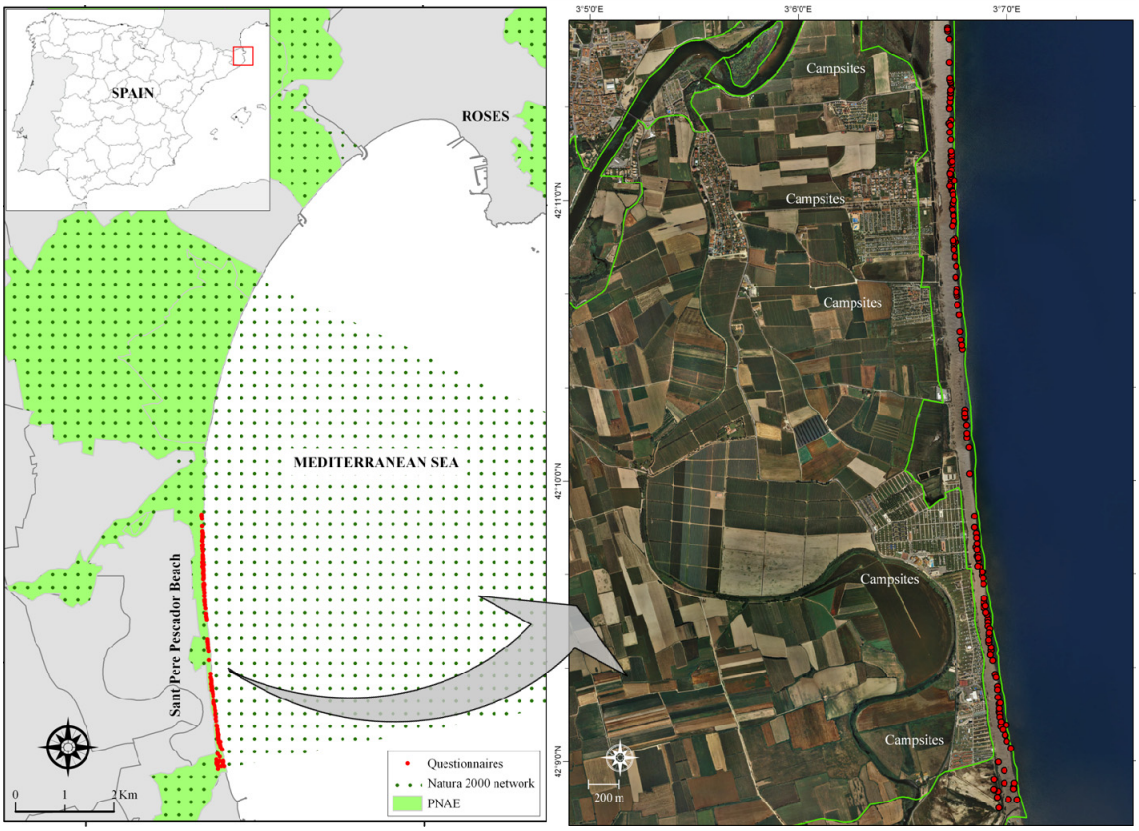

Figure 4.1- Location map of Sant Pere Pescador beach, showing the Natural Park of Els Aiguamolls de l'Empordà (PNAE), the Natura 2000 network (dotted area) and the study site where the questionnaires were delivered (red dots in the coastal fringe).

This network includes Special Areas of Conservation (SAC) and Special Protection Areas for birds (SPAs), both contributing to ensure European biodiversity through the conservation of natural habitats, wild flora and fauna. In 2006 (Acord GOV/112/2006) the PEIN of Aiguamolls de l'Alt Empordà was declared a SPA, and was proposed as a Site of Community Importance (LIC), in order to be integrated into the Natura 2000 network as an SAC. This double designation, contained in the Special Protection Plan of the natural environment and

landscapes of the Aiguamolls de l'Alt Empordà, covers 7,263 ha of land and 5,888 ha of sea, including the PNAE and some new sectors of its surroundings as a new marine area (Generalitat de Catalunya, 2010b) (Figure 4.1).

Users' motivations, expectations, and priorities

In order to assess users' motivations, expectations and priorities, we conducted a survey based on a self-administered questionnaire (see Annex 7.1). During two consecutive days at the peak of the bathing season (August 2010), two interviewers followed a zigzag path along the entire beach, detailing the survey objectives and explaining the questionnaire structure to visitors staying at the beach. The response time for the questionnaire was shortened to no more than 10 minutes (24 questions). Questionnaires were collected half an hour later in order to motivate the respondents to answer more "accurately" and therefore to increase data quality. All respondents were at least 18 years old, but randomly selected, trying to include the highest possible diversity (e.g. age, activities, national origin). In this sense, and in response to the high presence of foreign tourists, the questionnaires were distributed in both English and Spanish.

Questionnaires had three main sections: (i) a first general section designed to define the users' profile, (ii) a second section planned for assessing users' priorities and perceptions, and (iii) a final section designed to assess users' willingness to pay (WTP) to ensure the functioning of the Natural Park and the conservation of the beach, as a means of determining their willingness to accept a particular management approach in this protected beach.

Following recommendations obtained in related previous works (Tunstall and Penning-Rowsell, 1998; Fredline and Faulkner, 2000; Williams and Lawson, 2001; Aguiló and Rosselló, 2005; Cihar and Stankova, 2006; Roca et al., 2009; Oh et al., 2010), results were analyzed grouping beach users in *Locals* (i.e. who stay overnight in their own primary or second-home) and *Tourists* (i.e. who do not stay overnight in their own home), and finally, as a whole group.

Respondents were asked about their willingness to pay (WTP) a hypothetical entrance fee for visiting the Parc Natural dels Aiguamolls de l'Empordà (PNAE) and the Sant Pere Pescador beach. Considering that the access to the PNAE is free of charge at present, a payment principle question was used to see if respondents were in favor of paying at least some

amount. Those who were in favor were then asked to state how much they would be willing to pay and the reason for their answer, adhering to one of five pre-determined reasons. Those who were not in favor of any amount were also asked to justify their answer, by adhering to one of three pre-determined reasons.

Management priorities

To study beach management's priorities, we analyzed the General Urban Plan of Sant Pere Pescador Municipality (PGOU, 2006) and particularly the Use Plan for Sant Pere Pescador beach (2011-2015) (Pla d´usos, 2011). It should be noted that Beach Use Plans are regulated documents, essentially designed to specify and regulate the services offered at a beach for a bathing season, which coastal Municipalities in Spain are required to prepare annually. Although these documents essentially refer to beach services, if we take into account that the beach in question is located within a National Park included in the Natura 2000 network, we would expect that the municipality should also emphasize (and even protect) the beach's natural attributes, and clearly express its aim for sustainable development. It was our intent to capture the real vision behind the management of this beach through this analysis, assessing the relative importance of both services intended for users, and protection (and information) of natural beach attributes.

4.2.2. Results

Users' motivations, expectations, and priorities

A total of 251 useful questionnaires were collected in the Sant Pere Pescador beach, allowing a clear picture of users' profile, motivations, priorities, perceptions and willingness to pay to use this protected natural beach.

Users' Profile

Most of the users (73%) were middle-age Adults (i.e. 31 to 59 years old), who came to the beach with their families (64%) or their partner (16%). The average monthly income of responders was around 1,500 €·adult^{-1} and 43% of them held at least a Master's degree (Table 4.1). This latest statistic is worth noting because despite being a family beach, this high level of education of visitors does not seem very typical. Users were mainly from the Barcelona (31%) and Girona (18%) provinces (i.e., domestic tourism), although international tourism (mainly from Germany, Netherlands and France), was also very important (40%) (Table 4.1).

This significant presence of domestic and international tourists is in accordance with the long-established importance of the tourism industry along the Costa Brava, evidenced by its numbers (3.9 million international tourists and about 691,000 domestic visitors received in 2009; Generalitat de Catalunya, 2009b). From the 251 useful questionnaires, 21% (52 questionnaires) were filled out by *Locals* and 199 (79%) by *Tourists*.

Table 4.1- Beach user profiles for Sant Pere Pescador beach.

USERS' PROFILE		***n***	***%***
Origin			
Spain	Barcelona	78	31.1
	Gerona	46	18.3
	Rest of Spain	25	10.0
Germany		34	13.5
Netherlands		25	10.0
France		21	8.4
Rest of Europe		21	8.4
No response		1	0.4
Age			
Adult *(31-60 years old)*		183	72.9
Youth *(<30 years old)*		37	14.7
Elderly *(>60 years old)*		28	11.1
No response		3	1.3
Companions			
Family		160	63.7
Couple		41	16.3
Friends		33	13.1
Alone		13	5.2
Others		2	0.8
No response		2	0.8
Education level			
Master or higher		108	43.0
Bachelor		45	17.9
College		41	16.3
High school		34	13.6
Elementary		15	6.0
Others		3	1.2
No response		5	2.0

Users' Motivations, Priorities, and Perceptions

The main motivation for users (altogether, locals and tourists) in Sant Pere Pescador beach was "swimming & sunbathing" (71%); the percentage of other answers was much smaller: "playing with children" (10%), "nautical sports" (7%) and "landscape & nature" (5%) were the next highest motivations (Figure 4.2). The strikingly high percentage obtained for "nautical sports" can be explained by the great development that kite-surfing and windsurfing has had lasting recent years in this area of the Mediterranean coast, being particularly supported by the Municipality of Sant Pere Pescador in order to increase the recreational offer for these beaches. When a distinction was made between locals and tourists, locals tend to

prefer “swimming & sunbathing” and “playing with children”, “landscape and nature” (9.5%), the latter almost doubling the preference for nautical sports (4.8%). Although this percentage was much smaller than the one for "swimming & sunbathing" (71%), these results suggest that natural attributes may be a component with some importance for Locals.

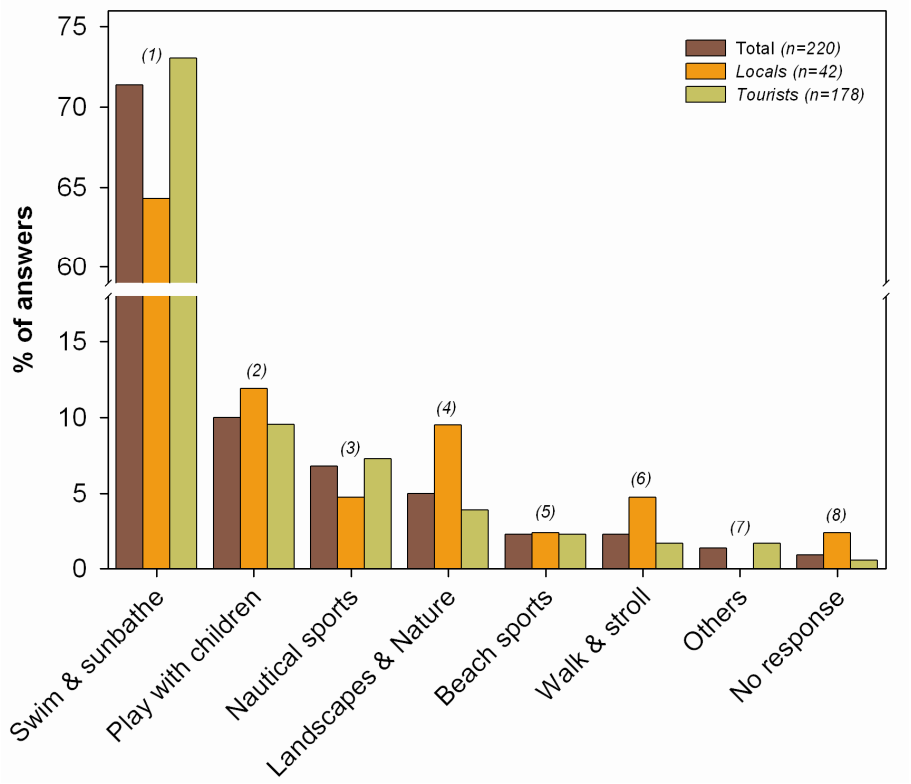

Figure 4.2- Main motivations for users to go to Sant Pere Pescador beach, presented for *Locals*, *Tourists*, and the Total of the users. Results of a Chi-square test (Chi^2 test, df=1) performed to assess significant differences between *Locals* and *Tourists* are also showed: *(1)* Chi^2 test=1.27; p=0.259; *(2)* Chi^2 test=0.21; p=0.647; *(3)* Chi^2 test=0.06*; p=0.804; *(4)* Chi^2 test=1.21*; p=0.270; *(5)* Chi^2 test=0.27*; p=0.600; *(6)* Chi^2 test=0.39*; p=0.530; *(7)* Chi^2 test=0.01*; p=0.914; *(8)* Chi^2 test=0.05*; p=0.830. (*)Yates corrected Chi-square test.

On the other hand, tourists tend to prefer “nautical sports” over “landscape and nature”. Nevertheless, no significant differences were found between *Locals* and *Tourists* concerning primary motivations (Figure 4.2).

Users’ priorities were defined according to the importance that each user places on different characteristics when they decide which beach to visit. In this sense, respondents were asked to classify twelve beach characteristics with five categories: Very important (5); Important (4); Neutral (3); Not important (2) and Not important at all (1). A Total Mean Importance score (TMI) was calculated in order to prioritize these characteristics, based on the category’s coefficient (increasing in importance from 1 to 5) and calculated as the mean of all obtained

classifications for each characteristic (e.g. if 70 users classified "Quietness" as Very important and 80 users as Neutral, TMIQuietness= (70·5+80·3)/150 and TMIQuietness=3.9).

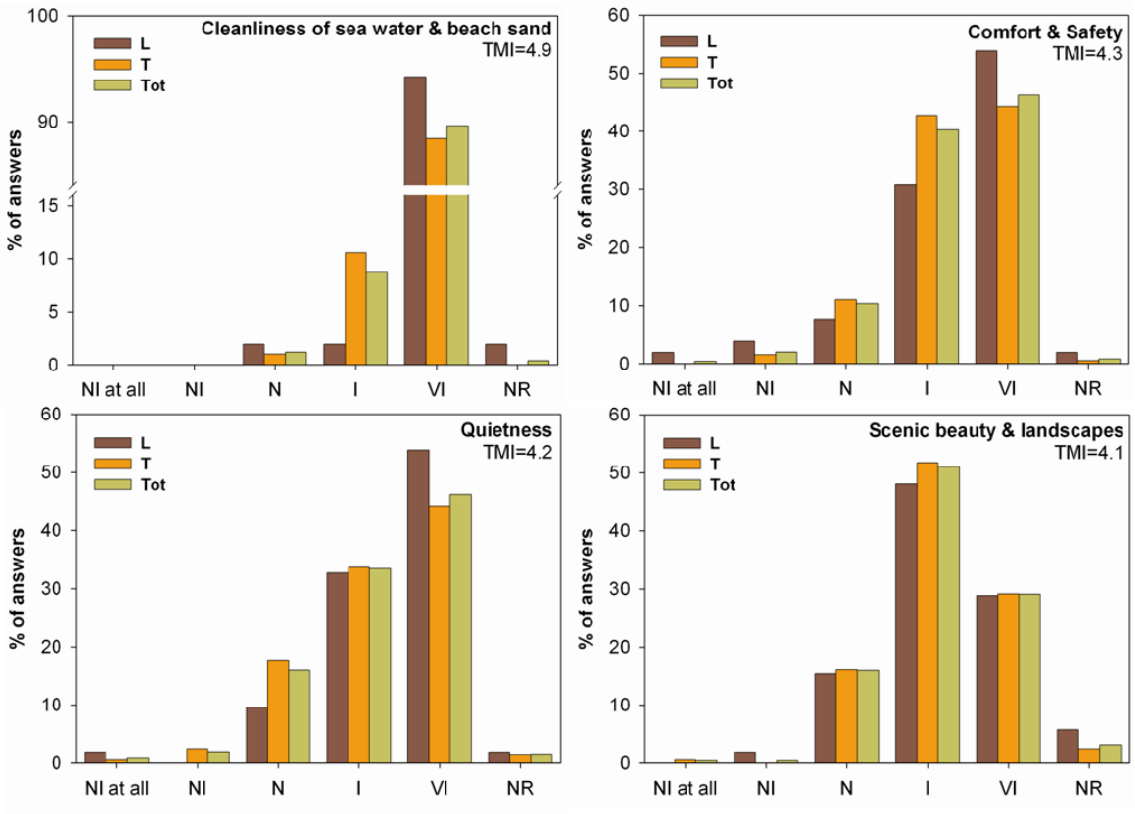

Figure 4.3- Priorities of Sant Pere Pescador beach users based on their classification (not important at all: *NI at all*; not important: *NI*; neutral: *N*; important: *I*; very important: *VI*; no response: *NR*) of different beach characteristics. Based on this classification, a Total Mean Index (TMI) was calculated to prioritize the characteristics. Results are presented for the four features with higher TMI values, for *Locals* (L), *Tourists* (T), and the Total of users (Tot).

"Cleanliness of sea water & beach sand" (TMI=4.9) and "comfort & safety" (TMI=4.3) were the most important characteristics, being classified as Very important for almost 90% and 45% of users, respectively (Figure 4.3). Following in importance, and defined as low density of users, "Quietness" (TMI=4.2) was Very important for 46% of users, while "Scenic beauty & landscapes" and "Nature & unspoiled environments" (TMI=4.1) were Important for 51% and 41% of users, respectively (Figure 4.3 and 4.4).

"Beach quality" (TMI=4.0), based on beach quality certifications (e.g. Blue Flag, ISO 14001, EMAS) was Very important and Important for 39% and 32% of users, respectively. "Good access & parking areas" (TMI=3.6) were Important for 39% of users, but Very important for 38% of Locals (Figure 4.4).

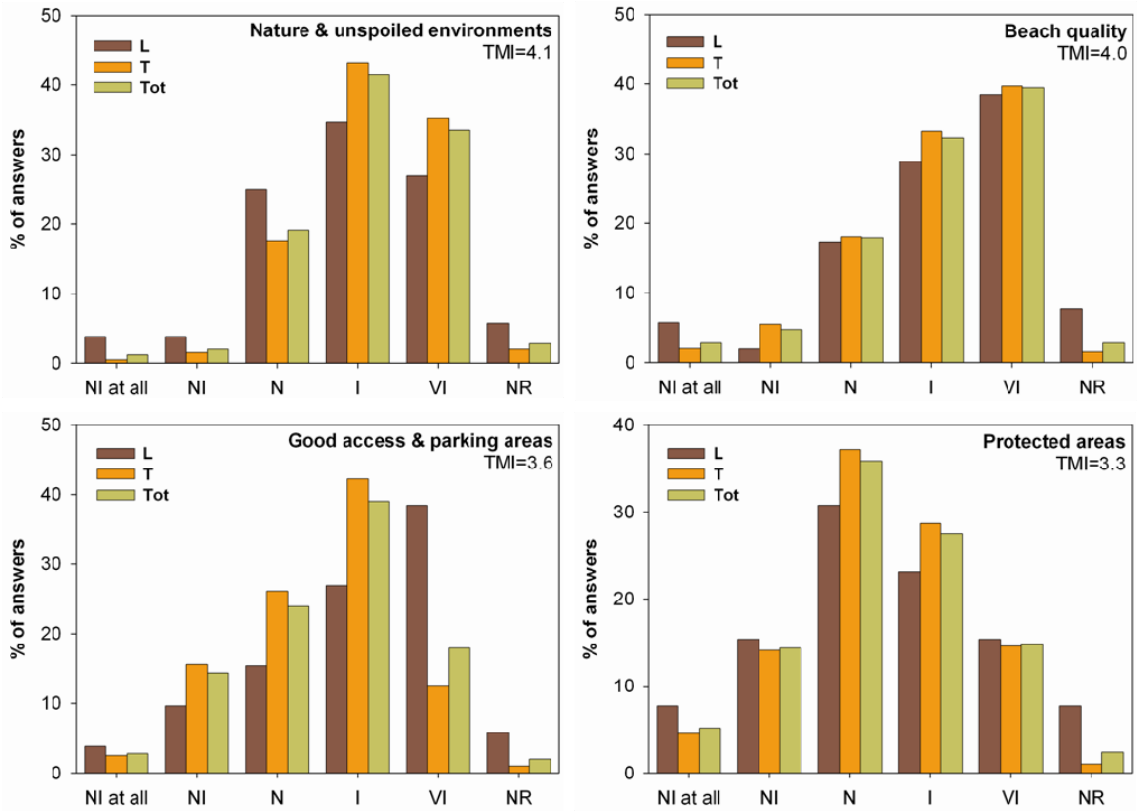

Figure 4.4- Priorities of Sant Pere Pescador beach users based on their classification (not important at all: *NI at all*; not important: *NI*; neutral: *N*; important: *I*; very important: *VI*; no response: *NR*) of different beach characteristics. Based on this classification, a Total Mean Index (TMI) was calculated to prioritize the characteristics. Results are presented for the following four features according to their TMI values, for *Locals* (L), *Tourists* (T), and the Total of users (Tot).

That result appears logical, as this beach is far from urban centers and mainly local users need good access to reach the beach and parking facilities for their cars. Unlike the *Locals*, 40% of *Tourists* are living in the campsites located in the hinterland of the beach, and hence already have assured access to these facilities. The fact that the beach was protected or within a Natural Park ("Protected areas", TMI=3.3) was Neutral for 36% of users, and Important for 28% of them (Figure 4.4).

The existence of "good facilities" (TMI=2.8) as defined by available rentals, toilets, showers, or stalls, and the cultural offer near the beach ("Culture" TMI=2.7) were Neutral for the majority of users (28% and 41% for *Locals* and *Tourists*, respectively) and Not important for more than 20% of them (Figure 4.5). "Recreational offer" and "Proximity" (with regards to train station, town or airport) were a Not important aspect for 31% of users (TMI= 2.6). For 39% of those surveyed, the former was a Neutral characteristic (*Tourists* and *Locals* were in accordance), while "Proximity" was Important for 31% of *Locals* and Not important for 34% of *Tourists*, indicating that *Locals* prefer beaches within the area where they live (Figure4. 5).

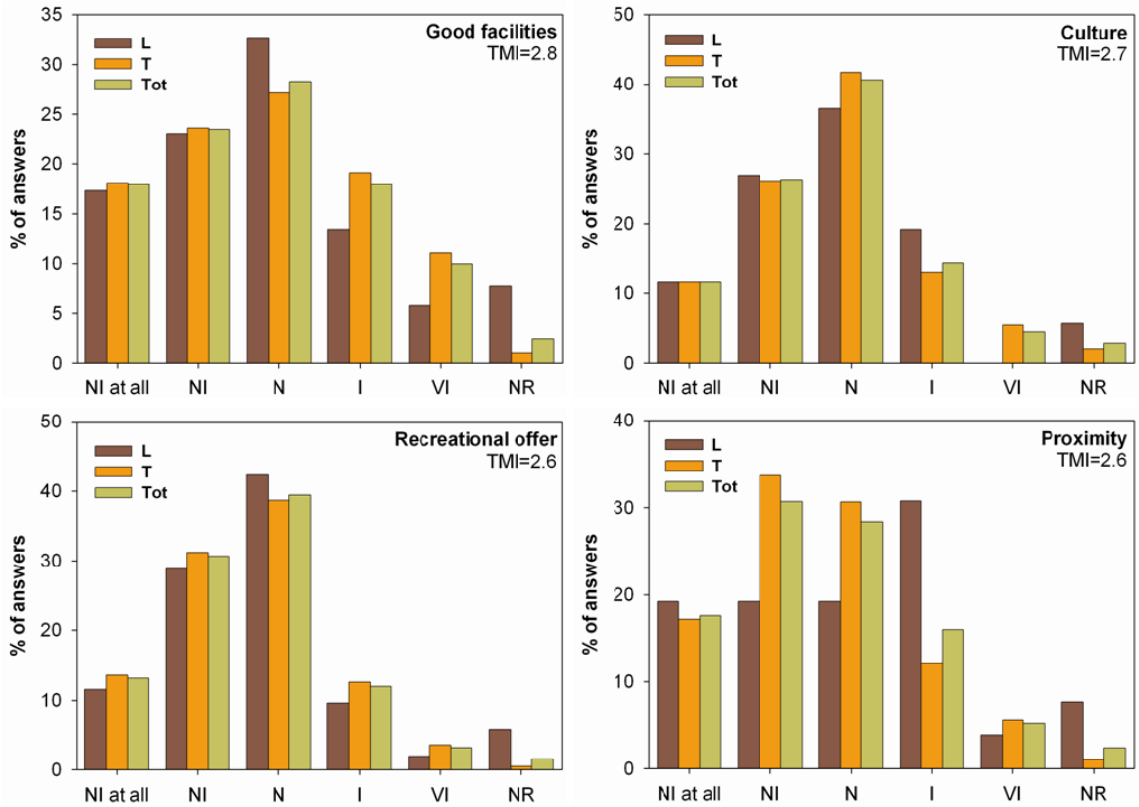

Figure 4.5- Priorities of Sant Pere Pescador beach users based on their classification (not important at all: *NI at all*; not important: *NI*; neutral: *N*; important: *I*; very important: *VI*; no response: *NR*) of different beach characteristics. Based on this classification, a Total Mean Index (TMI) was calculated to prioritize the characteristics. Results are presented for the four features with lower TMI values, for *Locals* (L), *Tourists* (T), and the Total of users (Tot).

Users' perception was assessed based on twenty-two parameters which were evaluated by respondents, who gave a score from 1 (minimum) to 10 (maximum) depending on the level of satisfaction they provided. These parameters cover several aspects of the beach, which can be classified within four major groups: a) morphological aspects, b) natural aspects, c) infrastructures and services, and d) design and comfort.

The overall perception was positive with a general mean of 7.1, confirmed by both *Locals* (7.0) and *Tourists* (7.2). Almost all parameters received an acceptable mean evaluation (i.e. higher than 5.0), with "beach dimensions" assigned the highest score (9.0) (Figure 4.6). Despite the positive overall perception, there were several facilities and services offered at Sant Pere Pescador beach that showed mean evaluations under 5.0 (e.g. rentals) or not much above it (e.g. toilets: 5.8, showers: 5.7). In several cases *Locals* were even more demanding (e.g. rentals: 3.7, toilets and showers: 5.1, litter bin: 5.7) than *Tourists*. These results suggest that most of the currently offered services at the beach did not satisfy users' requirements, especially those of the *Locals* (Figure 4.6). On the other hand, beach attributes related to

"natural aspects" as landscapes (8.4) or quietness (8.0) had mean evaluations above the general mean (i.e. 7.1), suggesting a broad satisfaction of users (*Locals* and *Tourists*) regarding those aspects. However, it should be noted that the general opinion of users concerning the beach ("global evaluation", *Locals* and *Tourists*: 8.0), suggests that they were satisfied overall.

The study only showed significant differences in perceptions between *Locals* and *Tourists* (Mann-Whitney U test) in three aspects: "presence of rocks", "access", and marginally in "water cleanliness" (Table 4.2). Although the three evaluations were very positive (see Figure 8), *Locals* were more demanding than *Tourists* with regard to access and water cleanliness, but less severe with rocks on the beach, probably because they are more accustomed to them.

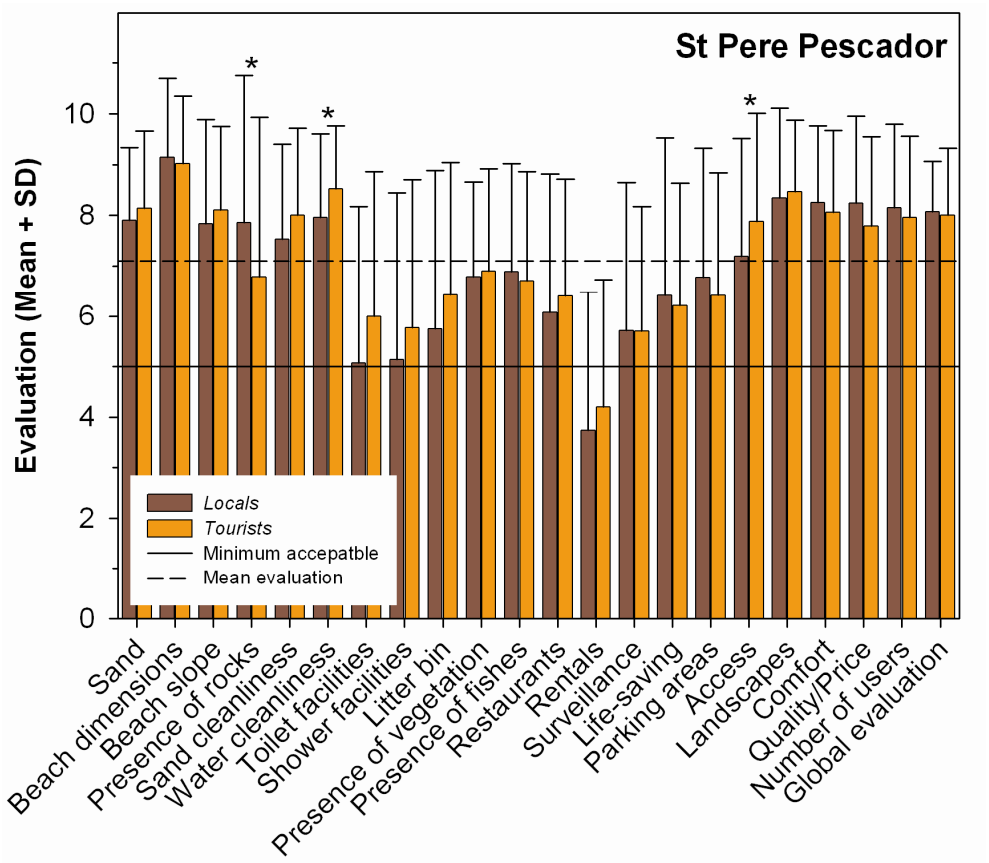

Figure 4.6- Perceptions of Sant Pere Pescador beach users, based on mean (+SD) evaluation (from 1 to 10, depending on the level of satisfaction they provided) of 22 parameters covering several aspects of the beach (i.e. morphology, environment, infrastructures and services, and design and comfort). The solid line represents the minimum acceptable evaluation (i.e. 5.0), the dotted line shows the general mean evaluation, and stars highlight the parameters where significant differences were found between *Locals* (L) and *Tourists* (T).

Table 4.2- Results of a series of *Mann-Whitney U tests* to assess significant differences between *Locals* and *Tourists* perceptions about the 22 parameters proposed. Only the results of the comparisons showing significant differences are presented.

PARAMETERS	Users	Mean Evaluation	*n*	Rank Sum
Presence of rocks	*Locals*	7.9	34	3,589.5
	Tourists	6.8	144	12,341.5
	U Mann-Whitney			1,901.5
	P			0.039
Access	*Locals*	7.2	48	4,743.0
	Tourists	7.9	182	21,822.0
	U Mann-Whitney			3,567.0
	P			0.046
Water cleanliness	*Locals*	8.0	50	5,372.0
	Tourists	8.5	198	25,504.0
	U Mann-Whitney			4,097.0
	P			0.053

A final open question was included for users to express their worst perceived aspect of the beach, in order to identify suggested ways to improve their experience. To analyze this open question we used Wordle, a web application that generates word clouds from an original text that is provided, giving greater prominence to words (in this case the 100 most used) that appear more frequently in the source text" (http://www.wordle.net/).

Figure 4.7- Word cloud (http://www.wordle.net/) obtained using the open question writing words of users.

As was expected, and in accordance with the lowest perceptions (see Figure 4.6), infrastructures and services were the most criticized aspects, outstanding showers and toilet facilities, and lifeguard service (Figure 4.7). Results are consistent with users' mean evaluations, and reinforce the fact that even if "good facilities" were not a priority, beach users expect a minimum level of services, especially those related to safety, as some of the main criteria for selecting a beach (see Figures 4.3 and 4.5). It should also be noted that 13%

of respondents answered "nothing" to this question (i.e. “good conditions” in Figure 4.7). This result suggests that those users were very pleased with their experience on the beach, which coincides with the generally very positive perception obtained previously (see Figure 4.6).

Users’ Willingness to pay

35% of the respondents expressed a willingness to pay. The amounts pledged by users willing to pay ranged from between 0.25€ and 10€ per adult per day, with a mean value of 2.7€ (SD=1.9; median=2.0). Based on these results, the use value (Blakemore & Williams, 2008) for adults in Sant Pere Pescador beach was estimated to be 0.95€, which is in line with estimates obtained for other Mediterranean touristic beaches (e.g. Maltese Islands and Turkey, see Blakemore et al., 2002).

The most frequent reasons provided for WTP were “conserving natural resources” (i.e. existence value) and “conserving for future generations” (i.e. bequest value), while “retaining recreation opportunity for future use” (i.e. option value) was the least common one (Table 4.3). On the other hand, the most common reason for refusing to pay, “others (usually the government) must pay for the proper protection and management of the PNAE” was the most frequent response (86.3%). There were no significant differences between *Locals* and *Tourists* for %WTP (*Locals*: Yes=26%, No=74%; *Tourists*: Yes=38%, No=62%; Chi-square test=2.32, p=0.128), WTP amount (median WTP: *Locals*=1.3, *Tourists*=2.0; Rank sum: *Locals*=359.5 and *Tourists*=3,043.5; U Mann-Whitney=304.5, p=0.431; n: *Locals*=10 and *Tourists*=72), nor reasons chosen to pay or not (Table 4.3).

Table 4.3- Results of reasons choose for not being, or being willing to pay a hypothetical entrance fee for visiting the Parc Natural dels Aiguamolls de l’Empordà (PNAE) and the Sant Pere Pescador beach. Results of *Chi-square test* (Chi^2 test) performed to assess significant differences between *Locals* and *Tourists* are also showed.

REASONS PROVIDED FOR	**Total** (%)	***Locals*** (%)	***Tourists*** (%)	**Chi^2 test** (df=1)	***P***
NOT being willing to pay a conditional fee					
I have to pay everywhere	11.6	11.4	11.7	0.07*	0.797
I do not feel the need to participate to resource preservation	2.1	-	2.7	0.09*	0.764
I am not the one who should pay these costs	86.3	88.6	85.6	0.20	0.654
BEING willing to pay a conditional fee					
Actual recreational use (*Actual use*)	6.1	8.3	5.7	0.09*	0.762
Conserve natural resources (*Existence value*)	50.0	41.7	51.4	0.39	0.532
Conserve for future generations (*Bequest value*)	34.1	50.0	31.4	1.57	0.210
Limit number of users (*Visitation control*)	7.3	-	8.6	0.21*	0.650
Retain recreation opportunity for future use (*Option value*)	2.4	-	2.9	0.18*	0.674

Note: (*) Yates corrected *Chi-square test*.

Management's priorities

The Use Plan for Sant Pere Pescador beach describes and clearly establishes all the facilities and services which are to be provided on the beach, both public (e.g. parking, access, showers, toilets, bathing areas, lifeguards, beach cleaning, information points), and private (e.g. kiosks, restaurants, hammocks and umbrellas rental, boats and nautical entertainment rental, education and practice of nautical sports), specifying their location (e.g. maps with the different zones and services) and standards for exploitation.

Regarding environmental aspects, the Use Plan begins (page 1, line 10) with the mention that the entire beach has been classified as a "natural system of ecological and landscape value" (i.e. Sistema natural ecològic i paisatgístic) by the General Urban Plan of Sant Pere Pescador Municipality (PGOU). In this sense, the appendix of the Use Plan defined the rear zone of Sant Pere Pescador beach as "a special area of natural and landscape value". A deeper examination of the document revealed that dunes were one of the main concerns for managers, who stressed their protection since they were considered as "one of the most special attributes of this beach." Of special concern was the consequences of circulation and parking of vehicles. When addressing management issues concerning beach cleaning, the plan specifies that manual cleaning is the only authorized method, strictly prohibiting the use of machines in order to avoid sand movements which could affect the mobile dunes system. Concerning landscapes, it is mentioned that beach installations (e.g. kiosks, toilets) must not be fixed or be made of durable materials, and that the Municipality may eventually define their design, in order to ensure sustainability and landscape integration (page 5, line 1).

On the other hand, when we analyzed (using Wordle http://www.wordle.net/) the frequency of some keywords in the Use Plan, in order to capture the real vision behind the management, we observed that the ones related to natural aspects of the beach, such as Natural, Dune or Medi (i.e. Environment), were much less employed (i.e. their relative sizes in Figure 8 are much smaller) than those related to tourism, recreation, water sports, and of course, services.

Figure 4.8- Word cloud obtained based on the text of the *Use Plan of Sant Pere Pescador Beach*. Words related to natural aspects of the beach (e.g. "medi"-"environment", "dunes" and "natural") are highlighted. This word cloud has been made based on the official document and hence in Catalan (i.e., the original language). Coincidentally, the words "dunes" and "natural" are spelled the same in Catalan and English.

Considering that the main objective of the text we analyzed is to plan and organize all the uses and activities that we can find on that beach, it is not surprising that words like Zones and, of course Platja (i.e. Beach) have been the most frequently used (i.e. with the highest sizes in Figure 4.8). Nevertheless, it is significant that one of the main characteristics of the beach, as was textually defined in the Use Plan (i.e. Dunes: 10 times), has been used 3 times less frequently than Vela (i.e. Sail) (30 times) and Kite-surfing (28 times). In this sense, there is a clear intention on the part of the Municipality to promote and properly manage these nautical activities. Unlike the beach's natural attributes, these activities received great attention in the document: "An information point will be located primarily for the people who want to practice Kite-surf on the beach of Sant Pere Pescador". Whereas, in the entire document there is no mention of any point of information referred to natural values of the beach, its protected area status, its inclusion in the Natura 2000 network, or its categorization as a natural system of ecological and landscape value.

4.2.3. Discussion

Despite the singular natural and protected characteristics of the Sant Pere Pescador beach (i.e. a Natura 2000 site), user motivations to go to this beach mirrored the classical ones for other Mediterranean tourist destination sites: "recreation" (Blakemore et al, 2002) and particularly "swimming and sunbathing" (Breton et al, 1996; Roca et al, 2008). These motivations follow typical expectations of the Mediterranean Tourism model of "sun, sand and beach" (Apostolopoulos and Sönmez, 2000; Satta, 2004; Aguiló et al, 2005). Natural attributes such

as “quietness”, “scenic beauty & landscapes”, or “nature & unspoiled environments” were highlighted by those surveyed. However, these attributes were clearly ranked behind others such as “cleanliness” or “safety”, already cited as the main drivers behind any beach selection (Breton et al, 1996; Tudor and Williams, 2006; Roca and Villares, 2008; Marin et al, 2009). In accordance with our hypothesis, “good facilities” was not a main priority for Sant Pere Pescador beach users. These results concur with the ones obtained for both Welsh natural beaches (Nelson et al, 2000a) and Mediterranean semi-urban and urban beaches, despite the fact that the former’s meteorological conditions do not favor bathing uses as do the latter’s (Roca and Villares, 2008). However, despite this reduced priority, the lack of or poor offer of some facilities (e.g. rentals, toilets, or showers) was identified as the worst aspect of the beach. These findings suggest a clear demand for better services, which seems to be essential for users’ satisfaction.

In Spain the law requires free access to beaches. Despite this issue, 35% of users were willing to pay a mean entrance fee of 2.7€ (i.e. a *use value* of 0.95€). “Conserving natural resources” (i.e. existence value) was the main reason for most of the respondents, and no significant differences were found between *Locals* and *Tourists*. The %WTP values obtained in Sant Pere Pescador beach are lower than those recorded in most European tourist beaches (e.g. 57%, Micallef, 1996; 60-87%, Blakemor and Williams, 2008; 70%, Kafyri et al., 2012; 88%, Blakemor et al, 2002), being similar only to the lowest ones (e.g. 36% Marin et al., 2009; 39% Koutrakis et al., 2011). It should be noted that in contrast to Spain, beach entrance fees are fairly common in several other Mediterranean countries which could explain the lower percentages obtained in Sant Pere Pescador. However, the *use value* estimations, based on %WTP and WTP amounts, agreed with those calculated for most of beaches mentioned above (e.g. 1.2€, Micallef, 1996; 1.0€, Blakemor and Williams, 1998; 2008, Unal and Williams 1999; 0.8€, Blakemor et al., 2002; 0.9€, Koutrakis et al., 2011). This would indicate that even if the %WTP was lower, the WTP amounts were greater that in the other beaches. This result suggests that the users of Sant Pere Pescador would be more “generous”. Additionally, only 2% of users who were not willing to pay in this beach were not really interested in conservation. Most of these respondents (86%) argued that conservation was a government responsibility.

Sant Pere Pescador beach is a special area of natural interest. Notwithstanding, the management framework used for this beach (at the municipal level) does not incorporate its

natural attributes as one of the main highlighted factors. The dunes were the only element that was specially considered, for which some limitations and management measures were defined. As for other natural and urbanized beaches of the Costa Brava (see Ariza et al., 2008a), there is no provision for special management of natural beaches, only a reduction in the services offered to users. In contrast, nautical sports (e.g. kite-surfing, sailing) were really a centerpiece of beach management in Sant Pere Pescador, showing clear planning, arrangement, and information for users. Nautical sports have direct support of the local government, who is trying to increase the recreational offer in this beach. Although the local government recognizes this beach as natural and protected, there is neither effort made nor expressed objective in its management plan that seeks to exploit these natural attributes and their singularity to attract tourists with a profile that really highlights these exceptional natural conditions in a traditionally urbanized coastal region. Users, despite their relatively good evaluation and prioritization of natural attributes, still consider as normal several services that would not necessarily be offered in a natural beach within a protected area. It would be expected that in this type of beach the main attraction are its natural features, landscapes, quietness, and not the presence of showers, toilets and kiosks that one would expect to find at urban beaches.

In circumstances like the one in Sant Pere Pescador, where the natural singularity of the beach is only partially perceived and valued, goals and visions of its management should be audited. Based on directives of the competent authority, strategic policy objectives (which are the key to properly setting the scope of any management exercise), should be revised. Within the context of ecosystem-based management practices, these overarching goals should be expressed in terms of sustainable development and the protection or conservation objectives set at the ecosystem level (e.g. PAR/RAC, 2007; Forst, 2009; Curtin and Prellezo, 2010). For Sant Pere Pescador beach, managers should recover Natura 2000 network guidelines and plans for special protection of the environment and landscapes (e.g. Generalitat de Catalunya, 2006; 2010b). These documents encourage a sustainable development of such areas, allowing touristic promotion of natural values, but demanding their dissemination, protection and preservation. Information and educational campaigns become basic issues when territorial attributes are explained to people, expounding upon natural wonders and virtues but also about stressing commitments and behaviors that must be engaged within these areas. The large number of Tourists coming to visit these areas increases even more the importance of these activities. It has been suggested that many of the tourists visiting beaches and natural

areas are sophisticated in their global information but shallow in their local knowledge (Knudson et al., 1995), probably due to their lesser knowledge of the area, which is based solely on the summer season and not on a year-round analysis (Tunstall and Penning-Rowsell, 1998; Cihar and Stankova, 2006; Roca et al, 2009). A manual of good practices for visitors in Natura 2000 network areas has been also suggested, in order to educate users about the impact of their behavior on the conservation of habitats and species. In this sense, the use of coastal dunes for environmental education, as a significant component of these highly-valued natural landscapes, was also encouraged (Generalitat de Catalunya, 2006).

Managers should emphasize and promote the natural attributes of this beach, informing and contextualizing users to be aware of the beach and the characteristics of the beach of their choice. Thus, users would better know what attributes and facilities to expect and enjoy there, and possibly adjust their expectations of a natural beach and of a sustainable development model. It has long been maintained that educating individuals and improving their knowledge about natural ecosystems as well as the consequences of human activities, will link users to their environment, and bring out environmentally-responsible behaviors (Hines et al., 1987; Morgan et al., 1993; Kilbourne and Beckman, 1998; Nordstrom and Mitteager, 2001). Users must perceive resource degradation and attribute that degradation to their own use, realizing that individual benefits accumulate into collective costs (Burke, 2001). In this sense, both personal attribution (i.e. consciousness about the effects of individual actions as well as the ability to scale these effects to broader outcomes) and perception (including knowledge, culture and experiences), have been proposed as significant factors in the phenomenon of the "Tragedy of the Commons" (Hardin, 1968 in Alessa et al., 2003). Although no negative effects on the beach caused by users has been considered in this paper (it was not our objective), the above-mentioned thought should not be considered as an overstatement. It should be noted that this beach is located in one of the most highly anthropized traditional tourist destinations on the Mediterranean coast, mainly due to the "sun, sand and beach" massive tourism model (Sardá and Fluvià, 1999; Sardá, 2001; Suárez de Vivero and Rodríguez-Mateos, 2005). In this context, a precautionary approach (e.g. EEA, 2001) does not seems excessive, especially if management efforts lie, at least at the start, primarily in promoting information and the education of users, regarding a main ecosystem services (i.e. Cultural/Educational service MEA, 2005) that should be provided at a natural ecosystem such as Sant Pere Pescador beach.

In order to effectively communicate the risk of the visitor's action on the ecosystem, managers must first identify how the users form their perceptions about risks and their effective responses (Slovic, 1986). In this sense, the challenge of managing for multiple uses of varying levels of resource consumption requires a thorough understanding of the socio-cultural drivers of these multiple uses (Alessa et al., 2003). Beaches must be analyzed as social-ecological systems, taking into consideration that social drivers could produce significant environmental impacts at local, regional and global scales. In order to attain the most ecologically sustainable, socially equitable and economically efficient development of coastal areas, data which reveal motivations, perceptions and human behaviors must be incorporated into management plans, particularly for beaches where policing is extremely challenging.

4.3- Users' expectations as a key factor for sustainable beach management: results from two *antagonistic* beaches of the Costa Brava [2]

The objective in this third section was to asses and compare users' expectations and perceptions in two *antagonistic* beaches of the Costa Brava (i.e. urban setting *vs.* protected setting). Taking into account the prioritization of natural attributes detected in Sant Pere Pescador (see Section 4.2 in this Chapter), the goal was to identify possible particular requirements to promote the sustainable management of these beaches.

4.3.1. Methods

Study sites

The assessment was carried out for two *antagonistic* beaches within the Costa Brava (Northwestern Mediterranean coast, Spain): Sant Pere Pescador (natural and protected setting) and S´Abanell beach (urban and unprotected setting). For a detailed description of these beaches see the previous chapters (Chapter 4, Section 2 and Chapter 3, respectively), where they have already been presented.

Data collection

This study used a survey approach based on a self-administered questionnaire (see Chapter 7, Annex 7.1 and 7.2). The interviewer delivered the questionnaire explaining the survey objectives and the questionnaire structure. Questionnaires took about 10 minutes each, and were collected half an hour later. This approach was used to motivate the respondents to answer more "accurately" and, therefore, to increase data quality. The survey took place during the peak of the bathing season (i.e. August 2010 for Sant Pere Pescador, and August 2011 for S´Abanell beach). The interviewers followed a zigzag trajectory in order to cover the whole beach. Respondents were at least 18 years old.

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[2] Edited version of *Users' expectations as a key factor for sustainable beach management: results from two antagonistic beaches of the Costa Brava by JP Lozoya, R Sardá & JA Jiménez, intended for publication.*

Questionnaires were prepared from previous assessments carried out in the Catalan Coast and specially in the Costa Brava (e.g Villares et al, 2006; Roca and Villares, 2008; Roca et al, 2008; 2009), examples reported in the literature (e.g. Togridou et al, 2006; Blakemore & Williams, 2008), and the inclusion of new questions on the base of our specific needs. The questions were grouped in three main sections: (i) a first general section designed to define the users' profile, (ii) a second section planned for assessing users' priorities and perceptions, and (iii) the last section designed to estimate users' willingness to pay (WTP) to improve beach management.

In both cases this last section concerned the willingness to pay (WTP) a hypothetical entrance fee that would improve both management and state of the beach. However, these questions were not exactly the same in both beaches. While in Sante Pere Pescador the revenue would be used "to avoid the alteration or loss of this natural and protected beach due to the absence of a correct management", in S´Abanell they would be used to "improve and better maintain the beach". In this analysis, WTP estimates were not used to obtain an economic valuation of these ecosystems, but as an indicator of user engagement regard to a sustainable management of these beaches.

4.3.2. Results

A total of 251 and 207 useful questionnaires were collected in the Sant Pere Pescador and S´Abanell beach, respectively. These results allowed a clear picture of users' profile, motivations, priorities, perceptions and willingness to pay to improve management in these *antagonistic* beaches.

Users' Profile

In Sant Pere Pescador as in S´Abanell, most of the users (73% and 56%, respectively) were middle-age *Adults* (i.e. 31 to 59 years old), who came to the beach with their families (64% and 39%, respectively) or their partner (16% and 24%, respectively) (Figure 4.9).

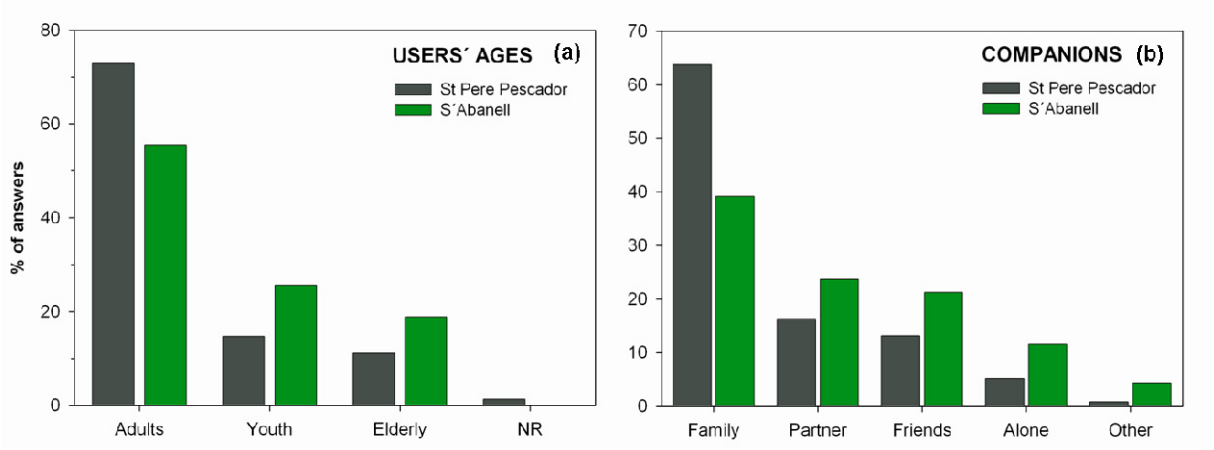


Figure 4.9- (a) Ages of interviewed users: *Youth* (<31 years old), *Adult* (31-59 years old), *Elderly* (>59 years old) y *NR* (no response), and (b) main users' companions.

Users in both beaches were mainly from Spain (i.e. domestic tourism) (59% in Sant Pere Pescador and 71% in S´Abanell) while especially in Sant Pere Pescador the international tourism (mainly from Germany, Netherlands and France) was also important (40%) (Figure 4.10a). Concerning Spanish users, the ones coming from Barcelona were the most frequent (especially in S´Abanell, 68%), while in Sant Pere Pescador 17% of users came from "Other Provinces" (i.e. provinces other than the closest Gerona or Barcelona) (Figure 4.10b).

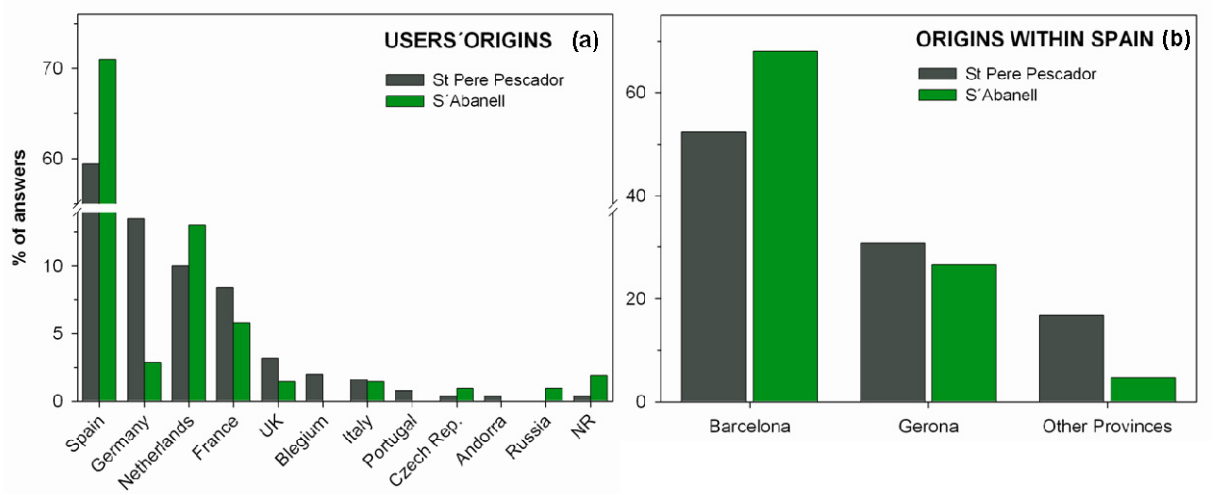


Figure 4.10- (a) Origin of the users in both beaches, and (b) detail concerning Spanish users, grouped regarding the closest provinces (i.e. Barcelona and Gerona) and the other provinces of Spain.

The average monthly income of responders was around 1,500 €·adult^{-1} in both beaches. But the percentage of users with higher incomes (i.e. more than 3,000€) was higher in the protected setting than in the urban one (34% and 26%, respectively). On the other side, the percentage of users with lower incomes (i.e. less than 1,500€) was higher in the urban beach than in the natural one (12% and 23%, respectively) (Figure 4.11a). It is noteworthy the high

educational level of users in both beaches, where the majority were University students (44% and 61% in S´Abanell and Sant Pere Pescador, respectively), and 43% in Sant Pere Pescador beach held at least a Master's degree (Figure 4.11b).

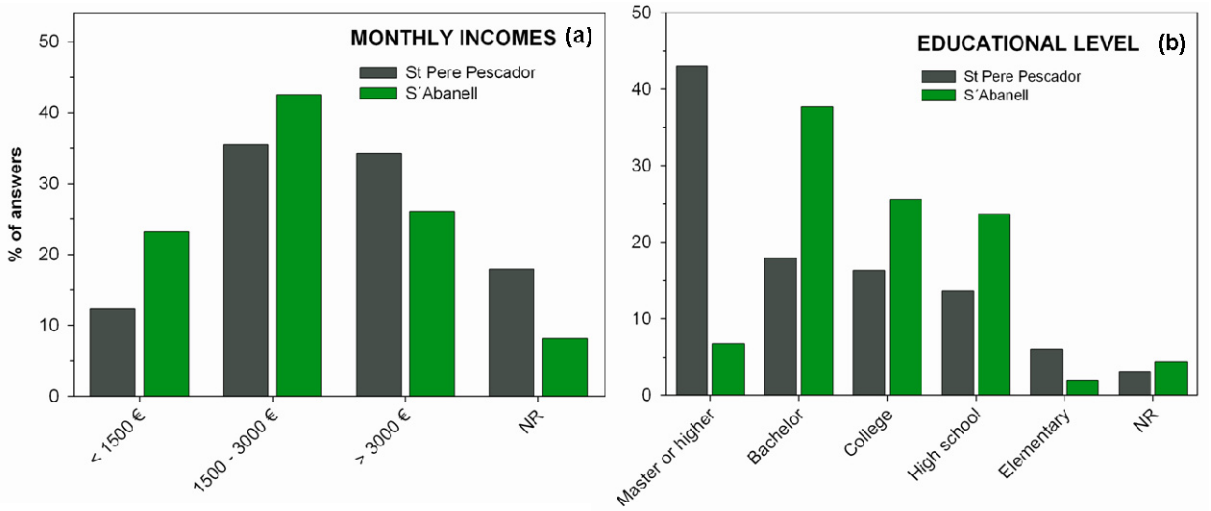


Figure 4.11- (a) Average monthly income of responders (€·month^{-1}): *Low* (<1500€·month^{-1}), *Medium* (1500-3000€·month^{-1}), *High* (>3000 €·month^{-1}), and *NR* (no response); (b) educational level of users in both beaches.

Users' Motivations, Priorities and Perceptions

The choice of holiday's destination is not a trivial decision, since it involves the investment of our rest days and usually a significant economic effort. Travelers have several motivations and expectations which should be satisfied during holidays, in order to get their satisfaction and hence their future returns.

Motivations

In both beaches "swimming & sunbathing" was the main reason for going to the beach. Yet, the difference between "swimming & sunbathing" and the following motivation was much higher in S´Abanell than in San Pere Pescador (84% vs. 6% and 71% vs. 10%, respectively) (Figure 4.12). The strikingly high percentage obtained for "nautical sports" in Sant Pere Pescador beach can be explained by the great development that kite-surfing and windsurfing have had in recent years in this area of the Mediterranean coast. This growth has been particularly supported by the Municipality of Sant Pere Pescador, in order to increase the recreational offer (see Section 2 in this Chapter).

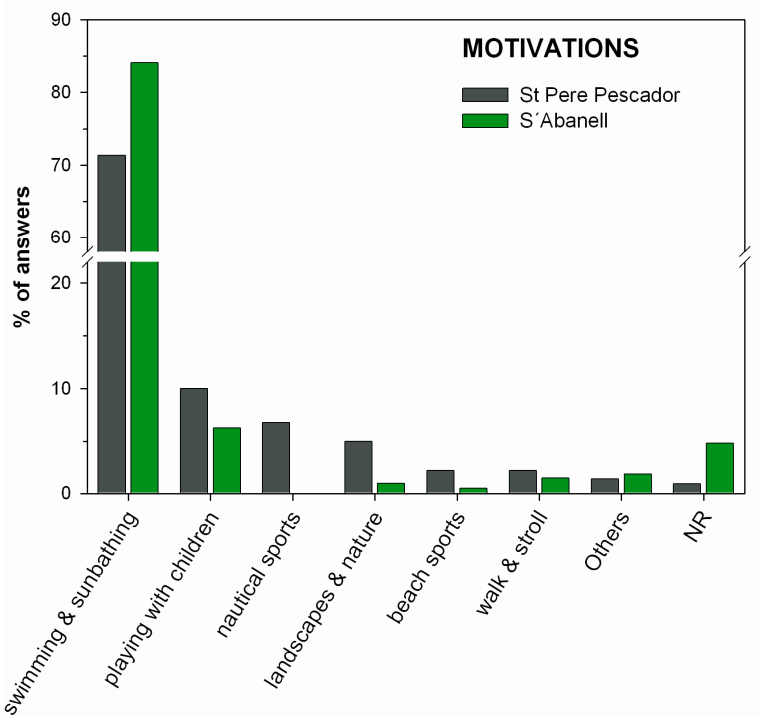


Figure 4.12- Motivations of the users of Sant Pere Pescador beach and S´Abanell beach.

Priorities

Users' priorities were defined according to the importance that each user places on different characteristics when they decide which beach to visit. In this sense, respondents were asked to classify twelve beach characteristics with five categories: *Very important (5)*; *Important (4)*; *Neutral (3)*; *Not important (2)* and *Not important at all (1)*. A Total Mean Importance score (TMI) was calculated in order to prioritize these characteristics, based on the category's coefficient (increasing in importance from 1 to 5). This score was calculated as the mean of all obtained classifications for each characteristic (e.g. if 70 users classified "Quietness" as *Very important* and 80 users as *Neutral*, $TMI_{Quietness}$= (70·*5*+80·*3*)/150 and $TMI_{Quietness}$=3.9).

"Cleanliness of sea water & beach sand" (TMI=4.9 in Sant Pere Pescador and TMI=4.6 in S´Abanell) and "comfort & safety" (TMI=4.3 in Sant Pere Pescador and TMI=4.1 in S´Abanell) were the most important priorities in both beaches. The former was classified as *Very important* by 90% and 78% of users, while "comfort & safety" was classified as *Very important* by 45% and 46% of users (Sant Pere Pescador and S´Abanell, respectively). Analyzing the following priorities, we see that "protected areas" and "unspoiled habitats" increased their relative importance in the protected beach, while "quality certifications", "services" and "proximity" did it in the urban beach (Figure 4.13a and 4.13b, respectively).

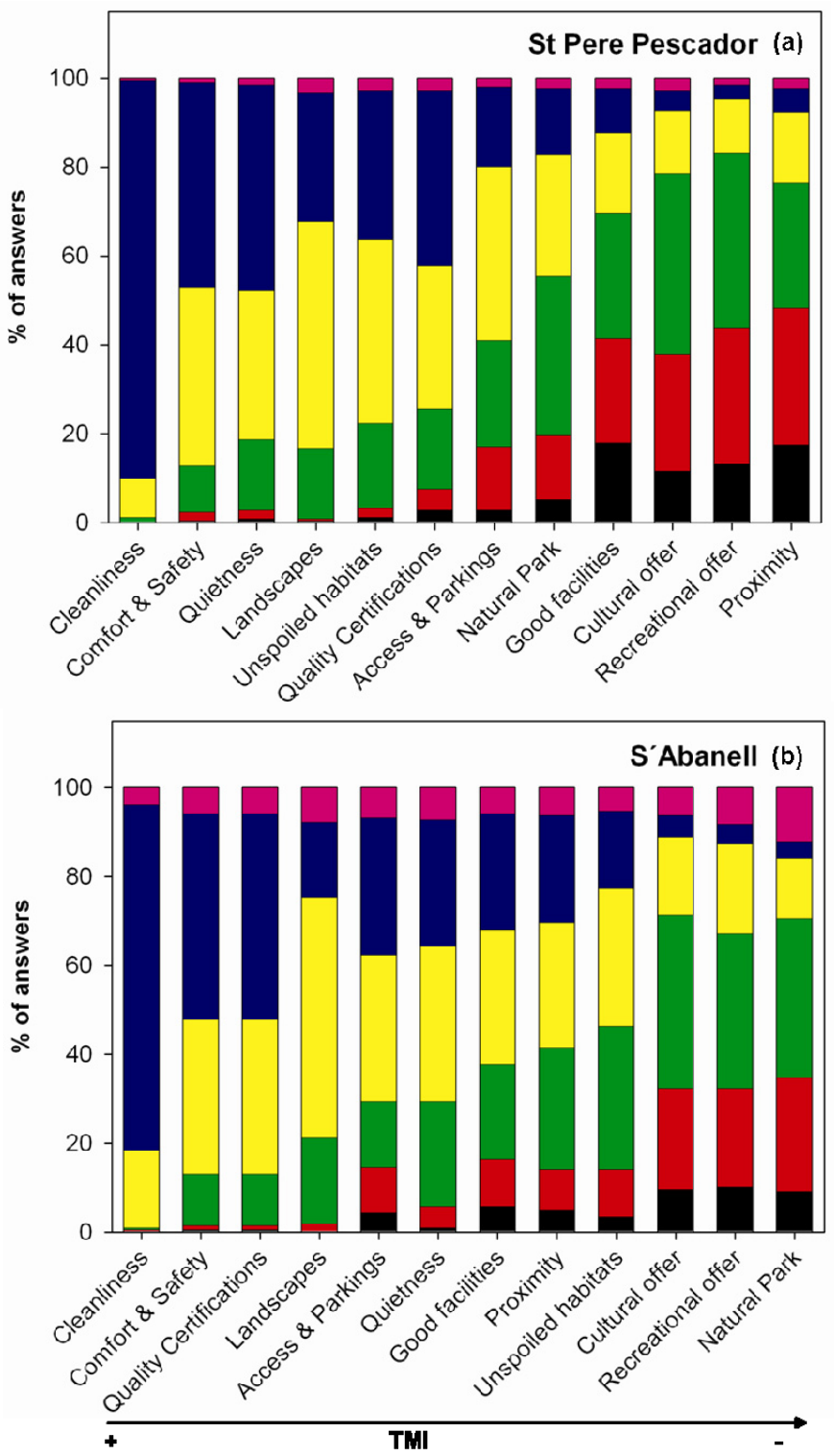


Figure 4.13- Priorities of beach users based on their classification of different beach characteristics as *Very important* (■), *Important* (■), *Neutral* (■), *Not important* (■), *Not important at all* (■), and *No response* (■). A Total Mean Importance Score (TMI) was calculated to prioritize beach characteristics. Results are presented for Sant Pere Pescador beach (a) and S´Abanell beach (b).

In order to confirm these observations, significant differences between beaches were assessed, regarding the "most positive" prioritizations of each characteristic. In this sense, the

proportions of users that classified each characteristic as *Very important* and *Important* were compared using the *Z-test* for proportions, fulfilling normality requirements (Zar, 1999).

Table 4.4- Results of the *Z-test* (proportions) to identified significant differences between beaches, in the proportions of "most positives" prioritizations (i.e. *Very important* + *Important*) of the different beach characteristics. (**: P<0.05; **: P<0.010; ***: P<0.001; n.s.: non significant*).

Beach Characteristics	**Users proportion**		***P***		
	Sant Pere Pescador	S´Abanell			
Access & parking	0.58	0.68	0.013	*	S´Abanell
Cleanliness	0.99	0.99	0.421	*n.s.*	-
Comfort & safety	0.87	0.86	0.378	*n.s.*	-
Cultural offer	0.19	0.24	0.129	*n.s.*	-
Landscapes	0.83	0.77	0.068	*n.s.*	-
Natural Park	0.43	0.20	0.000	***	St. Pere P
Proximity	0.22	0.56	0.000	***	S´Abanell
Quality certifications	0.74	0.87	0.000	***	S´Abanell
Quietness	0.81	0.68	0.001	***	St. Pere P
Recreational offer	0.15	0.27	0.002	*	S´Abanell
Good facilities	0.29	0.60	0.000	***	S´Abanell
Unspoiled habitats	0.77	0.51	0.000	***	St. Pere P

Z-test results confirmed the initial observations (Table 4.4). The proportion of users who rated the natural attributes of the beach (e.g. "natural park", "unspoiled habitats", "quietness") as very important or important were significantly higher in Sant Pere Pescador than in S´Abanell beach. On the other side, the proportion of users in S´Abanell beach who prioritized those attributes more related to urban beaches (e.g. "good facilities", "quality certifications", "proximity", "access & parking") were significantly higher than in the protected natural beach. Four characteristics do not present significant differences between beaches. "Cleanliness of sea water & beach sand" and "comfort & safety" were the most important characteristics in both beaches, and were already cited as the main drivers behind any beach selection (e.g. Breton et al, 1996; Tudor and Williams, 2006; Roca and Villares, 2008; Marin et al, 2009). "Cultural offer" has been mainly classified as a *Neutral* characteristic in both beaches (41% in Sant Pere Pescador and 39% in S´Abanell), even if the Greek and Romanesque ruins of Ampúries are located only a few kilometers from Sant Pere Pescador beach. On the other hand, "landscapes" was classified as the fourth characteristic in both beaches according to the TMI scores, which is confirming that this attribute is quite important even for urban beaches of the Costa Brava (Roca and Villares, 2008; Roca et al., 2008; 2009).

Perceptions

Users' perception was assessed based on twenty-two parameters which were evaluated by respondents, who gave a score from 1 (minimum) to 10 (maximum) depending on the level of satisfaction they provided (5.0 was the minimum acceptable). These parameters cover several aspects of the beach, which can be classified within four major groups: a) morphological aspects, b) natural aspects, c) infrastructures and services, and d) design and comfort.

The overall perception was acceptable in both beaches, whit a higher total mean evaluation in Sant Pere Pescador (7.1) than in S´Abanell beach 5.8 (Figure 4.14). In the latter, several parameters were barely acceptable, reflecting a clear dissatisfaction with certain services (e.g. "toilets": 4.66, "showers": 5.23), and some natural aspects of the beach (e.g. "presence of vegetation": 4.81, "presence of fish": 5.08) (Figure 4.14b). In Sant Pere Pescador users were also unhappy about certain services such as "rentals" (4.10), "showers" (5.68), "surveillance" (5.71) or "toilets" (5.84) (Figure 4.14a). On the other hand, natural attributes as "landscapes" (8.4) or "quietness" (8.0) had mean evaluations above the general mean (i.e. 7.1), suggesting a broad satisfaction of users regarding those aspects. The general opinion of users concerning this beach was also very positive (i.e. "global evaluation": 8.0), confirming a wide satisfaction (Figure 4.14a).

Regarding beach morphology, beach dimensions were highlighted as very positive (8.0) in Sant Pere Pescador beach, while for S´Abanell beach the users confirmed the already documented problem of coastal erosion suffered by this beach (Valdemoro and Jiménez, 2006; Jiménez et al., 2011). "Beach width" and "slope" were at the limit of acceptability, with mean values of 5.3 and 5.1, respectively.

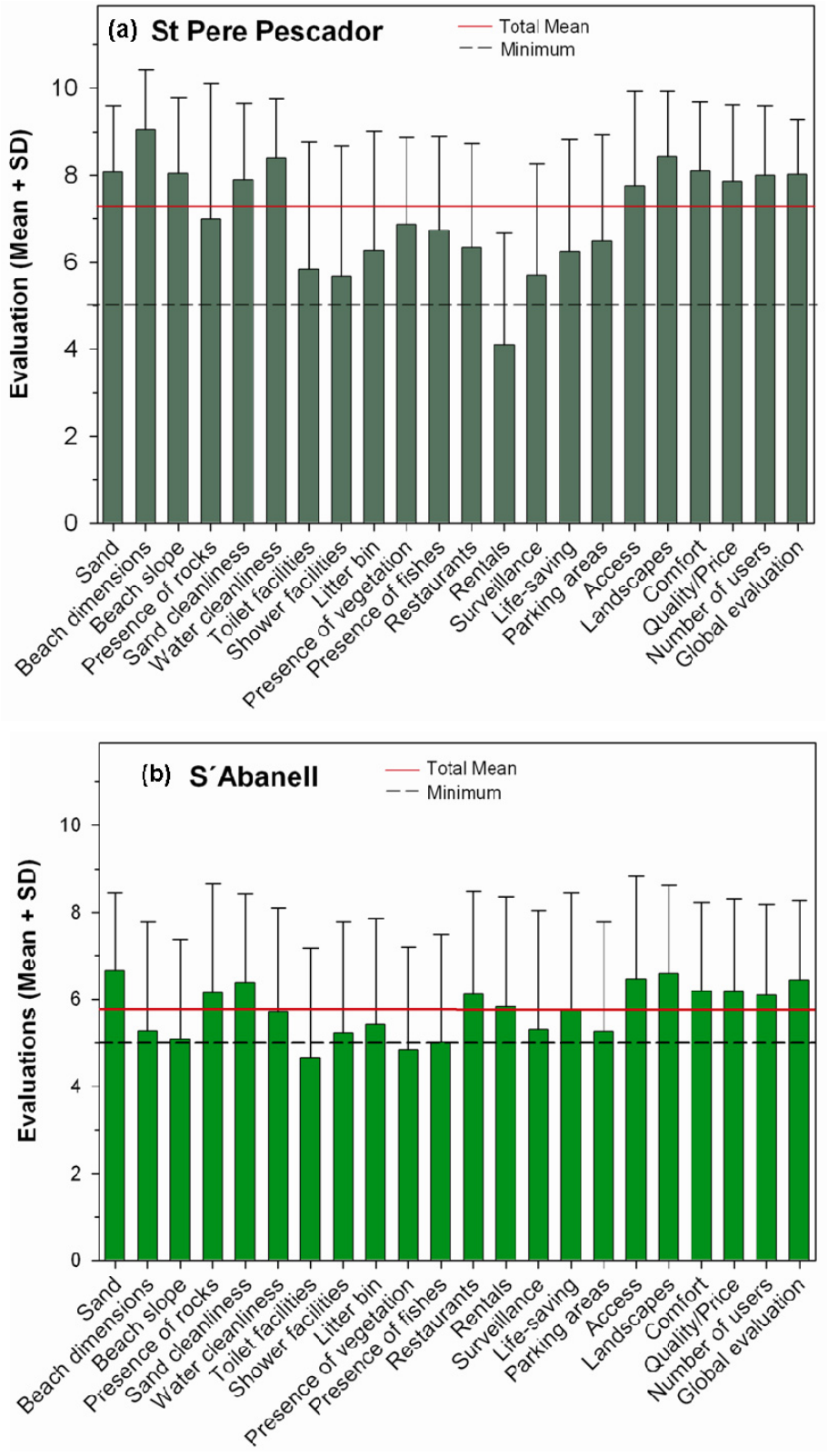


Figure 4.14- Users' perceptions based on mean evaluation (from 1 to 10, +SD) of 22 parameters of the beach. Solid lines represent the total mean evaluation and dotted lines show the minimum acceptable evaluation. Results are presented for Sant Pere Pescador beach (a) and S´Abanell beach (b).

However, these results are considerably more worrying (i.e. 2.2 and 2.9, respectively) if we consider only the evaluations obtained in the southern zone of S´Abanell beach which is the

one most affected by this processes. The perception of this problem as well as the perception of the risk related to it and the management performed justified a more detailed analysis. In this sense, it is intended to develop in the near future, an analysis that include not only the perceptions of beach users, but also the ones of other stakeholders potentially affected as managers, traders, and neighbors.

An open question about the worst aspect of the beach was included at the end of the questionnaire, in order to identify suggested ways to improve users' experiences. The answers were analyzed using Wordle. This web application generates word clouds from an original text (in this case the answers from users), giving greater prominence to words that appear more frequently (http://www.wordle.net/) (Figure 4.15).

Figure 4.15- Word cloud (http://www.wordle.net/) obtained using the open question writing words (150 most used) of users. Results are showed for Sant Pere Pescador beach (a) and S´Abanell beach (b).

This analysis confirmed some of the negative evaluations already detected (e.g. "toilets" and "showers" in Sant Pere Pescador, "beach width" and "slope" in S´Abanell, Figure 4.14a). The lack of or poor offer of some facilities (e.g. rentals, toilets, or showers) was also confirmed as the worst aspect in the protected beach, suggesting that these services could be essential for users' satisfaction (Figure 4.14a).

However, the results of this open question also highlighted new deficiencies as "dirty (sea) water" in S´Abanell beach. Although mean users' perception concerning "water cleanliness" was acceptable (5.7 in Figure 4.14b), "dirty water" was the most criticized aspect at this beach (Figure 4.15b). This negative perception is possibly associated with the cancellation or reduction of cleaning service of coastal waters. This service was in charge of the Catalan Water Agency but was seriously affected by the budget reduction. In Sant Pere Pescador, some unrest regarding the development of nautical sports (especially Kite-surfing) were also recognized (Figure 4.15a). Although these initiatives have been supported and managed by the local government (see Section 4.2 in this Chapter), there were some conflicts between surfers and general beach users, mostly due to discomfort and fortuitous accidents (Roca and Villares, personal communication).

Despite this criticism, "good condition" was a fairly common response in both beaches suggesting that many users did not find any objection (Figure 4.15a and b). This result agrees with the acceptable mean global evaluations obtained previously (8.0 in Sant Pere Pescador and 5.8 in S´Abanell) (Figure 4.14).

Willingness to pay (WTP)

Most users were not willing to pay an entrance fee, even for improving beach management or beach conditions. Despite this widespread opposition and even anger about the possibility of charging for access to the beach, 33.5% (Sant Pere Pescador) and 16.4% (S´Abanell) of respondents expressed their willingness to pay (Figure 4.16a). The percentage of users willing to pay (%WTP) was significantly higher in the natural and protected beach than in the urban one (*Chi-square test*=16.93, *P*=0.000).

The amounts pledged by users willing to pay ranged from 0.25€ and 10€ per adult per day in Sant Pere Pescador (mean value=2.7€, SD=1.9, median=2.0), and from 0.30€ and 7€ per adult per day in S´Abanell (mean value=2.4€, SD=1.8, median=2.0). Based on these results, and calculated as the fraction willing to pay multiplied by the mean value stated by those users willing to pay (Blakemore and Williams, 2008), the *use value* for adults was 0.94€ in Sant Pere Pescador beach and 0.46€ in S´Abanell beach. The most common reason for refusing to pay was "*I am not the one who should pay*", usually referring to the government (national or local) as the responsible for the expenses to assure a proper management and maintenance of

beaches (81% and 79% in Sant Pere Pescador and S´Abanell, respectively) (Figure 4.16b and c, respectively).

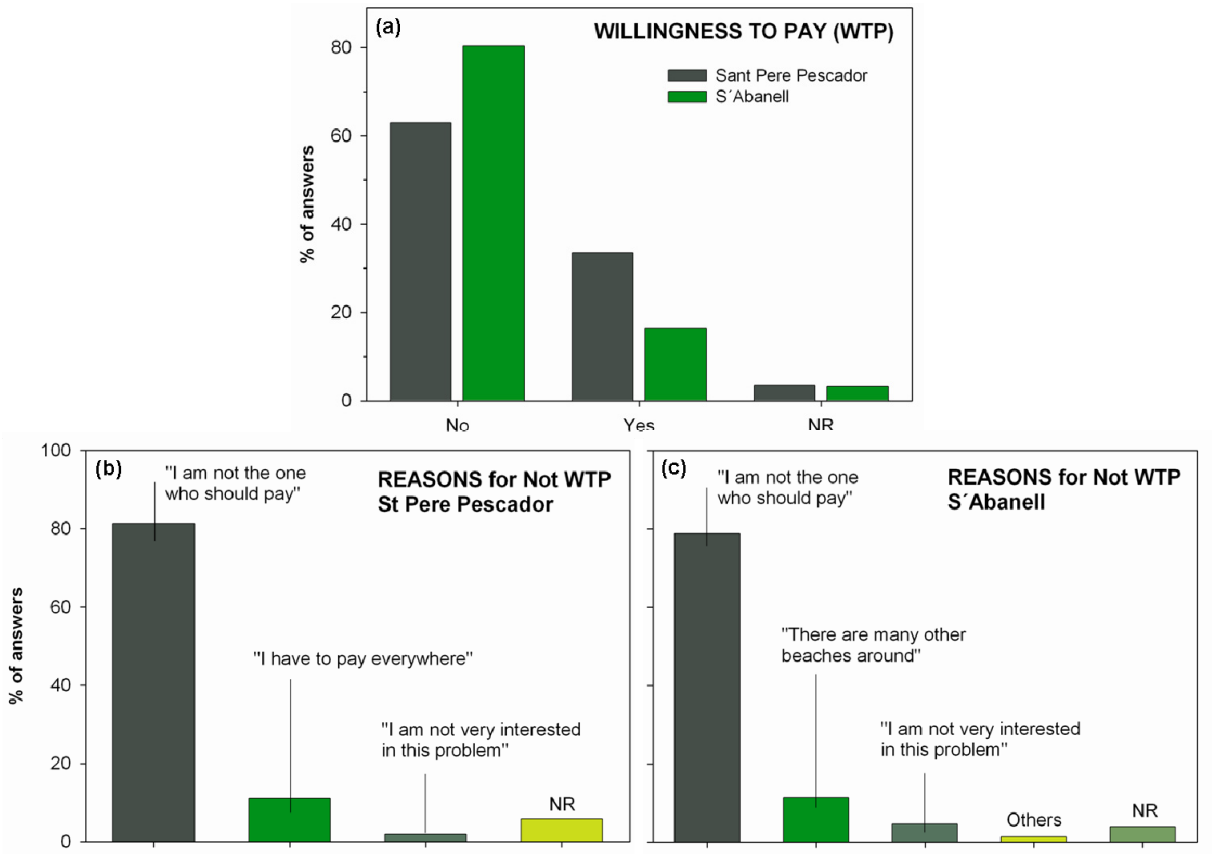


Figure 4.16- Percentage of users willing to pay an entrance fee (WTP) (a) and most common reasons for refusing to pay for Sant Pere Pescador beach (b) and S´Abanell beach (c).

4.3.3. Discussion

Considering that Sant Pere Pescador beach is a protected natural beach it was expected to find that its users desired more "nature" than "services". The opposite trend was expected for S´Abanell beach, where users are probably more habituated and demanding about the facilities commonly offered in urban beaches. However at first glance, the results of these surveys suggest that motivations, priorities, and perceptions of users in these two *antagonistic* beaches are not so different.

The users motivations to visit these beaches mirror the classical reasons already obtained for Mediterranean tourist destinations: "recreation" (Blakemore et al, 2002) and particularly "swimming and sunbathing" (Breton et al, 1996; Roca et al, 2008). These motivations are in accordance with usual expectations of the Mediterranean "sun, sand and beach" tourism

model (Apostolopoulos and Sönmez, 2000; Satta, 2004; Aguiló et al, 2005). Likewise, main priorities were also the same in both beaches (i.e. "cleanliness" and "comfort & safety"), confirming the classic hypothesis that holds these two attributes as the main drivers behind any beach selection (Breton et al, 1996; Tudor and Williams, 2006; Roca and Villares, 2008; Marin et al, 2009).

However, looking beyond that clear dominance of "cleanliness" and "safety", the first significant difference between these two beaches appears. In accordance with our initial hypothesis, the natural attributes of the beach (e.g. “unspoiled habitats”, “quietness”, and “natural park”) were significantly positively prioritized in the protected setting regarding the urban one. On the other hand, in S´Abanell beach the attributes more related to services and facilities were the most positively prioritized (i.e. classified in a higher percentage as *very important* or *important*), confirming the "sun, sand and beach" model assumed a priori.

Yet, despite the positive prioritization of natural attributes in Sant Pere Pescador, the lack of or poor offer of some facilities (e.g. rentals, toilets, or showers) was identified as the worst aspect of this beach. These results suggest a clear demand for better services, which seems to be essential for users’ satisfaction. In this sense, a low evaluation of services was also recorded in S´Abanell beach despite its broad offer. Today, even if natural aspects result quite important for some users, the presence of certain services at the beach (e.g. toilets, showers, parasols) seems to be something natural and even a requisite for most users at any beach. This requirement seems widespread but particularly essential in coastal areas where tourist industry has been as important as in the Costa Brava. Concerning the worst aspects of S´Abanell beach, the users showed *new* risky factors (i.e. with very high levels of dissatisfaction) and confirmed some already known. Within the former we found the emphatic complaint about dirty sea water, while within the latter, coastal erosion is probably the most important claim. In order to improve these beaches, these feedbacks should be considered in their management processes.

Although the obtained %WTP might seem low for the Mediterranean region (see more details in Section 4.2), suggesting a doubtful users’ engagement about beach management improvement, we cannot ignore that the Spanish law requires free access to beaches. The fact that users of Spanish beaches are not as used to paying beach entrance fees could be a possible explanation for these results. Nevertheless, although WTP amounts were quite

similar between these beaches, the %WTP in Sant Pere Pescador was significantly higher than in S´Abanell beach. While it is not possible ensure the reasons underlying these significant differences from our results, some possible explanations might be guessed within this context.

The largest percentage of tourists in Sant Pere Pescador beach, probably more used to paying beach entrance fees, could be a possible explanation for the significant higher %WTP. However, no significant differences regarding %WTP were detected between *Locals* and *Tourists* for this beach (see Section 4.2 in this Chapter), invalidating that possibility. Looking the other side of this coin, the lower %WTP registered in S´Abanell beach might be due to the fact that users consider the beach as a basic service traditionally provided by the municipality of this town. In the last decades this town has been based primarily on a "sun, sand and beach" tourism model. Thus, it is logical that the users of this beach are not willing to pay for a service that has traditionally been guaranteed and maintained by "the government". A greater awareness of users in Sant Pere Pescador about conservation and protection of natural attributes might be another possible explanation for the significant difference in %WTP. That will be coincident with the significant positive prioritization of natural attributes registered in Sant Pere Pescador beach, which would be consistent with our initial hypothesis.

Nevertheless, these explanations should be handled carefully, keeping in mind that the questions referred to users' WTP were not exactly the same for both beaches. Although both purposes involved an improvement of beach management, the fact that the questions were not exactly the same might affect the %WTP. Beyond that, to know the likely reaction of users facing a beach entrance fee or tax implementation could be of great importance for the management of these beaches. In this regard, Ariza et al. (2012) suggested the feasibility of implementing some kind of "beach management tax" for this region. This tax for beach-related economic activities could be used to improve beach management, and would be particularly important to protect landscapes, ecosystems or communities of special natural interest in this coastal zone (Ariza et al., 2012).

Behind the apparent homogeneity in perceptions and expectations of users, significant differences between these two antagonistic beaches would support our initial hypothesis. Although certain "usual priorities" (e.g. sand and sea water cleanliness, safety) were common in both beaches, natural attributes were the priority in Sant Pere Pescador, as well as facilities in S´Abanell beach. The significantly higher %WTP in the protected natural beach could

suggest a greater concern for proper management and conservation of this socio-ecological system. However, it is undeniable the strong influence that the traditional "sun, sand and beach" mass tourism model of the region has on users' expectations (e.g. widespread demand for services and facilities). Therefore, particular management frameworks are necessary for those beaches that have singular natural characteristics (both for its location and its users), and especially for those located in traditional tourist areas like the Costa Brava. In this sense, and as pointed out in Section 2 of this Chapter, the educational and informative functions are critical to warn and sensitize beach users, being a cornerstone to achieve a sustainable use and management of these socio-ecological systems.

4.4- Conclusions

Nowadays, it is recognized that human activities and the ecosystems in which they occur should be managed as a whole (*human-in-nature* concept, Berkes and Folke, 1998). This is the fundamental basis for the Ecosystem Approach and has resulted in the emergence of the concept of social-ecological systems, reflecting the inextricable link between society and ecology. Consequently, beaches must be analyzed taking into consideration that social drivers could produce significant environmental impacts at local, regional and global scales. In order to attain the most ecologically sustainable, socially equitable and economically efficient development of coastal areas, data which reveal motivations, perceptions and human behaviors must be incorporated into management plans, particularly for beaches where policing is extremely challenging. Social participation and public engagement have been emphasized as critical for successful public management and thus as a cornerstone of integrated coastal management (ICM) processes (Hildebrand, 1997; Olsen et al., 1997; Ballinger et al., 2010; Roca et al., 2009; Areizaga et al., 2012a; 2012b).

This chapter analyses users' perception as a feedback of management measures, helping managers in the evaluation and adaptation of management process. This stage has already been defined as one of the most important element for ICM, since it allows learning from previous actions (e.g. Areizaga et al., 2012b). In this sense, the performed assessment identified potential risk factors, some new and some already known, which could interfere with the satisfaction of current users of these two beaches of the Costa Brava. This feedback

allows prioritizing actions based on the reality perceived by users, thus improving their perceptions and feeling about the beach.

This evaluation also showed significant differences between these *antagonistic* beaches that at least from the point of view of users would justify a differential management. However, these differences were not as obvious as one would expect according to the stereotyped initial hypothesis "protected natural environment vs. urban setting". In this sense it is remarkable that the significant positive prioritization by users of natural attributes in Sant Pere Pescador occurred in spite of the scarce information and relevance that managers give to the natural values of the beach. Although increasing public participation is a key step forward in sustainable policies, it must be carefully developed in order to assure the usefulness, validity and representativeness of these opinions (Areizaga et al., 2012b). This chapter highlighted the importance of information and education, as two crucial needs for a valid and informed opinion. In this sense, a major effort in education and dissemination to users should be part of this differential management, especially in Sant Pere Pescador beach as a protected natural area (Natura 2000), as a key element of the sustainable management of these beaches.

We must be aware that these conclusions are based on the perceptions of one of the many stakeholders who, with different visions and expectations, should be engaged in beach management processes, in order to achieve an integrated and sustainable use of these social-ecological systems.

Chapter 5

From managing competences to managing results: towards the sustainable use of beach environments

5.1- Introduction

The relationship between humans and their coastal environments has been historically based on the increasing exploitation of its resources. Coastal regions have been especially attractive environments for human settlements, because of their climate, geo-morphology and ecology. Hence, coastal zones have become significant centres of economic, productive, cultural and traditional development for several cultures (Juanes, 2009). However, within these areas, complex social-ecological systems as beaches have been generally seen as natural places supporting hedonic social-cultural activities, despite the complexity and diversity of all its dimensions (i.e. natural, economic and social-cultural) (James, 2000; Ariza et al., 2008a). Although these systems may provide several other functions such as Regulation, Habitat, Production, or Information (de Groot, 1992; Costanza et al., 1997; MEA, 2003; Farber et al., 2006; Brenner et al., 2010), beach management has traditionally focused on geomorphological hazards and recreational human use of beaches, largely ignoring their ecological and broader environmental values (James, 2000).

As has been emphasized throughout this thesis (see e.g. Chapter 2), a broader conception of beaches must be incorporated building on the principles of Ecosystem Approach (EA), recently incorporated within the recommended guidelines for ICM (World Summit on Sustainable Development, Johannesburg, 2002). These social-ecological systems must be recognized as multidimensional systems rather than one-dimensional physical or recreational sites (James, 2000; Ariza et al., 2008a). In this sense, the EA (Ecosystem-Based Management, EBM in its management applications) proposes a shift in the focus of management, from individuals to ecosystems, from exclusively small spatial scales to multiple spatial scales, from short-term to long-term expectations, from humanity outside the ecosystem to "*human-*

in-nature", from managing commodities to sustaining the production potential for ecosystem goods and services (Cheong, 2008; Forst, 2009). In order to cope with the uncertainty of such complex systems, management should be adaptive, proactive, and transparent, assuring the active participation of all stakeholders as well as their integration and coordination (Chua, 2003; Barragán, 2003; Ariza, 2010).

However in Spain (and particularly in the Costa Barva), the (eco)systemic vision is still not the most common approach in managing these natural areas, especially in coastal zones where the Tourism Industry has a long tradition and its natural resources tend to be "less" important. In many countries beaches play a significant role in the maintenance of that industry, which use to be an essential sector for their economic welfare (e.g. in Spain 0.001% of its surface (beach areas) can be related with the generation of 10% of the National GDP, Yepes, 2005). Consequently beaches are considered one of the country's major assets and beach management processes have been traditionally service-oriented considering these systems as another product/service on offer to users and visitors. In this line, satisfying beach user needs is the main existing goal in beach management processes, while beaches are suffering today other important pressures deriving from erosion, climate change effects, alteration of hydrographic and oceanographic regimes, or natural degradation, which are not adequately addressed (CIIRC, 2010; Jiménez et al., 2011; Sardá et al., 2012). In the western Mediterranean coast, tourism is probably the most important driver in coastal-related changes, and its "sun, sand and beach" massive model has already been identified as one of the main responsible on the anthropization of the Mediterranean Spanish coast (Sardá and Fluvià, 1999; Sardá, 2001; Suárez de Vivero and Rodríguez-Mateos, 2005; Ariza, 2010). Furthermore, these negative impacts on beaches, and particularly on its natural attributes, have begun to affect users' perceptions, reducing the quality of the recreational experience that they are looking for (Roca et al., 2009).

This situation recalls "the goose that lays the golden eggs" fable, and clearly shows a lack of both long-term vision and integration in beach management processes. In this sense, integration has been highlighted as an essential aspect for ICM, providing a broader and cohesive perspective of the entire process, which enables to focus efforts on sustainable development goals (Chua, 1993). Beaches management in Spain has a clear *disintegrated* structure where the recreational function is the one properly managed and the rest of functions are only addressed where reactive actions are needed. The managerial structure developed in

the past is not prepared to deal with these issues. The common situation is the presence of highly fragmented management where different social-ecological qualities are considered separately by different actors having different objectives and responsibilities (Sardá et al., 2012). Legal responsibilities are scattered throughout different management bodies, often not well structured and related (for a detailed analysis see Ariza, 2010). Although recent management schemes such as Integrated Coastal Zone Management (ICZM) frameworks should integrate these actions, the further implementation of potential new resulting management plans is hampered by the complexity and potentially conflicting jurisdictional policy objectives of various levels and arms of government and offices in a given geographical area. The lacks of adequate institutions and social capital, have been identified as key impediments for the sustainable use of beach environments (Ariza, 2010; Sardá et al., 2012).

This chapter presents the results of an institutional analysis performed in eight beaches along the Costa Brava, including those treated in the past chapters (i.e. S´Abanell and Sant Pere Pescador). The analysis of institutions has already been identified in Chapter 2 as a key component to improve the performance of natural resource management. The objective in this chapter has been to describe the diversity of management structures, as well as the structural weaknesses of the present institutional situation of beach planning and management in a highly touristic region of Catalonia (Spain). This analysis will serve as a starting point to develop a road map in order to find a much better and integrated beach management scheme for social-ecological systems.

5.2- Methods

The present management model, largely based on managing responsibilities, has been analyzed in eight municipalities along the three counties (*Comarcas*) of the Costa Brava (Girona, Spain): Roses, Castelló d'Empúries, Sant Pere Pescador, L'Escala, Palamós, Calonge, Lloret de Mar, and Blanes (Figure 5.1). The institutional analysis was carried out through in depth interviews conducted to the first municipal actors (i.e. councillors or municipal officers) with responsibility for managing beaches (see Annex 7.3 for the questionnaire). The objective of these surveys was to identify the agencies in charge of beach

management processes in each one of these beaches, as well as to determine in which period of the year that management is performed.

Considering beach management an integrated holistic process, which should include all the functions of these systems, this analysis used the *Beach Quality Index* (BQI, Ariza et al., 2010) as a guide to identify the key processes that should be included in beach management schemes.

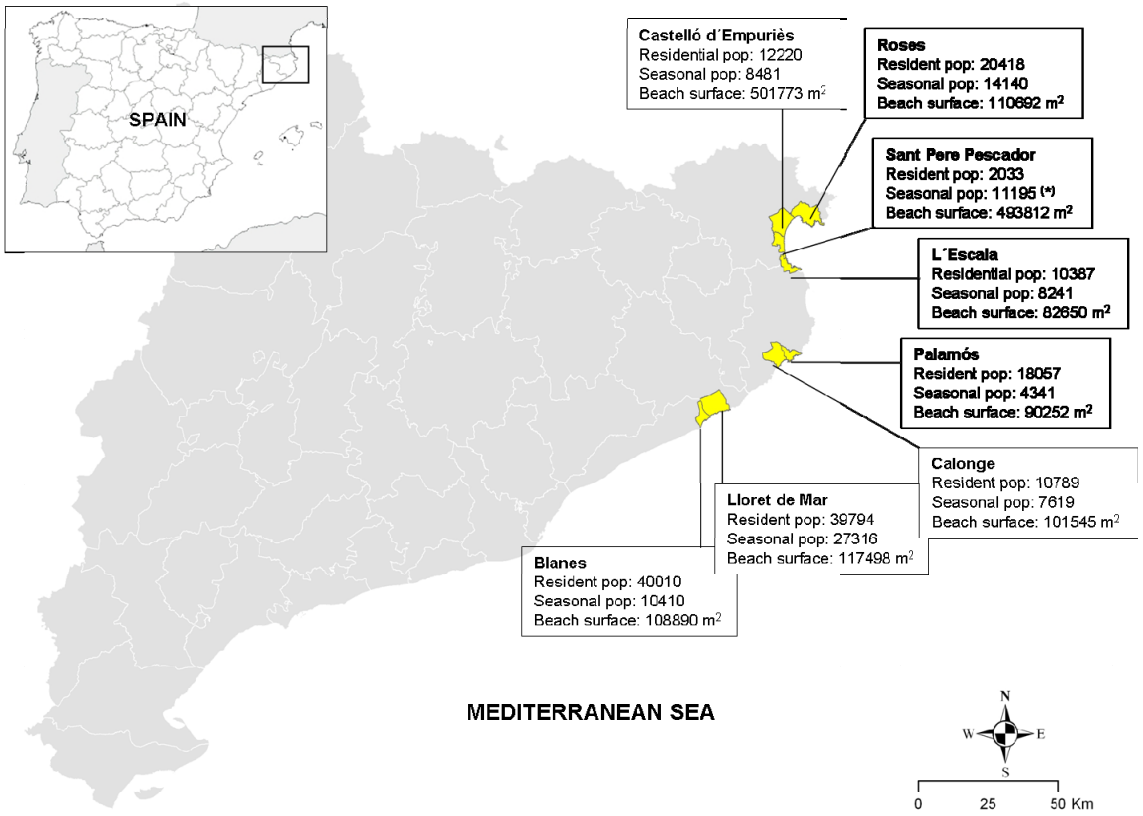


Figure 5.1- Map of the study zone. Beach surface and population data have been extracted from CIIRC (2010) and IDESCAT (2011) (resident population for 2010 and seasonal population for 2003), respectively. (*) Seasonal population of Sant Pere Pescador, not available in IDESCAT, has been extracted from a proper database (Sardá et al., 2005).

The BQI considers the three basic functions of the beaches, and for this purpose three sub-indices were designed: the Natural Function (*NFI*), the Protective Function (*PFI*), and the Recreational Function (*RFI*). In turn, each one of these sub-indexes has been designed to add different partial indicators (Table 5.1). Therefore, the information obtained by the BQI can be decomposed into 13 partial indicators (14 if we add the process of cultural aspects separately) that can be used as a balance scorecard to help in the management process, and can be used to analyze the environmental aspects related to beach management and control programs. Hence, each partial indicator will assess each of the 13 (or 14, see above) basic processes identified

for beach management. Based on these processes, the survey was designed to identify the agencies responsible for the management of each one of them, as well as its planning and implementation actions.

For each of the selected processes, the surveys attempted to identify: a) the municipal or supra-municipal organization responsible for its management, b) the person or administrative office responsible for its management and monitoring, c) the seasonality of management activities, d) the frequency of these activities, and e) the economic cost of them. A final open question was raised about *Beach Use Plans* (i.e. a regulated document essentially designed to specify and regulate the services offered in a beach for a bathing season, which coastal Municipalities in Spain must prepare yearly following regulatory approaches), about management processes that have been or are actually undergoing (with or without certifications), or other aspects not considered (see Annex 7.3).

Table 5.1- Structure of *Beach Quality Index* (BQI) (Ariza et al., 2010).

$$\boldsymbol{BQI} = p_{1(A,B)}(\mathbf{RFI})+p_{2(A,B)}(\mathbf{NFI})+p_{3(A,B)}(\mathbf{PFI})$$

$$\mathbf{RFI} = \alpha[t_1(IC)+t_2(IEQ)+t_3(ISerF)+t_4(IAct)+t_5(IAcPar)+t_6(IComf)+t_7(IS)+t_8(IBS)]$$

$$\mathbf{NFI} = u_1(IN)+u_2(IWSP)+u_3(IPQ)$$

$$\mathbf{PFI} = IPP$$

	Urban beaches	Urbanized beaches
RFI	p_{1A}	p_{1B}
NFI	p_{2A}	p_{2B}
PFI	p_{3A}	p_{3B}

***BQI* index**	**Sub-indexes**	**Partial indexes**
	RFI: Recreational Function	α: Microbiological Water Quality
		IC: Beach Crowding
		IEQ: Environmental Quality
		ISerF: Services and Facilities
		IAct: Disturbing Activities
		IAcPar: Access and parking
		IComf: Comfort Quality
		IS: Surrounding Area Quality
		IBS: Beach Safety
	NFI: Natural Function	*IN*: Natural Conditions
		IWSP: Water-Sand Pollution
		IPQ: Physical Quality
	PFI: Protection Function	*IPP*: Protection

The results section is presented in two major sub-sections: a) the first one shows the results concerning management actions, their timing, and the quality certifications or management systems employed in these beaches, while b) the second section presents the analysis of responsibilities, showing the different agencies involved in the different management processes, as well as an estimate of the economic investment for each process. All the

analysis have been based on the 13 (+1) BQI's partial index, which actually are describing fourteen management processes that are carried out (or not) in these beaches.

5.3- Results

5.3.1. Beach management

Based on the surveys performed to the first municipal actors, we obtained eight different chronograms of management actions associated to the different municipalities assessed. In these eight municipalities, beach management has been performed proactively almost exclusively during summer, and particularly during the bathing season. In these beaches, the main objective of management is to set up the beach in order to reach the quality standards required mainly by its recreational function. That includes allowing the user to enjoy the beach safely and comfortably, as well as to be able to accommodate all the services that used to be offered at these beaches (e.g. hammocks, umbrellas, beach bars). Usually, the management objective was to achieve a certain level of quality, which in some cases leads to the granting or renewal of some standard of quality or management. During the rest of the year, and usually in a reactive manner, certain actions linked to the natural and protective functions can be activated. An example would be an exceptional storm surge, justifying the activation of, and thus the use of certain cleaning, emergency and/or civil protection equipments. In this case the processes to be performed are not well defined and are usually slow and inefficient.

None of the eight municipalities studied showed a similar timetable of activities. The analysis of these schedules confirmed how, in most cases, the management of much of the 14 processes occurs only during the bathing season (Table 5.2). This management occurs mainly from the 1st of June until the 31st of September. Just in some case such as L'Escala, the tourist season (and thus the management processes) starts at Easter. Just "Access and parking" and "Natural conditions", which are not exclusive processes of the beaches, are managed throughout the year. On the other hand, the processes "Disturbing activities", "Environmental quality" and "Water-sand pollution" (in this case besides the mechanical cleaning, or some exceptional situations that imply some municipal and supra-municipal risk prevention plan)

do not have any type of management during the year in none of the municipalities. The management process of water quality monitoring is done during the bathing season, and since is defined by law this is the only one to be performed in the same way for all municipalities and beaches analyzed. Finally, the actions concerning beach morphodynamic processes as "Physical quality" and "Protection", are just occasionally and reactively made (see $P^{(\Delta)}$ in Table 5.2).

Table 5.2- Timing of management processes along the entire year for the eight beaches analyzed. $P^{(\Delta)}$ refers to the management actions that are undertaken occasionally and reactively.

	Roses	*Castelló d'Empúries*	*Sant Pere Pescador*	*L'Escala*	*Palamós*	*Calonge*	*Lloret de Mar*	*Blanes*
α	Jun-Sep	Jun-Sep	Jun-Sep	Jun-Sep	Jun-Sep	Jun-Sep	Jun-Sep	Jun-Sep
IC	Jun-Sep	Jun-Sep		$P^{(\Delta)}$				
IEQ	Jun-Sep	Yearly	Jun-Sep	Apr-Sep	(Apr) Jun-Sep	Jun-Sep	Jun-Sep	Jun-Sep
ISerF	Jun-Sep	Jun-Sep	Jun-Sep	Apr-Sep	Jun-Sep	(Apr) Jun-Sep	Apr-Sep	Jun-Sep
Iact								
IAcPar	Yearly		Yearly	Yearly	Yearly	Yearly	Yearly	Yearly
IComf	May			$P^{(\Delta)}$	$P^{(\Delta)}$	$P^{(\Delta)}$	May	May
IS								
IBS	Jun-Sep	Jul-Ago	Jun-Sep	Apr-Sep	Jun-Sep	Jun-Sep		Jun-Sep
IN	Yearly	Yearly	Yearly	Apr-Sep	Yearly			
IWSP								
IPQ	$P^{(\Delta)}$							
IPP					$P^{(\Delta)}$	$P^{(\Delta)}$		$P^{(\Delta)}$
IAcSoc	May-Sep	Jun-Jul	May-Jun	May-Sep	Jun-Sep	Jun-Sep	Apr-Sep	Jul-Ago

Concerning quality standards, rating systems, and environmental management systems, these municipalities cover a large spectrum of options and models (e.g. *Blue Flag award, ISO 14001, EMAS, Q of Quality*). These standards have been introduced to establish a set of minimum requirements in order to guarantee a certain level of quality on a particular beach. The *Blue Flag award* is probably the best established international performance standard for beaches. That qualification is based on 26 specific criteria covering several aspects such as environmental education/information, water quality, environmental management, safety and services. This award has been developed for use as an environmental-based beach quality tool and has also been well accepted as a public marketing tool. The *Blue Flag award* was introduced in 1987 and is currently awarded to around 3100 beaches and marinas y in 34 countries (Nelson et al., 2000b; Ariza et al., 2008b).

In another group of management tools, we can observe the *ISO 14001 for beaches*, The *Eco-Management and Audit Scheme* (EMAS, EC Council Regulation 761/2001) and the *Q of Quality* developed by the "Sistema de Calidad Turística Española en Playas" (SICTE) (for

detailed information see Massó and Yepes, 2003; Yepes, 2003; 2005). All these latter frameworks are environmental management standards, which unlike the general performance standards or rating systems, allow a steady improvement of beach management incorporating new objectives, evaluating the implementation of measures and hence the progress towards those objectives. The *ISO 14001 for beaches* is probably the most recognized environmental management system adapted for beach management. It has emerged in Spain as an adaptation of the widely recognized international quality standard, following the increasing use of it in the private sector during the last decade. This version maintains the original three general objectives: commitment to environmental policy, commitment to the compliance with legal and other applicable regulations, and steady improvement. Therefore, the requirements for certification of the environmental quality of beaches are the same as those used in the administrative and industrial sectors, although some specific factors considering beach management has been added (AENOR, 2003 in Ariza et al., 2008b).

Table 5.3 presents the results of the different EMS or standard certification that are used or approved for the eight beaches under study. All the municipalities analyzed have developed their *Agenda 21*, and the majority also had the standard *Blue Flag award*.

Table 5.3- Main quality standards, rating systems, and environmental management systems obtained or used by the beaches under study.

Beaches	*Agenda 21*	*Blue Flag*	*ISO 14001*	*EMAS*	*Q of quality*
Roses	Yes				
all the beaches			Yes	Yes	No
Castelló d'Empúries	Yes				
Can Comes		No	No	No	No
Empuriabrava		Yes	Yes	Yes	Yes
la Rubina		No	No	No	No
L'Escala	Yes				
all the beaches		No	Yes	Yes	Yes
Sant Pere Pescador	Yes				
all the beaches		No	No	No	No
Palamós	Yes				
all the beaches			Yes	Yes	No
la Fosca		Yes			
Calonge	Yes				
es Monestrí		Yes	Yes	Yes	No
Sant Antoni		Yes	Yes	Yes	Yes
Torre Valentina		Yes	Yes	Yes	Yes
en Cristus		Yes	Yes	Yes	No
Calas Naturales		No	No	No	No
Lloret de Mar	Yes				
Lloret Centre		Yes	Yes	No	No
Fenals		Yes	Yes	No	No
Blanes	Yes				
S´Abanell		Yes	No	No	No

In this sense, it is noteworthy that, all the beaches despite Lloret de Mar and Blanes (i.e. the two biggest ones), certified with the *ISO 14001* also have achieved the European *EMAS* certification. Likewise, the municipality of L'Escala, as well as some beaches from Castelló d'Empúries and Calonge, have also received the *Q of quality* (from the Spanish Institute for Tourist Quality) a novel certification also based on an EMS. Having the European EMAS management system gives more publicity to such service and forces managers to communicate their activities to the society. Given that management measures are based on service that benefit the society, this dissemination is highly positive and often leads to an improvement in management. However, this scheme implies more time dedicated to management and a greater administrative complexity. In the case of Lloret de Mar, this administrative overload led the Municipality to not applying for renewal of EMAS since 2009.

5.3.2. Analysis of responsibilities

Before presenting the results obtained from the surveys, the legal framework of beach management in Spain is briefly described, in order to keep in mind the main responsibilities of each administrative level. This description also complements the characterization of legal responsibilities held in the application of the multi-hazards risk assessment framework in the S´Abanell beach (see Chapter 3, Section 2).

In Spain, several public administrations are responsible for coastal management. With several laws and regulations, they are spread over three administrative levels: the central government of the Spanish State, the Autonomous Governments (in this case the one of Catalonia), and the Municipalities.

The central government has the main responsibility for coastal management, and in this sense, the Shores Act 22/1988 (BOE, 1989) is the main jurisdictional framework, defining the coastal zone as public property according to the Spanish Constitution. This is the Spanish regulation that most resembles a coastal management law. This Act offers a general coastal zoning schema with three main fringes: terrestrial domain, Public Terrestrial-Marine Domain (DPMT), and marine domain (see Figure 5.2). However, even if it defines the DPMT limits, competencies and responsibilities related to its management, this Act was created just for the

DPMT and does not define management attributions to the entire coastal zone (Barragán, 2003; Suarez de Vivero and Rodríguez Mateos, 2005; Ariza et al., 2008a; Brenner, 2007).

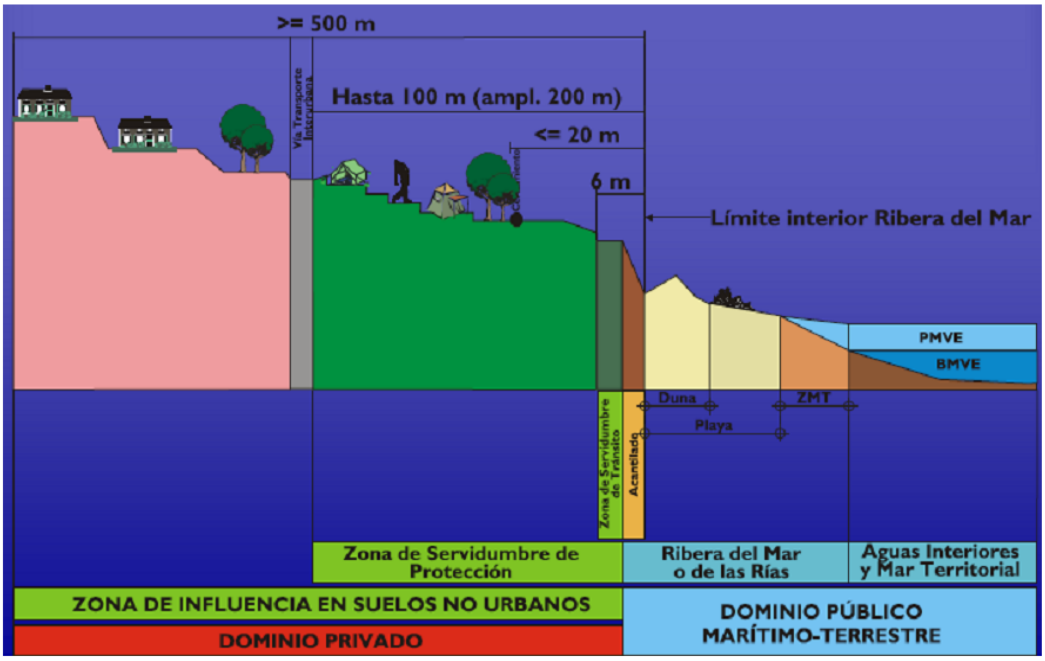


Figure 5.2- Coastal zone delimitation according to the Shores Act 22/1988 (BOE, 1989).

The Public Terrestrial-Marine Domain (PTMD) represents the area between the mean lowest tide and the line where the highest storm waves reach in the beach, or the highest tides level. It could include inland areas with sand dunes and vegetation that are directly influenced by the marine environment. In the terrestrial domain (500 m buffer zone from the inland limit of the sea Riviera) where the land can be privately owned, easement zones have been established: the protection easement zone includes the first 100 m inland where urban and transportation infrastructure and use is forbidden. The first six meters of the former, represent the public transit easement zone, especially meant for surveillance and rescue activities (BOE, 1989). Although this general coastal zoning schema results very useful, it can be applied if there is no infrastructure prior to the implementation of the Shores Act (1989), which in many cases is an exception.

Concerning the Autonomous administrative level, the Statute of the Autonomous Community of Catalonia is the legislation which sets out the competencies of the Autonomous Government with respect to the Catalan coast and its marine environment (BOE 1979). Although the central government has the main responsibility, some activities affecting the structure and dynamics of the shoreline are managed by local municipalities (e.g. rivers and

interior waters, seasonal services, upkeep and cleaning of beaches). In Spain, Municipalities constitute the minimum administrative level unit, which in theory should be best placed to achieve or improve coastal zone management, having the ability to recognize and handle the peculiarities of each of those social-ecological systems. As a complement to the Shores Act, the Catalan Government (Generalitat) developed the Coastal System Urbanization Plan (PDUSC) whose main objective was to plan and zone conveniently the coastal territory under sustainable development basis (DPTOP, 2005). Although this Plan has no competencies in the PTMD, it has skills in the terrestrial buffer zone (500 m) where uses are regulated. Influencing land use planning and regulating the growth of urbanization on the waterfront, this plan can be considered a coastal conservation tool (Brenner, 2007). Following the European ICZM recommendations (COM/00/545), in 2004 the Generalitat has also launched its ICZM Strategic Plan (PEGIZC; DMAH 2004). This Plan constitutes a first step in a long-term move towards a much more rational management of the coast (Brenner, 2007), but the implementation of this plan never has arrived since its redaction.

In our case, the management of the fourteen processes assessed for these eight beaches along the Costa Brava, involved the participation of the three general scales of management described above: a) the Municipalities with their different departments, b) the Catalan Autonomous Government with its different offices, and c) the Ministry of the Environment with the General Directorate of Coasts (DGC). However, the implication of these offices concerning these processes is variable, and tends to decrease as we move away from the territorial area of the beach under management. Figures 5.3 to 5.6 show the flowcharts obtained from the questionnaires. In these flowcharts, the different offices at the three management levels are connected based on the managerial processes separately analyzed in the BQI index. The higher thickness of connectors highlights the processes which are managed only by one agency. The processes considered in the analysis are also showed, grouped in the three main functions of the beach. In this case the “social” function has been considered apart from the original recreational function. In some cases (e.g. Blanes, Lloret de Mar, and Roses) the economic investment in the management of each process has been also obtained, but this information was not always available (Figure 5.3 to 5.6).

The first result that stands out when analyzing the overall structure of beach management in these municipalities is the great variability of management structures. This is clear considering both the internal structure of Municipalities and the management measures

concerning the 14 processes under analysis. Concerning the internal structure of the different municipalities, several arrangements have been found, ranging from “regidurías” (term used in the Catalan public service) to municipal areas and/or services. They can be divided in 7 major services like in Lloret de Mar, or be up to 17 large municipal areas of management as in Castelló d' Empúries. The left side of the diagrams (Figures 5.3 to 5.6) shows nine large municipal areas that usually have responsibilities in beaches management (i.e. *Environment*, *Tourism*, *Culture, Recreation and Amenity*, *Public Security*, *Finance*, *Roads and Traffic*, *Sports*, *Planning and Urban*, and *Services for the Community*), and whose position in the municipal structure may vary for each study site.

The number of processes currently integrated in the management of these beaches also varied considerably, especially in those that are the responsibility of municipalities. On the other hand, certain processes such as the “Microbiological water quality” or “Protection” were constant for all the beaches. This is due to the distribution of competencies throughout the three levels of government presented earlier in this chapter. Water quality is by law the responsibility of the Catalan Water Agency (ACA) (upper right side of the diagram), and is developed following the evaluation criteria established by Directive 1976/160/EC on the quality of bathing water, recently modified by the new Directive 2006 / 160/EC. Concerning actions related to the Protective function (e.g. maintenance of a minimum functional size of the beach), although they are generally reactive and caused by a specific request, they are a responsibility of the central government of the Spanish State (lower right side of the diagram). The rest of the processes, included within the Recreational Function, are mainly managed by municipalities, except for specific aids such as the case of Roses, where the ACA and the public company Costa Brava Consortium provide help in the management of the "Environmental Quality" of beaches.

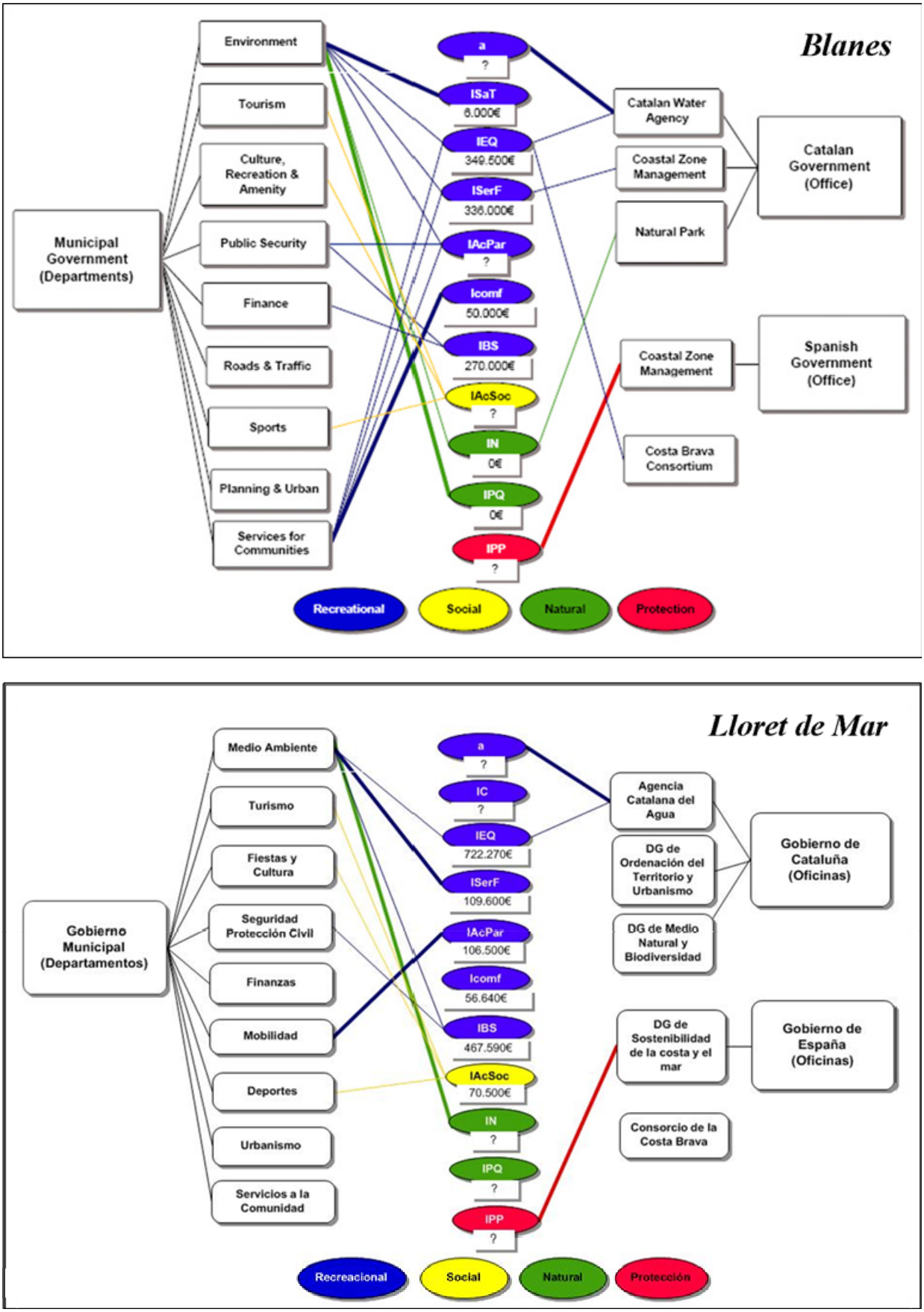


Figure 5.3- Flowcharts obtained for Blanes and Lloret de Mar describing the relationships among the different agencies involved in beach management for each of the processes considered.

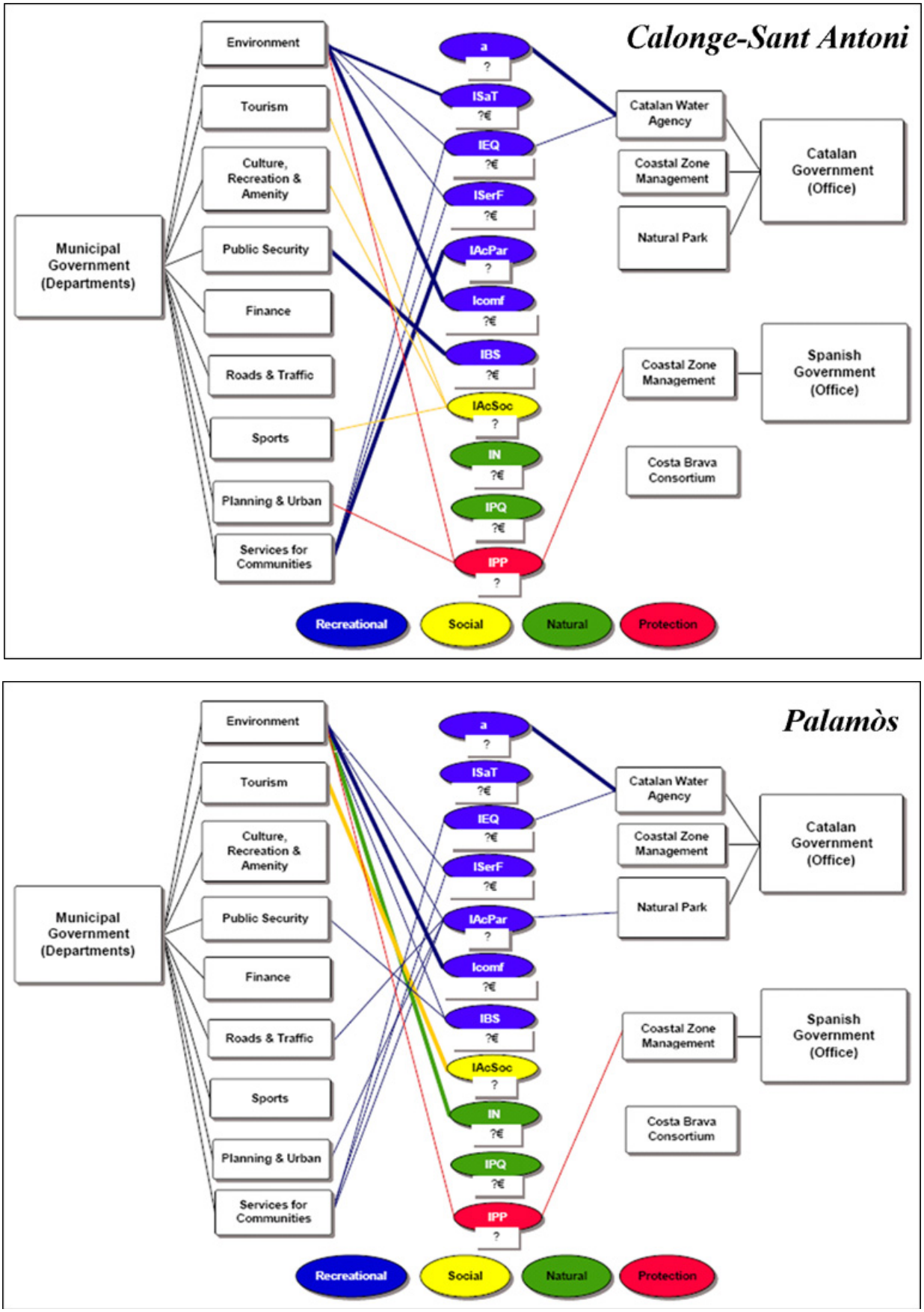
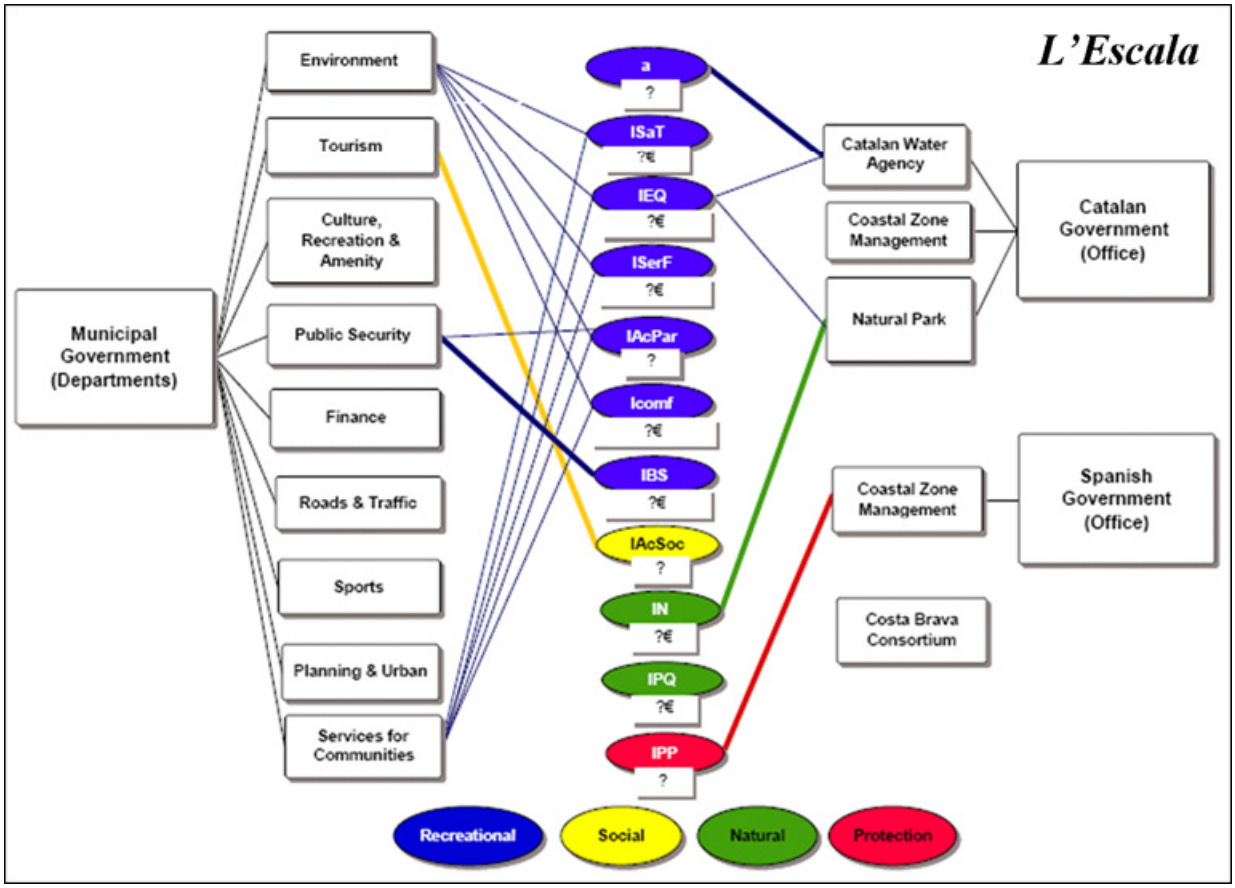


Figure 5.4- Flowcharts obtained for Calonge-Sant Antoni and Palamós describing the relationships among the different agencies involved in beach management for each of the processes considered.



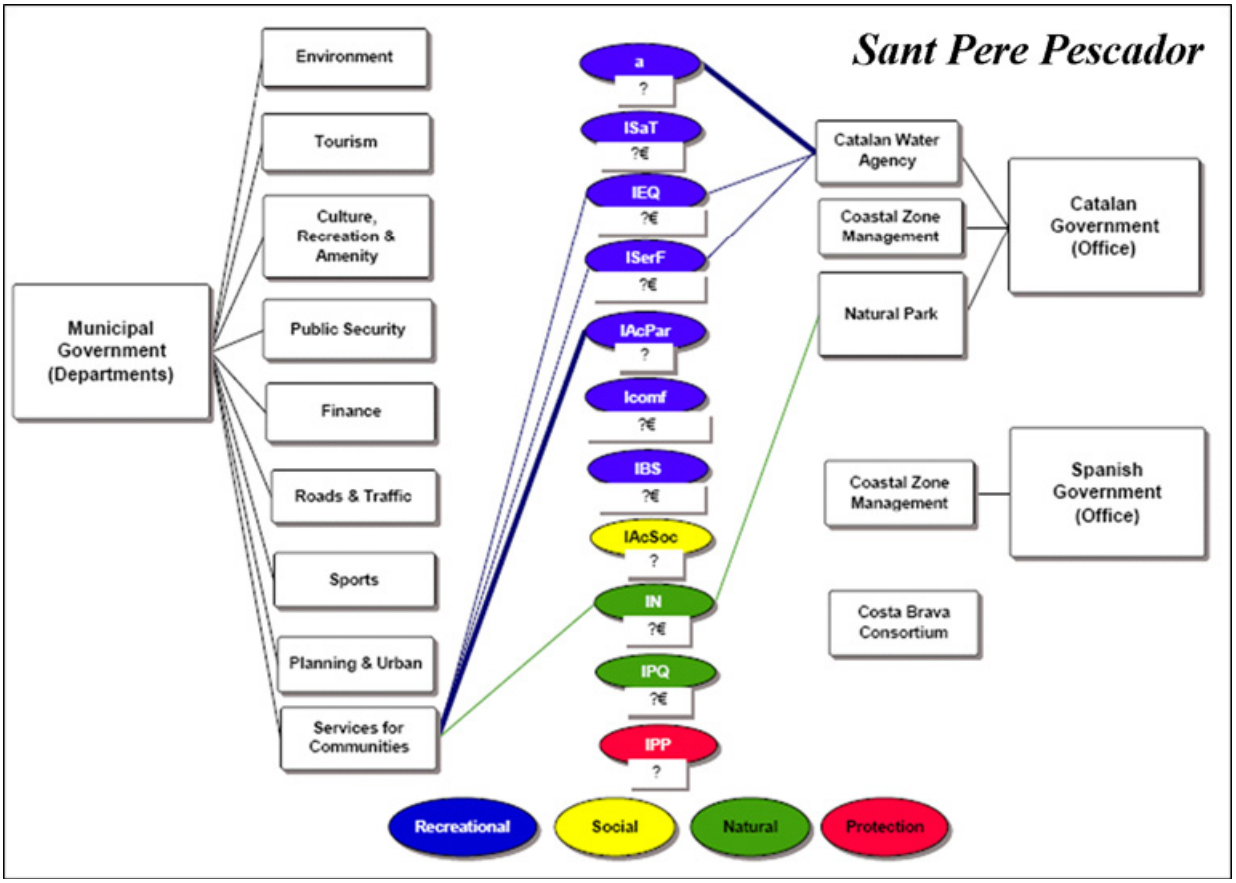


Figure 5.5- Flowcharts obtained for L'Escala and Sant Pere Pescador describing the relationships among the different agencies involved in beach management for each of the processes considered.

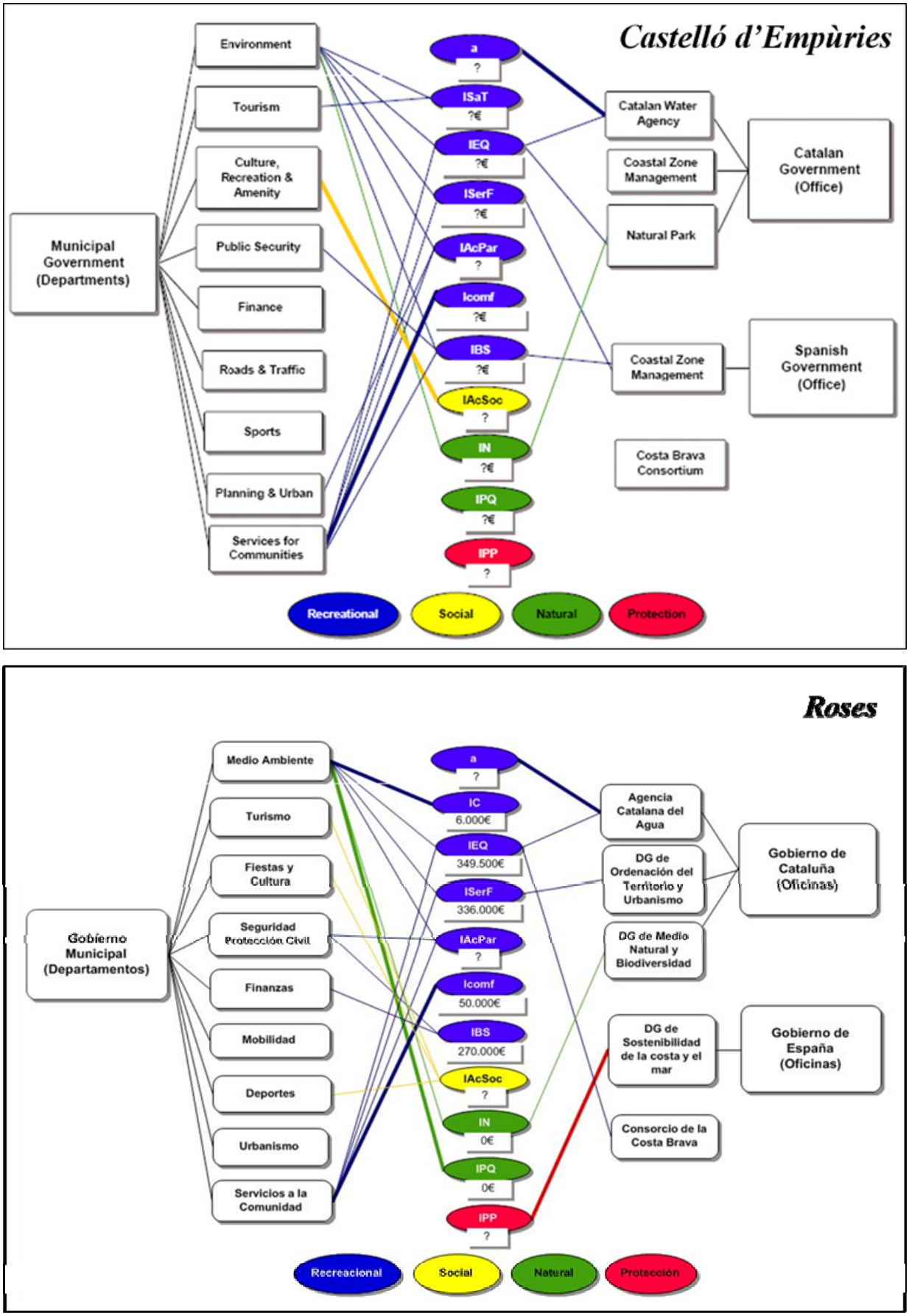


Figure 5.6- Flowcharts obtained for Castelló d'Empúries and Roses describing the relationships among the different agencies involved in beach management for each of the processes considered.

The municipality of Calonge is the only one who has a specific division for beach management that is responsible for all of these processes with the exception of cleaning that depends on the area of Environment. In the other municipalities, in general there are two areas that usually are the most involved in beach management: *Environment* and *Public Services*, which use to manage "Environmental Quality", "Services and Facilities" and "Comfort Quality". In the case of Lloret de Mar and Sant Pere Pescador, these competencies are within the same municipal area, while in the remainder municipalities they are divided in different areas. Most processes within the Recreation Function are managed in almost all the municipalities. An exception is Sant Pere Pescador, the least populated municipality where "Beach Crowding", "Comfort Quality", "Beach Safety" and "Socio-cultural Activities" are not evaluated. Neither is evaluated "Beach crowding" at Blanes, Lloret de Mar, and Palamós.

In order to progress in the description of beach management in these municipalities, two descriptive indicators were calculated based on the obtained flowcharts. These indicators allowed the comparison of management structures both between municipalities and functions (and processes).

Duplicity ratio: for the comparison between Municipalities it was defined as the percentage of processes managed by more than one office, in the total number of processes managed in the Municipality. For the comparison between functions and processes, this indicator was defined as the percentages of Municipalities where the process is managed by more than one office, in the total number of Municipalities. In the case of functions, the used value was the average of the percentages obtained for each sub-indexes within each function.

Absence ratio: for the comparison between Municipalities it was defined as the percentage of processes that do not have a defined responsible for its management, in the 14 processes analysed in this study. Concerning the comparison between functions and processes, this indicator was defined as the percentage of Municipalities that do not manage the process under study, in the total number of Municipalities. In the case of functions, the used value was the average of the percentages obtained for each sub-indexes within each function.

Regarding the duplicity of effort (i.e. *Duplicity ratio*), which would indicate the degree of dispersion that exists in management, it was noted that with the exception of Sant Pere Pescador (0%) for all the municipalities between 20% and 40% of the processes were

responsibility of more than one office. In this sense, Roses and Castelló d'Empúries were the municipalities with the highest duplicity ratio (43%), while Lloret de Mar presented the lowest one (21%) (Figure 5.7a).

Concerning the processes, the *Duplicity ratio* presented a greater variability, ranging from the "Microbiological Water Quality (α)" that is the responsibility of just one office (0%) to "Services and Facilities (ISerF)" which presented a value of 75% (Figure 5.7b). Concerning beach functions, the recreational has been the one with higher percentage (34%) while natural presented the lowest values (13%). Regarding protection function, even if by law the responsible is only the Spanish Government (see brief description of legal responsibilities for Spanish coastal management made above), this analysis also included the local agencies that should ensure that the conditions of protection are given (e.g. Local Civil Protection Agency) (Figure 5.7c).

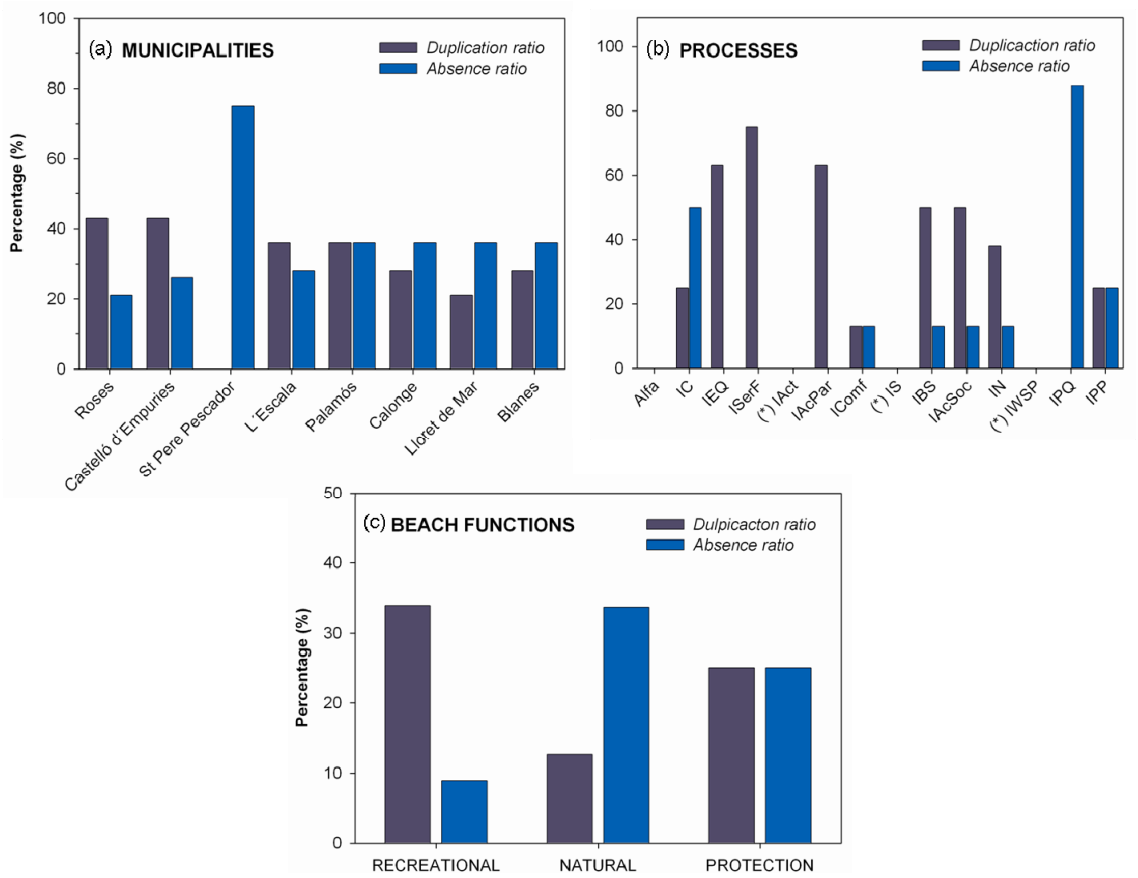


Figure 5.7- Results of *Duplication ratio* and *Absence ratio* calculated based on the flowcharts obtained from the interviews. Results are presented allowing the comparison between Municipalities (a) and Processes (b), as well as for beach functions (c). (*) These processes were not managed in any of the Municipalities that were analyzed (see Table 2).

Concerning the lack of management (i.e. *Absence ratio*), Sant Pere Pescador has been the municipality with the higher percentage (57%), while Roses has been the one with the lower percentage (21%) (Figure 5.7a). Although the ratio in Roses has been fewer than the half of the former, it is noteworthy that almost a quarter of the BQI sub-indices were not currently analyzed in what may be considered the most "complete" beach management of the study area. Regarding the processes it should be noted that those marked with (*) are not addressed by any of the municipalities, while "Microbiological Water Quality (α)" has been the only to be managed by all administrations. On the other hand, "Physical Quality (IPQ)" (88%), "Beach crowding (IC)" (50%), and "Protection (IPP)" have been the less managed within the 14 analyzed processes (Figure 5.7b). The fact that Protection has a 25% of absence is that two of the eight beaches (i.e. Sant Pere Pescador and Castelló d'Empúries) are located within a Natural Park whose competencies have been completely transferred to the regional government (i.e. Government of Catalonia). Regarding the analysis based on beach functions, once again the results showed that the recreational function is the most managed (only 9% are absent), while natural function is the one less managed (34% of absence) (Figure 5.7c). This occurs even though there are different natural areas protected by law (e.g. Natura 2000, PEIN) in some of these beaches (e.g. Sant Pere Pescador, see Chapter 4).

5.4- Discussion

As a first step towards a more integrated beach management, this institutional analysis presents a diagnosis of the current situation in the Costa Brava, a situation largely extrapolated to the rest of the Spanish littoral, describing the institutions involved and their links based on the 14 processes identified by the BQI. Based on a beach functional approach, this analysis allows us to identify the institutions responsible for each process, and to assess the eventually need for more integration and cooperation (vertical or horizontal, in or out of the same organization).

The performed analysis confirmed the particular emphasis that beach management has almost exclusively on beach recreational function, at least in this zone of the Spanish Mediterranean Sea. Likewise, this analysis clearly showed the scarce or even non-existent consideration that the current beach management has of the other functions of these social-ecological systems.

Because management is almost exclusively focused on the recreational function, management processes are active mainly during the summer, being almost non-existent during the rest of the year. Only in the case of extraordinary events that might endanger the system (e.g. extreme storm surges), certain risk prevention plans based on ad hoc and reactive measures could be activated out of that season.

The mean *Duplicity ratio* for municipalities was 34%, while for the process was 37%. Therefore, within the current scheme, integration results a key factor for sustainable management of these beaches, which is in accordance with what has already been established for ICM (e.g. Olsen et al., 1997). In the present situation, most municipalities evaluate on average 65.5% of the indexes suggested by the BQI as necessary for an integrated beach assessment, ranging from 79% (e.g. Roses) to 43% (e.g. Sant Pere Pescador). While some indexes are managed in all municipalities (e.g. Microbiological Water Quality), there are others that are evaluated only in some of them (e.g. Beach Crowding, Natural Conditions), or even not evaluated at all (e.g. Disturbing Activities, Surrounding Area Quality, Water-Sand Pollution). In this line some processes, such as the one described by the Protection sub-index or the Comfort Quality sub-index, are usually assessed and managed in a reactive way and in specific circumstances such as extraordinary climatic events.

Better institutional schemes for beach management can be created for the future. Based on the diagnosis made in this analysis it will be possible to imagine general structures leading to a more transparent and integrated beach management. From the analysis of the different flowcharts obtained and the ratios calculated, in a near future it would be possible to sketch an ideal theoretical institutional arrangement that could facilitate a management that considers all the functions and services given in a beach environment. This ideal scheme should reduce the *Duplicity ratio*, as well as the *Absence ratio*, and therefore it should probably centralize management in just one agency. Following the subsidiarity concept (Golub, 1996 see Chapter 2) this office should be at the municipal level, but in direct communication with those agencies at higher levels that have direct competences in beach management (e.g. ACA managing the microbiological quality of coastal waters). In this sense, concerning *Duplicity* the scheme obtained in Sant Pere Pescador is probably the closest to this ideal, managing almost all the processes from the *Services for Communities* office. Concerning *Absence ratio*, beach management in Roses is probably the closest to the ideal.

A case by case roadmap would be then given to the municipalities to adapt their managerial processes to a more integrated one solving problems of communication, blocking processes, different and overlapping objectives, incorrect timings or functional aspects absences. Theoretically, when this effective management structure should be incorporated, the introduction of a managerial standard tool as the EBMS could transform management into governance by incorporating other stakeholders in the process and by helping us in the design of an environmental desired vision. Working with effective governance structures and managerial standard tools we could move our model based on managing responsibilities to a much more integrated model based on results, to get the desired vision for our beach environments.

Although ICZM should integrate all actions and interests, it is common to find highly fragmented management practices, in which different social-ecological qualities are considered separately by different actors having different objectives and responsibilities. This reality is a key impediment for the sustainable use of beach environments. Currently, beaches are managed in a clear disintegrated structure; the recreational function is the only one properly managed and the remaining functions are only addressed where reactive actions are needed. This current managerial structure, developed in the past, is not prepared to deal with all activities, interests, actors, services, and pressures currently occurring at beaches. A more integrated management structure based on integrated assessments may adequately ascertain these pressures. However, the further implementation of potential new resulting management plans is hampered by the complexity and potentially conflicting jurisdictional policy objectives of various levels and arms of government and offices in a given geographical area (Sardá et al., 2012).

Chapter 6
Conclusions

This study presents a series of elements contributing to the development of ecosystem-based beach management systems. The need to move towards a truly integrated and holistic management, as well as the gap between the current management of beaches in Spain and the majority of both international and European policies on coastal and marine management have been highlighted. The scarcity of tools and frameworks to manage in a holistic manner, based on "*sources*" and not on "*resources*", has been identified as one of the main constraints to the sustainable use of these socio-ecological systems.

The development of tools and methodologies that could be really implemented, reducing the gap between theoretical developments (and associated regulations) and real application of these theories, is a fundamental step towards this evolution of beach management. This thesis has been focused on this direction, developing and applying a set of tools and methodologies based on the introduction of the Ecosystem Approach principles for the improvement of beach management.

In order to do that, we make use of a new formal system of public good management for coastal and marine environments: the Ecosystem-Based Management System (EBMS), to verify its possible utilization in beach management frameworks. Throughout this thesis several tools and methodologies have been presented and applied, which, combined, and used within the structure of this management system, would provide a step towards their implementation in the real world.

The first and most important contribution to be implemented in Beach EBMS has been the development of a multi-hazard risk assessment framework for beaches, which in this work has been developed and applied to the specific case of the S´Abanell beach: an example of a Mediterranean beach subjected to intense human-pressure. This methodology allows managers to identify the main hazards potentially disturbing the beach and affecting existing

ecosystem services. As a result, managers should be able to adapt their management strategies according to their priorities, visions of the system and availability of economic resources. This methodology would be part of the planning step of the Managerial Pillar of the EBMS, allowing the prioritization of social-ecological key issues.

In the aforementioned case of S´Abanell, seven main hazards and six ecosystem services provided by the beach were identified. In spite of some them being site-specific, most of them can be considered as common in Mediterranean beaches.

The main affected beach ecosystem services were disturbance regulation (protection provided by the beach) and recreation & aesthetic (leisure space of a given quality provided by the beach). With reference to identified hazards, most of them are natural ones, such as river floods and the impact of coastal storms (generating flood and erosion), although human use also induces quantifiable impacts, especially in the northern part of the beach.

Considering the obtained total risk scores, the northern zone of S´Abanell beach involved a greater risk than the southern one, mainly due to the great importance of disturbance regulation, and recreation and aesthetic services. These results obtained by using a risk-based prioritization are extremely useful for the management of S´Abanell beach, since it properly accounts existing values and resources (it is an important tourist destination mainly managed to guarantee this industry) and elements/processes potentially affecting them. As it has been developed, it is easily applicable to any other beach.

Beaches must be analyzed as social-ecological systems, taking into consideration that social drivers could produce significant environmental impacts at local, regional and global scales. In order to attain the most ecologically sustainable, socially equitable and economically efficient development of coastal areas, data which reveal motivations, perceptions and human behaviors must be incorporated into management plans, particularly for beaches where policing is extremely challenging. In this thesis the assessment of users' perceptions has been used as a feedback or audit of management measures. This feedback allows prioritizing actions based on the reality perceived by users, learning from previous actions. This analysis also demonstrated the importance of the participation of all stakeholders involved as well as information and education, these latter as key elements of a legitimate opinion. Within the structure of the EMBS, users' opinions would be framed in the Participatory Pillar.

This element has been applied in a comparative manner to two beaches in the study area of different characteristics: an urban and a natural one. Even if, a priori, significant different perception was expected for both environments, the results obtained in situ showed that users' perception in the protected setting (Sant Pere Pescador beach) were not too different to the ones observed in an urban setting (S´Abanell beach).

However, behind this apparent homogeneity, there were significant differences between these two *antagonistic* beaches. Although certain "usual priorities" were common to both beaches (sand and sea water cleanliness, safety), "nature" has been considered a priority in Sant Pere Pescador, while S´Abanell users have prioritized "beach facilities".

Although Sant Pere Pescador beach is a catalogued area of natural interest, the framework used to manage this beach (at the municipal level) does not properly highlight its natural attributes. The lack of information and education provided to the users, together with the fact that the beach management almost exclusively considers its recreational function, were identified as the main factors driving the low importance given by users to the natural singularity of the beach.

The feedback provided by the public participating in management processes is extremely useful, allowing the correction (e.g. revaluation of the natural attributes of Sant Pere Pescador beach, as well as its condition as natural protected area) or enhancement (e.g. intensification of sea waste harvest in S´Abanell beach) of previous actions, in order to improve the management of these beaches.

Given the great difficulty in the real implementation of integrated management approaches mentioned in this thesis, an institutional analysis which identifies responsible authorities and key officers in charge of beach management is also essential to achieve an integrated beach management. This study identified not only duplications and absences in the management of key processes underlying main beach functions, but also showed the great diversity and complexity of the current management structures of beaches on the Costa Brava. Working with effective governance structures and managerial standard tools, we could move our model based on managing responsibilities to a much more integrated model based on results, to get the desired vision for our beach environments.

The analysis performed in this thesis has demonstrated and confirmed, for this zone of the Spanish Mediterranean Sea, the particular emphasis of current beach management on the recreational function. Therefore, this work's results make clear that management processes are active mainly during summer and especially during the bathing season, being almost non-existent during the rest of the year.

While the three main legal scales involved in the management of beaches in Spain are clear, a *myriad* of layouts have been identified regarding the internal structure of municipalities. Several arrangements have been found, ranging from 7 major services, for example, in Lloret de Mar, to up to 17 large municipal areas in Castelló d'Empúries. Although diversity can bring adaptability, it is at once a clear handicap in coordinating and integrating regional policies.

Within the current scheme of beach management, and based on the results obtained in this thesis, integration and coordination have been confirmed as key factors for sustainable beach management in the Costa Brava:

- On average, in any of the 8 beaches analyzed, 34% of their management processes involve more than one office.
- On average, any of the 14 management processes analyzed involve at least two offices in 37% of the beaches considered.

The current managerial structure is not prepared to deal with all activities, interests, actors, services, and pressures currently occurring at beaches. A more integrated management structure based on integrated assessments may adequately ascertain these pressures.

New beach management tools as well as a critical assessment of actual models are needed to ensure an efficient and equitable use of ecological services, minimizing the environmental impacts exerted by human activities (i.e. the ecosystem approach). The methodologies presented in this thesis could contribute to the development of a pathway in order to move away from a competence-based model to integrated management based on processes, applying the ecosystem approach to the sustainable management of beach social-ecological systems.

Chapter 7
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7.1- Annex I

Questionnaires used to obtain users' perceptions in Sant Pere Pescador beach (Chapter 4, Section 1).

IMPORTANT: THIS QUESTIONNAIRE IS ANONYMUS AND CONFIDENTIAL, AND WILL BE USED FOR RESEARCH PURPOSE ONLY.

This questionnaire is part of a research project which main objective is to improve beach management in Catalonia, leading to an integrated and sustainable beach management. It is essential for us to have your opinion, so we would appreciate your participation.

1. Age ☐ Less than 30 years ☐ 31-59 years ☐ More than 60 years

2. Gender ☐ Female ☐ Male

3. Hometown and country _____ _____

4. What is your degree of education? (*Please tick ONE box only*).

☐ Less than 8 years of education
☐ Up to 12 years of education but no high school
☐ High school graduate
☐ Bachelor's degree / Vocational training
☐ Master degree or higher
☐ No answer
☐ Other

5. Are you member of any environmental NGO? ☐ Yes ☐ No

6. How many people live in your household, including you?

____persons: _____adults and _____children (<18 years)

7. What are your household monthly income (yours and of other adults living with you)?
This is need for our research.

☐ Less than 1.500 €/month
☐ Between 1.500 and 3.000 €/month
☐ More than 3.000 €/month

8. From which village/town have you arrived to the beach? _____

9. Where are you living these days? (*Please tick ONE box only*).

☐ Campsite
☐ Hotel
☐ Rented house
☐ My holiday home
☐ My own home

10. How did you travel to the beach today? (*Please tick ONE box only*).

☐ On foot ☐ By bicycle ☐ By taxi
☐ By urban bus ☐ By train ☐ Other (specify):_____
☐ By cruise ☐ By car/motorcycle

11. With whom have you come to the beach? (*Please tick ONE box only*).

☐ Alone
☐ With a group of friends
☐ With the family
☐ With the partner
☐ Other (specify):_____

12. How long (in hours) do you usually stay at the beach?

☐ Less than 1 hour
☐ 1 - 3 hours
☐ 3 - 5 hours
☐ More than 5 hours

13. How much do you usually spend per day in the beach? (€/person).
Consider restaurant, leisure, supermarket, beach services, etc.

☐ Less than 10 €/person
☐ 11 - 20 €/person
☐ 21 – 40 €/person
☐ 41 - 60 €/person
☐ More than 60 €/person

14. On average, how often do you come to this particular beach?

On holiday:

☐ Every day
☐ Most days
☐ Weekends
☐ About once a week
☐ Only rarely
☐ This is the first time

Rest of the year:

☐ Every day
☐ Most days
☐ Weekends
☐ About once a week
☐ Only rarely
☐ Never

15. When you choose **any beach for holidays**, the following characteristics are Very important, Important, Neutral, Not important or Not important at all?
(*Please tick ONE box only for each characteristic*).

Beach characteristics	***Very Important***	***Important***	***Neutral***	***Not Important***	***Not important at all***
Cleanliness of sea water & beach sand	☐	☐	☐	☐	☐
Scenic beauty & landscapes	☐	☐	☐	☐	☐
Comfort & safety for sunbathing and swimming	☐	☐	☐	☐	☐
Quietness and low number of users	☐	☐	☐	☐	☐
Recreational offer (sports areas, restaurants)	☐	☐	☐	☐	☐
Good access & parking areas	☐	☐	☐	☐	☐
The beach is within a Natural Park	☐	☐	☐	☐	☐
Proximity (town, airport, train station)	☐	☐	☐	☐	☐
Cultural offer near the beach	☐	☐	☐	☐	☐
Beach quality certifications (e.g. *Blue flag*)	☐	☐	☐	☐	☐
Good facilities (sun-umbrella, deckchair, WC)	☐	☐	☐	☐	☐
Nature & unspoiled environment	☐	☐	☐	☐	☐

17. Which is the main purpose of for your visit here today? (*Please tick ONE box only*).

☐ Swim and sunbathe
☐ Walking and stroll
☐ Enjoy landscapes and nature
☐ Beach sports
☐ Water sports
☐ For children's play
☐ Other reason (specify) _____

18. What thing do you most dislike of the **beach in which you are right now**?

_____

19. How do you rate the following features **of the beach where you are right now**? Please mark a score **from 1** (*VERY BAD*) **to 10** (*EXCELLENT*), being 5 the minimum acceptable.

1 2 3 4 5 6 7 8 9 10

Very Bad Fair Excellent

Beach features	***Scores***
Sand colour and texture	----------
Beach dimensions (width and length)	----------
Beach slope	----------
Presence of rocks	----------
Sand cleanliness	----------
Water cleanliness	----------
WC facilities and maintenance	----------
Shower facilities and maintenance	----------
Litter bin	----------
Presence of vegetation	----------
Presence of fish	----------
Restaurants, Bars and Stalls	----------
Rentals (umbrellas and hammocks)	----------
Surveillance	----------
Life-saving	----------
Parking areas of the beach	----------
Access to the beach	----------
Landscape	----------
Comfort	----------
Quality/price ratio	----------
Number of users	----------
Global evaluation	----------

21. Would you be willing to pay an entrance fee for visiting the *Parque Natural dels Aiguamolls del Empordà* and hence in favour of paying a fee to enter in this beach if this meant that the beach would be better managed?

☐ Yes ☐ No

If "*No*", which would be the main reason? (*Please tick ONE box only*).

☐ I'm not the one who should pay for these costs (Government, private sector).
☐ I have to pay everywhere.
☐ I do not feel the need to participate to resource preservation.

If "*Yes*", what you consider a reasonable charge **per person and per visit**? ____
This is need for our research.

For which of the following reasons are you willing to pay? (*Please tick ONE box only*).

☐ For preservation of natural resources
☐ For actual recreation use
☐ To limit the number of visitors
☐ To retain the recreation opportunity for possible future use
☐ To endow future generations with natural resources

22. Do you have any additional comment or opinion that you would like to share?

_____

7.2- Annex II

Questionnaires used to obtain users' perceptions in S´Abanell beach (Chapter 4, Section 2).

BEACH QUESTIONNAIRE

IMPORTANT: THIS QUESTIONNAIRE IS ANONYMUS AND CONFIDENTIAL, AND WILL BE USED FOR RESEARCH PURPOSE ONLY.

This questionnaire is part of the project **MeVaPlaya II**, which main objective is to improve beach management in Catalonia, leading to an integrated and sustainable beach management.
It is essential for us to have your opinion, so we would appreciate your participation.

1. Age ☐ Less than 30 years ☐ 31-59 years ☐ More than 60 years

2. Sex ☐ Female ☐ Male

3. Hometown and country _____ _____

4. What is your degree of education? (*Please tick ONE box only*).
- ☐ Less than 8 years of education
- ☐ Up to 12 years of education but no high school
- ☐ High school graduate
- ☐ Bachelor's degree / Vocational training
- ☐ Master degree or higher
- ☐ No answer

5. Are you member of any environmental NGO? ☐ Yes ☐ No

6. How many people live in your household, including you?

____persons: _____adults and _____children (<18 years)

7. What are your household monthly income (yours and of other adults living with you)?
This is need for our research.
- ☐ Less than 1.500 €/month
- ☐ Between 1.500 and 3.000 €/month
- ☐ More than 3.000 €/month

8. From which village/town have you arrived to the beach? _____

9. Where are you living these days? (*Please tick ONE box only*).
- ☐ Campsite
- ☐ Hotel
- ☐ Rented house
- ☐ My holiday home
- ☐ My own home

10. How did you travel to the beach today? (*Please tick ONE box only*).
- ☐ On foot
- ☐ By bicycle
- ☐ By taxi
- ☐ By urban bus
- ☐ By train
- ☐ Other (specify):_____
- ☐ By cruise
- ☐ By car/motorcycle

11. With whom have you come to the beach? (*Please tick ONE box only*).
- ☐ Alone
- ☐ With the partner
- ☐ With a group of friends
- ☐ Other (specify):_____
- ☐ With the family

12. How long (in hours) do you usually stay at the beach?
☐ Less than 1 hour ☐ 3 - 5 hours ☐ 1 - 3 hours ☐ More than 5 hours

13. How much do you usually spend per day in the beach? (€/person).
Consider restaurant, leisure, supermarket, beach services, etc.

☐ Less than 10 €/person
☐ 11 - 20 €/person
☐ 21 – 40 €/person
☐ 41 - 60 €/person
☐ More than 60 €/person

14. On average, how often do you come to this particular beach?

On holiday:

☐ Every day
☐ Most days
☐ Weekends
☐ About once a week
☐ Only rarely
☐ This is the first time

Rest of the year:

☐ Every day
☐ Most days
☐ Weekends
☐ About once a week
☐ Only rarely
☐ Never

15. If you had not come to this beach, which would you choose instead?

☐ Blanes (village center)
☐ St. Francesc
☐ Malgrat de Mar
☐ Treumal - Sta. Cristina
☐ Lloret de Mar
☐ None

16. When you choose **any beach for holidays**, the following characteristics are Very important, Important, Neutral, Not important or Not important at all?
(*Please tick ONE box only for each characteristic*).

Beach characteristics	***Very Important***	***Important***	***Neutral***	***Not Important***	***Not important at all***
Cleanliness of sea water & beach sand	☐	☐	☐	☐	☐
Scenic beauty & landscapes	☐	☐	☐	☐	☐
Comfort & safety for sunbathing and swimming	☐	☐	☐	☐	☐
Quietness and low number of users	☐	☐	☐	☐	☐
Recreational offer (sports areas, restaurants)	☐	☐	☐	☐	☐
Good access & parking areas	☐	☐	☐	☐	☐
The beach is within a Natural Park	☐	☐	☐	☐	☐
Proximity (town, airport, train station)	☐	☐	☐	☐	☐
Cultural offer near the beach	☐	☐	☐	☐	☐
Beach quality certifications (e.g. *Blue flag*)	☐	☐	☐	☐	☐
Good facilities (sun-umbrella, deckchair, WC)	☐	☐	☐	☐	☐
Nature & unspoiled environment	☐	☐	☐	☐	☐

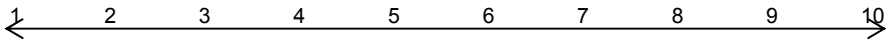
17. Which is the main purpose of for your visit here today? (*Please tick ONE box only*).

☐ Swim and sunbathe
☐ Walking
☐ Enjoy landscapes and nature
☐ Beach sports
☐ Water sports
☐ For children's play
☐ Other reason (specify) _____

18. What thing do you most dislike of the **beach in which you are right now**?

_____

19. How do you rate the following features **of the beach where you are right now**? Please mark a score **from 1** (*VERY BAD*) **to 10** (*EXCELLENT*), being 5 the minimum acceptable.



Very Bad Fair Excellent

Beach features	***Scores***
Sand colour and texture	----------
Beach dimensions (width and length)	----------
Beach slope	----------
Presence of rocks	----------
Sand cleanliness	----------
Water cleanliness	----------
WC facilities and maintenance	----------
Shower facilities and maintenance	----------
Litter bin	----------
Presence of vegetation	----------
Presence of fish	----------
Restaurants, Bars and Stalls	----------
Rentals (umbrellas and hammocks)	----------
Surveillance	----------
Life-saving	----------
Parking areas of the beach	----------
Access to the beach	----------
Landscape	----------
Comfort	----------
Quality/price ratio	----------
Number of users	----------
Global evaluation	----------

20. Are you concerned about reduction in beach size due to the loss of sand (coastal erosion)?

☐ Yes ☐ No ☐ Don't know

If "*Yes*", for which of the following consequences are you more worried? (*Please tick ONE box only*).

- ☐ Loss the current recreational use
- ☐ Loss of a social-historical trait of the village
- ☐ Impact of storms on the beachfront
- ☐ Loss of beach ecosystem
- ☐ Other reason (specify) _____

21. Would you be willing to pay to use the beach if this meant that the beach would be better maintained or improved?

☐ Yes ☐ No ☐ Don't know

If "*No*", which would be the main reason? (*Please tick ONE box only*).

- ☐ I'm not the one who should pay
- ☐ There are many other beaches around
- ☐ I am not very interested in this problem

If "*Yes*", what you consider a reasonable charge **per person and per visit**? ____
This is need for our research.

How would you prefer to pay? (*Please tick ONE box only*).

Residents	***Tourists***
☐ By a local tax	☐ Paying a fixe price per visit
☐ Paying a fixe price per visit	☐ A box to put contributions into
☐ A box to put contributions into	☐ Other means (specify) _____
☐ Other means (specify) _____	

22. Do you have any additional comment or opinion that you would like to share?

_____

7.3- Annex III

Questionnaire used for the institutional analysis (Chapter 5).

Qüestionari d'anàlisi del model de gestió de platges

Qui / Què /Quan realitza cada tasca

Cost / Benefici de cada activitat

Com es realitza cada tasca

Platges que es diferencien en el municipi (identificar-les en el mapa).

Nom de cada platja del municipi.

Distingir les platges segons la gestió aplicada.

Nom de les platges amb igual gestió.

Funció Recreativa

Qualitat sanitària - microbiològica

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació:

Freqüència:

Qualitat ambiental

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació:

Freqüència:

Cost de l'actuació:

Qualitat visual de l'aigua

Embarcació de neteja (recollida de residus sòlids flotants)

Qualitat visual de la sorra (neteja de la sorra)

Recollida d'escombreries i transport de residus

Certificacions / Sistemes de Gestió de la Qualitat (ISO 9001, Q de Qualitat Turística)

Certificacions / Sistemes de Gestió Ambiental (ISO 14001, EMAS, Bandera Blava, Agenda 21)

Col·lectors d'aigua de pluja

Emissaris submarins

***Freqüentació* (recomptes de l'afluència de persones)**

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació:

Freqüència:

Cost de l'actuació:

Instal·lacions i serveis

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació:

Cost de l'actuació:

Dutxes i rentapeus

Fonts

Papereres

Contenedors de reciclatge

Àrees de jocs infantils

Instal·lacions per a discapacitats (platges accessibles amb suport al bany: cadira amfíbia, sistema "àudio-platja"...)

Panels informatius (plànols localització de serveis, zones protegides...)

Instal·lacions sanitàries

Cabines sanitàries (WC mòbils)

Instal·lacions esportives / Zona d'esports (camp de vòlei, ...)

Zona de pesca amb canya

Plataformes flotants

Passeres de fusta

Vestidors

Bancs

Palmerars / Ombratge

Restaurant / bar, quiosc i guingueta

Tendal, para-sol i gandula / hamaca

Patins, caiacs, piragües, ..

Telèfon

Accessos i aparcaments

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació:

Accessos (a la platja) per a vianants

Accessos de trànsit (a la platja)

Senyalització (per arribar a la platja)

Aparcaments

Aparcaments de bicicletes

Transport públic

Passarel·les

Accessos per a discapacitats (rampes)

Comfortabilitat – Acondicionament de la platja

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació:

Freqüència:

Cost de l'actuació:

Modificació de la morfologia de la platja

Vigilància i seguretat: Accions de socorrisme i rescat

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació:

Pla de prevenció d'emergències

Cartell informatiu del risc (per a cada accés)

Indicadors d'accidents

Senyalització de les zones i de les activitats prohibides, restringides i perilloses

Senyalització d'informació sobre l'estat de la mar (banderes verda...)

Senyalització de regulació de les activitats nàutiques

Senyalització i avaluació de riscos de cada platja (onatge. meduses...)

Abalisament de la zona de bany

Abalisament dels espigons

Alerta d'emergència (megafonia, ...)

Torre d'observació

Cadira de vigilància

Lloc de socors

Torre d'intervenció

Embarcació de salvament

Vehicle ambulància

Servei de vigilància policial

Funció Sòcio-cultural

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació

Cost de l'actuació:

Esdeveniments

Funció natural

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació:

Cost de l'actuació:

Acordonament de les dunes

Cartells informatius sobre el valor de les dunes

Control de les espècies invasores en les dunes

Neteja de la brossa de les dunes

Adeqüació de passeres pels usuaris

Treballs de restauració de dunes

Funció Protectora – Regeneració de platges

Organització/ns implicada/des:

Gestió:

Monitorització:

Temporalitat de l'actuació:

Cost de l'actuació:

Canvis en la superfície de la platja

Altres

Inventari dels esdeveniments realitzats a la platja (aforament, superfície ocupada, temporalització, …)

Pla d'usos

Declaració ambiental en el cas de disposar d'EMAS i ISO 14001

Plans de conca

Dunes: inventari de les espècies de les platges i dunes, superfície ocupada per les dunes, caracterització morfològica de les dunes.

Fotografies antigues de la platja (anteriors als anys seixanta)

7.4- Publications, participation in symposia and appointments

- **Research appointment**

2012 *Beques per a la recerca a l'estranger* (Beca de Investigación en el Extranjero) Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR, Generalitat de Catalunya). Visiting scholar, Ecosystem Management Department, Gulf Region Office, Fisheries and Oceans Canadá (DFO). March, 2012 [working with Roland Cormier and his team, Regional Director].

- **Publications in peer-reviewed journals & symposia proceedings**

Submitted- **Lozoya JP**, Sardá R and Jiménez JA. Management's priorities and users' expectations in an environmentally protected spot within a tourist-intensive area: are we aware of its value? *Journal of Environmental Management*.

2012- **Lozoya JP**, Sardá R and Jiménez JA. 'La dimensión social en la GIZC: expectativas de los usuarios en dos playas antagónicas de la costa brava (Mediterráneo español)'. Proceedings of the *1er Congreso Iberoamericano de Gestión Integrada de Áreas Litorales*, Cádiz.

2012- Sardá R, Ramis J, **Lozoya JP**, Pintó J,Martí C, Fraguell RM, Ariza E, Jiménez JA, Rucabado J, Valls JF and Vico C. 'De la gestión por competencias a la gestión por resultados: hacia un uso sostenible de los sistemas de playa'. Proceedings of the *1er Congreso Iberoamericano de Gestión Integrada de Áreas Litorales*, Cádiz.

2011- **Lozoya JP**; Rafael Sardá; José A Jiménez. A methodological framework for multi-hazard risk assessment in beaches. *Environmental Science & Policy*, 14: 685-696.

2011- **Lozoya JP**; Rafael Sardá; José A Jiménez. Beach multi-risk assessment in the Costa Brava (Spain). *Journal of Coastal Research*, SI61: 408-414.

2011- **Lozoya JP**, Sardá R & Jimenez JA. "Users' expectations in a Mediterranean natural beach: A key factor for sustainable Beach management?" Proceedings of the *2nd International Symposium on Integrated Coastal Zone Management*, Arendal.

2011- Sardá R, Ramis J, **Lozoya JP**, Pintó J, Martí C, Fraguell RM, Jimenez JA, Ariza E, Rucabado J, Valls JF & Vico C. "From Managing Responsibilities to Managing Results: towards the sustainable use of beach environments". Proceedings of the *2nd International Symposium on Integrated Coastal Zone Management*, Arendal.

2010- **Lozoya JP**, Sardá R & Jimenez JA. "Beach multi-risk assessment in the Costa Brava (Spain)". Proceedings of the *3rd International Conference on the Management of Coastal Recreational Resources*, Grosseto.

2009- **Lozoya JP**, Sardá R & Jimenez JA. "Beach multi-risk assessment considering ecosystem services and coastal hazards: a tool for ICZM". Proceedings of the *5th International Symposium on Sandy Beaches*, Rabat.