Journal of Integrated Coastal Zone Management
Revista de Gestão Costeira Integrada

http://www.aprh.pt/rgci/pdf/rgci-661_Cristiano.pdf | DOI: 10.5894/rgci661

Evaluation of Coastal Scenery in Urban Beaches: Torres, Rio Grande do Sul, Brazil*

Samanta C. Cristiano[@, a, b]; Gabriela C. Rockett[a, b]; Luana C. Portz[b]; Giorgio Anfuso[c]; Nelson L. S. Gruber[b, d]; Allan T.Williams[e]

ABSTRACT

The Brazilian coastal zone (CZ) is recognized as a National Heritage by the Federal Constitution and the lack of adequate planning results in inappropriate soil occupation, which threats the integrity of the coastal and marine environments. In this context, the recognition of coastal and adjacent marine zone characteristics is essential for adequate CZ planning. This research evaluated coastal scenery of Torres municipal district, located on the north coast of Rio Grande do Sul State, south of Brazil, which receives a large number of visitors during the summer season, i.e. from December to March. In January 2014, a landscape quality evaluation of the beaches was realized. The method evaluates 26 natural and human parameters in order to classify beaches into 5 classes' class 1 being the one with the highest landscape attractiveness and class 5 the less attractive one. In order to apply the checklist, the Torres coastline was divided into 12 sectors. These are all urban beaches, so human related characteristics had considerable weight on the analysis results indicated that the assessed sectors are distributed between classes 3, 4 and 5. The Guarita Park beach stands out from the others, being the only one classified as a class 3. Cal and Molhes beaches were classified as class 4, and the other sectors were classified as class 5. Results highlighted poor coastal zone management with much litter being found on the beaches, tourist support facilities located in inappropriate places together with discharge of waste waters from effluents. Most sites have physical parameters for which coastal zone managers can do little or nothing to alleviate scenic impact, so emphasis should be given to assessing ways of improvement/upgrading the different human usage parameters, amongst them special attention must be devoted to litter and waste water management.

Keywords: coastal management; coastal landscape; landscape quality.

[@] Corresponding author to whom correspondence should be addressed: Cristiano <samantaccristiano@gmail.com>

[a] Universidade Federal do Rio Grande do Sul, Instituto de Geociências, Programa de Pós-Graduação em Geociências, (PPGGEO), Av. Bento Gonçalves, 9500 Bloco I Prédio 43113 Sala 207 - Porto Alegre - RS - Brazil CEP 91501-970 Caixa Postal 15001

[b] Universidade Federal do Rio Grande do Sul, Instituto de Geociências, Laboratório de Gerenciamento costeiro (LABGERCO), Av. Bento Gonçalves, 9500 - Porto Alegre - RS - Brazil CEP 91501-970 Caixa Postal 15001.

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

[d] Universidade Federal do Rio Grande do Sul, Instituto de Geociências, Centro de Estudos de Geologia Costeira e Oceânica (CECO), Campus do Vale, Av. Bento Gonçalves, 9500 - Porto Alegre - RS - Brazil CEP: 91501-970 Caixa Postal 15001

[e] University of Wales, Faculty of Architecture, Computing and Engineering, Trinity Saint David (Swansea), SA1 6ED, Mount Pleasant, Swansea, Wales, United Kingdom

* *Submission: 6 APR 2015; Peer review: 4 MAY 2015; Revised: 13 DEC 2015; Accepted: 26 DEC 2015; Available on-line: 27 DEC 2015*

This article contains supporting information online at http://www.aprh.pt/rgci/pdf/rgci-661_Cristiano_Supporting-Information.pdf

RESUMO

Avaliação da paisagem costeira em Praias Urbanas: Torres, Rio Grande do Sul, Brasil

A Zona Costeira (ZC) brasileira é reconhecida como Patrimônio Nacional pela Constituição Federal, devido a sua biodiversidade e beleza paisagística. A falta de planejamento resulta na ocupação inadequada do solo ameaçando à integridade dos ambientes costeiros e marinhos. Neste contexto, o reconhecimento das características da região costeira e marinha adjacente é fundamental para o planejamento adequado da ZC. A presente pesquisa objetivou avaliar o cenário costeiro do município de Torres, Litoral Norte do Estado do Rio Grande do Sul, sul do Brasil. As praias de Torres recebem um grande público na temporada de verão (dezembro a março) e devido a isso foi realizada, em janeiro de 2014, a avaliação da qualidade paisagística das mesmas. O método utilizado foi o Sistema de Avaliação de Cenário Costeiro proposto por Ergin et al. (2004, 2006, 2011), que consiste na avaliação de 26 parâmetros, tanto naturais quanto antrópicos, com resultados incorporados em 5 classes, sendo a classe 1 a de maior atratividade paisagística e a 5 de menor atratividade. Para a aplicação do checklist, dividiu-se o litoral de Torres em 12 setores. Os resultados demonstram que os setores avaliados distribuíram-se entre as classes de paisagem 3, 4 e 5. O Sistema de Avaliação de Cenário Costeiro empregado evidenciou a gestão deficitária da orla, com ocorrência de resíduos na faixa de praia, colocação de equipamentos de apoio ao turista em locais inapropriados e a descarga de efluentes. Por se tratarem de praias urbanas, as características antrópicas tiveram um peso considerável na análise. A praia do Parque da Guarita se destacou das demais, sendo a única enquadrada na classe 3. As praias da Cal e dos Molhes se enquadraram na classe 4 de qualidade paisagística e os demais setores foram enquadrados na classe 5. A baixa atratividade da paisagem é resultante de fatores naturais e antrópicos, destacando-se o acúmulo de resíduos sólidos na faixa de praia – problema que pode ser manejado. No cenário das praias do Rio Grande do Sul, Torres é detentor de uma paisagem singular, com elevado potencial turístico, mas com problemas de planejamento e gestão. O município tem uma economia consistente e com infraestrutura para atender a demanda turística e, neste contexto, a avaliação da qualidade dos cenários costeiros do município pode ser uma ferramenta importante para subsidiar uma melhor gestão de sua paisagem.

Palavras-chave: gestão costeira; paisagem litorânea; qualidade paisagística.

1. Introduction

The Brazilian Coastal Zone (CZ) is recognized as a National Heritage by the Federal Constitution due to its scenic beauty and inherent biodiversity. The marine and coastal zones represent more than 50% of the Brazilian territory, covering a large diversity of ecosystems, such as coral reefs, mangroves, marshes, dunes, beaches, rocky shores, cliffs and estuaries (MMA, 2010).

Brazil consists of 26 states, of which 17 have an interface with the sea. Among the seven most populated metropolitan regions of the country, four are situated in the Coastal Zone: Rio de Janeiro (RJ), Recife (PE), Salvador (BA) and Fortaleza (CE) (IBGE, 2010). The urbanization rate of the country went from 36% in 1950 to 84.4% in 2010 (IBGE, 2010). Currently, the Brazilian Coastal Zone has 44 million inhabitants, with a population density six times higher than the national average (135 inhabitants/km²) (Oliveira & Nicolodi, 2012).

Lack of planning associated with the proliferation of areas for second residences, hotel projects and bathing areas has created inadequate land occupation, with landscape alteration and destruction of coastal and marine ecosystems. Recognition of the physiographic characteristics of the coastal and adjacent marine zone is fundamental for sound CZ planning. This must be carried out through observation of coastal geology/geomorphology and the interaction between the marine and coastal systems, all working as a basis for management, use, and occupation of the coast planning programs (Gruber *et al.*, 2003).

The current research consists of a coastal scenery evaluation of Torres, a municipal district located on the north coast of Rio Grande do Sul, Brazil, using the Evaluation of Coastal Scenery System proposed by Ergin *et al.* (2004, 2006, 2011). This method consists of a checklist application with natural and human related parameters, considered essential for an attractive coastal landscape. The Torres' coastal region, having approximately 16 km of coast (SI-I Figure 1), is limited at the north by the Mampituba river and at the south by the municipality of Arroio do Sal. It is the only coastal municipality of the State with cliffs which are being eroded. Torres has a large biodiversity of coastal landscapes, with the mouth of the Mampituba river, Violão Lagoon, cliffs, sandy beaches, an island, and dune fields. More information regarding the geological, ecological and social economic contexts of Torres is presented in SI-I text.

2. Material and methods

Evaluation of the Torres coastal scenery landscape quality was carried out through application of the Coastal Scenery Evaluation System proposed by Ergin *et al.* (2004, 2006, 2011). This methodology utilizes fuzzy logic to estimate weights for 26 parameters (18 relative to physical parameters – P - and 8 human related parameters – H) considered essential for an attractive coastal landscape. The main parameters which denote landscape quality were classified in a scale from 1 (absence/bad quality) to 5 (presence/excellent quality). A mathematical model based on fuzzy logic was utilized to integrate the parameters' weights in a special

system for the scenarios' classifications. The value "D" is the indicator of attractiveness of the evaluated place. The system has five classes according to the following "D" value (Ergin *et al*., 2008, 2011):

Class 1 (D value > 0.85): extremely attractive natural site;

Class 2 (D value 0.85 – 0.65): natural, attractive areas with high landscape value;

Class 3 (D value 0.64 – 0.4): mostly natural areas with low landscape value;

Class 4 (D value 0.39 – 0): urban areas, mainly unattractive, with low landscape value;

Class 5 (D value < 0): unattractive urban areas, with intense development and low landscape value.

The municipality coast was divided into sectors according to its landscape diversity. Some sectors coincidently agreed with sections of well-defined beaches, others are subdivided, as deemed convenient for a better assessment of the coastal scenery. Figure 1 presents the municipality coast division in the 12 sectors. The checklist was applied during the summer season of 2013/2014 (January 2014), i.e. the period with the highest tourist activity and each coastal sector was evaluated by means of field observations. The field team was formed by professionals of different disciplines, such as, geography, oceanology, and biology.

The method utilized in this study has already been tested in many–other places, such as, New Zealand, Australia, Japan, United States, Pakistan, Colombia, Cuba and Spain (*i.e*. Williams *et al*., 2012; Rangel-Buitrago *et al.*, 2013; Anfuso *et al.*, 2014). The results can be used to open new perspectives not only in relation to the potential development of coastal tourism in natural areas, but also in relation to policies for improving landscapes in current tourist areas (Rangel-Buitrago *et al.*, 2013).

3. Results and discussion

Results from this study showed that the 12 assessed sectors of Torres coastline were distributed amongst landscape quality classes 3, 4 and 5 (Figure 2). Since the investigated areas are essentially urban, the human related attributes acquired a considerable weight, especially regarding human occupation (presence of litter and sewage evidences), and social economic activities.

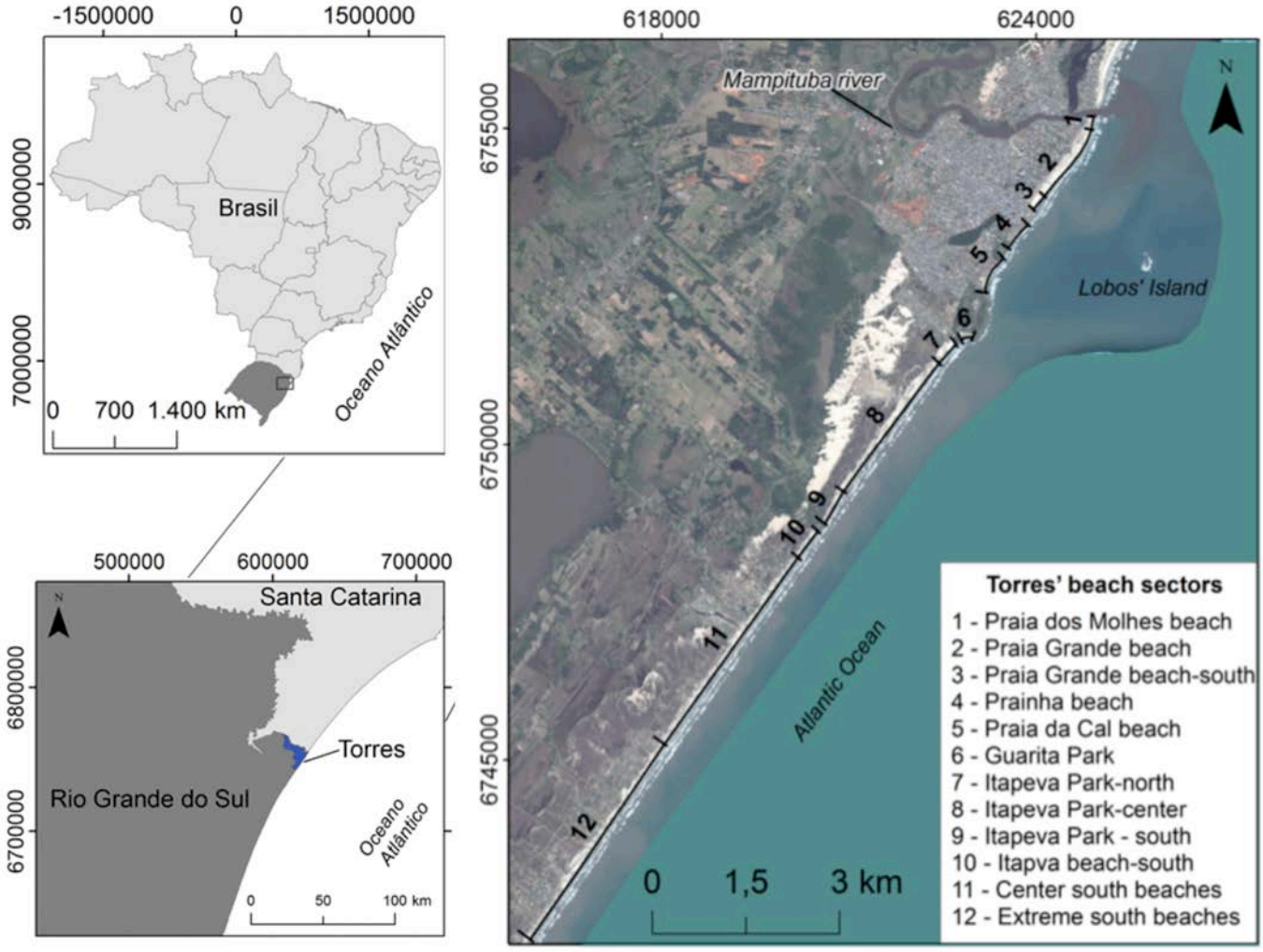

Figure 1 – Torres beach sectors evaluated to determine their landscape quality (base map ESRI, UTM-WGS84, 22J).

Figura 1 - Divisão dos setores praiais de Torres avaliados quanto a sua paisagem (mapa base ESRI, UTM-WGS84, 22J).

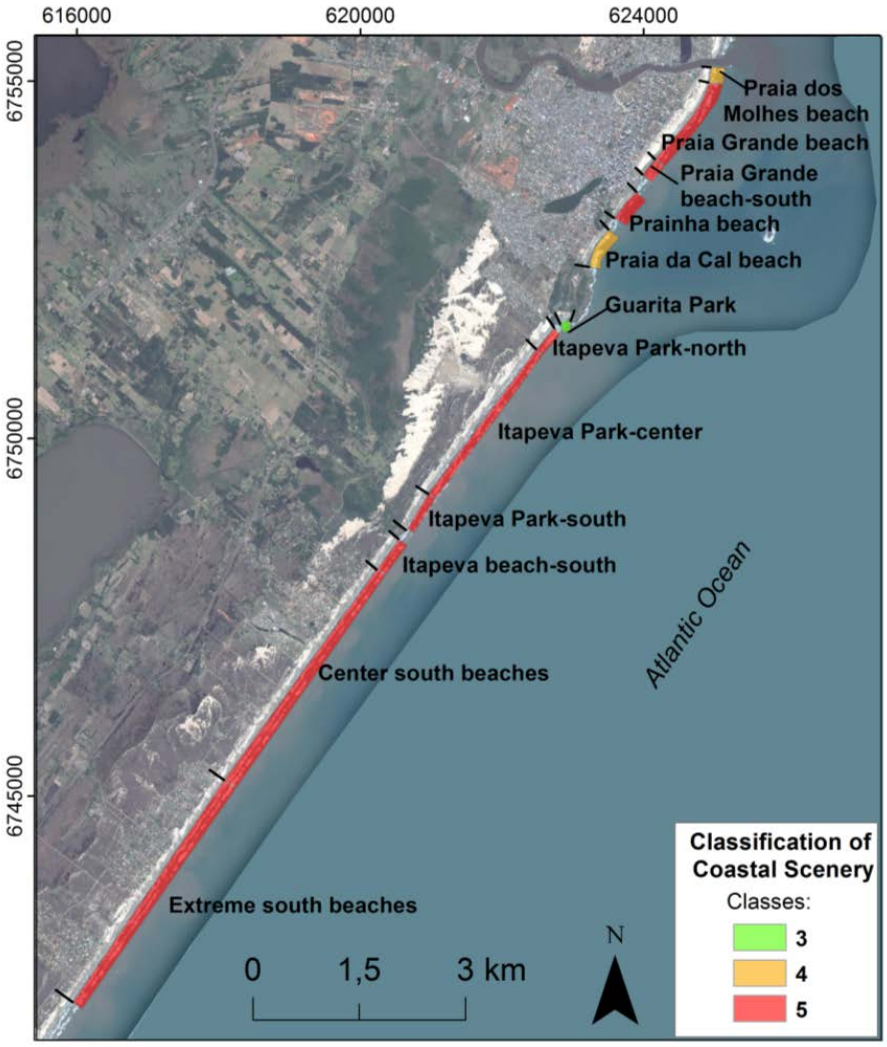

Figure 2 – Distribution of evaluated beach sectors and their respective classes (base map ESRI –WGS84, 22J).

Figura 2 - Distribuição dos setores praiais avaliados e respectivas classes (mapa base ESRI, UTM-WGS84, 22J).

Guarita Park beach stood out from the others, being the only one in class 3, with a D value of 0.52. This sector presented intermediate and low values for the physical and human related parameters, respectively (Figure 3A). Such scoring was influenced due to the vehicle access control in this section of the Guarita Park, as well as the presence of few seaside bars and restaurants. Undoubtedly Guarita Park constitutes an outstanding landscape site, with active cliffs of pink sandstone, which stand out of the sandy landscape; it has a high weighted average of physical parameters. The anthropogenic pressure is evident due to the presence of few litter items along the beach. In the membership degree curve, the graph inclination reflects the value of the evaluated attributes (Williams *et al.,* 2012). In the Guarita Park, the steepening (between 3 and 5) reflected the higher scenic values.

Praia da Cal beach (D=0.05) and Praia dos Molhes beach (D=0.04) were classified as class 4. The beaches present several natural scenic attractions, however they are highly influenced by humans parameters. Praia da Cal beach presents a long stretch of rocky coast; however, there is evidence of contaminated effluents (two spillways) and the presence of urbanization on the frontal dunes and the backshore. This beach presents a high concentration of beachgoers during summer months, culminating in a negative impact caused by the accumulation of litter. The weighted averages of this sector are balanced in their respective values for the physical and human related parameters (Figure 3B). When comparing the membership degrees of Praia da Cal beach and Praia dos Molhes beach with Guarita Park's, it is possible to note that there is a greater score in averages in lower attributes' values (1 and 2), which reflect the negative impact of physical or human parameters (Figures 3B and 3C).

Praia dos Molhes beach, located close to the mouth of the Mampituba river, has several attractions, i.e. the presence of sea lions close to breakwaters and dolphins at the river mouth. Behind the beach there is a well-devolved dune system, covered by native vegetation. The urbanized area along the margins of the Mampituba

river is responsible for pollution due to domestic sewage, which can be seen at the river mouth which is very close to the beach. As a consequence, at this beach portion, bathing is not allowed during a few months of the year, a factor that increased the weighted averages of the evaluated human related parameters (Figure 3C). The highest concentration of vegetation debris occurs next to the Praia dos Molhes beach sector, where aquatic macrophytes and other residues reach the sea through the Mampituba river's mouth. These are deposited on the beach by wave action, conferring an unpleasant effect on the landscape during some periods, especially when river discharges increase because of heavy rainfall in the basin. This aspect, a result of natural processes associated with anthropogenic impacts, reduces the landscape value of some beaches, particularly those located near mangroves (Anfuso *et al*., 2014). Investment of resources for the removal of vegetation accumulated on this beach portion is often required.

The majority of Torres beaches obtained scores corresponding to class 5 on the landscape quality evaluation. In a few cases, give names this classification was linked to the low attractiveness of the natural landscape associated with poor management, which does not take into account basic parameters of health and environmental well being. In other cases, -give names the attractiveness of the natural landscape was favorable, but human related factors contributed negatively on the assessment. The beaches ranking class 5 were: Praia Grande beach - south (D=-0.46) (Figure 4A), Itapeva Park - north (D=-0.42) (Figure 4B), Praia Grande beach, Extreme south beaches (D=-0.25); Centre south beaches (D=-0.22) and Itapeva Park - center (D=-0.14). Standout sectors of beaches ranked class 5, however with values very close to class 4 were: Prainha beach (D=-0.06), Itapeva Park - south (D=-0.02) and Itapeva beach - south (D=-0.03), caused by the anthropogenic influence. The presence of litter on these three sectors, and evidence of sewage discharge, made some beaches unsuitable for bathing purposes.

The membership degree curves reflect the attributes value, and, in the case of Torres, some beaches in the same Class (5) show peculiar curves (Figure 4). In the

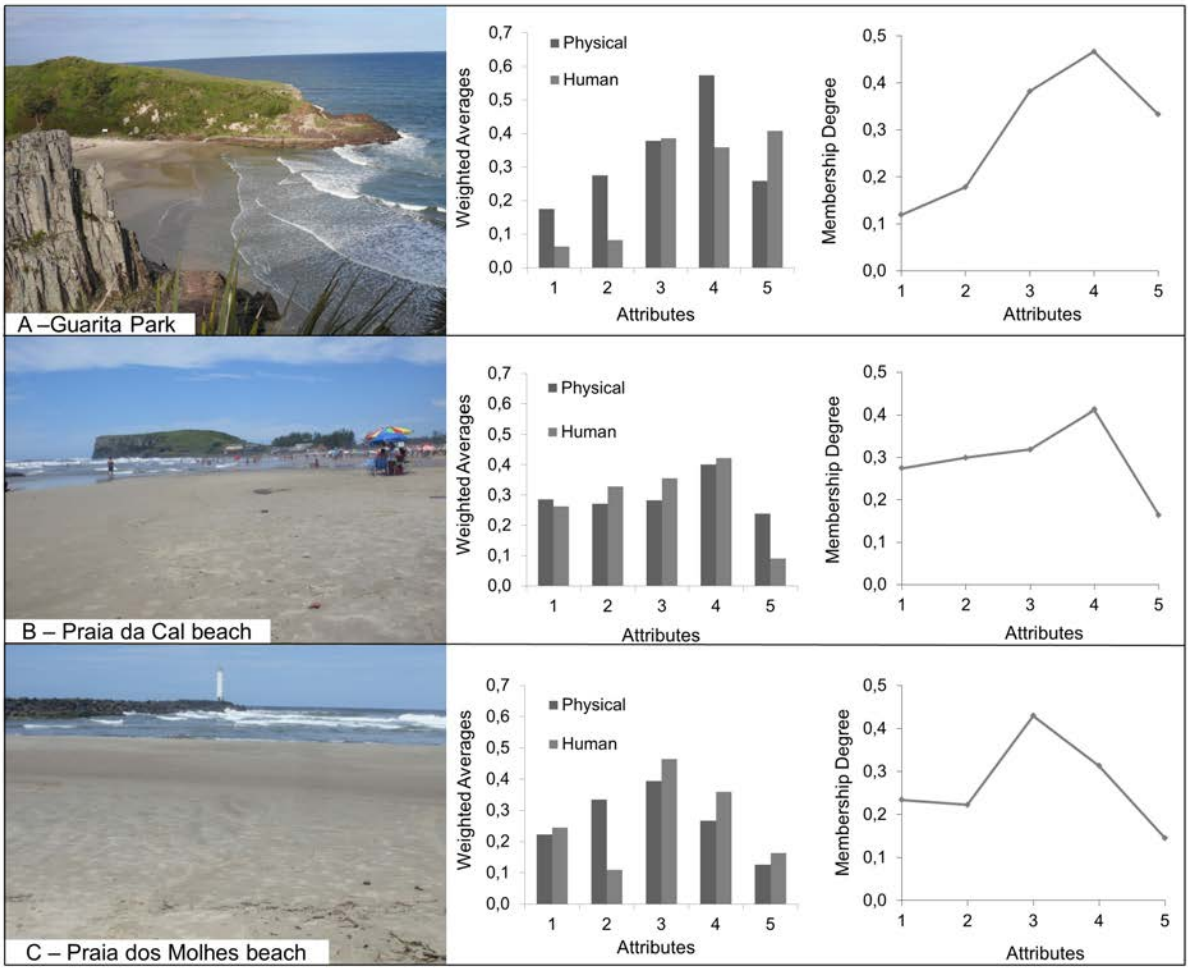

Figure 3 – Photography, weighted average for physical and anthropic parameters and membership degree for the beaches: A) Guarita Park; B) Praia da Cal beach; and C) Praia dos Molhes beach.

Figura 3 – Fotografias, medias ponderadas dos parâmetros físicos e antrópicos e graus de pertinência das praias: A) Guarita Park; B) Praia da Cal; e C) Praia dos Molhes.

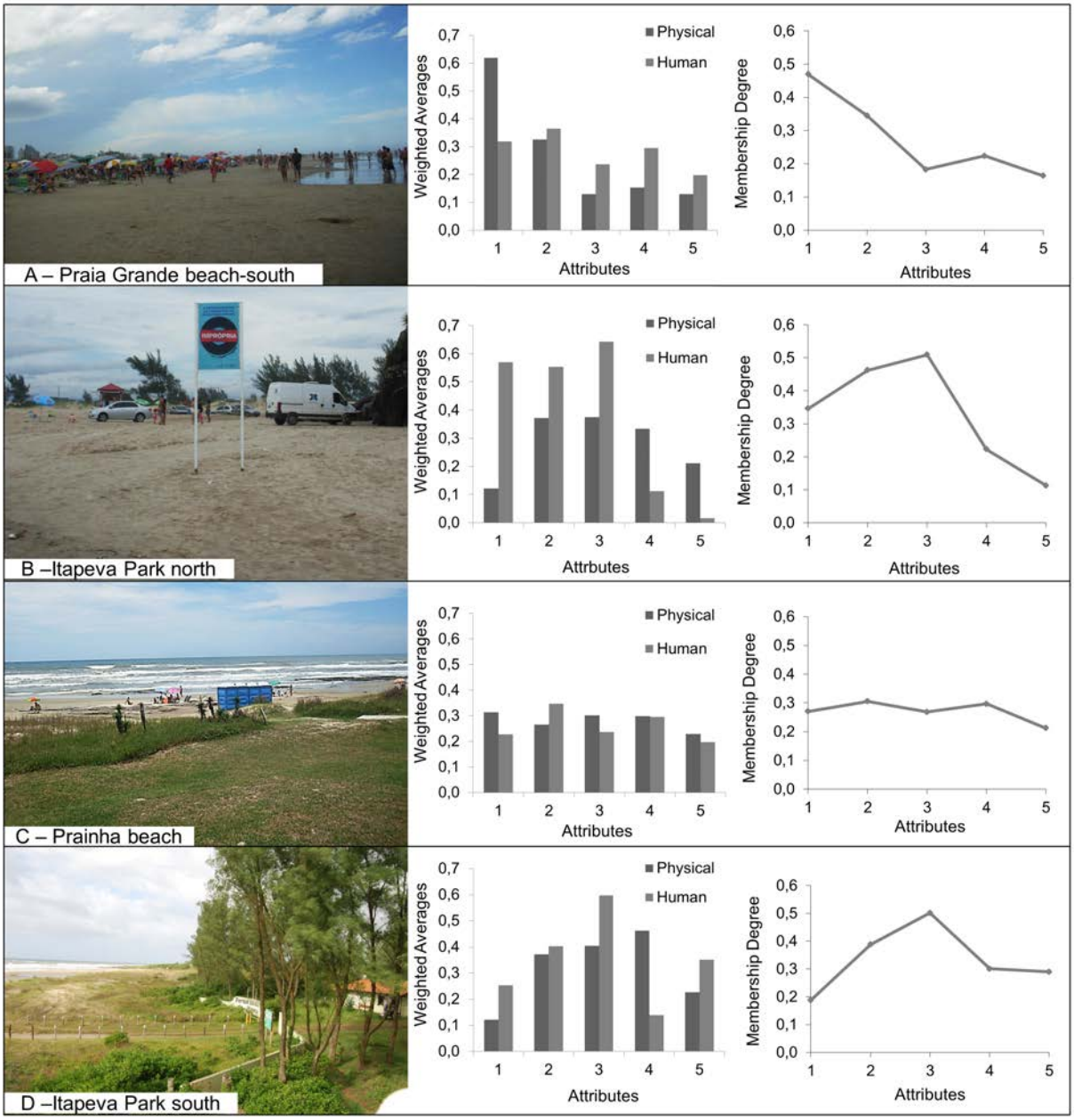

Figure 4 – Photography, weighted average for physical and anthropic parameters and membership degree for beaches: A) Praia Grande beach - south; B) Itapeva Park - north; C) Prainha beach; and D) Itapeva Park - south.

Figura 4 – Fotografias, médias ponderadas dos parâmetros físicos e antrópicos e graus de pertinência das praias: A) Praia Grande sul; B) Itapeva Park norte; C) Itapeva Park; e D) Itapeva Park sul.

Praia Grande beach there are low attributes' values, between 1 and 2; for the sector Itapeva Park-north, there is a greater curve steepening between values from 1 to 3 (value 3 due to the most attractive landscape); for Prainha beach, the graph shows a more straight line with constant attributes' values – results of a great quality landscape, impoverished by the installation of public facilities in unsuitable areas; for Itapeva Park-south, the graph shows steepening in attribute 3, but considerable values for attributes 2, 4 and 5 – the last ones emphasizes the positive landscape aspects in the conservation unit beach.

The sectors of Prainha beach (Figure 4C), Itapeva Park - south (Figure 4D) and Itapeva beach – south, may upgrade from class 5 to class 4 if management measures are taken. These sectors present high values for the physical parameters, but equally high values for the human related parameters. They are beaches of relevant natural characteristics, with occurrence of rocky shores outcrops contrasting in beaches with clear sand. Inadequate management on these beaches damages the landscape quality. It is possible to observe for example, the installation of chemical toilets on the beach area of Prainha beach sector that, in addition to disfiguring the

landscape, give an unpleasant odour and possible contamination resulting from poor handling, vandalism, tides and wind. These factors give high attribute (negative) values to the human related parameters.

In the sector of Itapeva Park - south and Itapeva beach - south, the landscape was also damaged due to the public accessing the beach by vehicles, which generates noise and degrades the environment. However, in May 2015, the Federal Public Ministry associated with Itapeva Park, whose land use plan is currently under review decided to prohibit all vehicle access to Torres beaches. Accordingly there is a trial period for the regulated use of vehicles in the Itapeva Park area; which the Municipal government did not attend. I do not follow this Is the sentence now correct The Federal Public Ministry founded its decision on the fact that the high circulation of vehicles causes segmentation of the dune environment, pollutes beaches with residues and noise, and creates insecurity to beach users. The decision brings benefits to the Torres coastal landscape, but the importance of management actions, such as the establishment of parking lots and instruments to support tourism that meets environmental conditions, as well as effective supervision, should be noticed.

Evaluation of Torres coastal scenery resulted in the distribution of its beaches between the classes 3, 4 and 5, i.e. they ranged from mainly natural areas with a few valuable scenery parameters to urban unattractive beaches, with intensive development and low landscape features. More discussions about Torres coastal landscape conservation and management are provided in SI-III.

4. Conclusion

The method utilized for the classification of Torres coastal scenery was extremely effective. It is evident that, among the landscape degradation factors, there are several ones linked to poor and insufficient management practices. Practices that stood out in some sectors include: (i) the disposal of litter on the coast, due to the lack of appropriate bins and environmental awareness actions; (ii) the placement of tourist support facilities in inappropriate places, such as chemical toilets and a large number of kiosks and restaurants on the coast; and (iii) sewage discharge, which gives rise to unsuitable conditions for bathing.

In general, the obtained D values (classes 3 to 5) reflect the urban characteristics of almost all investigated beaches. Only the natural beach of Guarita Park belonged to class 3. The beach reached this status because it is situated in a natural park, combining an attractive natural landscape with low anthropogenic impact. The beaches with lower landscape attractiveness are intensively used, being located in large urban areas with poor natural scenery parameters.

Within Rio Grande do Sul State, Torres municipality has a unique landscape characterized by sandy sectors and well developed cliffed sectors, which give high scenery values and a huge tourist potential. Loose or poor management was observed at many places. The results of this study can contribute to improvement of the management of the Torres beaches favouring coastal development in accordance with the preservation of an attractive landscape, that is only possible through adequate management and supervision measures.

Acknowledgments

The authors thank the *Secretaria de Meio Ambiente* (Department of Environment) of the *Prefeitura Municipal de Torres* (Torres' City Hall) for providing the Coastal Dunes Management Plan of the municipality for scientific purposes. We also thank the Graduate Program in Geosciences/UFRGS, by narrowing the Brazil-Spain link, enabling scientific and experiential exchange between professionals within the scope of coastal areas management.

Appendix

Supporting Information associated with this article is available online at http://www.aprh.pt/rgci/pdf/rgci-661_Cristiano_Supporting-Information.pdf

References

Anfuso, G.; Williams, A.T.; Cabrera-Hernández; Pranzini, E. (2014) - Coastal scenic assessment and tourism management in western Cuba. *Tourism Management*, 42:307-320. DOI: 10.1016/j.tourman.2013.12.001

Ergin, A.; Karaesmen, E.; Micallef, A.; Williams, A. T. (2004) - A new methodology for evaluating coastal scenery: fuzzy logic systems. *Area*, 36:367-386. DOI: 10.1111/j.0004-0894.2004.00238.x

Ergin, A.; Williams, A.T.; Micallef, A. (2006) - Coastal scenery: appreciation and evaluation. *Journal of Coastal Research*, 22(4):958-964. DOI: 10.2112/04-0351.1

Ergin, A.; Karaesme, E., Uçar, B. (2011) - A quantitative study for evaluation of coastal scenery. *Journal of Coastal Research*, 27(6):1065-1075. DOI: 10,2112/JCOASTRES-D-09-00093.1

Gruber, N. L. S.; Barboza, E. G.; Nicolodi, J. L. (2003) - Geografia dos Sistemas Costeiros e Oceanográficos: Subsídios para Gestão Integrada da Zona Costeira. *Gravel* (ISSN 1678-5975), 1: 81-89, Porto Alegre, RS, Brasil. Available on-line at http://www.ufrgs.br/gravel/1/Gravel_1_07.pdf

IBGE - Instituto Brasileiro de Geografia e Estatística (2010) - *Censo Demográfico 2010*. Instituto Brasileiro de Geografia e Estatística, Rio de Janeiro, RJ, Brasil. Available on-line at http://www.ibge.gov.br/home/estatistica/populacao/censo2010/default.shtm.

MMA, Ministério do Meio Ambiente (2010) - *Panorama da conservação dos ecossistemas costeiros e marinhos no Brasil*. Brasília: MMA, 2010. Available on-line at http://www.mma.gov.br/estruturas/205/_publicacao/205_publicacao03022011100749.pdf

Oliveira, M.R.L.; Nicolodi, J.L. (2012) - A gestão costeira no Brasil e os dez anos do Projeto Orla – Uma análise sob a ótica do poder público. *Revista de Gestão Costeira Integrada*, 12(1):89-98. DOI: 10.5894/rgci308.

Rangel-Buitrago, N.; Correa, I.D.; Anfuso, G.; Ergin, A.; Williams, A.T. (2013) - Assessing and managing scenery of the Caribbean Coast of Colombia. *Tourism Management*. 35:41-58. DOI: 10.1016/j.tourman.2012.05.008.

Williams, A.T; Micallef, A.; Anfuso, G.; Gallego-Fernadez, J.B. (2012) - Andalusia, Spain: An Assessment of Coastal Scenery. *Landscape Research*, 37(3): 327-349. DOI: 10.1080/01426397.2011.590586