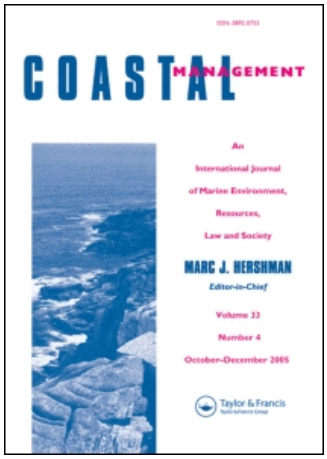

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Beyond Performance Assessment Measurements for Beach Management: Application to Spanish Mediterranean Beaches

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Performance assessment measures have traditionally been used by beach managers to guarantee beach quality. In order to know effectiveness of the ones applied to the Mediterranean coast and assess how functions assigned to beaches are covered, fourteen beach management criteria were selected. We studied how one standard (the Blue Flag award) and three rating systems (the ACA, CEDEX, and Cantabria indexes) covered those criteria and the results of their application to six beaches of the Costa Brava (Catalan Coast). No single assessment measurement considers all selected criteria and some general weaknesses were revealed. Of the analyzed tools, the CEDEX index proved to be the best for monitoring beach processes. The characteristics of Environmental Management Systems applied for Beach Management processes (EMSBs) were also assessed. The way in which those managerial frameworks are established has not been extensively considered, but the results suggest a need for its further development. This new tool will allow a general management framework to be adopted. Current standards/rating systems can be partially adapted and included within EMSBs.

Keywords beaches, Catalan coast, management systems

Introduction

Despite the widespread view of beaches as stretches of sand on which users lay their sun beds, they are in fact unique environments occupied by a variety of organisms adapted to particular physical processes. These environments are currently under substantial pressure from human activities and patterns of global change, and its stretches of sand, the beach faces, are just a part of the beach ecosystem. The human needs met by beaches can be divided into three categories: (a) protection of the landscape, promenades, and human

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facilities from waves impact, (b) recreational opportunities for users such as swimming, sunbathing, relaxation, and sports activities, and (c) provision of natural scenery and ecological reservoirs. A long list of ecological services are provided by these three assigned functions (better maintenance of human infrastructures by sea grass, absorbance of wave energy, provision of natural resources, enhanced income generated by ecotourism, etc.). However, in many coastal zones under substantial human pressure, beach ecosystems are only considered in terms of the recreational opportunities they provide and other ecological services are undervalued and/or not considered in decision-making processes. Ecological and protective functions are highly neglected and extensive degradation occurs. To stop this common trend in many coastal areas, a movement has appeared in recent decades demanding much greater awareness of beach ecosystems. These spaces must be considered multi-dimensionally and multi-functionally so that the varied components and their interactions can be analyzed in order to achieve appropriate management (James, 2000).

Coastal areas in the Mediterranean Sea are becoming progressively dominated by human activity and the ecology of the area is being degraded (Sardá & Fluvia, 1999; Sardá, 2001; UNEP, 2002; Suárez del Vivero & Rodríguez-Mateos, 2005). Both tourism (traditional and residential) and construction (creating a continuum of dense built-up areas) are challenging the future of coastal ecosystems and acting as a driving force for management initiatives. Beaches are a major attraction in Mediterranean coastal areas and are one of the main focuses of attention for coastal and tourism management, where they represent the main asset to be managed. Around 10% of the GDP (Gross Domestic Product) of Spain is directly or indirectly linked to beaches, which are one of its most marketed products. In Benidorm, economic analysis revealed annual earnings of over 12000 €/m^2 (Yepes, 2003). This massive use of beaches has forced management of these valuable ecosystems to focus on the service offered to users, and consequently, human activity and behavior have prevailed over other biological and physical processes that are normally seen as complementary. The pressure that tourism and construction, together with associated revenues, exert on coastal areas has led to strict and specific demands that affect beaches. The arrival of tourists who demand certain environmental conditions has led to the establishment of beach quality criteria. The main goal of these criteria is to evaluate the current state of each beach and to allow comparisons to be made between them so that users are able to consider beach quality in their choice of destinations. Various performance standards and rating systems have been developed to meet this need.

Performance standards were introduced to establish a set of minimal requirements that guarantee a certain level of quality on a particular beach. The best established performance standard, the international Blue Flag, is an exclusive eco-label organized by the Foundation for Environmental Education and was introduced in 1987 (Nelson et al., 2000). It is currently awarded to around 3100 beaches and marinas in 34 countries across Europe, South Africa, New Zealand, Canada, and the Caribbean. This international standard works alongside other national schemes such as the distinctive yellow and blue U.K. Seaside Flag award, introduced in 1992 by the Tidy Britain Group (now called ENCAMS) and the Good Beach Guide, which is published annually by the Marine Conservation Society in the United Kingdom.

All of these performance standards are based on a very descriptive method. The award is given if the applicable criteria specified by each performance standard are accomplished. In addition, several performance-rating systems have been developed to allow certain aspects of beach quality to be measured quantitatively. These are weighted aggregations of different performance indicators according to several quality criteria. The final aggregated

measure allows effective spatial and temporal comparison of beaches. In Spain, water agencies in the different autonomous communities have developed several indexes to monitor and control compliance with the EC Bathing Water Directive (CEC, 1976). In Catalonia, the Agència Catalana de l'Aigua (the public organization with responsibilities in water issues in the autonomic community) developed the ACA index. At a National level, several coastal agencies have developed other integrated indexes. The Centro de Estudios y Experimentación de Obras Públicas (CEDEX), the autonomous organization that provides technical service to the State Government in questions such as coastal public works, has created the CEDEX index. The University of Cantabria (Spain) has developed the Cantabria index. Both are intended for use in the Spanish coastal area. Other Performance Rating Systems have also been developed elsewhere as the Used-Based Rating System, BRS (Morgan, 1999) or the novel Bathing Area Registration and Evaluation technique, BARE (Micallef & Williams, 2004).

In the present article, we analyze the use of quality criteria in several performance standards and performance rating systems developed for the management of beaches in the Spanish coastal zone. The analysis was organized into three parts. The first involved a theoretical comparison of the chosen performance standards and performance rating systems to see what each one measures. The second part involved an application of the criteria to six beaches with different characteristics. The third part involved an assessment of the development of Environmental Management Systems applied to beach environments (EMSBs). Beaches were selected for use in this study on the basis of characteristics representative of most beaches in the Costa Brava, a typical area of the Northwestern Mediterranean seashore. The main aim was to see how these standards were employed in a particular beach and to identify those points that are either partially covered or not covered at all. The analysis also allowed the criteria used to be classified in terms of their ability to consider the different aspects of beach functions as well as their suitability for use with different types of beaches. Finally, we discuss the potential for improvements offered by the use of the much more comprehensive EMSB system for the management of beach ecosystems.

Methods

Performance Standards and Performance Rating Systems

An assessment of the most important quality criteria used today in the management of beach ecosystems worldwide was carried out prior to the analysis of their current use in the Spanish coastal region. The assessment was based on the existing literature (Buceta, 2002; Jiménez & Van Koningsveld, 2002; Villares, 1999; Yepes, 2005) and the analysis of several reports from organizations managing those ecosystems (ACA, 2002; Ajuntament de Barcelona, 2005; Universidad de Cantabria, 2002; Federation of Environmental Education, [FEE], 2004). The fourteen criteria that were finally selected were general blocks that attempt a synthesis of all the information required for correct eco-effective management of those ecosystems.

One environmental performance standard (the Blue Flag award) and three performance-rating systems (the ACA index, the CEDEX index, and the Cantabria index) were selected to compare the use of the selected quality criteria by those methods. Except that of the ACA, all of them are voluntary and are available for use in the Spanish coastal zone. Table 1 contains general information about these performance standards and rating systems. The

Blue Flag award is given if it is requested by the organization in charge of the management of the beach when all necessary requirements are met. The rates obtained with the other three rating systems depend on how those beaches performed during the season when evaluated against their own criteria. The ACA index is legally regulated in relation to water quality and is periodically measured to meet the EC Directive on Bathing Waters, and it has equivalent indexes in other autonomous communities because in Spain environmental responsibilities are largely dependent on regional governments.

The main goal of the different performance standards and rating systems varies from one to another. The Blue Flag award was developed for use as an environmental-based beach quality tool and is also well accepted as a public marketing tool. However, some studied have demonstrated that it is not one of the most important factors influencing beach user choices (Tudor & Williams, 2006).

The principal role of the ACA method was to give explicit information on compliance with the water quality requirements established by the Bathing Water Directive applied to Spain through the "Real Decreto 734/88." The ACA index is composed by three different measures: water microbiological quality, water aesthetic quality, and sand aesthetic quality. The five qualification categories for the three ACA parameters measured (poor, deficient, moderate, good, and very good) also allow a simple numeric index to be constructed (combining the three parameters, 0 for bad to 4 for very good, to give a final index from 0 for bad to 12 for very good).

The other two rating systems were developed to help managers rate the different beaches and ultimately quantify its quality. Both are aggregated indexes made up of different performance indicators. The CEDEX index was created in 1996. Opinion polls were undertaken for different Spanish beaches, a review of the literature was undertaken and field work was also performed, altogether to identify the factors considered most important by beach users and their individual weights (see Appendix for its metrics and factorial explanation).

The Cantabria beach quality index is another example of an aggregated index. The index uses different evaluation factors depending on the characteristics of the assessed beach: natural beaches, semi-natural beaches, urban beaches, and industrial beaches. This index uses two kinds of indicators, basic indicators and secondary indicators. Basic indicators are the most considered (bacteriological water quality, organoleptic water quality, and chemical sediment quality). Secondary factors differ for natural and non-natural beaches (see Appendix for its metrics and factorial explanation).

The fourteen quality criteria selected were: natural systems, geomorphology, water, sand, comfort, aesthetics, access, services, activities, usage, fulfillment of legal requirements, management coordination, steady improvement, and emergency planning (Table 2). These criteria could be classified into four categories that reflect the three main functional aspects of the beach ecosystem (the natural function, the protective function, and the recreational function) as well as the way in which all three functions and criteria are managed by humans (the managerial function). The managerial function appears when beaches are considered to be inevitably affected by human activities and therefore subjected to human usage. Analysis of ecosystem functions has been considered for different ecosystems (De Groot, 1992) and also specifically for bathing areas (Micallef & Williams, 2003).

The potential benefits of the analysed standards/rating systems were also compared with the use of EMS applied to the management of beach ecosystems (EMSB). This mainly included the use of ISO 14001 (Lamprecht, 1997) and the additional requirements for the Eco-Management and Audit Scheme (EMAS) implemented in Europe (EC Council Regulation 761/2001), but also addressed a specific Spanish management system, the Q of

Table 1
Characteristics of the analyzed performance standards and performance rating systems

Performance standard/Rating system	Scope	Publicity	Social knowledge	Type of required information	Behind regulatory	Standard type	Web page
BLUE FLAG	Global	Mass media	High	Qualitative	None	Performance standard	www.blueflag.org
ACA*	Catalonia	Mass media	High	Quantitative and qualitative	Yes	Rating system	http://mediambient.gencat.net/aca.ca//aiguamedi/costaneres/prog_vigilancia/inici.jsp
CEDEX	Spain	None	None	Quantitative and qualitative	None	Rating system	—-
CANTABRIA	Cantabria	Local	Low	Quantitative and qualitative	None	Rating system	—

*In different Autonomous Communities of Spain similar indices are used.

Table 2
The fourteen general criteria selected, classified into the four main functional aspects considered. For every criteria, its main structural components are included

	BLUE FLAG	CEDEX INDEX	ACA INDEX	CANTABRIA INDEX
NATURAL FUNCTION				
1. Natural System Quality				
Dune protection	Y	N	N	Y
Vulnerable areas	Y	N	N	Y
Ecosystem surrounding beaches	Y	N	N	Y
Beach dry ecosystem	N	N	N	Y
Beach wet ecosystem	N	N	N	Y
Beach submerged ecosystem	N	N	N	Y
Beach rocky ecosystem	N	N	N	Y
Beach functional ecological integration	N	N	N	N
Protective Function				
2. Geomorphologic Quality				
Beach width	N	Y	N	N
Beach erosion	N	Y	N	N
Slope	N	Y	N	N
Grain size	N	Y	N	N
Beach form	N	Y	N	N
MANAGERIAL FUNCTION				
3. Legal Compliment Quality				
Accomplishment of national, autonomic and local legal requirements	Y	N	N	N
4. Management Coordination				
Beach management planning, detailing responsibilities, funding and schedule	N	N	N	N
5. Steady Improvement				
Continuous assessment of goals and establishment of new objectives in accordance to beach reality	N	N	N	N
6. Emergency Plan Quality				
Possible warning mechanisms	Y	N	N	N
Contingency plans for beach emergencies	Y	N	N	N
RECREATIONAL FUNCTION				
7. Water Quality				
Directive 76/60/EC	Y	Y	Y	Y
Water organoleptic factors	Y	Y	Y	N
Visual appreciation of water aspects	Y	Y	Y	N
Presence of annoying biological components	N	N	Y	N
8. Sand Quality				
Microbiological, chemical and OM analysis	N	Y	N	N

Table 2
The fourteen general criteria selected, classified into the four main functional aspects considered. For every criteria, its main structural components are included (*Continued*)

	BLUE FLAG	CEDEX INDEX	ACA INDEX	CANTABRIA INDEX
Withdrawing of decaying material	Y	Y	N	N
Visual appreciation of sand aspects	N	Y	Y	N
9. Beach Confortability Quality				
Weather aspects	N	N	Y	N
Oceanographic conditions	N	Y	Y	N
Difficulties at the water-sand transition zone/ obstacles	N	Y	N	N
Sand and beach structural characteristics	N	Y	N	N
Dangerous cliffs	N	N	N	N
10. Aesthetic Quality				
Landscape condition	N	N	N	Y
Odour and/noises	N	N	N	N
11. Access Quality				
Safe access	Y	Y	N	Y
Access for handicapped people	Y	Y	N	N
Parking area criteria	N	N	N	Y
Maintenance and cleaning	Y	N	Y	N
12. Service Quality				
Information requirements to people	Y	Y	N	Y
Measures for maintaining quality in place (showers, cleaning, bins..)	Y	Y	N	Y
Measures to enhance safety	Y	Y	N	Y
Sanitary facilities (WC)	Y	Y	N	Y
Equipment (recreational)	N	Y	N	N
13. Activity Quality				
Presence of domestic animals	Y	Y	N	N
Annoying sports	N	Y	N	N
Dumping	Y	N	N	N
Driving and/ or similar	Y	N	N	N
Nautical activities	Y	Y	N	N
14. Frequentation Quality				
User count requirement	N	N	N	N

Quality of beaches (Sistema de Calidad Turística Española en Playas). The ISO 14001 EMS is recognized internationally as a quality standard and requires three general objectives to be met: commitment to environmental policy, commitment to the compliance with legal and other applicable regulations, and steady improvement. Its general structure can be seen in Figure 1. Following increasing use in the private sector in the last decade (Delmas, 2002), an initiative has recently emerged in Spain to implement ISO 14001 for beaches. The requirements for certification of the environmental quality of beaches are the same as

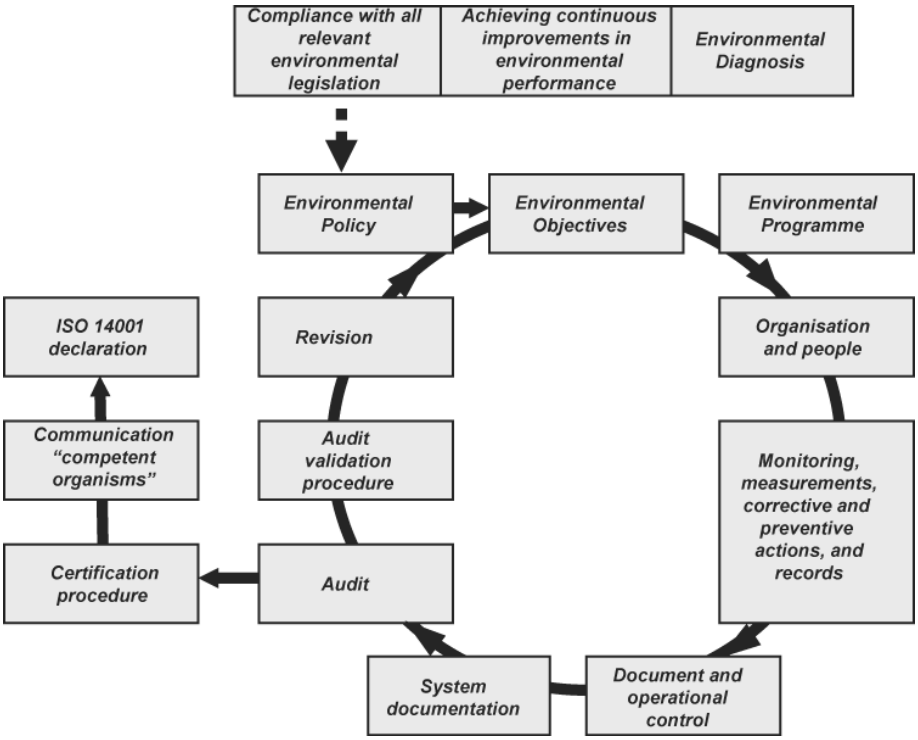

Figure 1. General structure of the ISO14001 Environmental Management Systems applied for Beaches.

those used in the administrative and industrial sectors; however, some specific factors also need to be considered in the management of beaches (AENOR, 2003).

Application to Mediterranean Beaches

We used two municipalities in the southern part of the Costa Brava (northeastern Mediterranean coast of Spain) to determine how the chosen performance standards/rating systems are calculated and how comparable the obtained values are. The two municipalities, Lloret de Mar and Blanes, are both well-known European tourist destinations and their economies depend strongly on their beaches (Sardá & Fluvia, 1999). Their coastal fringes contain beaches of varied characteristics, from highly frequented urban beaches like that in the center of Lloret de Mar, to natural beaches such as La Boadella. Six beaches were selected for the study: St. Francesc, Treumal-Sta. Cristina, La Boadella, Fenals, Lloret Centre, and Canyelles (Figure 2). Their main physical characteristics are shown in Table 3.

The environmental performance standard and the three performance-rating systems analyzed were applied to those selected beaches. For the purpose of this work, ACA Index components (water microbiological quality and water and sand visual quality) were monitored weekly during the whole bathing season. All variable CEDEX Index components and Cantabria index components, except those related with the microbiological water quality, were monitored one day at the peak of the season (first week of August).

Table 3
Main features of studied beaches

	Degree of urbanization	Exposure	Length (m)	Parking behind	Associated services	Access	Locality	Particularities
St. Francesc	Moderate	Sheltered	220	Yes	Complete	Easy	BLA	—
Treumal-Sta. Cristina	Non-urbanized	Sheltered	446	Yes	Moderate	Difficult path	BLA-LLO	High-class hotel behind Protected area
La Boadella	Non-urbanized	Sheltered	310	No	Basic	Difficult path	LLO	—
Fenals	Urbanized	Moderately exposed	775	Yes	Complete	Easy	LLO	Town-Promenade behind
Lloret Centre	Urbanized	Moderately exposed	1300	Yes	Complete	Easy	LLO	Town-Promenade behind
Canyelles	Moderate	Sheltered	400	Yes	Complete	Easy	LLO	Recreational marina

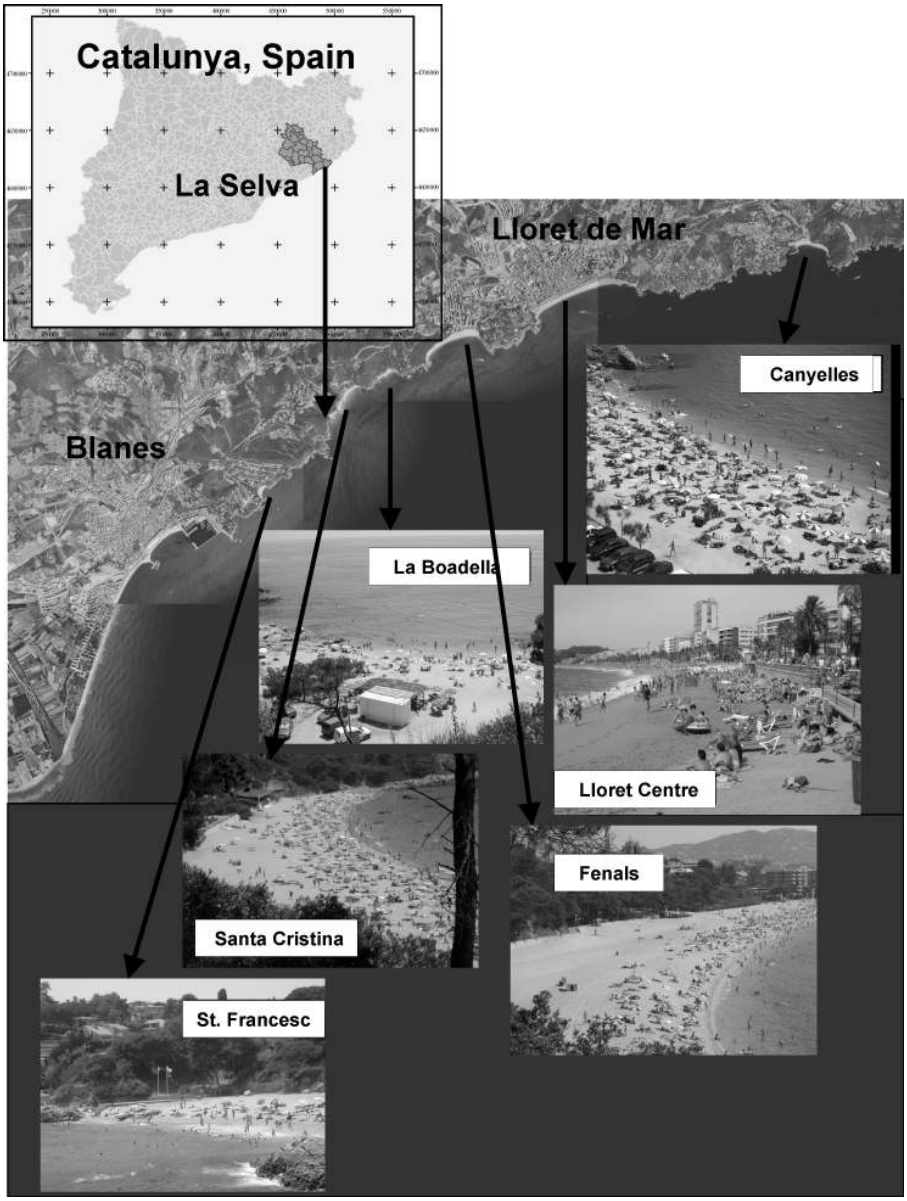

Figure 2. Studied municipalities in Selva Marítima and selected beaches.

Results

The selected criteria were evaluated in the four performance standards/rating systems (Table 2). No single standard considers all fourteen criteria and several of the criteria were not included in any of the analyzed standards. Out of the fourteen analyzed criteria, only two, water quality and access quality, could be identified in all of the standards/rating systems. The Blue Flag award partially covers eight criteria. It also fully covers two criteria: fulfilment of legal requirements and emergency planning. The CEDEX index covers 7 criteria, of

which geomorphologic quality, sand quality, and service quality are covered completely. The Cantabria index covers 5 aspects; although none of them are covered completely, natural system quality and service quality are addressed quite extensively. The ACA index covers 4 of the criteria, and of these, water quality is considered completely.

The natural function of beaches is not deeply covered and some of the analyzed indexes do not even consider it at all (CEDEX index and ACA index). The Blue Flag award covers the most apparent natural aspects of beaches, such as dune protection, vulnerable areas, and ecosystems surrounding beaches, whereas the Cantabria index covers the general beach landscape condition for natural beaches. None of the addressed standards specifically determines a set of indicators to monitor the structure and dynamics of the different beach communities (dry ecosystem, wet ecosystem, submerged ecosystem, or rocky ecosystem).

The protective function of beaches can be measured through its geomorphologic quality, but only the CEDEX index takes this geomorphologic quality into account. The aim in this case, however, is to satisfy user preferences rather than to evaluate coastal protection.

Most of the criteria considered were associated with the recreational function of beaches. All of the standards/rating systems consider the legal requirements on the regulation of water quality presented by directive 76/60/EC. To guarantee beach quality, some management tools (Blue Flag and Cantabria index) also address service quality but without considering other complementary quality aspects. For example, to guarantee the absence of waste on sand, they demand waste management services but do not establish quality based on the amount of waste on the beach. Beach use pattern is not considered. This fact is remarkable, because the intense dynamics of mass tourism in Spain are well known. The standards/rating systems assessed aim to guarantee beach quality in terms of monitoring services, facilities, and behavior that allow access and enjoyment while preventing the most obvious impacts on the natural system. The quality of the service provided by beach managers and assessed by the managerial function is not usually considered. Nevertheless, the performance of the standards is directly linked to the achievement of certain predefined goals but not to the commitment to improve those goals and change them once they are achieved.

The standards/rating systems generally provided complementary information rather than express commonality. No clear pattern has resulted from the application of beach management tools to selected beaches. More important differences were found with results obtained for the Cantabria Index. They occurred due to importance of water microbiological and organoleptic factors. A comparison of the evaluated management tools revealed that the Blue Flag award penalized natural beaches of the Costa Brava due to their characteristics, accessibility, and reduced services (Table 4). The CEDEX index detected aspects related to the comfort of analyzed beaches (those natural characteristics of beaches that affect experience of users, that is, weather aspects or oceanographic conditions), but does not consider local characteristics such as grain size, form, steep slope, step on the shore, and irregularities in the submerged zone. As a consequence, geomorphologic quality score was moderate in all beaches (Table 4). Some homogeneity was found in the assessment of water quality (except the Cantabria index). Scores were good in all beaches. Given that nowadays water quality is high in most of the Spanish coast, standards/rating systems did not allow differences to be established. In Sta. Francesc and La Boadella some oil and foam was detected by the Cantabria index (Organoleptic factors). The ACA index scored lower, water visual quality and sand visual quality in Fenals and Lloret. Characteristics of the environment assessed by Cantabria index were good in all beaches except in Sta. Cristina, due to access characteristics. Service quality assessment in the CEDEX Index was good in all beaches except in la Boadella. Cantabria Index scored Hygiene and Vigilance high

Table 4
Standard/rating systems application to studied beaches

Beach	Type of beach	BLUE FLAG 2003	ACA INDEX global score (maximum 12)	CEDEX INDEX global score (maximum 3)	CANTABRIA INDEX global score (maximum 100)		
St. Francesc (SF)	Urbanized	Yes	10	2,07	32,8		
Treumal-Sta. Cristina (STA. C)	Urbanized	No	10	2,31	71		
La Boadella (BO)	Natural	No	12	2,14	24		
Fenals (FE)	Urban	Yes	10	2,07	65,5		
Lloret Centre (LLO)	Urban	Yes	10	2,01	65,5		
Canyelles (CAN)	Urbanized	No	12	1,80	64		
ACA INDEX	Range	SF	STA. C	BOA	FE	LLO	CAN
Water microbiological quality	0–4	3	4	4	4	4	4
Water visual quality	0–4	4	4	4	3	3	4
Sand visual quality	0–4	3	4	4	3	3	4
CEDEX ÍNDEX		SF	STA. C	BOA	FE	LLO	CAN
Water Quality (ICAG)	0–3	2,65	2,82	2,82	2,82	2,85	2,82
Sand Quality (ICAR)	0–3	—	—	—	—	—	—
Water Physical Quality (ICFA)	0–3	—	—	—	—	—	—
Geomorphologic Quality (ICG)	0–3	1,21	1,47	1,53	1,27	1,14	0,87
Aesthetic Quality (ICE)	0–3	2	2,4	2,2	2	2,4	2,2
Service Quality (ICS)	0–3	2,01	1,54	1,30	2,21	2,54	1,52
Activity Quality (ICAC)	0–3	2,75	2,25	2	1,5	0	0

CANTABRIA INDEX	Range for no Natural Beaches	Range for Natural Beaches	SF	STA. C	BO	FE	LLO	CAN
Water Quality	0–1	0–1	0,8	1	0,8	0,8	0,8	0,8
Organoleptic factors	0–1	0–1	0,5	1	0,5	1	1	1
Sediment Quality	0–1 (industrial beaches)	—	—	—	—	—	—	—
Hygiene	0–30	—	30	28	—	28	28	28
Guarding	0–30	—	30	30	—	30	30	30
Signaling	0–20	—	5	5	—	5	5	5
Information		—	4	4	—	4	4	4
Environment characteristics	0–20 (urban type beaches)	100 (natural beaches)	13	4	60	15	15	13

Following the Ministerio de Medio Ambiente, 2000 guide, the CEDEX Index was calculated using 5 of the 7 considered factors, due to the lack of reliable data of Sand Quality and Water Physical Quality. The Sediment Quality factor from the Cantabria Index was not considered as no industrial beaches were assessed.

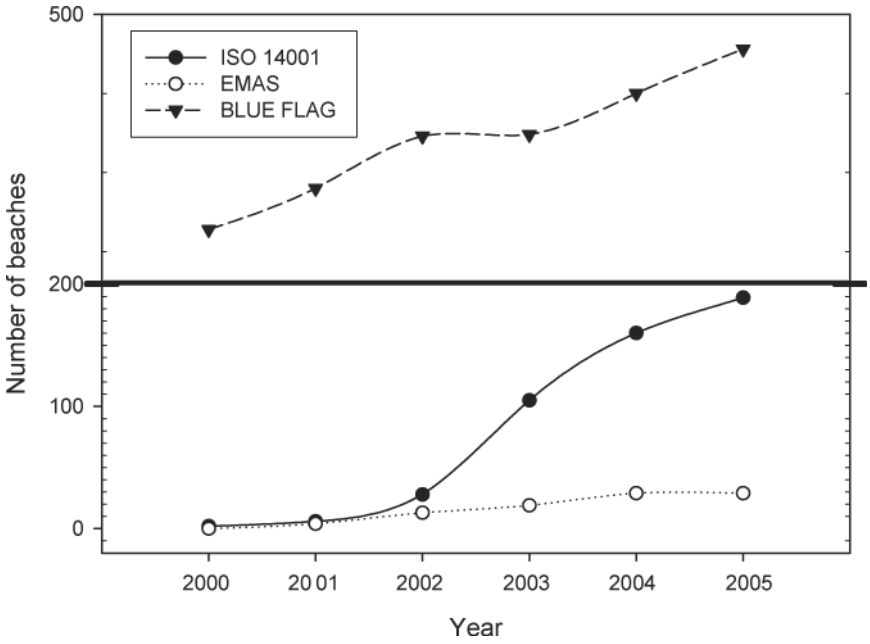

Figure 3. Evolution in the usage of Environmental Management Systems (ISO 14001 and EMAS) and Blue Flag, as beach management tools in Spain.

in all beaches. Signposting and Information scores were lower. In the case of la Boadella (natural beach) characteristics, the scored results were achieved by accounting for presence of singular elements, moderate human transformation of the area, and views that improve landscape quality. Activities score of the CEDEX Index was good in St. Francesc, Sta. Cristina, and la Boadella, regular in Fenals, and bad in Lloret and Canyelles.

The use of certified EMSBs began in Spain in the year 2000. In the country, the legal establishment of public responsibilities for beach management means local authorities can obtain that certification. Three types of those environmental management standards are currently used: ISO 14001, EMAS, and the Q of Quality. Although the Q of Quality is the most recently developed management system, two of the studied beaches achieved the distinction in 2004: Lloret de Mar Center and Fenals. To date, 25 municipalities have been certified and 7 of them have the EMAS distinction. In 2005, out of a total of 3100 Spanish beaches, 189 were managed according to ISO 14001 and 26 according to EMAS requirements. Despite a rapid increase in recent years, the use of EMSBs is still significantly less than that of the Blue Flag award. In 2005, 478 Spanish beaches obtained the Blue Flag award (Figure 3).

Discussion

Despite their popularity, most performance standards and performance rating systems fail to include an in-depth assessment of the three different functions (recreational, protective, and natural) that need to be addressed in relation to beach ecosystems. The Blue Flag award, ACA index, CEDEX index, and Cantabria index are all assessment tools but with differing characteristics. They each have specific standards to follow and monitor. Coastal managers

responsible for obtaining such awards frequently treat them as individual short-term projects to benefit conventional market-based economic activities.

Performance standards/rating systems address various goals and are mostly complementary. Some of them can be implemented in parallel for the same beach to provide useful information and help with management in different ways. However, while all of these performance standards and quality rating systems consider service quality and water quality extensively, and mirror almost exclusively the needs of human users during the bathing season, they fail to address other important criteria, especially when we consider beach faces as parts of beach ecosystems. Water quality criteria and service excellence are strongly emphasized. In contrast, some factors have not been quantified or even considered by the standards. Management coordination has been called for when measures are implemented by different administrations and/or organizations (Breton et al., 1996) but it appears not to have occurred in performance processes. The criteria on which beach quality is assessed should be at least partly based on user opinion (Williams & Morgan, 1995; Morgan, 1999). However, user opinion has only been considered sporadically. All of these factors seem to indicate that further developments are required in the management of beaches. Although recreation is the most extensively addressed function in beaches, there are other schemes used worldwide that may consider other aspects and functions according to other societal values (e.g., the user-based rating system [BRS] checklist designed by Morgan (1999) and the BARE system (Micallef & Williams, 2004)), covering others aspects related to geomorphologic quality, natural system quality, aesthetic quality, or safety quality. On the other hand, worldwide similarities and/or differences, performance standards/rating systems do not consider managerial issues such as management coordination, steady improvement, or emergency plans (except the Blue Flag award).

Biological aspects other than microbiological water quality are widely neglected (Moffet et al., 1998; Nardi et al., 2003). There is uncertainty about species that should be monitored in beach ecosystems (Gheskiere, 2005; Sarda, 2001). The lack of indicators providing information on many natural processes occurring in beaches leads to a failure to consider environmental aspects that may be affected by human activity (Lewellyn & Shackley, 1996; Dietvorst & Ashworth, 1995; Tremblay, 1998; Sousa, 1984; Hall, 1994). Apart from the need to develop appropriate indicators to cover the natural function and also the protection function, the failure to consider certain aspects of beach management has led to difficulties in managing different types of beaches, due to the extreme variability present in coastal systems. Consequently, there is a lack of clarity in beach management regarding the goals that beaches should achieve.

The need to move beyond performance assessment in the management of beaches must now be considered. Once performance standards are reached and/or rating systems get good scores, management is not improved any further. To move toward effective management, it becomes necessary to establish a framework in which all the quality criteria can be expressed, adapted, and substituted when necessary. This framework should recognise the extreme variability of coastal conditions and consider beach ecosystems instead of just beach faces. In this case, a systematic approach to the integration of the recreational, protective, and natural roles of the beach ecosystem together with their managerial activities should be emphasized. Managerial activities should be enhanced by developing proactive planning and establishing responsibilities. 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). If beaches are to be managed as the complex system they are, the managerial challenge is to ensure sustainable use of those resources rather than achievement of a particular standard. The use

of Environmental Management Systems for beaches (EMSBs) allows different visions to be employed according to the reality of each individual beach, while nevertheless managing all of them from within a similar framework.

The use of well-established, widely used certified EMSs such as the International ISO14001 or the European EMAS, as well as the Spanish National Q of Quality for beaches is highly recommendable. Although the Q of Quality requirement includes some aspects related to recreational activity, EMSBs do not have many intrinsic concrete specificities to achieve. Their requirements include the fulfilment of legal requirements and external references such as beach quality indexes. An interesting aspect of EMSBs is the opportunity to coordinate global management offered by their flexibility. Theoretically, all criteria considered in this study can be included in those systems and become projects that take place within a general process. Thus, the process of beach management includes the carrying out of a variety of projects, review of progress, implementation of corrective measures, and continuous improvement over time. The steady improvement paradigm allows us to move beyond isolated projects and guarantee constant improvement of beach quality through the establishment of new projects once the previous ones have been completed.

EMSBs cannot replace beach indexes and awards. Projects such as the Blue Flag award or the CEDEX index should be incorporated inside the management framework offered by ISO 14001 or EMAS. EMSBs can be used as general instruments serving a wide range of purposes, and the general framework is applicable both to urban beaches in which the main goal is recreational and to highly natural beaches where environmental goals should prevail. All beaches, regardless the level of human development, represent ecosystems with the potential to be altered by human activity. This makes it highly appropriate to establish a management framework that contains the principles of management according to beach characteristics.

When using EMSBs, emphasis should be placed on establishing indicators and references that guided the objectives and criteria to pursuit. It is not only recommendable but mandatory to include appropriate projects following significant environmental aspects in the management system so that it does not become a theoretical artifact. Of the four standards/rating systems analyzed, the CEDEX index offers the best quantitative monitoring of the most aspects of beach ecosystems and can be widely used in EMSBs. The CEDEX index allows changes in beach quality to be assessed over time. It is also the only index that extensively covers geomorphologic quality, sand quality, recreational equipment (services), and some activities such as antisocial sporting practices and water sports. Performance standards, such as the Blue Flag award, may help in achieving concrete goals but they do not provide for overall monitoring of beach quality once they are awarded. However, the requirement in the Blue Flag award to enforce national, regional, and local legal requirements, and to consider emergency planning measures such as warning mechanisms and emergency contingency plans is also recommendable for EMSBs. Other aspects, such as cleaning, access, prohibitions, parking, annoying biological components, coverage of beach natural components, landscape condition, and so on can be taken from other performance standards (ACA, Cantabria, BRS, etc.), and even beach usage can be an interesting factor to be considered (Leatherman, 1997).

Beach management must include considerations other than the environmental issues associated with the use of those natural and/or human-dominated ecosystems. Important deficits can be observed in today used performance standards. Management and organization usually become a weakness in this process and it is not considered at all in the performance standards and rating systems studied. EMSBs should also strengthen

the sense of obligation in management. Management coordination is usually a significant problem due to the different levels of government (national, autonomic, and local) involved in beach management, and limited or non-existent communication has often had negative consequences. Measurement principles must be adopted to address managerial performance indicators so that adaptive management and ecosystem management principles can be included in beach management practices (Grumbine, 1994). This will make it easier for beaches to be integrated in terms of their ecological role and allow beach processes to be correctly monitored. On the other hand, problems caused by storm damage are exacerbated by the absence of general planning and the lack of clear guidelines regarding financial responsibilities. However, these problems can be addressed by establishing protocols to be put into action under these circumstances. Emergency plan criteria require prior awareness of the local characteristics of beaches. They also necessitate a detailed protocol that includes measures to be taken in emergency situations, in order to guarantee minimal environmental damage. The use of EMSBs can help to include all those deficits under a general framework.

Assessment of beach management should be done by organizations outside of the managers themselves. It is also very important that the areas to be managed are defined for each type of beach and that methods and limits are standardized as far as possible so that EMSBs can become homogeneous for the different types of beach considered. Beach classification can vary from one site to another but the categories established in this study (urban, urbanized, and natural) can be adapted to other coastal zones.

Although the use of EMSBs is still in its infancy, the potential for improvement that it offers is clear. As performance standards are usually met, the use of EMSBs allows us to take a further step, not only to "do things right" but also to "do the right things" (Hamschdmit & Dyllick, 2001). In this way, we can improve eco-effectiveness in the management of beaches and, depending of the reality of the situation of each single beach, we can work with the entire beach ecosystem under a general framework. Such a process should allow us to manage a highly frequented urban beach such as S'Abanell or that in the centre of Lloret de Mar, and a beach inside a protected natural park area such as the Treumal-Santa Cristina complex, both with different goals, objectives, programs, and projects, but both supervised at the same time under the same scheme. EMSBs have the potential to drive current managerial activities on beaches toward eco-effectiveness; in this case in the direction of managing not only beaches per se but of managing all properties of the beach ecosystem. It is clear that we need to take into account the need for a broader experience in order to assess the strong and weak points of EMSBs. Although the possibilities should be considered with caution until sufficient information is obtained, evidence seems to suggest that EMSBs are suitable for wider management of beach ecosystems.

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Appendix CEDEX INDEX (metrics)

$$ICP = 4ICAG + 3ICAR + 2ICFA + 3ICG + 2ICE + ICCS + ICAC$$

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ICP = *Beach Quality Index* ("*Índice de Calidad de Playas*")

ICAG = *Microbiological and Chemical Quality of Water* ("*Índice de Calidad Ambiental de las aguas*"). It is assessed by analyzing Faecal Coliforms and Streptococcus and classifying results according to criteria based on Directive 76/160/CE.

ICAR = *Sand Quality* ("*Índice de Calidad Ambiental de las arenas*"). It is assessed by analyzing microbiological quality, heavy metals, and organic matter of sand.

ICFA = *Physical Quality of Water* ("*Índice de Calidad Físico de las aguas*"). It is assessed by analyzing temperature, turbidity, and wave regime of beach waters.

ICG = *Geomorphologic Quality* ("*Índice de Calidad Geomorfológico*"). It is assessed by analyzing beach width, beach form, sediment dynamics, slope, step on the shore, irregularities in the submerged zone, grain size, sand color, and grain form.

ICE = *Aesthetic Quality* ("*Índice de Calidad Estética*").- It is assessed by analyzing litter left by users, litter of sea origin, and gathering of shells on the swash area.

ICS = *Service Quality* ("*Índice de Calidad de los servicios*"). It is assessed by analyzing presence of leisure and service facilities (showers, WC, telephone, accesses), cleanliness and environmental control services and facilities (bins, waste segregation, sanitary control of water and sand), safety and rescue services, and information services.
ICAC = *Activity Quality (Índice de Calidad)*. It is assessed by analyzing disturbing activities such as sports activities on sand, animals, nautical motorbikes, motorboats, windsurf, and fishing.

CANTABRIA INDEX (metrics)

$$\mathbf{ICP = f_a{}^{*}f_s{}^{*}f_o\ (H + V + S + I + C)}$$

ICP = *Beach Quality Index* ("*Índice de Calidad de Playas*")
f_a = *Bacteriological Water quality*. It is assessed by analyzing accomplishment of guide and imperative criteria of Directive 76/160/CE.
f_s = *Organoleptic factors*. It is assessed by analyzing presence of oil and foam on water.
f_o = *Chemical sediment quality (calculated only for industrial beaches)*. It is assessed by analyzing heavy metal concentration.
H = *Hygiene (no applicable to natural beaches)*. It is assessed by analyzing cleanliness service, presence of bins, presence of drinking water, showers, and WC.
V = *Safety and rescue services (no applicable to natural beaches)*. It is assessed by analyzing existence of beach guarding service.
S = *Signposting (no applicable to natural beaches)*. It is assessed by analyzing presence of sea state flag, dangerous areas, signposting of different use areas, and signposting of services.
I = *Information (no applicable to natural beaches)*. It is assessed by analyzing information on water quality, sand quality, beach characteristics, and beach norms.
C = *Characteristics of the environment (no applicable to natural beaches)*. In non-natural beaches it is assessed by analyzing accesses, parking, public transportation, and facilities in beach areas. In natural beaches it is assessed by evaluating landscape: consideration of rare species, intensity of human impacts, and aesthetic quality.