Waste Management 58 (2016) 34–40

Contents lists available at ScienceDirect

Waste Management

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

Can persuasive and demonstrative messages to visitors reduce littering in river beaches?

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ARTICLE INFO

Article history:
Received 2 January 2016
Revised 12 August 2016
Accepted 26 August 2016
Available online 6 September 2016

Keywords:
Beach litter
Demonstrative message
Persuasive message
Littering behavior
Tourism impacts

ABSTRACT

Littering of public areas is a significant problem worldwide. Here we evaluate the success of persuasive and demonstrative messages at reducing littering in highly visited river beaches in Argentina. We made an intervention at the beaches which consisted of a personalized verbal request asking visitors to take their litter to the waste cans (persuasive message) while they were exposed to the example of picking up the litter already left on the beach (demonstrative message). We conducted 102 observations distributed over 29 dates, two years and four beaches. Each observation consisted of three or four rounds: before the presence of visitors we cleaned the beaches, during the stay of visitors we made the intervention (once or twice) in two out of the four beaches, and early next morning we estimated the amount of litter left per beach. Litter weight ranged from 0 to 53 g visitor^{-1} day^{-1}. Littering per visitor was reduced an average of 35% due to the intervention ($p = 0.049$). We also found differences among beaches ($p = 0.001$), and an increase in littering with crowding ($p = 0.005$). We show for the first time that the personalized request combined with the example of picking up litter is effective in reducing littering in a Latin American country.

1. Introduction

The deterioration of the environmental quality of beaches and natural areas as a consequence of inadequate waste disposition by visitors is a worldwide problem, which has been aggravated in the last decades because of an increase in tourism and population (Rodriguez-Santos et al., 2005; Araújo and Costa, 2006; Ariza et al., 2008; Brown et al., 2010; Eastman et al., 2013; Becken and Jobb, 2014; Cingolani et al., 2015a). Litter accumulation threaten the conservation of beach environments in touristic areas, particularly in highly visited beaches (Rodriguez-Santos et al., 2005; dos Santos et al., 2008; Rodríguez-Rodríguez, 2012). The most evident negative effect of litter accumulation is visual contamination; however, it can also contaminate the soil and water bodies, damage wildlife and risk human health (Mayer et al., 2007; Brown et al., 2010; Campbell et al., 2016). Also, littering in inadequate sites directly affects the satisfaction of tourists, which can, along with other factors, negatively influence the local economy (Pizam et al., 1978; Balance et al., 2000; Barragán Muñoz et al., 2003; Marion and Reid, 2007; Ariza et al., 2008).

One way of avoiding litter generation in natural areas may be encouraging visitors to dispose of their litter at sites suitable for litter collection and/or treatment. Persuasive communication, as a tool of environmental education, can be very useful for maintaining natural areas free of litter (Marion and Reid, 2007; Brown et al., 2010). Persuasive messages, whether through personalized verbal requests, signs or brochures, intend to communicate the reason for the norms without transmitting a threat of a sanction for non-compliance (Duncan and Martin, 2002). Persuasive messages to reduce littering stimulate visitors' awareness of the problem, thereby achieving their good predisposition to behave adequately (Orams, 1997; Marion and Reid, 2007).

In addition, if persuasive messages are combined with demonstrative messages, even better results can be obtained regarding compliance with rules of environmental protection by visitors (Cialdini, 2003; Keizer et al., 2008; Ardoin et al., 2015). Demonstra-

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http://dx.doi.org/10.1016/j.wasman.2016.08.028
0956-053X/

tive messages are designed to show people how most people behave in a given setting, and may be used as a tool for environmental education. They can consist of weak signals, such as simply maintaining the place clean, or stronger signals, such as picking up litter at the sight of the visitors (Schultz et al., 2013; Keizer et al., 2013). Demonstrative messages are effective due to the evolved human tendency to imitate what others are doing, as this tendency may be adaptive (Cialdini, 2003; Vugt et al., 2014). For these reasons, combining a verbal request (persuasive message) with an example of "good behavior" (demonstrative message) may be an effective technique to improve littering behavior of visitors (Brown et al., 2010; Rodríguez-Rodríguez, 2012; Gusmerotti et al., 2016).

Several studies have been conducted in Latin American countries, particularly in Chile, Brazil and Argentina, indicating the severity and high priority of the littering problem in protected areas, urban zones and beaches (e.g. Rodriguez-Santos et al., 2005; dos Santos et al., 2008; Bravo et al., 2009; Thiel et al., 2011; Seco Pon and Becherucci, 2012; Eastman et al., 2013; Cingolani et al., 2015a). Many of these studies propose environmental education as a strategy for improving people littering behavior. However, to the best of our knowledge, its effectiveness has not been experimentally evaluated in the region, but for one study of our own authorship (Cingolani et al., 2015a). Additionally, although it has been demonstrated that persuasive and demonstrative messages may influence the attitudes and behavior of people towards environment, few studies have assessed the effects of these tools directly on environmental quality (Marion and Reid, 2007).

In our previous study (Cingolani et al., 2015a) we evaluated whether it is possible to reduce visitors' littering through a personalized intervention in river beaches within a protected area in central Argentina. The intervention consisted in a personalized verbal request to visitors asking them to take their litter to the waste cans (persuasive message) while exposing them to the example of picking up the litter already left on the beach (demonstrative message). We found a non-significant trend suggesting a reduction of the amount of litter left by visitors after our intervention. We interpreted that the lack of significance was due to the lack of statistical power. A possible additional explanation may be that only one intervention during the day was not enough, as there existed a small but unquantified replacement of people during the evaluation period and thus not all visitors were exposed to the single daily persuasive and demonstrative coupled messages (Cingolani et al., 2015a). In turn, we found large significant differences among beaches related to their size. Interestingly, on small beaches each visitor left in average less litter than on larger ones. It was not clear if the differences were due to different people visiting each beach (i.e. different attitudes towards nature, age, socio-economic level and/or educational level), or to the lower absolute visitors' numbers "per se" on small beaches (Roca and Villares, 2008; dos Santos et al., 2008; Páramo, 2010; Keizer et al., 2008; Schultz et al., 2013; Cingolani et al., 2015a).

In the present study we strive to improve our understanding of littering behavior and better evaluate, through a more intensive sampling effort, the effectiveness of coupled persuasive and demonstrative messages in the same study area as before (mountains of Córdoba, Argentina). Specifically, the aims of the present study were (1) to analyze if the intervention can reduce the amount of litter that people leave behind when visiting the beaches in the protected area, (2) to evaluate if two daily interventions are more effective than only one, (3) to analyze if the total amount and/or density of people have an influence on the quantity of litter that visitors left on the beach, and (4) to analyze if differences among beaches are maintained when we control for density and/or quantity of people.

2. Methods

2.1. Study area

The study was conducted at an ecological and recreational reserve in the small locality of Cuesta Blanca (31°28′59″S, 64°34′34″W, 770 m a.s.l.), close to Carlos Paz city (Córdoba, Argentina, Fig. 1). The Cuesta Blanca Reserve is administrated by the local government, covers 14 ha and was created in 2009 with the aim of preserving a buffer area along the banks of San Antonio River. The river provides water to over three million people, and its basin is highly degraded. Degradation includes deforestation, invasion by exotic species, wildfires and overgrazing, which have increased soil loss and reduced rain water retention capacity, as well as the advance of the urban frontier, which basically involves sewage pollution (Cingolani et al., 2008, 2015b; Fernández et al., 2012; Berardo, 2014; Giorgis et al., 2016).

The climate is subtropical, with a mean annual temperature of 15.8 °C and 745 mm rainfall (Hijmans et al., 2005), concentrated in the warmest months (from October to March). The maximum temperature attained during the study period (2013–2014) was 38.1 °C, in January 2014 (R. Renison pers. com.). Visitors reach maximum numbers during January and February, coincident with the southern hemisphere summer. They consist of family groups, couples and groups of youngsters from near or distant localities in the country or from abroad (Cingolani et al., 2015a). The average density of visitors registered in the Reserve during the summer season was 7.35 people per 100 m^2, with peak visitation from 16 to 19 h (Cingolani et al., 2015a).

The reserve is dominated by xerophytic mountain woodland vegetation in different successional stages, mainly open and closed shrubland, with some sectors invaded by exotic species (Giorgis et al., 2011). The natural vegetation extends along a strip of variable width (5–80 m) on the river banks and alternates with rocky areas and sandy beaches that are highly valued by visitors (Fig. 1). Rivers in the region have a flooding regime after large summer storms which flood the beaches and maintain the sand clear of vegetation (Cingolani et al., 2015b). The aims of the reserve are to contribute to the conservation of water quality, avoid soil erosion, restore the original ecosystem at invaded or eroded sites, protect the native species, and provide an educational and recreational space for local inhabitants and visitors (Cingolani et al., 2015a). The reserve has a specific sign system indicating, among other things, the expected littering behavior of visitors, who should use the trash bins. Also, a group of resident volunteers contribute by providing information to visitors about the reserve objectives and indications to behave adequately, complementing the work of the remunerated park ranger.

2.2. Sampling design and data collection

We selected four beaches, two of them with high and two with low littering per visitor, according to the previous study (Cingolani et al., 2015a). One of the four beaches resulted from the union of two small beaches which were almost contiguous (but not visible from each other), as only a small rocky outcrop separated them (Table 1, Fig. 1). As those beaches were also the less frequented, we decided to treat them for this study as the same beach, to count with higher numbers of visitors per day and beach during the study. The beaches were located along 500 m on both margins of San Antonio River. People access the beaches by walking along trails of 46–204 m from the nearest parking site, where the trash bins are located. Beaches are generally separated by rocky areas that are less frequently used by visitors (Fig. 1).

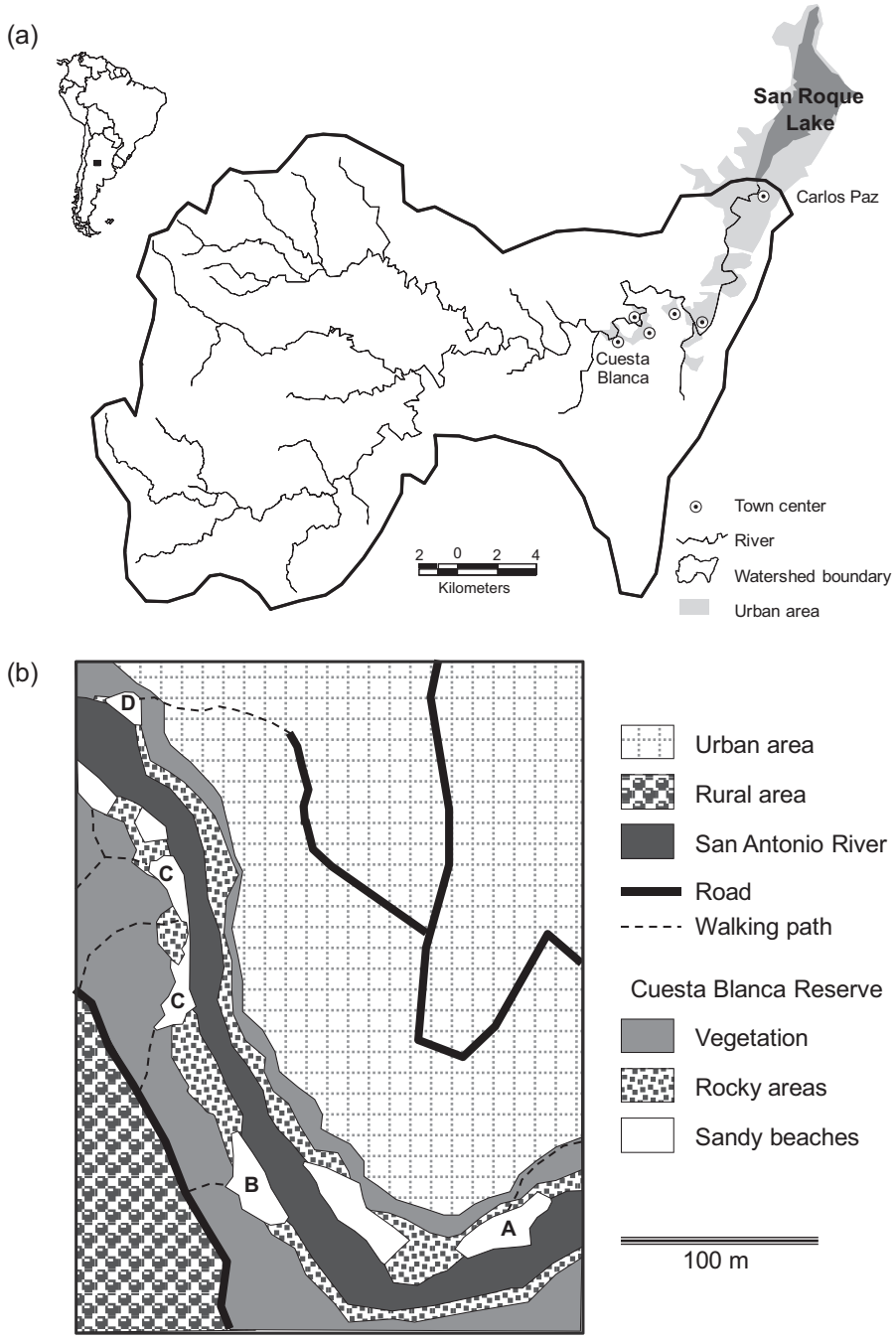

Fig. 1. (a) San Antonio River watershed and its location in South America, indicating Cuesta Blanca town and the nearest large city, Carlos Paz. (b) Study beaches (A, B, C and D) within the Cuesta Blanca Reserve, in Cuesta Blanca Town.

During January to March 2013 and 2014 we studied the four beaches on 10 and 19 dates respectively, summing up 102 observations (29 dates × 4 beaches, discounting 14 observations which had to be discarded because it was not possible to correctly com-

Table 1
Beach characteristics, from Cingolani et al. (2015a).

	Area (m^2)	Litter (g visitor^{-1} day^{-1})	Density (visitors100 m^{-2} day^{-1})	
			Early summer	Late summer
A	734	5.77	11.2	2.8
B	683	3.35	9.3	2.6
C	770	0.93	5.8	2.6
D	213	0.98	13.9	6.8

A: Curva beach; B: Piedra del Indio beach, C: two contiguous beaches (Guindillo and Escaladores) of 439 and 331 m^2 respectively, which were merged for this study; D: Ballena beach.

plete all the sampling process). At each date we visited the beaches three or four times: before, during (once or twice) and after visitor stays. Before the visitors arrival we picked up all the litter we could find so that beaches were clean at the start of the day. During the visitors stay we visited the beaches to perform (or not) the intervention, and count the number of visitors at the peak hour (see details below). After the stay of visitors, early in the next morning, we picked up the litter left by visitors on each beach. We did not consider as litter the organic waste because of its restricted amount, biodegradable nature and limited polluting effects.

The intervention was made in two of the four beaches at each date, and was always conveyed by the same person (I. Barberá) who identified himself as a volunteer environment caretaker. He approached all groups present in the beach and expressed the importance, both for nature conservation and people enjoyment, of keeping the site clean. Then, he asked visitors to collaborate taking their litter to the bins when leaving the beach. The explanation included, when necessary, the information that the bins could not be placed at the beach itself due to the river flooding regime (persuasive message). The volunteer carried a trash bag permanently and when available picked up the litter that was already left on the beach (demonstrative message). The persuasive and demonstrative messages were conveyed once per day during peak visitation in 2013, and twice per day in 2014 (at noon and at peak visitation). The noon period was from 12 to 14 h, and the peak visitation was from 17 to 19 h or from 16 to 18 h, for early and late summer, respectively. All litter per beach was collected either during the intervention or early next morning before the first visitors arrived (from 7 to 8 h), and weighed.

2.3. Data analyses

For each beach and day, we calculated the mean amount of litter left per visitor (g visitor^{-1} day^{-1}) as the quotient between weight of collected litter and number of visitors at the peak hour of visitor presence. This quotient slightly overestimates the amount of litter per visitor, because visitor numbers were estimated in a single count, whereas a proportion of the picked up litter might have been left by people that visited the beach before or after the count. However, as this proportion was low (Pers. obs.), we considered that it was not necessary to apply any correction to the calculation.

The amount of litter per visitor left on the beaches was ln-transformed (after adding 1 to allow for the transformation of zero weight data and avoid negative values) to improve the normality of residuals as evaluated with a q-q plot. Transformation was necessary because some weights were excessively high (mainly due to glass bottles). We used this transformed variable as the response variable in a general linear model. As explanatory categorical variables we considered: "intervention" (with and without), "beach" (four beaches) and "year" (2013 and 2014). We considered "visitor density" (visitors 100 m^{-2} day^{-1}) or alternatively "visitor absolute quantity" (visitors day^{-1}) as quantitative variables, in both cases ln-transformed. We discarded non-significant variables and then tested for interactions between pairs of significant variables, discarding those not significant from the final model.

3. Results

Litter left on the beaches varied between 0 and 52.8 g visitor^{-1} day^{-1}, while concurrence per beach varied between 2 and 128 visitors day^{-1}, and density between 0.27 and 31.9 visitors per 100 m^2 day^{-1}. On average, beaches had 35% less litter per visitor when we made the intervention than when not, and the difference was significant ($p \leqslant 0.05$, Table 2, Fig. 2). Differences among beaches were also significant, with beaches A and B having about four times more litter per visitor than beaches C and D ($p \leqslant 0.05$, Table 2, Fig. 2). Years did not differ among them ($p > 0.05$), so this variable was discarded from the final model. Additionally, litter left per visitor was increasingly higher as beaches were more crowded (Table 2). Both the absolute number of visitors as the density of visitors had significant effects on litter left behind per visitor ($p \leqslant 0.05$) when alternatively included in the model, but the model considering the absolute number had higher variance explained, thus we selected this last variable. Interactions were not significant in any case ($p > 0.05$). The variables included in the final model explained a relatively low proportion of the variance in the litter left behind per visitor (26%).

4. Discussion

Littering produces a serious and widespread impact to beaches and other natural areas, affecting their visual attraction and conservation status (Rodríguez-Rodríguez, 2012; Hartley et al., 2015). Our results can contribute to understand the littering problem and design management strategies to improve the aesthetic and environmental quality of natural areas.

As we found less per capita litter on the beaches after conveying our messages, we interpret that the intervention produced a behavioural change in a proportion of visitors. This result is in agreement with studies conducted in different countries, which had shown that demonstrative and/or persuasive messages can promote pro-environmental behavior (Orams, 1997; Cialdini, 2003; Marion and Reid, 2007; Brown et al., 2010; Osbaldiston and Schott, 2012; Keizer et al., 2013; Hartley et al., 2015; Gusmerotti et al., 2016). In particular, personalized verbal requests have been more effective than signs or brochures (Marion and Reid, 2007; Brown et al., 2010). Despite these antecedents in other parts of the world, experimental studies in Latin America are scarce. The littering problem in this part of the world has been addressed through beach surveys and questionnaires to visitors (e.g. Rodriguez-Santos et al., 2005; Bravo et al., 2009; Eastman et al., 2013). In one of such studies, conducted along the Pacific coast in Chile (Eastman et al., 2013), 56% of the surveyed people reported that they never litter, whereas 31% admitted to litter occasionally and only 13% admitted to do it frequently. The people who admit to litter occasionally do not have a strong habit of littering, and thus may be particularly receptive to the message prompted in the adequate moment, as a remainder to perform a "good" behavior (Brown et al., 2010; Osbaldiston and Schott, 2012). In another study conducted on Brazilian beaches, Rodriguez-Santos et al. (2005) indicated that about half the people that admitted to have littered the beaches (ca. 25% of respondents) feel guilty for their behavior, suggesting that they may be receptive to persuasive and/or demonstrative messages. Messages to visitors would be particularly effective if the guilty feeling for a previous littering behavior produce a cognitive dissonance with their values and beliefs (Osbaldiston and Schott, 2012). Cognitive dissonance is a mental discomfort experienced by an individual who holds two or more contradictory beliefs or performs an action that is contradictory with his/her beliefs (Osbaldiston and Schott, 2012). In contrast, people who admit to leave the waste on the beach and do not feel guilty for their behavior may be less receptive to pro-environmental messages, and could represent a portion of the visitors which in our study littered even after our experimental persuasive and demonstrative messages.

Littering usually is a habitual behavior, i.e. an automated cognitive response not preceded by elaborate reasoning. Habits may involve inaccurate perceptions, as people tend to focus on information that justifies their choices (Steg and Vlek, 2009). An example

Table 2
General linear model for litter left behind on the beach (g visitor^{-1} - day^{-1}) as a function of the number of visitors and the factors "intervention" and "beach".

Variable	B	t	F	p
Intercept	−0.331	−1.032	0.747	0.305
Ln (n° visitors)	0.240	2.900	8.408	0.005
Intervention			3.993	0.049
Without	0.348	1.998	–	0.049
With	0	–	–	–
Beach			7.047	<0.001
A	0.811	3.332	–	0.001
B	0.787	3.236	–	0.002
C	−0.002	−0.009	–	0.993
D	0	–	–	–

F_{model}: 6.893 ($p < 0.001$, $r^2 = 0.264$, $n = 102$).

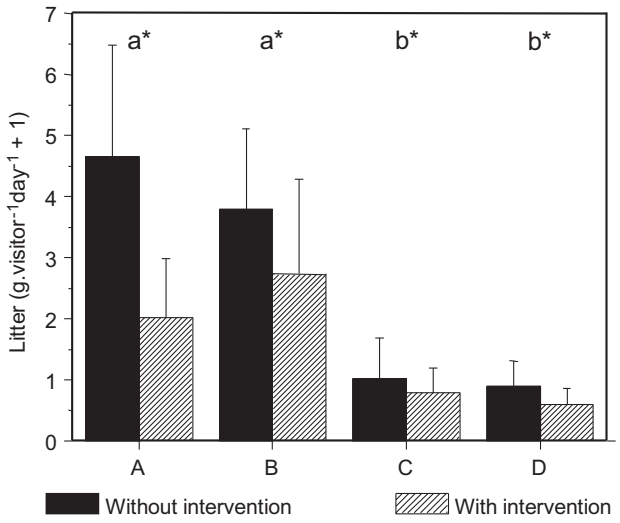

Fig. 2. Average litter left behind in the beach per visitor and day in the four study beaches, for the dates with and without intervention. To be consistent with the statistical analyses, the averages were calculated from the ln-transformed values and then re-transformed into the original scale. Different letters indicate significant differences ($p \leqslant 0.05$) among beaches, while the asterisks (*) represent differences between the intervention and no intervention treatments.

in our case would be to neglect information about flooding as the reason for the trash bins to be located at some distance of the beaches (Pers. obs.). In this way the responsibility is transferred to the government, which according to this inaccurate perception failed to put the bins in the adequate place, an attitude which was detected also in other studies performed in Latin-America (e.g. in Mexico, Armijo de la Vega et al., 2011). Considering these misperceptions, it has been suggested that some habitual anti-environmental behaviors can be reconsidered by the individuals only when they are temporarily forced to change (Steg and Vlek, 2009). Both on Brazilian and Chilean beaches (Rodriguez-Santos et al., 2005; Eastman et al., 2013), a large proportion of beach users (43 and 31%, respectively) suggested education as the best method to reduce beach littering. However, a proportion of visitors (8 and 25%, respectively) responded that the problem of littering should be solved by the application of fines. Interestingly, this last solution was supported not only by visitors who declared that they never litter, but also by those who admitted to litter frequently (Eastman et al., 2013). This suggests that forcing a change in habit through the application of fines to offenders could be a good strategy to induce a replacement of littering for non-littering habits. However, the application of fines may produce feelings of resentments or reactance, leading to attempts of contradicting the norms (Cialdini, 2003). Additionally, fines may be difficult to implement in the case of littering, as it is a short-duration and little noticed behavior, in particular when passive (i.e. leaving behind litter previously placed in the occupied area), as is generally the case in the beaches (Sibley and Liu, 2003).

A different alternative would be to promote informal, social sanctions (Marion and Reid, 2007). For example, the verbal message could include a request to visitors to ask other visitors to carry the trash to the bins, when observing a littering behavior. This may trigger in the visitors the feeling of being observed and disapproved if littering. It is known that the feeling of being observed prevents many anti-social behaviors (Ernest-Jones et al., 2011; Kahneman, 2011). Additionally, the evolved desire of status rooted in our human nature may be considered in the pro-environmental messages (Vugt et al., 2014). These authors suggest that this evolutionary bias is a factor which promotes anti-environmental behaviors, but it can also be an opportunity to promote pro-environmental behavior. It would be possible, for example, to transmit the message that people who deposit the waste in the adequate place and pick up the litter left by others is highly appreciated. This idea is supported by studies which show that people who are careful in using communal resources have more social prestige than people who are careless (Vugt et al., 2014).

Independently of the intervention and the number of visitors, we found a fourfold difference in littering between the largest beaches (A and B) and the smallest beaches (C and D, as C is the merging of two small beaches physically very close but not visible from one another). This could be due to different people choosing different beaches (Roig i Munar, 2003). For example, some studies had shown that littering behavior is less prevalent in older people, with a better socioeconomic and educational level (Rodriguez-Santos et al., 2005; Schultz et al., 2013; Slavin et al., 2012). We did not collect information about the socioeconomic characteristics of visitors, but we observed that younger people generally gathered in larger groups and tended to concentrate on larger beaches. In turn smaller beaches are generally visited by smaller groups, usually families. Additionally, visitors searching for a closer contact with nature tend to select quieter beaches (Roca and Villares, 2008). This could explain why visitors that selected smaller, and therefore, more quiet beaches, tended to be careful with their litter, and even pick up the litter left by others (Pers. obs.), compared to those who selected larger beaches.

A third finding of our study was that, controlling for the beach factor, the absolute number of visitors influences the littering behavior. Human behavior is usually driven by the action of other people (Cialdini, 2007; Páramo, 2010; Keizer et al., 2008; Vugt et al., 2014), which explains that littering by some people in natural areas usually triggers a similar behavior in other visitors (dos Santos et al., 2008; Schultz et al., 2013). Our results showed that

litter left per visitor is greater when beaches are more crowded, which is in line with these ideas. During crowded days, the probability that at least one person left litter may be higher than on less crowded days, and this can trigger littering in other people. This could partially counterbalance the effect of our demonstrative message showing that we voluntary pick up the litter left by others. Also helping to explain the higher littering per visitor when beaches were more crowded may be the different attitude towards nature of people arriving to the beaches at crowded and non-crowded dates. The most crowded dates coincided with hot summer weekends with a large number of city dwellers arriving at the beaches, while non-crowded dates included a larger proportion of local visitors and nature conservation enthusiasts which could be more predisposed to non-littering behaviors. Additionally, it is possible that at the hottest and most crowded dates, drink consumption is higher, and so more waste per visitor is generated.

The expectation that two daily interventions would be more effective than only one was not supported by our data, although we found a non-significant trend in the expected direction ($p = 0.14$). During the midday intervention concurrence was low, and as discussed above, biases may exist in the littering behavior of visitors seeking non-crowded beaches, days or times of the day. Thus, a possibility is that the midday intervention was applied to visitors with reduced littering behaviors and thus did not perceptively add to the effectiveness of the message, while peak visitation intervention was clearly effective. In practice, our findings imply that time and effort would be better invested in visiting more beaches rather than visiting beaches twice, given these are feasible options.

We found a relatively low explained variance in litter left behind per visitor. This was an expected result, as many factors besides those studied here may influence the amount of waste generated in the beaches and littering behavior of beach users. These factors may include gender, age, socio-economic and educational level, consumption habits, attitudes toward nature conservation and others (Schultz et al., 2013; Slavin et al., 2012).

5. Conclusion

We found a moderate but encouraging effect of litter reduction using coupled verbal persuasive and demonstrative messages. These results prove for the first time that these tools are effective in reducing littering in a Latin American country. It is possible that an improved message could produce a more drastic reduction of littering through volunteer or park ranger personalized effort. However, to reverse the littering problem in Argentina the personalized effort may be not enough. It will be necessary to implement long-term actions involving environmental education and sanctions imposed by different governmental, institutional and social actors (Marion and Reid, 2007). In this context, it is important to deal not only with the proximate causes of the problem (littering behavior) but also with the ultimate causes (waste generation). For example, to promote the use of environmentally responsible packaging by industry, and the generation of more eco-friendly purchasing habits by consumers.

Acknowledgements

We are grateful to the local government of Cuesta Blanca, to the Park Ranger Mariana Sosa, for logistic support, and to Park Ranger Joaquín Piedrabuena for encouraging persuasive communication techniques in Cuesta Blanca. We are also grateful to the local residents and volunteer environmental caretakers for their constant willingness to collaborate with conservation of the area. Jorgelina Brasca helped to improve English in an earlier version of the manuscript. One anonymous reviewer contributed substantially to improve the manuscript.

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