Title: **A co-designed method to guide decision-making in protected area visitor centres.**

Moreno-Llorca Ricardo A. [a*], García-Morales, Víctor J. [b], Lloréns-Montes, Javier F. [b], Ramos-Ridao Ángel F. [c], Alcaraz-Segura, Domingo [d], Navarrete Mazariegos Javier [e]

[a] *Andalusian Institute for Earth System Research, Avda. del Mediterráneo, s/n 18006. University of Granada, Spain ricuni@gmail.com; ricuni@ugr.es*

[b] *Faculty of Economics and Business, University of Granada, Campus Cartuja, s.n., Granada 18071, Spain   victorj@ugr.es; fllorens@ugr.es*

[c] *Department of Civil Engineering, University of Granada, Avda. Fuentenueva s/n, 18071 Granada, Spain ramosr@ugr.es*

[d] *Department of Botany, University of Granada, Avda. Fuentenueva s/n, 18071 Granada, Spain dalcaraz@ugr.es*

[e] *Directorate General of Environmental Management and Protected Areas of the Environment and Territorial Planning. Government of Andalucía. Casa Sundheim Avenida Manuel Siurot, 50 41071 - Sevilla, Spain. javier.navarrete.m@juntadeandalucia.es*

Corresponding author

 * Laboratorio de Ecología (iEcolab), Instituto Interuniversitario Sistema Tierra, Universidad de Granada, Avda. del Mediterráneo s/n, Granada 18006, Spain. Tel.: +34 685868704

E-mail address: ricuni@gmail.com (R.A. Moreno Llorca);

Title:

A co-designed method to guide decision-making in protected area visitor centres

Abstract

Protected areas (PAs) constitute the largest global effort for biodiversity conservation and the maintenance of ecosystem services. Science-based management, grounded in methods co-designed by scientists and managers, is necessary to improve the efficiency of PAs to achieve these goals and to promote sustainable development. Visitor centres (VCs) in PAs play an important role to facilitate the supply of recreational ecosystem services and to promote environmental awareness. In this study, scientists and managers co-developed a method to assess visitors' perceptions of the recreational activities carried out in VCs and how they depend on the type of visitors. The research was performed at 13 PAs in Andalusia (Spain). A questionnaire that measures users' satisfaction with the services provided by VCs was implemented in two phases: 1) selection of items through the critical incident technique, and 2) validation of the scale by using exploratory and confirmatory factor analysis. The main result is an instrument composed of 18 indicators classified into three dimensions: information, facilities and service received from personnel. The instrument provides additional information useful for managers, such as homogeneity of valuation throughout the PA network and sociocultural factors that may explain the differences in visitors' valuation. The instrument developed could either be used directly or adapted for recreation management in other similar PAs. The proposed methodology can also be reproduced to validate other measurement instruments. This study illustrates how the development of a collaborative research method by scholars and practitioners can improve recreational management in PAs.

Keywords: recreational management; nature-based tourism; co-production science; ecotourism; natural parks; Andalusia.

1. Introduction

Protected areas (PAs) constitute the largest global effort for biodiversity conservation (Jenkins & Joppa, 2009) and maintenance of ecosystem services (McNeely, 1994). Science-based guidance for managers is necessary to improve the effectiveness of PAs in conserving biodiversity, providing ecosystem services and promoting sustainable development. To this end, tools and methodologies that are co-designed by both managers and scientists are more successful than those

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developed in isolation (Enquist et al., 2017). To increase the probability of success, both managers and researchers must be involved in the process from start to end (López-Rodríguez et al., 2015). Scientists and managers must thus cooperate in defining the questions to be answered and the procedure for obtaining results useful for management through a scientific procedure. While time-consuming, this approach, termed translational ecology, increases the capacity to produce outcomes useful for decision-makers (Mauser et al., 2013).

In PA management, facilities such as visitor centres (VCs) are important to facilitating the supply of recreational ecosystem services (Kulczyk, et al., 2018) and performing different functions related to recreational activities. Their leading functions are interpreting, informing and educating visitors on values related to nature and on how to engage in recreational activities (Fallon & Kriwoken, 2003). VCs disseminate values, issues, stories and messages that influence appreciation of the PA and enhance the experience (Moscardo et al., 2000). Pearce (1991) notes that VCs offer distinctive landscape experiences, imaginative activities that extend beyond the facilities and a variety of distinctive experiences. In addition, visitor' activities in the centres foster their 'sense of place' and promote awareness of the local environment (Stewart, 1998). Uzun et al. (2017) link the decrease in the number of visitors to the PA in their study to closure of the VC, demonstrating the importance of VC management. Furthermore, many studies analyse the economic profits that enable sustainable development of the population living in PAs due to promotion of recreation activities (Chae et al., 2012; Pandit et al., 2015 ; Samos & Cañete, 2013). Proper management of VCs can thus improve visitors' recreational experience and environmental awareness, and sustainable development of the PA.

Recreation in PAs has grown significantly in the last decade (Barros & Gudes, 2015; Hindsley et al., 2011), making nature recreation a major research issue (Pickering et al., 2018). Recreation research covers a wide range of topics on PAs. One of the most important objects of research has been the impact of these activities on the conservation of biodiversity (Azizi et al., 2011; Lawson etal., 2003 ; Monz et a., 2013 ; Prato, 2001) . To achieve sustainable recreational use of natural habitats, several studies focused on determining recreational carrying capacity (Baró et al., 2016; Maes et al., 2012; Wolff et al., 2015). VCs have also been the subject of several studies (Arabatzis and Grigoroudis, 2010; Do et al., 2015). Abu Bakar et al. (2016) analyse willingness to pay in Kubah National Park and Matang Wildlife Centre, and value (mainly monetary) assigned by visitors to recreational activities is a common area of study (Caparrós et al., 2017; Egan et al., 2015; Hjerppe et al., 2017). Visitors' perception of recreation has also received

some study, although less. Ramli et al. (2018) conduct face-to-face interviews at VCs to assess users' perceptions. Eagles (2014) analyses the research priorities in PAs recreation, establishing "visitor satisfaction" as one of the most important research issues and highlighting the need to develop "theoretical structures to underpin satisfaction measurement of PAs visitor experiences" (pp. 10-11). Several authors (Moscardo et al., 2000; Pearce, 1991; Stewart, 1998) find that visitors' level of satisfaction with the recreational service at a PAs improves after visiting the VC.

The main objective of this paper is to fulfil managers' needs by designing and validating a measurement instrument to assess the level of satisfaction with VCs of PAs in Andalucía (Spain). The scope of the instrument is recreational activities delivered at the centres. The research process has involved scientist and PA managers from the beginning. We propose a case study of thirteen VCs in PAs based on research co-designed by scientist and managers. To achieve this goal, we first developed a scale based on subjective indicators to measure users' satisfaction with services provided by VCs. Once the scale was validated, we analysed whether user perceptions are homogeneous across PAs. Finally, we established which socioeconomic variables are related to differences in satisfaction with the recreational activities at the VCs.

To this end, the study is structured as follows: Next, we perform a bibliographic review of the state of the art on scales to measure user satisfaction after an experience and their approaches to recreation in PAs. We then describe the area of study, the sampling design, and the methodology used to validate the scale. Section 4 presents the final evaluation method and results obtained for the scale's validity and reliability, as well as the results of the first application of the scale. Finally, we discuss the results, focusing on justification of the scale dimensions resulting from the study, their consistency, and application of this method for recreational management in PAs.

2. Theoretical background

Measurement of visitors' perceptions of recreation was first analysed by Crompton (1988), who studied its application in activities in a natural metropolitan area by proposing a five-dimensional model based on the measurement scale SERVQUAL (Parasuraman et al., 1988). To confirm this scale's validity, another scale was developed to measure recreation experience in PAs (Hamilton et al., 1991). These and other authors (Absher, 1998) concluded that the tool was valid but had to be adapted to each PAs network. A study by Absher for the USDA Forest Service on recreation in forest areas started from 22 items developed by a consulting firm distributed over

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three dimensions: facilities, services and information. Factor analysis led to establishment of four dimensions by dividing "facilities" into two: adequacy and functioning of facilities.

A modified version of the ECOSERV scale was subsequently applied in a study at the Niah National Park in Sarawak (Said et al., 2013). Visitors' perceptions were analysed using 16 items of the six main dimensions to measure stakeholders' service experience. Finally, a study to measure service experience at campgrounds near natural lakes started from a model composed of 19 items grouped into four dimensions that explained the aspects of well-being experienced by visitors (Graefe & Burns, 2013).

One way to obtain items that determine users' perception of recreation experience is the "critical incident" technique (Flanagan, 1954). Items are obtained directly from users through interviews and/or questionnaires in which users express concrete simple ideas in negative and positive terms about aspects of the service received. Once a battery of items has been gathered, a group of experts or judges purifies and categorises them, combining and classifying the incidents into factors in an iterative process. This technique has several advantages. Most importantly, since items are gathered from the service users' perspective, they are not limited or conditioned beforehand by the researcher (Fawcett et al., 2014). The method also eliminates conditioning or initial bias as to what characteristics of the service will or will not be important (Gremler, 2004). Finally, classification of the critical incidents permits identification of determinants of the service experience defined by the customer, enabling more freedom in measuring perception of the service and preventing researchers' "blind spots" (Odekerken-Schröder et al., 2000).

One problem with these scales as tools for evaluating recreation experience is their length. There is a conflict between natural area managers' need for simple, quick-to-answer questionnaires and researchers' need to develop validated tools to measure quality (Ryan, 2003). Burns and Graefe (2006) propose a multi-item indicator, as opposed to a simple indicator of overall evaluation. Other authors argue for developing items and dimensions that explain stakeholder perceptions through interviews in which visitors recount their positive and negative experiences from the trip (Chan & Baum, 2007). Like other authors who consider measurement of visitor perceptions of recreational experience in PAs as a complex construct that must be developed in a multidimensional way (Eagles, 2014), Lian Chan & Baum (2007) conclude that perception of recreation experience is multidimensional. Many other studies use multi-item scales to assess users' perception of recreational experience (Table 2 and Supplementary Material S3).

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3. Methodology

The study was performed in two phases. The core of the study is its validation of the questionnaire. Subsequently, we used a case study to obtain and analyse information useful for decision-making.

3.1 Study location

This study was performed in 13 VCs in different types of PAs in the Andalusian Network of Natural PAs. We used a two-stage procedure to select the PAs and VCs studied. First, to cover the full diversity of natural areas, we chose PAs with different characteristics (coastal, mountain and inland lakes). We then chose specific PAs to obtain a sample heterogeneous in type and number of visitors, size of centre and services provided (Fig.1).
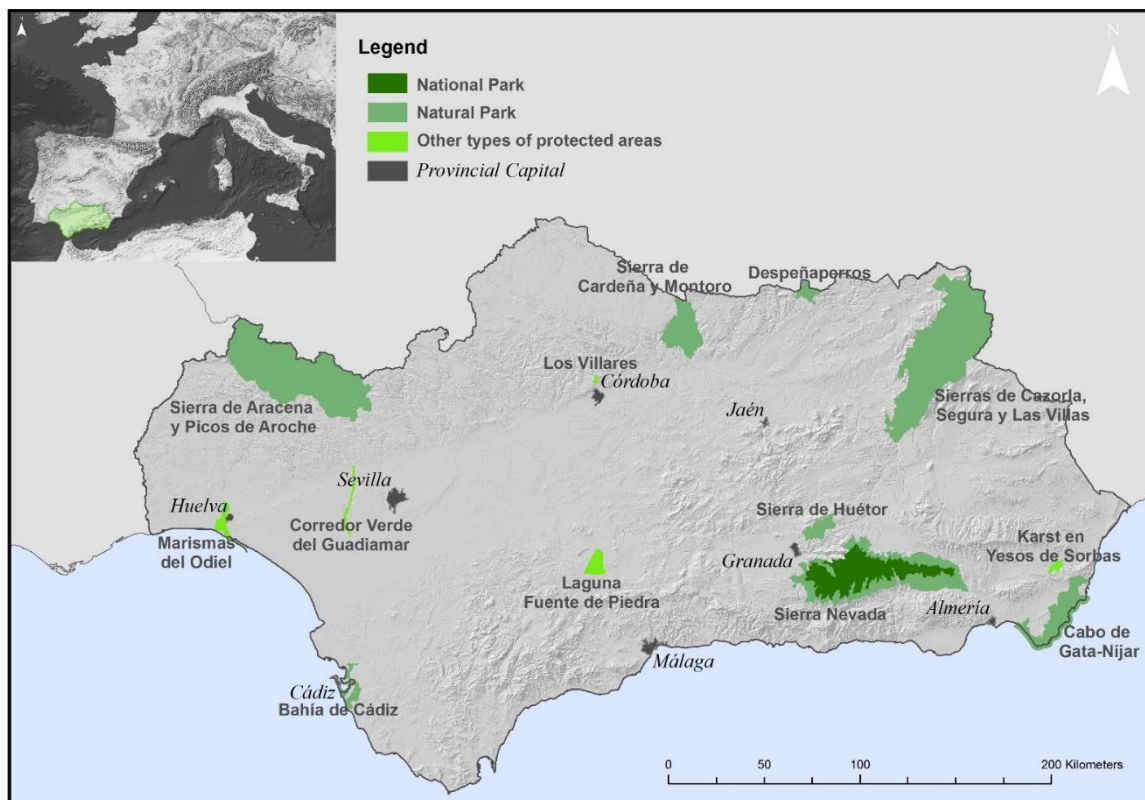

Fig.1. Region of study. PAs in map legend are presented according to their protection status. Provincial city names are in italics.

Questionnaire validation was performed in nine of the PAs: "Cabo de Gata", "Sierra de Cazorla", "Segura y Las Villas", "Sierra Nevada", "Sierra de Huétor", "Laguna Fuente de Piedra", "Marismas del Odiel", "Karst en Yesos de Sorbas", "Bahía de Cádiz" and "Aracena and Picos de

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Aroche". We then used the questionnaire to obtain information for decision-making from the full set of PAs, adding "Despeñaperros", "Sierra de Cardeña y Montoro", "Los Villares", and "Corredor Verde del Guadiamar" to the previous group (Fig.1). The names of the VCs in each PA are listed in the Supplementary Material.

3.2 Validation of the questionnaire

We developed the study questionnaire by creating a new validated scale, following authors like Absher (1998), Graefe and Burns (2013) and Lian Chan and Baum (2007) rather than adapting existing scales such as ECOSERV or SERVQUAL. We based our decision on the advantages indicated by Fawcett et al. (2014), Gremler (2004) and Odekerken-Schröder et al. (2000), detailed in Section 1.3. We developed the scale in two steps: gathering the initial set of items and validating the questionnaire.

3.2.1 Gathering the initial items

The initial items were gathered in structured interviews and surveys to record visitors' opinions of their visit to information centres and interpretation of the natural areas. Following their visit, we asked visitors to express the positive and negative aspects of their experience. Answers were to be simple—a single idea in each sentence. A total of 147 users were interviewed. To deseasonalise responses and obtain a robust number of cases, we also reviewed 576 suggestion forms completed by visitors to these centres over an entire year.

We collected 382 critical incidents (167 positive and 215 negative items). Analysing studies that apply the critical incident technique, Gremler (2004) concludes that most (n=69, 60%) use at least 250 incidents. After establishing sufficient sample size, we grouped similar incidents under the same concept. The critical incidents were then combined at a workshop of experts (managers of natural areas, individuals in charge of use of public spaces and workers who attended users of the services at the VCs and recreation areas). This procedure generated the set of 26 internally well-differentiated items that formed part of the scale to be validated.

3.2.2 Questionnaire validation process

After obtaining the initial set of 26 items, we designed the scale validation survey (Supplementary Material). The items were phrased positively and evaluated on a seven-point Likert scale, where 1 indicated "Strongly disagree" and 7 "Strongly agree." Items were not

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grouped by class to avoid conditioning similar responses within the same group. The survey was anonymous to avoid desirability bias and was made available to tourists over 18 years' of age who had completed their visit to the VC. The person administering the written questionnaire explained the instructions and answered questions prior to its completion. The sample was selected through proportional stratified sampling, with strata composed of different VCs. A total of 437 questionnaires from nine VCs in the six natural areas were collected, of which 372 were valid.

To validate the scale, we first identified the underlying dimensions in the initial set of 26 items (Supplementary Material) through exploratory factor analysis (EFA) with principal components extraction, Varimax rotation and Kaiser Normalisation. After completing the EFA, we validated the dimensions through confirmatory factor analysis (CFA). The multivariate normality test for continuous variables and PRELIS software were used to analyse normality, with the structural equations method Weighted Least Squares (WLS) (Hair et al., 2010) and LISREL 8.30 for statistical analysis. The iterative process eliminated items that did not fulfil the conditions of a t-value higher than 1.96 and a standardised solution higher than 0.4, ultimately producing the final scale.

The instrument developed to help PA managers (final scale) had to have validity, be reliable and show good fit. A measurement instrument is valid when it measures the construct for which it is designed, not a different one. Reliability is the degree to which an assessment tool produces stable and consistent results. Reliability is thus a necessary but not a sufficient condition for valid measurement. Model fit was evaluated on three levels: absolute global measures, and incremental and parsimony fit.

Validity was evaluated by reviewing the dimensions and items used in the prior scholarly literature on similar issues. We confirmed construct validity for the items through two different methods. First, the items obtained for validation of the scale included the full spectrum of issues reflected in other studies that measure visitors' perception of outdoor recreation activities connected with natural areas. Second, EFA and CFA were used to refine the dimensions of the proposed scale.

To complete the analysis, we assessed fit using absolute global measures, incremental fit and parsimony fit. After testing for individual reliability of the items, we analysed the scale's overall reliability. Accurate measurement of the construct was confirmed by measuring internal consistency of the instrument (Hair et al., 2010). We used the Alpha Cronbach indicator to evaluate internal consistency as a measure of global reliability and confirmed that this indicator

did not improve when one of the items was eliminated. The values for reliability and composite variance extracted were thus appropriate.

Finally, we analysed composite reliability and variance extracted for each construct.

3.3 Questionnaire application to obtain information relevant for PA managers

Once the questionnaire was validated, it was supplemented with a set of socioeconomic variables (Appendix I). This information, combined with visitors' perception of service, was used to obtain relevant information for decision-making. To determine differences in visitors' perception between PAs, we performed Tukey's multiple comparison test. We analysed the relationship between socioeconomic variables and visitors' perception using the multivariate analysis technique Multiple Correspondence Analysis. The level of user's satisfaction with the provided services was reclassified into three categories: low, medium and high.

As in the previous case, the sample was selected through proportional stratified sampling, with strata composed of different VCs. A total of 540 questionnaires from nine VCs in the six natural areas were collected, of which 470 were valid.

4. Results

4.1 Recration management instrument

The first result of the study was a valid, reliable scale to measure users' perceptions of the services provided by VCs using the responses of stakeholders visiting visitor welcome and information centres in natural PAs. The scale had to have validity, be reliable and show good fit.

4.1.1 Content validity

The preliminary items and dimensions obtained in this study cover the full range established in the prior scholarly literature for dimensions of stakeholders' valuation of the service after enjoying it. The items thus span aspects of attention, empathy and responsibility of personnel; information; state and appearance of facilities; and ease and reliability of using the service.

The initial items included were derived from users of the service through critical incident technique. Evaluating this technique for three measures of reliability and four measures of validity, Ronan and Latham (1974) find that content validity, construct validity and relevance of critical behaviours are all satisfactory.

4.1.2. Exploratory and confirmatory factor analysis

The results show the presence of six factors. Of the 26 items, six loaded on two factors. For these cases, we associated the item with the factor with the greatest loading. The other items loaded on a single factor only (Hair et al., 2010). The first group includes nine items: v9, v10, v11, v13, v16, v20, v22, v23 and v25; the second, seven items: v5, v6, v7, v12, v14, v17 and v21; and the third, three items: v1, v4, v8 and v15. The fourth, fifth and sixth factors are composed of two items each: v24-v26, v2-v3 and v18-v19, respectively.

The results of the multivariate normality test for continuous variables show non-normality of the data (see Table 1), thus requiring use of WLS.

Asymmetry		Kurtosis		Asymmetry and kurtosis	
z-score	p-value	z-score	p-value	Chi-square	p-value
31.925	0.000	12.877	0.000	1185.031	0.000

Table 1: Multivariate normality test for continuous variables

CFA recommends eliminating one item from Factor 1 (v25), leaving eight. Factor 2 maintained all seven variables. Factor 3 lost one item (v1), leaving three variables. Factors 4, 5 and 6 were discarded due to elimination of their items. Table 2 presents the items finally validated for each dimension.

4.1.3 Fit analysis

A non-significant statistical relationship of verisimilitude is the fundamental indicator of absolute fit. Here, the null hypothesis assumes no significant difference between the value matrices obtained and estimated. Since our sample is large, the indicator for the final three-dimensional scale is significant (x^2 370.18; 132 degrees of freedom) (Hair et al., 2010). Following recommendations in the literature (Hair et al., 2010), we thus perform other measures of fit quality with indicators less sensitive to sample size. One of these, the Goodness of Fit Index (GFI) (Table 3), ranges from 0 (worst fit) to 1 (best fit). Although no limit for affirming good fit has been

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Items	λ* (t-value)	R2	Dimensions of proposed scale	Authors	α	C.R	AVE
V09 The information panels are attractive	0.81** (28.96)	0.65	Information: quantity and quality	Graefe & Burns (2013)	0.826	0.981	0.855
V10 The layout of the rooms is very good	0.96** (50.20)	0.92		Said et al. (2013)			
V11 Information is available for visitors	0.81** (28.43)	0.66		Crilley et al. (2012)			
V13 The facilities are well lighted	0.88** (36.49)	0.78		Burns & Graefe (2006)			
V16 Free maps and brochures are available	0.85** (34.98)	0.72		Akama & Kieti (2003)			
V20 The information on video and panels is up to date	0.96** (69.70)	0.93		Absher (1998)			
V22 The explanatory video is of acceptable quality	0.88** (45.07)	0.77					
V23 Guides are available to give tours and explain what one is seeing	0.82** (29.81)	0.67					
V05 The signs indicating how to get there are accurate	0.84** (30.85)	0.71	Facilities	Graefe & Burns (2013)	0.830	0.972	0.835
V06 The facilities are clean	0.87** (37.63)	0.75		Said et al. (2013)			
V07 The access routes are good	0.85** (34.58)	0.73		Crilley et al. (2012)			
V12 The restrooms are in good condition	0.86** (33.59)	0.75		Lawton (2012)			
V14 The facilities are pleasant-looking	0.94** (43.19)	0.88		Chen et al. (2011)			
V17 The facilities and infrastructure are well maintained	0.84** (28.64)	0.71		Crilley (2008)			
V21 The access routes are in good condition	0.76** (24.51)	0.58		Akama & Kieti (2003)			
				Ryan (2003)			
				Absher (1998)			
				Crompton (1991)			
V04 The service received was very good	0.73** (20.53)	0.53	Attention from personnel	Graefe & Burns, (2013)	0.829	0.903	0.757
V08 The personnel give very good information	0.84** (28.15)	0.71		Said et al., (2013)			
V15 People are attended quickly and efficiently	0.83** (26.14)	0.68		Crilley et al. (2012)			
				Lawton (2012)			
				Chen et al. (2011)			
				Crilley (2008)			
				Burns & Graefe (2006)			
				Akama & Kieti (2003)			
				Absher (1998)			
				Hamilton et al. (1991)			
				Crompton et al. (1991)			

Table 2. The first column presents the refined items in each dimension. The table shows the dimensions of the proposed scale and the authors who identified them in previous studies, as well as the validity and reliability indicators of both (dimensions and items). λ*=Standardised structural coefficient (t-students in parentheses); R^2=Reliability; Performance α=0 Alpha Cronbach; C.R.=Composite Reliability; AVE=Average Variance Extracted; **p<0.001.

established, values between 0.90 and 0.95 are advisable (Hair et al., 2010). The GFI for the scale finally proposed has a value of 0.95, indicating very good fit (Hair et al., 2010).

The scale should also have good incremental fit. We confirm increase in fit by comparing a base model and the new model. The null model, which postulates total lack of relationship among the variables, is usually used as the base model. Adjusted Goodness of Fit Index (AGFI), Normal Fit Index (NFI) and Tucker-Lewis Index (TLI) values for our scale (AGFI=0.94; NFI=0.91; TLI=0.93) are within acceptable range (0 (worst fit) to 1 (best fit)). All fulfil the recommendation of values over 0.9 (Hair et al., 2010), ensuring good fit.

Finally, to test the proposed scale's parsimony, we analyse degree of fit of the coefficients estimated for the scale. The normalised Chi-square is a valid test for confirmatory analysis. A value lower than 1 may indicate over-fit of the data, and only values lower than 3 indicate that the scale truly represents the data (Hair et al., 2010). Our scale obtained the value of 2.81 (Table 3).These tests confirm that the measures of absolute fit, incremental fit and parsimony are within the recommended range of values.

Absolute fit measures	Optimal values	Initial scale	Final scale
Degrees of freedom	Highest	286	132
Value of Chi-square and significance level	Lowest	671.62	370.18
	p<0.01	0.0	0.0
Non-centrality parameter	Lowest	385.62	238.18
Goodness of fit index	>0.9 >0.95	0.95	0.95
Standardised root mean square residual	<0.05	0.38	0.32
Expected cross-validation index	Lowest	4.43	2.12
Incremental fit measures	Optimal values	Initial scale	Final scale
Adjusted goodness of fit index	>0.9>0.95	0.94	0.94
Normal fit index	>0.9>0.95	0.92	0.91
Tucker-Lewis index	>0.9>0.95	0.94	0.93
Comparative fit index	>0.9>0.95	0.95	0.94
Incremental fit index	>0.9>0.95	0.95	0.94
Relative fit index	>0.9 Close to 1	0.91	0.90
Parsimony fit measures	Optimal values	Initial scale	Final scale
Normed Chi-square	>1 and <3<5	2.35	2.81
Parsimony goodness of fit index	Highest	0.77	0.74
Parsimony normed fit index	Highest	0.81	0.79
Akaike Information Criterion	Lowest	702.00	448.18
Critical N	>200>75	93.86	99.44

Table 3: Global validity and reliability of the scale

4.1.4. Reliability analysis

The Alpha Cronbach determines how precisely indicators measure a construct and the effect of eliminating an element from the result, enabling confirmation of whether parsimonious

parametrisation is achieved in scales with very few items that contribute relevant and non-redundant information. The highest Alpha Cronbach value is 1, and values higher than 0.7 are acceptable. The Alpha Cronbach parameter is higher than 0.8 for all dimensions (Table 2) and decreases if any item is eliminated from the scale. Finally, analysis of composite reliability and extracted variance (limit values 0.7 and 0.5, respectively) shows that the conditions for both parameters are met for all dimensions.

4.2 Information relevant for PA managers

4.2.1. Visitors' valuation of the services provided in VCs

Applying the assessment questionnaire (Appendix I) at VCs in all PAs yielded dimension and item values. Overall assessment of satisfaction with the services provided was obtained from the visitors to each centre, and valuation by visitors to all VCs analysed was positive. The mean value was above 5.5 in all VCs, and 62% obtained mean values above 6 (Fig. 2). VC 2 showed a high percentage of scores of 7 (85.3%), and in 62% of VCs, the values were greater than or equal to 5. In all centres, scores of 5, 6 or 7 accounted for at least 85% of the total. These results suggest that the value visitors assign is not only high but homogeneous across all PAs.
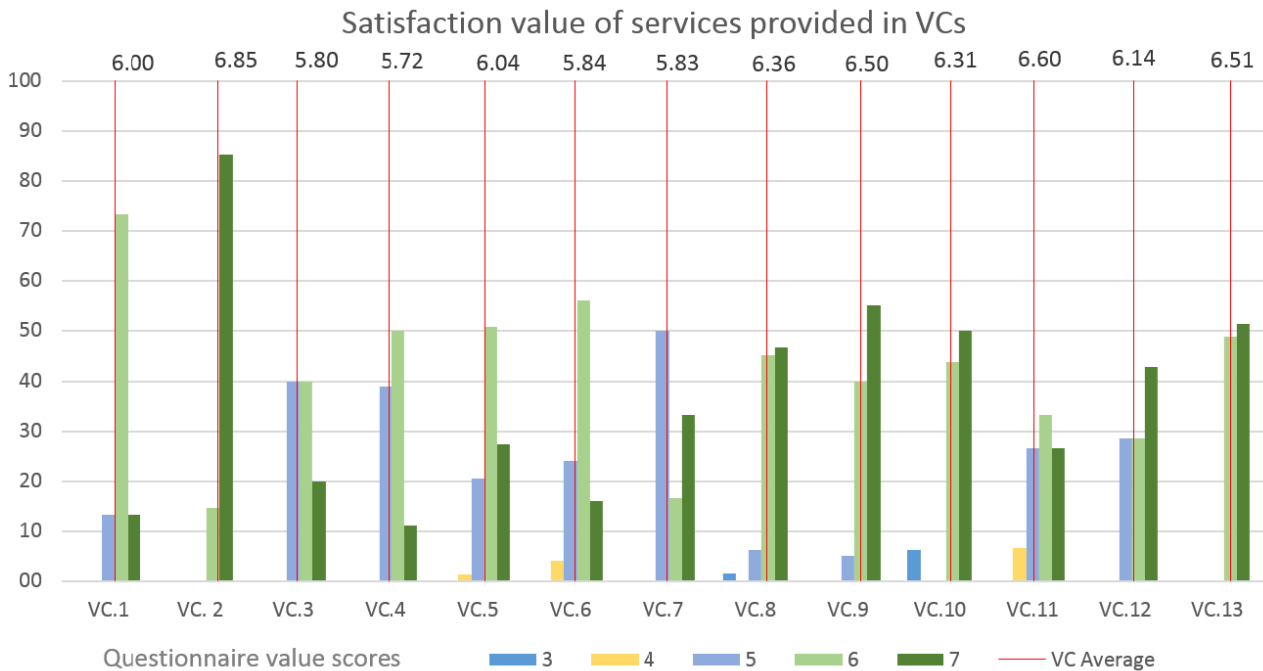

Fig. 2. Satisfaction value of services provided in the VCs. Bars shows percentage of score received by each VC that composes the global value. Red lines and their labels represent mean valuation. VC names are provided in the Supplementary Material.

4.2.2. Differences in visitors' valuation of services provided across VCs

Table 4 presents the results of Tukey's multiple comparison test for the cases in which visitors' valuation differed significantly between centres. In 86% of the cases, users' perception of the VC at PAs showed no significant differences. Note that VC 2 has better perception values than VCs 1, 4, 5, 6, 7 and 11. Further, valuation of VC 1 improves the results of VCs 4, 6 and 11. Finally, VC 11 shows worse results than four other centres (VCs 2, 8, 9 and 11).

VC comparison	Differences	Lowest point	Highest point	Adjusted p
2-1	0.853	0.095	1.611	0.013
2-4	1.131	0.418	1.844	0.000
2-5	0.812	0.304	1.320	0.000
2-6	1.013	0.368	1.658	0.000
2-7	1.020	0.198	1.841	0.003
2-11	1.253	0.495	2.011	0.000
8-11	0.759	0.058	1.461	0.021
9-11	0.900	0.064	1.736	0.022
13-4	0.790	0.098	1.482	0.010
13-6	0.672	0.051	1.293	0.021
13-11	0.912	0.174	1.650	0.003

Table 4: Tukey's multiple comparisons of means. 95% family-wise confidence level. Differences: difference in observed means. Lower point: lower endpoint of interval; Upper point: upper endpoint of interval; adjusted p: value after adjusting for multiple comparisons. The differences were significant in 11 of 78 pair wise comparisons.

4.2.3. Influence of socioeconomic variables on visitors' valuation

The socioeconomic variables analysed were income level, employment status, education level and NGO membership (Fig. 3)—all categorical variables (see descriptive statistics of people interviewed in Supplementary Material). Most but not all of these variable categories correspond to high valuation by visitors. People without education tend to assign a low valuation level. People with no income or higher incomes (over 3000€/month) usually assign similar, intermediate values. Students tend to express medium-level satisfaction with the services provided.

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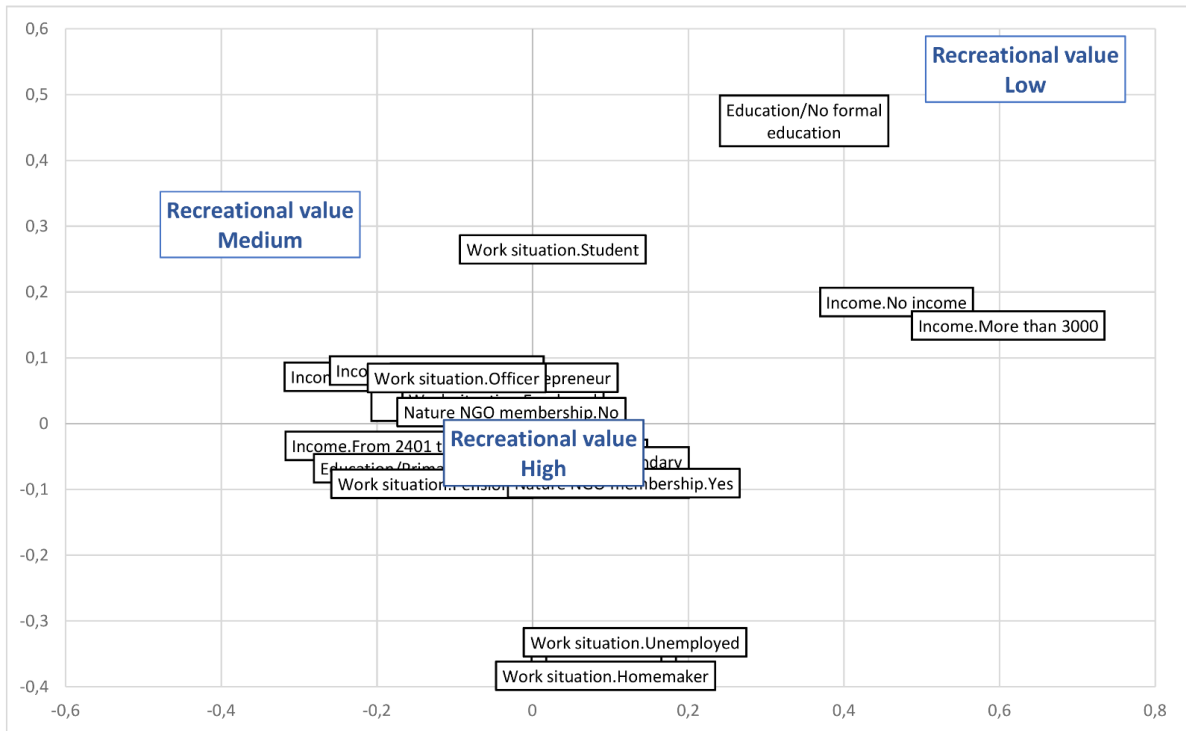56
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Fig. 3. Multiple correspondence analysis showing influence of socioeconomic variables on user satisfaction with services provided by VCs (Recreational value).

5. Discussion

5.1 Method to guide decision-making in PA VCs

The scale proposed in this study constitutes a valuable instrument for measuring users' satisfaction with the services provided by VCs in a PA network. First, the scale makes an important theoretical contribution. Each facet of the scale has high validity, and the scale's content validity has been contrasted and verified relative to similar studies in the field, in both dimensions and items (Absher, 1998; Chen et al., 2011; Crilley, 2008; Crilley et al., 2012; Crompton et al., 1991; Graefe & Burns, 2013, among others). The study also reviews scholarly knowledge to date on PA visitor valuation of experience of recreational activities. Another important contribution is its obtaining of the initial items through the critical incident technique (Flanagan, 1954) employed to design one of the scales most used in measuring service perception by users, SERVQUAL (Parasuraman et al., 1988). Although the technique has been widely validated in research on perception of service experience (Gremler, 2004), this is the first time it has been applied to design a method to guide decision-making in PA VCs. Items are thus collected from the perspective of

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the visitors and not limited or preconditioned by the researcher (Fawcett et al., 2014).

The study establishes three dimensions to assess visitors' valuation of the services provided in the VCs: information, facilities and service received from personnel. The first dimension is composed of eight items (Table 2), all of which refer to presence and quality of information available to visitors through questions on information available to the public, availability of maps and informational brochures, and interpretive guides who give information in person. We also evaluated quality of information panels and explanatory videos, and layout and lighting of information rooms in the centre (common denominator is quantity and quality of information provided to visitors to the natural PA). This dimension appears in recent studies in the field of recreation research (Crilley et al., 2012; Graefe & Burns, 2013) and in earlier studies (Absher, 1998; Burns & Graefe, 2006). Other studies that adapt the ECOSERV (Said et al., 2013) or SERQUAL (Akama & Kieti, 2003) scales include items clearly linked to this study's dimension "information". These items refer to whether employees have sufficient knowledge to give accurate information and whether the information about the natural area is relevant and attractive.

The second dimension that the study produces combines seven items related to the facilities where service is provided. The elements composing this dimension refer to whether the facilities are clean, and whether facilities and access routes are in good condition. All previous studies include infrastructures in their scales. Ryan (2003) uses two dimensions for this concept: infrastructures and ancillary infrastructures. Other authors include infrastructure in the dimension tangibles—for example, Crompton (1991), Akama (2003) and Said et al. (2013) establish ecotangible and tangible dimensions. Other authors, such as Chen et al. (2011), include this concept in the dimensions physical environment and technical quality. Crilley (2008) establishes the factor aesthetics and Absher (1998) the dimension facility-sufficiency. Other recent studies (Crilley et al., 2012; Graefe & Burns, 2013; Lawton, 2012) also use both dimensions and many items that measure state and quality of infrastructure. The third factor found encompasses three items to measure service the visitor receives from PA personnel. This factor evaluates courtesy of personnel and service received from them, and is prominent in all studies to date, primarily in the dimensions "Service" (Absher, 1998; Crilley et al., 2012; Graefe & Burns, 2013) and "Responsiveness and Empathy" (Akama, 2003; Crompton, 1991; Hamilton et al., 1991; Said et al., 2013).

Secondly, the scale makes a valuable contribution from the practical point of view, as it is adapted to recreational management at VCs in PAs. The questionnaire design fulfils a need among

managers in the PA network (Ryan & Cessford, 2003) by providing a simple, functional way to measure experience opinions concerning services and facilities after enjoying activities at VCs. The instrument is composed of a small number of items (compared to other scales) and is easy to answer (uses a seven-point Likert scale), as this study proves. Managers can thus apply it directly. Another contribution of the instrument is its potential to implement a long-term system to monitor value of recreational visitor centres and socioeconomic characterisation of stakeholders. A data set for several years would not only inform managers of the evolution of value but also provide feedback on the success or failure of their management actions.

5.2 Relevant information for PA managers

PA managers derive useful information from this questionnaire. First and most obvious is the high value of stakeholders' satisfaction with recreational experience at all centres (higher than 5 out of 7 in all VCs). Only three of the centres studied received scores below 4, and in all cases those responses constituted less than 10% of the total. In 62% of the VCs, values of 5, 6 and 7 constituted 100% of all scores, and scores of 5-7 represented at least 85% of the total for all VCs. From the managers' perspective, this is a great result for the entire PA network, due not only to the visitors' positive perception but also to the apparent homogeneity of value throughout the network.

We performed Tukey's multiple comparisons test to determine whether the differences in visitors' valuation between VCs were significant. In most cases (86% of pairwise comparisons), there were no significant differences in visitors' satisfaction between VCs. These results confirm high homogeneity of value throughout the network. This is a very important issue for managers of the recreational service, because they are worried to maintain a good level of service in all their centres. Our method allows monitoring homogeneity trough time across the network. However, VCs 2 and 13 obtained higher visitor valuation than others (VCs 1,4,5,6,7,11 and VCs 4,6,11 respectively) in a pairwise comparison. On the other hand VC 11 obtained significantly lower results than VCs 2,8,9 and 13. These results are very interesting for both, the local managers of the centres and the chief of the andalusian service of the network of protected areas. Not only by knowing the centres, but by detecting the causes of success or failure. They can detect which centres are better or worse valued by the visitors and investigate the reasons that explain the values. The questionnaire data may help them to apply the causes of success in the most valued centres to those who need to improve. Also detecting the reasons for worse valuations is useful to avoided those mistakes in other centres.

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Finally, sociocultural factors may explain perceptions and values assigned to recreational activities (Maestre-Andrés et al., 2016). Our measurement instrument enabled managers to identify what sociocultural variables influence visitors' valuation of VCs. The results suggest some unexpected conclusions. Although we expected members of environmentally conscious NGOs to evaluate recreational activities higher than non-member visitors, the multiple correspondence analysis shows no differences between these groups. This finding implies that promoting environmental organisation membership is not the way to get people to value recreation at a VC. Environmental organisations clearly have many social benefits, but not this one. It is important for managers to note, however, that people without education tend to attribute lower values to their experience in VCs. Positive evaluation of the environmental activities in the centres is linked to better knowledge of environmental values. This result is in line with Zoderer et al. (2016), who conclude that cultural background is an important driver of perceived importance of cultural services. Such findings emphasise to environmental managers the need to improve and promote environmental education and knowledge of the value of their PAs.

Other stakeholder profiles tend to assign recreational experience intermediate values—people with no income or high incomes (over 3000€/month). Visitors with no income tend to value the visit to VCs less than do other economic profiles. Along these lines, Martinez-Harms et al. (2018) highlight that people in lower-income areas have less access to the benefits of nature. This finding may explain our result, as low income is usually related to low level of culture. Maybe lack of economic capacity to access PAs results in less environmental knowledge, again highlighting the need to increase environmental knowledge in order to improve society's enjoyment and valuation of the benefits of nature. Lower valuation by high-income visitors may be explained by several factors. People with this profile may have low environmental interest or seek more complex environmental activities. Despite a high level of income, they may not have enough knowledge to value the information and activities at VCs. Managers found this result as an unexpected outcomes. However, to explain in a deep way the reasons will require the inclusion of more variables in the study. So, it would be interesting to explore this issue in further research. Finally, young people who are students tend to assign intermediate scores. This group has not yet completed higher education, and previous results suggest that higher education may improves people's knowledge of ecosystems and valuation of ecosystem services and related activities at VCs.

Despite common practice in the business sector, many areas of public management have not

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characterised users of a service. The measurement instrument designed here allows managers not only to improve their knowledge of recreational visitors but also to relate specific types of visitors to valuation of recreational activities. This information could guide managers' decisions on such issues as environmental education, recreational activities and promotional actions oriented to a specific type of user.

6. Conclusions

This study is the result of collaboration between scientists and managers that incorporates stakeholder engagement. The core product is an instrument to measure visitors' valuation of recreational activities after their experience at VCs of PAs in Andalusia (Spain). The resulting scale fulfils both the management's requirements and the conditions of validity and reliability required of a good measurement scale. The questionnaire developed is simple and functional, guaranteeing generation of a useful and directly applicable measurement tool. This method can either be used directly or adapted to recreation management in other PAs with similar organisation and government models. The methodology to develop a new measurement instrument can also be applied easily to assess recreation services at facilities in PAs.

The values obtained from the first application of the scale produced useful results for managers' decision-making process. In addition, the instrument provided managers with information useful for decision-making related to differences in visitors' valuation of recreational activities among centres throughout the PA network and socioeconomic factors that may explain perceptions and values assigned by visitors in the case study. However, investigation of factors that explain some of the relationship between visitors satisfaction and socioeconomic variables, will require the inclusion of more variables in the study. So, further researches are needed to explore this issue.

Yet all of this information is merely a snapshot of the recreational management status at VCs. One advantage of the measurement instrument is its potential for obtaining a long-term data series. There is increasing agreement on the need for a large-scale assessment methods (Bryce et al., 2016) to enable managers to measure not only feedback on recreational management at a given time but also changes over time and the relationship of sociocultural variables to these changes.

Finally, this study is based on solving a management problem using a scientific methodology. As knowledge co-production (between managers and scientists) ensures that managers can apply the management instrument developed (final questionnaire) directly, this

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study advances development of a method of collaborative research by scientist and practitioners to improve recreational management in PAs.

7. Acknowledgements

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Appendix I: Validated questionnaire

The University of Granada and the Andalusian Department of the Environment are performing a study to analyse valuation of the recreation ecosystem service in visitor reception centres in protected areas in Andalusia. Thank you for your collaboration.

On a scale of 1 to 7, please indicate your degree of agreement **with the following statements:**
(1 strongly disagree; 7 strongly agree;
DK/NA=Don't know/No answer)
(*The respondent must evaluate all of the statements.*)

a) The explanatory media (panels, models, reproductions, interactive displays...) are attractive.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

b) The layout of the rooms is very good.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

c) Information is available for visitors.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

d) The facilities are well lighted.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

e) Free informative maps and brochures are available.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

f) The information on video and panels is up to date.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

g) The audio-visuals are of acceptable quality.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

h) Guides are available to give tours and explain what one is seeing.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

i) The signs indicating how to get there are accurate.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

j) The facilities are clean.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

k) The access routes are good.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

l) The restrooms are in good condition.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

m) The facilities are pleasant-looking.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

n) The facilities and infrastructures are well maintained.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

o) The access routes are in very good condition.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

p) The service received was very good.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

q) The personnel give very good information.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

r) The service received was quick and efficient.
□1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7   □ DK/NA

In general, please rate your satisfaction with the activities performed in the visitor centre from 1 to 7: (1 strongly disagree; and 7 strongly agree)

□ 1   □ 2   □ 3   □ 4   □ 5   □ 6   □ 7

Finally, we would like to ask you some questions. Remember that this questionnaire is anonymous:

1. *Year of birth*:

2. *Marital status:*
□ *single*   □ *married*   □ *divorced*   □ *widowed*

3. *Do you have children?*   □ *yes*   □ *no*

4. *Education:*
□ no formal education
□ primary school
□ secondary school
□ vocational training
□ college
□ other (specify)

5. *Occupation:*
□ employed/salaried
□ business owner/self-employed
□ civil servant
□ independent professional
□ unemployed
□ homemaker
□ student
□ retired
□ other, specify

6. *Are you a member of any association for* protection of the environment?   □ yes   □ no

7. Does your average **NET MONTHLY FAMILY INCOME** fall within any of these ranges?

No income	
Up to **600 euros**	
601-1200 euros	
1201-1800 euros	
1801-2400 euros	
2401-3000 euros	
Over **3001 euros**	
Don't know	

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Supplementary material

Supplement S1: VC´s name in each protected area

Visitor Center (VC)	Visitor Center Name	Protected Area
1	"Cabildo Viejo"	"Sierra de Aracena y Picos de Aroche" Natural Park
2	"Bahía de Cádiz"	"Bahía de Cádiz" Natural Park
3	"Las Amoladeras"	"Cabo de Gata-Níjar" Natural Park
4	"Venta Nueva"	"Sierra de Cardeña y Montoro" Natural Park
5	"Río Borosa"	"Sierras de Cazorla, Segura y Las Villas Natural Park
6	"Guadiamar"	"Corredor Verde del Guadiamar" Protected Landscape
7	"Llanos de las Américas"	"Despeñaperros" Natural Park
8	"José Antonio Valverde"	"Laguna de Fuente de Piedra" Natural Reserve
9	"Puerto Lobo"	"Sierra de Huétor" Natural Park
10	"Los Villares"	"Los Villares" Periurban Park
11	"Anastasio Senra"	"Marismas del Odiel" Natural Park
12	"Dornajo"	"Sierra Nevada" National and Natural Park
13	"Los Yesares"	"Karst en Yesos de Sorbas" Natural Park

Supplement S2: Initial set of items obtained using the critical incident technique

V01	The personnel are courteous.
V02	The information about nature is attractive.
V03	The models are very attractive.
V04	The service received was very good.
V05	The signs indicating how to get there are accurate.
V06	The installations are clean.
V07	The access routes are good.
V08	The personnel give very good information.
V09	The information panels are attractive.
V10	The layout of the rooms is very good.
V11	Information is available for visitors.
V12	The restrooms are in good condition.
V13	The installations are well lighted.
V14	The installations are pleasant-looking.
V15	People are attended quickly and efficiently.
V16	Free maps and brochures are available.
V17	The installations and infrastructures are well maintained.
V18	Information is insufficient.
V19	The centre is a comfortable temperature.
V20	The information on the video and panels is up-to-date.
V21	The access routes are in good condition.
V22	The explanatory video is of acceptable quality.
V23	Guides are available to give tours and explain what one is seeing.
V24	There are objects and information on local customs.
V25	The centre provides a variety of activities.
V26	There are detailed topographical maps with information on routes.

Supplement S3: Dimensions used to measure recreation service by the stakeholders

Dimensions of the proposed scale	Authors	Related dimensions
Information: quantity and quality	Graefe &Burns (2013) Said et al. (2013) Crilley et al. (2012) Burns & Graefe (2006) Akama & Kieti (2003) Absher (1998)	• Information • Assurance • Information • Information • Assurance • Responsibilities • Information
Installations	Graefe & Burns (2013) Said et al. (2013) Crilley et al. (2012) Lawton (2012) Chen et al. (2011) Crilley (2008) Akama & Kieti (2003) Ryan (2003) Absher (1998) Crompton (1991)	• Facilities • Ecotangibles • Tangibles • Nine items • Four items • Physical environment • Technical quality • Aesthetics • Tangibles • Infrastructure • Ancillary infrastructure • Facility-Sufficiency • Tangibles
Attention from personnel	Graefe & Burns, (2013) Said et al., (2013) Crilley et al. (2012) Lawton (2012) Chen et al. (2011) Crilley(2008) Burns & Graefe (2006) Akama &Kieti (2003) Absher (1998) Hamilton et al. (1991) Crompton et al. (1991)	• Service • Responsiveness and empathy • Service • 1-item scale with the single construct Visitor satisfaction • Personal interaction • Staffing • Responsiveness of staff • Responsibilities • Reliability • Assurance • Service • Responsiveness and empathy • Responsiveness and empathy

Supplement S4: Descriptive statistics of interviewed people

Variable	Categories	N	Percentage	Variable	Categories	N	Percentage
Age	Under 30 years old	111	23,6	Marital status	Single	172	36,6
	30-45 years old	165	35,1		Married	207	44,0
	45-65 years old	110	23,4		Divorced	39	8,3
	Over 65 years old	36	7,7		Widow/Widower	28	6,0
	NA	48	10,2		NA	24	5,1
	Total	470	100		Total	470	100
Income	No income	41	8,7	Education	No formal education	29	6,2
	Up to 600	51	10,9		Primary school	38	8,1
	From 601 to 1200	103	21,9		Secondary education	118	25,1
	From 1201 to 1800	98	20,9		Undergraduate degree	107	22,8
	From 1801 to 2400	63	13,4		Degree	154	32,8
	From 2401 to 3000	26	5,5		Others	24	5,1
	More than 3000	24	5,1		NA	29	6,2
	NA	64	13,6		Total	470	100
	Total	470	100				
Nature NGO membership	Yes	77	16,4	Work situation	Employed	152	32,3
	No	360	76,6		Entrepreneur	60	12,8
	NA	33	7,0		Officer	39	8,3
	Total	470	100		Self-employed	44	9,4
					Unemployed	38	8,1
					Homemaker	42	8,9
					Student	31	6,6
					Pensioner	25	5,3
					Other	13	2,8
					NA	26	5,5
					Total	470	100