Ocean & Coastal Management 142 (2017) 173–185

Contents lists available at ScienceDirect

Ocean & Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

Evaluation of the scenic value of 100 beaches in Cuba: Implications for coastal tourism management

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A R T I C L E I N F O

Article history:
Received 15 September 2016
Received in revised form
25 March 2017
Accepted 31 March 2017

Keywords:
Coastal scenic evaluation
Physical and human parameters
Fuzzy Logic Assessment (FLA)
Tourism

A B S T R A C T

This paper provides coastal scenic values of 100 sites along coastal Cuba by the use of a weighted, fuzzy logic, based checklist containing 26 physical/human factors. Sites were categorized into five classes from Class I, top grade scenery, to Class V, poor scenery. Seven beaches belonged to Class I, *e.g.* rural areas with a low impact of human activities and high scores of natural parameters. Most Class II beaches were located at international resort areas in cays having white coral sand beaches, turquoise water and vigorous vegetation together with a low impact of tourist developments because of appropriate location and design. Classes III, IV and V presented a wide distribution and their lower scores were linked to a poor environmental setting. Results allow for improvements to beach management plans to be formulated for current international tourist destinations (in cays) and other potentially attractive coastal areas at new developing tourist destinations.

1. Introduction

In order to benefit from coastal tourist demand (Clark, 1996; Houston, 2013), many tourism oriented countries, *e.g.* around the Mediterranean, the Caribbean, etc., have developed proactive growth policies along the coastal area (Klein et al., 2004; Benoit and Comeau, 2005). The "3 S" market (Dodds and Kelman, 2008) achieves great importance in the Caribbean region which recorded 23.9 million visitors in 2015, with Cuba increasing by 5% from 2013 to 2014 and 18% from 2014 to 2015, giving a total of 3491 million visitors (UNWTO, 2015; 2016).

Most tourists, especially at good weather destinations, are interested in the bathing area (Botero et al., 2013; Williams, 2011; Williams et al., 2016) and numerous questionnaire surveys have showed that five parameters have been of prime importance with respect to beach choice (Williams and Micallef, 2009; Williams, 2011): "safety, facilities, water quality, no litter and scenery" and the latter is the focus of this paper.

In a first study, carried out in June 2012 by Anfuso et al. (2014), 43 beach sites located in north-western Cuba were classified from a scenic viewpoint. In a following investigation, carried out in May and June 2015, 57 additional beaches were classified along the central and eastern coast of Cuba. Results from the previously mentioned investigations (*i.e.* 2012 and 2015) have been incorporated into this paper (Fig. 1, Table 1), which provides a general and complete scenic assessment view of the Cuban coast so allowing considerations for coastal zone management.

2. Study area

The Cuban Archipelago, located in the Caribbean Region (Fig. 1), contains the Island of Cuba, the Isla de la Juventud (Island of Youth) and more than 1200 smaller islands and cays, with a total extension of 110,922 km^2. Three main chains of cays and reef crests are developed in shallow waters of the submarine plains of the Cuban insular shelf; Archipelago Jardines de la Reina and Archipelago

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http://dx.doi.org/10.1016/j.ocecoaman.2017.03.029
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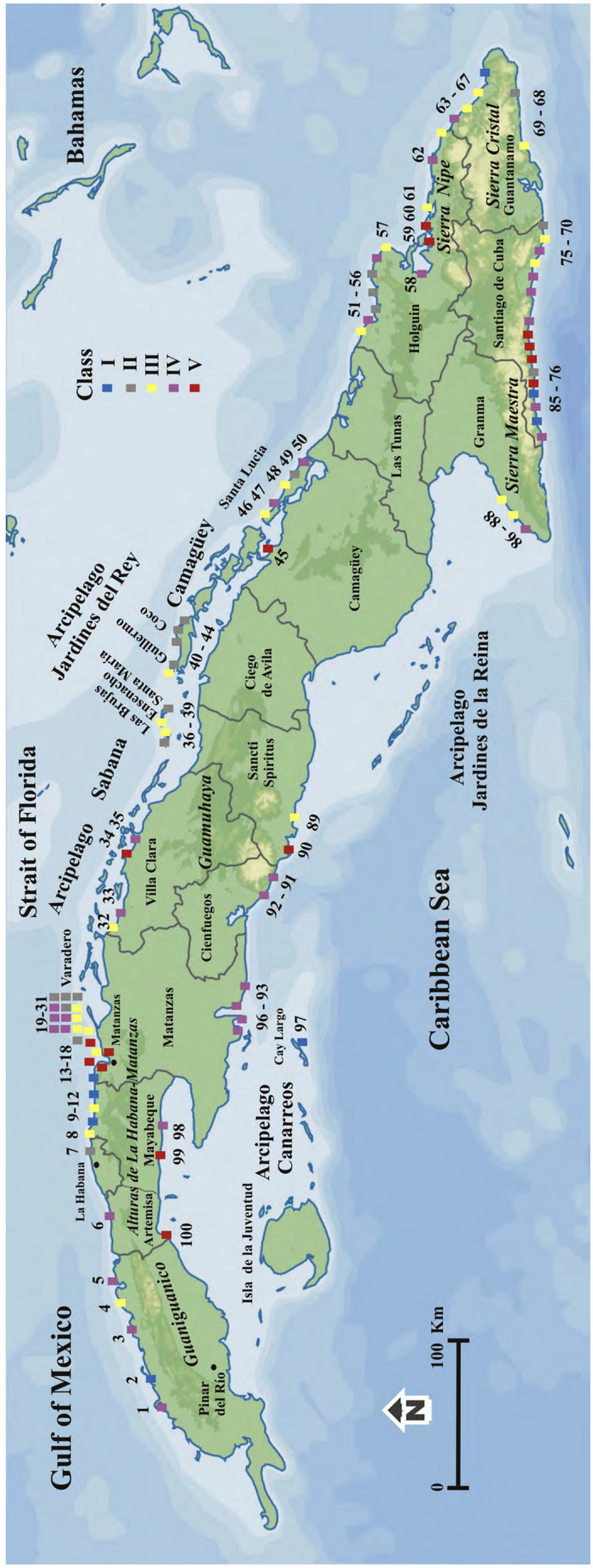

Fig. 1. Location map of investigated sites.

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

No	Site	Location	Type	Tourist	Score	Class
1	Puerto Esperanza	Pinar del Río	Village	N	0,06	IV
2	Cayo Levisa	Pinar del Río	Resort	I	0,93	I
3	Playa El Morrillo	Pinar del Río	Village	L	0,10	IV
4	La Altura	Pinar del Río	Rural	L	0,56	III
5	Playa Carenero	Pinar del Río	Rural	L	0,35	IV
6	Playa Banes	Northern Artemisa	Village	L	0,32	IV
7	Bocaciega	La Habana	Village	N	0,70	II
8	Guanabo	La Habana	Village	N	0,60	III
9	La Puntilla	Northern Mayabeque	Rural	N	1,14	I
10	Jibacoa	Northern Mayabeque	Rural	N	0,58	III
11	Los Cocos	Northern Mayabeque	Rural	N	0,93	I
12	Arroyo Berbejo	Northern Mayabeque	Rural	L	0,87	I
13	El Judío	Matanzas	Urban	L	−0,90	V
14	Tenis	Matanzas	Urban	L	−0,87	V
15	Allende	Matanzas	Urban	L	−0,22	V
16	El Mamey	Matanzas	Rural	L	0,64	III
17	Bueyvaca	Matanzas	Rural	L	0,57	III
18	Faro Maya	Matanzas	Rural	N	−0,42	V
19	Canal Oeste	Cárdenas	Rural	L	0,23	IV
20	Canal Este	Cárdenas	Urban	N	0,12	IV
21	Calle 46	Cárdenas	Urban	I	0,80	II
22	Calle 48-50	Cárdenas	Urban	I	0,54	III
23	Calle 55	Cárdenas	Urban	I	0,80	II
24	Calle 57 Museo	Cárdenas	Urban	I	0,79	II
25	Plaza America	Cárdenas	Resort	I	0,38	IV
26	Arenas Blancas	Cárdenas	Resort	I	0,41	III
27	Las Américas	Cárdenas	Resort	I	0,47	III
28	Sandals	Cárdenas	Resort	I	0,80	II
29	Solymar	Cárdenas	Resort	I	0,06	IV
30	Barlovento	Cárdenas	Urban	I	0,38	IV
31	Brisas	Cárdenas	Resort	I	0,69	II
32	Playa El Salto	Villa Clara	Rural	N	0,58	III
33	La Panchita	Villa Clara	Village	N	0,05	IV
34	Isabela	Villa Clara	Village	L	−1,08	V
35	La Punta	Villa Clara	Village	L	0,18	IV
36	Punta Periquillo	C. Las Brujas, Villa Clara	Resort	I	0,75	II
37	Hotel Iberostar	C. Ensenacho, Villa Clara	Resort	I	0,43	III
38	Hotel Meliá (CSM)	C. Santa María, Villa Clara	Resort	I	0,41	III
39	Las Gaviotas	C. Santa María, Villa Clara	Rural	I	0,81	II
40	Playa Pilar	C. Guillermo, Ciego de Ávila	Resort	I	0,76	II
41	Hotel Meliá (CG)	C. Guillermo, Ciego de Ávila	Resort	I	0,76	II
42	Campismo Uva Calita	C. Coco, Ciego de Ávila	Resort	N	0,62	III
43	Playa Larga (CA)	C. Coco, Ciego de Ávila	Resort	I	0,76	II
44	Hotel Sol Cayo Coco	C. Coco, Ciego de Ávila	Resort	I	0,72	II
45	Playa Piloto	Camagüey	Rural	L	−0,30	V
46	S. Lucia La Boca	Camagüey	Resort	I	0,40	III
47	S. Lucia Playa Coco	Camagüey	Rural	L	0,03	IV
48	S. Lucia Natural	Camagüey	Rural	N	0,58	III
49	S. Lucia Tararaco	Camagüey	Resort	I	0,74	II
50	S. Lucia La Concha	Camagüey	Rural	N	0,29	IV
51	Playa del Puerco	Holguín	Rural	L	0,48	III
52	Los Bajos	Holguín	Rural	L	0,31	IV
53	Playa Blanca (H)	Holguín	Resort	I	0,66	II
54	Don Lino	Holguín	Resort	I	0,79	II
55	Playa Pesquero	Holguín	Resort	I	0,81	II
56	Guardalavaca	Holguín	Resort	I	0,26	IV
57	Puerto Rico	Holguín	Rural	L	0,43	III
58	Morales Laguna	Holguín	Rural	L	0,15	IV
59	Juan Vicente 1	Holguín	Village	L	−0,53	V
60	Juan Vicente 2	Holguín	Village	L	−0,29	V
61	Corinthia	Holguín	Rural	L	0,54	III
62	Mejia	Holguín	Rural	N	0,02	IV
63	Maguana	Guantánamo	Rural	I	0,47	III
64	Toa	Guantánamo	Rural	L	0,21	IV
65	Duaba	Guantánamo	Rural	L	0,51	III
66	Cajuajo	Guantánamo	Rural	L	0,42	III
67	Playa Bariguita	Guantánamo	Rural	N	0,92	I
68	Cajobabo	Guantánamo	Rural	L	0,68	II
69	Imias	Guantánamo	Village	L	0,51	III
70	Baconao	Santiago de Cuba	Rural	L	0,80	II
71	Cazonal	Santiago de Cuba	Rural	N	0,47	III
72	Sigua	Santiago de Cuba	Rural	S	0,29	IV
73	Verraco	Santiago de Cuba	Rural	N	0,40	III
74	Juragua	Santiago de Cuba	Rural	N	0,31	IV
75	Siboney	Santiago de Cuba	Urban	N	0,29	IV

(*continued on next page*)

Table 1 (*continued*)

No	Site	Location	Type	Tourist	Score	Class
76	La Estrella	Santiago de Cuba	Village	L	0,39	IV
77	Mar Verde	Santiago de Cuba	Resort	L	−0,19	V
78	Buey Cabon	Santiago de Cuba	Rural	L	−0,07	V
79	Caletón Blanco	Santiago de Cuba	Rural	N	−0,02	V
80	Hicacal	Santiago de Cuba	Rural	L	0,73	II
81	El Frances	Santiago de Cuba	Rural	L	−0,10	V
82	Playa Colorada	Santiago de Cuba	Rural	N	0,91	I
83	Sierra Mar	Santiago de Cuba	Resort	I	0,38	IV
84	Playa Blanca (S)	Santiago de Cuba	Rural	N	1,03	I
85	Chivirico	Santiago de Cuba	Rural	L	0,04	IV
86	Las Coloradas	Granma	Village	L	0,37	IV
87	Playa Carenero	Granma	Rural	L	0,51	III
88	Playa Levisa	Granma	Rural	L	0,62	III
89	Ancón	Sancti Spiritus	Resort	I	0,48	III
90	La Boca (SS)	Sancti Spiritus	Village	L	−0,24	V
91	Yaguanabo	Cienfuegos	Rural	N	0,22	IV
92	Playa Ingles	Cienfuegos	Rural	L	0,04	IV
93	El Río	Southern Matanzas	Rural	L	0,34	IV
94	Campamento	Southern Matanzas	Rural	N	0,20	IV
95	Playa Larga (M)	Southern Matanzas	Village	N	0,08	IV
96	Buenaventura	Southern Matanzas	Village	L	0,02	IV
97	Playa Sirena	C. Largo, Southern Matanzas	Resort	I	0.86	I
98	Playa Rosario	Southern Mayabeque	Rural	L	0,26	IV
99	Playa Mayabeque	Southern Mayabeque	Village	N	−0,48	V
100	Playa Majana	Southern Artemisa	Village	N	−0,09	V

Canarreos on the southern coast and, on the northern coast, Archipelago Sabana-Camagüey, the longest (450 km) includes all cays from Varadero to Santa Lucía (Fig. 1).

The central part of Sabana-Camagüey Archipelago, some 200 km long, is named Jardines del Rey and includes five main cays in Ciego de Ávila and Villa Clara provinces. In the former lies Cay Coco, the largest cay with 22 km of fine sand beaches and Cay Guillermo, with 5 km of attractive beaches. At the latter, occurs Cay Santa María, with 10 km of sand beaches which is a UNESCO protected area, Cay Ensenacho, with just two beaches, and Cay Las Brujas with 2 km of sandy beaches (Fig. 1).

Cuba has a Köppen-Geiger classification, tropical savanna (Aw) climate with an average temperature of 25° C. The dry season starts in November and ends in April, with winter having the least precipitation. The wet season starts in May and ends in October, with the heaviest rainfall occurring in summer. The main meteorological events are associated with the Trade winds (Alisios) from the Atlantic Ocean (predominantly during summer time), the tropical hurricanes (from August to October) and the cold fronts from the Gulf of Mexico (Reguero et al., 2013).

Cuba essentially consists of coastal flats and interior mountainous areas. The Guanicanico Complex is developed along the Pinar del Rio and Artemisa provinces with a total length of about 160 km and maximum height of c. 700 m. It consists of two mountain chains (Sierra de los Organos and Sierra del Rosario) composed of sedimentary and metamorphic rocks of Jurassic age. The Alturas (heights) of La Habana-Matanzas, composed of folded and faulted sedimentary Cretaceous rock presents a smaller length with a maximum height of 380 m. The Complex of Guamuaya includesSierra Trinidad and Sierra Escambray in Sancti Spíritus, Villa Clara and Cienfuegos provinces. It is composed of metamorphic rocks from Jurassic, Cretaceous to the Paleocene, and reaches a maximum height of 1140 m. Sierra Maestra, Sierra Cristal and Sierra Nipe reach a maximum height of 1974 m and run along 250 km in the south-eastern part of Cuba, *i.e*. Granma, Santiago de Cuba and Guantanamo provinces. They are composed of volcanic and sedimentary Paleocene rocks.

Cuba has more than two hundred rivers. The coast is micro-tidal characterized by exposed and embayed coastal sectors consisting of sand beaches (16%), mangrove swamps (40%), carbonate rocky shores (*e.g.* beachrock, 30%) and cliffs (14%) of different composition. Cuban beach sediments may be classified as biogenic (formed by calcareous remains of marine organisms), oolitic (formed by precipitation of calcium carbonate), and terrigenous (formed by sediment eroded/transported by rivers), UNEP/GPA (2003). Terrigenous supplies have been greatly reduced in past decades because of the construction of more than 200 dams and 800 micro-dams (Maal-Bared, 2006).

Open coastal sectors formed by sand beaches (with dunes at a few places) and cliffs predominate in the provinces of La Habana, on the northern coast of Mayabeque, in southern Matanzas and Cienfuegos, at Holguin, Santiago de Cuba and Guantanamo. Long and uninterrupted sand beaches are especially observed at the open side of cays and at the 22 km long Hicacos Peninsula a natural sand spit on which is located Varadero (Cárdenas, Province of Matanzas). Mangrove swamps are especially abundant on sheltered coastlines protected by fronting cays and in embayed sectors, along the southwest coast (Menéndez et al., 1994, 2004).

Coastal areas are not excessively populated with 10% (c. 1 million) of Cubans living along 5746 km of coastline. Cuban tourism is highly concentrated in two areas, La Habana and Varadero (Cerviño and Cubillo, 2005). Other areas of tourist interest, especially because of the great affluence of international visitors, are the Archipelago of Sabana-Camagüey and, in a lesser extent, Canarreos (Fig. 1).

3. Coastal tourism in Cuba

Present tourism in Cuba is still largely based on the “3 S” market (Dodds and Kelman, 2008) despite efforts to promote other attractions, such as, history, colonial architecture, nature and ecotourism (Cerviño and Cubillo, 2005; Pérez et al., 2013).

The Tourism Ministry created in 1994, targeted eight regions around the island for tourism development. The two poles of La Habana and Varadero beach concentrate together 70% of tourist revenues (Cerviño and Cubillo, 2005). To have a better balance throughout the island, importance has been given from 1999 to 2004 to six other regions by investing US$700 million in regional infrastructure, *e.g.* for 10 international airports (Cerviño and Cubillo, 2005). The new areas include principally “sun, sand and sea” destinations in Jardines del Rey cays, North Camaguey (Santa Lucía area) and the Archipelago of Canarreos (Fig. 1), and places located at - or close to - the majority of Cuba's natural, historic, and cultural attractions, including the UNESCO World Heritage Sites, *e.g.* North Holguin area, Santiago de Cuba, and the Trinidad (Sancti Spiritus) - Cienfuegos area (Cerviño and Cubillo, 2005).

Jardines del Rey cays, the prime developing area among the new six sites, commenced development at the end of the 1980s and actually has a total capacity of 20,000 hotel rooms generally in 4–5 star international resorts. The first hotel, named Jardines de los Cocos - currently Trip Cayo Coco, was constructed in 1993 at Cay Coco. At this locality an international airport, a marina with a 300 slip capacity and several golf courses exist. An international airport and a marina can also be found at cay Las Brujas. In 1990, construction of a 48 km long motorway connecting cays to the mainland was finished, the motorway being emplaced on an artificial fill interrupted by 46 bridges to guarantee good water circulation (Cerviño and Cubillo, 2005).

An important further change in tourism, not discussed by Anfuso et al. (2014), is taking place in Cuba - *i.e.* the opening up of the country to USA visitors. A first increase of US visitors was recorded in 2014 with 91,000 visitors and 150,000 in 2015 because of the re-establishment of direct flights between USA and Cuba and of ferry and cruise ships. At least in the near term (Padilla and McElroy, 2007), the opening of Cuba to US tourists and investors is likely have major repercussions in the internal market on competing destinations (Henthorne and Miller, 2003). Furthermore, political unrest in other counties, *e.g.* Kenya, Tunisia, Turkey, Libya, and Egypt will undoubtedly further increase the tourism potential for Cuba.

The internal market will probably record a readjustment (lowering) of prices because of the visitor increase of US tourists (Romeu, 2008). The future opening of the Cuban market is also producing changes in the internal US market, *i.e.* Miami is seen as vulnerable to a Cuban comeback as a US vacation destination, given they both offer sunny getaways during winter months (www.miamiherald.com, 2016) and Miami coastal managers plan to lobby the state for beach-re-nourishment money as a way of protecting the Sunshine State from its rival in the south.

4. Methods

Landscape value has been assessed by means of many techniques such as photographs, landscape assessment numbers, best-worse scores from grid squares, scenic uniqueness, public attitudes and perception etc., *e.g.* Leopold (1969), Penning-Rowsell (1982), Kaplan and Kaplan (1989) and the Countryside Council for Wales (CCW, 1996, 2001).

In this paper the methodology used was a result of a three year research project funded by the British Council (BCR, 2003) subsequently rewritten and published by Ergin et al. (2004). Initial interviewees of >1000 bathing area users chosen by random number tables in the UK, Turkey and Malta were asked the question, ‘what are the essential parameters that make up a beautiful coastal scene’ and the converse, ‘coastal ugliness’ (Ergin et al., 2004). Replies were analyzed and the number of times a parameter mentioned summed. A large break point was found at 26 parameters - 18 physical and 8 human (Table 2). In a checklist, these 26 parameters (x axis) were attributed a value (y axis) ranging from a low (1) to high rating (5). These were then ranked (most to least important) by additional beach surveys (n= >500), enabling a weighting parameter to be added to the computer algorithm. When investigating what parameters were important, most previous investigations frequently have ignored this point, as all parameters are NOT equal, some are more important than others. There is also a possibility of the assessor ticking the wrong attribute box due to uncertainty in the values shown. Fuzzy Logic Assessment (FLA; Patel, 2002) was applied to the programme as it eliminates this possibility - a jump of two attributes is extremely unlikely, *e.g.* checking an attribute 2 rather than 4 (Table 2). All an assessor has to do is put a tick in the relevant box of the 26 parameters. A detailed account of this methodology can be found in Ergin et al. (2004).

Assessment matrices were calculated for all sites and presented as histograms, membership degree of attributes and weighted average of attributes (Ergin et al., 2004, 2006; Williams et al., 2007; Rangel-Buitrago et al., 2013). Histograms provided visual summaries for all 26 parameters and are very useful for immediate assessment of high and low rated attributes. Similarly, the membership degree vs. attribute curve presented an overall scenic assessment where curve interpretation is based on the skew. Weighted averages delineated the relative comparisons of physical and human parameters.

Based on the above summed parameter evaluations, a final value (D; Fig. 2) is computed, which divides coastal scenery into five distinct classes: Class I scenery (extremely attractive natural sites) had D values > 0.85; Class II, between 0.85 and 0.65; Class III, between 0.65 and 0.4; Class IV, between 0.4 and zero; Class V (very unattractive, intensively developed urban) below zero. Since these pilot surveys were undertaken, >4000 scenic evaluations have been carried out in diverse countries, such as, Spain, Portugal, Croatia, Morocco, New Zealand, Fiji, Australia, the USA, Japan, China, Pakistan, Brazil, Colombia etc. and these breakpoint values have been found to be constant, *e.g.* Ergin et al. (2006), Langley (2006), Ullah et al. (2010), Williams et al. (2012), Rangel-Buitrago et al. (2013).

5. Results and discussion

Description of beaches distribution and characteristics is presented in section 5.1 and suggestions for suitable coastal management given in section 5.2.

With respect to data presented by Anfuso et al. (2014), of special importance to the results given in this paper is the 2015 change in the relationships between Cuba and USA and the large associated implications for present and future tourism developments in Cuba, as well as in the greater spatial distribution of investigated sites. Emphasis has been also given to the Cuban model of tourism development.

5.1. Investigated sites characteristics and distribution

Analysis of investigated sites produced a scenic score (D value, Table 1) and the characteristics and distribution of each Class, from Class I, extremely attractive natural beaches, to Class V, very unattractive urban beaches, were related to their geographical-geological setting and human activities/uses.

5.1.1. Class I

Extremely attractive natural sites with very high landscape values - *D* scores above 0.85. Seven out of 100 beaches belonged to this class (Table 1, Fig. 2), almost all being rural areas with a low impact of human activities essentially related to national tourism and to the presence of bars, kiosks and/or small restaurants at places not directly on the backshore. High scores in both natural and human parameters are recorded, *e.g.* Playa Blanca (S), a rural area in Santiago (Table 1; Figs. 1 and 2).

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 (marram/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.

Their distribution around Cuba was not homogeneous and their high scores were linked, for all but Cayo Levisa and Playa Sirena, to the presence of high values at points 1 to 3 (Cliff, Table 2), 7 to 9 (Rocky shore, Table 2) and 12 (Skyline landforms, Table 2) and, at places, 11 (Valley, Table 2) and 14 (Coastal landscape features, Table 2). Such characteristics were related to the presence of mountainous areas close to the shoreline (Fig. 1), forming cliffs and/or rocky shore platforms and/or give rise to an undulating or mountainous landscape, etc. This took place:

i) at La Puntilla, Los Cocos and Arroyo Berbejo, in Northern Mayabeque, because of the montain chain of Alturas de La Habana-Matanzas;
ii) at Playa Blanca, Playa Bariguita and Playa Colorada at Santiago and Guantanamo provinces, in the southeast Cuba, where the Sierra Maestra and Sierra Cristal mountain chains run parallel to the shoreline reaching a height of 1974 m at Pico Turquino, 1 km from the coastline.

The two beaches within this class which did not record high scores of the previously mentioned points were Cayo Levisa and Playa Sirena. They are resort areas geared to international tourists, Playa Sirena (Figs. 1 and 3 a), in one of the "new" tourist areas (Cerviño and Cubillo, 2005) belonging to Cay Largo (Canarreo cays) and both resorts show a very small level of human intervention; a good score regarding vegetation (point 17, Table 2) and white sand (point 6 and point 16; Table 2). This is a common result within this class because of the feeding of biogenic sand to the beach, comprising mostly coral fragments, calcareous algae and foraminifera from the facing reef (UNEP/GPA, 2003). Concerning white sand color, two exceptions were recorded: an attractive strong yellow-red color sand at Playa Colorada (Fig. 3 b), due to the presence of iron oxides resulting from limestone weathering in the small watershed feeding this beach, and dark sand at Playa Bariquita, due to the erosion of basalt and porphyritic basalt (Pranzini et al., 2016).

5.1.2. Class II

Attractive sites with high landscape values and a *D* value lying between 0.65 and 0.85. Along the investigated coast, 19 out of 100

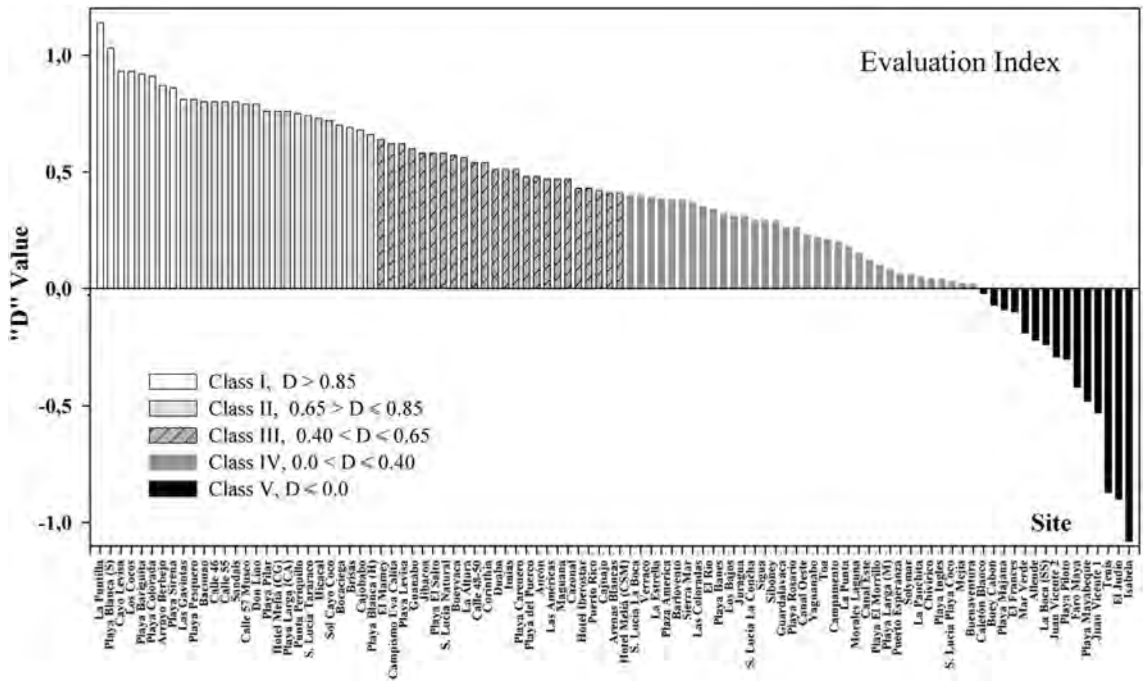

Fig. 2. Evaluation index curve for 100 sites along the coast of Cuba.

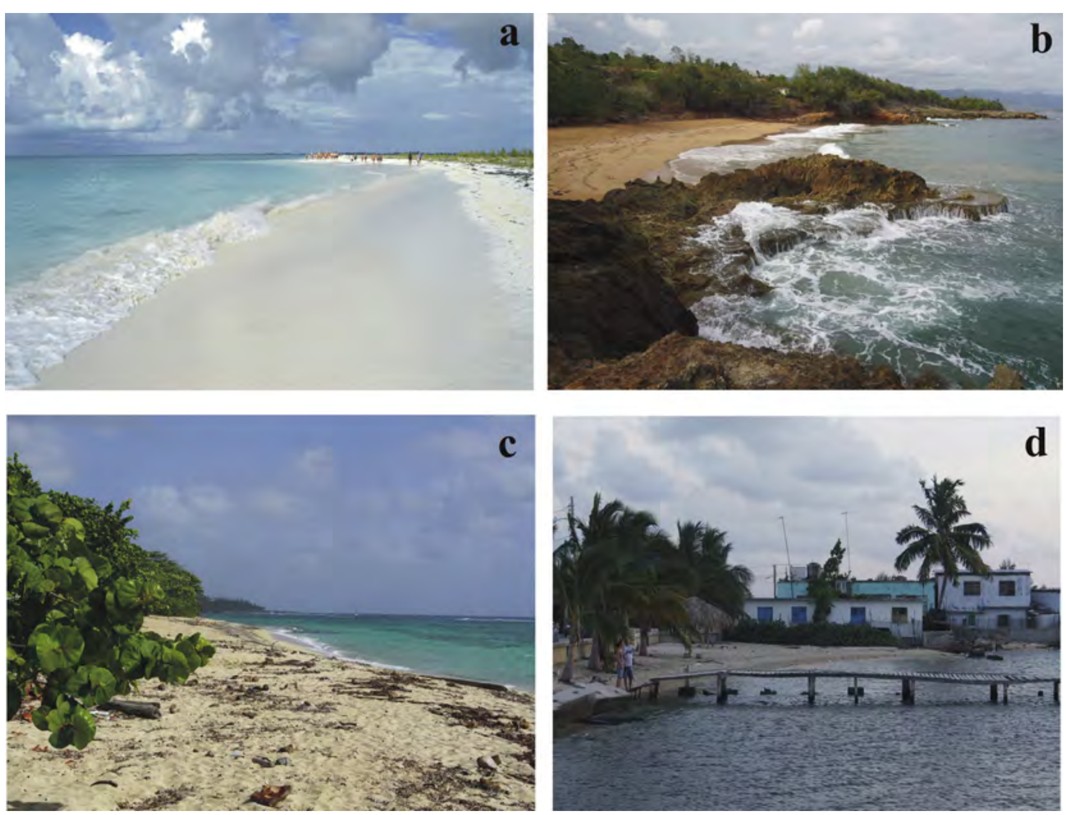

Fig. 3. Examples of Class I (**a**, Playa Sirena, Cay Largo; **b**, Colorada, Santiago de Cuba), Class III (**c**, Maguana, Guantánamo) and Class V (**d**, Isabela, Villa Clara).

beaches belonged to this class (Table 1, Fig. 2). They represented a wider distribution with respect to Class I beaches but are essentially concentrated at one of the "new" tourist areas, *i.e.* Jardines del Rey cays in the northern coast of Cuba, along open beaches fronting resorts belonging to overseas investors and frequented almost exclusively by international tourists, Cubans living abroad and a few selected national tourists. These sites generally rated lower than Class I due to the lower scoring at cliff, rock shore, skyline landform and landscape special features (Table 2), but maintained high scores with respect to dunes, vegetation cover, water and beach sediment (type and color). The presence of dunes and vegetation was linked to their natural setting and low human pressure. White sediments forming the investigated beaches were naturally supplied by a 450 km long fronting coral reef at Cay Coco (4 beaches, Prov. Ciego de Ávila), Cay Santa Maria (2, at Villa Clara), Holguin (3), Santa Lucía (1) and La Habana (1) or linked to the presence of nourished sands injected in recent years (*e.g.* 5 beaches at Varadero – Matanzas).

Within Class II, only three sites were observed in the southern part of Cuba, at Hicacal and Baconao (Santiago) and Cajobabo (Guantanamo). At such places, high scores of the physical parameters were partially linked to its mountainous nature, namely Sierra Maestra and Cristal, which gave rise to the presence of cliffs, high undulating skyline landforms and landscape features. Other physical (at Hicacal and Baconao) or human (at Cajobabo) parameters did not record such very high scores.

In general, sites belonging to this class showed very low human pressure linked to activities carried out in resorts (principally, 11 out of 18), urban and rural (3 and 4 each) and village (1) areas. Specifically, the human parameter's influence was limited because of the absence or acceptable level of noise, sewage evidence and litter. Highlighted was the absolute absence of evidence of sewage discharges (point 19, Table 2) in all investigated sites in Cuba because of appropriate management of waste water.

5.1.3. Class III

Included 26 sites with a *D* value between 0.4 and 0.64 (Table 1, Fig. 2). An example is the beach at Maguana (Table 1), in a rural area at Guantánamo (Fig. 1), which recorded intermediate values for both natural and human characters.

Sites included 16 rural, 7 resorts, 2 villages and 1 urban area. In general, human activities/developments had no great impact on rural areas and were essentially limited to the presence of scattered litter items from a marine origin or abandoned by beach users (usually local or national visitors). Low scores at rural areas were fundamentally linked to the flat coastal morphology and associated absence of attractive coastal landscape features and presence at several places (*i.e*. Maguana, Guantanamo; Fig. 3 c), of litter items, because of the absence of cleaning operations, and abundant vegetation debris linked to the beautiful, lush, natural vegetation cover, a common sight along the Caribbean Sea (Rangel-Buitrago et al., 2013).

The few resort areas observed in this class were principally frequented by international visitors and surprisingly did not show excellent scores for the physical parameters. Further, sites within this category showed an increasing human impact aspect because:

i) the low sensitivity design of bungalows, bars, etc. that at many places were visible from the beach since they were only partially masked by dunes or vegetation,
ii) human activities, *i.e.* noise because of loud music beach and the massive presence of beach chairs, umbrellas, etc. However at village and urban areas, the impact of human developments increased slightly.

5.1.4. Class IV

This included the largest number of surveyed sites (32 out of 100), with a *D* value between 0 and 0.4 (Table 1, Fig. 2). It included mainly rural (16), village (9), resort (4) and urban (3) sites located in different environments with poor natural parameters and/or human ones.

Sites with poor natural parameters are often observed on the northern coast of Pinar del Río, Mayabeque and Villa Clara and in the southern coast of Matanzas and Cienfuegos, all being rural and village sites frequented by local and national visitors (Table 1). Their low scores were due to the poor physical setting, as all are located in flat, sheltered coastal areas often extensively colonized by mangrove swamps. As a result they gave low scores for valley, skyline landform and vistas (points 11, 12 and 15, Table 2), additionally water color and clarity parameter values are low, often muddy/brown/grey (scoring 1 at point 16, Table 2) because of the presence of algae and/or dark brown water stained by organic acids originating from mangrove swamps. Abundant vegetation debris, essentially seaweed in fronting shallow and calm waters and litter coming from the sea, accumulate on the beach (low score at points, 18 and 20, Table 2).

Other sites belonging to this class are located on open coasts, in Varadero (Cárdenas), Santa Lucía, Holguin and Santiago (Fig. 1). They presented better physical characteristics with respect to previously analyzed sites, but their scores were significantly damaged due to undesirable anthropogenic activities/developments, which influences the D value range according to the level of use/urbanization - increasing from rural, resort, village, to urban. Rural and village areas, frequented by local and national tourists, reflected the presence of a few human constructions, in general wood houses or bars, located close to the back beach with a small or no buffer zone and abundant vegetation debris and litter items accumulated because of the non-existence or low frequency of cleaning activities, *e.g.* Toa, Guantanamo.

Resort and urban sites, frequented by local, national but also international visitors at Holguin and Santiago, presented a major impact relating to constructions, often high buildings visible from large distances, a reduced buffer zone because of deteriorated dunes and vegetation cover, coastal defense structures and massive presence of beach chairs and umbrellas, as observed at Varadero for resort and urban sites within this category (Anfuso et al., 2014).

5.1.5. Class V

In general, this class included very unattractive sites with intensive development, poor landscape importance and a *D* value below zero (Table 1; Fig. 2). This class showed a relatively limited number of sites (*i.e.* 15) located in different natural environments, exposed and sheltered coasts, with village (6), rural (5), urban (3) and resort (1) uses (Table 1). Usually, natural parameters presented low and very low values, especially if located in sheltered environments, as previously observed for sites belonging to Class IV. Human parameters presented low scores especially in urban sites, all of them in Matanzas, and village sites, *e.g.*Isabela, Villa Clara (Fig. 3 d), very negatively impacted by a buffer zone absence and human constructions, such as, high/low buildings, coastal roads, etc. Village areas in southern Mayabeque and Artemisa obtained low values essentially due to the presence of coastal protection structures, *i.e.* groins and revetments, *e.g.* at Playa Majana and Mayabeque (Anfuso et al., 2014), which favor erosion in downdrift areas according to the "domino" effect (Anfuso et al., 2012; Rangel-Buitrago et al., 2015).

5.2. Scenic classification as a tool for coastal management

In next few decades Cuba will continue experiencing a massive increase of both international tourist arrivals, essentially related to the opening of the US market (Pérez et al., 2013; Hingtgen et al., 2015) and national tourists (Romeu, 2008). Of special interest is the adoption of suitable management ideas from the present "3 S" international tourist destinations (currently essentially located in cays) and identification of the proper means of calculating/improving the scenic characteristics of other coastal areas which are potentially attractive to international tourism. These are found in/close to North Holguin, Santiago de Cuba, and the Trinidad (Sancti Spiritus)-Cienfuegos areas, which have been classed by the Cuban government as new tourist fulcrum points because of their natural, historic and cultural attractions (Cerviño and Cubillo, 2005). Information obtained will also be useful for characterization and improvement of sites frequented by local visitors and national tourists.

Many international beach tourists travel long distances to Cuba being attracted by white sand, turquoise and clear water, presence of natural vegetation, all culminating in what is called scenery (Botero et al., 2013; Rangel-Buitrago et al., 2013; Pranzini et al., 2016). In Cuba, international and selected national tourists, are able to enjoy all the "Big Five" categories at resort areas in "new" destinations, *i.e.* ones promoted since 1999, in order to achieve a better tourist balance throughout the island (Cerviño and Cubillo, 2005) — *e.g.* Jardines del Rey, Canarreos and other cays and North Camagüey (Santa Lucía sites) as well as at the "traditional" destinations of Varadero.

Concerning the new "3 S" destinations, coastal scenic values appear to be good and Class II and even two Class I sites were found (Table 1). This is because of good scores of the physical parameters (especially fine white sand beaches and turquoise water color), and the absence of important erosion processes and coastal protection structures. Concerning the other "Big Five" parameters, water quality is guaranteed because sites are located on open coasts with no sewage discharges and other ones are assured because in resort areas there is: no litter because of frequent manual cleaning operations; facilities, *e.g.* beach chairs, umbrellas, etc. are provided as is safety by lifeguards - in general for smooth dissipative beaches. Appropriate beach environment management is reflected by implementation of sensitively designed human developments (point 23, Table 2) often masked by dune ridges (point 10, Table 2) and natural or artificially planted vegetation (points 17 and 22, Table 2) forming an effective buffer zone (point 24, Table 2) separating the beach environment. An example is that of Cay Coco where good arrangement and design of cottages and bungalows at Hotel Sol Cayo Coco was accompanied by the presence of high palm trees that make any human construction almost indistinguishable when viewed from the beach (Fig. 4 a). Additionally, dune and vegetation maintenance is often associated with the emplacement of appropriate pathways (*e.g.* hotel Melía Cayo Santa María, Fig. 4 b).

Despite the general positive evaluation of present day settlements, attention must be paid to future scenarios. Excessive and unregulated urbanization in cays, including emplacement of new high buildings (Fig. 5, Cay Guillermo), produces heavy negative impacts on coastal scenery (score 2 "heavy tourism" at point 23, Table 2), an increase of visitors' pressure on beach environment with related ecological and environmental degradation (Semeoshenkova and Newton, 2016) and a consequent loss of attractiveness and 'naturalness' (Williams, 2011), as observed at Mediterranean destinations in Spain (Mir Gual et al., 2015; Manno et al., 2016).

Coastal scenic values can be easily improved at other sites. At Campismo Uva Calita (Ciego de Avila), a Class III resort area essentially devoted to national tourists, an increase of just 1 attribute of the vegetation debris parameter (point 18, Table 2), would upgrade the site from 0.62 to 0.66, *i.e.* to Class II. At Hotel Iberostar (Fig. 6 a), in Cay Ensenacho (Villa Clara), a Class III resort area for international tourists, decreasing the volume of beach music and removing excessive and poor designed wood/straw beach umbrellas would upgrade the site to Class II. Improvements could be carried out at different sites at North Camagüey (Santa Lucía area), which has great potential in that its physical setting is very similar to beach locations at open cays. Despite these comments it presents overall good scores for most natural parameters; poor human scores lowered the total score and many places belonged to classes III and IV. As an example, Santa Lucía La Boca (Camagüey, Table 1) is a Class III resort area that could be easily upgraded to Class II by improving vegetation debris (point 18, Table 2) and skyline (point 25, Table 2), by reducing the impact of several wood constructions.

A similar situation, *e.g.* an elevated number of international (but also national tourists after 2008) was observed at Varadero, a traditional tourist Cuban destination (Cerviño and Cubillo, 2005). At such localities, proper environmental policies adopted in response to erosion problems, greatly improved scenery: beach nourishment and dune restoration, *i.e.* the "soft" solution, was preferred to the "hard" engineering solution. Such kinds of approaches to beach erosion are applied when coastal tourism is the main target for beach management and actions are designed to fulfill tourism requirements, essentially by increasing beach carrying capacity (Quintela et al., 2012; Zielinski and Botero, 2015). Coastal management has been principally devoted to quality improvement and development for recreational beach use and attention has been devoted to coastal environment protection and the ecosystem by dune restoration and vegetation implantation. As a result, at Varadero, many sites even if located in resort and urban areas (Table 1), belong to Class II, a sound achievement linked to proper environmental management policies, such as beach nourishment, dune restoration and demolishment of illegal constructions (Anfuso et al., 2014).

Results indicated few quality "3 S" international destinations (three Class I sites at resort areas at Holguin, one Class III - rural area at Guantanamo and one Class III resort at Sancti Spiritus) and several Class I to III rural areas devoted to national tourists, already exist close to North Holguin, Santiago de Cuba and Trinidad (Sancti

Fig. 4. Examples of good management practices at Hotel Sol Cayo Coco (**a**, Cay Coco, Ciego de Ávila) and Hotel Melía (CSM) (**b**, Cay Santa María, Villa Clara).

Fig. 5. Hotels under construction at Cay Guillermo (Archipelago Jardines del Rey).

Fig. 6. Beach facilities at Hotel Iberostar (**a**, Cay Ensenacho, Villa Clara); beach view at Varadero (**b**); beach facilities and high backing buildings at Guardalava (**c**, Holguin); revetments and dark brown water at Playa Mayabeque (**d**, Southern Mayabeque). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Spiritus)-Cienfuegos areas (Fig. 1). Existing investigated sites can be better managed and even new areas can be promoted due to the generally good scenic value of these regions because of the presence of mountainous chains close to the coastline, clear and attractive water color and, at many places, white sand. Other areas, *e.g.* a resort area devoted to international visitors, Guardalavaca (Holguin, Fig. 6 c), presented good scores for water color and clarity and sand color, but had very negative impacts for human settlements and protection structures. Existing rural areas can be improved at specific points and transformed to attractive international destinations in respect of environmental conditions, *e.g.* by promoting nature and ecotourism. At Maguana beach, a rural area in Guantanamo (Fig. 3 c), improvement of the vegetation debris and litter scores at points 18 and 20 (Table 2), would upgrade it to Class II. Sustainable tourism in the respect of environment and beach carrying capacity, *e.g.* daily regulated beach visits, can be proposed in northern Mayabeque, an area with a high scenic value presently frequented only by locals and national visitors, and high potential value for international tourism because of its vicinity to La Habana.

No studies have ever been carried out concerning beach visitors and national tourist's preferences in the less attractive areas, especially those located on sheltered coasts. It seems visitors here are not very concerned about sand color, water clarity, coastal structures, noise, and absence of facilities; it is true that site selection in such cases is a mandatory fact due to proximity, the principal and final reason for beach selection in many places (Williams, 2011). Cases belonging to classes IV and V from the southern coast of Artemisa, Mayabeque and Matanzas have been presented here and were also analyzed by Anfuso et al. (2014).

At many places (*e.g.* Mayabeque, Fig. 6 d), defense structures negatively influenced skyline characteristics and utilities (points 24 and 25, Table 2). The improvement of scenic values at Southern

Mayabeque and Artemisa areas is complicated by a general low quality of physical parameters. Abandonment and landward relocation (as observed at Playa Rosario), or the removal of present defense structures and the implementation of nourishment projects, should be considered. Such a solution has been already carried out at Varadero and at beaches used by local and national visitors in less tourist areas. At Playa El Salto (Fig. 7 a), a Class III site in a popular camping area in Villa Clara, nourishment works were carried out in 1989–1990 using white calcareous biogenic sediments from land deposits (Tristá Barrera et al., 2008). Similar actions were performed at the urban beach of Tenis (Fig. 7 b) and Allende in Matanzas. Nourishment works at these sites very likely increased the beach color lightness, thus meeting stakeholders' desires. Although original beach color should be maintained, being a natural characteristic of the landscape and determining specific ecosystems on the coast, projects aimed at increasing the tourist appeal of beaches must be considered (Pranzini et al., 2016).

5.3. Cuba coastal development versus the traditional "3S" typology

Modern tourism development in Cuba is linked to the governmental decision (at the end of the 1980s), that this activity should be the main source of foreign currency income (Sharpley and Knight, 2009) to mitigate the heavy economic crisis experienced during the "Special period" due to the Soviet Union dissolution (Miller and Henthorne, 1997; Jayawardena, 2003) and the United States embargo against Cuba (in force since October 1960).

To achieve such an objective, different initiatives were implemented. After 1993 Cuba allowed local people to rent rooms in their houses to tourists (Taylor and McGlynn, 2009; Hingtgen et al., 2015), and opened its market to foreign firms, which proved to be an excellent opportunity for hotel investors. The first joint tourism venture was formed in 1988 by Cubanacan (the then-new state tourist corporation), with the Spanish hotel group Sol Melía in order to build a hotel that opened in 1990 in the tourist resort of Varadero. Another hotel opened in the same year in a joint venture with the German company, LTI International Hotels (Cerviño and Cubillo, 2005) and now many foreign companies are present, especially at Varadero and the Jardines del Rey cays (Hingtgen et al., 2015).

A few considerations arise regarding the environmental and economic impacts of coastal tourism development in Cuba. At places, *e.g.* at cays and Varadero essentially, coastal scenic value and environmental aspects have been partially sacrificed in the name of employment and profit generation. Despite the fact that this type of coastal occupation is apparently similar to the "3S" related coastal urbanization typology, *e.g.* at Cancun (Mendoza et al., 2015) or along the South of Florida and many Mediterranean areas (Pranzini and Williams, 2013), several significant differences can be highlighted. The Cuban Government is the majority partner in international hotel ventures and obviously the largest part of profits and gains of such companies is retained in the country and reinvested in social and environmental projects. This is very different from the rest of the World where foreign companies have to pay local revenues but benefit from all profits and limited gains materialise to local communities. Recently, in 2012, a Tributary Law (n. 113, articles 238 and 239), was approved in Cuba to tax all activities related to coastal tourism in order to establish a public fund devoted to environmental beach conservation. Concerning environmental constrains, urban developments in Cuba are strictly regulated by specific laws and directives; *e.g.* Cuban Constitution (article n. 27) claims the rational use of natural resources; Environmental Law n. 33 (approved in 1981) concerns environmental protection and preservation, updated by the actual Environmental Law n. 81 enforced in 1997. As regards coastal development, a specific legislation *(e.g.* Law Directive 2012) was enforced in 2000 and applied under the supervision of the Cuban Ministry of Science, Technology and Environment (UNEP/GPA, 2003). This Law forbids construction within 40–80 m from the shoreline (value depending on coastal type, *e.g.* sandy, rocky, etc.) and building on sand dunes. At Varadero and other selected sites, since 1987, when Cancun (Mexico) and the Mediterranean Spanish coast were still experiencing an intensive urbanization process to the detriment of dune ridges, coastal lagoons and back-beach areas (Mendoza et al., 2015; Garcia et al., 2013; Manno et al., 2016), coastal occupation took place according to an accurate Coastal Management Program, supervised by the Cuban Ministry of Science, Technology and Environment, which only permitted buildings construction 40 m behind dune ridges (UNEP/GPA, 2003). In recent years, the Ministry of Science, Technology and Environment and the Ministry of Land Planning with local and regional governments have embarked on coastal protection schemes in which a great number of beachfront government structures and few privately owned buildings have been demolished (www.psmag.com, 2016). Lastly, beach nourishment has always been preferred to hard solutions (Caballero et al., 2006) in order to avoid related environmental degradation processes observed in other places by, for example, Semeoshenkova and Newton (2016) and Manno et al. (2016).

Of relevance is the fact that Cuban beaches are classed as 'public domain' and everybody is allowed to access. At places, *e.g.* at few hotels at cays, access to a beach was in the past denied to the local population but today local authorities are guarantying this constitutional right. Changes have also occurred in hotel frequentation in Varadero and at cays: a great increase in national tourism took place after 2008 when the Cuban government allowed Cubans to stay in international tourist hotels. Internal visitors increased exponentially to reach 1.2 million in January–April 2014 with an increase to 1.5 million in 2015 (ONEI, 2015). Such an increase in internal visitors seems to be related to special tour packages to national visitors and the increase of purchasing power of Cubans

Fig. 7. Beach nourishment at Playa El Salto (**a**, a camping area in Villa Clara), and at Tenis (**b**, an urban beach at Matanzas).

that carried out private activities, such as, restaurants, room rental, etc. and especially from the monetary help of Cubans living abroad. At Varadero, national visitors already constitute the second most numerous tourist groups after Canadians. Of great increase also is the number of Cubans living abroad, especially USA, who are able since 2009 to return to Cuba to visit relatives and spend their holidays there.

As a result, in the last few decades, tourism has greatly improved, *e.g.* 3 million international tourists in 2014 and an increase of 18% during the first months of 2015, the tourist beaches and coastal resorts generating US$2.6 billion each year (www.psmag.com, 2016).

6. Conclusions

High scenic values, *i.e.* Class I beaches, were related to the presence of coastal mountainous chains and low levels of human activity. Stunning beaches were observed in rural areas between La Habana and Matanzas and in Santiago de Cuba and Guantánamo. Class II beaches were essentially located in cays which presented optimal sand, water and vegetation cover characteristics and very acceptable level of human constructions, essentially appropriately designed buildings - behind dune ridges and/or vigorous vegetation - and good management practices, such as, vegetation and dune maintenance by construction of appropriate pathways to access the beach. Similar good management practices, *e.g.* dune reconstruction and beach nourishment, have been carried out at many sites in Varadero. However, despite appropriate past environmental preservation activities, attention must be paid to future tourist developments, especially within the cays, because excessive urbanization processes may occur and produce negative impacts on coastal scenery and in general on environmental conditions, with a consequent reduction of tourist interest, as observed in many heavily urbanized coastal sectors along the Spanish, French and Italian Mediterranean coasts.

Classes III to V sites presented wider distributions around Cuba and were related to the progressive decrease of physical parameters and an increase of human impacts because they were generally located in village or urban areas. At many places, coastal scenic values could be improved by means of simple measures, such as, removal of vegetation debris and litter and improvement of beach facilities (excessive presence of beach chairs and wood straw beach umbrellas, etc.). More difficult procedures are needed to counteract erosion processes and past human responses to prevent/slow down erosion processes. Beach erosion causes degradation and the emplacement, especially in Southwestern Cuba, of hard, disorganized protection structures. Coastal structure dismantlement and beach nourishment represent proactive responses and have been carried out with good results at several urban areas devoted to local and national visitors.

Acknowledgements

We are grateful for field assistance to Celene Milanes Batista, Universidad de Oriente, Santiago de Cuba (Cuba) and to Iacopo Petrocelli, University of Florence (Italy), who provided the photo of Playa Sirena. Research was funded by the Department of Earth Science of the University of Florence, Italy. This work is a contribution to the PAI Andalusia (Spain) Research Group RNM-328 and to the RED PROPLAYAS network.

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