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Coastal scenic assessment and tourism management in western Cuba

G. Anfuso [a,*], A.T. Williams [b], J.A. Cabrera Hernández [c], E. Pranzini [d]

[a] Departamento de Ciencias de la Tierra, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Polígono Río San Pedro s/n, 11510 Puerto Real, Cádiz, Spain

[b] Built Environment, University of Wales, Trinity St. David, Swansea, Wales SA1 6ED, UK

[c] Centro de Estudios de Medio ambiente y Energía (CEMAE), Universidad de Matanzas, Autopista Varadero, km 3 1/2, Matanzas, Cuba

[d] Dipartimento di Scienze della Terra, Università degli Studi di Firenze, Borgo Albizi 28, 50122 Firenze, Italy

HIGHLIGHTS

- This paper suggests a five-fold classification of landscapes for coastal areas.
- This classification is applied to Cuba.
- Northern rural areas evidence small anthropogenic impacts (Type 1).
- Varadero hosts type 2 sites and is a centre for international tourism.
- Types 3,4, and 5 include sites of progressive decay of natural and human parameter.

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ABSTRACT

Coastal scenic assessments via checklist tables (18 natural, 8 human related parameters), can provide benchmark measures regarding desirable/non-desirable beach conditions and also classify sites. The scenic value for 43 sites in western Cuba was investigated, with the aim of helping managers improve bathing areas, especially for tourism purposes. Sites were categorised from Class 1, (top grade scenery), between La Habana and Matanzas, as extremely attractive, with white sand, turquoise water and additional scenic elements. Class 2 sites were located in Varadero, and their high scores were greatly due to appropriate human interventions, e.g. beach nourishment and dune restoration works. Classes 3 to 5 (the latter having very poor scenery), included sites with low scores for natural parameters. For these sites, coastal managers can do little to alleviate scenic impact, apart from addressing the human parameters, where improvement is possible, e.g. by litter removal together with the present chaotic protective structures.

1. Preamble

Coastal Zone Management (CZM) is a subject area first introduced and implemented in 1972 with the USA Coastal Management Act and many excellent books/papers have been written on the topic, e.g. Cicin-Sain and Knetch (1998), Kay and Alder (2005), etc. In the Mediterranean, the CZM protocol has the objective of coastal zone sustainability by ensuring that the environment and *landscapes* are in harmony with the economic, cultural and social development (UNEP-MAP, 2008). The catholic spectrum of elements that make up CZM represent many different challenges/themes, i.e. financial sustainability, inadequate capacities, governance, weak law enforcement, lack of integrated/collaborative efforts. Beach management (BM), a sub-set of the more voluminous ICM literature, has similar, but smaller scale elements, which have particular reference to pragmatic local management issues. *All* CZM elements are applicable to beach management, which has a more focused specific approach (individual beaches) to this zone - the outcome level of Olsen, Lowry, and Tobey (1999) , 56 pp. Books/papers on the BM topic are scarce, as it is a much younger discipline (Williams & Micallef, 2009, 445 pp.).

Despite many years since its inception, Sorenson (1997), Phillips and Jones (2006), have argued that uncertainty and little information exist regarding successful CZM strategies and effective CZM still *'remains a considerable challenge in many parts of the world'* (Garcia-Aguilar et al., 2013, p. 94). CZM is a broad-brush coastal zone approach that traditionally emphasised fisheries, tourism, recreation and hazards. Some current CZM key issues involve

* Corresponding author. Tel.: +34 956016167; fax: +34 956016195.
E-mail addresses: giorgio.anfuso@uca.es (G. Anfuso), allan.williams@virgin.net (A.T. Williams), alfredo.cabrera@umcc.cu (J.A. Cabrera Hernández), epranzini@unifi.it (E. Pranzini).

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obtaining robust reliable information, lack of sound networks, little long term planning, public participation, financial capacity – many CZM schemes in developing countries have failed at the implementation stage because of this - and a low take up of new techniques. With respect to these issues at the BM level, this research paper, authored by a multi disciplinary network group, provides a wealth of information - over 4,000 beach users, i.e. stakeholders, participated in the methodological research (Hage, 2010) required to develop this innovative technique (Ergin et al., 2004), enabling Cuban coastal scenery to be analysed in a semi-objective manner. It is not the intention of this paper to provide a discourse on the issues associated with CZM/BM, but sound BM can lead to an increase in overseas/local tourism, quality of recreational opportunities, promotion of sustainable coastal development and effective utilisation of an increasingly valuable socio-economic/ecological national resource. Invariably indicators are used in current CZM/BM programmes to monitor the coastal state, indicting progress/non-progress of policies and for this paper, scenery is the chosen indicator. It is one of the five parameters identified by beach users (Williams & Micallef, 2009), as having a major importance on beach choice and effective BM can increase beach quality with by reference to just this one aspect. This is clearly shown by comparison of Varadero beaches (managed) with those on the southern Cuban coast (unmanaged) – see Discussion section.

2. Introduction

Tourism is one of the largest growth industries in the world and is expected to reach 1.6 billion international tourists by 2020 (www.Tourismconcern, accessed February 2013). Tourism's role with respect to the worldwide gross domestic product (GDP) in 2011 was *circa* 5 percent and in employment it was *circa* 6–7 percent of the overall number of direct and indirect jobs worldwide (United Nations World Tourism Organization UNWTO, 2011). Its contribution to GDP ranges from approximately 2 percent for countries where tourism is a comparatively small sector, to over 10 percent for countries where tourism is an important pillar of the economy, but for small islands and developing countries, the weight of tourism can be even larger, accounting for up to 25 percent in some destinations. Europe is currently still the world's largest source region (UNWTO, 2012), generating just over half of international arrivals worldwide, followed by Asia and the Pacific (22 percent), the Americas (16 percent), the Middle East (4 percent) and Africa (3 percent).

On the world scale, tourist arrivals grew by 4.6 percent to reach 983 million worldwide in 2011, up from 940 million in 2010 (UNWTO, 2012); International tourism receipts for 2011 are estimated at US$ 1030 billion worldwide, up from US$ 928 billion in 2010 (+3.9 percent in real terms), setting new records in most destinations. According to the latest UNWTO World Tourism Barometer (http://media.unwto.org/en/press-release/2013-01-28/international-tourism-continue-robust-growth-2013, accessed February 2013), the International tourist arrivals grew by 4 percent in 2012 to reach 1.035 billion. Emerging economies (+4.1 percent) regained the lead over advanced economies (+3.6 percent), with Asia and the Pacific showing the strongest results. Growth is expected to continue in 2013 only slightly below the 2012 level (+3 percent to +4 percent) and in line with UNWTO long term forecast.

In the Americas, arrivals (+4 percent) were boosted by South America (+9 percent), which continued to lead growth in the region for the second consecutive year. Since the early 1980s, the Caribbean regional economy has moved toward deeper integration and shifted away from traditional agriculture towards more competitive manufacturing and service industries (ranging from tourism to construction and information technology). For Caribbean island economies, in 1990, the US$9 billion tourism sector brought in six times the revenue of all traditional agricultural exports. For Cuba in 1994, sugar exports accounted for over 50 percent of GDP. In the same year Cuba joined the Caribbean Tourism Organization and the Association of Caribbean States (ACS) and, by 2003, tourism revenues reached US$2.1 billion, providing almost half of Cuba's total hard currency. This has become the engine, which now drives the economy (Taylor & McGlynn, 2009): international tourist arrivals have increased greatly in recent decades, from 11.4 millions in 1990 to 17.1 millions in 2000 and 19.5 millions in 2010. In 2011 and 2012 international tourism arrivals increased by 4 percent per year (20.1 and 20.9 millions respectively recorded in 2011 and 2012), boosted by sound results from the larger island destinations in 2011, such as Cuba (+7.2 percent, 2.7 millions of international arrivals) and the Dominican Republic (+4 percent), UNWTO (2012).

According to the *Oficina Nacional de Estadísticas e Información* of Cuba (ONEI, www.one.cu, accessed February 2013), 2.83 millions of tourists visited Cuba in 2012 and hotel occupation increased from 46.8 percent in 2011 to 46.9 percent in 2012. Most important tourists source region in 2012 were Canada (109,636 visitors), England (11,329), Germany (10,554), Italy (10,413) followed by Mexico, Russia, France and Spain. In 2011 and 2012, revenues linked to tourism in Cuba increased from 1.73 to 1.86 billions of US$ (ONEI, www.one.cu, accessed February 2013). The coastal area between La

Table 1
Location and main characteristics of investigated sites (name, setting, "D" value and class).

Site	Location	Type	Score	Class
La Puntilla	Northern Mayabeque	Rural	1.14	1
Los Cocos	Northern Mayabeque	Rural	0.93	1
Cayo Levisa	Pinar del Río	Resort	0.93	1
Arroyo Berbejo	Northern Mayabeque	Rural	0.87	1
Calle 46	Cárdenas	Urban	0.80	2
Calle 55	Cárdenas	Urban	0.80	2
Sandals	Cárdenas	Resort	0.80	2
Calle 57 Museo	Cárdenas	Urban	0.79	2
Bocaciega	La Habana	Village	0.70	2
Brisas	Cárdenas	Resort	0.69	2
El Mamey	Matanzas	Rural	0.64	3
Sitio Punta Perdiz	Cienaga de Zapata	Rural	0.63	3
Guanabo	La Habana	Village	0.60	3
Jibacoa	Northern Mayabeque	Rural	0.58	3
Bueyvaca	Matanzas	Rural	0.57	3
La Altura	Pinar del Río	Rural	0.56	3
Calle 48–50	Cárdenas	Urban	0.54	3
Sitio Cueva Peces	Cienaga de Zapata	Rural	0.49	3
Hotel Melia Las Américas	Cárdenas	Resort	0.47	3
Hotel Arenas Blancas	Cárdenas	Resort	0.41	3
Barlovento	Cárdenas	Urban	0.38	4
Plaza America	Cárdenas	Resort	0.38	4
Playa Carenero	Pinar del Río	Rural	0.35	4
El Río	Cienaga de Zapata	Rural	0.34	4
Banes	Northern Artemisa	Village	0.32	4
Sitio Bahía	Matanzas	Urban	0.28	4
Rosario	Southern Mayabeque	Rural	0.26	4
Canal oeste	Cárdenas	Rural	0.23	4
Campamento	Cienaga de Zapata	Rural	0.20	4
Canal este	Cárdenas	Urban	0.12	4
Playa El Morrillo	Pinar del Río	Village	0.10	4
Playa Larga	Cienaga de Zapata	Village	0.08	4
Hotel Solymar	Cárdenas	Resort	0.06	4
Puerto Esperanza	Pinar del Río	Village	0.06	4
Buenaventura	Cienaga de Zapata	Village	0.02	4
Playa Majana	Southern Artemisa	Village	−0.09	5
Allende	Matanzas	Urban	−0.22	5
Sitio Cajío	Southern Artemisa	Village	−0.23	5
Faro de Maya	Matanzas	Rural	−0.42	5
Mayabeque	Southern Mayabeque	Village	−0.48	5
Tenis	Matanzas	Urban	−0.87	5
El Judío	Matanzas	Urban	−0.90	5
Sitio Mariel	Northern Artemisa	Industrial	−0.93	5

Habana and Matanzas is the most important tourist area of the Country. Specifically, since 2008, the Varadero region acquired a special relevance with more than 16,000 rooms and 1 million visitors per year, corresponding to 40% of all visitors to Cuba.

It is important to highlight that according to enquires carried out in 2012 by the University of Matanzas and Local Office of Tourism, 87 percent of visitors visited Cuba for leisure holidays, tourists being interested in enjoying the beach. This is probably the key parameter in Caribbean or Mediterranean tourism and can be summed up in three words – the bathing area – a part of the coastal landscape, which can be defined as, *'a littoral area, as perceived by people, whose character results from the numerous interactions of natural and/or human factors'* (Council of Europe, 2000, p. 32).

As a major component of the desires of tourists, scenery is a combination of the physical and cultural environment and it can be argued that the former is fixed by nature and only the cultural can be modified by man. Williams (2011) has indicated from >4000 questionnaire surveys, that beach user preferences and priorities in many countries, e.g. Turkey, UK, Malta, Croatia, New Zealand, Portugal, the USA, confirmed that there are five main parameters that beach users look for. These are safety, water quality, no litter, facilities and scenery, with the weighting of these being a function of the beach type, which spans a spectrum ranging from resort to remote. For example, at resort areas, safety, water quality and litter are pre-eminent; at rural/remote areas, there is no expectation for safety parameters and scenery becomes a favoured choice. Botero, Anfuso, Duarte, Palacios, and Williams (2013) in the first study of this kind in Latin America investigated these findings in Colombia and whilst water quality, safety and facilities were found to be important, a relaxed friendly beach atmosphere was deemed to be a parameter that was missing from the European/USA study. This is a very interesting and important cultural finding and further research is being carried out on this issue. Preliminary results argue that this finding is essentially due to the fact that beach users look at the beach essentially as a recreational place where they have a good time and fun with friends, plus they enjoy the presence of bars and restaurants with a good atmosphere.

But what is asked can be different depending on beach type (rural or urban beaches) and if beach users are locals or tourist, as demonstrated by Concu and Atzeni (2012) in Sardinia (Italy). Roca, Villares, and Ortego (2009) in Costa Brava (Spain), through cluster analysis, also found significant difference among beach users where different socio–demographic profiles (locals vs. tourists) expressed satisfaction or dissatisfaction towards beach quality. Enquires carried out by Botero et al. (2013) were done on Columbian urban beaches where local users were just interested in safety, facilities, etc. Probably different results would be obtained for remote or rural beaches belonging to natural protected areas where users (local and tourists) have to walk long distances to arrive at a beach.

It is with assessment of coastal scenery at 43 sites in the provinces of Pinar del Río, Artemisa, Mayabeque y Matanzas of a Caribbean island (Cuba), that is dealt with in this paper *via* an innovative scenic assessment methodology of fuzzy logic analysis and parameter weighting matrices in order to overcome subjectivity and quantifying uncertainties (Ergin, Karaesmen, Micallef, & Williams, 2004). Scenic evaluation can be used as an extremely important tool for coastal preservation, protection and development, as this provides a sound scientific basis for envisaged management plans, *i.e.* it can prevent degradation of an important tourist choice parameter.

Knowing what 'the customer' wants is a pre-requisite for sound effective management and in this respect, it behoves managers to try to provide the best service dependent upon beach type. For example, Miami Beach was dramatically changed by beach nourishment in the 1970s, from a small beach undergoing severe erosion to one that brings in>US$65 billion per year to Florida's economy (Houston, 2008). As a major component of the desires of tourists and as stated earlier, scenery is a combination of the physical and cultural environment, it can be argued that the former is fixed by nature and only the cultural can be modified by man. However, the example of Miami clearly shows that the natural

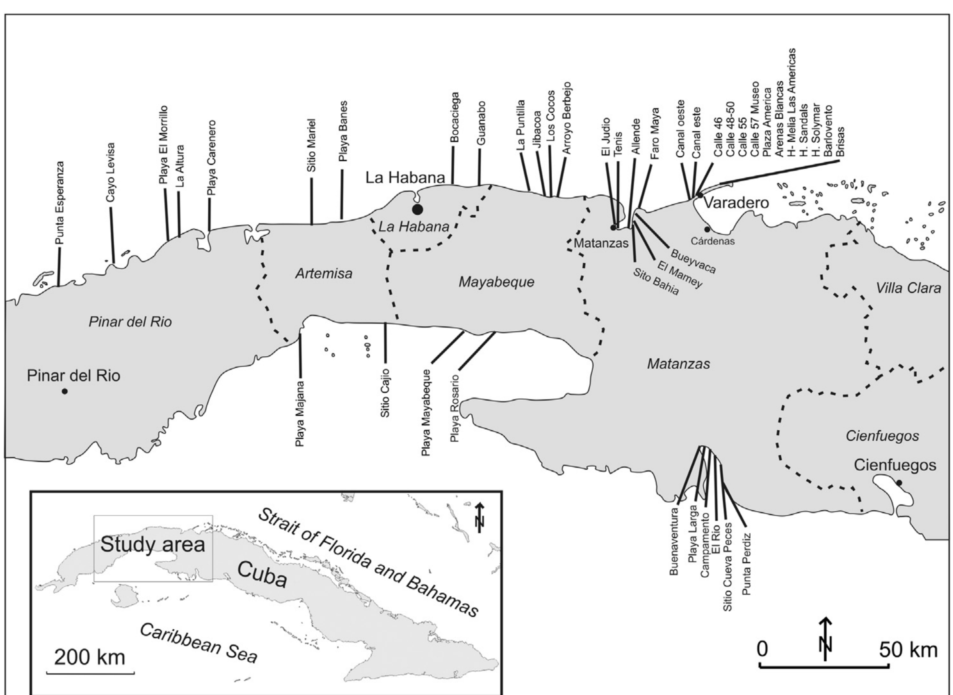

Fig. 1. Location map of investigated sites.

environment can be changed albeit only a few of the parameters on the scenic checklist (see later) can be changed.

3. Study area

The scenic value of 43 sites distributed in the provinces of Pinar del Río, Artemisa, Mayabeque and Matanzas in Cuba was investigated (Table 1, Fig. 1). The Cuban Archipelago is located, in the Caribbean Region between 23° 17′ 07″ and 19° 49′ 36″ latitude North and 74° 07′ 52″ and 84° 57′ 54″ longitude West (Fig. 1). It consists of the Island of Cuba, the Isle of Youth and more than 1200 smaller islands and cays, with a total extension of 110,922 km^2. Four chains of cays and reef crests are developed in shallow waters of the submarine plains of the Cuban insular shelf. The Island of Cuba faces the Gulf of Mexico to the west, the Strait of Florida and Bahamas (Atlantic Ocean) to the northwest and the Caribbean Sea to the south.

Cuba has a tropical monsoon climate according to the Köppen classification, with an average temperature range between 25 °C and 26 °C. The dry season starts in November and ends in April, with December being the driest month. The wet season starts in May and ends in October, with the heaviest rainfall occurring in August (Gauga, Zarembo, & Izquierdo, 1989). Main meteorological events are associated with the Trade winds (*Alisios*) from the Atlantic Ocean (which predominate during summer time), the tropical hurricanes (from August to October) and the cold fronts from the Gulf of Mexico (Reguero, Méndez, & Losada, 2012).

Cuba essentially consists of coastal flat areas and interior mountainous areas, the latter are particularly extended south of central Cuba and in the easternmost and westernmost part of the island. Specifically, in the investigated zone for this article - the western area of Cuba (Fig. 1), the province of Pinar del Rio is characterised by the presence of the *Sierra de los Organos* and *Sierra del Rosario* mountains and the provinces of La Habana and Matanzas by the chain of La Habana-Matanzas. In the Country, there are more than two hundred small rivers, streams and creeks. The Cuba littoral is micro-tidal characterized by exposed and embayed coastal sectors consisting of sand beaches (16 percent), mangrove swamps (40 percent), carbonated rocky shores (e.g. beachrock, 30 percent) and cliffs (14 percent) of different composition. Cuban beaches sediments may be classified in biogenic (formed by

Table 2
Coastal scenic evaluation system. Physical and human parameters.

No:	Physical parameters		Rating 1	2	3	4	5
1		Height (m)	Absent	5–30 m	31–60 m	61–90 m	>90 m
2	CLIFF	Slope (°)	Absent	>45°	*circa* 60°	*circa* 75°	*circa* vertical
3		Special features[a]	Absent	1	2	3	Many (>3)
4		Type	Absent	Mud	Cobble/Boulder	Pebble/Gravel	Sand
5	BEACH FACE	Width (m)	Absent	≤5 > 100	>5 ≤ 25	>25 ≤ 50	>50 ≤ 100
6		Colour	Absent	Dark	Dark tan	Light tan/bleached	White/gold
7		Slope (°)	Absent	<5°	5°–10°	10°–20°	20°–45°
8	ROCKY SHORE	Extent (m)	Absent	<5 m	5–10 m	10–20 m	>20 m
9		Roughness	Absent	Distinctly jagged	Deeply pitted and/or irregular	Shallow pitted	Smooth
10	DUNES		Absent	Remnants	Fore-dune	Secondary ridge	Several
11	VALLEY		Absent	Dry valley	(<1 m) Stream	(1–4 m) Stream	River/limestone gorge
12	SKYLINE LANDFORM		Not visible	Flat	Undulating	Highly undulating	Mountainous
13	TIDES		Macro (>4 m)		Meso (2–4 m)		Micro (<2 m)
14	COASTAL LANDSCAPE FEATURES[b]		None	1	2	3	>3
15	VISTAS		Open on one side	Open on two sides		Open on three sides	Open on four sides
16	WATER COLOUR & CLARITY		Muddy brown/grey	Milky blue/ green/opaque	Green/grey/blue	Clear blue//dark blue	Very clear turquoise
17	NATURAL VEGETATION COVER		Bare (<10% vegetation only)	Scrub/garigue (marran/gorse, bramble, etc.)	Wetlands/meadow	Coppices, maquis (±mature trees)	Varity of mature trees/mature natural cover
18	VEGETATION DEBRIS		Continuous (>50 cm high)	Full strand line	Single accumulation	Few scattered items	None
	Human parameters						
19	NOISE DISTURBANCE		Intolerable	Tolerable		Little	None
20	LITTER		Continuous accumulations	Full strand line	Single accumulation	Few scattered items	Virtually absent
21	SEWAGE DISCHARGE EVIDENCE		Sewage evidence		Same evidence (1–3 items)		No evidence of sewage
22	NON_BUILT ENVIRONMENT		None		Hedgerow/terracing/ monoculture		Field mixed cultivation ± trees/natural
23	BUILT ENVIRONMENT[c]		Heavy Industry	Heavy tourism and/or urban	Light tourism and/or urban and/or sensitive	Sensitive tourism and/or urban	Historic and/or none
24	ACCESS Type		No buffer zone/heavy traffic	No buffer zone/light traffic		Parking lot visible from coastal area	Parking lot not visible from coastal area
25	SKYLINE		Very unattractive		Sensitively designed high/low	Very sensitively designed	Natural/historic features
26	UTILITIES[d]		>3	3	2	1	None

[a] Cliff Special Features: indentation, banding, folding, screes, irregular profile.
[b] Coastal Landscape Features: Peninsulas, rock ridges, irregular headlands, arches, windows, caves, waterfalls, deltas, lagoons, islands, stacks, estuaries, reefs, fauna, embayment, tombola, etc.
[c] Built Environment: Caravans will come under Tourism, Grading 2: Large intensive caravan site, Grading 3: Light, but still intensive caravan sites, Grading 4: Sensitively designed caravan sites.
[d] Utilities: Power lines, pipelines, street lamps, groins, seawalls, revetments.

Table 3
Assessment matrix for Los Cocos, northern littoral of Mayabeque.

Los Cocos (Mayabeque)																					
Assessment matrices																					
No;	Assessment parameters		Graded attributes	Weights of parameters	Input matrices di					Fuzzy assessment matrices											
										G matrices	Grade matrices gi					R matrices	Fuzzy weighted assessment matrix Rm				
	Physical										Attributes (1–5)						Attributes (1–5)				
											1	2	3	4	5		1	2	3	4	5
1	Cliff height	(1–1)	1	0.02	1	0	0	0	0	GP	1.00	0.00	0.00	0.00	0.00	RP	0.019	0.000	0.000	0.000	0.000
2	Cliff slope	(1–2)	1	0.02	1	0	0	0	0		1.00	0.00	0.00	0.00	0.00		0.017	0.000	0.000	0.000	0.000
3	Special features	(1–3)	1	0.03	1	0	0	0	0		1.00	0.00	0.00	0.00	0.00		0.028	0.000	0.000	0.000	0.000
4	Beach type	(2–1)	5	0.03	0	0	0	0	1		0.00	0.00	0.00	0.00	1.00		0.000	0.000	0.000	0.000	0.034
5	Beach width	(2–2)	3	0.03	0	0	1	0	0		0.00	0.20	1.00	0.20	0.00		0.000	0.006	0.029	0.006	0.000
6	Beach colour	(2–3)	5	0.02	0	0	0	0	1		0.00	0.00	0.00	0.00	1.00		0.000	0.000	0.000	0.000	0.024
7	Shore slope	(3–1)	2	0.01	0	1	0	0	0		0.00	1.00	0.50	0.00	0.00		0.000	0.014	0.007	0.000	0.000
8	Shore extent	(3–2)	4	0.01	0	0	0	1	0		0.00	0.00	0.50	1.00	0.40		0.000	0.000	0.007	0.015	0.006
9	Shore roughness	(3–3)	5	0.02	0	0	0	0	1		0.00	0.00	0.00	0.50	1.00		0.000	0.000	0.000	0.011	0.022
10	Dunes	(4)	2	0.04	0	1	0	0	0		0.00	1.00	0.00	0.00	0.00		0.000	0.039	0.000	0.000	0.000
11	Valley	(5)	1	0.08	1	0	0	0	0		1.00	0.00	0.00	0.00	0.00		0.079	0.000	0.000	0.000	0.000
12	Landform	(6)	4	0.08	0	0	0	1	0		0.00	0.00	0.60	1.00	0.20		0.000	0.000	0.051	0.085	0.017
13	Tides	(7)	5	0.04	0	0	0	0	1		0.00	0.00	0.00	0.00	1.00		0.000	0.000	0.000	0.000	0.036
14	Landscape features	(8)	2	0.12	0	1	0	0	0		0.00	1.00	0.20	0.00	0.00		0.000	0.121	0.024	0.000	0.000
15	Vistas	(9)	4	0.09	0	0	0	1	0		0.00	0.00	0.00	1.00	0.30		0.000	0.000	0.000	0.095	0.029
16	Water color	(10)	5	0.14	0	0	0	0	1		0.00	0.00	0.00	0.20	1.00		0.000	0.000	0.000	0.028	0.140
17	Vegetation cover	(11)	5	0.12	0	0	0	0	1		0.00	0.00	0.00	0.20	1.00		0.000	0.000	0.000	0.023	0.117
18	Seaweed	(12)	3	0.09	0	0	1	0	0		0.00	0.00	1.00	0.20	0.00		0.000	0.000	0.086	0.017	0.000
Fuzzy weighted averages matrix for subset physical VP																	0.144	0.180	0.205	0.280	0.424
Human																					
19	Disturbance factor	(1)	5	0.14	0	0	0	0	1	GH	0.00	0.00	0.00	0.20	1.00	RH	0.000	0.000	0.000	0.027	0.137
20	Litter	(2)	4	0.15	0	0	0	1	0		0.00	0.00	0.20	1.00	0.20		0.000	0.000	0.030	0.149	0.030
21	Sewage	(3)	5	0.15	0	0	0	0	1		0.00	0.00	0.20	0.00	1.00		0.000	0.000	0.030	0.000	0.149
22	Non-built Environment	(4)	5	0.06	0	0	0	0	1		0.00	0.00	0.20	0.00	1.00		0.000	0.000	0.013	0.000	0.064
23	Built Environment	(5)	4	0.14	0	0	0	1	0		0.00	0.00	0.30	1.00	0.00		0.000	0.000	0.041	0.137	0.000
24	Access Type	(6)	5	0.09	0	0	0	0	1		0.00	0.00	0.00	0.20	1.00		0.000	0.000	0.000	0.018	0.091
25	Skyline	(7)	4	0.14	0	0	0	1	0		0.00	0.00	0.40	1.00	0.00		0.000	0.000	0.055	0.137	0.000
26	Utilities	(8)	5	0.14	0	0	0	0	1		0.00	0.00	0.00	0.20	1.00		0.000	0.000	0.000	0.027	0.137
Fuzzy weighted averages matrix for subset human VH																	0.000	0.000	0.168	0.495	0.608
Fuzzy weighted averages matrix																					
Elements of fuzzy weighted averages matrix											Weights of subsets WF					Matrix K	Attributes (1–5)				
																	1	2	3	4	5
Fuzzy weighted averages matrix of subset physical VP											1/2						0.144	0.180	0.205	0.280	0.424
Fuzzy weighted averages matrix of subset human VH											1/2						0.000	0.000	0.168	0.495	0.608
Final fuzzy assessment matrix (WF × K)																					
Final assessment matrix (C)																	0.072	0.090	0.186	0.388	0.516
Final D value for			Los Cocos (Mayabeque)								0.93										

calcareous remains of marine organisms), oolitic (formed by the precipitation of calcium carbonate), and terrigenous (formed by minerals dragged by rivers).

Embayed sectors and extended mangrove swamps prevail in the provinces of Pinar del Rio and Artemisa and in the southern part of Matanzas and Mayabeque (Borhidi, 1996; Menéndez, Alcolado, Oráis, & Milian, 1994). Open coastal sectors formed by sand beaches (with dunes at some places) and cliffs predominate in the province of La Habana, in the northern coast of Mayabeque and especially in Varadero (Prov. of Cárdenas, Matanzas) which occupies the north part of the Hicacos Peninsula, a natural 22 km long sand spit (Fig. 1).

4. Methodology

In an initial survey, Ergin et al. (2004) interviewed more than 1000 bathing area users chosen by random number tables in the UK, Turkey and Malta regarding the question, 'what are the essential parameters that make up a beautiful coastal scene' (and the converse, coastal ugliness). Replies were analysed and the number of times a parameter mentioned summed. The curve produced was such that the break point was found at 26 parameters - 18 physical and 8 human (Table 2). Further beach surveys were then undertaken in the same countries ($n \geq 500$) to *rank* these parameters, enabling a weighting parameter to be introduced on each parameter – a detailed account of the methodology utilized can be found in Ergin et al. (2004). Previous investigations on such topics have frequently ignored the weighting effect when investigating what parameters are important in judging, for example, the 'best' beach. All parameters are NOT equal, some are more important than others. As a result, a checklist approach (Table 2) loosely based on the work of Leopold (1969), was obtained for quantifying scenery (Ergin, Williams, Micallef, & Karakaya, 2002, 2004, Ergin, Karaesmen, & Uçar, 2011; Williams & Micallef, 2009, 445 pp.; Williams, 2011) and successful field-testing (>4000 interviews) have been carried out in the countries mentioned above. Additional field testing took place in New Zealand, Australia, Japan, USA, the South Pacific and Pakistan (Ergin, Williams, & Micallef, 2006; Ergin, Özölçer, & Şahin, 2010; Langley, 2006, 65 pp.; Ullah, Johnson, Micallef, & Williams, 2010). The 26 parameters were imputed into a checklist (*y* axis; Table 3 exempla of Los Cocos, Mayabeque) and ranked on a 1–5 attribute scale (*x* axis), from presence/absence or poor quality (1) to excellent/outstanding (5).

A mathematical analytical tool, the Fuzzy Logic Assessment (FLA), can be used for processing data that contains a modicum of uncertainty with the aim of helping eliminate individual subjectivity. It has been used in many fields where subjectivity effects achievement of accurate results, from financial systems to remote sensing of cloud and ice cover. In this case it was introduced to eliminate the possibility of the scenic value assessor (who ticks one box for each parameter), ticking the wrong attribute box due to uncertainty in the values shown. For example, beach width can be: absent, $\leq 5 > 100$ m, between 5–25 m, 25–50 m and 50–100 m, and this mathematical technique overcomes the problem of the wrong attribute being selected and placed in the checklist box, i.e. a beach width being recorded in the 25–50 m box when in fact it was 50–100 m. It is extremely unlikely that a jump of two attributes would be checked.

Final assessment matrices developed for all sites, are graphically presented as histograms, weighted average of attributes and membership degree of attributes (Figs. 2–4). The algorithm involving both weighting and fuzzy logic values and incorporating all of the above enabled a Scenic Evaluation Value (D) to be obtained (Fig. 5), which could classify scenic assessment into one of five classes (Ergin et al., 2004; Ergin et al., 2006) ranging from Class 1 (extremely attractive natural beaches) to Class 5 (very unattractive urban beaches). The higher the D value the higher the scenic

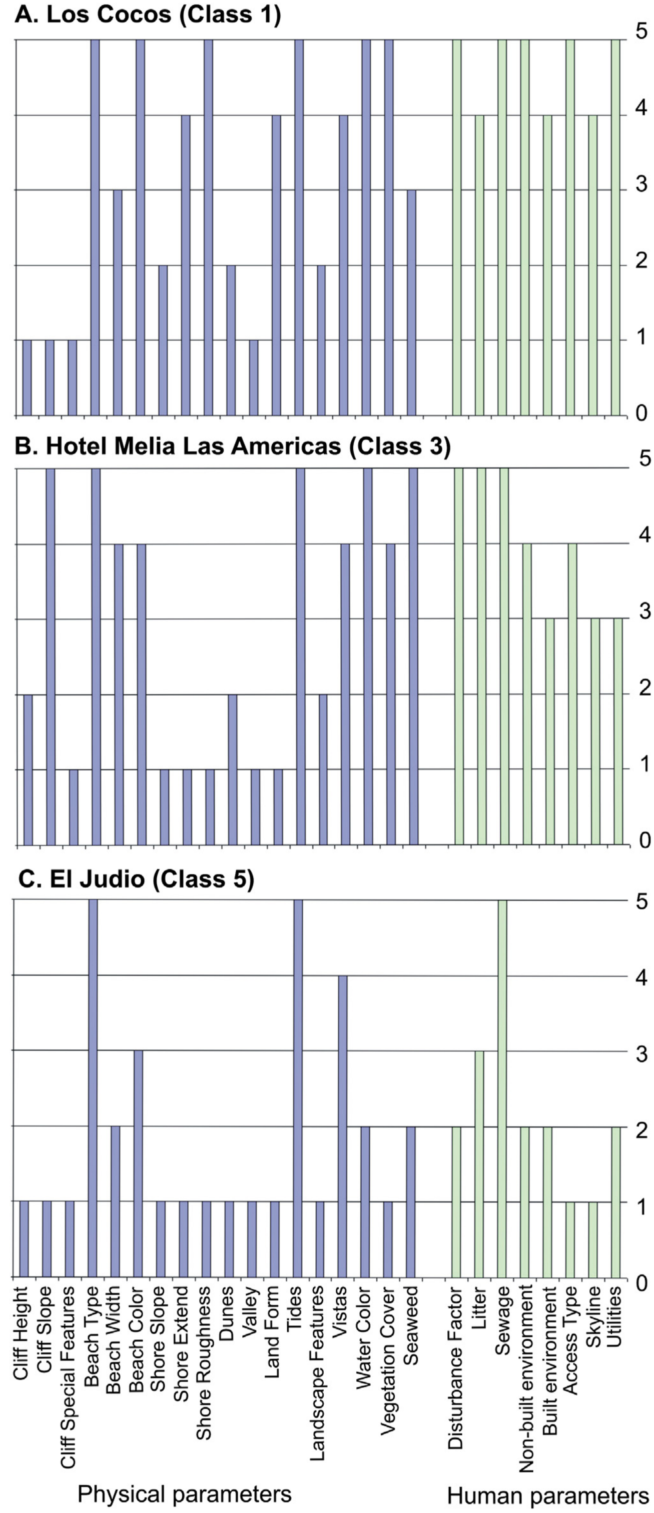

Fig. 2. Scenic evaluation rating histograms for Los Cocos (northern coast of Mayabeque, Class 1), Hotel Melia Las Americas (Varadero – northern coast of Matanzas, Class 3), El Judio (northern coast of Matanzas, Class 5).

evaluation. The site scenic value, calculated from membership degree versus attributes graphs (Fig. 3) was obtained from:

$$D = \frac{(-2.A_{12}) + (-1.A_{23}) + (1.A_{34}) + (2.A_{45})}{\text{Total area under curve}} \quad (1)$$

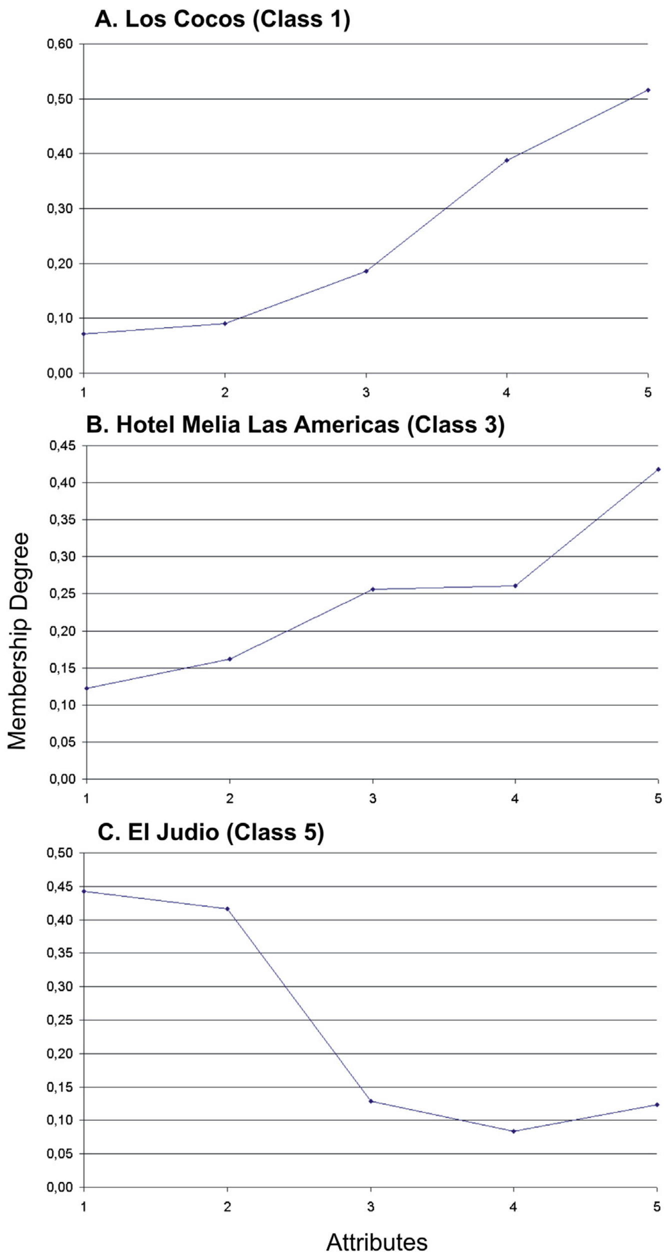

Fig. 3. Membership degree curve for Los Cocos (Class 1), Hotel Melia Las Americas (Class 3), El Judio (Class 5).

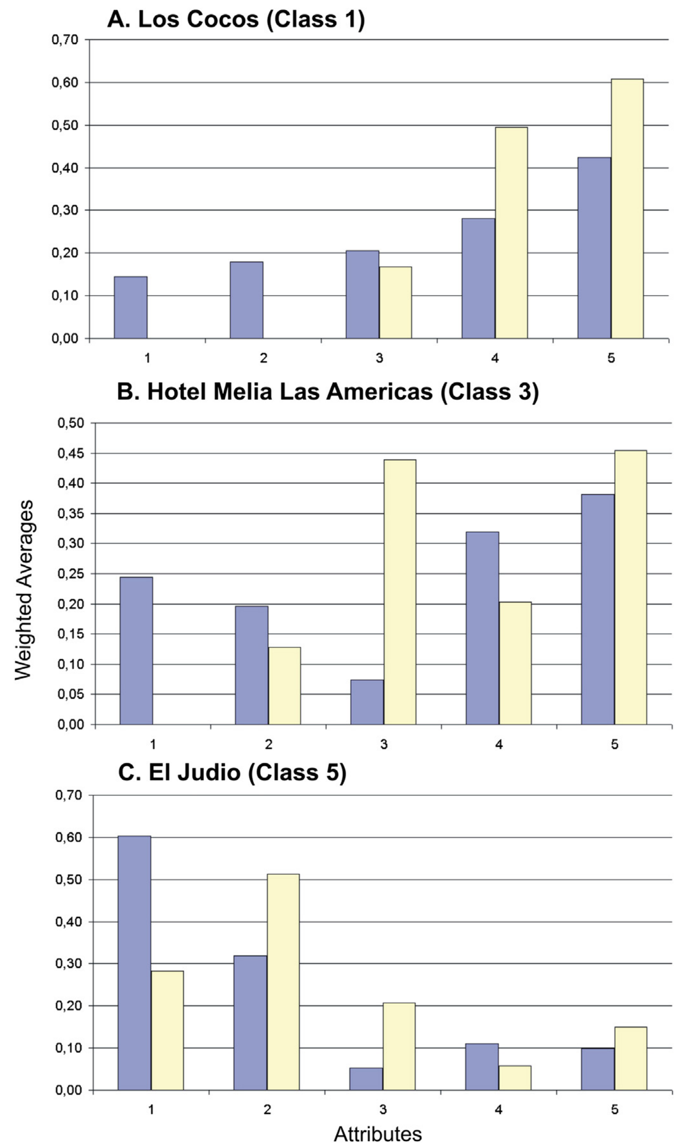

Fig. 4. Scenic histogram of weighted averages for Los Cocos (Class 1), Hotel Melia Las Americas (Class 3), El Judio (Class 5).

Where: A_{12} = total area under the curve between attributes 1 and 2. Similarly, areas under the curve may be calculated for A_{23}, A_{34}, A_{45}.

Classes 1 and 5 occur within the top 85th percentile and lowest 15th respectively. Testing break points for Gaussian distributions (0.05 level) conformed normality (Figs. 5 and 6) indicating *study unbiasedness*, and this has been confirmed by assessments in many countries, e.g., UK, Turkey, Croatia, Bosnia, Malta, Portugal, Tunisia, Cyprus, Japan, China, Pakistan, eastern USA, several Pacific islands, New Zealand. Normality tests using chi-square and Kolmogorov–Smirnov tests have been performed at the 5 percent significance. Once the checklist (Table 2) had been produced and algorithms written, each of the 43 sites investigated in western Cuba were ranked on a 1–5 attribute scale (Table 2). Other information was also gathered, such as location in natural areas, beach awards status, etc. (Williams & Micallef, 2009, 445 pp.; Williams, 2011).

5. Results

In the present study, scenic evaluation scores were produced according to the described methodology. Histograms, weighted averages and membership degrees were presented as graphs, histograms (Fig. 2), membership degrees (Fig. 3) and weighted average of attributes (Fig. 4), grouped into physical and human parameters for each site. Interpretation of membership degree *vs.* attribute graphs produced visual scenic assessment graphs, whilst histograms (Fig. 2) gave a visual state for recorded checklist attribute values. For example, Los Cocos (Table 3), a natural beach within a rural area in the northern littoral of Mayabeque, showed high scores in both natural and human parameters. The beach at Hotel Melia Las Americas, in a resort area at Varadero (Prov. of Cárdenas), recorded intermediate and low values for natural and human characters respectively, and the urban beach of El Judio at Matanzas presented low scores at both human and natural parameters (Fig. 2).

Concerning membership degrees (Fig. 3), a curve skewed to the right - Los Cocos reflects high scenic quality due to low scoring on

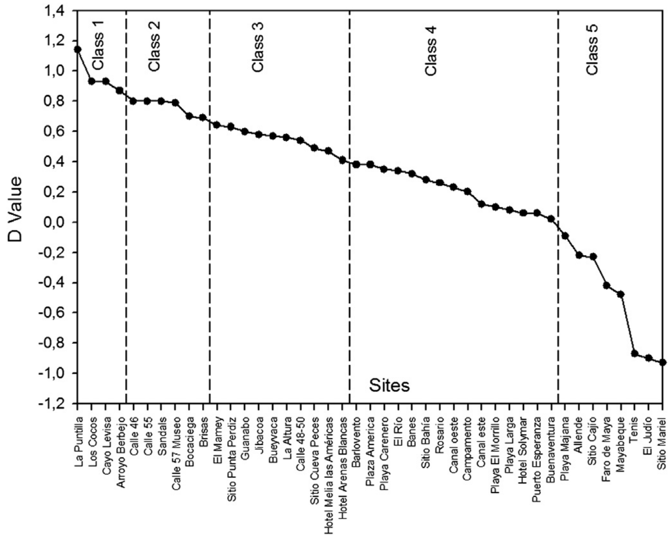

Fig. 5. Evaluation index curve for the western coast of Cuba.

attributes 1 and 2 (Fig. 3A); *vice versa* for a left hand skew e.g. Hotel Melia Las Americas and El Judio sites (Fig. 3B and C). High attribute values, *i.e.* 4 and 5, reflected the positive influencing impact of the physical/human parameter (e.g. Fig. 4A); whilst high weighted averages at lower attribute values (*i.e.* 1 and 2), reflect the adverse impact of the physical or human parameter (Fig. 4C and B).

Analysis of the Scenic Evaluation Value (D) for the 43 sites (Table 1, Fig. 5) gave the following results.

Class 1: Extremely attractive natural sites with a very high landscape values, having a D value above 0.85. A total of four beaches were classified within this category, i.e. La Puntilla (Fig. 6 A), Los Cocos (Fig. 6B), Arroyo Berbejo and Cayo Levisa. All (but one) are located in a rural area (northern littoral of Mayabeque, between La Habana and Matanzas) with excellent coastal scenery, such as, white sand, turquoise and transparent water and additional elements, such as, rock shore platform (La Puntilla), or developed dune ridges, natural vegetation cover and special landscape features (Arroyo Berbejo and Los Cocos). The non rural beach, Cayo Levisa, is located in a resort area in a cay at Pinar del Río (Table 1).

Class 2: Attractive sites with high landscape values and a D value lying between 0.65 and 0.85. Along the investigated littoral, six beaches were classified within this category, most located in Varadero (Prov. of Cárdenas). These sites generally rated lower than Class 1 due to a lower scoring of landscape features - they do not have special features, cliff or rock shore but show high scores with respect to water and sediment parameters, dunes and well developed vegetation cover. Five are located in Varadero both in urban (3) and resort (2) areas (Table 1).

Fig. 6. Examples of Class 1 (A, La Puntilla; B, Los Cocos), Class 3 (C, Hotel Melia Las Americas; D, Sitio Cueva Peces) and Class 5 sites (E, El Judio; F, Sitio Cajío).

Class 3: Little outstanding landscape features with a D value between 0.4 and 0.65. A total of 10 beaches belong to this category e.g. Hotel Melia Las Americas (Fig. 6C), Sitio Cueva Peces (Figura 6D), etc., found through the spectrum of rural (6), resort (2), urban (1) and village (1) areas (Table 1).

Class 4: Mainly unattractive urban sites having low landscape values, together with a D value which lies between 0 and 0.4. Fifteen beaches were classified within this category, consisting of rural (5), village (5), urban (3) and resort (2) areas. Both class 3 and 4 sites are common in the northern and southern coast of Cuba (Table 1).

Class 5: Very unattractive urban with intensive development and poor landscape values. Eight beaches e.g. El Judio (Fig. 6E), Sitio Cajío (Fig. 6F), belong to this category. Four are urban areas and three are village having features, such as, an absence of buffer zone, a degraded natural environment and poor skyline quality. In the southern coast, low values are essentially due to the presence of anthropogenic structures, i.e. groins and seawalls, for example, Playa Majana and Mayabeque (Table 1).

6. Discussion

6.1. Site characteristics and distribution

Classification of analysed sites very much depended on the geological setting, vegetation land cover and the degree of human occupation and related socio-economic activities. As seen from the results of scenery classifications given in many different countries (Ergin et al., 2010; Ergin, Karaesmen, & Uçar, 2011; Rangel, Correa, Anfuso, Ergin, & Williams, 2013; Williams, 2011; Williams, Sellars, & Phillips, 2007), sites with high scenic quality (Class 1) are generally located in natural protected areas, while very low scenic quality sites (Class 5) are observed in high urbanized areas with human parameters exhibiting low attribute values (for example, areas with an environmentally insensitive skyline). Such general findings were broadly confirmed in this study even if important differences were observed at some places. Despite the non-homogeneous distribution of investigated sites, the following general and specific trends can be highlighted.

With respect to beach sediment colour, which is linked to their origin, few beaches of terrigenous sediments are located in the northwestern part of the island, where the contribution of rivers that run through mountainous areas, guaranteed a sound sand supply. In most investigated sites, beach sediment composition and genesis varied, since materials of two large different sources occur in their formation, e.g. the production of marine bio-components and the terrigenous influence, the former giving rise to white/golden sediments (score 5 at point 6, Table 2); the latter giving rise to dark tan and light tan/bleached sediments (score 3–4 at point 6, Table 2).

All sites located in La Habana, Varadero (Prov. of Cárdenas, Matanzas) and the northern coast of Mayabeque, showed high scores for beach colour due to white or golden sand sediments (Table 2, points 4 and 6), composed of carbonates, and for water colour and clarity (Table 2, point 16). Such clear water and sediment quality was also observed at Cayo Levisa (Pinar del Río). In the north coast and in all cays around Cuba, it is evident that the prevalence of biogenic sand sectors, together with the oolitic-biogenic sectors, represents 93 percent of the beach area in the northwestern part of Cuba and the whole of the Sabana-Camaguey Archipelago, plus a good part of the northeastern coast of the island (UNEP/GPA, 2003). At Varadero and La Habana, clear water is often associated with white and golden sand and related to the absence of suspended sediments because rivers/streams generally drain rocky areas or small alluvial plains, consequently supplying relatively small amounts of fine sediments to the coast.

Concerning water colour and turbidity, dark colours are observed in different sites located close to mangrove swamps in the southern and north-western part of the investigated coast. This is because water that flows through streams and rivers originates in mangrove swamps and becomes stained dark brown by organic acids. This was observed at all sites at the southern coast of Artemisa (Sitio Cajío, Fig. 6D) and Mayabeque, at Puerto Esperanza (Pinar del Río) and the Cienaga de Zapata (e.g. Buenaventura – Fig. 7A, El Río and Playa Larga), where water colour was muddy/brown/grey (score 1 at point 16, Table 2). The sites located at the Peninsula of Zapata are protected under different categories (Ransar, Natural Park, etc.). Low scores were generally obtained at all sites for “valley” and “skyline landforms” (points 11 and 12, Table 2) because of the general flat morphology of the investigated area, the absence of valleys and the no visibility of skyline landform.

Natural vegetation cover (high score at point 17, Table 2) was generally well developed and represented by bushes and trees growing on dune ridges, one of the prevalent species being the *Coccoloba Uvifera* an evergreen plant common in the Caribbean. Vegetation cover was also particularly vigorous in sites backed by mangrove swamps, essentially in the Cienaga de Zapata, and the southern coasts of Artemisa and Mayabeque and (partially) at Pinar del Río. Vegetation debris (point 18, Table 2) was observed at very few places and mostly consisted of seaweed because both the intrinsic characteristics of the natural vegetation cover (which do not produce great amounts of debris in contrast with observations carried out along the Caribbean littoral of Colombia by Rangel et al., 2013) and the limited number of river/stream that supply great quantities of materials. An exception to this general trend was observed in sites backed by mangroves which produce great amounts of debris that are transported to the coast by small streams. Concerning human parameters, what must be highlighted

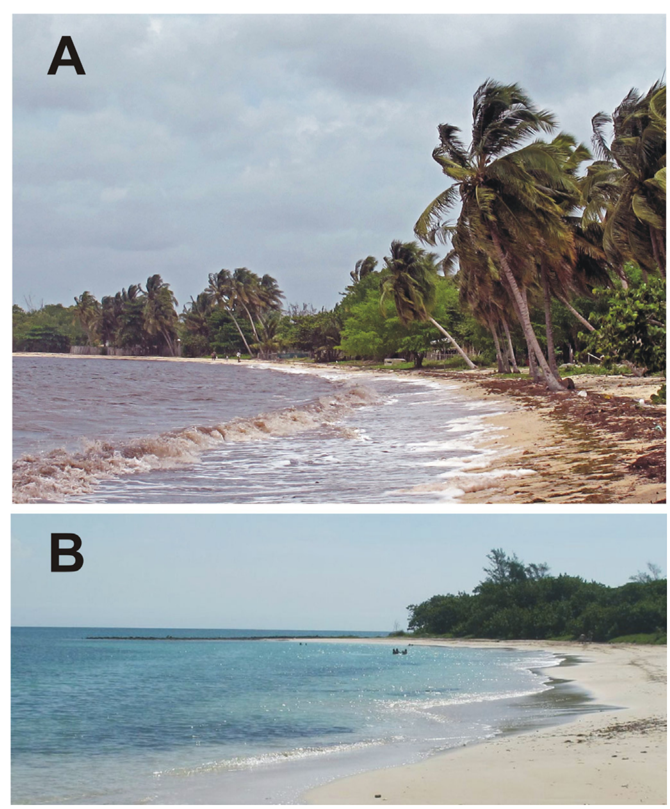

Fig. 7. A) Vegetation debris and dark brown water at Buenaventura, southern coast of Matanzas; B) Rock shore platform and clear and transparent water at Arroyo Berbejo, northern coast of Mayabeque.

was the absolute absence of evidence of sewage discharges (point 19, Table 2) in all investigated sites.

With respect to the specific spatial distribution of Class 1 sites, one, Cayo Levisa, is located in a cay in the northern of Pinar del Río. The beach shows very high scores for water and sediment characteristics, presence of dunes and vegetation and low impact of human factors, but does not present cliff and rock shore platforms, special coastal features, etc. because of the very specific cay morphological and geological characteristics. Other beaches belonging to Class 1 are located in a rural mountainous area (northern coast of Mayabeque) between La Habana and Matanzas. The geological and relief setting favour formation of several features, such as coastal rocky sectors, valleys and mountainous skyline landforms that increase the scenic value (Table 2). Specifically, rock sectors, essentially composed by sedimentary rocks, give rise to extended rock shore platforms and special landscape features which further increase the scenic value (point 14 in Table 2 (e.g. La Puntilla – Figure 6A, and Arroyo Berbejo, Fig. 7B). The small degree of human occupation, essentially represented by camping areas and isolated small kiosks and shops, does not give rise to low scores at human parameters. Well known beaches around the world, such as Long Reef (Australia), Ilha de Santa Catarina (Brazil) and Sumner (New Zealand) belong to this category (Ergin et al., 2006).

Most Class 2 sites are classified as urban and rural and are located in Varadero, a natural sand spit that has been urbanised since the 70s for the development of international tourism. Tojo Beach (Japan) belongs to this category (Ergin et al., 2006). A few of these Varadero beaches show a beach award (the only one existing in Cuba), named "Playa Ambiental" (Environmental beach); it was originally created in 2001 for the Varadero area to improve beach characteristics but nowadays the idea has been exported to other sectors of the Cuban coast. The award is based on continuous monitoring of 12 parameters concerning environmental beach parameters, e.g. microbiological, physic and chemical water characteristics, geomorphologic and legal aspects, waste water and litter management, beach facilities, beach carrying capacity, landscape value, etc.

Sites belonging to Classes 3, 4 and 5 are observed along all investigated sectors and their low classification corresponds to a progressive decrease of both natural and (especially) human parameters. The increase of human pressure and occupation in sites with intermediate scores corresponding to natural parameters, usually gives rise to Class 3 sites, Sitio Cueva Peces and Sitio Punta Perdiz (Cienaga de Zapata) being good examples. Both sites are located in attractive rural areas with excellent water colour and rock shore platform, but have low scores of human parameters due to the absence of a buffer zone (a littoral road and parking areas behind the shore) and a few utilities. The tip of Magellan Foreland (Ireland) and Austenmeer Beach (Australia) belong to this category (Ergin et al., 2006).

Class 4 broadly includes two categories of sites. Four out of five of the rural sites (Table 1) are natural environments with well developed vegetation cover but no attractive landscape. They show very little or no visible human occupation (good score at points 23, 24 and 25, Table 2), but achieve low score at water colour and clarity and vegetation debris – because they are located close to mangroves in the southern and north-western investigated coastline; and litter, which is accumulated on the beach but comes from the sea. The other (larger) group includes village, urban and resort areas that generally presented low scores for all human parameters apart from litter and noise. Magellan Foreland and the Burren Area in Ireland and Bondi Beach in Australia belong to this category (Ergin et al., 2006).

Class 5 sites includes urban areas with very unattractive skylines and built environment (urban beaches at Matanzas, Table 2), together with village areas having both poor water colour and vegetation debris (being sited close to mangroves) and low scores of human parameters especially because the presence of utilities such as groins, rip-rap revetments, etc., emplaced to counteract coastal retreat. Sitio Mariel, attended only by local young people, is located in an industrial and port area and it is not a bathing area approved by the Cuban government. Ergin et al. (2006) classified St George's Bay (Malta), Amroth (United Kingdom) and Manley (Australia) within this category.

6.2. *Implications for coastal management*

Evaluation of environmental physical and usage parameters makes possible identification and characterisation of those variables that must be managed in a more effective way in order to promote overall improvements of the scenic value. In this sense it must be highlighted that coastal occupation along the Cuban coast took place in different ways but two models of coastal development essentially exist which differ in the typology of developments and the tourist demand offered.

a) Settlements of small villages and residences for Cubans. It was especially observed in the southern and north-western part of the investigated coast where since the '80s, numerous human settlements were emplaced to satisfy local tourist demand. Although these beaches are not included in the group, which have the best potential for tourism purposes, they constitute an important recreational option for local population, and are of high social significance and management plans exist for their environmental improvement (UNEP/GPA, 2003). Such kinds of settlements were affected by different natural and human related processes. Coastal zone managers have to find ways, if possible, of improving/upgrading the different anthropogenic usage parameters and to alleviate the negative impact of natural ones. Specifically the north-western and southern part of the investigated coast presented negative scores because of the presence of litter and vegetation debris (Playa Larga, Campamento and El Río at Cienaga de Zapata) and different kinds of human structures (Playa Rosario, Sitio Cajío, Punta Esperanza, La Altura, Playa Banes, etc.). Concerning litter and vegetation debris (low score at point 18 and 20, Table 2), litter was essentially composed of different kind of plastic objects brought to the beach by waves and currents and the vegetation debris consisted of seaweed. Beach cleaning operations are usually organised at the beginning of the tourist season (July and August), but when field work for this paper was carried out (end of June, 2012) they were not implemented. If the presence of litter and seaweed is reduced at Playa Larga and Campamento, as is supposed to occur during July and August, the beaches improve to Class 3 and El Río upgrades to Class 2. Probably, if initial beach cleaning operation is carried out, than beach maintenance could take place at a weekly or even longer scale.

Construction and emplacement of promenades, summer houses, hotels, restaurants, groins, jetties, seawalls, etc. decreased the landscape value and affected coastal ecological significance and biodiversity. Coastal erosion has also a negative effect on scenery since it reduces beach width (point 5, Table 2) and induces emplacement of different structures (point 26, Table 2). According to UNEP/GPA (2003), 100 percent of beaches of the north and south coast of Cuba are affected by erosive processes. In detail, in the southern and north-western areas, beaches have been greatly affected by coastal erosion, e.g. Maybeque beach, Sitio Cajio, El Rio and Playa Rosario in the southern, and at Punta Esperanza, La Altura, Playa Banes, etc. in the north-western coast (Fig. 1). On the southern coast, erosion rates higher than 2.5 m/yr were recorded in the 1983–1993 period (UNEP/GPA, 2003) and further increase in erosion processes took place in following years because of the impact of Hurricanes Michelle in 2001 and Lili and Isidore in 2002. Additional retreat and human settlement destruction especially in the western and southern part of Cuba, was linked to Hurricanes Ivan (in 2004, US$ 1.2 billion of damages), Dennis (2005, US$ 1.5 billion) and Gustav and Ike in 2008, which respectively caused damage of 2.1 and 7.3 billion of US$. Perhaps the most illustrative example is that of Playa Rosario which was severely impacted with the disappearance of the sand fringe and the collapse of beach facilities and summer houses located near the shoreline. Only facility foundations and a coastal road at sea level position remain (Fig. 8A). At this site no reconstruction has taken place and a sense of desolation and sadness prevails. At other areas, coastal retreat has been counteracted in past years by the progressive and disorganized emplacement of numerous small and poorly designed groins, seawalls and riprap revetments. At Mayabeque many different types of structures have been emplaced greatly impoverishing the scenery (Fig. 8B), a common problem associated with coastal armouring is also the "coastal squeeze" (Doody, 2004), which takes place when a coastline is deprived of its potential landward migration by seawalls or other man-made structures emplaced in the backshore. Coastal erosive processes associated with sea-level rise and increasing storminess can cause the complete disappearance of the beach or mangrove swamps and deepening of nearshore areas fronting coastal structures (Pilkey & Dixon, 1996, 272 pp.).

On the northern coast, erosion rates of 3 m/yr for the 1983–1993 period were estimated for the sector east of La Habana (e.g. Bocaciega and Guanabo), the intense occupation of the beach by tourist facilities being the main erosion cause (UNEP/GPA, 2003). At Pinar del Rio and Artemisa, coastal erosion was less evident and linked to human actuations, e.g. dam constructions: by 1992, Cuba had completed construction of 200 dams and 800 micro-dams (Maal-Bared, 2006). At many localities, revetments were emplaced to protect houses, this being the case of La Altura and Playa Banes. A similar situation was also observed at Faro de Maya, a beach located in a rural area (Prov. of Matanzas). It exhibits superb water colour and white calcareous sand linked to the sediment supply from nearby algae communities and coral reefs that, at this point, is very close to the shoreline. The presence of coastal structures emplaced to protect a lighthouse, litter, vegetation debris and low sensitive designed skyline generally decreases the coastal scenic value, in spite of the lighthouse presence.

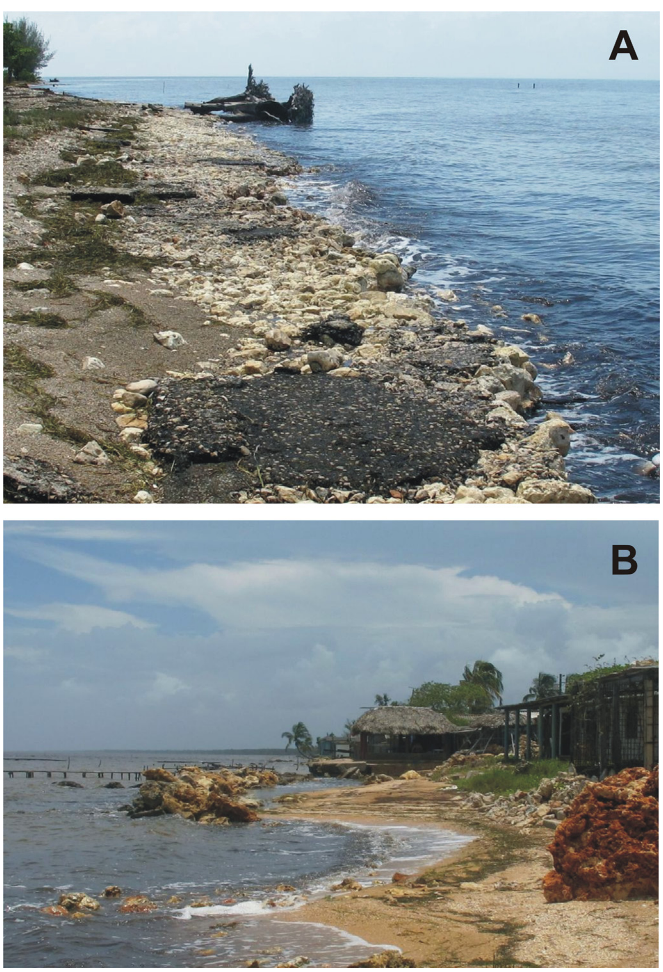

Fig. 8. Southern coast of Mayabeque: A) erosion at Playa Rosario and B) coastal defence structures at Playa Mayabeque.

b) Constructions of large tourism developments according to the practices and models of coastal occupation inherited from Europe and the USA (Taylor & McGlynn, 2009). Examples of this type of coastal occupation are observed at different localities - such as Varadero, La Habana, Turiguano, Cay Coco, etc. This model of coastal development started in the '70s but experienced a great increase between 1990 and 2000 (Taylor & McGlynn, 2009), when the number of hotel rooms in Cuba, in pace with arrivals, doubled from 18,565 to 37,178 (Pérez-López, 2002). In La Habana alone, the total number of rooms increased from 4682 in 1988 to 12,002 in 2002. To make this expansion possible, Cuba engaged in joint ventures with foreign companies that possessed financial, technical, and marketing expertise (Espino, 2000a). With the expansion of tourism, Cuba increased the quality as well as the quantity of available rooms; in fact the quality of hotels during the nineties was typically lower than that of competing Caribbean destinations (Espino, 2000b). In 1998, only 7.1 percent of the hotels in Cuba had a 5 star rating, 30 percent had 4 stars, and 66 percent were either 2 or 3 stars.

At the same time, the offer for cheap accommodation in the self-employment sector greatly increased. After 1993 the government allowed local people to rent rooms in their homes to tourists, with an increase of such kind of accommodation from 1537 (in 1998) to 4980 (in 2002), Taylor and McGlynn (2009). In this contest, according to Maal-Bared (2006), the most extravagant tourist areas, such as Varadero, Cay Coco, Turiguano, Jiguey, and Cay Cruz not only experienced an increase in hotel numbers but also in associated infrastructures, such as, causeways and other bridge structures between archipelago islands. Developments at cays consisted of hotels and resorts, composed of isolated bungalows in general well integrated into the natural environment. Varadero symbolizes the principal beach resort of the Country and represents an area where the economic plans of the Cuban authorities, the profit prospects of joint venture companies meet the vacation dreams of tourists (Tribe & Snaith, 1998). It also constitutes a very particular coastal sector from the socio-economic and environmental point of view, because of the tourist development that it is experiencing and its vicinity to large urban and industrial towns as La Habana, Matanzas and Cárdenas.

With respect to coastal scenery classification, it is interesting to notice the high scores presented by Varadero beaches, considering their elevated level of human occupation. In general, Class 2 areas mainly correspond with natural sites with high landscape values and low intrusion of human presence (very acceptable anthropogenic activities/structures, Ergin et al., 2010; Ergin et al., 2011; Williams et al., 2007; Williams, 2011; Rangel et al., 2013). The very good scores observed at Varadero beaches (Table 1) are linked to an important change in the approach to coastal erosion and environmental problems, such as ones related to human usage of backbeach and dunes. At Varadero, at the beginning of the 1970s, beaches began to evidence certain levels of water and air pollution linked to the increase in oil exploitation in the area (UNEP/GPA, 2003), together with strong erosive processes mainly in the urbanized sector. The causes for beach and dune erosion at Varadero were sand mining, emplacement of jetties and construction of houses, buildings and other structures on the dunes (Garcia & Juanes, 1996). Sand mining in beach, dune and nearshore was the main reason for beach erosion and constituted a normal practice until 1978, with an estimated volume of illegally dredged sand of 2 millions m^3. Jetties were emplaced in 1956 in the western part of the spit to stabilize an artificial navigation channel built to connect a coastal lagoon with the open sea. Lastly, *circa* 150 hard structures (buildings, houses, etc.) strongly interfered with coastal marine and aeolian processes because they were built in backbeach and dune areas along a 5 km long coastal sector. All the above initiatives securely favoured erosion problems and greatly reduced coastal aesthetic characteristics.

An important change in environmental issues was recorded since the late ‘70s, and in 1986–1987 the National Institute of Tourism, in collaboration with the Institute of Oceanology, elaborated a management plan whose aim was to solve the aforementioned environmental problems. After 1996, interventions were co-ordinated by the new formed “Office for the Management of Varadero Beach”, the institution in charge of providing and executing solutions to existing problems, which represents the interface between the Cuban Ministry of Tourism and the Cuban Ministry of Science, Tecnology and Environment (UNEP/GPA, 2003). The most important initiatives consisted in the protection of facilities, the guidance to investors for the location of new tourist and public works, regeneration, monitoring and periodic maintenance of beach, rehabilitation of dunes and their natural vegetation, and the establishment of environmental training activities. Specifically, in order to achieve an integral view of these actions, at the end of 2000, was created a multidisciplinary group to carry out a “Physical–Environmental Diagnosis of Varadero Beach” that allowed identification of the problems and to elaborate and put into practice an “Integrated Action Program for the Recovery, Maintenance and Improvement of the Beach” (UNEP/GPA, 2003). The programme has the following main objectives:

i) protect and manage the coastal system, its elements, resources and processes as natural basis of all the tourist exploitation to which the zone is subject;
ii) recover and improve beach sectors that currently present an unfavourable situation as regards their ecological-environmental functioning and their aesthetic scenic view and
iii) contribute to the success of the tourist activity that currently takes place in the peninsula, offering a favourable image of its natural environment.

In order to understand beach behaviour, several monitoring program were implemented. The first was carried out with a monthly periodicity during the 1978–1994 time span (Garcia & Juanes, 1996; Juanes, 1995,129 pp.). It indicated the predominance of a east to west transport, beach seasonal behaviour (erosion takes place during winter and it is related to the impact of huge waves linked to cold fronts formed in the Gulf of Mexico, Juanes, Ramírez, Caballero, Medvediev, & Yurkevich, 1986), and long term evolution (obtained retreat rates ranged from 0.72 to 1.8 m/yr, *i.e*. an average sand loss of 50,000 m^3/yr, Garcia & Juanes, 1996). Observed erosion trends continued in following years (Izquierdo, 2004).

One of the most important achievements of new management initiatives was the execution of various beach and dune nourishment projects (Juanes, García, Martell, & Rodríguez, 1993, 19 pp.). Such activity improved scenic value, increased beach carrying capacity and efficiently protects the backbeach, since inland areas become more vulnerable to hurricanes and tropical storms when the dune line is weakened. The first beach nourishment project consisted in the injecting of around 700,000 m^3 of sand during the 1986–1992 period. As a tangible result, an evident improvement in the aesthetic and recreational conditions of the beach was observed, *i.e.* it was able to resist heavy storm seasons recorded in February 1992 and March 1993, but recorded erosion and damages to tourist structures in October 1996 because of strong waves associated with Tropical Storm Josephine. In response to this, during summer 1998, 1,087,835 m^3 of sand were split along a 12 km long coastal sector to enlarge the beach and reinforce the dune foot (Caballero, Juanes, Izquierdo, Hernández, & Guerra, 2006). After the passage of Hurricane Michelle in 2002 new nourishment works were carried out in 2003 and 2004: injected volumes (456,686 m^3) increased the dry beach width by 140,000 m^2 and borrow sand was also used to restore the dune ridge along a 2 km long sector (Caballero et al., 2006). Nourished sand was dredged in the nearshore, which had a light tan colour with greyish tonalities being composed of biogenic material, essentially algae (40 percent), foraminifera (20 percent) and molluscs (19 percent). This fact generated certain discontent, as local beach users were used to white coral sand. Actually, sand color changes due to beach nourishment is unwelcome by beach users, and even more if borrow sediments are darker than native ones (Pranzini, Simonetti, & Vitale, 2010). Several erosive ‘hot spots’ exist today along Varadero beach linked to a general sedimentary deficit and the existence of irregular nearshore sandbars that control wave refraction, thereby concentrating wave energy at specific points (Izquierdo, 2004, 2006). From 2008 to the present day, several minor nourishment works were carried out according to the results of a detailed beach monitoring program.

Further works are being carried out by the local agency of the Ministry of Science, Technology and Environment (CITMA) under Law 212 for Coastal Zone Management. Specifically, cleaning, restoration and recovery of environmentally degraded spaces have been carried out at several places. Hotels, houses and other kind of hard structures constructed on dune ridges have been demolished and dune reconstruction and stabilization enhanced by means of sand nourishment, construction of pathways, planting of native vegetation or emplacement of fences to facilitate and accelerate sand accumulation.

Overall, realised interventions have enlarged beach widths, protected and enhanced dune formation, which prevents loss of life and property during storms and hurricanes and also preserves and increases the coastal beauty and natural ecosystems protection. As a tangible result, many physical and human parameters of coastal scenery characterization gained good scores at urban and resort areas at Varadero because of the modalities of adopted environmental recovery solutions (Table 1). Beach nourishment works favoured formation of large beaches composed of white or bleached sands, e.g. high scores at points 4, 5 and 6 of Table 2. Sediment grain size and colour was also responsible for high score at water colour and clarity (point 16, Table 2). Dune reconstruction and vegetation recovery directly influenced physical parameters (e.g. point 10 and 17, Table 2) and, indirectly, did several human parameters (points 19, 22, 23, 24 and 25, Table 2). In fact a well vegetated dune works as a buffer area between beach and backing urbanised areas – that reduces noise disturbance linked to urban traffic and increases skyline quality constituting a natural protection to any bad visual impact of the built environment.

7. Conclusions

Cuba recorded a great increase in tourist arrivals in past decades and tourism nowadays represents important revenues for the Country. The 87 percent of visitors, who visited Cuba for leisure holidays, were essentially interested in enjoying the beach. One of the most important aspects of the bathing area is scenery, which depends on natural parameters and human interventions on original environment. Using the checklist methodology gave important and useful information on coastal scenic characteristics together with the present state of different bathing areas in the northern and southern part of western Cuba. Investigated sites belong to a great spectrum of typologies, from rural, village and resort to urban areas and support different kind of tourist developments and activities. Glavovic (2006) has argued that strategic imperatives to transform

CZM/BM thinking must include: authentic public participation, improved knowledge and understanding, collaborative management and have to have a practical focus. This scenic assessment technique emphasises these points and adds greatly to any information data base. Management, CZM or BM, should pay cognisance to the importance of scenic attributes for tourists and this is especially so with respect to new developing world tourist destinations.

Class 1 sites show small anthropogenic impacts since they are located in rural and (one) resort areas in the northern coast and are linked to very clear water and sediment colour and the presence of features, such as, coastal cliffs, rock shore platforms and mountainous areas. Class 2 sites are mostly located at Varadero, the most important international tourist destination in the Country, and include resort and urban areas, which have good scores of water and sand characteristics, but they do not have special features, e.g. cliffs or rocky shores. It is important to highlight that their high score is not only linked to their intrinsic natural characteristics, but also to proper coastal management polices carried out by local administrators. In last two-three decades, existing human constructions within dunes and the backshore plus hard coastal defense structures were partially removed, and beach nourishment works and dune restoration programmes carried out to increase beach width, improve coastal scenic value and protect the backbeach from hurricanes impacts.

Class 3 and 4 sites correspond to a progressive decrease of both natural and human parameters. They include sites with different degree of human occupation, essentially linked to local tourism and are located in the southern and westernmost coast. Their poor classification is due to low scores of natural parameters, because the presence of dark/brown water-colour and vegetation debris linked to swamp areas and locally, to human interventions. Class 5 sites show low scores at natural parameters, especially human ones. They consist of unattractive bathing sites located in urban areas or villages and rural areas where, at places, ongoing severe erosion processes were counteracted by the chaotic emplacement of small and poor designed protective structures that greatly degraded scenic quality. Concerning classes 3 to 5 sites - that quite often have a high social significance for national beach users - different situations can be highlighted. In very urbanised areas almost nothing can be done to improve the low human parameter score and in a few rural and village areas, scenic characteristics can be improved by removing hard and disorganised existing protective structures and implementing beach nourishment and dune restoration projects.

Overall, the geographical and geological setting and natural vegetation cover greatly conditioned the scenic value of the investigated sites in a positive or a negative way. The degree and type of human occupations and management strategies carried out by local administrators to counteract coastal erosion processes, achieved a great importance in coastal scenery. A positive example of this being the initiatives carried out at Varadero, and this is a model that could be exported to other coastal areas. Presently, management plans also exist for environmental improvement of southern areas.

Last, it must be highlighted that the checklist methodology for coastal scenic classification can be easily applied to other coastal areas in the Caribbean Sea which is an important and growing destination for international tourist market. The methodology used can be useful to proper organize coastal occupations in growing areas and improve coastal scenic qualities and environmental conditions in developed coastal sectors.

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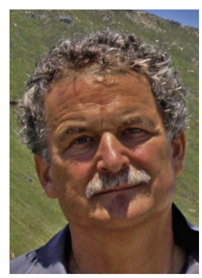
Giorgio Anfuso is Professor of Coastal Geomorphology at Cadiz University (Spain) and carries on research on coastal morphodynamics, evolution and management.

Allan T. Williams is a Professor at the Swansea Metropolitan University (UK), working on coastal processes, geomorphology, tourism management, litter and coastal scenery.

Juan Alfredo Cabrera worked during many years at the Environmental Office of Varadero (Cuba) and nowadays is professor at the University of Matanza, working on Coastal Zone Management.



Enzo Pranzini is Professor of Coastal Geomorphology at Firenze University (Italy) and works on coastal processes and erosion management carrying out intensive collaboration with Public Administrations.