





Article

An Attempt to Characterize the “3S” (Sea, Sun, and Sand) Parameters: Application to the Galapagos Islands and Continental Ecuadorian Beaches

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Abstract: Sea, Sun, and Sand (3S) are relevant and determining elements for choosing a tourist destination in Ecuador, a country with about 1200 km of coast along the Pacific Ocean. This study analyzed the market potential of the 3S in 64 beaches, 10 located in the Galapagos and 54 in the continental zone (of Ecuador). The methodology used was exploratory and bibliographical, complemented by a descriptive analysis. The color of the water was assessed by direct observation, sand samples were taken to a laboratory for color analysis, and information on the hours of light was obtained from international archive data. The data obtained were compared with other world famous 3S tourism destinations. The Galapagos had the best results, with attractive white sand beaches, sea blue water color, and an elevated sunshine time; meanwhile, the continental zone presented poor beaches with dark sand and unattractive water color. To strengthen 3S tourism, managers should work on the enhancement of complementary aspects such as culture, gastronomy, and architecture, promoting the creation of new coastal tourist routes and destinations.

Keywords: management; coast; tourism; culture; gastronomy; architecture

1. Introduction

Interest in tourism has increased rapidly in recent years [1]. In 2019, tourism generated 10.3% of global GDP, supporting 330 million jobs [2], and coastal and marine tourism is the largest segment of this industry [3]. In the Tropics, incomes related to beach tourist activities constitute a relevant part of many countries' GDP [4], especially in the Maldives (76.6%), the Seychelles (65.3%), Capo Verde (44.9%), Fiji (40.3%), Jamaica (32.9%), Zanzibar (25%), Mauritius (23.8%), Tonga (18.2%), Bermuda (17.1%), and Cuba (10.7%) [5,6]. The importance of in these countries is also reflected by the high number of direct and indirect jobs related to tourism: 66% in the Seychelles, 39.3% in Cabo Verde, 37.4% in the Maldives, 36.5% in Fiji, 29.8% in Jamaica, 22.6% in Mauritius, 20.7% in Bermuda, 19.6% in Tonga, and 9.9% in Cuba, although several negative fallouts on local population were also assessed [7]. Despite this, beach recreation has recorded little attention in the economic literature [8].

Coastal tourism is constantly growing worldwide, mainly due to the attraction of Sea, Sun, and Sand (“3S”), scenic beauty, and recreational activities [9]. In places where cultural sites and activities are geographically close to the coast, 3S tourism and cultural tourism, which are initially distinct segments of the tourism market, can be developed in a complementarity way [10,11].

Enjoying 3S is the main reason for choosing to visit coastal areas, especially beaches [12]. In many places around the world, 3S tourism has coincided with the total or partial urbanization of coastal areas. For example, in a few Spanish coastal areas, the built-up zone exceeds 45%, evidence of the great contemporary importance of the enhancement of sustainable tourism [13–15]. The latter contributes to social equity, economic efficiency, and environmental conservation by integrating economic and recreational activities in order to seek the conservation of natural and cultural values [1,14–16]. Sustainable tourism arises from five basic principles: (i) natural and cultural resources are conserved for future use; (ii) tourism development is planned and managed with environmental and socio-cultural responsibility; (iii) the level of satisfaction of the visitors considered of great relevance is guaranteed, and the destination preserves its prestige and commercial potential; and, (iv) the benefits of tourism are widely shared throughout society [17–19].

Concerning the preferences of beachgoers, numerous questionnaires have been carried out in different countries to find out that travelling distance is a relevant selection criterion, but that five parameters (the “Big Five”), i.e., safety, facilities, water quality, absence of litter, and scenery, are of the greatest importance to coastal visitors [20]. Beach users have an idyllic concept of the beach: they prefer sunny white sand beaches bordered by dark blue seas in places flanked by the additional opportunities provided by nature [21], culture [22], and food [23], etc.

Hence, according to the desires of beachgoers, tourism planners must be aware of the 3S potentialities in their countries, and, if these are low, they need to increase the attractiveness of beaches in different ways. The suitability of beaches for developing “3S” tourism activities has been analyzed in terms of landscape [24], climate conditions [25], facility of access [26], environmental quality [27,28], sand color [29], and other aspects [30,31], but never concerning the whole 3S offer. Sunshine/cloudiness, on a par with “comfortable temperature”, are the most important factors that reflect the climatic component influencing the quality of the experience and the attractiveness of the site [32], and, hence, are probably the main tourism resource of a beach destination [33,34].

This paper analyzes the 3S market potential of 64 beaches located in the Galapagos and along the continental coast of Ecuador. Presently, the tourism industry is worth approximately 5.4% of the Ecuadorian GDP and absorbs 5.1% of the employers [2]. The international flow of tourists into Ecuador are interested in culture (58.9%), ecotourism (20.8%), adventure and sports (3.2%), 3S tourism (15.9%, especially those who visit the Galapagos Islands), and other reasons (1.2%). Tourism is the main economic activity in the Galapagos Islands and contributes directly and indirectly to the business development and population growth by generating about 80% of total employment [35].

The 1200 km of the continental coast of Ecuador are almost forgotten by international visitors and contribute very little to foreign currency entrance [36]. Hence, analyzing the country’s 3S offer and comparing it with other competitor destinations can help in identifying the weakness of the tourist desirability and encourage planners to develop alternative resources along the coast to better utilize this part of the country. This paper also constitutes a relevant database on beach sand characteristics that will be very useful to properly designing future nourishment plans, especially in more sensitive sectors or tourist areas [29,37,38].

2. Materials and Methods

2.1. Study Area

Ecuador has a total surface of 270,670 km² and is one of the smallest countries in South America (Figure 1). The Ecuadorian coastline, which has a total length of 1200 km, includes several continental

provinces, i.e., Esmeraldas, Manabí, Santa Elena, Guayas and El Oro, and the insular province of the Galapagos.



Figure 1. Location Map.

The Galapagos province consists of 234 islands, islets, and emerged rocks that give rise to an attractive and wide archipelago of great ecological importance [39]. Sandy sectors, essentially constituted by pocket beaches, are composed of white coral rich sand and shell fragments, with headlands and cliffs composed of black volcanic rocks whose formation, emergence, and paleogeography are still highly uncertain [40]. The Galapagos Islands were declared a World Heritage Natural Site by UNESCO in 1978, and since that date their reputation and eminence as one of the last pristine natural paradises on Earth greatly grew all around the world, especially because of their great biodiversity and, to a lesser extent, their geological heritage [41].

In the continental provinces of Esmeraldas, Manabí, and Santa Elena, the coastline is essentially composed by quartz rich long beaches interrupted, in places, by cliffed sectors. The provinces of Guayas and El Oro are constituted by deltaic and flat areas that create a low coast consisting of wide mangrove swamp areas and muddy tidal flats [42].

The most populated and important towns along the continental coast of Ecuador are Esmeraldas (154,000 inhabitants), Manta (307,000 inhabitants), Guayaquil (2.7 million inhabitants), and Machala (230,000 inhabitants); the last two contain the most important commercial ports in the country.

In past decades, the Ecuadorian government has enhanced tourism to improve the quality of life for the inhabitants of Ecuador [43]. Quito and the Galapagos Islands are now the most important destinations [44], and Ecuador is becoming an appealing destination in Latin America for natural tourism [45]; in 2016, 600,000 visitors, i.e., almost half of the total international tourists, came to the country to exclusively visit protected areas [46].

2.2. Methods

For the present paper, in order to assess the 3S set, sea water color, beach sand color, and sunshine time were determined for 64 Ecuadorian beaches, 10 located in the Galapagos Islands and 54 on the mainland. Sand samples were gathered during field surveys carried out in February 2018. The obtained data were also compared with other famous 3S tourist destinations. The methodology used to determine each one of the 3S parameters is described hereafter.

2.2.1. Sea (Water Color/Clarity)

Pioneer studies carried out along several rivers in New Zealand have investigated human responses to two important aspects of water quality perception, visual clarity and color [47]. Such aspects were considered by users as the most relevant for both bathing and aesthetic requirements, and this is unsurprising because, intuitively, one would expect aesthetic appeal to be a strong element for bathing water. Water quality is one of the most important aspects for beach choice in the USA, Turkey [48], Spain [49] and Portugal [44], and refers to visual aspects such as color, clarity, and the absence of algae, etc. Water color essentially depends on natural factors, the most relevant of which are water-dynamic characteristics, bottom and beach sediments, and the presence of currents carrying abundant vegetation debris onto the beach [30]. Muddy brown water color transmits the idea of dirty/unattractive water characteristics and gives a very negative impression, especially to international visitors who are interested in clear turquoise water, as observed by Williams and Micallef [44,50].

Water quality reflects the “Sea” component in the “3S” set and is one of the “Big Five” parameters [32], and the parameter “Water color and clarity” is one of 26 landscape parameters (16 natural and 8 human) used to create a Coastal Scenery Evaluation System (CSES) [33,34]. Within the CSES method, each one of the 26 parameters are rated on a scale from 1 to 5, with 1 being absence or poor quality and 5 excellent quality. Specifically, the CSES method gives “Water color and clarity” a score from 1 (Muddy brown/grey), 2 (Milky blue/green; opaque), 3 (Green/grey blue), 4 (Clear blue/dark blue), and 5 (Very clear turquoise) [48], and this scale has been used in this paper.

2.2.2. Sand (Beach Color)

Persons in different countries were asked how important sand color was when choosing a site for a beach holiday [51], and an average value of 6.4, in a range between 1 (poor) to 10 (high), was obtained. Sand color depends on mineralogical composition, the presence of vegetation debris and degraded organic matter, and litter, etc.

International tourists prefer white and golden sand beaches [52], and dislike beaches which sediments that become progressively darker in color [29]. This aspect is of paramount importance on tropical beaches, where foreign tourists desire and expect to find white sand beaches much more than in mid-latitude beaches [53].

In this paper, the beach samples were collected in an intermediate point of the dry beach from the beach surface to a 5 cm depth, and sand color was determined in CIEL*a*b* 1976 color space, which is certified by the Commission Internationale de l'Éclairage (International Commission on Illumination) [54], through a Konica Minolta CR-410 colorimeter with diffuse lightning (Illuminant D65) and an Ø 50 mm field of view [29]. Specifically, L^* is the Lightness component and ranges between 0 and 100 (although pure black has $L^* = -16$), whereas a^* and b^* are related to the opponent colors yellow–blue and redgreen and can theoretically shift from -200 to $+200$. CIEL*a*b* was proposed as a standard, suitable system for the sand color compatibility assessment for beach nourishment [29]. The lightness (L^*) values of the studied beaches were divided into 5 classes, from 0 to 100 (Table 1).

Table 1. Proposed score intervals for the 3S parameters.

Score	Sea	Sand (L^* Value)	Sun (Hours)
1	Muddy brown/grey	$0 < L^* \leq 20$	$840 < h \leq 1475$
2	Milky blue/green opaque	$20 < L^* \leq 40$	$1475 < h \leq 2111$
3	Green/grey blue	$40 < L^* \leq 60$	$2111 < h \leq 2747$
4	Clear blue/dark blue	$60 < L^* \leq 80$	$2747 < h \leq 3383$
5	Very clear turquoise	$80 < L^* \leq 100$	$3383 < h \leq 4018$

Note: L^* is the Lightness component and ranges between 0 and 100 (although pure black has $L^* = -16$).

2.2.3. Sun (Sunshine Time)

As far as sun is concerned, monthly and yearly sunshine days were considered using the World Weather and Climate Information dataset [55] for the Galapagos and Guayaquil, and compared with those of other 3S destinations accessible on the same site. Sunshine hours are those during which the direct solar irradiance exceeds 120 W/m^2 WMO (2003, App. 6, p. 49). Five classes of yearly mean sunshine hours (Table 1) were created for homogeneity with the other 3S parameters, comprising the lowest registered site on the Earth (Tórshavn, Faeroe, 840 h) and the sunniest (Yuma, Arizona, 4018 h).

Lastly, sun and sand parameter values for the 64 Ecuadorian beaches in the provinces of Esmeraldas, Manabí, Santa Elena, and the Galapagos were compared with those of a few top 3S tourist destinations (in Cuba, Australia, Morocco, Guatemala, Santa Domingo, and Zanzibar) in order to evaluate the competitiveness of Ecuador in this market.

3. Results

We present the results corresponding to the 64 studied beaches in Ecuador ordered in Table 2 by province; the first 10 beaches belong to the Galapagos Islands (Island Region), the following to Esmeraldas (19 sites), Manabí (27), and Santa Elena (8). Additional information on visitors' origin and the 3S parameters (ranked from 1 to 5) are also presented in Table 2.

Table 2. The location of investigated beaches and the typology of beach visitors (L = Local, N = National, I = International), and 3S scores.

Prov.	N	Beach	Tour.	Sea	Sand	Sun	Prov.	N	Beach	Tour.	Sea	Sand	Sun
GALAPAGOS	1	Mansa	I	4	4	2	MANABI	33	Punta Prieta	N	4	3	2
	2	Tortuga Bay	I	5	4	2		34	Don Juan	N	4	3	2
	3	Los Alemanes	I	5	4	2		35	Cabuyal	N	4	3	2
	4	Estacion	I	5	4	2		36	Canoa	I	4	3	2
	5	Ratonera	I	5	4	2		37	Sol	N	4	3	2
	6	El Garrapatero	I	5	4	2		38	San Vicente	N	2	3	2
	7	Punta Carola	I	5	4	2		39	Bahia de Caraquez	N	2	3	2
	8	Oro	I	5	4	2		40	San Clemente	N	4	3	2
	9	Loberia	I	4	4	2		41	Crucita	N	4	3	2
	10	Puerto Chino	I	5	4	2		42	Tarqui	N	3	3	2
ESMERALDAS	11	Las Penas	L	3	3	2	43	Murciélagos	N	4	3	2	
	12	Africa	L	3	3	2	44	San Mateo	L	4	3	2	
	13	Bocana del Lagarto	L	2	3	2	45	La Tinosa	L	4	3	2	
	14	Paufi	L	3	3	2	46	Santa Marianita	N	4	3	2	
	15	Rocafuerte	L	3	3	2	47	San Lorenzo	N	4	3	2	
	16	Rio Verde	L	3	3	2	48	San Jose	L	4	3	2	
	17	Las Palmas Urban	N	3	3	2	49	Puerto Cayo	N	4	3	2	
	18	Las Palmas Rural	N	3	3	2	50	Machalilla	L	4	3	2	
	19	Tonsupa	N	4	3	2	51	Los Frailes	I	5	3	2	
	20	Atacames	N	4	3	2	52	Puerto López	L	4	3	2	
	21	Sua	N	4	3	2	53	Salango Urban	N	5	3	2	
	22	Same Urban	N	4	3	2	54	Salango Rural	N	5	3	2	
	23	Same Rural	N	4	2	2	55	Las Tunas	N	4	3	2	

Table 2. Cont.

Prov.	N	Beach	Tour.	Sea	Sand	Sun	Prov.	N	Beach	Tour.	Sea	Sand	Sun
	24	Escondida	L	3	3	2		56	Ayampe	I	4	3	2
	25	Punta Galera	L	3	3	2		57	Olon	I	4	3	2
	26	Estero Platano	N	5	2	2		58	Montanita	I	4	3	2
	27	San Francisco	N	3	3	2	SANTA ELENA	59	Ayangué	I	4	4	2
	28	Mompiche	I	3	3	2		60	Rosada	N	5	4	2
	29	Isla Portete	I	4	3	2		61	Salinas San Lorenzo	N	4	3	2
MANABI	30	Pedernales	N	3	3	2		62	Salinas Chipipe	N	4	3	2
	31	Punta del Fraile	N	4	3	2		63	Puntilla de Santa Elena	N	5	3	2
	32	Tasaste	N	4	3	2		64	Punta Carnero	N	5	3	2

The sum of the scores obtained for each one of the three parameters (Sea, Sand, and Sun) in the 64 beaches of Ecuador are presented in Figure 2. The beaches located in the Galapagos obtained better scores in all the considered parameters. In the following lines, each one of the 3S parameter is separately described.

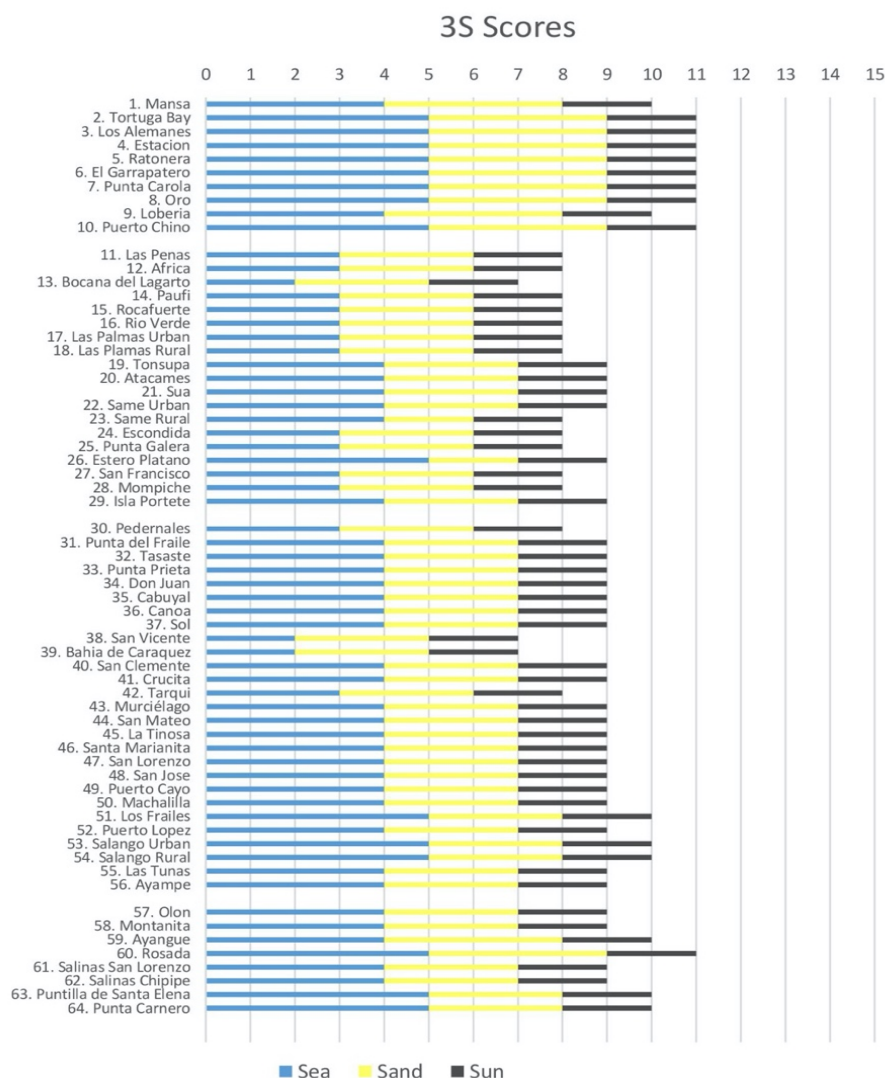


Figure 2. Scores for Sea, Sand, and Sun at the 64 investigated beaches. Fifteen is the highest possible value score that a sum can reach.

3.1. Sea

According to the obtained results, “Water color and clarity”, here the “Sea” parameter, ranged within the CSES from 1 (Milky blue/green/opaque) to 5 (Very clear turquoise) (Tables 1–3). The worst scores were found in mild sloping and sheltered beaches and/or those close to river mouths at Bocana del Lagarto, Esmeraldas Province, San Vicente, the Bay of Caraquez, and Manabí (Figures 1 and 2, Table 2), where fine sediments are frequently in suspension due to a regular river discharge given by the wet equatorial climate (e.g., rainfall in Ecuador ranges from 800 mm/year on the coast to 2000 mm/year in the mountains [56]). In addition, weathering under warm–humid conditions, favors silt and clay formation. Specifically, in Esmeraldas Province (Figure 2, Tables 2 and 3), 11 beaches out of 19 were scored 3 (Green/grey/blue) because of the abundant discharges of several water courses, such as the Esmeraldas, Mira, Verde, Cayapas, and Mataje rivers. Manabí and Santa Elena provinces essentially recorded the prevalence of rate 4, with few sites rated 5, and all of them located very far

from river mouths and/or very exposed to wave energy (e.g., Estero Platano, Los Frailes, Salango, La Puntilla, and Punta Carnero; Figures 1 and 2, Tables 1 and 2).

Table 3. Water color and clarity at investigated sites.

Province ¹	Water Color and Clarity (Range: from 1 to 5)				
	1	2	3	4	5
Esmeraldas	0	1	11	6	1
Manabí	0	2	2	20	3
Santa Elena	0	0	0	5	3
Galapagos	0	0	0	2	8
Total	0	3	13	34	15

¹. Number of beaches in each range per province.

Last, the best score (rate 5) was observed at all the sites in Galapagos Islands, except two (Manda and Loberia) which were rated 4 (Figures 1 and 2, Tables 1 and 3).

3.2. Sand

Photos of beach samples collected within this study are presented in Figure 3 and the Lightness (L^*) values in Figure 4. Interviews that were undertaken far from the coast, i.e., with people that did not select a special beach, proved a direct correlation between sand lightness and people's positive opinions [29]. Several of Ecuador's continental beaches had Lightness values around 50 (score 3) and at two places lower than 40 (score 2), placing them among the less appreciated ones; only in the Galapagos was sand color attractive and lightness > 60 , (i.e., a presented score 4; Figures 2 and 4, Tables 1 and 2).

Differences were observed in beaches no. 23 and 24 (Figure 4), which presented $L^* = 38.16$ and 37.26 , respectively, and are located in the southern part of Esmeraldas province. Their sand was characterized by the high presence of organic matter and elements such as iron and titanium due to sediment supply from the water basins of the Rio Same and Estero Platano rivers. Runoff has increased in river basins during last decades because of the changes recorded in land use, i.e., the transformation of forest into agricultural land.

Not only Lightness must be considered, since gold and yellow sands proved to be attractive as well [48]. In this respect, some continental beaches can be considered very attractive, having a higher red–yellow component (a^* and b^* positive values in CIEL*a*b* color space). One is in Esmeraldas, Las Palmas beach, and the other is named Playa Rosada (“Pink” beach in English), and is in Santa Elena.

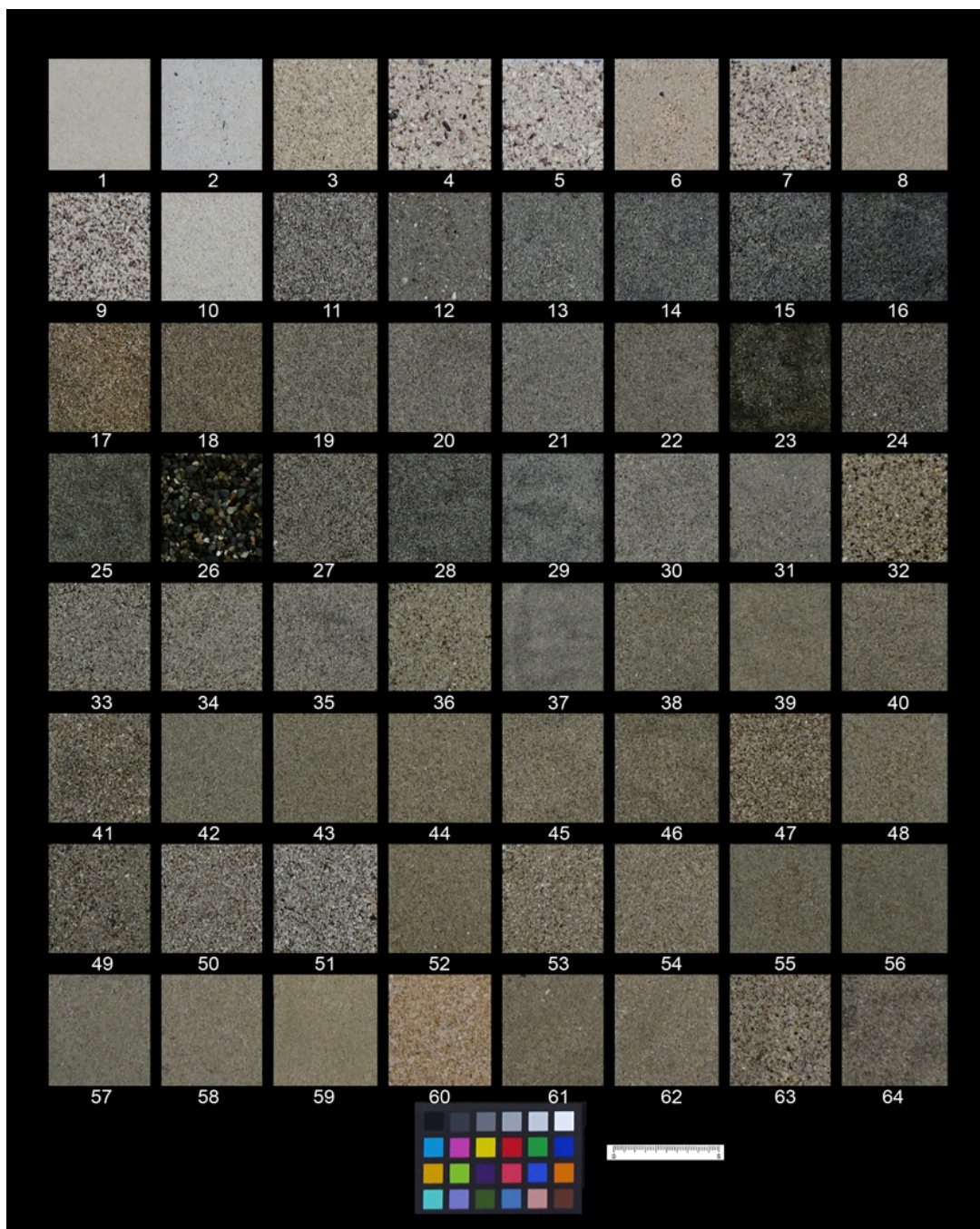


Figure 3. The 64 beach sand samples collected in the Galapagos (1–10) and on the mainland coast (11–64) of Ecuador. Single photo shoot capturing all the samples in order to have the same illumination. X-rite color checker for calibration.

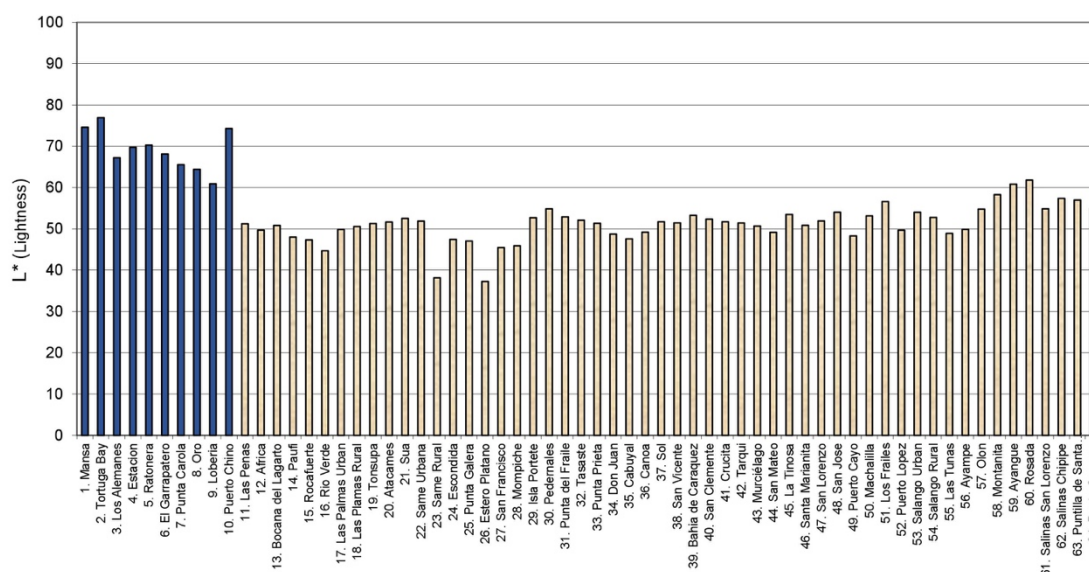


Figure 4. Lightness (L^*) scores at the 64 continental (beige) and Galapagos (blue) beaches of Ecuador.

3.3. Sun

As the study area was inside the Intertropical Convergence (ITC) zone, clouds are very frequent and greatly reduce sunshine hours, but the sun is also dimmed by the mist that is very frequent due to the high level of air humidity that also does not favor open-air activity, since it increases the perceived temperature. Further, due to the proximity to the equator, seasonality is limited, and sunshine hours do not present a seasonal peak that could promote a more profitable period for beach use.

Beaches in the Galapagos and along the continental coast of Ecuador (Figures 1 and 2, Table 2) presented only 1993 and 1614 sunshine hours, respectively, which represents 45.5% and 36.8% of the 4380 astronomically possible hours per year, respectively. The aforementioned values are both scored 2 in Table 1. The Galapagos' sites presented higher values with respect to the continental coast and they were close to the upper limit of the considered class.

4. Discussion

4.1. Sea

The investigated sites received good scores (4 and 5) in the Galapagos (Figures 1 and 2), whereas the worst water color values (2 and 3) were found on the beaches belonging to the province of Esmeraldas, especially in its northern part where fine sediments are frequently in suspension due to the permanent discharges of the Esmeraldas, Mira, Verde, Cayapas, and Mataje rivers. A similar trend, i.e., the increase of water turbidity due to the discharges of relevant quantities of fine sediments, was observed at many localities along the Caribbean coast of Colombia, e.g., south (downdrift) of the Magdalena river mouth [57].

The provinces of Manabí and Santa Elena essentially recorded the prevalence of rate 4, with few sites classified as 5, and all of them located far from river mouths and/or exposed to high wave energy (e.g., Estero Platano, Los Frailes, Salango, La Puntilla, and Punta Carnero; Figures 1 and 2, Tables 1 and 2).

4.2. Sand

The glamorized idea in beachgoers' minds of a tropical tourist destination as a white fine sand beach with clear turquoise water was invalidated by several Coastal Scenic Assessment studies performed in different countries [24,47], and this was also the case in this paper. Ecuadorian beaches

presented a great variability of sand lightness and color, but gray to dark sediments prevailed and white sand beaches were observed only in the Galapagos, the most popular international tourist destination in Ecuador (Figures 2 and 3), even if they are also visited by national tourists; this was not the case for many white sand beaches in several cays in Cuba, the use of which is mostly restricted to international visitors [58].

Attractive, clear or colored sand beaches were Las Palmas (at Esmeraldas, no. 17 and 18 in Figure 3) and Playa Rosada (at Santa Elena, no. 60 in Figure 3). A special case was Las Palmas (Urban beach, sample 17), which acquired this color after artificial nourishment; the native sand (Rural beach, sample 18) did not have that chromatism. The sand used for the artificial nourishment was sampled as well (sample N in Figure 5) and proved to be even more red: sample 17 had a color intermediate between the native beach sand and that used for the nourishment.



Figure 5. Las Palmas beach sand (17) after the addition of borrow materials (N) to the native ones (18).

The beaches as Playa Rosada, despite having no white sand, were extremely appealing, and have had to be protected and transformed into geosites and included in naturalistic tours. This process is easy, especially when such sites are close to (or located within) natural parks or areas of great scenic beauty such as Los Frailes. Los Frailes is located within the Machalilla National Park (MNP), the largest park with a total area of 55,095 hectares, in the coastal region in the south west of the province of Manabí. The MNP includes two nautical miles of coastline, which has islands, small islets, cliffs, continental shelves, rocky shoals, coral reefs, and several beaches with the potential for sea turtle nesting [59].

Comparing the Ecuadorian continental and the Galapagos L^* values of beach sand with data from other 3S international tourist destinations (Figure 6), it is evident that, apart from the dark black sands of Bali and Guatemala, other localities showed better L^* values. Specifically, the values from 50 to 60 recorded in Essaouira (Morocco) and Varadero (Cuba) were close to the mean values observed in Santa Elena Province and in the Galapagos. The other four presented localities that included beaches in famous tropical destinations in Cuba, Santo Domingo, Australia, and Africa showed values even better than the ones recorded in the Galapagos Islands (Figure 6).

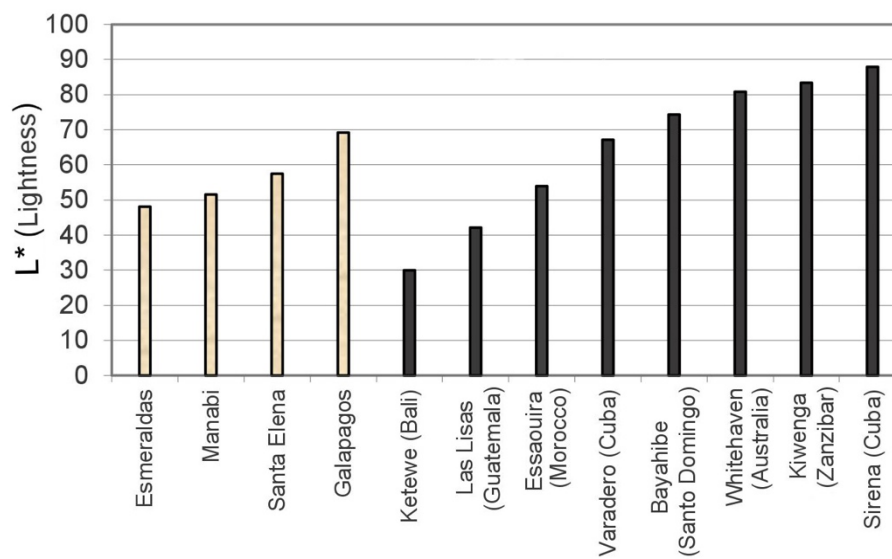


Figure 6. Mean Lightness values for the Galapagos and Ecuadorian continental provinces and the values of famous 3S destinations [55].

4.3. Sun

Sunshine constitutes one of the most important elements for a pleasant tropical beach holiday, not only for its own value (i.e., the sunshine timing), but also because it strongly influences water color, i.e., the Sea component, which only under full illumination conditions can achieve an attractive blue or turquoise color, both of which are highly rated within the CSES method. In addition, for those visitors looking for diving and snorkeling, our interview results showed that extensive cloud cover and low light conditions reduced water visibility and the brightness of underwater fauna, resulting in a degradation of visitor enjoyment [60]. Another aspect influencing tourists' satisfaction was the possibility to shoot good photographs, and this is easier with an almost clear sky.

International tourists, if going to the mainland Ecuadorian coast looking for sun, will be disappointed: clouds or mists persist most of the time during the day, flattening the landscape and negatively influencing sea water color. The sun shines for only 36.8% of the time. Sunshine time is longer on the Galapagos, at 45.5% of the time, but it is still a limited value when compared to direct competitors: the Habana is only a little sunnier (2137 h, 48.8%), but all the other sites here considered had sunshine values ranging for 2542 to 2947 h (from 50.0% to 67.3%)—this not including Dubai, where the sun shines for 80.0% of the time (Figure 7). Considering daily beach use, and despite little extant data on the average time that a tourist stays on the beach (2.7 h in Honolulu, Hawaii; [61]; 3.5 h in Valencia, Spain) [49], beachgoers rarely stay on the beach for an entire day, so the possibility they have of resting on the beach under a blue sky is very limited.

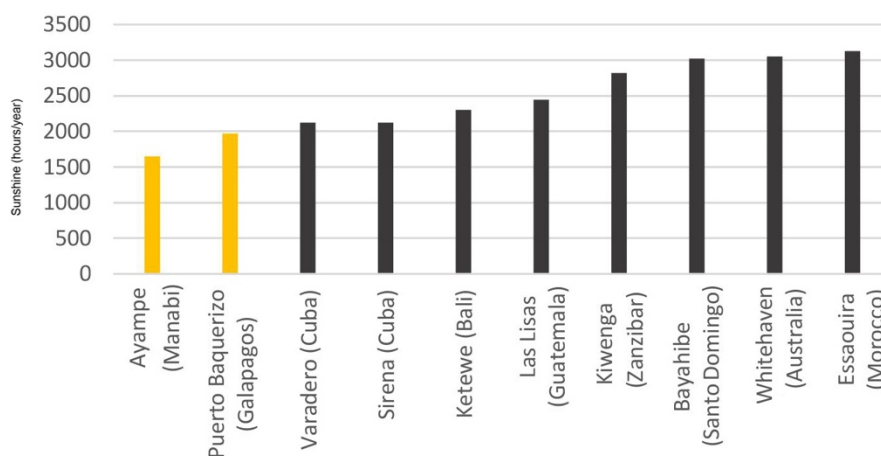


Figure 7. Sunshine hours per year on Ecuador continental and Galapagos beaches and at other famous 3S destinations [55].

As far as seasonality is concerned, both continental Ecuador and the Galapagos showed small variations due to the limited shift of the ITC in this part of the Earth, with a little advantage for the Galapagos, where in May the sun shines for 195 h (54.2% of the daytime).

4.4. Management of 3S Destinations

As previously said, most of the 3S components are natural invariants that leave little room for coastal management, although this activity has always tried to integrate site-specific elements with human action.

Water color/clarity, which is also influenced by litter and other elements produced by human actions, like silt from agricultural and industrial (mining) activity, can be improved with legal and technical instruments whose cost/effective ration should be assessed.

Although no actions are possible to improve natural parameters such as water color and clarity at a regional scale [24], it is sometime possible at a local scale: water quality is in fact also linked to human factors related to the presence of floating litter, which is linked to beachgoers activities, wastewater discharges, and marine-based sources [62,63]. Indeed, the impact of floating litter is increasingly reported worldwide [64,65], and litter has negative effects on beach tourism by reducing local tourism incomes [63]. Preliminary results on continental Ecuadorian beaches were reported by Mestanza et al. [66], but further efforts are required to identify litter sources and litter spatial and temporal variability. Discharges are linked to sewage effluents and/or rivers. Fluvial inlets are difficult to manage directly on the coast, but several actions could be done upstream to reduce sediments and litter content. More direct actions could be taken to reduce sewage discharges, which should not directly flow into the coast without any previous treatment; nevertheless, these marine pollution sources are still very common in several countries [67]. Lastly, coastal defense structures often affect sediment resuspension, which reduces water transparency. This can be prevented by means of an adequate design of the structures, or by adjusting/improving the design of existing structures.

Sand color is the only component of the 3S asset that can be, in part, directly managed. In the case of nourished beaches, the color of borrow sediments acquires a huge relevance in order to keep the luminosity and appeal of the beach. Several cases, e.g., in Cuba [60] and Italy [68], showed that a negative impact on beach color can be produced when this issue is not considered. In this paper, despite this not being among the aims of the study, it was still observed, as the nourishment carried out at Las Palmas improved the color of beach sand, making it more attractive to visitors. Nonetheless, attention must be paid to nourishing natural beaches since a change in beach sand color and/or mineralogy can produce relevant environmental effects [31]—this is not a relevant issue in urban beaches. The database on beach sand color produced within this paper could be of great utility to avoid errors in

beach nourishment works done by project designers in other countries, and to improve beach quality. Color data, together with grain size characteristics of native and potential borrow sediments in areas located along the coast (e.g., harbors) and on the continental shelf, could assist in the development of an Integrated Coastal Sediment Management Plan [69] that will be useful in order to design and carry out programmed beach nourishment works within a long-term sustainable strategy.

Lastly, it has to be highlighted that sand color and, in general, quality/attractiveness, depend on the presence of beach litter and vegetation debris—a widely studied topic [70]. Correct planning is also relevant because it determines the vertical height of buildings located on the beachfront and their design according to the orientation of the movement of the sun. Since the appearance of shaded areas on a beach is not yet a major problem, there are not many studies on this subject, but some authors have warned about the “shadow effect” of tall buildings located too close to the beach [71].

In the case of Ecuador, low scores observed for the 3S parameters were related to the low values of natural features along the majority of the continental coastal zone, being different to the case of the Galapagos. Hence, tourism management should not be focused only on the improvement of beach quality (that is difficult or almost impossible) but on the whole tourist offer. Figure 8 shows on the right-hand side some tourism management actions, based on the “Honey Pot” strategy [72].

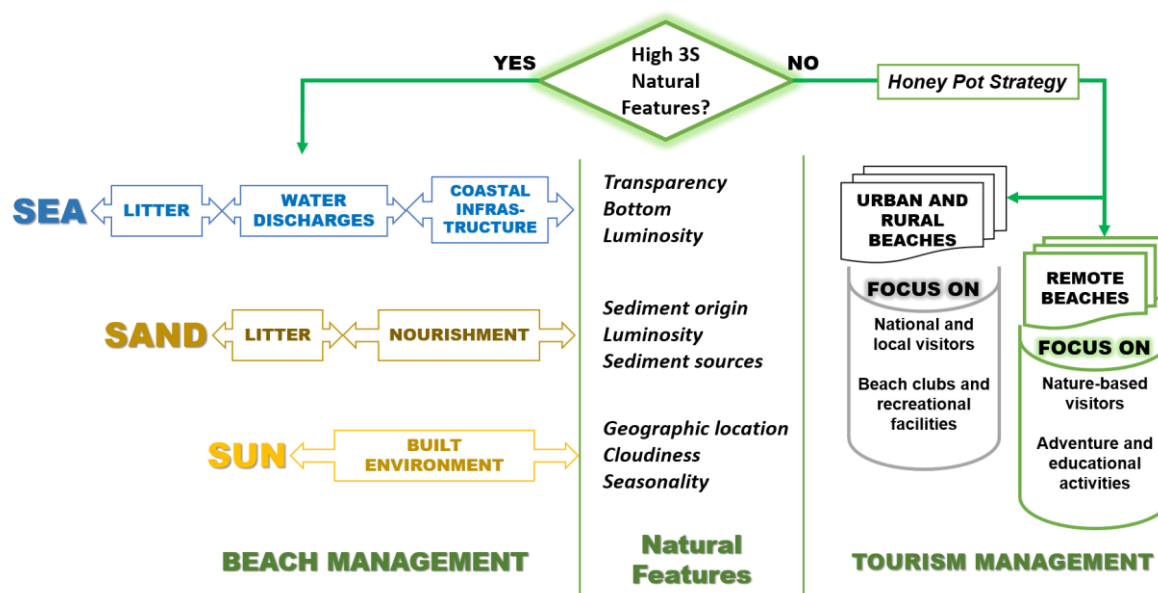


Figure 8. A pathway for management in 3S destinations.

Recreational facilities in Ecuador are of low quality compared to other countries, for example Italy or Spain (Figure 8), and several improvements could be made. Urban beaches with high visitor demand must implement facilities already offered, such as restaurants or nautical schools, but above all be prepared, in terms of customer service, to obtain something close to the concept of “Beach Clubs”, conceived as recreational facilities located in front of or on a beach.

5. Conclusions

Even considering the 3S offer alone, the Galapagos archipelago, with light sand, clear water and greater hours of sun, can compete with many famous tropical tourist destinations. In addition to this, its rich biodiversity, correct environmental management, and the historical legacy of Darwin make the Galapagos one of the most desired tourist site, despite their geographical remoteness.

On the contrary, most of the continental beaches in Ecuador, with the exception of a few in the Santa Elena province, do not present favorable conditions for this kind of tourism, since the sand is dark, the water turbid, and the sky often cloudy.

Here, the national and local government entities in charge of managing and promoting tourism in Ecuador should focus their efforts on strengthening natural, cultural, gastronomic, and architectural aspects, whose diversity is a potential resource for strengthening 3S tourism in the coastal zone.

Finally, it is necessary to carry out further studies in 3S tourist destinations, preferably in the tropics, in order to apply and make more robust this methodological model and enrich future comparisons and discussions.

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