



Can coastal scenery be managed? The Valparaíso region, Chile as a case study

Nelson Rangel-Buitrago^{a,*}, Manuel Contreras-López^b, Carolina Martínez^c, Allan Williams^d

^a Departamentos de Física - Biología, Facultad de Ciencias Básicas, Universidad del Atlántico, Barranquilla, Atlántico, Colombia

^b Facultad de Ingeniería y Centro de Estudios Avanzados, Universidad de Playa Ancha, Valparaíso, Chile

^c Instituto de Geografía, Pontificia Universidad Católica de Chile, Santiago, Chile

^d Faculty of Architecture, Computing, and Engineering, University of Wales: Trinity Saint David Swansea, Wales, UK



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ABSTRACT

Coastal tourism developed along the Valparaíso region of Chile is being threatened by a very particular issue: scenery degradation related to extreme urbanization and collateral effects. This paper presents the results of scenic evaluation of 96 sites along this region. The scenic evaluation assesses values from a checklist of 18 physical and 8 human parameters, and permits calculation of a scenic evaluation index (D Value), which classifies coastal sites into five classes: Class I, usually natural areas of top scenic characteristics, to Class V, poor scenic natural areas with a higher impact of human interventions. In summary, 14 sites (15%) appeared in Class I; 7 (7%) in Class II; 9 (9%) in Class III; 17 (18%) in Class IV and 49 sites (51%) in Class V. This evaluation provides a complete scenic assessment overview of the Valparaíso Region, allowing implementation of an adequate management strategy based on knowledge of coastal scenery for the maintenance and preservation of scenic quality.

1. Introduction

The coast is one of the most dynamic and precious morphological features on Earth. From the beginning of mankind, these areas have played a significant role as a place for human settlement and economic development (Pilkey and Cooper, 2014; Barragan and Andreis, 2015). Coastal economic growth has always been strongly dependent on exploitation of several natural resources among which is its Scenery.

Coastal Scenery is the appearance of a coastal area, and its character and quality that are the result of multiple interactions between natural and human factors (Council of Europe, 2000). Also, scenery is a reflection of the mutual interactions between living organisms and their coastal environment, and it is considered to be a fundamental part of the ecosystem (Van der Meulen and Salman, 1996; Williams, 2019).

Coastal Scenery is a resource, partly because of the economic value and partly because it is an accepted component of the existing resource assessment programs (Kaye and Alder, 1999). The unique and distinctive character of scenery turns it into one of the most significant assets for humankind thanks to a growing industry: **Coastal Tourism** (Rangel-Buitrago, 2019). Coastal tourism includes those recreational activities that involve travel away from one's place of residence, which has as their host or focus the coastal zone (Hall, 2001). This industry

necessarily depends on the coastal environment to attract tourists (Lekakou and Tzannatos, 2001; White et al., 2006). Several studies demonstrate that excellent scenery is perhaps the prime factor considered by a potential tourist in choosing a coastal vacation destination (Jędrzejczak, 2004; Papageorgiou, 2016).

According to UNTWO (2016), tourism is one of the ten largest business sectors of the World economy. This industry by itself generates five in one hundred jobs globally, and between 35 and 45% of the world's exports services (UNTWO, 2016). Also, its contribution to gross domestic product in any given country can range from 2% for small scale tourism countries where tourism weighting can be significant, to more than 50% in countries where the tourism industry is well developed.

The growth of coastal tourism is undeniable, and several studies have highlighted an exponential growth in the last three decades (Miller, 1993; Hall, 2001; Rangel-Buitrago et al., 2013). Tourism's importance is unquestionable, and its growth is related to the natural physical and socio-economic characteristics of the coastal area (UNEP, 2009). A place with superb coastal scenery has an invaluable “plus effect” because the coast is an ideal area for tourism development.

Chile has an 83000 km of coastline (SHOA, 1994) and its unique geological and geomorphologic conditions make the coast a perfect

* Corresponding author.

E-mail address: nelsonrangel@mail.uniatlantico.edu.co (N. Rangel-Buitrago).

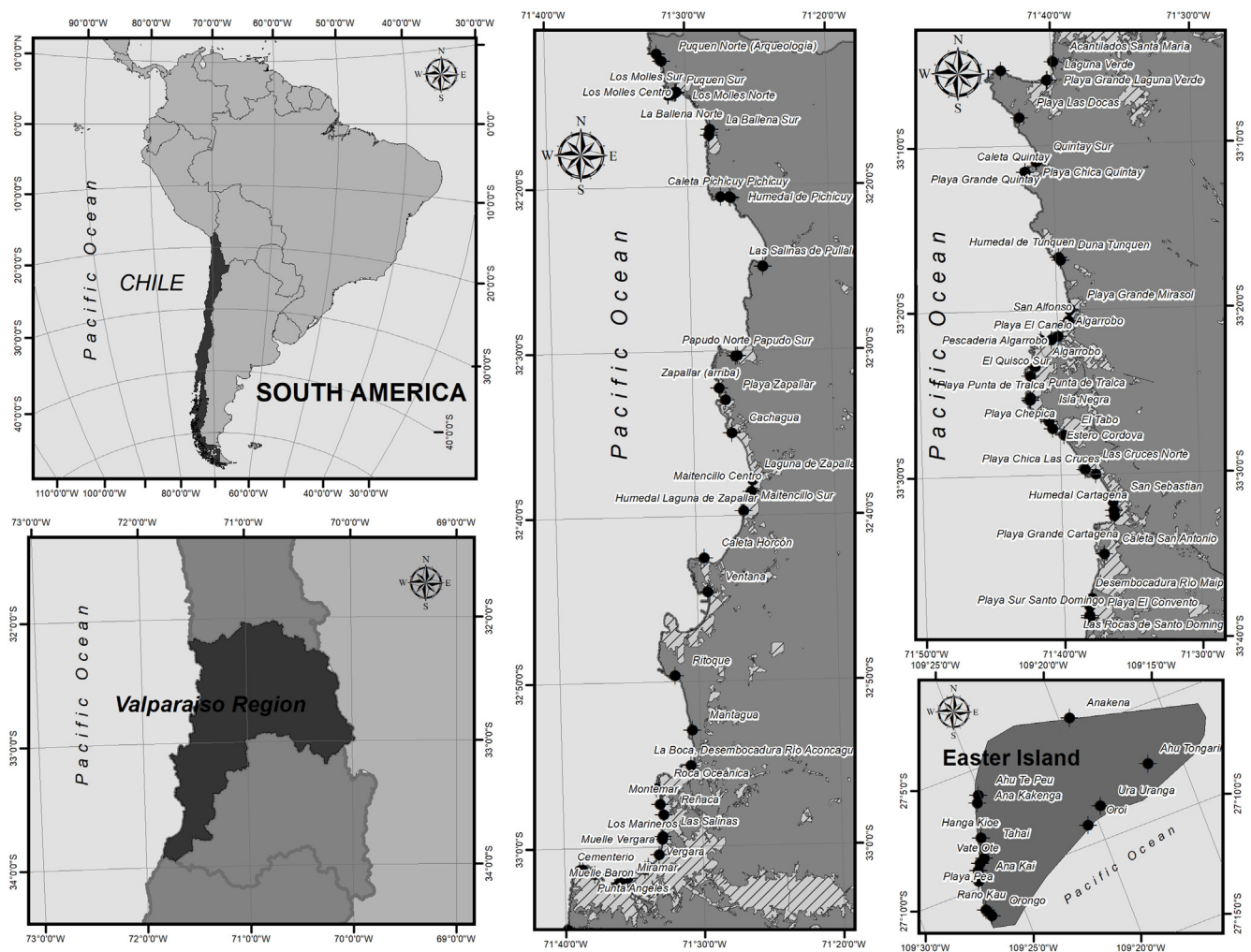


Fig. 1. Study area with indication of the administrative division of the Valparaíso Region. Easter Island inset is located.

place for tourism development. The above is well known by Chilean authorities, and from the mid-1990s the tourist industry, especially coastal tourism, has become one of the most important sources of income for the country and the key to the economy of many regions of the country, such as the Valparaíso region. Chile had 5.6 million visitors in a 2016 and with respect to international tourist arrivals it was ranked the second leading destination in South America and the sixth in the Americas after the United States, Mexico, Canada, Brazil and Dominican Republic with revenues from foreign tourists that reached US\$2.7 billion in 2016 (UNTWO (2017)).

Coastal tourism, especially along the Valparaíso Region, is being threatened by a very particular issue: scenery degradation related to extreme urbanization and the collateral effects (e.g., litter, accelerated coastal erosion due to engineering structures, and pollution). Most of the time coastal scenery degradation begins with repeated exploitation goals of the tourism industry. Many countries (including Chile) utilize proactive urbanization growth policies along the coast to benefit from more tourist arrivals based on the wrong premise: **More urbanization (facilities) means more tourists.**

Coastal degradation related to extreme urbanization activities produces a negative reaction in beach users due to the feeling of limited space, unhealthy conditions, and above all, a poor aesthetic value. As a result, extreme urbanization is a strong reason to leave or not visit an area (Pilkey et al., 2011). For the Valparaíso Region, scenery degradation of coastal areas increased at the same time as the coastal tourism boom, mainly because of the construction of intensive secondary housing cooperatives, hotels and tourism facilities (Negrete

et al., 2000; Hidalgo et al., 2014, 2016). What began as part of a prosperous industry, coastal tourism is now a big issue that is affecting its very development.

The above leaves an important question to resolve: **How can one overcome scenery degradation and restore or improve the scenic quality of the Valparaíso Region's coastline?** The answer is the objective of this paper.

This paper provides a scenic assessment of 96 coastal sites located along the Valparaíso Region coastline (continental and insular), by means of the use of fuzzy logic analysis and parameter weighting matrices to overcome subjectivity and quantifying uncertainties (Ergin et al., 2004; Ergin, 2019; Rangel-Buitrago, 2019). Similarly it deals with the main factors relating to an innovative scenic assessment methodology applied to a coastal area whose intrinsic geological characteristics, and in particular the physical context, control the natural factors considered in the classification. Utilizing this analysis and classification will result in a significant thrust for coastal tourism, currently threatened by extreme urbanization and related impacts. The technique opens new perspectives for analysis of the potential for coastal tourism development in natural areas, and scenic quality improvement of current tourism-developed regions. It also, provided is a complete scenic assessment of the Valparaíso Region, so allowing implementation of an adequate management strategy based on coastal scenery knowledge for the maintenance and preservation of the scenic quality.

Table 1

Location and general characteristics of the investigated coastal sites. The Commune column lists administrative subdistricts (see Fig. 1 for locations).

N	Site	Commune	Typology	D value	Class
1	Puquen Norte (Límite Regional)	La Ligua	Rural	0.82	II
2	Puquen Norte (Arqueología)		Rural	1.05	I
3	Puquen Norte (Mala Bajada)		Remote	0.60	III
4	Puquen Sur		Remote	0.98	I
5	Los Molles Norte		Village	−0.76	V
6	Los Molles Centro		Village	−0.42	V
7	Los Molles Sur		Village	−0.09	V
8	La Ballena Norte		Village	−0.04	V
9	La Ballena Sur		Village	0.17	IV
10	Caleta Pichicuy		Urban	−0.26	V
11	Pichicuy		Village	−0.11	V
12	Humedal de Pichicuy		Rural	0.48	III
13	Las Salinas de Pullally		Village	0.39	IV
14	Papudo Norte	Papudo	Village	−0.31	V
15	Papudo Sur		Village	−0.23	V
16	Zapallar (arriba)	Zapallar	Village	0.48	III
17	Playa Zapallar		Village	0.32	IV
18	Cachagua		Village	0.65	III
19	Laguna de Zapallar		Village	−0.50	V
20	Humedal Laguna de Zapallar		Village	−0.03	V
21	Maitencillo Centro	Puchuncaví	Village	−0.48	V
22	Maitencillo Sur		Village	−0.05	V
23	Caleta Horcón		Urban	−0.85	V
24	Ventana	Quintero	Urban	−0.85	V
25	Ritoque		Village	0.31	IV
26	Mantagua		Rural	0.19	IV
27	La Boca. Desembocadura Río Aconcagua	Concón	Urban	−0.75	V
28	Roca Oceánica		Rural	0.95	I
29	Montemar	Viña del Mar	Village	−0.54	V
30	Reñaca		Urban	−0.57	V
31	Las Salinas		Urban	−0.65	V
32	Los Marineros		Urban	−0.22	V
33	Muelle Vergara		Urban	−0.50	V
34	Avenida Peru		Urban	0.20	IV
35	Caleta Abarca		Urban	0.03	IV
36	Caleta Portales	Valparaíso	Urban	−0.85	V
37	Miramar		Urban	0.01	IV
38	Muelle Barón		Urban	−0.69	V
39	Playa San Mateo		Urban	−0.76	V
40	Las Torpederas		Urban	−0.55	V
41	Punta Angeles		Urban	−0.04	V
42	Cementerio		Urban	−0.27	V
43	Acantillados Santa María		Rural	0.10	IV
44	Laguna Verde		Village	0.05	IV
45	Playa Grande Laguna Verde		Village	−0.64	V
46	Las Gaviotas - Punta Curaumilla		Rural	0.73	II
47	Playa Las Docas		Village	0.50	III
48	Playa Grande Quintay	Casablanca	Resort	0.22	IV
49	Quintay Sur		Village	0.40	IV
50	Playa Chica Quintay		Urban	−0.24	V
51	Caleta Quintay		Urban	−0.50	V
52	Humedal de Tunquen		Remote	0.74	II
53	Duna Tunquen		Remote	0.54	III
54	Balneario Algarrobo Norte	Algarrobo	Urban	−0.35	V
55	Playa Grande Mirasol		Village	−0.63	V
56	Humedal San Alfonso		Rural	0.75	II
57	San Alfonso		Resort	−0.21	V
58	Playa Las Cadenas		Urban	−0.26	V
59	Playa Los Tubos		Urban	−0.76	V
60	Playa El Canelo		Village	−0.25	V
61	El Quisco Norte	El Quisco	Urban	−0.29	V
62	El Quisco Sur		Village	−0.49	V
63	Punta de Tralca		Village	0.25	IV
64	Playa Punta de Tralca		Village	−0.44	V
65	Isla Negra		Rural	0.89	I
66	Estero Cordova	El Tabo	Rural	−0.12	V
67	Playa Chepica		Village	−0.67	V
68	El Tabo		Village	−0.37	V
69	Las Cruces Norte		Village	0.44	III
70	Playa Chica Las Cruces		Village	−0.15	V

Table 1 (continued)

N	Site	Commune	Typology	D value	Class
71	San Sebastian	Cartagena	Village	−0.66	V
72	Playa Grande Cartagena		Urban	−0.48	V
73	Humedal Cartagena		Village	−0.61	V
74	Caleta San Antonio	San Antonio	Urban	−0.94	V
75	Desembocadura Río Maipo	Santo Domingo	Village	0.10	IV
76	Las Rocas de Santo Domingo		Village	0.46	III
77	Playa Sur Santo Domingo		Village	−0.13	V
78	Playa El Convento		Village	0.38	IV
79	Playa El Convento - Dunas		Rural	0.85	II
80	El Yali, entrada playa		Rural	0.64	III
81	El Yali, Albufera		Rural	0.11	IV
82	El Yali, Lado Sur		Rural	0.80	II
83	Orongo	Eastern Island	Remote	1.23	I
84	Rano Kau		Remote	1.51	I
85	Ana Kai		Rural	1.18	I
86	Hanga Piko		Village	−0.05	V
87	Vate Ote		Village	0.09	IV
88	Playa Pea		Village	−0.03	V
89	Tahai		Remote	1.07	I
90	Hanga Kioe		Remote	0.71	II
91	Ana Kakenga		Remote	1.51	I
92	Ahu Te Peu		Remote	1.23	I
93	Anakena		Remote	1.24	I
94	Ahu Tongariki		Remote	1.56	I
95	Ura Uranga		Remote	1.44	I
96	Oroi		Remote	1.44	I

2. Study area

The Valparaíso Region (also known as V Region) is one of the first-order administrative regions of Chile, and encompasses a total coastal population of 966,811 inhabitants, corresponding to 5.5% of the national total (INE, 2018). The Region is composed of 15 continental coastal municipalities and two island municipalities (Juan Fernandez and Easter Island) and contains some of Chile's oldest coastal settlements that were developed as a trans-oceanic rest stop for fishing ships, sea cruise-liners and international naval ships (Vicuña-Mackenna, 1869). The Coastal population is concentrated mainly in the conurbation of Gran Valparaíso (69.7% of the region's inhabitants). On the continental coastline, three industrial and port developments stand out (San Antonio, Valparaíso, and Quintero), and which are interspersed with numerous tourist settlements. For its part, Easter Island has a permanent population of 6832 inhabitants, which is increased by about 70,000 tourist visits per year (CONAF, 2017).

The study area includes 96 coastal sites: 82 continental sites distributed between latitudes 32° to 34°S, and 14 island sites surrounding the entire perimeter of Easter Island (Fig. 1 and Table 1). The continental coastline has a N-S rectilinear orientation typical of a collision coast derived from the Nazca plate subduction, under the South American plate. The coast is typical of an active plate margin, close to and parallel with a large submarine trench, which has acquired its present form due to marine erosion and interseismic and coseismic elevation (Melnick, 2016). Coastal morphology is characterized by bays, pocket beaches, coastal wetlands, dunes and rocky shorelines dominated by cliffs carved in metamorphic, intrusive or volcanic rocks.

Easter Island is located in the middle of the Pacific Ocean 3700 km from the South American continent. The island's location is the result of the coalescence of three shield volcanoes that erupted between about 770,000 and 100,000 years ago (Rano Kau, Poike, and Terevaka) at the boundary of the Easter Microplate and the Nazca Plate, and are part of the Easter seamount chain. These volcanoes formed over a hot spot and grew from the seafloor to emergence. This volcanic origin has generated kilometers of rocky coastline, dominated by erosional features, such as, cliffs, small islets, stacks, shore platforms, and caves. On this Island there are only three sandy beaches: Anakena Beach and Ovahe Beach, both located on the northern side, and Pea Beach, in the town of Hanga

Roa.

The continental side of the Valparaíso coastline is considered as a Mediterranean environment with a climate gradient ranging from semi-arid to humid with average temperatures of $< 15^{\circ}$ and maximum precipitation values of 200 mm per year in the extreme north, and 450 mm per year in the extreme south of the region. The marked seasonal variation shows a rainy period from April to August and a dry period for the rest of the year (di Castri and Hajek, 1976). Easter Island's climate is typical of a tropical rainforest, but sometimes changes to a humid sub-tropical climate due to rain that average 1100 mm per year. The geographic location allows winds to keep temperatures between a 15°C avg. in July–August (coldest season) to 29°C in February (summer season).

Tides are mixed semi-diurnal, with maximum amplitudes of 160 cm along the continental coastline and less than 80 cm on Easter Island (SHOA, 2018). Wave climate of the continental coast of the Valparaíso Region is dominated by waves generated in a west wind belt (40°S - 60°S) which moves through the Pacific Ocean. Significant wave heights range between 1.8 and 2.4 m with an average peak period of 10s. Seasonal variability of waves is low despite the northward movement of the western wind belt during the winter months, allowing cyclones of higher energy to form at lower latitudes which generate powerful winter swells that affect the entire coast. Waves on Easter Island are produced in the same area as the waves that affect the open coast of Chile. Wave heights and average peak periods in deep waters present a low spatial variability, with average values ranging between 2.4 m and 2.8 m, and with peak periods between 13.1 s and 13.5 s respectively (Beyá et al., 2016).

Currently, the tourism industry represents one of the Valparaíso coast's most important activities with 424,198 international arrivals (mostly from the USA, European Union, and Argentina) and 1,074,097 domestic tourism arrivals to its coastal areas in the 2016 period (SERNATUR, 2016), the capacity for growth appearing to be almost limitless. When comparing 2014 and 2016, an increase of 197,419 national and international arrivals was observed (SERNATUR, 2016). Visitors' peaks are observed during the summer season December–February. The most visited coastal sites are Viña del Mar, Valparaíso, and Easter Island. Viña del Mar is the most visited destination both for cultural and beach associated tourism. As a result, this area is experiencing a great increase of 'elite' tourism developments, essentially consisting of five stars hotels. Further developments are observed in some areas as enlargement of existing coastal towns and villages with associated impacts on landscape beauty.

3. Methodology

The landscape quality has been determined using diverse techniques that include best-worse scores, scenic uniqueness, public perception, and attitudes, among others (see Leopold, 1969; Kaplan and Kaplan, 1989; CCW, 2001; Williams, 2019). For the coastal scenery assessment in the study area the Coastal Scenery Evaluation System (CSES) was used. This method was first presented by Ergin et al. (2004), and updated by Ergin (2019) and Rangel-Buitrago et al. (2018). This methodology consists of a checklist that evaluates 26 coastal weighted parameters (18 physical and 8 human, see Table 2) by the use parameter weightings and fuzzy logic mathematics.

To fill in the scenic evaluation checklist each of the 96 coastal sites listed in Table 1 were visited, and each one was recorded for the relevant parameter boxes given in Table 2. This evaluation allowed the determination of each site's state according to its current attributes. As an example, the beach-face color parameter has five attributes: absent, dark, dark tan, bleached and white/gold. A coastal site with dark beach-face color would be scored as 2; a place with white color sand would be scored as 5. Although some parameters can be easily quantified (such as beach width, number of utilities, etc.), several parameters used in this classification are subject to the perception over the coastal site, e.g.,

built environment.

Final assessment matrices were calculated and graphically presented as histograms, a weighted average of attributes and membership degree of attributes graphs. Histograms provide a graphic summary of physical and human parameters obtained from Table 2, and allow an immediate assessment of high and low rated attributes. Membership degree vs. attribute curve presents an overall scenic evaluation over the surveyed characteristics, and weighted averages of attributes delineated the relative comparison of physical and human parameters assessed.

The Coastal Scenery Evaluation System (CSES) algorithm involving weighting and fuzzy logic values, and incorporating all of the above data, and summaries a Scenic Evaluation Decision Value "D" to be obtained. The limits among different classes coinciding with clearly identifiable cut-off points. The coastal site scenic value was categorized into five distinct classes:

- Class I: Top natural, extremely attractive sites with very high landscape value (Scenic Evaluation Decision Value > 0.85).
- Class II: Natural: attractive sites with high landscape value (Scenic Evaluation Decision Value between 0.65 and 0.85).
- Class III: Mainly natural sites with little outstanding landscape features (Scenic Evaluation Decision Value between 0.4 and 0.64).
- Class IV: Mainly urban, poor sites with average landscape value and light development (Scenic Evaluation Decision Value between zero and 0.39).
- Class V: Very unattractive urban sites, with intensive development, and a low landscape value (Urban: poor sites with low landscape value and intensive urban development below zero).

For further details about this methodology see Ergin et al. (2004, 2010), Ergin (2019), and Rangel-Buitrago (2019) and Rangel-Buitrago et al. (2013, 2017).

4. Results and discussion

4.1. The classes

Ninety-six coastal sites were classified in the Valparaíso region (continental and island area). Scenic evaluation categorized sites into five classes. 14 sites (15%) appeared in Class I; 7 (7%) in Class II; 9 (9%) in Class III; 17 (18%) in Class IV and 49 sites (51%) in Class V. Overall results represented in percentage and by typology are shown in Fig. 2 and summarized as follows:

Class I: Fourteen rural and remote coastal sites (out of 96) were categorized into Class I. Ten are located on Easter Island, while the remaining four are located in the continental area. This class includes stunning scenic natural sites with very high landscape values ($D \geq 0.85$). The excellent scores reached are the result of superb physical features with a null or minimal level of human influence (Fig. 3).

Unique geologic settings and particular geomorphologic characteristics of sites within this class acquire significant importance. In the checklist "cliffs," "rocky shore," "valley," "skyline landform" and (partially) "coastal landscape features" are frequently linked to the presence of high rocky coasts, and (often) an undulating or mountainous landscape (e.g., Orongo, Roca Oceánica and Isla Negra). In beach sites, the dominant sediment is white/gold sand (e.g., Anakena beach).

With respect to human parameters, human occupation observed in Class I sites was almost null, and no presence of litter or sewage related items were found. All sites are free of utilities and noise disturbance problems, and the skyline is characterized by keeping its natural state (e.g., Puquén Sur), or as a historic place (e.g., Ahu Tongariki - Easter Island). Histograms presented in Fig. 3 highlight very high scores on physical and human parameters. Likewise, the membership degree and attribute curve presents a right-hand sided curve that reflects high scenic value quality due to low scoring on attributes 1 and 3, and high values in attributes 4 and 5.

Table 2
Coastal Scenic evaluation checklist.

N	Physical parameters		Rating				
			1	2	3	4	5
1	CLIFF	Height (m)	Absent	5–30 m	31–60 m	61–90 m	90 m
2		Slope (°)	Absent	45°	circa 60°	circa 75°	circa vertical
3		Special features ^a	Absent	1	2	3	Many (3)
4	BEACH FACE	Type	Absent	Mud	Cobble/Boulder	Pebble/Gravel	Sand
5		Width (m)	Absent	5 > 100	> 5 ≤ 25	> 25 ≤ 50	> 50 ≤ 100
6		Color	Absent	Dark	Dark tan	Light tan/bleached	White/gold
7	ROCKY SHORE	Slope (°)	Absent	5°	5°–10°	10°–20°	20°–45°
8		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 COLOR & CLARITY		Muddy brown/grey	Milky blue/green/ opaque	Green/grey/blue	Clear blue//dark blue	Very clear turquoise
17	NATURAL VEGETATION COVER		Bare (10% vegetation only)	Scrub/garigue (marran/gorse, bramble, etc.)	Wetlands/meadow	Coppices, maquis (mature trees)	Variety 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, scree, 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.

All sites belonging to this class are characterized as being under a conservation figure status whether State National Park or Private Protected Area (Indeed this is a requirement to reach this class Williams and Micallef, 2009). Well-known coastal sites around the world with similar geomorphologic/geological settings and D scores are Gritviken (Antarctica), Playa Chikitu (Bonaire) and Dee Why (Australia, Williams et al., 2012; Ergin et al., 2006; Rangel-Buitrago, 2019).

Class II: Valparaíso coastal areas with D values $0.85 > D \geq 0.65$ usually include natural or semi-natural remote/rural sites with high landscape value and low human-impact values (acceptable anthropogenic activities/well-developed structures).

Along the study area, seven of 96 coastal sites (7%) achieved Class II status, and are distributed in rural (5) and remote (2) areas. As in Class I sites, all Class II sites are under a conservation status whether State National Park (e.g., Hanga Kioe) or Private Protected Area (e.g., Pukuén Norte), but these sites rate lower than Class I due to a lower scoring of landscape features. Usually, they do not have present particular features such as rocky shores or cliffs, but have high scores concerning water and sediment parameters dunes and well-developed vegetation cover, or good scores linked to natural settings are slightly lowered due

to human influence. Examples of this class along the study area are Humedal de Tunquen, Las Gaviotas, and The Convento beach, among others (Table 1 and Fig. 4). Examples of world coastal sites with similar D values are Silveira (Brazil), Los Naranjos (Colombia) and Tojo Beach (Japan, Williams et al., 2012; Ergin et al., 2006; Rangel-Buitrago, 2019).

Class III: Over Class III sites D value ranges between ≥ 0.40 and < 0.64 . Along the study area, 9 of 96 coastal sites achieved Class III (9%). These are distributed in rural (2 locations), village (5) and remote (2) locations.

Class III sites present an attractive scenario that is commonly altered by features such as non-attractive buildings, no buffer zones, and different kinds of anthropogenic utilities usually poorly emplaced, together with litter and noise (Fig. 5). Weighted average and membership degree graphs show relatively good scores at high attribute values, i.e., 4 and 5. The above reflects the positive impact of the physical/human parameters (in this case mainly human), and average values at lower attribute values (i.e., 1 and 2) which reflect an adverse impact of the physical/human parameters, in this case the low natural scenic characteristics. Examples of this class along the study area are Las Rocas de

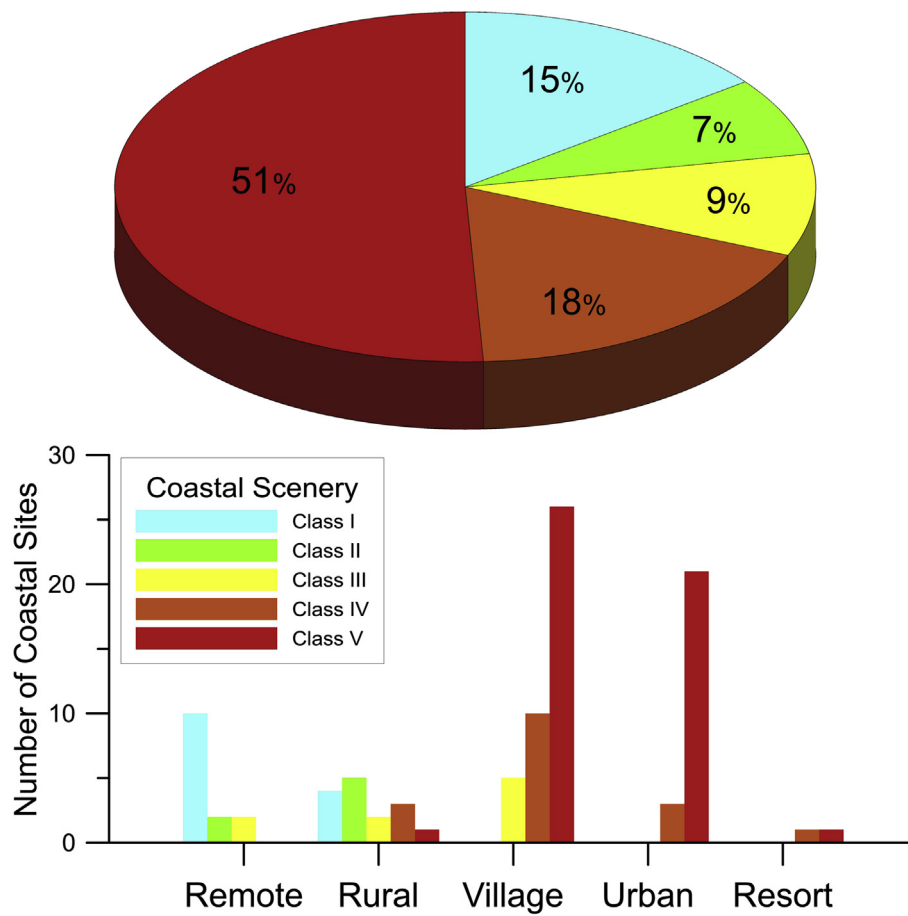


Fig. 2. Coastal Scenery Percentage distribution by class and by type of beach along the study area.

Santo Domingo, Las Cruces and Las Docas Beach (Table 1 and Fig. 5). Coastal sites around the world with similar characteristics are Caucana (Italy), Taj (India), Austenmeer beach (Australia) and La Arena (Spain, Ergin et al., 2011; Williams et al., 2018; Rangel-Buitrago, 2019).

Class IV: Includes sites with $0 \leq D < 0.4$ values and corresponds to areas with poor landscape values, and damaged due to high anthropogenic pressures (Fig. 6).

Along the study area, 17 of 96 coastal sites achieved Class IV (18%). These sites are distributed as resort (1 location), village (10), urban (3) and rural (3). Sites with poor natural parameters were often observed along the Valparaíso Coastline, all being sites with litter and severe coastal erosion problems (e.g., beaches narrow to absent, engineering structures) (Fig. 6). Low scores were due to poor physical settings giving low ratings for parameters, such as, valley, skyline landform, and vistas. Additionally, beach width, watercolor and clarity parameter values were low, often muddy/brown/grey because of the presence of dark brown water (pollution). Abundant vegetation debris, essentially seaweed in fronting shallow and calm waters, and litter coming from rivers and sea, accumulates on the beach. Examples of this class are Avenida Perú, La Ballena Sur and Desembocadura del Río Maipo (Table 1 and Fig. 6). Sites around the world with similar characteristics and D scores are South Beach (Jordan), N°1 beach, Qingdao (China), Tekirova (Turkey) and Angle (Wales, Ergin et al., 2004; Williams et al., 2012; Rangel-Buitrago et al., 2013).

Class V: This class includes sites with D values lower than 0 that have very low scores for both natural and human parameters (Fig. 7). The principal factors causing low D values are direct human pressures associated with extreme urbanization, characterized by buildings not in keeping with the environment (i.e., skyline, utilities and non-built environment that bring the attribute values down considerably). Also

common in this class are sites with large amounts of litter over the coast and with severe erosion problems (Table 1 and Fig. 7).

This class included the most significant number of surveyed sites with 49 out of 96 coastal locations (51%). These sites are distributed in village (26), urban (21), and rural and resort (one location in each). Low scores for both natural and human parameters are clearly reflected in the scenic evaluation rating histograms graphs (Fig. 7). Low weighted averages of attributes 1 and 2, produced a low scenic (low rating) value. The membership degree vs. attribute curve presents a left-skewed curve (downward sloping), which reflects the low scenic values typical of this class. Typical examples of this class for the study area are Caleta San Antonio, Muelle Vergara and Ventana (Table 1 and Fig. 7). Beaches around the world with similar characteristics and D scores are Makadi, Hurghada (Egypt), Tubará (Colombia), Bacvice (Croatia) and Gileston (Wales, Williams et al., 2012; Rangel-Buitrago et al., 2013, 2019).

4.2. What is impacting coastal scenery of the Valparaíso region?

The complexity of human activities throughout the coastal zone has been widely addressed by means of diverse methodologies (Burak et al., 2004). As a result, a strong interrelationship between anthropogenic influence and scenery degradation has been found (Anfuso et al., 2017; Peña-Alonso et al., 2018; Rangel-Buitrago et al., 2018). The abundance of class III, IV and V coastal sites (78%) along the Valparaíso coast also indicates the substantial importance of human-induced processes over scenery degradation. Of these, urbanization, port development, shoreline retreat, and litter pollution are of particular note in the Valparaíso Region.

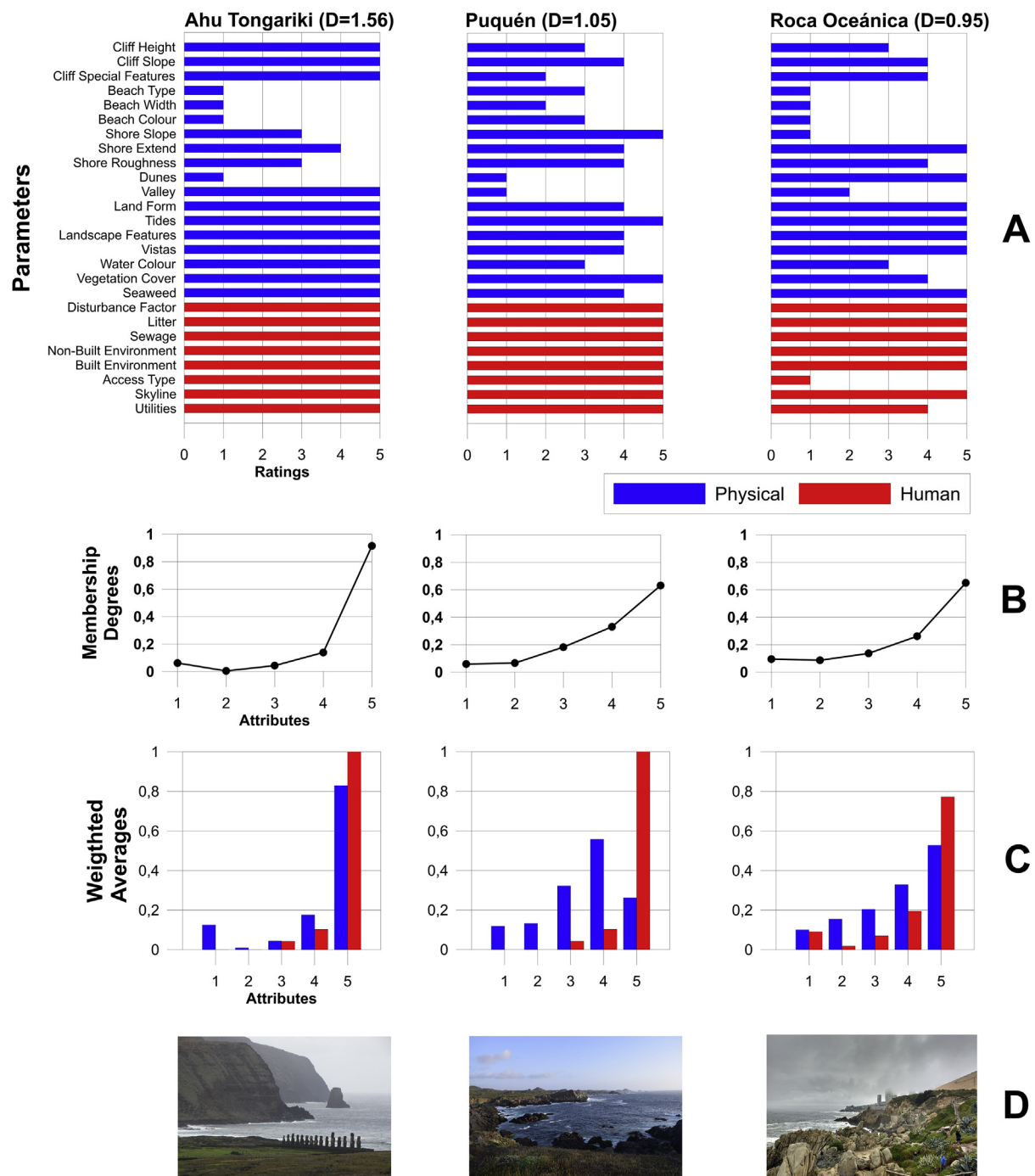


Fig. 3. Three examples of Class I sites (place names at top) with their respective Scenic evaluation rating histograms (A), Membership degree curve (B), Weighted average curves (C), and (D) photo examples of Class I characteristics.

4.2.1. Extreme urbanization and port development

Coastal Urbanization can be defined as the development associated with the increase of urban population over time in proportion to a region's rural population. This growth usually is studied regarding its effects on the ecology and economy of the coastal site, and also includes urban land uses, land occupation and related infrastructure development (i.e., ports, roads, utilities, buildings).

As the second largest agglomeration of Chile, The Valparaíso Region also known as “The Chilean Gateway of the World” is subjected to high pressure from urban and port development related to increasing coastal population (Fig. 8, see: Hidalgo and Arenas, 2012; Booth, 2014; Borsdorf et al., 2016). Along the entire area, coastal population has

increased at an average rate of 25% during the last three decades. To the local population must added the more than one and a half million tourists that travel to the region during the summer and long weekends, due to its proximity to the Santiago metropolitan region where 50% of the total population of the entire country lives (Borsdorf et al., 2016; SERNATUR, 2016; Quintana, 2017).

This coast mainly is affected by a high degree of linear urbanization with peaks around centers of production (e.g., Ventana), ports (e.g., Valparaíso, San Antonio and Puerto Quintero), and areas of intense tourist development (e.g., Viña del Mar, Reñaca and Cartagena). Currently, small cities, already with infrastructure facilities well below optimal, have to face congested population problems coupled with

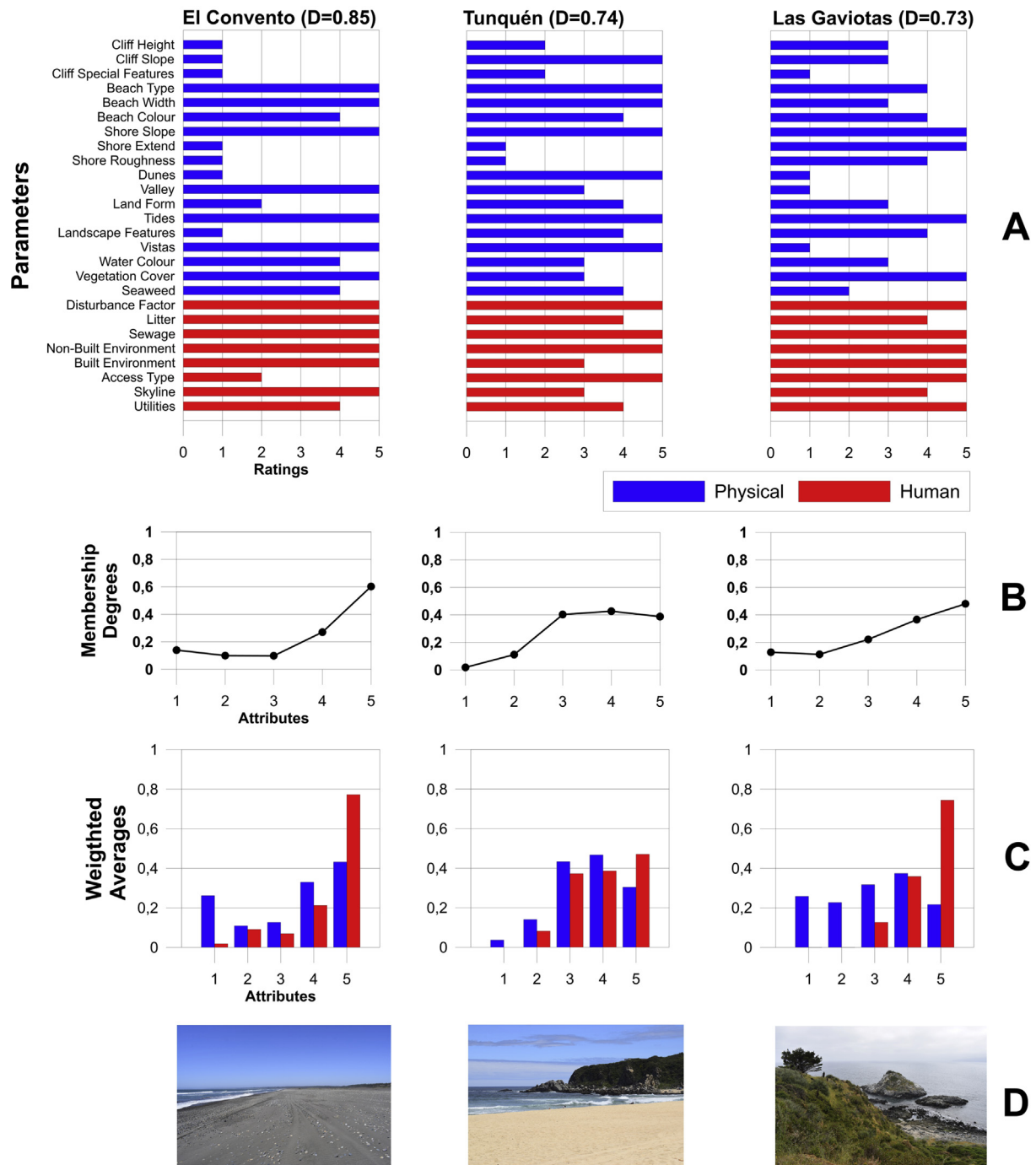


Fig. 4. Three examples of Class II sites (place names at top) with their respective Scenic evaluation rating histograms (A), Membership degree curve (B), Weighted average curves (C), and (D) photo examples of Class II characteristics.

illegal settlements (e.g., Concón and Laguna Verde). Also, some coastal areas have become increasingly urbanized as a result of incentives to encourage coastal tourism investment (e.g., Quintero). Construction of hotels and secondary housing cooperatives has increased because of unearned and real income expectations to the detriment of fertile land, creating a severe coastal scenery impact (e.g., Santo Domingo).

Also, on less than 100 km of coastline, are located two of the country's ten main state ports (Valparaíso and San Antonio) and the main private port of central Chile (Puerto Quintero-Ventanas). Together, these three ports mobilize more than 30 million tons of cargo per year (Carrillo and Santander, 2005; PVSA, 2017) which forces them to develop their related urbanization expansion projects. Along the

study area, current port-activities development does not consider marine spatial planning, and is characterized by a total absence of any mechanism to minimize environmental impacts, including coastal scenery degradation. All ports located in the study area (even the Easter Island port) are generating severe pressure on the landscape; evidence of this is the large number of Class V sites situated around these maritime commercial facilities e.g., San Antonio.

Due to tourism massification and port development, migration to coastal areas has played an essential role in the extreme urbanization process and its collateral coastal scenery degradation. Despite its high susceptibility to earthquakes (Nealy et al., 2017), tsunamis (Contreras-López et al., 2016) and extreme wave events (Carvajal et al., 2017), the

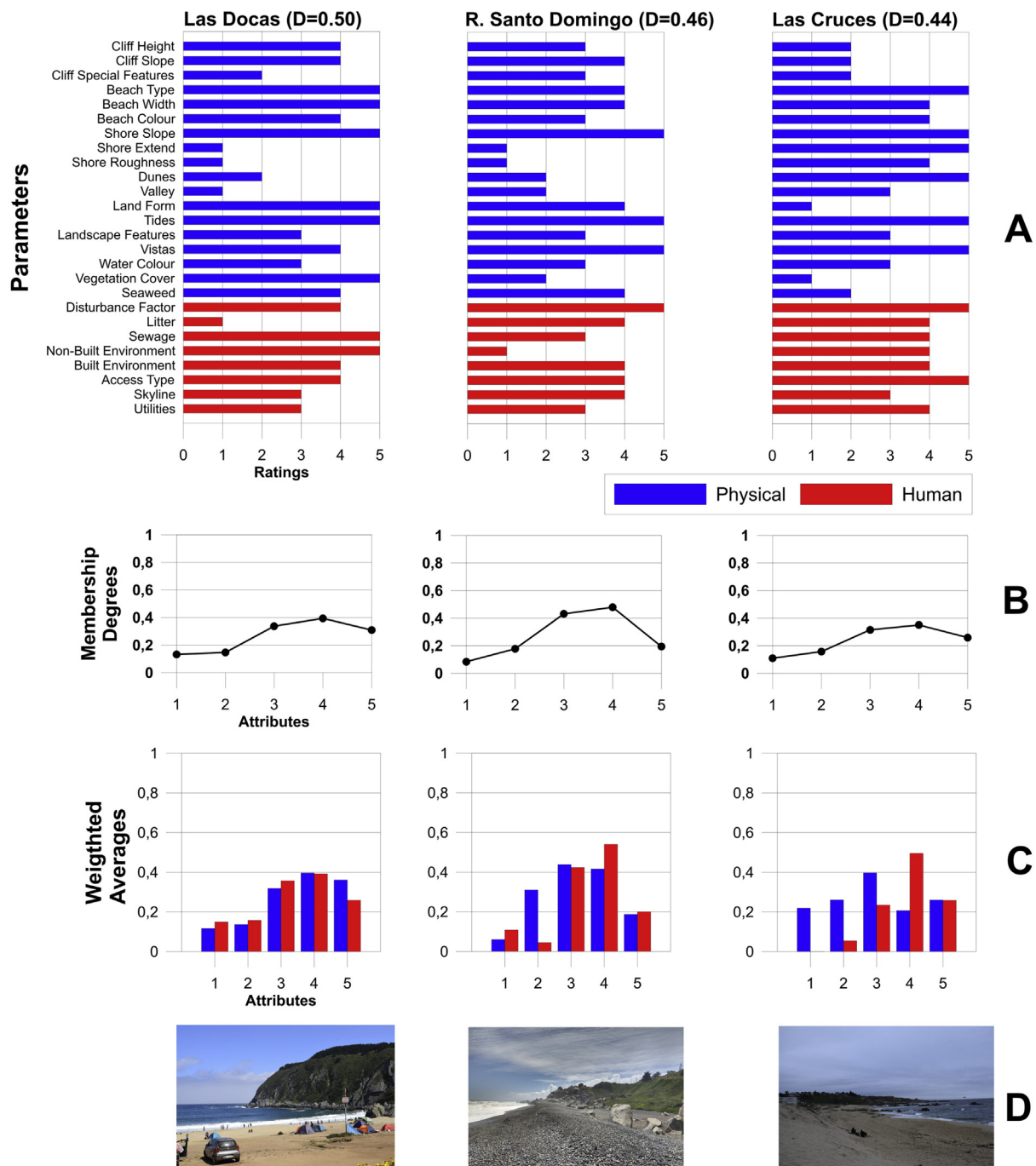


Fig. 5. Three examples of Class III sites (place names at top) with their respective Scenic evaluation rating histograms (A), Membership degree curve (B), Weighted average curves (C), and (D) photo examples of Class III characteristics.

Valparaíso coastal zone is still an attractive area for people (local and foreign). Therefore, the stress on coastal regions and subsequent scenery impacts have been largest primarily due to urbanization as follows:

- Migration to coastal areas where the central city (Valparaíso) have been the most attractive area for industrial, port, commercial activities, and tourism.
- Migration to coastal areas after retirement (mainly people that move to Valparaíso from Santiago).
- Inter-city migration from Santiago (Country capital) settlements from the 20th century due better life quality.

- Construction of secondary homes by local investors.
- Construction of hotels and golf courses ('elite' tourism), where local and foreign investors are increasingly becoming active.

4.2.2. Landward retreat of the shoreline (coastal erosion)

Low scenic rated values sites were observed in areas affected by coastal impacts resulting from human responses to shoreline retreat (e.g., shore hardening by coastal engineering). Examples include Muelle Barón, La Boca, and Humedal Cartagena. Currently, coastal processes are impacting the coastal scenery in three specific ways (Fig. 9):

- With the decreasing of beach width due to the loss of sediment

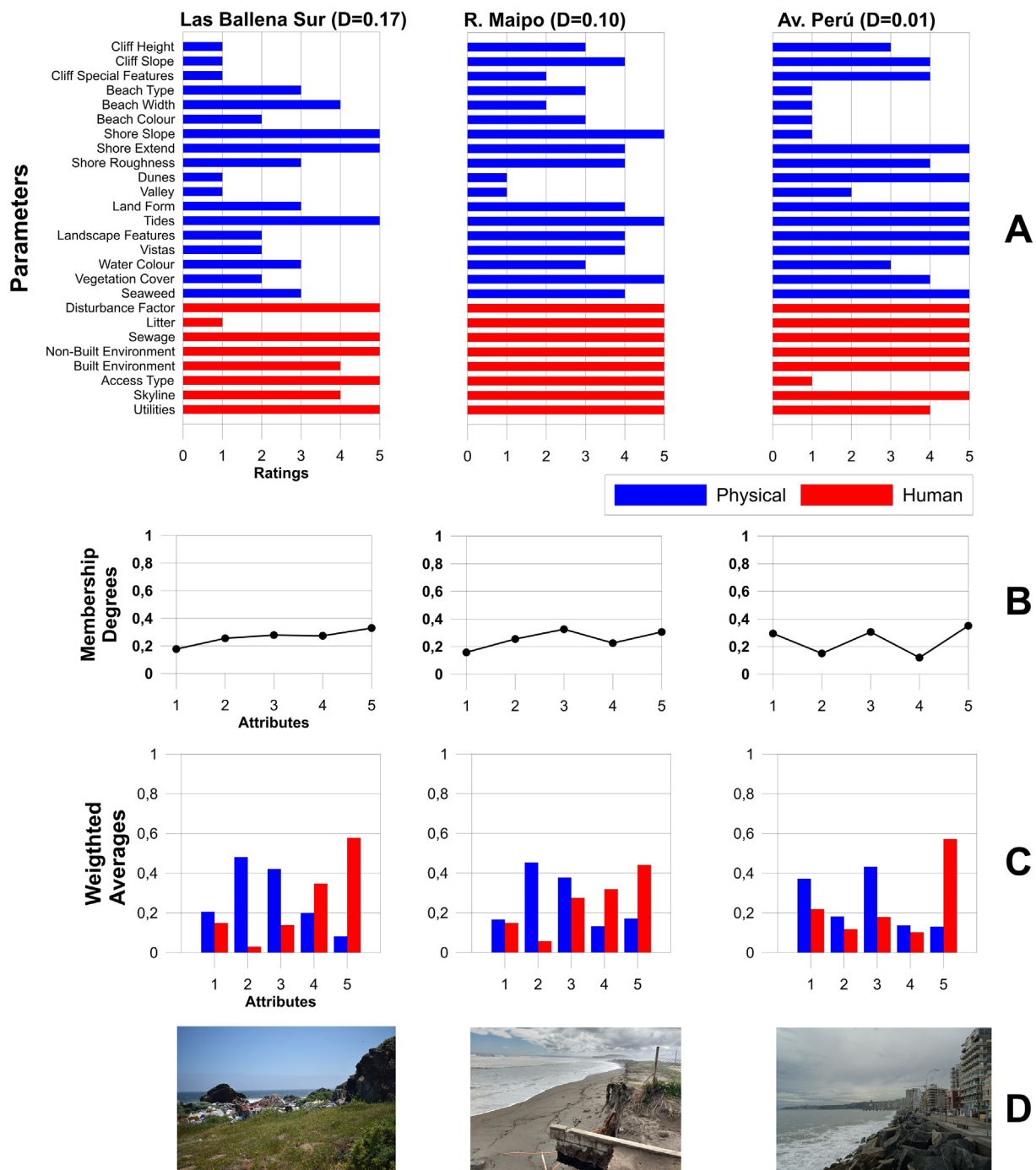


Fig. 6. Three examples of Class IV sites (place names at top) with their respective Scenic evaluation rating histograms (A), Membership degree curve (B), Weighted average curves (C), and (D) photo examples of Class IV characteristics.

supply and blockage of beach migration.

- With direct damage to buildings, houses and infrastructure facilities placed too close to the shoreline i.e., in high-hazard wave and inundation zones.
- With the construction of engineering hard structures to protect buildings from hazardous coastal processes.
- With the failure to maintain said beaches and/or shore-hardening structures.

Landward shoreline migration, often called coastal erosion, had not been identified as a recurring hazard in the study area, perhaps because all attention was focused on other processes that are considered more

“dangerous” such as earthquakes and tsunamis. However, [Martínez et al. \(2018\)](#) found landward retreat trends up to -12.6 m/yr due to two primary processes:

- a sea level rise of up to 30 cm observed during ENSO warm phases and
- an increase in the frequency of extreme wave events, which shifted from nearly 5 events per year in the 1960s to more than 20 per year in recent years.

In addition, it seems that the effects of shore-hardening structures such as narrowing and steepening of beaches in front of seawalls, or the

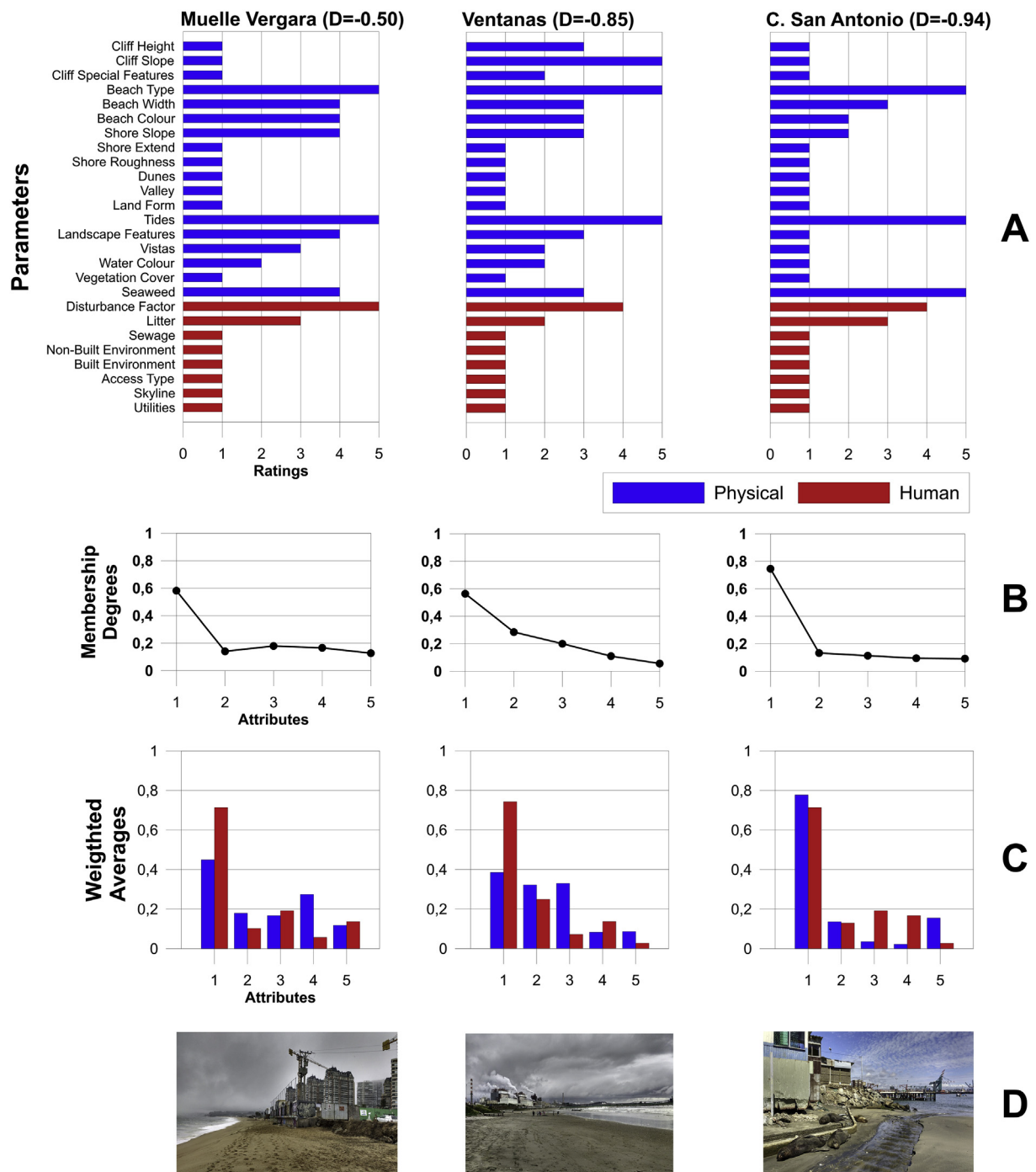


Fig. 7. Three examples of Class V sites (place names at top) with their respective Scenic evaluation rating histograms (A), Membership degree curve (B), Weighted average curves (C), and (D) photo examples of Class V characteristics.

loss of sediment supply to beaches down-drift of groin fields or breakwaters, have been ignored. Although not the general trend, along some parts of the Valparaíso coastline the misconception has existed that a “hard structure” approach to coastal erosion management must be applied (Fig. 9). For example, at the Muelle Barón and Avenida Perú sites (both class V), seawalls, revetments, and rip-rap emplacements were designed and constructed to protect pleasure drives, promenades, and buildings (Fig. 9). The result is loss of both beach quality and the scenery aesthetic.

Rangel-Buitrago et al. (2018) and Williams et al. (2018) have argued seawalls, revetments, and rip-rap structures are never built simply to protect the coast. Instead, these structures are designed to protect

property (e.g., buildings and related development at the back of the beach or on cliffed uplands). Such protection schemes ultimately have a negative effects on coastal scenery; one of the essential parameters for coastal users (Williams and Micallef, 2009). When a hard structure is constructed, an area of the coast will be covered by the structure, and as a direct consequence, an area of the beach also will be lost. As with all coastal scenery impacts, such beach loss is an essential issue in which the public interest is ignored in order to benefit private property owners (Griggs, 2010). Along the study area, hard structures also contribute to litter retention placing coastal sites in low scenic categories. For scenic grade improvement, extreme litter clean-ups and in some cases removal of hard protection structures are required.



Fig. 8. Examples of extreme urbanization impacting coastal scenery. a) Puerto Valparaíso, b) Reñaca, c) San Antonio, d) Concón.

4.2.3. Litter

Currently, Litter is a problem that affects all coastal areas of the world. Its impact is of global significance, and litter has been recognized as a severe pollutant problem for around the last 60 years (Ryan et al., 2009, 2013; Tudor and Williams, 2018).

For example, Krelling et al. (2017) investigated two Brazilian sub-tropical beaches, with different physiographical settings (Pontal do Sul, PS, estuarine beach; Ipanema, I, open-ocean beach) and showed that stranded litter may potentially reduce local tourism income by 39.1%, representing losses of up to US\$ 8.5 million per year. Economic losses due to stranded litter should consider not only costs involved for cleaning the environment but also the reduction of visitors' interest for a certain site (Ofiara and Brown, 1999; Ten Brink et al., 2009; Leggett et al., 2014).

Litter along the Valparaíso Region produces deterioration of scenic quality, increases health hazards for humans and wildlife, requires substantial financial investments for 'cleanups,' and currently is a severe threat to the growing and productive '3S' industry (Fig. 10):

Along the study area each scenery class has specific litter sources and typologies:

Class I: Along these sites high-buoyancy litter prevails. This litter has traveled from distant sources (i.e., coastal sites surveyed along Eastern Island). Typical items include general litter plastic items and food packaging, especially polystyrene, and bottles.

Class II: Over these sites litter with high buoyancy prevails, but this litter comes primarily from nearby sources such creeks (e.g., El Yali). Along these sites general litter is dominate (i.e., food packaging, and bottles). Significant amounts of polystyrene, and also rubber, can be



Fig. 9. Examples of coastal erosion and ineffective past management strategies that failed and now are impacting coastal scenery, rather than conserving beaches, tourist attraction, and scenic aesthetics. a) Desembocadura Río Maipo, b) Caleta Portales, c) Miramar.



Fig. 10. Examples of litter impacting coastal scenery. a) San Antonio, b) La Ballena, c) Cartagena, d) Playa Las Docas.

found.

Class III: Litter that comes from local sources prevails. Sources include small drainages off the land and village dumps, as well as litter that is discarded by beach users (usually general litter, e.g., Playa las Docas). Water bottles, straws and food packaging, were found.

Class IV: Over these sites the prevalent litter is derived from direct anthropogenic activities (urban and village dumps as well as beach users, e.g., Caleta Abarca). General litter, as well as a small proportion of harmful litter e.g., medical waste is the common denominator.

Class V: At these sites litter derived from direct anthropogenic activities prevails (municipal and village dumps, and refuse generated by beach users, e.g., Caleta San Antonio) as well as litter that comes from distant sources, found mainly in remote and rural sites. On these sites, significant amounts of general litter, sewage-related debris, harmful litter, oil, and even faeces were observed.

In general terms, plastic is the most abundant litter item observed along the Valparaíso coastline as well beaches and seas of the world (Jambeck et al., 2015; Geyer et al., 2017). In a country like Chile plastic waste generation can reach values of 664,805 kg per day, the world average being 1,420,189 kg per day (Jambeck et al., 2015). Extreme urbanization plus tourist activities developed under weak management practices (i.e., no recycling bins, no cleanups, among others) generates large amounts of litter every day. It is important to highlight that regular beach clean-ups could quickly improve scenery scores (D value).

4.3. An overview of the coastal governance and existing conservation areas

In Chile, specifically in the Valparaíso Region, various institutions influence management of the coastal zone. Unfortunately, each works in a specific way and also no central entity exist to coordinate these agencies, or have the authority to manage the coast integrally. This lack of a centralized coastal management authority brings with it disorganization related to functions and jurisdictions between institutions, although in part a solution has been sought through the creation of several conservation areas.

Currently, there are state-owned conservation over-sight figures that correspond to areas that belong to the National System of State Protected Wildlife Areas (Sistema Nacional de Áreas Silvestres Protegidas del Estado - SNASPE, in Spanish). These are administered by the National Forestry Corporation (Corporación Nacional Forestal

-CONAF), which directly depends on the Ministry of Agriculture. CONAF does not have the capacity and legal authority to supervise protected coastal areas, so the National Fisheries Service (Servicio Nacional de Pesca- SERNAPESCA) does this work, but only focuses on monitoring of marine resources of economic interest (mainly fishing activities).

During the mid-twentieth century, some universities created conservation areas for some of the region's emblematic coastal ecosystems, such as Montemar and Las Cruces (Castilla, 1986). However, these areas can be considered as small and are often used to prevent passage through enclosures that are meant to protect coastal scenery.

Thirty years ago a conservation area focused on the administration of coastal spaces, was created by artisanal fishermen. However, this was concentrated only in the management of benthic resources of economic interest without considering aspects related to tourism or the coastal landscape, although its goal is the administration of coastal spaces.

At the same time, coastal municipalities saw the need to manage beaches and coastal areas with tourist potential e.g., Algarrobo, transferring the responsibility for maintaining cleanliness and managing leisure and recreation activities to private individuals e.g., Viña del Mar.

From the beginning of the 21st Century onwards, specific conservation areas were created for the coast, establishing two types:

- Marine and protected coastal areas: focused only on conservation purposes.
- Multipurpose coastal marine areas: created to focus on preservation, exploitation of resources, and tourism.

Currently, all of these areas are characterized by a total absence of optimal management and monitoring mechanisms. This deficiency above explains why it is common that some coastal areas with a status of conservation are located in the lowest scenery classes (e.g., El Yali, which despite being a Ramsar site No. 878 is currently classified as Class IV).

Some areas are kept under high vigilance and conservation, generally with interests focused on ecotourism, but under private initiatives without formally protected district definition or governance. For example, the Puquén and Isla Negra sites that are ranked as Class I and protected by a private initiative.

4.4. Can one manage coastal scenery?

Human activities have shaped the coastal environments for millennia through agriculture, husbandry, amongst other activities (Tzatzani et al., 2003). Due to the significant decline of agriculture in the last century, large-scale developments for tourism, the process of urbanization, and the increase of summer visitor numbers, has caused a more severe impact on coastal scenery. Coastal scenery degradation is occurring on a world scale (Cendrero, 1989; Nordstrom, 2000; Pilkey et al., 2011) and Chile is no the exception to the rule (Rojas et al., 2013; Hidalgo et al., 2016) which leaves the question to solve: **How can one manage coastal scenery?**

One response to this important question can be found in land use. According to Williams and Micallef (2009) and Micallef and Rangel-Buitrago (2019) coastal land use is the major influence over degradation of coastal scenery (as happens along the Valparaíso Region coastline). Coastal land use comprises the human element of scenery and its impact may be best described by influences impacting tourism development: urbanization, river damming, deforestation, bad agriculture practices, and re-routing of drainage (resulting in reduced coastal sediments) and physical coastal defense works (Barrachina, 2007; EUR-OSTAT, 2017; Rangel-Buitrago et al., 2018).

Currently, diverse mechanisms exist to address management of coastal land use. For example, Integrated Coastal Zone Management (ICZM) as well as Spatial Planning are endorsed as optimal instruments to reach this goal (European Commission, 2017). Spatial Planning is concerned with more than just wise land-use planning, as it also attempts to resolve numerous and often conflicting sectorial (e.g., agriculture and environment policy demands) encouraging a more balanced distribution of activities (in an often-limited land and sea space) and addressing competing policy demands (UNECE, 2008; Felter and Morris, 2016; Micallef and Rangel-Buitrago, 2019). Spatial planning is able to contribute to coastal scenery management because such planning:

- has the ability to reconcile different sectorial needs and provide a multi-agency approach,
- brings a common approach (ICZM) to problem identification, planning, implementation and evaluation cyclical framework,
- has the suitability as an information platform to satisfy multi-level and multi-institutional requirements (including cross-border),
- offers a spatially categorized GIS-based data organization system that aids in multiple geographic area scale representation and data exchange,
- can keep track and record stakeholder participation and land use conflict management, and
- can project resource use and conservation conflict resolution over long-term scenarios.

Adequate coastal scenery management and conservation necessarily requires that present coastal land use meets the needs of the population, without endangering the ability of future generations to respond to their needs (Rangel-Buitrago et al., 2013, 2018). This outlined approach seems complicated, but is not impossible. Any coastal scenery management strategy to be implemented requires application of effective and efficient solutions based on scientific knowledge, and that includes coastal users' priorities and preferences identifying, maintaining and, where possible, enhancing the value of the coast to the economic, environmental and social well-being of local communities (Komar and McDougal, 1988).

Short-term perspectives, conditioned by economic considerations manifested in either an action-reaction basis or cost-benefit analysis approaches, do not work under this framework. Clearly coastal scenery management must be focused on identifying the problems that affect the coast together with implementation of strategies from a regional and long-term perspective. Given the close association between

terrestrial and marine components and the resultant impact of anthropogenic activities on coastal ecosystems, an ecosystem-based approach also must be incorporated into scenery management (Friend and Rapport, 1991; Ehler and Douvere, 2009; de Jonge et al., 2012; Elliott et al., 2017). Ecosystem-based management (EBM) is one where human influence is considered central to the entire ecosystem's functioning and where all coastal uses and users are therefore assessed. In this context, EBM aims to sustain ecosystem services via sustainable management of all human activities and sectors.

Chile is concerned about the quality of its environment, including the aesthetic value of the vast coastline; particularly its scenery values. Given the current trends of world 3S tourism and the favorable conditions of the country, Chile can expect, to experience a significative increase of tourist arrivals in coming years, especially the Valparaíso coastline.

The prime interest should be on the generation and adoption of real management strategies from the standpoint of tourism development, based on tools that allow preservation, enhancement and/or restoration of coastal scenic characteristics. This management strategy is found in a simple principle that most of the time is overlooked: **high-quality scenery enhances people's lives and benefits society in many diverse ways.**

The primary goal of coastal scenery management lies in the creation and maintenance of a landscape having an evident scenic diversity, harmony, and unity for the benefit of the coast from an ecosystem point of view, and for society in general. In that sense scenery management should:

- be ordered, and logical,
- serve scenic assessment needs at all levels of planning and implementation,
- allow for managers to be capable of interacting with the values and needs of diverse disciplines, and
- have a systematic approach so that others can replicate methodologies and then compare results.

According to the USDA (1995), optimal scenery management should identify the following:

Coastal Landscape Character: including the existing attributes, characters and scenic attractiveness of various landscapes within a specific geographic area (e.g., The Easter Island coastal scenery).

Visual Sensitivity: based on the context of the scenery being viewed.

Scenic Integrity: including the continuum of scenic integrity levels, the role of structures in the scenery, methodologies to determine impact and examples of areas affected by human's actions.

An optimal scenery management requires a detailed knowledge of the natural geomorphologic characteristics and the impact of human interventions on the dynamic character and resilience of the coastal system. This management must integrate the benefits, values, desires, and preferences regarding aesthetics and scenery for all levels of coastal and marine spatial planning, taking into account:

- User influences over scenery (Rangel-Buitrago et al., 2013).
- Development of "healthy and resilient" ecosystems and ecosystems services (de Jonge, 2007; de Jonge et al., 2012).
- The correct exploitation of scenery as a renewable natural resource (Rangel-Buitrago, 2019).
- A sustainable tourism industry (Marafa and Chau, 2014).
- Projected urban development and associated requirements (Cooper and McKenna, 2008).

Also, scenery management should be based on strategies that allow an inherent ability of any coastal site to accommodate change induced by anthropogenic activities (e.g., urbanization) while maintaining to maximum the functions initially fulfilled by the system. A short-term

approach does not allow the above, being mandatory consider the diverse coastal sites typologies and their related processes with the purpose of choosing the optimal intervention approach (Williams and Micallef, 2009).

According to Micallef and Rangel-Buitrago (2019) management of coastal scenery may be achieved by various approaches such as Legal Voices, Constituent Elements, Protected Areas, Education and Public Participation; each one of these describing different aspects of scenery considerations. These same authors considers that scenery also can be protected by direct management approaches and actions as well as the indirect influence of ancillary mechanisms such as national and local planning policies and designations.

Regardless of the focus, Terkenli (2010) considered that management will be successfully achieved if scenery is viewed as:

- An integral part of the natural and cultural heritage.
- A repository of collective meaning and symbolism through time.
- A policy-relevant issue in contemporary urban and regional planning and resource management.
- A system of energy, material and information flow, interwoven in harmonious environmental wholes.
- A material construction, reflective of the primary organization of society, culture, and economy; ever supporting, representing and affecting ways of life and local knowledge.

4.5. Suggested approach (steps to manage coastal scenery)

In Chile, specifically in the Valparaíso Region from a governance viewpoint, many management strategies failed or are currently failing due to a weak and confused institutional framework (previously noted), that is further weakened by diluted and compromised management regulations. Coordinated management must be developed to improve, preserve and enhance the coastal environment in the interest of present and future generations. The above must be included in supporting strategies identified in a **Coastal Scenery Management Plan**.

Scenery characteristics, integrity as well as constituent preferences, are vital considerations to be integrated into analysis, planning and implementation stages of management. The application of such components within different stages of planning and management can help identify, achieve and sustain desired coastal scenery character and integrity. The plan aims to improve overall conditions in the coastal zone and ensure the provision of long-term goods and services for local communities and tourists. It guides littoral managers to anticipate future impacts related to human interventions. This plan must set out realizable and measurable objectives including:

- The prevention of landscape degradation.
- Public awareness.
- Education and Enforcement.

The suggested plan should achieve continual improvement of coastal scenery quality throughout the entire region. From our point of view, such a scenery management plan must be based on five clear stages (Fig. 11):

Coastal Scenery Evaluation: The survey of environmental, physical and usage parameters enables the identification and characterization of those variables that must be managed more efficiently to promote overall improvement of scenic value. Survey results can be applied by coastal managers, planners, academics, government agencies and the local community.

Alternative development: During this stage the different alternatives are established that can contribute to solving critical issues (e.g., what are the alternatives to solve the litter issue). To complete this stage, relationships between crucial scenery components and processes identified in the characterization phase must be further tested for their compatibility with particular scenarios or alternatives.

Adjustments to alternatives are made to achieve desired values and benefits while sustaining the coastal site.

Alternative evaluation: This stage includes a description of predicted changes to scenic elements (e.g., what will happen if groins are built in a coastal reach). These predictions and outcomes are developed around to critical issues and desired conditions, and then communicated to decision makers and constituents.

Implementation: This stage is focused on the development and formalization of an alternative “selected” as the desired condition for scenic management of a coastal site. This condition is the result of the preceding planning stages. Minimally acceptable levels define the objectives and the direct intent of achieving the highest scenic grade possible.

Monitoring and Evaluation: To ensure that the scenic values of the area are protected efficiently, interested community members are trained in monitoring coastal scenery using standardized techniques. Selection of trainees and implementation of continuous monitoring are made in coordination with the community. Monitoring and evaluation help to detect the magnitude and duration of changes in conditions including scenic integrity and landscape character, and also can help better understand these causes and predict impacts.

In all stages, the following steps can be useful:

- Quantify coastal services.
- Consider scenery in vulnerability assessments of coastal communities.
- Develop scenarios and tools that model impacts over the scenery.
- Build decision support systems to help communities visualize negative effects and possible solutions.
- Enact policies to ensure the environmental integrity of the coast.
- Incorporate proven scenery management interventions.
- Strengthen the capacity for implementation.

The above can be included in policies supporting strategies and above all, must be constructed with enough robust scientific research for decision makers to make rational decisions. Sustained political support is also required that helps the integration of different tools into coastal scenery management strategies. It is recommended that an adequate financial, knowledge and technological resources be allocated respectively for integrating scenery management in national portfolios. This must be included in national policy-setting and awareness raising, planning, practices and, capacity building. Several key features of coastal scenery management make this a competitive strategy in a wide range of settings:

Economy: High capital investments derived from damages related to building infrastructure will be avoided or mitigated.

Extra Benefits: Implementation of this strategy also improves water quality, supports recreation, provides habitats, and delivers economic and other societal benefits.

High Community Value: This strategy can be popular with local communities, and can be critical in raising new project funds and building political support.

Flexibility: Under the right conditions, coasts can adapt to scenic improvement by themselves.

Complementary support: Existing restoration and conservation projects can be enhanced.

A considerable level of cooperation is required from all stakeholders to take action on the landscape degradation. Such cooperation will help foster close existing links between coastal management, disaster risk reduction, as well as between science and policy.

5. Conclusions

The Valparaíso Region's coastline region is a popular crescent destination for many national and international tourists, attracted by rural and remote sites of great scenic beauty i.e., Easter Island, as well as

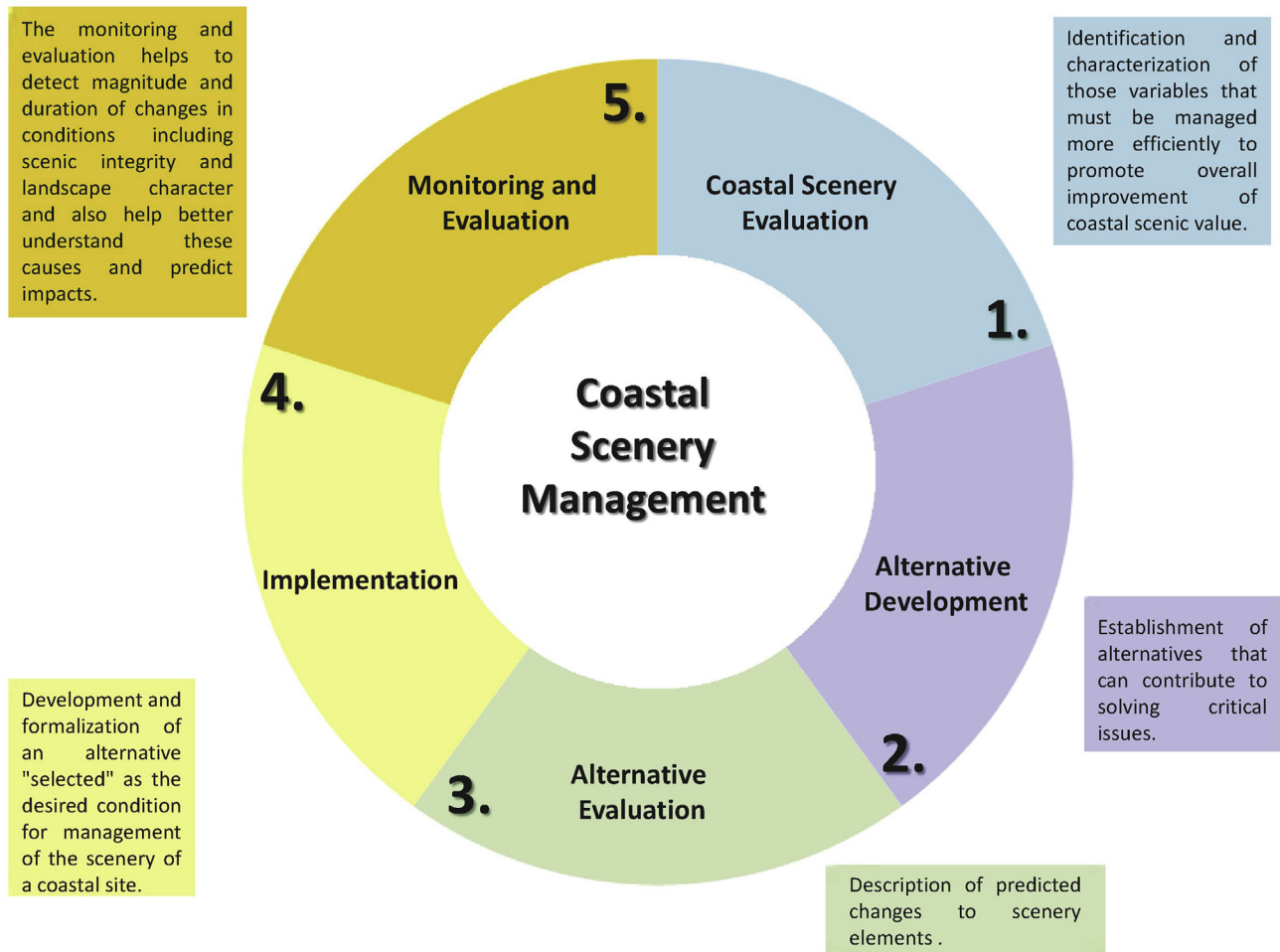


Fig. 11. Steps to follow in the suggested scenery management plan.

urban sites because of their beach-related activities and local entertainments i.e., Viña del Mar. Scenery is an essential component of tourism, and drives the economy of many coastal areas. To recognize scenic potential for optimal coastal tourism development in rural and remote areas, and scenic quality improvement of village, urban and resort areas, a scenic assessment of 96 sites along the investigated coast was developed for this paper.

Sites were divided into five classes, from Class I - including areas of high scenic values to Class V, including urban regions degraded with low scenic scores. 14 sites (15%) appeared in Class I; 7 (7%) in Class II; 9 (9%) in Class III; 17 (18%) in Class IV and 49 sites (51%) in Class V.

Almost all Classes I and II sites are remote, and rural sites with spectacular water and landward geomorphological characteristics, as well as exuberant vegetation. In contrast, places categorized within Classes III, IV and V correspond to areas where a progressive decrease has occurred to both natural and (especially) human parameters. Lowest scores were recorded mainly in urban and village sites where extreme urbanization and/or high levels of litter were frequently observed. At many sites, beach degradation was enhanced by erosional processes because they were counteracted by the construction of hard structures that further reduce the scenic value.

This work concludes that 75 of 96 coastal sites (78%) surveyed along the Valparaíso coastline are not in optimal or acceptable scenery conditions. These results highlight the importance of natural and environmental characteristics and the enormous impact of urban settlements and tourist activities. Coastal urbanization has increased in recent decades and produced the destruction of natural environments with a subsequent decrease of coastal scenic value. Obtained results

constitute a valuable baseline of information for any envisaged management plan. Coastal zone managers have to upgrade the different anthropogenic usage parameters, and to reverse the negative impact on natural ones. Efforts are needed to regulate future (and present) coastal development and occupation by respecting (or favouring the formation of) natural environments, such as dunes and vegetated natural areas which constitute an essential buffer zone between the coast and urbanized environment. In eroding coastal sectors, especially observed along the City of Valparaíso, beach maintenance is a priority to be achieved versus the emplacement of hard defense structures (e.g., seawalls and revetments) that result in beach degradation or complete loss.

Results of this paper are related to parameters geared to Chilean economic aspirations, specifically the tourism industry. Currently, this country is building its coastal tourism industry with an avowed aim of increasing its international appeal. The primary goal of this effort must focus on controlled urbanization and litter issues because extreme urbanization, low cleanliness conditions, and beach loss all contribute to lowering scenic value which will not be appealing to potential visitors. Among other parameters, tourists want excellent scenic quality in the coast. Tourists expect scenery, security, and service — lose any one of these, and tourists will go elsewhere.

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