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The Recreational Value of Azibo Beaches: A Case Study in the Interior North of Portugal[1]

O Valor Recreativo Das Praias De Azibo: Um Estudo De Caso No Interior Norte De Portugal

João Oliveira Soares
joaosoares@tecnico.ulisboa.pt
CEG-IST, Instituto Superior Técnico, Universidade de Lisboa

Filipa Coutinho Soares
filipa.mco.soares@gmail.com
Departamento de Biologia Animal, Faculdade de Ciências, Universidade de Lisboa

Abstract/ Resumo

Located in the interior North of Portugal, the Azibo Reservoir Protected Landscape was created by the Portuguese authorities to preserve a rich natural environment, home of numerous species of fauna and flora. Later, a recreational area was created in its reservoir, with two public beaches that were awarded the Blue Flag eco-label. In this paper, the zonal travel cost method is used to estimate the recreational value of these two beaches, concluding that their economic benefit clearly exceeds the management costs incurred by the authorities. These results are in line with other studies for coastal areas.

Keywords: Tourism and Development, Ecosystem Services; Environmental Economics; Environment and Development; Regional Economic Activity

JEL Code: Z32, Q57, Q58, Q56, R11

Localizada no interior norte de Portugal, a Paisagem Protegida da Albufeira do Azibo foi criada pelas autoridades portuguesas para preservar um rico ambiente natural, lar de inúmeras espécies de fauna e flora. Posteriormente, foi criada na albufeira uma área de lazer com duas praias públicas receptoras do galardão ambiental Bandeira Azul. Neste artigo utiliza-se o método de custo de viagem zonal para estimar o valor recreativo dessas duas praias, concluindo-se que seu benefício económico excede claramente os custos de gestão incorridos pelas autoridades. Estes resultados estão alinhados com outros estudos realizados para áreas costeiras.

Palavras-chave: Turismo e Desenvolvimento; Serviços dos Ecossistemas; Economia Ambiental; Ambiente e Desenvolvimento; Atividade Económica Regional.

Código JEL: Z32, Q57, Q58, Q56, R11

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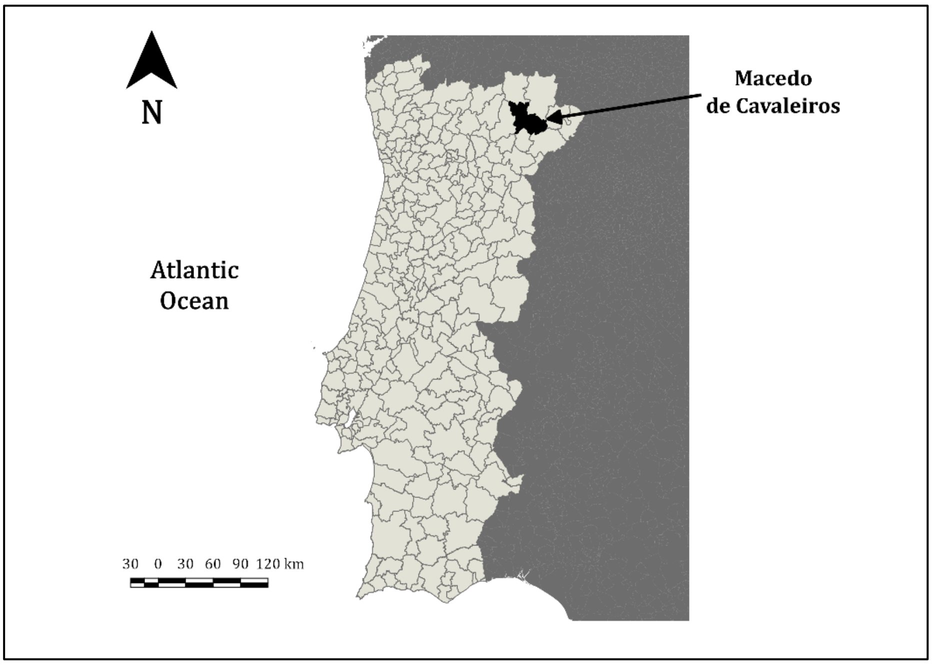
1. INTRODUCTION

The Blue Flag Eco-Label is a programme dedicated to the improvement and environmental preservation of beaches, marinas and boats, launched worldwide by the Foundation for Environmental Education, which is based in Copenhagen, Denmark (FEE, 2017). The programme started in 1987 and by 2019, the initiative had already affected 4,4573 sites and 47 countries through the Blue Flag national operators.

ABAE (*Associação Bandeira Azul da Europa*) is the Portuguese Blue Flag operator. Each year, in association with some of the most relevant national environmental organizations, ABAE is responsible for assessing and selecting new beaches for the award, taking into consideration a series of environmental, educational, safety and accessibility criteria. In turn, and as in other countries (see, e.g. Creo and Fraboni, 2011 or Lucrezi et al., 2015), it is the local municipalities who must put forward their beaches and marinas for the award. If they succeed, they have to allocate a part of their budget to the environmental preservation of the awarded sites. Consequently, and since the main source of municipal financing comes from taxes and municipal fees paid by citizens, the information about the return of these municipal expenses must be made public. This had led to the initiative by ABAE and some Portuguese municipalities to organise a study aimed at estimating the economic value of these awarded sites, by comparing the benefits against the costs incurred by the public authorities.

The analysis reported in this paper is a part of that study, with a focus on the recreational benefits of two beaches located far from the Portuguese Atlantic coastline, at the Azibo Reservoir, in the municipality of Macedo de Cavaleiros, in northeast Portugal (fig. 1). This geographic incidence is uncommon in the travel-cost literature, as most examples involve coastal beaches (see e.g. Bell and Leeworthy, 1990; Dharmaratne and Brathwaite, 1998; Bin et al., 2005; Rolfe and Gregg, 2012).

Figure 1. Location of the municipality of Macedo de Cavaleiros in the Northeast of Portugal.



The rest of this paper is organised as follows: section 2 presents the characteristics and the data used in the Azibo case study, as well as the methodology employed in the analysis, comparing it to other approaches in the literature; section 3 presents the results of the evaluation undertaken using the zonal travel cost method; finally, the results are summarized and discussed in section 4, which contains the main conclusions of the study.

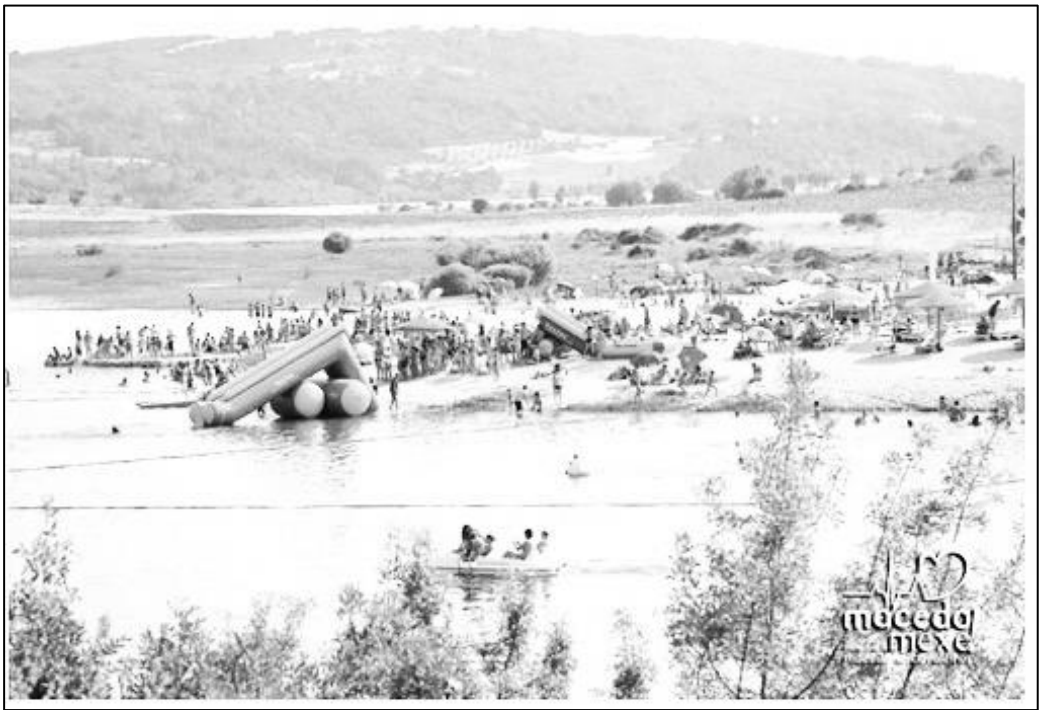
2. MATERIAL AND METHODS

2.1. Azibo: location, visitors and main characteristics

The 3,281.7 hectares of the Azibo Reservoir Protected Landscape, in Macedo de Cavaleiros, contains an interesting mixture of Mediterranean and Atlantic flora. There, one can find two native deciduous tree species – oaks (*Quercus faginea*) and chestnut (*Castanea sativa*) – along with areas of loam, olive trees, vineyards, cork oaks and other sparser vegetation including various species of spontaneous orchids (I.C.N.F., 2017). In the late 1970s, a dam was built with two main goals: to provide agricultural irrigation and household water supply. This dam gave rise to the Azibo reservoir (410 hectares) and attracted the presence of several bird species, which in turn attracted birdwatchers. More recently, two public beaches have opened with the corresponding amenities, namely parking and recreational facilities.

These two beaches have been subject to several investments over the years, allowing them to meet the criteria of the Blue Flag programme. As a consequence, *Fraga da Pegada* (Figure 2) is now the European river beach that has held the Blue Flag for the longest period of time — 14 years; and *Ribeira Beach* has held the blue flag eco-label for 8 consecutive years.

Figure 2. Azibo, *Fraga da Pegada* Beach



Source: Câmara Municipal de Macedo de Cavaleiros, 2017

To analyse the economic benefits provided by the two beaches, we estimate what the users of these beaches would be willing to pay as a hypothetical entrance fee in addition to the various costs incurred with the trip to Azibo. This is the logic behind the Travel Cost Method, an idea first suggested by Hotelling (1947), refined by Clawson and Knetsch (1966) and detailed, among others, in King and Mazzotta (2000), Boardman et al. (2011), and Parsons (2017). The method is frequently used to estimate the economic value of ecosystems used for recreation, namely beaches and lakes (e.g. Fleming and Cook, 2008; Rolfe, J. and Gregg, D., 2012; Zhang et al., 2015). Based on data on the origin of visitors, costs to the different origins are estimated; one can then infer the demand curve for the ecosystem in question and assess the economic benefit ('consumer surplus') that visitors gain from the visit.

The analysis will be based on the results of a questionnaire carried out by the municipality of Macedo de Cavaleiros during the bathing season of 2016, from 1 July to 15 September. It is a survey held by the municipality independently from this study, to collect information concerning the travellers that visit the region and their degree of satisfaction with their stay. The information extracted from this questionnaire was complemented with public data concerning road distances, travel times, population, fuel costs and wages.

Two hundred and twenty-four visitors answered the questionnaire at the Azibo car parks: 1% of the respondents were travelling alone, 15% as a couple, 20% with friends, and 64% with their family. The vast majority of visitors (74%) had come to spend the day on the Azibo beaches and the other 26% were mainly motivated by a visit to Azibo but also intended to visit other sites nearby. A high percentage of respondents (83%) classified their visit as “Very Good” or “Excellent”.

It was also possible to estimate the total number of visits during the bathing season — 200,000 people — a calculation carried out by counting the number of vehicles entering the Azibo car parks over the whole period and considering an estimated average of 2.5 persons per vehicle. Due to the geographic characteristics of these beaches, located in an isolated reservoir, the car parks are the only possible entrance to the site.

2.2. Origin of the visitors – zonal versus individual travel cost method

The first step of the travel cost method consists of collecting information about the origin of the visitors, corresponding in our case to the municipality of origin. After collecting this information, two approaches found in the literature are possible: the individual travel cost method (Brown and Navas, 1973; Gum and Martin, 1975) or the zonal travel cost method (Clawson and Knetsch, 1966).

The individual travel cost method is based on a linear regression between the number of visits per period by each interviewee and the average travel costs per visit, as well as some socioeconomic characteristics of the interviewee (gender, age, income, educational level, etc). The authors who favour this approach emphasize the fact that by specifying these individual characteristics it is possible to achieve a more accurate estimation of the demand function (Ward and Beal, 2000; Zhang et al., 2015). However, the accuracy requires the survey to be based on a significant sample of travellers and assumes that individual characteristics have a relevant influence on the decision to travel.

On the contrary, the zonal travel cost method trusts the virtues of average data, avoiding eventual outliers that may contaminate the conclusions, especially when the respondents’ sample is small. Here, the explanatory variable is the average travel cost per trip for each zone of origin, and the explained variable is the visitation rate per zone. Some authors also considered several average socio-economic variables as explanatory, but no statistical significance was found to sustain their inclusion (Nillesen, Wesseler & Cook, 2005; Fleming, C. M. and Cook, A.,2008). The method also relies on secondary data concerning average distances to the site and the inherent travel costs, complementing the information collected from visitors.

The zonal method approach was used in this research owing to the lack of information to perform the individual analysis. There was, for example, no data concerning the travellers’ income, their exact place of origin (just the municipality, which might correspond to a considerable area), or even the number of visits per respondent. On this point, the questionnaire was formulated imprecisely, e.g. ‘*How often do you visit the region? ‘First-timer’; ‘Rarely’; ‘Once per year’; ‘Twice per year’; ‘Several times per year*’. In contrast, as previously stated, reasonably accurate information was available about the total number of travellers per year.

Following the choice of the method, respondents were classified into different zones of origin. Eight zones were chosen, not necessarily concentric, some referring to small cities or counties, and others to NUTS2 regions or metropolitan areas. The option for this diversity was to reflect the geographical distribution evidenced by the questionnaire responses as much as possible. Table 1 lists the zones, the number of estimated visits per zone and the corresponding visitation rates per 1,000 inhabitants. This rate decreases with the geographical distance, as one would expect, with the exception of Bragança, the capital of the administrative district that is very close to the Azibo.

Table 1. Zones, Visits and Population.

I	II	III	IV	V
Zone of Origin	**% Visits**	**No. Visits**	**Population**	**Visits /1000 inhabitants**
Macedo de Cavaleiros	8%	16 000	15 776	1 014.20
Bragança	20%	40 000	35 341	1 131.83
Vila Real	10%	20 000	51 850	385.73
North (others)	45%	90 000	1 842 967	48.83
Spain-Zamora	1%	2 000	64 986	30.78
Porto	9%	18 000	1 759 524	10.23
Centre	4%	8 000	2 327 755	3.44
Lisbon Metropol. Area	3%	6 000	2 665 212	2.25
Total	100%	200 000	8 763 411	

2.3. Breakdown of costs per trip

The second step consisted of estimating the total cost per visit taking into account the origin in each of the eight zones. The total cost included the round-trip transport, meals and accommodation, and the opportunity cost for the travel time spent (Tables 2A and 2B). Details of the assumptions used in the estimates are as follows:

a) An average of 2.5 people per vehicle, calculated from the answers to the questionnaire. This estimate coincides with the one used by local authorities to extrapolate the number of visitors through the number of cars that entered the Azibo car parks;

b) Transport costs obtained through the site www.viamichelin.pt, considering the average price of diesel at the time of the survey (€1.22/litre) and the respective tolls. Diesel is cheaper in Portugal than petrol and its consumption in 2016 corresponded to 81.6% of the petroleum products consumption (ENMC, 2018);

c) For the 'North (others)' Zone, which includes several locations such as Chaves, Mirandela, Braga, Gaia, Santo Tirso and others, an average distance of 100 km from Azibo was assumed. For ‘Centre’, another large zone, the distance from Azibo to the capital of the zone, Coimbra, was used;

d) The hourly opportunity cost of travel time (column X), was considered to be equal to 40% of the average net monthly salary in Portugal in 2016 (€838), multiplied by the percentage of the active population over the total population (50.16%) and divided by the typical number of working hours per month (22x8h). Authors like Zhang et al. (2015), Blackwell (2007) or Ward and Beal (2000) adopted a similar percentage of the income or wage of the visitors. Other literature on Cost-Benefit Analysis, when dealing with the value of travel time savings (e.g. in Boardman et al, 2011; Waters, 1996), separates travel time savings into work time, commuting time and leisure time. This last one is valued somewhat less than commuting time, which is usually assumed to be 40% to 50% of the after-tax wage rate per hour saved. The approach followed here is particularly prudent in estimation, since it considers salary values net of taxes and Social Security contributions, and the fact that only a proportion of the visitors are employed and earn a salary. Furthermore, the calculation only includes the time that could be saved if travellers chose a destination closer to their points of origin; it does not include the time spent on-site, what may be controversial, as discussed by Cesario (1976) and Karasin (1998);

e) Finally, the food and accommodation cost for each zone was computed from the available aggregate data, expressed in terms of percentages per class of spending: 69% of the respondents declared expenses less than €50; 27% between €50 and €100; 3% between €100 and €200; and 1% more than €200. These figures show the relevance of including food and accommodation costs, as pointed out by other authors (e.g. Beal, 1995), and also that there are sharp differences in these items for the various respondents. Furthermore, since there was no individual information correlating the origin of the respondent and the implicit food and accommodation cost, it was necessary to infer this same cost per zone of origin from a two-step procedure. First, from the mid-points of the first three intervals and the lower limit of the fourth interval, we obtained the weighted average cost: 0.69*25 + 0.27*75 + 0.03*150 + 0.01*200= €44. Secondly, the zones were allocated into three groups according to their distance from Azibo, then assuming costs of 50%, 100% and 150% of the initial average value (see column VI).

Table 2A. Costs per individual round trip.

	II	III	IV	V	VI	VII
Zone of Origin	**Distance (Km)**	**TC per round trip(€)**	**TC per person**	**Total TC**	**FA per person**	**Total FA costs**
Macedo de Cavaleiros		2.0	0.80	12 800	22	352 000
Bragança	50	7.2	2.88	115 200	22	880 000
Vila Real	95	12.1	4.84	96 800	44	880 000
North (others)	100	14.0	5.60	504 000	44	3 960 000
Spain-Zamora	140	18.2	7.28	14 560	44	88 000
Porto	182	36.2	14.48	260 640	66	1 188 000
Centre	260	43.0	17.20	137 600	66	528 000
Lisbon Metropol. Area	462	95.7	38.28	229 680	66	396 000
Total				1 371 280		8 272 000

Note: Transport costs (TC). Food and Accommodation (FA).

Table 2B. Costs per individual round trip (cont.).

I	VIII	IX	X	XI	XII	XIII	XIV
Zone of Origin	**TT per round trip**	**TT per round trip in decimals**	**OC of work per hour**	**OC of work per person**	**OC of travel time**	**Total costs per trip**	**Total costs**
Macedo de Cavaleiros	34'	0.57	0.96	0.54	8 661	23.34	373 461
Bragança	1h44'	1.01	0.96	0.96	38 490	25.84	1 033 690
Vila Real	2h46'	2.77	0.96	2.64	52 857	51.48	1 029 657
North (others)	2h40'	2.67	0.96	2.55	229 258	52.15	4 693 258
Spain-Zamora	4h28'	4.47	0.96	4.27	8 533	55.55	111 093
Porto	4h40'	4.67	0.96	4.46	80 240	84.94	1 528 880
Centre	6h30'	6.50	0.96	6.21	49 673	89.41	715 273
Lisbon Metropol. Area	11h04'	11.07	0.96	10.57	63 428	114.85	689 108
Total					531 140		10 174 420

Note: Travel time (TT). Opportunity cost (OC).

3. RESULTS — ECONOMIC VALUATION USING THE ZONAL TRAVEL COST METHOD

Next, we searched for a functional relation between the number of visits per 1,000 inhabitants (Table 1, column V) and the total costs per trip (Table 2b, column XIII). This functional relation might lead us subsequently to build a demand function, assuming as usual that increases in travel costs will be comparable to increases in price, in terms of their impact on the demand for the recreational site.

Different functions were tested. As in (Fleming and Cook, 2008), we present the statistics for the linear, linear-log, log-linear, and log-log models (Table 3). The log-linear and log-log models are the best in all the four criteria (R^2, adj R^2, Log likelihood and *F*-statistic), showing very similar values. However, the results of the Shapiro-Wilk test on the normality of residuals (Shapiro and Wilk, 1965; Razali and Wah, 2011) recommend the rejection of the log-log model:

Log-log model — Shapiro-Wilk normality test: W = 0.7766, p-value = 0.016 (1)

Log-linear model — Shapiro-Wilk normality test: W = 0.94499, p-value = 0.6607 (2)

Table 3. Visits per 1000 inhabitants (VM) as a function of Total Costs per trip (TC).

	Linear	**Linear-log**	**Log-linear**	**Log-log**
β_0 (*p*-value)	1070.161 (0.006)	3351.5 (0.001)	8.499 (1.86e-05)	20.348 (9.66e-05)
β_1 (*p*-value)	-11.926 (0.018)	-755.9 (0.002)	-0.073 (0.0004)	-4.101 (0.0003)
R^2	0.634	0.815	0.897	0.902
adj R^2	0.572	0.784	0.880	0.886
Log likelihood	-56.159	-53.435	-8.937	-8.741
***F*-statistic (*p*-value)**	10.37 (0.018)	26.34 (0.002)	52.28 (0.0004)	55.21 (0.0003)

The demand curve for the Azibo beaches was then derived from the Log-linear equation — log (VM) = 8.499 − 0.073 TC — by computing the number of visits that would correspond to different admission prices, paid in addition to the zonal travel costs computed in the previous section (Table 4).

Table 4. Possible entry prices to Azibo beaches and corresponding visits.

(I) Admission price (P)	(II) Estimated no. of visits (V)
0	200 000
5	199 643
10	138 481
15	96 056
20	66 628
25	46 216
30	32 057
35	22 236
40	15 424

Subsequently, the pairs of values in Table 5 were used to estimate the equation of the inverse demand function. The respective equation shows a very high R-squared (Table 5):

Table 5. Prices as a function of the logarithm of estimated number of visits

	P = b0 + b1 ln(V)
β_0 (*p*-value)	180.124 (2.25e-08)
β_1 (*p*-value)	-14.469 (4.98e-08)
R^2	0.988
adj R^2	0.987
Log likelihood	-15.754
Durbin-Watson (*p*-value)	1.451 (0.162)
Akaike information criterion (AICc)	42.31
Schwarz criterion	38.099
***F*-statistic (*p*-value)**	594.2 (4.98e-08)

From this equation, using the (Wolfram|Alpha, 2017) software, we compute the integral corresponding to the area under the demand curve, which may be seen as the inherent consumer surplus, since Azibo is a free-of-charge beach (3) (fig.3):

$$\int_0^{200000}(-14.469\log(x)+180.124)\,dx = 3{,}596{,}670 \qquad (3)$$

This consumer surplus of €3,596,670 is an estimate of the total economic benefits that Azibo beach users enjoy, beyond the travel expenses needed to visit this leisure area (€10,174,420). This total economic value corresponds to €17.98 per visit, considering the total number of 200,000 visits.

Finally, for comparison purposes and as a counterpart to these benefits, the costs incurred by the municipality in 2016 for maintaining and developing the beach infrastructures amounted to €162,651 (Table 6).

Figure 3. Integral and Demand Curve for Azibo

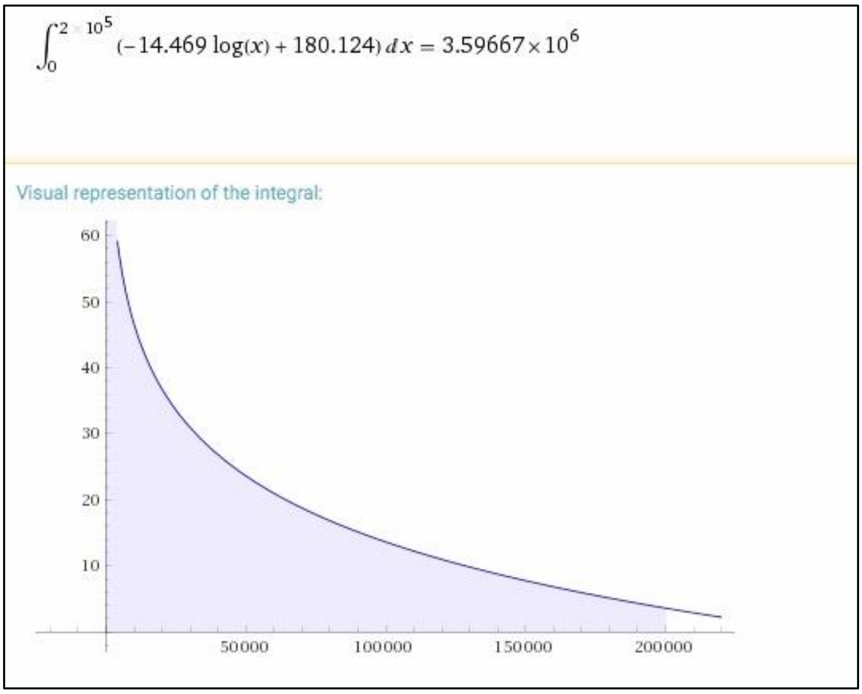


Table 6. Annual Operating Costs of the Azibo Bathing Zone (2016).

Management of the Bathing Area	Cost in euros
Watchers	19 913.43
Sand Replacement	15 596.40
Lifeguards	43 235.73
Control of spontaneous vegetation	4 180.00
Equipment	
Footbridges	66 500.00
Maintenance of infrastructures	
Signalling	592.80
Fence Repair	5 555.74
Flags	210.16
Floating platform	6 041.76
Miscellaneous	824.89
Total	**162 650.91**

4. DISCUSSION AND CONCLUSIONS

In recent decades we have witnessed increasing environmental awareness and a realisation that public resources are limited and frequently financed by private contributions (taxes), justifying a tighter control on public spending. This is the context behind this study, the main objective of which was to estimate the benefits and costs of two beaches located at a dam reservoir in the North of Portugal, made available to the population through public investment from central Government and local authorities.

From the analysis carried out, we concluded that in 2016 the Azibo beaches had about 200,000 visits during the bathing season, after about 180,000 visits the previous year. Based on the questionnaire carried out by the municipality and applying the zonal travel cost method (ZTCM), we also concluded that these visits implied an estimated total travel cost in 2016 of around 10.17 million euros for the visitors to Azibo. In turn, visitors' net benefits were estimated at around three million, six hundred thousand euros. If we compare these figures with the municipality’s annual expenditure on the management of the bathing area, which is around

162,500 euros, we may conclude that there is a clear net surplus associated to this leisure area, excluding the other benefits inherent to the preservation of this ecosystem. This conclusion is consistence with other examples in the literature: e.g. in another area but with a similar methodology (ZTCM), Voltaire et al. (2017) also concluded that the recreation benefits of their object of study, the Mont Saint-Michel, by far exceeded the inherent preservation and maintenance costs.

Obviously, it is possible to point out limitations of the study. For instance, it was not possible to pre-format the questionnaire, which meant the absence of individual responses regarding some socioeconomic characteristics of the respondents. This information could have allowed the application of the individual travel cost method, seeking to isolate the price factor (associated with the aggregate cost of travel, food and accommodation) from other possible determinants of the demand (income, level of education, etc.). Moreover, there was also no information about the number of annual visits of each respondent.

One last limitation stems from the lack of information regarding the more distant visitors, who might not limit their trip to one day at the beaches of Azibo, but also visit other sites in the region. The lack of information prevented the separate treatment of data for this type of visitor. Nevertheless, given their reduced weight in the sample as a whole, it can be assumed that this fact would not substantially change the major conclusions of the study. On the other hand, the geographical characteristics of restricted and controlled access to the beaches (to their car parks) ensure reasonable confidence in the estimation of the number of users of Azibo beaches. In other studies involving natural resources with a more open access, this is one of the frequent limitations to the estimation of the economic benefits.Taking those factors into account, the approach chosen in this study seems to be fully justified and the values obtained are in line with other studies in the literature. We obtained €17.98 as the consumer surplus for a visit to the Azibo beaches and as a comparative example for Australia, Blackwell (2007) reports a value of A$17.51 in Australian dollars, which after taking into account inflation and the exchange rate corresponds to approximately 18.03 euros. Rolfe and Gregg (2012), also for Australia, reported a value of A$35.09 in 2011, which corresponds to 26.46 euros taking into account inflation and the currency conversion. Also in Australia, the paper of Zhang et al (2015) based on a 2011 survey reports a value of A$19.47, which corresponds roughly to 14.69 euros in 2016. For sake of comparison, in North Carolina, United States of America, Bin et al. (2005) exhibit a range of values between $11 and $80 per day for users making day trips, and between $11 and $41 for users that stay onsite overnight. These values correspond approximately to the range from 10.90 to 79.73 euros in 2016. Overall, the values obtained in Azibo are in this range of values and indeed exceeded our expectation, which predicted lower values, taking into account the difference in GDP per capita between those countries and Portugal. But, it also seems reasonable to assume the intrinsic value increases because of the fact the Azibo beaches are inland, with no competitors nearby.

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