The recreational value of beaches in the Nelson Mandela Bay area, South Africa

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Abstract

Using beach visitation data collected via the administration of a questionnaire to 226 respondents, this paper estimates a random utility model of beach recreation. The relative value of selected attributes of beaches is estimated, and the recreational values of lost access to four Blue Flag beaches in the Nelson Mandela Bay area, namely Kings beach, Humewood beach, Hobie beach and Wells Estate beach, respectively are calculated to be R44.73, R24.61, R37.85 and R2.68 per person, per trip.

1 Introduction

Studies have shown that beach awards, such as the Blue Flag award, play a role in recreational users' beach visitation decisions and, for this reason, may be an important determinant of the recreational value of such beaches (Thomsen, 2001; Nahman and Rigby, 2008; McKenna, Williams and Cooper, 2010). Blue Flag status indicates that the beach has complied with water quality, environmental education and information, environmental management and safety criteria (Blue Flag Programme, 2006). These awards signal quality and serve to increase the public certainty in the recreational service yield (Nahman and Rigby, 2008; McKenna *et al.*, 2010). The loss of a beach award, or the closure of a Blue Flag beach, are adverse publicity and in many cases translate into falling levels of tourist visitation, and tourist income (McKenna *et al.*, 2010).

In 2001, South Africa became the first country outside Europe to employ the Blue Flag system - 26 beaches in South Africa have Blue Flag status. At the time the pilot study for this paper was conducted, five of South Africa's Blue Flag beaches had had their status withdrawn, mainly due to pollution of the bathing - four Durban beaches and Margate (McKenna *et al.*, 2010). The cost to Durban in lost tourist spending of losing Blue Flag status at four of its beaches was estimated to be approximately R100 million per annum (McKenna *et al.*, 2010), while the cost in lost tourist spending to the Margate region was estimated to be between R17 and R25 million per annum (Nahman and Rigby, 2008).

The Nelson Mandela Bay area is the location for some of South Africa's most appealing beach destinations (Frontier Events, 2010). At the time this pilot study was conducted, four beaches in this area had been awarded Blue Flag status, namely King's beach, Humewood beach, Hobie beach and Wells Estate beach[1].

The primary aim of the study was to estimate welfare measures for the loss of access to Blue Flag status beaches and relative values of selected features of the Nelson Mandela Bay beaches,

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[1] During the period following the writing of this paper and later resubmission, all four of these beaches lost their Blue Flag status (May, 2011).

by applying a random utility model (RUM) of site choice[2]. Value estimates of beach features are important for guiding beach management and development plans. They also indicate how important it is to address potential environmental threats, such as water pollution. To the authors' knowledge, this is the first formal attempt to value recreational values at South African beaches by means of the RUM of site choice, and the first formal attempt to value key features of beaches in this geographic area.

Section one of the paper briefly overviews the travel cost method. Section two outlines the design of the site choice RUM. Section three specifies the model and defines the variables. Section four estimates the model. Section five calculates the relevant welfare measures and Section six concludes.

2 A short theoretical background to the travel cost method

Beach visits are most often non-rival, in the sense that one visitor's consumption of a beach's recreational services does not decrease other visitors' access to it. For this reason, if the beach is not heavily congested, another visitor does not decrease the utility of those already using the beach. Given this public good feature, typically no entry charges are levied at beaches and there are no price and quantity data which can be used to construct a demand curve, and thereby calculate visitors' consumer surplus. To overcome the problem of the absence of price and quantity data for beach recreation, non-market valuation techniques are therefore an appealing option.

There are two broad categories of non-market valuation techniques, those that use expressed preference and those that use revealed preference (Hanley and Spash, 1993). Expressed preference methods include the contingent valuation method (CVM) and the choice modelling method (CM). The former method entails obtaining information about preferences for improvements in public goods by means of asking direct questions. The main objective of the CVM is to estimate individual willingness to pay (WTP) for changes in the quality or quantity of public goods, with the aid of selected explanatory variables for WTP (Haab & McConnell, 2002). The credibility of the values generated with this method rests heavily on the plausibility attached to the answers given to a hypothetical question on WTP. The CM method models choice among a set of hypothetical alternatives. Each alternative is defined by attributes with differing levels. Three different types of choice are modelled: ranking of alternatives, selecting a preferred alternative and rating alternatives on a cardinal scale (Haab & McConnell, 2002).

Revealed preference models infer people's preferences for environmental goods and estimate demand curves by observing their actual behaviour (Hanley and Spash, 1993). Two revealed preference techniques that are often used are the hedonic pricing method (HPM) and the travel cost method (TCM). The HPM relies on the principle that a person's utility is based on the characteristics of the good consumed (Lancaster, 1966). Hedonic modelling utilises the systematic disparity in the prices of a good, which can be attributed to the characteristics of the good, to determine the WTP for the characteristics. This technique is most often applied to the housing market (Haab & McConnell, 2002).

The TCM entails the valuation of a recreation site by determining the travel costs that individuals incur when visiting the site in question. There are three versions of the TCM, namely the single-site zonal (Clawson-Knetsch) TCM, the single-site individual TCM, and the random utility model (RUM) of site choice. In its simplest form, the TCM analysis entails the estimation of a trip generating function (TGF), in which travel costs predict the number of visits that will be undertaken by a person to a recreational site (Bockstael, 1995; Ward & Beal, 2000). The travel cost incurred in visiting the site is used as a proxy for the "price" paid by the visitor for the site's use (Liston-Heyes & Heyes, 1999). Over and above travel costs, a range of socio-demographic variables are also usually included in the TGF (Bockstael, 1995; Hanley & Spash, 1993). A demand function can then be

[2] An anonymous referee pointed out that the concurrent execution of a contingent valuation study valuing the same Blue Flag beaches would have been a useful addition to the results presented in this paper.

derived from the TGF and be used to calculate values for the recreational site (Bateman, 1993; Hanley & Spash, 1993).

This study applies the RUM of site choice. Numerous RUM studies have been conducted in the United States and elsewhere to value recreational sites (Caulkins, Bishop and Bouwes, 1986; Bockstael, McConnell and Strand, 1991; Morey, Rowe and Watson, 1993; Peters, Adamowicz and Boxall, 1995; Adamowicz, Swait, Boxall, Louviere and Williams, 1997; Johnstone and Markandya, 2005). Examples of the application of the method to value beach recreation include Parsons, Massey & Kealy (1999), McConnell and Tseng (2000) and Hicks and Strand (2000). The main advantage of the RUM is the inclusion of substitute sites in the model, which allows the researcher to incorporate the effects of substitute sites in welfare estimation (Haab and McConnell, 2003).

Not unlike other non-market valuation techniques, the TCM suffers from a number of application problems. These problems include multi-purpose trips, the calculation of distance costs, and the value of time. Multi-purpose trips give rise to the problem of determining what proportion of the total travel costs may be allocated to the visit to the recreational site on which attention is focused. It has been shown by Martinez-Espineira and Amoako-Tuffour (2008) that ignoring the multi-purpose nature of trips leads to an over-estimation of consumer surplus by almost 50%. There is, however, no distinct theoretically adequate way of addressing this problem (Hanley and Spash, 1993). One option is to ask visitors to apportion the importance of a visit to the recreational site, relative to their whole trip, expressed as a number between 0 and 1. This can then be used to weight their aggregate travel cost (Hanley and Spash, 1993).

The cost of travel is normally calculated as the product of the distance travelled in kilometers and the price per kilometer. The price per kilometer depends on the vehicle used.

The cost allocated for time used to travel depends on the degree of sacrifice made and the wage rate associated with this sacrifice (Freeman, 2003; Zawacki & Bowker, 2000; Hesseln, Loomis, Gonsalez-Caban & Alexander, 2003; Parsons, 2003; McKean, Johnson & Taylor, 2003). Many studies propose the use of some fraction of the wage rate to estimate the opportunity cost of time sacrificed (Cesario & Knetsch, 1970; Cesario, 1976; Bateman, 1993; Bowker, English, & Donovan, 1996; Liston-Heyes & Heyes, 1999; Zawacki & Bowker, 2000; Hagerty & Moeltner, 2005; Martinez-Espineira & Amoako-Tuffour, 2008). As some of the time used in travel may be part of the recreation, time costs ranging between 25% and 50% of the wage rate are often recommended in the relevant literature (Bateman, 1993; Bowker *et al.*, 1996; Zawacki & Bowker, 2000), especially 33% (Sarker & Surry, 1998; Liston-Heyes & Heyes, 1999; Sohngen, Lichtkoppler & Bielen, 2000; Hagerty & Moeltner, 2005; Martinez-Espineira & Amoako-Tuffour, 2008).

3 The Random Utility Model of Site Choice

The RUM allows the researcher to analyse choices among many alternatives. The individual's decision to visit a specific beach, for example, as opposed to other substitute beaches, is treated by the RUM as a stochastic, utility-maximising choice (Parsons *et al.*, 1999; Louviere *et al.*, 2000; Haab and McConnell, 2003). Since the RUM includes substitute sites, the multicollinearity problem that commonly afflicts single-site, individual TCMs is avoided.

The utility derived from a visit to beach j may be described by the indirect utility function,

$$V_{ij} = V(z_{ij}, x_i), \tag{1}$$

where: z_{ij} = a vector of attributes of beach j, including travel and time costs to the beach, and x_i = a vector of individual i's characteristics.

Individual i will visit beach j if the utility of a visit to beach j exceeds the utility of visits to all other beaches k in the choice set, where $k = (1, 2, \ldots, n)$. The utility consists of the sum of two parts, a systematic or observable element (V_{ij}), observable to both the researcher and the decision-maker, and a random or unobservable element (e_{ij}), unobservable to the researcher, but known to the decision-maker,

$$U_{ij} = V(z_{ij}, x_i) + e_{ij} \quad (2)$$

This model may be specified in terms of a conditional logit (CL) (Louviere *et al.*, 2000; Haab and McConnell, 2003). The CL model assumes that e_{ij} is independent and has a type I extreme value distribution. The probability, $\Pr_i(j)$, that individual i chooses beach j out of n beaches is given by

$$Pr_i(j) = exp(V_{ij}) / \sum_{j=1}^{n} exp(V_{ij}) \quad (3)$$

where: $\exp(\cdot)$ = the antilog function.

One of the assumptions of the CL is independence of irrelevant alternatives (IIA) (Morey *et al.*, 1993; Parsons *et al.*, 1999; Haab & McConnell, 2003). The IIA assumption requires that the relative probabilities of choosing between any two alternatives are unaffected by the introduction or removal of other options (Haab and McConnell, 2003). If there is a violation of the IIA principle, a nested logit (NL)[3] model may be more appropriate to estimate (Morey *et al.*, 1993). The NL model applies a series of decisions (Louviere *et al.*, 2000; Haab & McConnell, 2003). In a two-level decision structure (the most common one), the nesting levels can be represented by j and k, where j represents the lower-level choice and k represents the top-level choice. For the top-level choice, K represents the number of choice options and for the bottom-level choice, J represents the number of choice options (J_1, J_2,..., J_K) for each top-level option (Haab & McConnell, 2003). If a person selects option $k = 1$ from the top-level nest, then J_1 options are available to this person at the lower-level nest (j = 1, 2, ..., J_1). The decision tree structure is shown in Figure 1 below.

Each branch of the tree represents a choice set of options with identical levels of substitutability. In the NL two-level case, the utility associated with a person selecting option (j, k) is expressed formally as:

$$U_{jk} = V_{jk} + e_{jk}.; \forall (jk)^o JK \quad (4)$$

The probability of observing a person selecting option j, k from a nest of J options can be expressed as follows when e is distributed as generalised extreme value:

$$\Pr(j,k) = \frac{a_k \exp\left(\frac{V_{jk}}{\theta_k}\right)\left[\sum_{l=1}^{J_k} \exp\left(\frac{V_{lk}}{\theta_k}\right)\right]^{\theta_k - 1}}{\sum_{m=1}^{K} a_m \left[\sum_{l=1}^{J_m} \exp\left(\frac{V_{lm}}{\theta_m}\right)\right]^{\theta_m}} \quad (5)$$

In Equation 5, a_m and θ_m represent distributional parameters that need to be estimated (Haab & McConnell, 2003). Both the CL and NL models are estimated in this study using the LIMDEP Nlogit Version 4.0 program.

4 Model Specification and Variable Definitions

To estimate the RUM, a specific form must be assumed for the indirect utility function. In this study a linear indirect utility function was assumed. Table 1 describes the variables used in the beach-choice estimation models.

The indirect utility function estimated in this paper can be formally expressed as follows (Haab and McConnell, 2003):

$$\begin{aligned} V_{ij} = {} & \beta_1 Travelcost_{ij} + \beta_2 Length_{ij} + \beta_3 Wide_{ij} + \beta_4 Narrow_{ij} + \beta_5 Prom_{ij} + \beta_6 Play_{ij} \\ & + \beta_7 Reserve_{ij} + \beta_8 Indust_{ij} + \beta_9 Blueflag_{ij} \end{aligned} \quad (6)$$

[3] Alternatives to the nested logit include the heteroscedastistic extreme value (HEV) model and the random parameters (RP) model.

5 The Data

The trip data required to apply the RUM of site choice in this study was obtained by conducting personal interviews with Nelson Mandela Bay residents, with the aid of a structured questionnaire during the Christmas holiday period (December/January 2009/10). Time and budget constraints allowed a sample of 226 respondents to be interviewed. In the survey, respondents indicated which beaches, from a set of ten beaches in and around the Nelson Mandela Bay area, they had visited during the past year. These beaches included Wells Estate, Bluewater Bay, Brighton, King's, Humewood, Hobie, Pollok, Sardinia Bay, Beachview and Van Staden's (see Figure 2).

Of the ten beaches in the choice set, four currently have Blue Flag status – Wells Estate, King's, Hobie and Humewood. The majority of the beaches are located within Algoa Bay, namely Wells Estate, Bluewater Bay, Brighton, King's, Humewood, Hobie, Pollok, while the remaining beaches are located west of Cape Receife Point. This point forms the south-eastern boundary of Algoa bay.

Of the 226 questionnaires collected, five were found to have no visitation information, thus were removed from the sample. In the survey, visitors were asked about the number of day trips[4] they had made to each of the ten beaches in the past year, their home location[5] within the Nelson Mandela Bay area, the round trip distance travelled, the duration (in minutes) of the round trip, the type and engine capacity of the motor vehicle used to undertake the trip, and some demographic information. In total, the sample of 221 respondents took 10 042 day trips to the ten beaches. Respondents took 9035 trips to beaches in Algoa Bay and 1007 trips to beaches outside of Algoa Bay. The number of day trips per annum to each beach is presented in Table 2.

Of the beach visits made, the majority were to Kings, Humewood, and Hobie beaches. The frequency was mostly between one and five visits per annum.

The representivity of the population and size of the sample relative to the population could not be determined, other than comparing the sample population composition with available statistics relating to the annual Splash Festival that is held at the Port Elizabeth beachfront over the Easter weekend. The characteristics of the surrogate population from the Splash Festival are compared to the sample of beach goers in Table 3. The characteristics of the Splash Festival population and the sample of beach goers appeared to be a close match (Table 3).

The main difference in characteristics was the age structure of the sample – the average age of the sample respondent was eight years higher than that of the population – a product of a bias toward household heads in the selection of the sample.

The travel costs for each respondent were calculated as the sum of distance costs and time costs. The costs of travel were calculated from motor vehicle operating costs. Following standard practice in the literature (Hesseln *et al.,* 2003; Bin *et al.,* 2005; Martinez-Espineira & Amoako-Tuffour, 2008), the total operating costs per kilometre, as provided by the Automobile Association of South Africa (AA), were multiplied by the roundtrip distance travelled.

A straightforward *ad hoc* specification[6] of travel time cost was applied in this study - one third of the hourly wage rate was used (Bowker *et al.,* 1996; Zawacki & Bowker, 2000). The hourly wage rate for each individual was estimated by dividing their annual income by the total number of working hours per annum (Bin *et al.*, 2005; Martinez-Espineira & Amoako-Tuffour, 2008). The travel time was calculated by taking the distance travelled to get to and from the beach and assuming an average driving speed of 60km/h. The time cost of travelling was calculated as the product of the number of hours travelled and the opportunity cost of time per hour.

[4]The number of day trips per person was used as the dependent variable in the model estimation.

[5]In the case of out-of-town visitors, Nelson Mandela Bay was viewed as their 'temporary place of residence', and as such their home location within the Bay area was sought.

[6]More meticulous treatments of the issue surrounding the opportunity cost of travel time have been suggested (Shaw, 1992; McConnell, 1999; McKean *et al.,* 2003).

6 Analysis of the Results

6.1 *Descriptive statistics*

Table 4 shows the descriptive statistics for the independent quantitative variables used in the beach-choice estimation models.

The independent variable, Travel Cost, was derived using the components described in Table 5.

The longest distance travelled was approximately 123 kilometers, with the maximum travel time being just under two hours.

The other independent variables used in model estimation are dummy variables representing different beach characteristics. The number of beaches with each characteristic is given in Table 6.

6.2 *Model Estimation*

Table 7 presents the estimation results from the CL and NL models on all ten beaches. The selection of an appropriate nesting structure for the NL model is a strategic modelling decision that, in many cases, has a large effect on welfare measurement (Morey *et al.*, 1993; Haab & McConnell, 2003). The nests are most often based on a thorough comprehension of the choice setting. In this study, Cape Receife Point serves as a natural boundary between beaches in and outside of Algoa Bay (see Figure 2 above). An uncomplicated nesting structure for beach-choice decisions can be applied if this natural boundary is used (Parsons *et al.*, 1999; Haab & McConnell, 2003). Individuals choose between visiting a beach in or outside Algoa Bay (at the upper nest level), and conditional on this choice, they choose the actual beach to visit (at the lower nest level).

The signs and significance of the NL model coefficients, without exception, correspond to those of the CL model. All coefficients are statistically significant at the 5% level with the exception of beach width. All coefficient signs conform to *a priori* expectations. The estimate of the travel cost (price) coefficient is negative and statistically significant. An increase in travel costs to a beach reduces the probability of choosing that beach. This result is very encouraging since the travel cost coefficient is important for marginal value estimation. Other variables increasing the probability of a visit include: the length of the beach, the presence of a promenade, the presence of a playground, Blue Flag status, and a nature reserve. Longer beaches have increased space for use and may be more aesthetically pleasing than short beaches, but wide beaches have lower probabilities of visitation, perhaps due to water access being made more difficult by the width of the beach (Parsons *et al.*, 1999). The presence of "side attractions", like a promenade and children's playground at a beach, are major drawcards for visitors (Parsons *et al.*, 1999). Findings from international studies of the influence of beach awards on beach visitation are similar – the Blue Flag status of a beach increases the probability of a trip. As with the Parsons *et al.* (1999) study, the nature reserve variable was included to "pick up beaches having a more natural character". Beaches with a view of industry reduce the probability of a visit because industry is aesthetically a less pleasing environment.

To test whether the CL should be rejected in favour of the two-level nesting structure of the NL model, the IV parameter for the Inbay nest was normalised to one for the estimation of the NL model (see Table 7). The Wald-test was then applied to statistically test whether the IV parameter of the Outbay nest was different to one (Louviere *et al.*, 2000). If the Outbay parameter is statistically equal to one then the two nests should collapse into a single nest, which is equivalent to the CL model. The Wald-test can be expressed as follows:

$$Wald - test = (IV_{parameter} - 1)/stderror \tag{7}$$

Estimating Equation 7, using the data from Table 7, produced a test-statistic of -2.75 [(.89770690 - 1)/.03715029]. Comparing the test-statistic of -2.75 to the critical value of +/- 1.96 (at an alpha equal to 0.05) shows that there is more than a 95% probability that the Outbay parameter is not equal to one, and it was deduced that the use of the two-level nesting structure of the NL model was warranted[7].

6.3 *Implicit prices*

The implicit prices for all significant beach attributes, estimated using both the CL and NL model results, are shown in Table 8. It is important to note that the discussion of implicit prices entails mostly the interpretation of attributes represented by dummy variables. Each attribute coefficient was divided by the travel cost (price) coefficient to calculate its implicit price (Parsons *et al.*, 1999; Haab and McConnell, 2003). The estimation of implicit prices is important since these prices reveal the rate at which individuals are willing to trade off attributes for each other. From these estimates, the composition of potential resource allocation options can be analysed. The relative importance people attach to individual attributes can be deduced from the implicit prices. This information affords policy makers and other stakeholders an opportunity to improve recreation opportunities in the future. In order to effect such improvements, an increase in the levels of attributes with higher implicit prices should be affected. For example, if the research reveals that the presence of a children's playground at a beach is valued less than the presence of a promenade, investment in promenades should be favoured over playgrounds, all other things being equal.

The signs and magnitudes of the implicit prices for the CL and NL models broadly correspond in Table 8. The implicit price of the Blue Flag status variable is the highest out of all the positive prices for the NL and CL models. This establishes its importance in terms of beach visitation decisions. The relatively high implicit price for the playground attribute emphasises how important access to children's activities is to overall beach recreation. Consistent with this finding was that the view-of-industry variable has the highest price out of all the negative prices shown in Table 8 (in both models). A view of industry from a beach has a major negative impact on the attractiveness of the beach for recreation. There are no other South African studies which have calculated implicit prices for beach attributes, so no comparative analysis was possible.

7 Some Welfare Implications – the cost of closing a beach

There are a large number of interesting implications of these findings. This paper addresses one of these – the cost of losing access to beaches with Blue Flag status. The results from both the CL and NL models[8] may be used to measure the value of a loss of access to four Blue Flag beaches in the Nelson Mandela Bay area. In the CL model, the WTP to avoid the loss of a beach option to visit (for example, beach 1) can be estimated as follows:

$$WTP_{11} = ln(1 - Pr(1))/\beta_{tc} \tag{8}$$

where: β_{tc} = the travel cost coefficient. Pr(1) = the proportion of visits to beach 1 (Haab and McConnell, 2003).

In the case of the NL model, if one assumes that the first site in the first nest (1, 1) is closed, the WTP for avoiding the loss of this option is:

$$WTP_{11} = ln[(1 - Pr(1|1))^{\theta} Pr(1) + (1 - Pr(1))].1/\beta_{tc} \tag{9}$$

where: θ = the inclusive value parameter for nest 1. Pr(1|1) = the conditional proportion of visits to beach 1 in nest 1 (Haab and McConnell, 2003).

[7] Other nested models that aimed at accommodating heteroskedasticity influences were also estimated, but yielded little additional insight .

[8] With the CL model, WTP is calculated by incorporating the proportion of visits to all beaches. With the NL model, on the other hand, WTP is calculated by incorporating the conditional proportion of trips taken to a beach in a particular nest. In this case, "conditional" refers to conditional on each trip being to a "In the bay" beach.

The overall proportions of visits for the four Blue Flag beaches were as follows: King's beach (KB) (Pr(KB) = 0.303), Humewood beach (HWB) (Pr(HWB) = 0.180), Hobie beach (HB) (Pr(HB) = 0.263) and Wells Estate beach (WE) (Pr(WE) = 0.02).

All four Blue Flag beaches are located in the Inbay nest, and the conditional proportion of trips taken (conditional on each trip being to an Inbay beach) is 0.34 for King's beach (Pr(KB|Inbay)), 0.20 for Humewood beach (Pr(HWB|Inbay)), 0.3 for Hobie beach (Pr(HB|Inbay)), and 0.03 for Wells Estate beach (Pr(WE|Inbay). Of the trips taken, 0.8997 (Pr|Inbay) were to beaches in the Bay. The WTP to avoid loss of access[9] to King's beach, Humewood beach, Hobie beach and Wells Estate beach were calculated from Equations 8 and 9. The results are shown in Table 9.

The WTP values for the CL and NL models are very similar (Table 9). When these WTP values are multiplied by the mean number of beach trips undertaken by a beachgoer per annum, the (average) WTP value per beachgoer per annum is calculated. The average beachgoer to King's beach, Humewood beach, Hobie beach and Wells Estate beach, respectively, reported undertaking 13.78, 8.2, 12 and 0.97 trips per annum. It followed that the annual WTP value per beachgoer to avoid losing access to King's beach, Humewood beach, Hobie beach and Wells Estate beach, respectively were R616.38, R201.80, R454.20, and R2.60.

From these annual values per beachgoer, and the total annual numbers of beachgoers, a total value was estimated of losing access to all four of Port Elizabeth's qualifying Blue Flag status at beaches. The total annual number of beachgoers estimated to have visited King's beach, Humewood beach, Hobie beach and Wells Estate beach, respectively in 2009 were 53 602, 25 602, 37 324 and 40 882 (Cain, 2010). The total recreational value of Blue Flag loss for King's beach, Humewood beach, Hobie beach and Wells Estate beach, respectively were calculated to be R33 039 201, R5 166 484, R16 952 561, and R106 293; a grand total of R55 264 539.

This total is less than the R100 million per annum estimated cost of losing access to four Durban Blue Flag status beaches in 2008 due to poor water quality (McKenna *et al.*, 2010) but more than the R17 and R25 million per annum cost due to loss of access to the Blue Flag status for Margate Beach in KwaZulu-Natal.

A number of international studies have also addressed the impact of beach closures. Parsons *et al.* (1999) applied the RUM of site choice and estimated the value of lost beach access ranged from \$0 to \$16.85 per individual per trip for six sites in the Mid-Atlantic region of the U.S.A. McConnell and Tseng (2000) applied the RUM and estimated the value of lost beach access to range from \$1.94 to \$3.55 per person per trip. Bin *et al.* (2005) applied a single-site TCM to calculate consumer surplus estimates for North Carolina beaches. They found that consumer surplus ranged from \$11 to \$80 per person per trip, depending on the beaches visited. Our estimates[10] are of the same order of magnitude as the results from the McConnell and Tseng (2000) study, but lower than those estimated for beach closure in the Mid-Atlantic area of the U.S.A. (Parsons *et al.*, 1999), and substantially lower than the results obtained for North Carolina beaches (Bin *et al.*, 2005).

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[9] $\text{WTP}_{KB} = \ln[(1 - \Pr(\text{KB}|\text{Inbay}))^{\theta}\ \Pr(\text{Inbay}) + (1 - \Pr(\text{Inbay}))]\ .\ 1/\beta_y$
$= \ln[(1 - 0.337)^{1}\ .(0.8997) + (1 - 0.8997)]\ .\ 1/0.00808$
= -R44.73
and
$\text{WTP}_{HWB} = \ln[(1 - \Pr(\text{HWB}|\text{Inbay}))^{\theta}\ \Pr(\text{Inbay}) + (1 - \Pr(\text{Inbay}))]\ .\ 1/\beta_y$
$= \ln[(1 - 0.2004)^{1}\ .(0.8997) + (1 - 0.8997)]\ .\ 1/0.00808$
= -R24.61
and
$\text{WTP}_{HB} = \ln[(1 - \Pr(\text{HB}|\text{Inbay}))^{\theta}\ \Pr(\text{Inbay}) + (1 - \Pr(\text{Inbay}))]\ .\ 1/\beta_y$
$= \ln[(1 - 0.2986)^{1}\ .(0.8997) + (1 - 0.8997)]\ .\ 1/0.00808$
= -R37.85
and
$\text{WTP}_{WE} = \ln[(1 - \Pr(\text{WE}|\text{Inbay}))^{\theta}\ \Pr(\text{Inbay}) + (1 - \Pr(\text{Inbay}))]\ .\ 1/\beta_y$
$= \ln[(1 - 0.0279)^{1}\ .(0.8997) + (1 - 0.8997)]\ .\ 1/0.00808$
= -R2.68

[10] At an exchange rate of R7.30/\$.

The RUM used in this paper has the benefit of estimating the welfare loss due to beach closure based on actual behaviour, but it only provides a part measure of the total benefits from beaches. Non-use values, such as existence and bequest values are not reflected in the benefit measures estimated here.

8 Conclusion

That South African beaches are a vital element in generating recreational value is already well known, but what is not well known is the relative worth of the attributes of these beaches. This paper estimates this worth for selected beaches in the Nelson Mandela Bay area. A random utility model of beach choice was used. A very important finding is that the most valued attribute was Blue Flag status – so that qualifying for Blue Flag status is value enhancing or recognising. It was also found that proximity to industry is value reducing. The following attributes also increase the probability of beach selection: length, promenade, playground, and the presence of a nature reserve.

It is clear that there is a diverse set of features that attract households to beaches – not only are the presence of promenades and playgrounds attractive (perhaps mainly for the younger elements) but also the length of beach and presence of a nature reserve. The latter finding is consistent with one of negative perceptions toward the presence of industry – beaches are most attractive for recreation in natural settings. This appeal is enhanced with longer beaches, but not with wider beaches (perhaps because this increases the distance from the sea). Wide beaches have lower probabilities of visitation than narrow ones, but the width of the beach was found to be an insignificant beach visitation attribute.

Applying a nested logit model showed that the values of lost access to King's beach, Humewood beach, Hobie beach and Wells Estate beach, respectively were R44.73, R24.61, R37.85 and R2.68 per person, per trip, and serves as a basis for determining the loss to Port Elizabeth of closure to its four Blue Flag status qualifying beaches. This loss was estimated at about R55 million per annum.

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Table 1: Definition and description of the variables[1]

Variable name	Operational definition	Expected sign
Travel cost	Distance cost plus time cost (Rands)	-
Length	Length of beach in kilometers	+
Wide[1]	Wide beach (=1 if width > 150 meters; 0 otherwise)	-
Narrow	Narrow beach(=1 if width < 120 meters; 0 otherwise)	+
Prom	Promenade present =1; 0 otherwise	+
Play	Playground near beach =1; 0 otherwise	+
Reserve	Beach located in nature reserve =1; 0 otherwise	+
Indus	View of industry from beach =1; 0 otherwise	-
Blue flag	Beach has Blue Flag status =1; 0 otherwise	+

Note: Two attributes, namely parking and restrooms, were included in the Parsons *et al*. (1999) study, but were left out of this one because all the beaches provide these facilities. These two variables would enter the indirect utility function as invariants. With multinomial-type models, invariants drop out during estimation.

Table 2: Number of day trips per annum, by beach (n = 221)

No of visits per annum	Kings	Hobie	Humewood	Pollok	Brighton	Wells Estate	Bluewater	Sardinia	Beachview	Van Stadens
0	38	51	93	152	200	179	172	167	184	175
1-5	93	92	70	37	12	32	37	43	30	36
6-10	24	23	18	10	4	3	5	6	4	5
11-20	28	21	14	10	1	5	3	0	0	3
21-30	11	12	8	5	4	2	2	2	1	1
31-50	13	9	9	2	0	0	2	0	2	0
>50	14	13	9	5	0	0	0	3	0	1

Table 3: A comparison of the Splash Festival population and sample statistics

Characteristic	Population[1]		Sample	
Race	African	37.92%	African	40%
	Asian	7.10%	Asian	7%
	Coloured	21.60%	Coloured	21%
	White	32.20%	White	32%
Gender	Male	52.72%	Male	56%
	Female	47.28%	Female	44%
Average age	31 years		39 years	

Note: About 1.18% gave their race as "other".
Source: Frontier Events (2010)

[1] The expected negative sign for the Wide parameter estimate is due to ease of access

Table 4: Descriptive statistics for independent quantitative variables (n = 221)

Variable name	Mean	Std. dev.
Travel Cost (Rand)	229.16	169.33
Length (km)	5.78	7.79

Table 5: Descriptive statistics for the independent variable, Travel Cost (n = 221)

	Mean	Median	Min	Max	Std Dev
Distance Roundtrip (km)	40.93	35.4	0	123.2	24.16
Distance Cost (per km)	5.19	5.73	0.04	9.55	1.96
Total Distance Cost (Rand)	210.51	179.89	0	924.44	155.06
Travel Time Roundtrip (hrs)	0.82	0.8	0	1.83	0.39
Wage Rate (Rand per hr)	77.77	62.5	0	500	84.49
Total Time Cost (Rand)*	19.19	10.63	0	265	26.43
Total Travel Cost (Rand)	229.7	194.09	0	1032.44	169.33

Note: Distance cost per kilometer was based on values provided by the Automobile Association of South Africa (AA). The average distance cost per kilometer corresponds to a motor vehicle with, on average, a 1600 cc engine capacity. * Proportion of total = 1/3

Table 6: Frequency of characteristics per beach (n = 221)

	Number of Beaches	Beach
Wide	3	Beachview, Kings, Van Stadens
Narrow	3	Brighton, Hobie, Pollok
Promenade	5	Brighton, Hobie, Humewood, Kings, Wells Estate
Playground	4	Brighton, Kings, Wells Estate, Van Stadens
Reserve	1	Sardinia
Industry	2	Brighton, Wells Estate
Blue Flag Status	4	Hobie, Humewood, Kings, Wells Estate

Table 7: Parameter estimates of CL and NL models

Dependent variable = Number of day trips per person				
Variable	Conditional logit		Nested logit	
	Coefficient	Standard Error	Coefficient	Standard Error
Travel cost	-.00797402*	.00023362	-.00808092*	.00023735
Length	.01887663*	.00508387	.01604616*	.00546594
Wide	-.12254798[a]	.10578072	-.13236304[a]	.10608406
Narrow	.50521257*	.02830993	.50033620*	.02853652
Prom	.26676653**	.11510811	.24228836**	.11599671
Play	.62653502*	.09969562	.63612568*	.09998038
Reserve	.42562589*	.05760256	.32189457*	.07841725
Indust	-2.3074949*	.13624336	-2.29617524*	.13685691
Blue flag	.98837950*	.10544912	1.00164804*	.10563580
IV Parameters				
Inbay (θ_1)			1.00000000	-
Outbay (θ_2)			.89770690	.03715029
N	221			
Log-likelihood	-17616.28		-17612.59	

Note: * Coefficients significant at 99% level of confidence.
** Coefficient significant at 95% level of confidence.
[a] Coefficient insignificant.

Table 8: Implicit prices

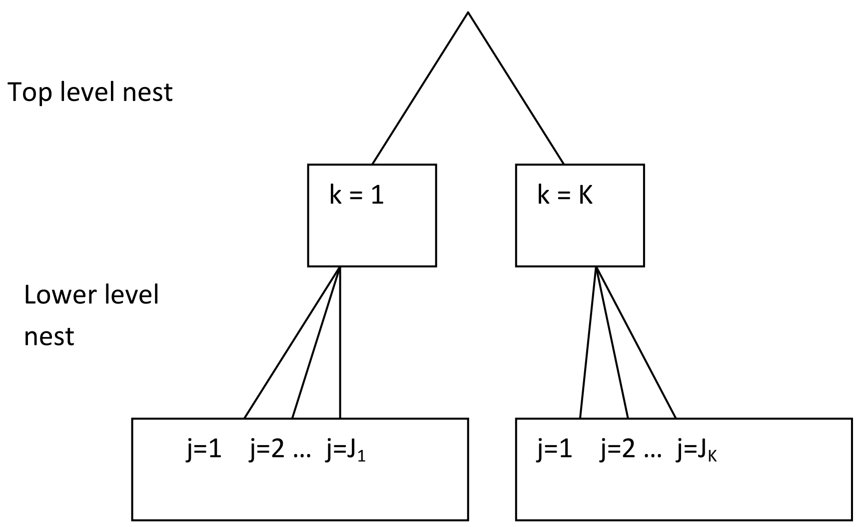
Attribute	Implicit price (Rand)	
	Conditional logit	Nested logit
Travel cost	1.0	1.0
Length	2.37	19.86
Narrow	63.36	61.92
Prom	33.45	29.98
Play	78.57	78.72
Reserve	53.38	39.83
Indust	-289.38	-284.15
Blue flag	123.95	123.95

Note: The implicit price for the width attribute was omitted due to coefficient insignificance

Table 9: The WTP to avoid the loss of Blue Flag beach access

Blue Flag beach	WTP	
	Conditional logit	Nested logit
King's beach	+R45.33	+R44.73
Humewood beach	+R24.94	+R24.61
Hobie beach	+R38.35	+R37.85
Wells Estate beach	+R2.71	+R2.68

Figure 1: Nested logit tree structure



Source: Adapted from Haab & McConnell (2003)

Figure 2: The geographical location of beaches