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**Nature-based tourism in the Agulhas Plain:
A vehicle for integrated biodiversity
conservation and sustainable economic
development**

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Abstract

With scarce funding and resources being prioritised to meet human development needs in South Africa, it is critical that biodiversity conservation benefits be packaged in a way that emphasises their economic contribution to such developmental goals. The Cape Action Plan for the Environment (CAPE) does this by positioning sustainable nature-based tourism as the conduit between the local community and the biodiversity that surrounds it. In this way, nature-based tourism acts both as a framework for the protection of the biodiversity upon which it depends and as a driver of economic development in the local community. It is in this context of biodiversity conservation and particularly since CAPE has pronounced the Agulhas Plain as a terrestrial pilot region within the Cape Floristic Region, that it is so important to attempt to put a value on tourism in the region. With these objectives in mind, this study has found that tourism in the Agulhas Plain could reap between R64 to R123 million per annum (or R418 - R803 per hectare), at current levels of protection and conservation. This value sits very well in the current South African literature, specifically with valuations for the Cape Floristic Region and Kruger National Park.

“By the year 2020, the natural environment and biodiversity of the Cape Floral Kingdom will be effectively conserved, restored wherever appropriate, and will deliver significant benefits to the people of the region in a way that is embraced by local communities, endorsed by government and recognised internationally.”¹

¹ Younge and Fowkes, 2003: 23.

1. Introduction

This paper investigates the role that nature-based tourism has to play as a vehicle for biodiversity conservation in the Agulhas Plain, which is part of the Cape Floristic Region (CFR) in South Africa. It has long been recognised that biodiversity conservation differs from traditional development undertakings in some key respects. These are namely the time, spatial and generational differentials between the costs - which are usually short-term, local and borne by the current generation - and the benefits - which are usually longer-term, more global in nature and enjoyed by future generations. Such disparities generally make it more difficult to raise funds specifically for the conservation of biodiversity (Lochner, 2003).

In the South African context, such challenges are further exacerbated by the sheer magnitude and depth of the human developmental issues faced by the nation. With a significant proportion of its population facing the harsh daily realities of severe unemployment, food shortages and a lack of proper housing and energy provision, the government finds it must prioritise its human development agenda over other objectives (Younge & Fowkes, 2003). With scarce funding and resources being prioritised to meet human development needs, it is critical that biodiversity conservation benefits be packaged in a way that emphasises their *economic* contribution to such developmental goals (Lochner, 2003).

The Cape Action Plan for the Environment (CAPE) was a multi-stakeholder conservation planning programme that ran between 1998 and 2000, co-ordinated by the World Wide Fund for Nature South Africa and funded by the Global Environment Facility. CAPE was initiated to identify conservation objectives for the CFR, to produce a long-term conservation strategy and a five-year action and investment plan for conservation in the region (Younge & Fowkes, 2003). Lochner (2003) identified a fundamental underpinning of CAPE would be in the recognition that “global-local integration” would be crucial in making this conservation strategy sustainable in the long run. Such integration would ensure success by fusing a strong bottom-up local participation and buy-in together with a visionary top-down global sponsorship.

Amongst its many strategic areas of concern, CAPE aims to turn the threat to conservation from international tourism-fuelled development, particularly in the coastal areas of the CFR, into a local opportunity (Lochner, 2003). It does this by positioning sustainable nature-based tourism as the conduit between the local community and the biodiversity that surrounds it. In this way, the nature-based tourism industry acts both as a framework for the protection of the very

biodiversity upon which it depends and as an economic driver of development and upliftment in the local community through job creation (Gelderblom, 2003; Younge & Fowkes, 2003).

Figure 1 aims to give a graphical depiction of this idea of linkage giving rise to an integrated and sustainable framework for both development and biodiversity conservation. In this framework, nature-based tourism offers a path to employment and economic development to the local community. Thus the community is much more inclined to respect, conserve and protect the natural environment around it, now that it depends on it economically.

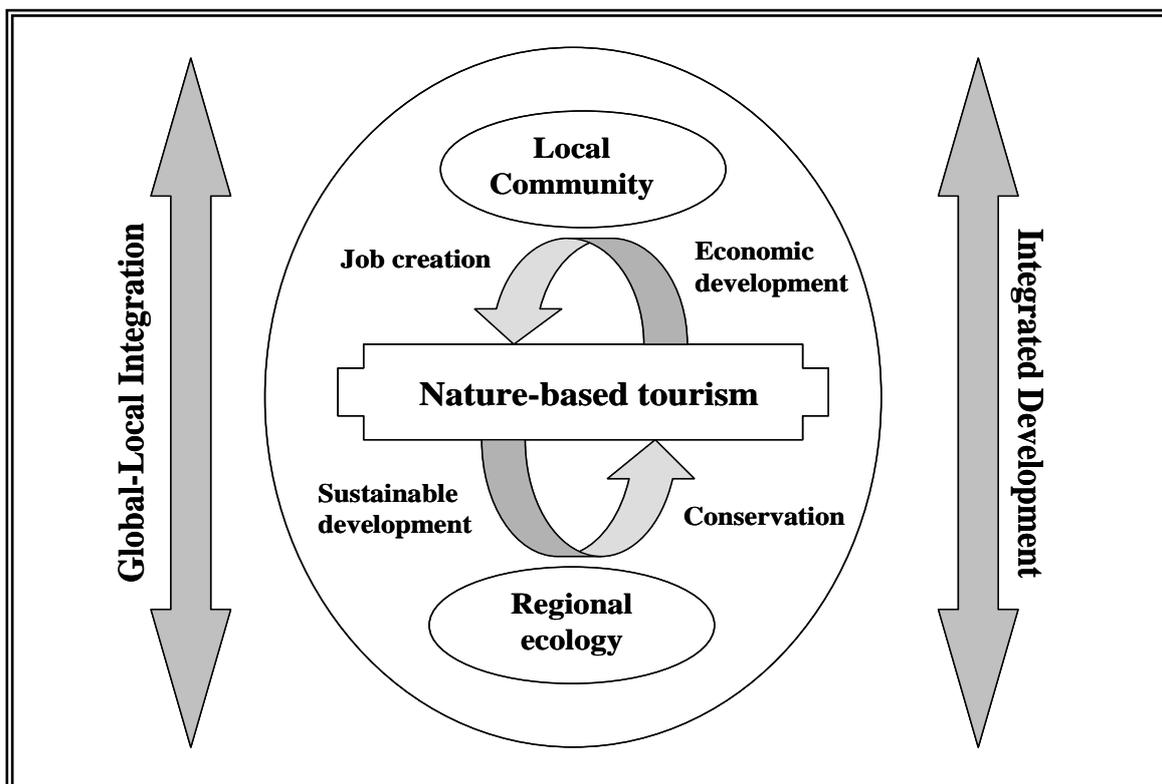


Figure 1: Integrated and sustainable development and biodiversity conservation through nature-based tourism

“By 2020, the tourism industry is contributing significantly to the sustainability of the natural resources of the Cape Floral Kingdom. Nature-based tourism is attracting visitors to the region, and in turn is providing sustainable benefits to communities, increased incentives for on-going conservation, a contribution to the costs of managing the natural resource base of the industry, a stimulus to the regional economy and a world-class experience for tourists.”²

² Younge and Fowkes, 2003: 25.

“At least 70% of its 9,000 plant species are found nowhere else on Earth” (Younge & Fowkes, 2003), therefore, it is no wonder that the CFR is considered one of the world’s unique biodiversity treasures (Cowling & Richardson, 1995). It is one of only six floral kingdoms on the planet, covering 9 million hectares and straddling three provinces in South Africa, primarily the Western Cape with some of it reaching into the Eastern Cape and the Northern Cape (see Figure 2). However, its ecosystems face the threat of degradation and exploitation in the name of development and through expanding agriculture. A mere 5% of the vulnerable lowlands are currently protected under any formal conservation status (Younge & Fowkes, 2003).

The CAPE programme recognises the need to focus on nature-based tourism in the CFR and in doing so it recommends terrestrial biodiversity pilot projects “to exploit opportunities in less transformed but highly threatened landscapes, such as the Agulhas Plain, in order to establish protected area systems that will achieve conservation targets before these are compromised by on-going development” (Younge & Fowkes, 2003).

The Agulhas Plain is a little biodiversity gem within the CFR, spanning just 153,000 of its 9 million hectares and forming the southern-most region of the African continent (see Figure 2). It is home to around 2,000 species of indigenous plants, around 100 of which are endemic to the region, 230 species of birds including South Africa’s national bird, the Blue Crane, as well as the Agulhas Long-billed Lark and Orange-breasted Sunbird which are also endemic to the Plain, and around 65 species of mammal and a thriving marine world off its shores.³ Of the 36 types of vegetation that can be found at fine-scale in the Plain, the predominant types are fynbos such as Mountain fynbos and Dune asteraceous fynbos (Rouget, 2003).

For the purpose of this study, the Agulhas Plain has been demarcated as the geographical area ‘below’ the N2, with Gansbaai as the furthest town in the west and Infanta in the east (see Figure 3). It includes the main towns of Stanford, Napier, Bredasdorp, Elim, L’Agulhas, Struisbaai and Arniston, and areas of touristic interest such as the Lighthouse (declared a National Heritage site in 1973)⁴ which is at the southern-most tip of the African continent; De Hoop and De Mond nature reserves and the Agulhas National Park. The multitude of nature-based attractions available to tourists in the area includes land-based whale watching when in season and shark-cage diving for the adrenalin seekers.

³ Agulhas Plain facts and figures kindly provided by the L’Agulhas Tourism Bureau

⁴ Ibid.



Figure 2: The Cape Floristic Region (striped area) contains the Agulhas Plain (black area).

Source: maps from Pence et al (2003) and Turpie (2003) and customised by author.

It is in this context of biodiversity conservation and particularly since CAPE has pronounced the Agulhas Plain as a terrestrial pilot region within the CFR, that it is so important to attempt to put a value on tourism in the Agulhas Plain. Therefore, to position this study within the context of other tourism valuations undertaken in South Africa, the value of nature-based tourism in the CFR (Turpie, 2003) and of tourism in the Kruger National Park (KNP) (Turpie & Joubert, 2001) have been examined as a starting point. A rough calculation was performed scaling down the tourism values of each by the same proportion one would scale down their size in hectares to match the 153,000 hectares of the Agulhas Plain, to determine a *starting approximation* for the value of tourism in the Agulhas Plain.

It is important to note that this paper attempts to put a value on *tourism*, not specifically *nature-based* tourism, in the region. However, some conclusions can be drawn from the data collected on the nature-based preferences of tourists visiting the Agulhas Plain. Whilst causality cannot be inferred, it is safe to assume that if nature-based recreation features highly in the preference rankings of tourists to the Agulhas Plain, that there may be scope for making a general connection between these nature-based preferences and the value of tourism estimated in this study.

Turpie (2003) estimates that nature-based tourism in the CFR, which spans 9 million hectares, is worth R7.4 billion using a combination of travel cost, contingent and conjoint methods; which when used together estimate use *and* non-use values.⁵ In her KNP study (2001), she also estimates that there is around R1 billion of tourism worth in the KNP, which spans 2 million hectares. These figures imply that the potential of tourism in the Agulhas Plain should be expected to be in the region of between R77 and 126 million.⁶

With the wider context now set and the initial approximation above in mind, this paper will now estimate the value of tourism in the Agulhas Plain more rigorously using the Travel Cost methodology. The next section describes this methodological approach and highlights the considerable literature on the subject along with the limitations of the approach. In section 3, the survey approach and data collection and analysis stages of the study are outlined, as well as descriptive analysis of the visitors sampled to begin to build a picture of the tourism demand in the region. In section 4, the variable construction phase is outlined and the key assumptions underlying data construction and manipulation are stated. Section 5 deals with the matter of functional form selection and the model building process that follows, whilst section 6 outlines how the demand function is then derived and the consumer surplus calculations obtained. In section 7, a thorough examination of consumer surplus values is undertaken. Finally, section 8 discusses the implications of such findings and offers conclusions.

⁵ Essentially, the total value of a recreational service or site can be split into its use and non-use values – the latter capturing the insurance premium people would be willing to pay in order to preserve the site or service for future use or future generations or as an expression of its inherent ‘existence’ value. For more see: Freeman, 1993; Garrod, 1999.

⁶ The CFR spans 9m hectares; it is 59 times bigger than Agulhas Plain. Tourism value in CFR is R7.4 billion, which when scaled down by 59 gives approximately R126 million. The same is done for KNP values (KNP size = 2m hectares and tourism value = R 1 billion), scaling down by 13 gives approximately R77 million. This is clearly not meant to be in any way a scientific approach, since hectare-size alone is not a factor in such valuations. However it does allow a starting point to be identified for tourism value in the Agulhas Plain, approximately ranging between R77-126million, which can now be confirmed or not by the rest of this paper.

2. Methodological approach undertaken

In the absence of well-defined economic markets, the valuation of environmental goods and services is conducted by means of non-market valuation techniques. These techniques fall roughly into two categories: revealed and stated preference methods. The travel cost method, which falls into the revealed preferences category, enables an estimate of the value tourists place on a recreational site to be calculated using their reported expenditure of time and money spent visiting the site. Travel and time expenditure are used in lieu of price since generally such sites are public areas with no entrance charge, or one so small that it is considered negligible as a measure of the site's real value. In this study, the valuation of an entire geographical area that has recreational appeal, the Agulhas Plain, is undertaken using the travel cost approach. Only the actual use value is determined using this approach, revealed preference methods say nothing about the non-use or option values of a region or site (Freeman, 1993; Garrod, 1999; Ward & Beal, 2000).

The underlying ideas of the travel cost approach were first conceived by Harold Hotelling (1949) in his letter dated 1947 on the evaluation of recreation in National Parks in the United States of America. The approach was further developed initially by Clawson (1959), then refined into the now recognised 'travel cost' approach by Clawson and Knetsch (1966) and still further by Cesario and Knetsch (1970, 1976) as they worked together on further refinements of the process, particularly in the area of estimation bias. The fundamental economic theory on which the travel cost method is built is that as price (as expressed by travel and time costs involved in reaching a recreational site) increases, quantity demanded (number of visits in a specific timeframe, say a year) decreases. Thus, those who live nearer to the site will visit more regularly in a given timeframe, whilst those living farther away will visit less. This gives the expected reciprocal relationship between price and quantity, and thus generates the familiar downward sloping demand curve for tourist recreation. From the area below this derived demand curve, consumer surplus is estimated, which infers the recreational value tourists place on the site in excess of their actual expenditure (Freeman, 1993; Garrod, 1999; Ward & Beal, 2000; Markandya, 2002).

There are two estimation frameworks in the travel cost approach: individual and zonal travel cost methods. The individual travel cost method (ITCM) requires solicitation of individual visitor data by means of survey questionnaires. Specific information is gathered with respect to number of visits, purpose of visit, trip itinerary and duration, travel costs, on-site expenditure and socio-

economic or demographic information. The zonal travel cost method (ZTCM) is a more generic approach, which places less emphasis on obtaining individualised data. Visitors are analysed in terms of their city or country of origin, which are then categorised into zones of increasing distance from the site being studied and an aggregated visitation rate then calculated based on overall visitor numbers obtained from available data sources (Garrod, 1999; Markandya, 2002).

The clear differences in informational requirements that separate the ITCM and ZTCM approaches also differentiate them in terms of complexity of application and robustness of results generated. It is usually considered easier and less expensive to perform a zonal study. However if the complex data collection requirements of an ITCM can be planned for in advance, as was the case in this study, the more rigorous methodology of the two should be given serious consideration. Walsh et al (1989) found in their study that estimates generated with an ITCM could be anything in the region of 46% higher than their zonal counterparts.⁷ Whilst this does not imply that ITCM estimates are automatically more reliable, its design lends itself to greater data complexity and statistical rigour.

This paper therefore adopts the ITCM as the methodological approach for this study. As mentioned previously, there are critical areas of the travel cost approach that have received considerable attention in the literature regarding the accuracy of estimates generated. These are summarised as follows:

1. *Opportunity costs of time* – whilst it is relatively easy to gather data on money spent by visitors on means of transport, tickets and accommodation when on a visit to a region, the calculation of the opportunity cost of their *time* is much more challenging. This is considered an area prone to great inaccuracy and guesswork by many practitioners, as different approaches are taken to estimating the value of visitors' time (Cesario & Knetsch, 1970, 1976; Freeman, 1993; Common, 1997). There is little agreement in the literature at which rate an individual's time should be measured. If the wage rate were used, as some suggest, there is debate regarding the fraction that should be used to value recreational time, and in how to treat the time of visitors who are self-employed, retired or using annual leave from work. Therefore, an attempt to address the issue, in the light of such uncertainty in the literature, would detract from the rigour of this paper, and so following Bellù and Cistulli (1997), this paper opts to leave out opportunity costs of time in its analysis.

⁷ Comparing models with the same functional form.

2. *Treatment of substitutes* – as a fundamental determinant of demand, the inclusion of the price of substitute offerings is important when assessing the drivers of demand for a particular good or service. Thus, substitute sites or regions that the visitor considered visiting, other than their chosen destination, should be included in any travel cost analysis to avoid incorrect value estimates. However, as this is considered in the literature to be one of the more complex issues to resolve, it has not been attempted here since the solutions prove too technical for adoption in a study of this scope (Rosenthal, 1987; Common, 1997; Garrod, 1999).
3. *Multi-site and multi-purpose visits* – if an individual is undertaking a trip that takes in many different recreational sites, one of which being the site under analysis, then it is necessary to ensure that overall costs are proportioned properly to the site of interest. This is in order not to over-allocate costs to that site and thus overestimate its value to the visitor on that particular trip. The same applies to trips that have purposes other than recreational, for instance those which include a work element. In this case, costs must also be proportioned appropriately amongst all the various purposes so that the recreational value is not over-estimated. The issue of multi-site, or more appropriately in this case, multi-*destination* visits, has been taken into account in this study through survey design. An itinerary question asks respondents to list all the destinations on their trip. Thus travel costs can be proportioned appropriately depending on whether their trip to the Agulhas Plain formed part of a larger journey within South Africa or not. Whilst the concerns in the literature regarding multi-*purpose* visits are acknowledged (Common, 1997; Martínez-Espiñeira & Amoaka-Tuffour, 2009), the assumption has been made in this study that tourists were on purely recreational trips, due to the fact that the questionnaire was located at tourism offices (see section 3 for details regarding data collection).
4. *Functional form chosen* – this should be guided by both economic theory and econometric technique since different forms can produce very different estimates of consumer surplus (Ziemer 1980; Kling 1989; Garrod, 1999). There are specific estimation issues arising from functional form selection that should be considered, such as infinite visits as costs tend to zero and therefore infinite consumer surplus (log-log and linear-log forms) and negative visits predicted past a certain level of costs (linear and linear-log forms). This study has attempted to adhere conscientiously to as much guidance as possible from the literature on the topic of functional form selection, which will be treated later in section 5.

5. *Data truncation issues* – the on-site nature of the survey approach results in some part of the population never being sampled at all: those tourists who were not currently on a visit in the region but could have been surveyed at home using a postal or telephone survey. Therefore, the sample is zero-truncated. In this case, the sampling design leads to a non-random sample with endogenous sample selection and therefore there will be some bias in the ordinary least-squares (OLS) estimates. However, as there is some evidence to suggest the effects of truncation are not as influential on consumer surplus values as variable selection (Smith, 1988) and since advanced modelling techniques⁸ are out of the scope of this analysis (Garrod, 1999; Woolridge 2009), OLS estimation has been utilised despite these bias concerns.

The outline above, whilst quite comprehensive in its own right, only serves to uncover a very small proportion of the conceptual, analytical and informational issues in each area. This list is by no means exhaustive, however these have been identified as the most common areas of concern from the vast literature available on the travel cost method and its applications. Walsh et al (1989) find that studies, which do not include the opportunity cost of time, *underestimate* values by around 34%, whereas studies, which omit substitute prices, *overestimate* values by 30%. In this light, the omission of both from this study could well be seen as a means of avoiding unnecessary bias.

3. Data collection and analysis

A questionnaire was designed in order to collect the relevant information from visitors⁹ and it was located at four of the five Cape Agulhas tourism bureaux: L'Agulhas, Bredasdorp, Napier and Elim, as well as in two of the Overberg tourism bureaux: Gansbaai and Stanford. In addition, some restaurants, accommodations and activity businesses (such as the shark-cage diving centre) in the area were willing to participate and surveys were left with them for completion by visitors at those locations. The surveying of visitors began on Easter weekend 2010 (2nd April) and the data collection period was four weeks long. The tourist office staff was instructed to ask each person travelling on their own to complete a questionnaire, or that one survey should be completed per

⁸ Poisson (for discrete integer dependent variables), Tobit (for corner solution dependent variables) or MLE (maximum likelihood estimation).

⁹ See Appendix for the full version questionnaire used.

party of people travelling together, as long as they all belonged to the same household.

Due to the expensive and extensive manpower requirements of administering a questionnaire randomly across such a large geographical area, the resources available for this study did not permit the use of a more complex sampling design such as stratification or clustering, which should be considered in future studies of this nature. The tourist office allocation was non-exhaustive and as such resulted in a non-random sample, since only tourists who chose to visit an office were included (Rea & Parker, 2005; Nardi, 2006). Together with the data truncation issue discussed previously, these sample design issues means that bias in the OLS estimates cannot be avoided and so the results are not fully generalisable to the population (Woolridge, 2009). However, this does not mean that these findings for this sample of visitors will not play a crucial part in the first steps to valuing recreational benefit in the Agulhas Plain, within the wider context of integrated biodiversity conservation and sustainable development.

In total, there were 196 surveys completed by either individual travellers or parties travelling together. These represented a total of 411 adults and 106 children (defined as under 16 years of age). Of the adults, 370 were defined as economically active (this was determined through inspection of party composition). Only the economically active adults of a party were of interest in the sample as it was assumed they were bearing the total travel costs of their trip between them.

3.1. Visitor profile and preferences

The majority of visitors to the Agulhas Plain (61%) live in the Western Cape Province, the other significant number of visitors to the region come from overseas. The full breakdown can be seen in Figure 4 (on the next page). It seems that visitors are either South African residents living very locally who take advantage of the proximity, and therefore the lower travel and time costs, to visit the region, or international visitors. Of the latter, around half only put the Agulhas Plain on their itinerary once they are in the country and then only visit the region for a day to do shark-cage diving.

In many such studies conducted in South Africa, information regarding the race of respondents is collected in order to determine whether racial origin influences the behaviour or decisions of respondents. A race question was included on the survey, however analysis on racial lines is not possible or relevant in this study

since the overwhelming majority of visitors to the Agulhas Plain are white (83% of the sample), with a mere 4% of visitors being coloured, 1% of Indian origin and no black visitors captured in the sample at all. Although the absence of non-white visitors would seem to indicate that racial origin is a strong factor in the composition of visitors to the region, more than this cannot be inferred without further analysis with a more complex sampling design that attempts to capture non-visitation data.

The gender split in the sample was 53% females and 47% males and Figure 4 (on the next page) shows their age distribution. There seems to be a strong representation of all age groups, meaning the Agulhas Plain has something to offer both young and older visitors alike.

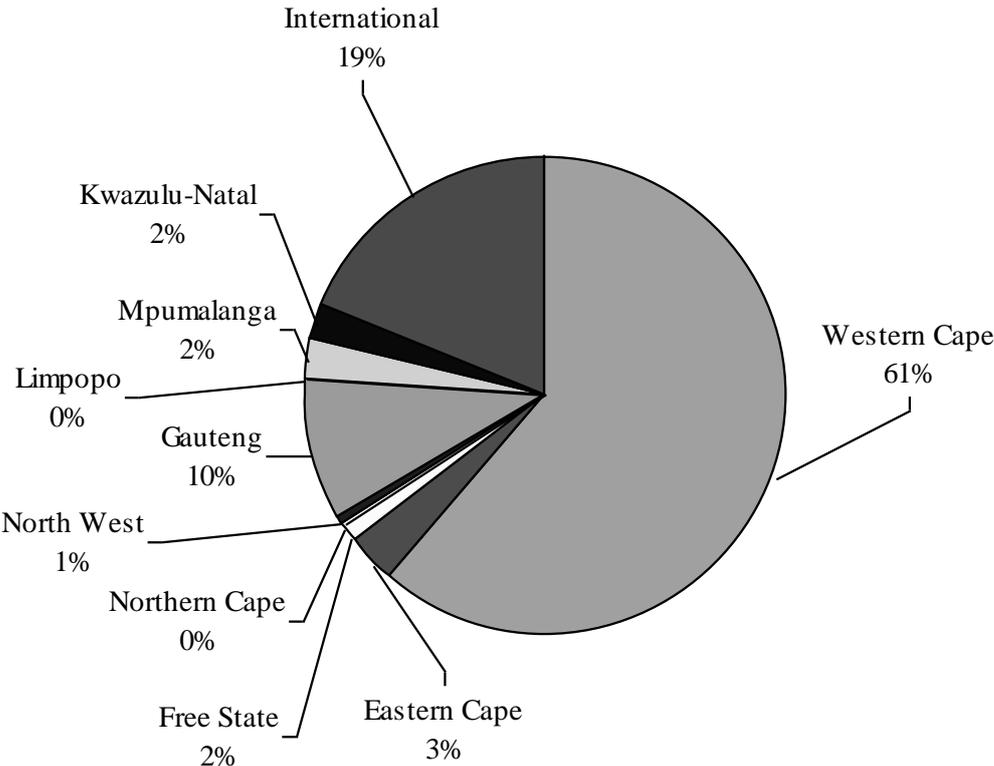
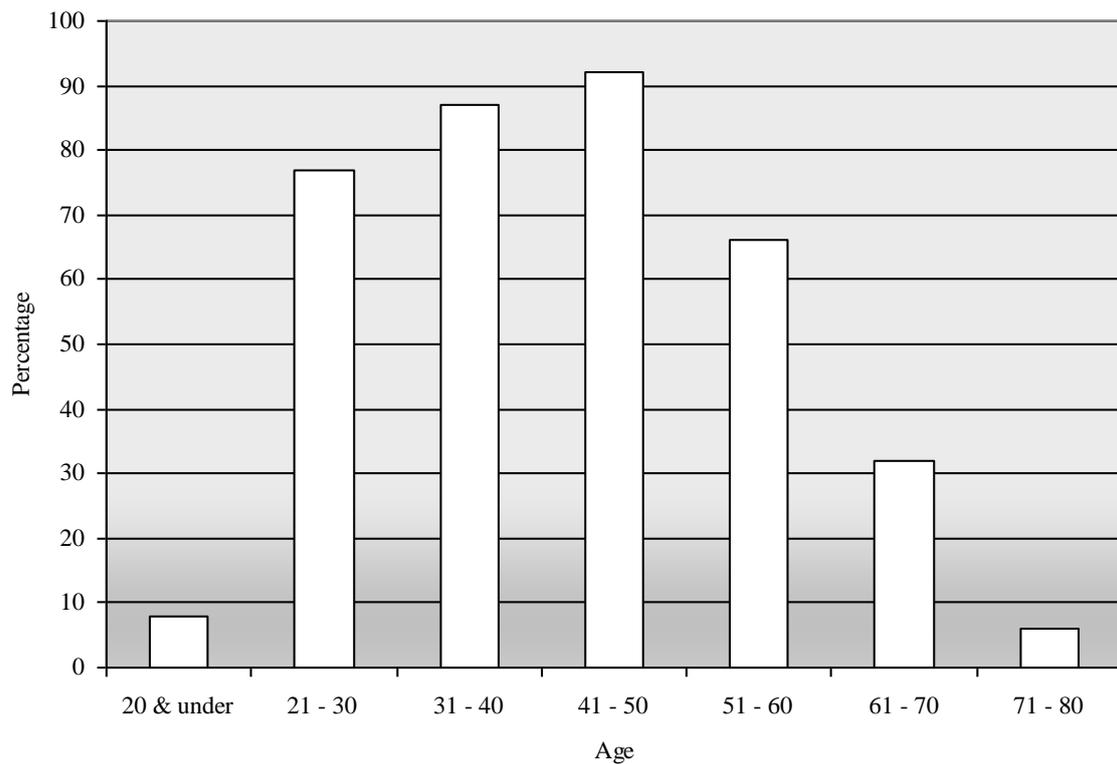


Figure 4: Breakdown of origin (above) and age distribution (on the next page) of visitors to the Agulhas Plain. (Sample size=370)



The average monthly after tax income was in the R20,000 - R24,999 bracket. Figure 5 (top chart) shows the income distribution for the sample, including the 16% of respondents which did not respond to the income question on the survey. This was considered a fairly good response rate to an income question of this type (Rea and Parker, 2005; Nardi, 2006). Figure 5 (bottom chart) also illustrates the highest level of education completed by respondents in the sample.

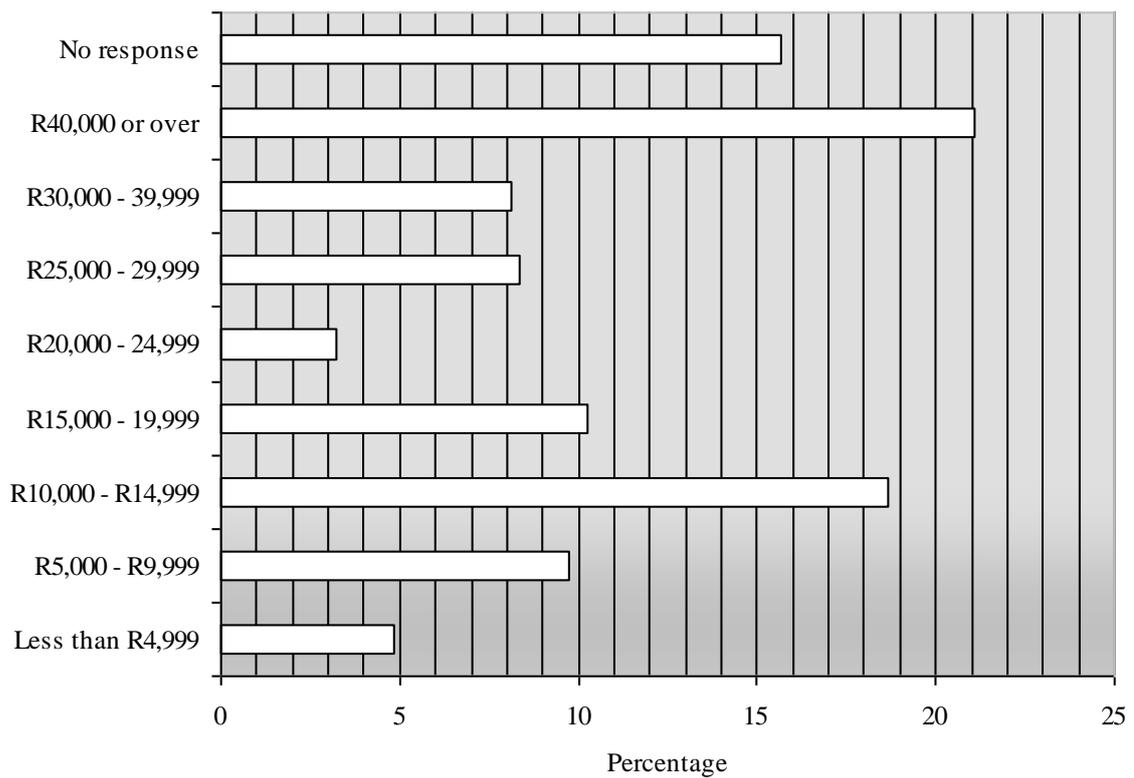


Figure 5: Breakdown of income distribution (above) and highest level of education attainment (below) of visitors to the Agulhas Plain. (Sample size = 370)

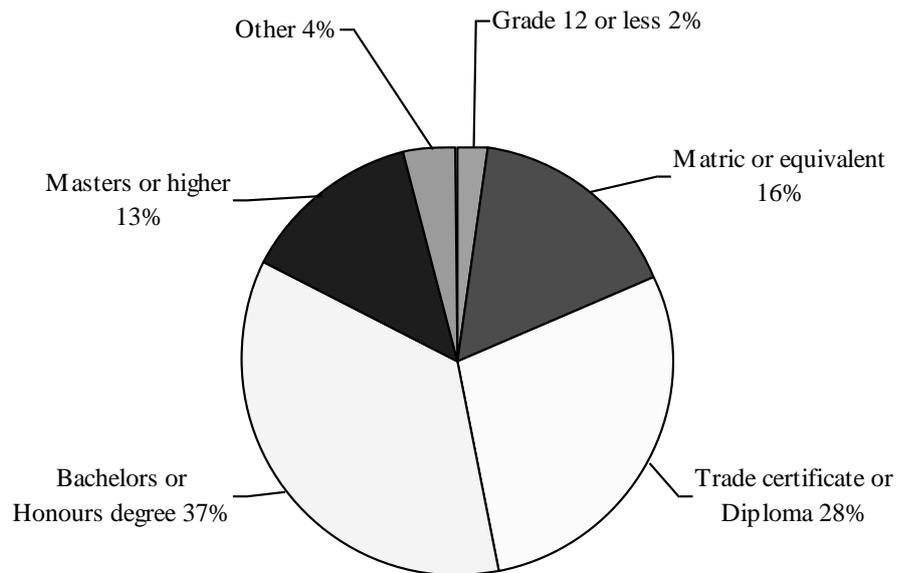


Figure 6 below (top chart) captures the *actual* visitor statistics for the calendar year July 2009 to June 2010. It shows the peak in tourist numbers in the high summer months of December and January, and the next two peaks in visitation, which occurred in March and April 2010. The breakdown of actual visitors in the Agulhas Plain in April 2010, the same month this survey was being administered, shows 7,400 visitors (International and South African) to the region. Therefore, the sample in this study represents 5% of the April 2010 actual visitor population. A breakdown of some of the locations these April tourists visited is also depicted in Figure 6 (on the next page).¹⁰

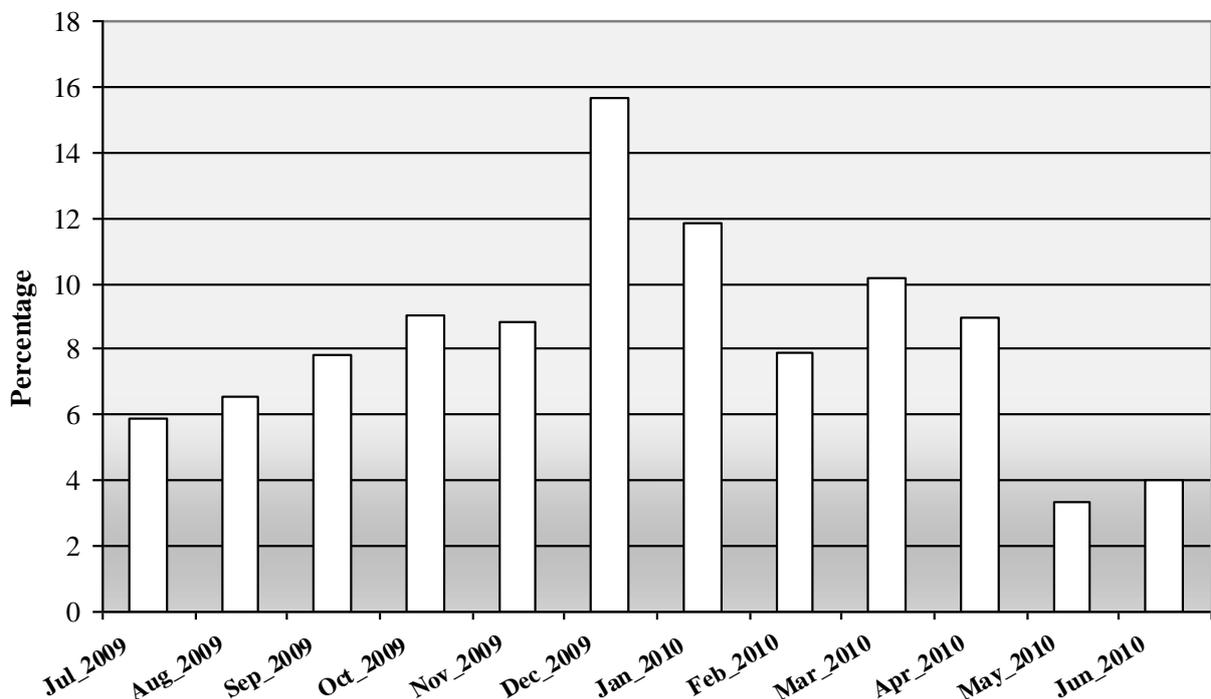
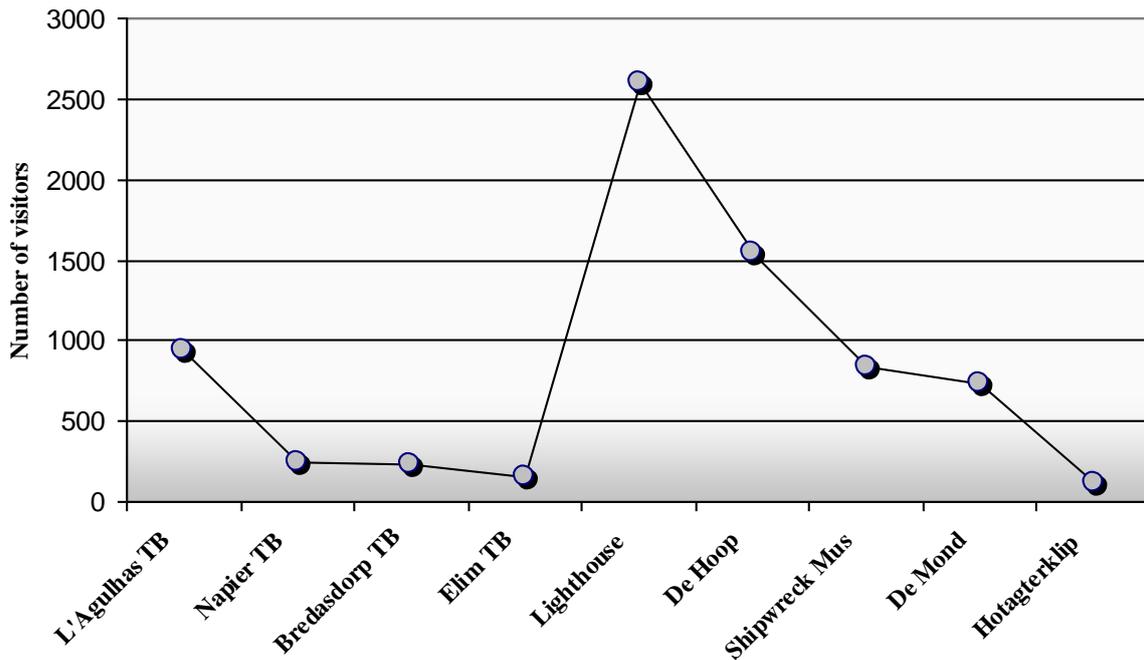


Figure 6: Visitors statistics for the year July 2009 – June 2010 (above) and Locations tourists visited in April 2010 (on the next page)

¹⁰ It was not possible, with the data provided by the Tourism Bureau, to provide further breakdown analysis on how International visitor numbers compare with that of South African visitors.



Of the 370 individuals travelling to the Agulhas Plain in the month of April who were surveyed and whose data were captured for this study, 36% were in the region for the first time ever. Of the 64% who had been to the Agulhas Plain before, they stated that they had made 934 separate visits to Agulhas in the past 12 months, giving an average of nearly 3 visits per visitor in the sample in the past year. A generous 79% of visitors said they were likely to return in the next 12 months. On average people were away from home for 14 days in total and in the Agulhas Plain region for 5 days. Of the 34% of respondents who were on a larger trip within South Africa, 60 visitors (48%) had not planned to visit the Agulhas Plain when they set off from home. These unplanned visitors were predominantly shark-cage divers who came to the region for a day trip to shark-cage dive in the Gansbaai/Hermanus area but they had only formulated this plan to do so on arrival in Cape Town (usually organised by their hotel). Thus 66% of visitors in the sample were not on a larger trip around South Africa, meaning that a grand total of 304 visitors of the 370 planned to come to Agulhas, whether they were on a larger trip or not (82% of the sample).

To the question on the survey regarding trip expenses, the 81% of the sample who responded, indicated that they had budgeted or spent an average of R6,700 on accommodation, food and activities on their trip and a further R799 on travel costs, whilst making their 537km round trip journey to get to the region. Visitors were asked to rank a series of factors based on how influential or not they were in their decision to visit the Agulhas Plain (see Figure 7).

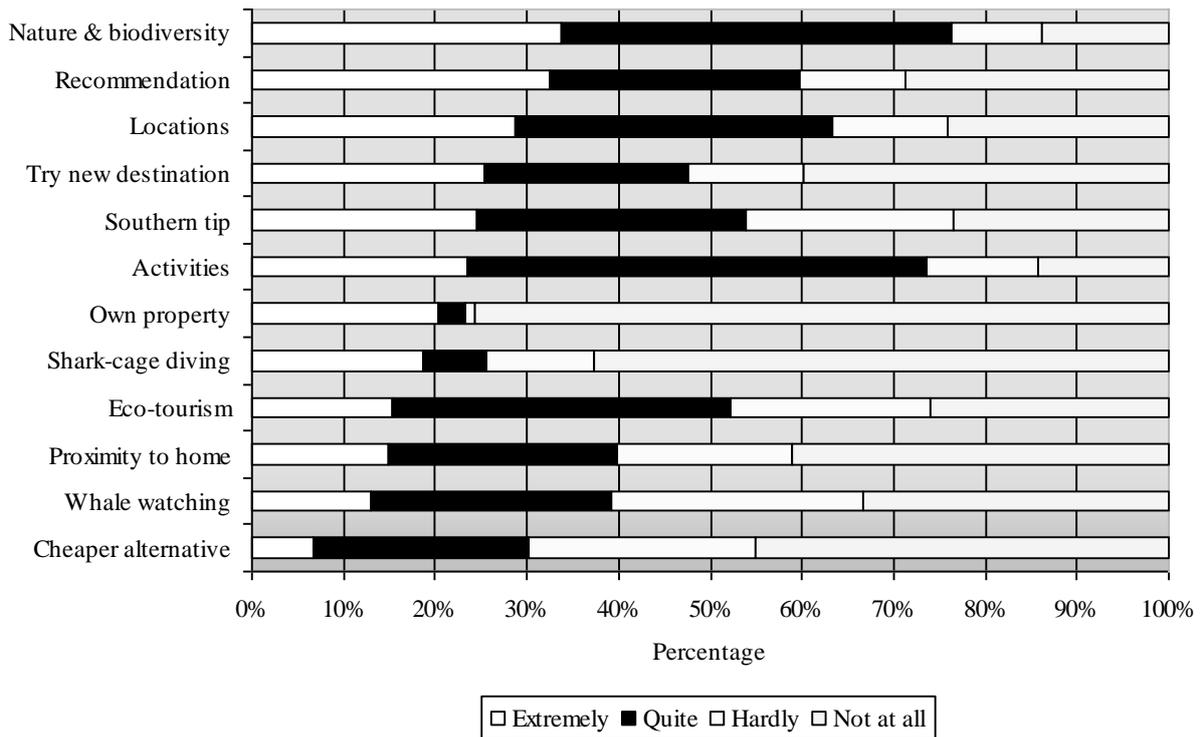


Figure 7: Breakdown of influential factors on decision to visit the Agulhas Plain. (Sample size = 370)

It is worthwhile noting that 34% of the sample stated nature and biodiversity were *extremely* influential in their decision to visit the Agulhas Plain, which ties in with the biodiversity hotspot status the region enjoys (Younge & Fowkes, 2003). ‘Recommendation by friends or relatives’ features as a strong second influential factor, followed closely by ‘locations’, ‘try new destination’ and ‘southern-most tip’. In addition, the survey was also designed to collect information on the activities and locations in the region that visitors had enjoyed. This data provides valuable insight into tourist preferences (nature-based or otherwise) and helps determine how unique the Agulhas Plain region is in meeting such preferences. Most activities, whilst not specific to the Agulhas region, do point towards nature-based enjoyment, such as hiking and fishing (see Table 1). Many locations in the region are unique and have a strong nature-based element, such as Agulhas National Park, De Hoop nature reserve and Hermanus/Gansbaai for whale watching and shark-cage diving (see Table 2). Such unique nature-based attractions are vital magnets for tourism in the region and this is confirmed by the data since so many are highly ranked by tourists in the sample. It is clear that tourism in the Agulhas Plain is strongly motivated by the desire of the tourist to pursue nature-based activities and visit areas of natural interest.

Table 1: Activity preferences of respondents ranked. (Sample size = 370)

Activity	% of sample	Rank
Sun, swimming & beach	68	1
Hiking	61	2
Experiencing nature & wildlife	48	3
Fishing	34	4
Cycling	20	5
Diving	14	6
Horse-riding	13	7
Sailing & motor boating	13	8
Canoeing	12	9
Quad biking	12	10

Table 2: Location preferences of respondents ranked. (Sample size = 370)

Location	% of sample	Rank
Fishermen's harbour	60	1
Lighthouse museum	59	2
Waenhuiskrans cave	47	3
Land-based whale watching	43	4
Agulhas National Park	43	5
Gansbaai harbour	38	6
Kassiesbaai	37	7
Shipwreck museum	37	8
Meishu Maru wreck	32	9
De Hoop Nature Reserve	32	10

4. Variable construction and model assumptions

Having set the context of the valuable role nature-based tourism can play in integrated biodiversity conservation and development, as well as highlighting the importance placed by tourists sampled in this study on nature-based locations and activities; it is now the objective of the rest of this paper to estimate a value of tourism in the Agulhas Plain using an ITCM.

It is an essential assumption of the ITCM, when constructing the dependant variable (number of visits to the region in a specific period of time, in this case, one year), that all previous trips in that year have the same characteristics as the visit to the region the tourist is currently on when they are surveyed. This is structurally necessary since asking the visitor to describe the characteristics of all previous trips would be prohibitive to the overall data collection process (Garrod, 1999; Markandya, 2002). In this study, the dependent variable *total visits per annum* (TV) is a numerical variable constructed by taking the number of visits the visitor had made to the region in the last twelve months¹¹ and adding one for the visit they were currently making when they were questioned for this study.

From the various questions on the survey, explanatory variables were constructed for use in the regression-modelling phase. An indicator variable for *first visit*, given a value of '1' if the visitor was on their first ever visit to the region and a '0' if not. A numerical variable for *total party size* indicates the size of party, both adults and children. A variable *enjoy travel* indicates the level of enjoyment experienced by the party when travelling to and from the destinations on their trip¹². An indicator variable named *larger trip* was constructed to differentiate between those visitors who were on a trip just to the Agulhas Plain and those who were on a larger trip in South Africa. To determine how influential certain factors, unique to the Agulhas Plain, were in the decision of visitors to come to the region, indicator variables were constructed for the following four factors: *owning property*, *nature and biodiversity*, *shark-cage diving*, and *activities*. An expenses question was included in the questionnaire, however due to poor response, a variable was constructed (*missing expenses* (*misexp*)) to indicate if a respondent had provided expenses data or not. The income question on the survey asked respondents to indicate which after tax monthly income bracket they belonged to from a list of eight. This information was split into eight income indicator variables (Ziemer, 1980), listed as follows: *income1* (less than R4,999), *income2* (R5,000 - R9,999), *income3* (R10,000 – R14,999), *income4* (R15,000 – R19,999), *income5* (R20,000 – R24,999), *income6* (R25,000 – R29,999), *income7* (R30,000 – R39,999) and *income8* (R40,000 or over).

Before the main independent variable, *total travel costs* (TC), could be constructed for each economically active adult in the sample, calculations were applied to travel related data collected from them on the survey. Car running

¹¹ Question 1.5 on the survey. Refer to Appendix for the questionnaire in full.

¹² 3 points indicating 'a lot' of enjoyment, 0 indicating 'indifference' through to -3 for 'not at all'

costs (Rands/km) were calculated using data collected on vehicle type, engine size and fuel type, together with data from the Automobile Association,¹³ using the following calculation:

$$\text{Car running cost} = (\text{Petrol factor} * \text{petrol price}) + (\text{service/repair factor}) + (\text{tyre cost factor})$$

Itinerary information provided by respondents, together with an on-line route planner,¹⁴ was used to calculate round trip distance travelled to the region.¹⁵ In addition, the survey collected information on how much respondents had spent (in Rands) on aeroplane, bus or coach tickets and on car rental.

Thus, the independent variable, TC, could be calculated using the following formula:

$$\text{TC} = [(\text{Car running costs} * \text{Distance travelled}) + (\text{Total spent on tickets}) + (\text{Total spent on car rental})]$$

An overview of the summary statistics of the variables used in this study is provided in Table 3.¹⁶

¹³ The Automobile Association website was used at:
<http://www.aa.co.za/content/62/vehicle-operating-costs/>

¹⁴ The South African Arrive Alive website was used at:
<http://www.arrivealive.co.za/routeplanner.aspx>

¹⁵ Distance travelled has been defined in this study as the distance in kilometres to the 1st point of entry into the region and then multiplied by two to constitute a round trip

¹⁶ A full dataset is available on request.

Table 3: Summary statistics

Variable	Obs	Mean	Std. Dev	Min	Max
<i>TV</i>	370	3.52	5.44	1	46
<i>TC</i>	370	799.03	2293.12	18	30,402
<i>First Visit</i>	370	0.36	0.48	0	1
<i>Total Party Size</i>	370	3.09	1.53	1	7
<i>Enjoy Travel</i>	370	0.84	0.36	0	1
<i>Larger Trip</i>	370	0.34	0.47	0	1
<i>Owning Property</i>	370	0.23	0.42	0	1
<i>Nature and Biodiversity</i>	370	0.76	0.43	0	1
<i>Shark-cage Diving</i>	370	0.26	0.44	0	1
<i>Activities</i>	370	0.73	0.44	0	1
<i>Income1</i>	312	0.06	0.23	0	1
<i>Income2</i>	312	0.11	0.32	0	1
<i>Income3</i>	312	0.22	0.41	0	1
<i>Income4</i>	312	0.12	0.33	0	1
<i>Income5</i>	312	0.04	0.19	0	1
<i>Income6</i>	312	0.10	0.30	0	1
<i>Income7</i>	312	0.10	0.29	0	1
<i>Missing Expenses</i>	370	0.19	0.40	0	1

Finally, additional rules were applied to distinguish between different types of visitor to tackle the previously mentioned issue of multi-destination trips (Common, 1997; Martínez-Espiñeira & Amoaka-Tuffour, 2009). The two key distinctions made were firstly, whether a visitor was on an overall larger trip within South Africa or not, and secondly, whether a visitor had planned their trip to the Agulhas Plain from the outset of their journey or not. Depending on the outcome of these two distinctions, the travel costs of an individual may be further reduced (see Table 4 for calculations).

The purpose of reducing travel costs in this way is to ensure that the correct proportion of total travel costs are attributed to the journey specifically being studied in this paper, namely the individual's trip to the Agulhas Plain. Since total travel costs acts as a proxy for 'price' in the ITCM, any overstatement of travel costs would result in a derived demand curve for total visits per annum to the Agulhas Plain positioned much higher than if costs had not been overstated. As consumer surplus is the area under the derived demand curve, a demand curve which is too high will lead to overstated valuation estimates of tourism worth in the Agulhas Plain.

Table 4: Treatment of multi-destination and unplanned visits

Larger Trip	Planned	Rationale and impact on individual total travel costs (TC_i)
Yes	Yes	<p>Visitors on a larger trip in South Africa of which their visit to Agulhas Plain was a smaller part. However, since their stop in Agulhas was <i>planned</i>, it is fair to attribute some of their overall travel costs to their Agulhas visit, but clearly not all. The allocation rule applied in these cases was:-</p> <p><i>Proportion only</i>¹⁷ of total spent on tickets + distance travelled from the last place visited <i>outside</i> the region to the 1st place visited <i>in</i> the region (x2 for ‘round trip’)</p>
Yes	No	<p>Visitors on a larger trip in South Africa, but their trip to Agulhas was <i>unplanned</i>, it would be grossly overstating if much of their overall travel costs were attributed to their visit to Agulhas. The rule applied in these cases:-</p> <p><i>Only distance travelled</i> from the last place visited <i>outside</i> the region to the 1st place visited <i>in</i> the region (x2 for ‘round trip’)</p>
No	Yes	<p>Visitors <u>not</u> on a larger trip in South Africa, their entire trip was in the Agulhas Plain, as such all of their travel expenditure should be attributed in full to their total travel costs calculations. The rule applied in these cases:-</p> <p><i>100%</i> of total spent on tickets + <i>100%</i> distance travelled from home to the 1st place visited <i>in</i> the region (x2 for ‘round trip’)</p>
No	No	Does not occur in the data and in reality was not an expected outcome.

5. Selecting a functional form and model building

There is a wealth of guidance in the literature regarding the functional forms that have been utilised with success in travel cost models (Carr and Mendelsohn, 2003; Garrod, 1999; Kling 1989, Ziemer 1980). The key to functional form selection is in sound statistical techniques in model building and testing, underpinned of course by the logical application of economic theory to model estimates. Despite the knowledge that the data are not random and that OLS estimates will likely exhibit some bias, it is still necessary to limit bias as much

¹⁷ Proportion only here means that total spent on tickets (by each economically active adult) is divided by the total number of days they are away from home and then multiplied by the days they are in the Agulhas Region – thus allocating the appropriate proportion of their ticket costs to the Agulhas part of their trip

as possible through the use of thorough econometric techniques to ensure as much accuracy as possible in the consumer surplus values finally obtained.

Four of the most commonly used functional forms in the literature were taken as the starting point (Bellù & Cistulli, 1997; Garrod, 1999; Ward & Beal, 2000). An additional form, not so commonly used, a polynomial in the quadratic (Carr and Mendelsohn, 2003) was considered suitable on cursory inspection of the data at the outset and was also included. For the same reason (data inspection) the linear functional form was not chosen since it would not fit the convexity of the data well and lead to inflated consumer surplus estimates as a result.

The direct demand function for *total visits per annum* (TV) is modelled as a function of independent variable, *total travel costs* (TC) and other factors such as income (I), tourist preferences (X) and location specific factors (L). The models are shown below with specified functional forms for both TV and TC:

Model 1: Reciprocal	$TV = 1/TC + f(I,X,L)$
Model 2: Log-log	$\ln(TV) = \ln(TC) + f(I,X,L)$
Model 3: Quadratic	$TV = \ln(TC) + [\ln(TC)]^2 + f(I,X,L)$
Model 4: Log-linear	$\ln(TV) = TC + f(I,X,L)$
Model 5: Linear-log	$TV = \ln(TC) + f(I,X,L)$

In the model building process, the explanatory variables described in the previous section were used to control for the other factors that determine TV. For income factors (I): seven of the eight income indicator variables (*income1...income7*) were used, as well as *missing expenses*; for tourist preferences (X): *first visit*, *total party size*, *enjoy travel*, and *larger trip* were included; and for location factors (L): *owning property*, *nature and biodiversity*, *shark-cage diving*, and *activities* were used.

It was discovered that heteroskedasticity was present in the data. However, the models were first built without robust standard errors so that a satisfactory R²-adjusted could be achieved, then non-constant error variance was taken into account by running all final models with heteroskedastic robust standard errors for results reporting. All models were reviewed and tested under the following criteria: statistically significant explanatory variables with expected signs on

coefficients, Wilcoxon signed rank test¹⁸ and residual plot for normally distributed errors (Garrod, 1999; Woolridge, 2009).

The final models, with explanatory variable beta coefficients, robust standard errors [in square parenthesis] and significance levels are summarised in Table 5.

It is clear from these regression results, that the data collected have generated variables that are statistically significant in explaining ‘visits per annum’ behaviour in the sample of visitors. Each model boasts mostly all statistically significant variables and the signs of the coefficients provide logical insight into the economic decision-making of the visitors sampled. In all models bar model 3, the main independent variable, TC is statistically significant at the 1% level and in every case displays the expected sign, such that as travel costs increase, the number of visits per annum decreases, in line with economic theory. In the end, none of the demographic factors, such as age or gender, were significant in explaining the variation in the dependent variable once travel costs, income, expenses and tourist tastes were controlled for, so they were left out of the final specification. Models 2 and 4 successfully passed the Wilcoxon sign rank test and the same models produced residuals that were normally distributed.

The constant-elasticity model (model 2) states that a 1% increase in travel costs results, on average, in a 0.16% decrease in the number of visits per annum demanded, *ceteris paribus*. For instance, if a visitor faces average travel costs of R800 to the region and has visited 15 times in the past year, then a 10% increase in their costs (scaled up to make practical sense), which is an increase of R80, would result in their annual visitation decreasing to 14.76 visits, which, when rounded up, is practically no change at all. However, an increase in costs of 20% would decrease annual visitation to 12 visits per annum. This indicates a very inelastic relationship exists between travel costs and total visits per annum as estimated by this model.

¹⁸ Wilcoxon sign rank test compares predicted values against actual values of the dependent variable (TV) and is passed statistically if they are from the same distribution.

Table 5: Regression estimation results. (TV = total visits per annum, TC = total travel costs)

	Model 1 Reciprocal	Model 2 Log-log	Model 3 Quadratic	Model 4 Log-linear	Model 5 Linear-log
Dep var:	TV	Ln(TV)	TV	ln(TV)	TV
Indep vars:					
Total travel costs (tca1)	(1/TC) 443.826 *** [149.431]	Ln(TC) -0.1599 *** [0.034]	ln(TC) -9.6509 ** [4.017] [ln(tca1)] ² 0.7117 ** [0.306]	TC -0.0001 *** [0.000]	ln(TC) -0.8669 *** [0.262]
First visit	-1.8609 *** [0.483]		-2.7981 *** [0.548]		
Total party size	-0.6300 ** [0.268]		-0.6502 ** [0.275]		-0.3448 [0.269]
Enjoy travel	1.6301 *** [0.614]				1.4246 *** [0.545]
Larger trip	-1.2438 ** [0.516]	-0.3034 *** [0.095]		-0.3409 *** [0.098]	-2.0215 *** [0.572]
Owning property	5.0305 *** [1.182]	1.0574 *** [0.106]	5.0658 *** [1.171]	1.0807 *** [0.108]	5.6482 *** [1.180]
Nature & biodiversity	-3.1020 *** [0.770]	-0.3277 *** [0.101]	-3.4423 *** [0.864]	-0.3306 *** [0.103]	-2.8243 *** [0.831]
Shark-cage diving		-0.3700 *** [0.092]		-0.3586 *** [0.091]	
Activities influential			1.2552 *** [0.445]		
Income1 (less than R4,999)	-0.8343 [0.738]	-0.3027 ** [0.139]	-0.3623 [0.785]	-0.3564 ** [0.150]	-1.2431 Δ [0.793]
Income2 (R5,000-9,999)	-2.7791 *** [0.816]	-0.4950 *** [0.117]	-2.1486 *** [0.741]	-0.5037 *** [0.119]	-2.7255 *** [0.854]
Income3 (R10,000-14,999)	-1.1933 [0.864]	-0.2152 * [0.119]	-1.0501 [0.836]	-0.2007 * [0.120]	-1.1400 [0.891]
Income4 (R15,000-19,999)	0.1027 [1.820]	-0.1724 [0.155]	0.7277 [1.794]	-0.1614 [0.157]	0.0630 [1.828]
Income5 (R20,000-24,999)	-1.8944 ** [0.919]	-0.1132 [0.166]	-1.3639 Δ [0.910]	-0.0914 [0.175]	-1.7476 * [0.960]
Income6 (R25,000-29,999)	-1.9425 ** [0.857]	-0.4478 *** [0.139]	-1.5276 ** [0.755]	-0.4725 *** [0.142]	-1.9941 ** [0.899]
Income7 (R30,000-39,999)	-1.2901 * [0.732]	-0.2882 ** [0.122]	-1.1030 Δ [0.735]	-0.3485 *** [0.122]	-1.9242 ** [0.836]
Missing expenses	-1.9190 *** [0.574]	-0.3101 *** [0.092]	-2.0454 *** [0.609]	-0.2949 *** [0.090]	-1.7607 *** [0.587]
Constant	5.9131 *** [1.547]	2.1554 *** [0.253]	39.5697 *** [13.611]	1.2748 *** [0.167]	11.3669 *** [2.183]
R²-adjusted	0.3501	0.5430	0.3403	0.5256	0.3106
R² robust	0.3815	0.5621	0.3721	0.5454	0.3416
# Observations	312	312	312	312	312
Model Signf.	***	***	***	***	***

Key: *** significant at 1%; ** significant at 5%; * significant at 10%; Δ significant at 15%

This would seem to make sense considering so many attractions in the area are currently free of charge. Since visitors are enjoying so much for free, they might be more inclined to absorb a 10% increase in costs, for instance, if they felt they should have been paying something for the privilege anyway. This of course is purely conjecture, and further analysis would be needed to confirm this or not. In terms of policy implications, this would mean that if prices were to increase in the area, by say 10%, this change would be generally absorbed by visitors without much resultant change in the total number of visits per annum.

The quadratic model (model 3) implies a reciprocal relationship between travel costs and annual visits until a turning point is reached, beyond which an increase in travel costs also results in an increase in number of visits. This functional specification features TC logged for scale purposes, and this transformation results in the model fitting the data, prior to the turning point, reasonably well. This can be seen from its acceptable R^2 -adjusted and many variables significant at the 1% level. The model implies that annual visitation ceases to decrease with travel costs past a turning point where average costs are R880, which is around R80 higher than the sample average travel cost; so the model fits the ‘average’ visitor adequately.

Model 4 is a semi-elasticity model, implying that a 10 Rand increase in travel costs would result in a 0.1% decrease in annual visits, on average (*ceteris paribus*). Given more practical significance, if a visitor, whose travel costs were R800, had visited the region 15 times in the previous year, a R100 increase in their travel costs would result in them coming to the region practically the same number of times per annum. This implies a strong semi-inelastic relationship, where travel costs would have to increase by around R1,000 before the number of visits decreases by 10%.

Model 5 is another form of semi-elasticity, this time logged in the independent variable, and it implies that a 10% increase in travel costs would result in a 0.087 unit decrease, on average, in number of visits per annum, *ceteris paribus*. Again, to make this interpretation more meaningful in reality, it would take a 100% increase in travel costs, on average, to result in a decrease by approximately one visit (0.87) in the number of visits per annum, all else held equal. Again, a very strong semi-elasticity relationship is implied by this model.

Respondents in the sample who were visiting Agulhas for the first time are correctly predicted by the models to have a lower number of total visits per annum than those on repeat visits to the region. Those visitors travelling in larger sized parties (i.e. with more adults or their children) were estimated to

have visited the region less times in the last year than their smaller party counterparts, which would make logical sense as larger parties need to organise more people and schedules to take holidays than those travelling on their own or in much smaller groups. Those visitors who claimed to enjoy travelling to and from their destinations a lot or a little, were estimated by the models to have visited the region approximately 2 more times in the past year compared to those who stated they were indifferent or did not enjoy time spent travelling. Visitors on a larger trip within South Africa were likely to have visited the region 1 or 2 less times in the past year than those visitors who were not on a larger trip in South Africa. This is also confirmed on inspection of the visitor profile information in section 3, since the typical traveller on a larger trip is usually from overseas and unlikely to travel the long distance to visit the Agulhas Plain frequently in the short timeframe of one year.

The Agulhas region-specific variables proved very statistically significant and helped describe well visitor preferences when visiting the area. It was assumed that those visitors who had stated that owning property in the Agulhas Plain was ‘extremely’ or ‘quite’ influential in their decision to visit the region would visit the region more times in the year than those who did not own property. This was confirmed by all models which estimated visitors who owned a property had made 5 or 6 more visits in the year, compared to those who did not own property. An interesting outcome was regarding those visitors who had stated that nature and biodiversity were ‘extremely’ or ‘quite’ influential in their decision to visit the Agulhas Plain. These visitors were estimated to make fewer visits per annum to the region than those who stated nature and biodiversity were ‘hardly’ or ‘not at all’ influential. It could well be a sign of a more attentive, environmental traveller who keeps car travel to a minimum and who therefore takes fewer, but perhaps longer, trips per annum. In contrast, visitors who claimed that specific activities available in the region were influential in their decision to visit, were estimated to have made just over 1 more visit in the year than those who did not prioritise activities. This is logical since the great variety of recreational activities available to tourists in the region, such as fishing, hiking, cycling and many sea-based activities can certainly tempt visitors to keep coming back to the region as they try to sample all that the region has to offer.

Those respondents who declined to complete the expenses question on the survey were estimated by the models to have made up to 2 visits less than those visitors who had responded. Since the visitors who visit the region less times tend to come from greater distances, and thus spend larger amounts of money, they may not have the inclination or recollection necessary to complete this question on the survey. There is a slight positive correlation (0.145) between

non-response of expenses and non-response on the income question on the survey, meaning that those respondents who left out expenses also did not divulge their income level, perhaps having a general aversion to filling out ‘money’ type questions on surveys. The statistically significant income dummy variables in the models are to be interpreted against the base case of those visitors whose monthly after tax income was in the highest bracket (R40,000 or more). Thus visitors who earned between R5,000 and R9,999 per month after tax would have made 2 to 3 visits per annum less than visitors who earned R40,000 or more. Visitors who earned between R25,000 and R29,999 made nearly 2 visits per annum less than visitors earning R40,000 or more, and finally visitors earning between R30,000 and R39,999 made 1 to 2 visits per annum less than visitors in the highest income bracket. This implies an increase in visits per annum as *income* increases, which indicates that tourist recreational demand (in visits per annum) is a normal good, as expected from standard economic theory.

6. Derivation of the demand function and calculating consumer surplus

Each of the following steps will be detailed using model 1 and then a summary for all models will be provided at the end of each step before moving onto the next.

Step 1: The derived demand equation

The rather cumbersome estimated regression equation for model 1 was simplified by evaluating the model at the mean value of all non-cost variables (Markandya, 2002), giving the following transition:¹⁹

$$\hat{TV} = \beta_0 + \beta_1(1/TC) + \beta_2(\text{first visit}) + \beta_3(\text{total party}) + \beta_4(\text{enjoy travel}) + \beta_5(\text{larger trip}) \\ + \beta_6(\text{property}) + \beta_7(\text{nature}) + \beta_8(\text{inc1}) + \beta_9(\text{inc2}) + \beta_{10}(\text{inc3}) + \beta_{11}(\text{inc4}) \\ + \beta_{12}(\text{inc5}) + \beta_{13}(\text{inc6}) + \beta_{14}(\text{inc7}) + \beta_{15}(\text{misexp}) + \epsilon$$

¹⁹ Beta coefficient estimates are obtained from Table 5 and variable mean values from Table 3.

$$\begin{aligned} \hat{TV} = & 5.913 + 443.826(1/TC) - 1.861(\text{first visit}) - 0.630(\text{total party}) + 1.630(\text{enjoy travel}) \\ & - 1.244(\text{larger trip}) + 5.030(\text{property}) - 3.102(\text{nature}) - 0.834(\text{inc1}) - 2.779(\text{inc2}) \\ & - 1.193(\text{inc3}) + 0.103(\text{inc4}) - 1.894(\text{inc5}) - 1.942(\text{inc6}) - 1.290(\text{inc7}) \\ & - 1.919(\text{misexp}) + \varepsilon \end{aligned}$$

$$\begin{aligned} \hat{TV} = & 5.913 + 443.826(1/TC) - 1.861(0.362) - 0.630(3.089) + 1.630(0.846) - 1.244(0.340) \\ & + 5.030(0.232) - 3.102(0.762) - 0.834(0.058) - 2.779(0.115) - 1.193(0.221) \\ & + 0.103(0.122) - 1.894(0.038) - 1.942(0.099) - 1.290(0.096) - 1.919(0.194) + \varepsilon \end{aligned}$$

The final derived demand equation for model 1 and for the rest of the models are summarised below:

$\hat{T} = 1.670 + 443.826 (1/TC) + \varepsilon$	Model 1
$\ln(\hat{T}) = 1.673 - 0.160(\ln(TC)) + \varepsilon$	Model 2
$\hat{T} = 34.904 - 9.651(\ln(TC)) + 0.712(\ln(TC))^2 + \varepsilon$	Model 3
$\ln(\hat{T}) = 0.782 - 0.0001(TC) + \varepsilon$	Model 4
$\hat{T} = 8.555 - 0.870(\ln(TC)) + \varepsilon$	Model 5

By using incremental values for travel costs, the derived demand curve for total visits per annum can be plotted from the simplified equations above. Figure 8 shows the plotted derived demand curves for all the models.

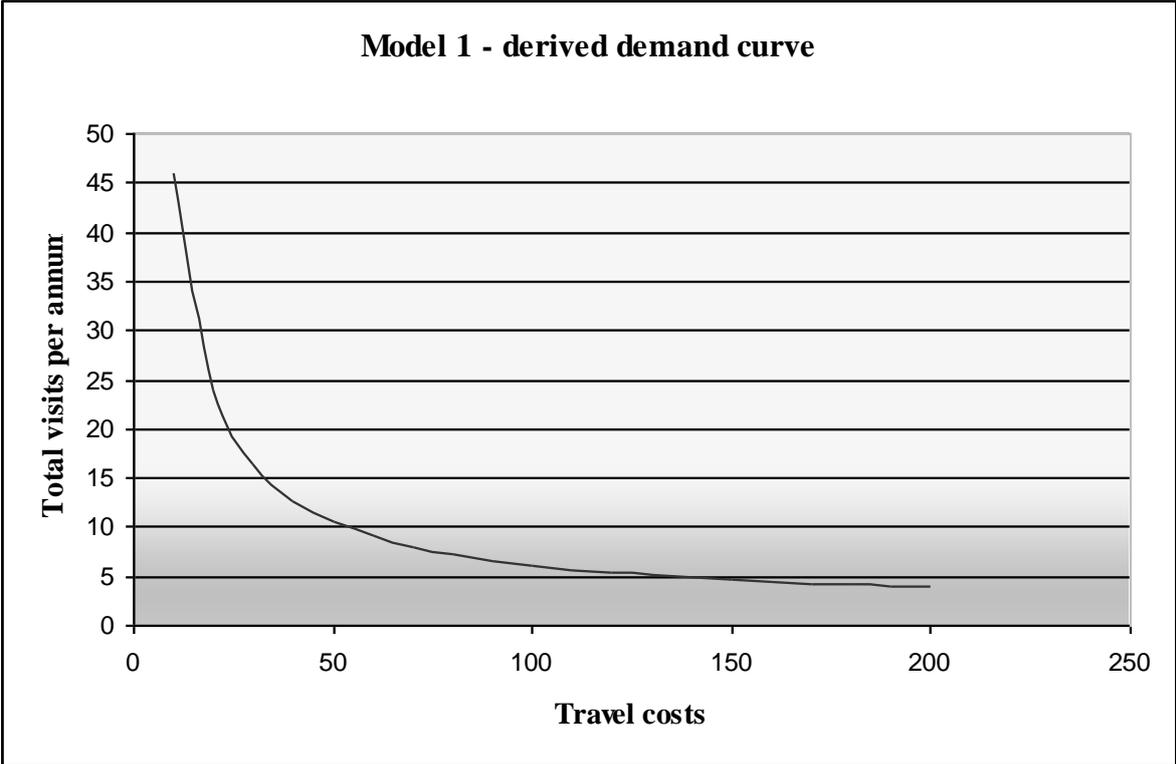
Step 2: Choke price

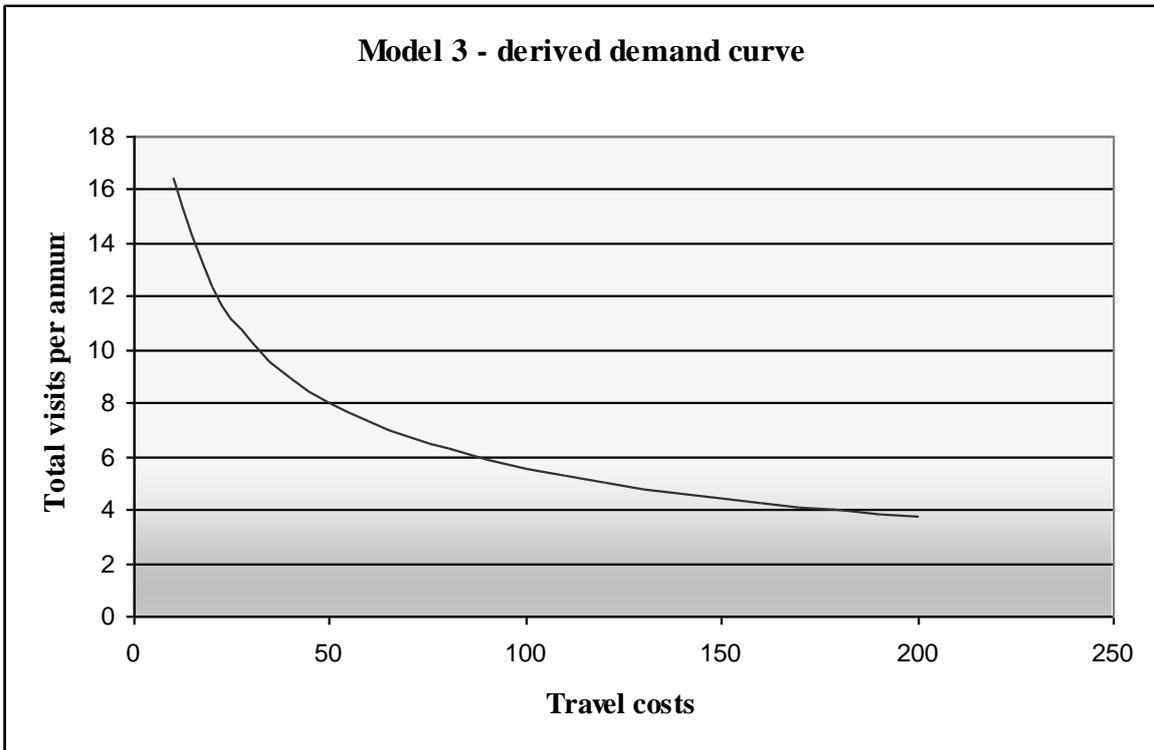
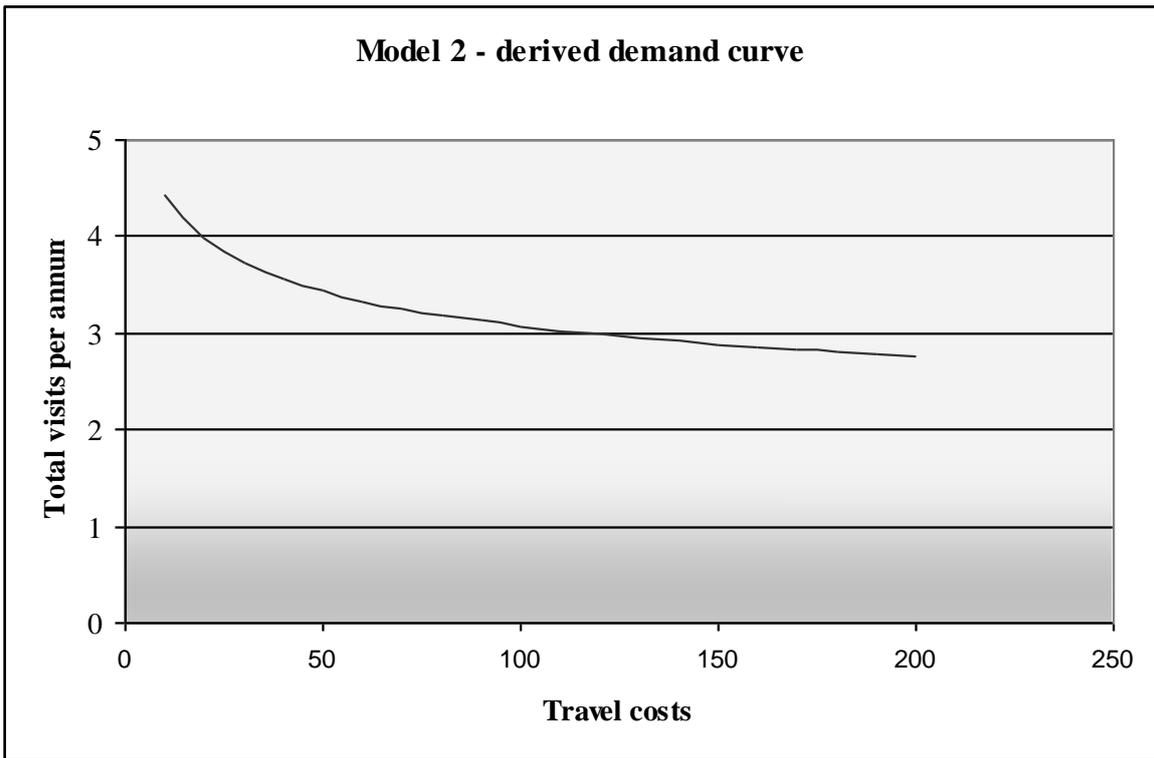
The travel cost at which visitation drops to zero, the choke ‘price’, is worked out if definable. In most cases, the derived demand equation implies an asymptotic tendency such that, as total visitation (TV) tends towards zero, total travel costs (TC) tends towards \pm infinity. Such an impossibly high choke price can lead to hugely inflated consumer surplus estimations, and so, in this study, wherever an appropriate choke price cannot be defined, an upper percentile of the sample travel cost data was utilised instead (Markandya, 2002).

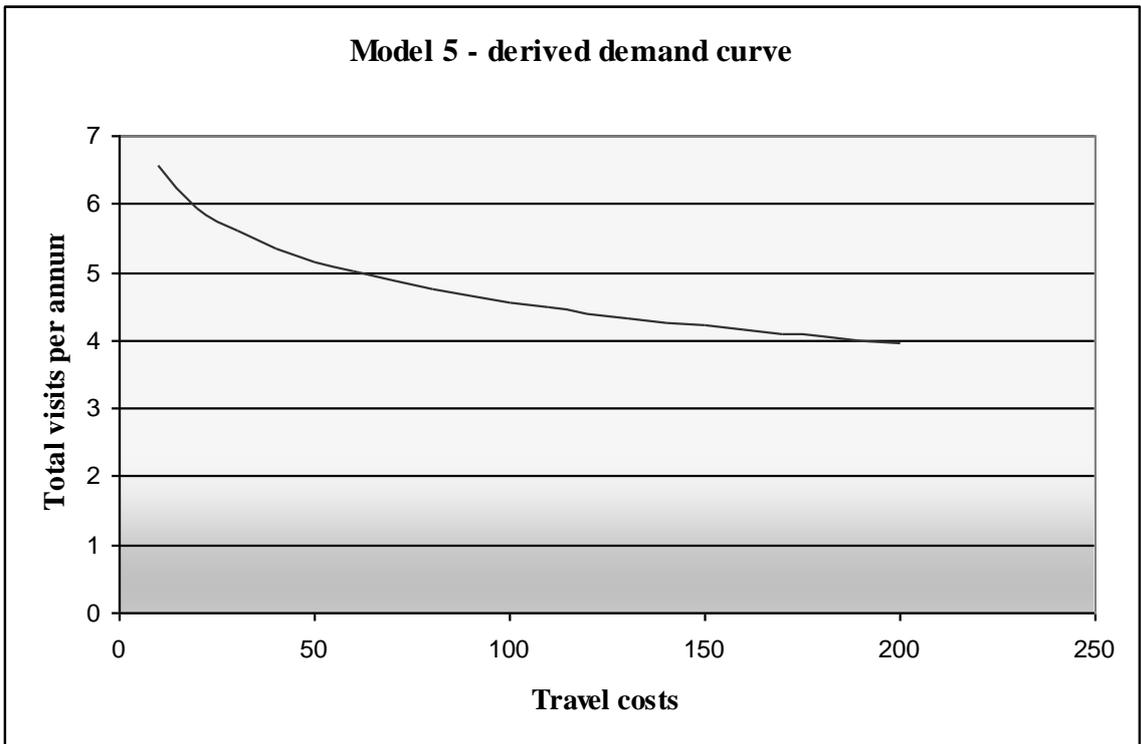
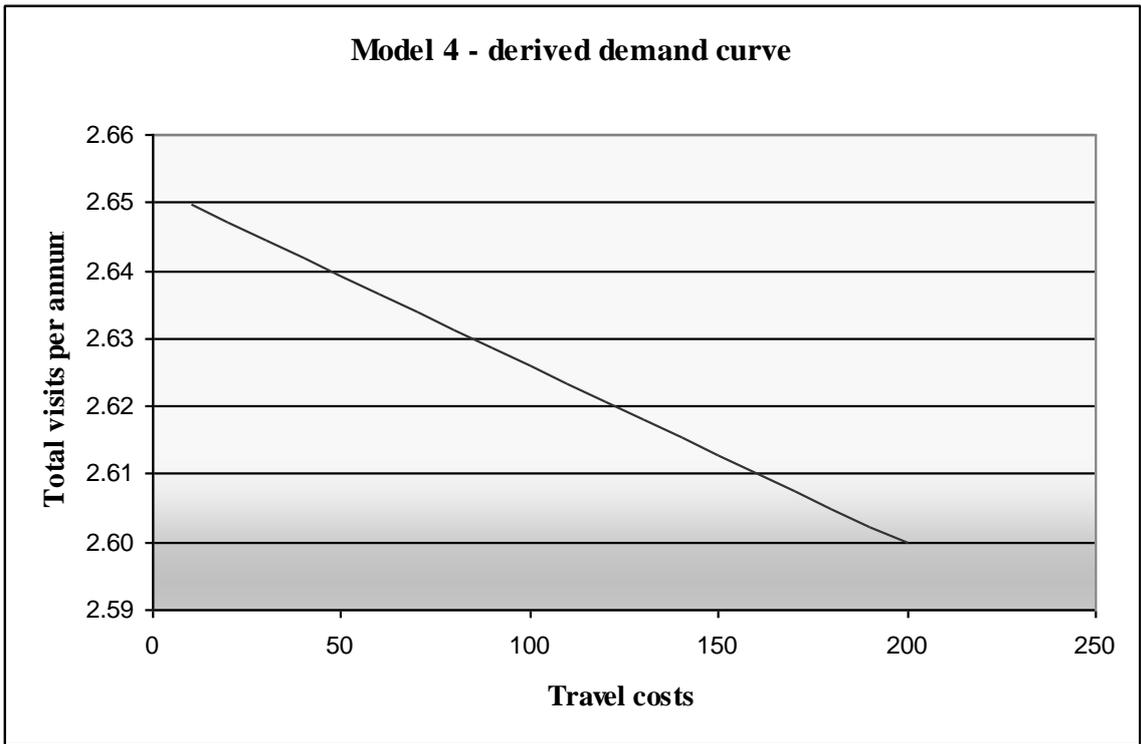
It was important to investigate the influence that different choke prices exerted on consumer surplus values. A moderate percentile (90th) was chosen which would yield a more conservative consumer surplus value, along with the 95th and the 97th percentiles, the latter choice being in line with the findings of Bellù and Cistulli (1997) in their simulations of percentile choice on consumer surplus values.

Due to the asymptotic nature of model 1 at both axes, choke prices at the upper percentiles were used, these were R 1,217 (90th), R 2,266 (95th) and R 2,896 (97th). In fact these upper percentiles were used for the remaining models, since their choke prices were either undefined or implied a consumer surplus of infinity.

Figure 8: Derived demand curves for models 1 - 5







Step 3: Consumer surplus calculation

The direct demand function for total visits per annum (TV) was determined in order that it could be integrated to calculate consumer surplus (Markandya, 2002). The equation for model 1 was integrated between the choke price and the actual travel cost for every individual in the data set, yielding an individual consumer surplus value for each economically active adult in the sample (see calculations that follow).²⁰

$$\text{Individual CS} = \int_{(TC)_i}^{\text{choke}} TV \, d(TC)$$

$$\text{Individual CS} = \int_{(TC)_i}^{\text{choke}} \left[\beta_0 + \beta_1(1/TC) + \beta_2(\text{first visit}) + \beta_3(\text{total party}) + \beta_4(\text{enjoy travel}) + \beta_5(\text{larger trip}) + \beta_6(\text{property}) + \beta_7(\text{nature}) + \beta_8(\text{inc1}) + \beta_9(\text{inc2}) + \beta_{10}(\text{inc3}) + \beta_{11}(\text{inc4}) + \beta_{12}(\text{inc5}) + \beta_{13}(\text{inc6}) + \beta_{14}(\text{inc7}) + \beta_{15}(\text{misexp}) \right] d(TC)$$

$$\text{Individual CS} = \int_{(TC)_i}^{\text{choke}} \left[\left[(\beta_0 + \beta_2(\text{first visit}) + \beta_3(\text{total party}) + \beta_4(\text{enjoy travel}) + \beta_5(\text{larger trip}) + \beta_6(\text{property}) + \beta_7(\text{nature}) + \beta_8(\text{inc1}) + \beta_9(\text{inc2}) + \beta_{10}(\text{inc3}) + \beta_{11}(\text{inc4}) + \beta_{12}(\text{inc5}) + \beta_{13}(\text{inc6}) + \beta_{14}(\text{inc7}) + \beta_{15}(\text{misexp})) * (TC) \right] + [\beta_1(\ln(TC))] \right] d(TC)$$

$$\text{Individual CS} = [(\beta_0 + \dots + \beta_{15}(\text{misexp})) * (\text{choke} - TC_i)] + [\beta_1((\ln(\text{choke}) - \ln(TC_i)))]$$

²⁰ This represents Marshallian consumer surplus. However, if income effects are negligible, which is generally assumed in such studies, then Marshallian consumer surplus is no different from Hicksian consumer surplus and therefore acceptable for valuation purposes. See Carr and Mendelsohn, 2003; Ziemer, 1980 for more on this issue.

The final individual consumer surplus equation for model 1 and for the remaining models are summarised as follows:²¹

<p>Model 1: Individual CS = $[(\beta_0 + \dots + \beta_{15}(\text{misexp})) * (\text{choke} - \text{TC}_i)] + [\beta_1(\ln(\text{choke}/\text{TC}_i))]$</p> <p>Model 2: Individual CS = $e^{(\beta_0 + \dots + \beta_{13}(\text{misexp}))} [1/(\beta_1+1) [(\text{choke})^{\beta_1+1} - (\text{TC}_i)^{\beta_1+1}]]$</p> <p>Model 3: Individual CS = $[(\beta_0 + \dots + \beta_{15}(\text{misexp})) * (\ln(\text{choke}) - \ln(\text{TC}_i))] + (\beta_1)/2 [(\ln(\text{choke}))^2 - (\ln(\text{TC}_i))^2] + (\beta_2)/3 [(\ln(\text{choke}))^3 - (\ln(\text{TC}_i))^3]$</p> <p>Model 4: Individual CS = $1/(\beta_1) [(e^{(\beta_0 + \beta_1(\text{choke}) + \dots + \beta_{13}(\text{misexp}))}) - (e^{(\beta_0 + \beta_1(\text{TC}_i) + \dots + \beta_{13}(\text{misexp}))})]$</p> <p>Model 5: Individual CS = $[(\beta_0 + \dots + \beta_{14}(\text{misexp})) * (\text{choke} - \text{TC}_i)] + \beta_1 [[\text{choke} (\ln(\text{choke}) - 1)] - [\text{TC}_i (\ln(\text{TC}_i) - 1)]]$</p>

Step 4: Consumer surplus aggregation

Once individual consumer surplus was calculated, an average was taken and then divided by the average number of visits per annum in the sample to produce a final consumer surplus value per individual per visit (Markandya, 2002). This was then aggregated by the number of visitors to the region in the ‘population’ in the past year. In the year from July 2009 to June 2010, approximately 105,000 visitors visited the Agulhas Plain.²²

Table 6 summarises the consumer surplus values that are of interest: average individual consumer surplus (CS), average individual consumer surplus per visit and average total willingness to pay (WTP) per visit, along with the aggregated values for WTP and CS for the region on a per annum basis which are shown in the last two columns (aggregated by 105,000 visitors per annum) (Markandya, 2002).

²¹ Refer to Appendix for the derivation of consumer surplus equations for models 2-5 in detail

²² Data provided for this study by Angela Millar, CEO, Cape Agulhas Tourism Bureau.

Table 6: Consumer surplus (CS) and willingness to pay (WTP) estimates for the Agulhas Plain

	Average Individual CS	Average CS Per visit	Average Total WTP Per visit	Aggregated Average Total WTP per annum (millions)	Aggregated Average CS Per annum (millions)
Model 1: Reciprocal					
[90 th percentile]	R 1,566	R 444	R 1,243	R 130.6 m	R 46.7 m
[95 th percentile]	R 2,754	R 781	R 1,580	R 166.0 m	R 82.0 m
[97 th percentile]	R 4,406	R 1,250	R 2,049	R 215.2 m	R 131.3 m
Model 2: Log-log					
[90 th percentile]	R 1,974	R 560	R 1,359	R 142.7 m	R 58.8 m
[95 th percentile]	R 3,833	R 1,088	R 1,887	R 198.1 m	R 114.2 m
[97 th percentile]	R 6,403	R 1,817	R 2,616	R 274.6 m	R 190.7 m
Model 3: Quadratic					
[90 th percentile]	R 5	R 1	R 800	R 84.0 m	R 0.14 m
[97 th percentile]	R 3	R 1	R 800	R 84.0 m	R 0.10 m
Model 4: Log-linear					
[90 th percentile]	R 2,327	R 660	R 1,459	R 153.2 m	R 69.3 m
[95 th percentile]	R 4,458	R 1,265	R 2,064	R 216.7 m	R 132.8 m
[97 th percentile]	R 7,281	R 2,066	R 2,865	R 300.8 m	R 216.9 m
Model 5: Linear-log					
[90 th percentile]	R 2,356	R 668	R 1,467	R 154.1 m	R 70.2 m
[95 th percentile]	R 3,838	R 1,089	R 1,888	R 198.2 m	R 114.3 m
[97 th percentile]	R 5,504	R 1,562	R 2,361	R 247.9 m	R 164.0 m

7. Examination of consumer surplus values

The aggregated average consumer surplus per annum ranges given by the models are as follows:

Model 1:	R 47 m to R 131 m
Model 2:	R 59 m to 191 m
Model 3:	R 0.10 to R 0.14 m
Model 4:	R 69 m to R 217 m
Model 5:	R 70 m to 164 m

The extremely low consumer surplus and WTP values of model 3 indicate that the quadratic functional form modelled in this study, with the independent variable TC logged for scale purposes (Woolridge, 2009), performs well as a fitted model as previously discussed but it is where the functional form does not fit the data that is cause for concern in the estimation of consumer surplus. It is clear from Figure 9 below that without its log transformation of TC, only a very small part of model 3 relates to the sample data (the downward sloping portion to the left of the turning point). With the logarithmic effect on scale taken into account, there is considerably less area under the untransformed graph compared to the other models (refer back to Figure 8) which would account for the low consumer surplus estimates model 3 generates.

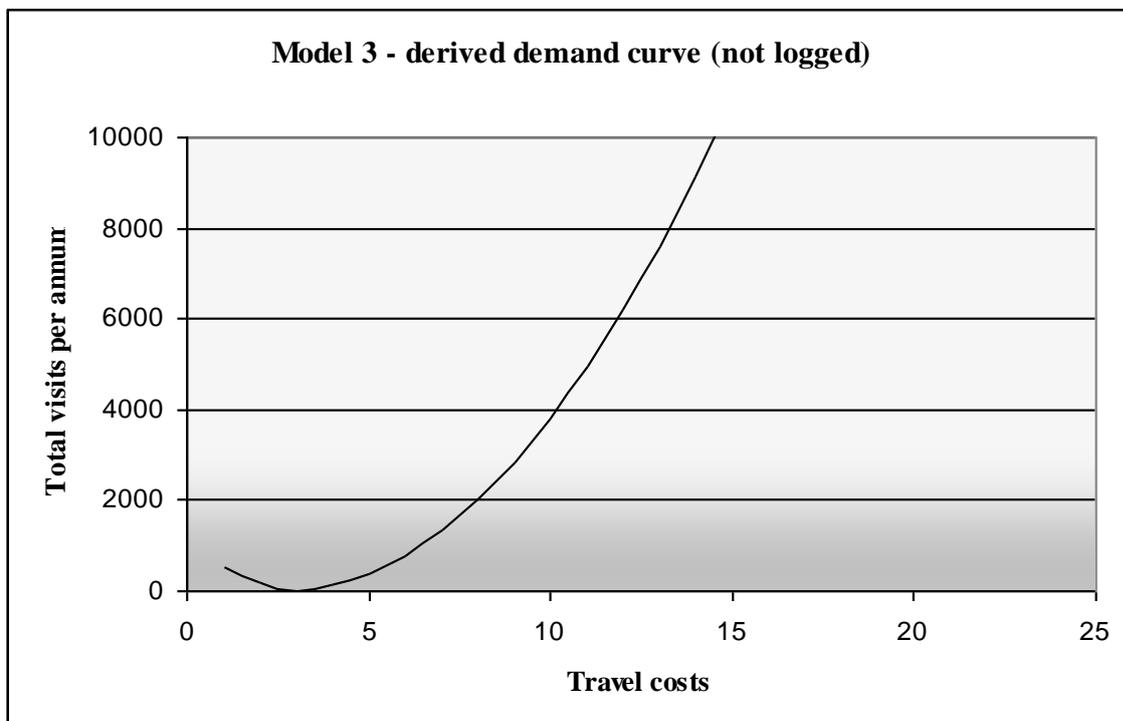


Figure 9: The quadratic form of model 3 once TC shown in non-logged form

Furthermore, inappropriate functional form selection also explains why there is little difference between the 90th and 97th percentiles estimates for this model (refer to Table 6). The asymptotic behaviour of the curve as it reaches its turning point explains why there is such little difference between the two percentiles. As total visits per annum slopes downwards towards zero, as if to intersect the x-axis from the left, travel costs tends towards infinity. The slope is near vertical at this point and so the areas under the curve almost identical at both percentiles, hence the consumer surplus estimates are also identical.

The case of model 3 confirms the importance of functional form selection as outlined earlier in the paper, clearly illustrating the impact an inappropriate functional form can have in the estimation of consumer surplus (Ziemer, 1980; Kling, 1989; Garrod, 1999). It is for this reason that model 3 will be excluded from the discussion which follows on the value of tourism in the region.

On inspection, the remaining models yield a value range from R 47 million to R 217 million. It is felt that this overall maximum, and indeed all the estimates using the 97th percentile of sample data, seem very high. The usefulness and pragmatism of such high estimates is called into question since, again, they seem to depend heavily on the shape of the derived demand function, which in turn is dependent on the functional form chosen at the outset. Any asymptotic behaviour of the curve as total visits per annum tends towards zero - which is exhibited in most of the functional forms investigated - results in such incredibly high consumer surplus values that demand begins to take on infinitely inelastic tendencies. For these reasons, the consumer surplus values at the 97th percentile are also excluded from the general discussion that follows.

Examining the results in the absence of model 3 and of the 97th percentile estimates of all models, a slightly more conservative and certainly more practical picture starts to emerge:

Model 1:	R 47 m to R 82 m
Model 2:	R 59 m to 114 m
Model 4:	R 69 m to R 132 m
Model 5:	R 70 m to 114 m

The value of tourism in the Agulhas Plain now ranges from R47-132 million, which seems very reasonable considering the initial approximation obtained from Turpie's CFR and KNP value estimates (R77-126 million). If the maximin-minimax approach were to be applied to the estimates,²³ a narrower still range would be identified of R70-82 million. Whilst the minimum-to-minimum approach²⁴ yields a slightly wider range of R47-82 million (which is that estimated by model 1). An 'averages' approach²⁵ yields a range of R61 million to 110 million, which could well be the safest approach to take with a number of the ranges available and with all models performing so well statistically. Models 2 and 4 generate estimates closest to this 'averages' approach.

Decision-making based on performance of the models in statistical analysis and significance can go some way, although not all, in fine-tuning the choice. On the basis of their R^2 -adjusted, models 1, 3 and 5 could be grouped together for selection, since the dependent variable has the same functional form and neither model was nested in any other(s). On this basis, model 1 would be chosen as it has the highest R^2 -adjusted of the three models; and model 2 would be chosen between models 2 and 4 (although with very little separating them). Considering the statistical tests, models 2 and 4 performed the best. From an economic theory point of view, model 2, being a constant-elasticity model, is perhaps the most intuitive approach to modelling visitation 'demand' in this economic context. Thus, it would appear that model 2 presents a winning case when judged by statistical and theoretical robustness criteria.

Thus, model 2 estimates a value of tourism in the Agulhas Plain between R59-114 million and model 4 between R69-132 million. The average of these two well performing models gives a value range between R64-123 million, which is incredibly close to the starting approximation range generated from Turpie's estimates (2001, 2003) and the 'averages' range obtained above of all four models considered.

²³ Taking the maximum of the minimums and the minimum of the maximums. An approach often taken in inferential statistics and operational research techniques. For more see Sam L. Savage (2003), *Decision Making with Insight*. Thomson-Brooks/Cole.

²⁴ Ibid.

²⁵ Ibid. (Average of the minimums and average of the maximums).

8. Implications & conclusions

It is abundantly clear from the analysis of consumer surplus estimates that the implications for policy of model misspecification in these studies are grave. Low consumer surplus numbers, due to incomplete specification of the model against actual visitation data, vastly underestimate the value of the region and lead to understated conclusions regarding tourism expenditure in the region. The multi-model approach of this paper provided a backdrop against which it was possible to experiment with the quadratic functional form in this study and illustrate the extent to which functional form selection leads to considerable value underestimation.

The consumer surplus estimation process also raises serious questions regarding what is considered reasonable in such estimation exercises and the extent to which hugely inflated estimates are useful when attempting to estimate value and make allocation decisions. Inflated values of tourism in the region can, to a certain degree, hinder rather than help the cause for nature-based tourism. Such unreasonable estimates suffer both in credibility and in practicality, implying that huge normative judgements be made in favour of the preservation of nature for the tourism industry at the expense of other important development objectives. It would be constructive for this paper to highlight a slightly more conservative value range for nature-based tourism in the Agulhas Plain, which could thus result in any future action plans being declared economically viable and resources thus allocated, rather than to focus on the estimates that are prohibitively high, which would make any future action seem unfeasible.

With this objective in mind, this study has found that tourism in the Agulhas Plain could reap between R64 to R123 million per annum (or R418 – R803 per hectare), at *current* levels of protection and conservation. This value sits very well in the current South African literature, specifically with valuations for the Cape Floristic Region and Kruger National Park.²⁶ Furthermore, the models estimated in this study imply that there would be much tolerance amongst visitors to considerable increases in the travel costs they face before the number of visits they make per annum to the Agulhas Plain is adversely affected. In other words, the total number of visits made by tourists per annum to the region is relatively inelastic to changes in prices. Considering over three quarters of visitors in the sample prioritised nature and biodiversity as influential in their decision to visit the Agulhas Plain, as well as high ratings for locations and

²⁶ From which an approximate value of R77-126 million for tourism in the Agulhas Plain may be implied

activities, which in the Agulhas Plain tend to be largely nature-based, it can safely be assumed that the substantial majority of the values estimated in this study can be attributable to *nature-based* tourism within the region.

This analysis has raised many important questions, the answering of which remains a recommendation for further research in the future. What kind of jobs can be created for the local community to tap into the potential worth of nature-based tourism in the area? Does the community have the skills required to undertake such employment or are specific vocational tourism-training centres needed in the area to build such skills? Are some forms of nature-based tourism more lucrative than others and will the pursuit of the potential in the area favour the conservation of some forms of nature above others? What exactly are the nature-based tourism offerings that will exploit the identified potential in this study?

The valuation provided by this paper offers huge incentive for the continued protection and conservation of the nature and biodiversity in the region as it stands today, considering its sizeable worth to the tourists who visit the region and as expressed by them directly in this study. Furthermore, there is scope for a strategy that introduces a degree of fee charging at some locations in the area and designs tourism offerings which create jobs for the local community, whilst leveraging the consumer surplus potential estimated by this paper. By putting a value on tourism in the Agulhas Plain, this paper has provided an economic foundation to substantiate the potential that nature-based tourism has to offer for economic and sustainable development, poverty and unemployment reduction and integrated biodiversity conservation in the region.

Appendix

VISITOR SURVEY

DATE: _____

- 1.1 What is your town or city of residence? _____
- 1.2 What is your country of residence? _____
- 1.3 Please state the number of adults & children (aged below 16) travelling in your household?
Adults: _____ **Children:** _____
- 1.4 Is this your FIRST EVER visit to the Agulhas Plain or a REPEAT visit? FIRST EVER REPEAT
- 1.5 If you are a repeat visitor, how many other separate trips have you made to the region in the last 12 months? _____
- 1.6 Do you think you will come back to the region again within the next 12 months? YES NO
- 1.7 How influential or not were the factors below on your decision to come to the Agulhas Plain on this visit or previous visits?

(please rank every option)

		EXTREMELY	QUITE	HARDLY	NOT AT ALL
1.7.1	I/we own property in the region	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.2	Activities available in the region	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.3	Southernmost tip of African Continent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.4	Whale-watching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.5	Shark cage diving	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.6	Proximity to home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.7	Nature and/or biodiversity unique to the Agulhas Plain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.8	Availability of eco-tourism establishments in the region	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.9	To visit a specific locations or towns of interest only found in the region	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.10	Recommendation by friends or relatives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.11	Decided to try a new destination	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.12	The Agulhas Plain is cheaper than other destinations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 1.8 What aspects of interest do you think will bring you back to the region for further visits (or have already brought you back)?

2.1 Please tick all the activities you HAVE enjoyed or PLAN TO enjoy on this or previous trips:-

	Location	Recreational activity
2.1.1	Hermanus / Stanford	<input type="checkbox"/> Whale watching (land based) <input type="checkbox"/> Whale watching (boat based) <input type="checkbox"/> Whale House museum <input type="checkbox"/> Fernkloof nature reserve <input type="checkbox"/> Abalone tour <input type="checkbox"/> Birkenhead Brewery <input type="checkbox"/> River boat cruise
2.1.2	Gansbaai	<input type="checkbox"/> Dangerpoint Lighthouse / Birkenhead Memorial <input type="checkbox"/> Gansbaai Harbour <input type="checkbox"/> Strandveld museum <input type="checkbox"/> Shark cage diving <input type="checkbox"/> Platbos forest <input type="checkbox"/> Klipgat Cave
2.1.3	Arniston / Waenhuiskrans	<input type="checkbox"/> Kassiesbaai fishing village <input type="checkbox"/> Waenhuiskrans cave
2.1.4	Bredasdorp	<input type="checkbox"/> Shipwreck museum <input type="checkbox"/> De Hoop nature reserve <input type="checkbox"/> Heuningberg nature reserve <input type="checkbox"/> De Mond nature reserve <input type="checkbox"/> De Hoop Whale Trail
2.1.5	Elim	<input type="checkbox"/> Geelkop nature reserve <input type="checkbox"/> Elim museum <input type="checkbox"/> Elim Wine Route
2.1.6	L'Agulhas / Suiderstrand	<input type="checkbox"/> Agulhas National Park <input type="checkbox"/> Lighthouse museum <input type="checkbox"/> Meishu Maru wreck
2.1.7	Struisbaai	<input type="checkbox"/> Hotagterklip fishermen's houses <input type="checkbox"/> Fishermen's harbour
2.1.8	Napier	<input type="checkbox"/> Grootberg trail <input type="checkbox"/> Napier Brewery <input type="checkbox"/> Boat and toy museum
2.1.9	<u>GENERAL ACTIVITIES:</u> <input type="checkbox"/> Sunbathing or swimming <input type="checkbox"/> Hiking, rambling or walking <input type="checkbox"/> Cycling <input type="checkbox"/> Fishing	<input type="checkbox"/> Diving <input type="checkbox"/> Canoeing / kayaking <input type="checkbox"/> Experiencing nature or wildlife <input type="checkbox"/> Horse-riding <input type="checkbox"/> Sailing or motor-boating <input type="checkbox"/> Quad-biking <input type="checkbox"/> Windsurfing or surfing <input type="checkbox"/> Jet-skiing or water-skiing <input type="checkbox"/> _____

3.1 How many days in total do you plan to be away from home on this holiday/trip? (Day only visitors should please indicate this with a 1) _____

3.2 Is this visit to the Agulhas Plain part of an overall larger journey within South Africa? YES NO

3.3 Please give a NIGHT by NIGHT breakdown of this entire holiday/trip (from the day you left home to the day you will return)

<u>Example</u>	Night 1: Struisbaai
	Night 2: Struisbaai
	Night 3: Home

<u>Location</u>	<u>Location</u>
Night 1: _____	Night 12: _____
Night 2: _____	Night 13: _____
Night 3: _____	Night 14: _____
Night 4: _____	Night 15: _____
Night 5: _____	Night 16: _____
Night 6: _____	Night 17: _____
Night 7: _____	Night 18: _____
Night 8: _____	Night 19: _____
Night 9: _____	Night 20: _____
Night 10: _____	Night 21: _____
Night 11: _____	Night 22: _____

3.4 If you have travelled by plane, bus/coach or train, how much have you spent on tickets for your household on this trip? (in ZAR) R _____

3.5 If you have travelled by car on this trip (private or rental) please indicate your vehicle type:
 Ordinary / Passenger cars Light Commercial / Bakkies SUV / Campervan

3.6 Please also state your vehicle engine size AND fuel type:
Engine capacity: cc _____ PETROL OR DIESEL

3.7 If the car you are using is rented, how much are you paying per day to hire it? (in ZAR) R _____

4.1	How much spending money have you budgeted for your household on this trip for accommodation, food, equipment & entertainment? (in ZAR)	R _____
4.2	As you complete this survey today, would you say you are on, over or under budget? <input type="checkbox"/> ON budget <input type="checkbox"/> OVER budget <input type="checkbox"/> UNDER budget	
4.3	If under or over, by what percentage (approximately)?	% _____
4.4	How much would you say your personal <i>monthly after tax</i> income is? (in ZAR) (Please note: this is strictly confidential and for research analysis only) <input type="checkbox"/> less than R4,999 <input type="checkbox"/> R5,000 – 9,999 <input type="checkbox"/> R10,000 – 14,999 <input type="checkbox"/> R15,000 – 19,999 <input type="checkbox"/> R20,000 – 24,999 <input type="checkbox"/> R25,000 – 29,999 <input type="checkbox"/> R30,000 – 39,999 <input type="checkbox"/> R40,000 & over	

4.5	Does your household enjoy the time spent travelling to and from destinations on this trip? <input type="checkbox"/> Yes, a lot <input type="checkbox"/> Yes, a little <input type="checkbox"/> We're indifferent <input type="checkbox"/> No, not that much <input type="checkbox"/> Not at all
4.6	If you had <u>not</u> taken this holiday/trip would you still have taken a trip to another destination, stayed at home or be at work/working? <input type="checkbox"/> Home <input type="checkbox"/> Work/Working <input type="checkbox"/> Alternative Trip, specify destination: _____

4.7	On the day you left home, was this visit to the Agulhas Plain planned or not? <input type="checkbox"/> YES, this visit was planned <input type="checkbox"/> NO, this visit was not planned
4.8	If NO, please give the reasons why you made this <i>unplanned</i> visit to the Agulhas Plain? <input type="checkbox"/> Proximity / En Route <input type="checkbox"/> I/we needed to stop before reaching our next destination <input type="checkbox"/> Suited our needs more than planned alternatives <input type="checkbox"/> Cheaper than planned alternatives <input type="checkbox"/> Found out about places & activities of interest in Agulhas Plain whilst on our trip & decided to fit it into our holiday <input type="checkbox"/> Other, please specify _____
4.9	And again if NO (to Q 4.7), how highly or not does the Agulhas Plain <u>now</u> rank as a destination on this trip? <input type="checkbox"/> 1st <input type="checkbox"/> In the Top 3 <input type="checkbox"/> In the Top 5 <input type="checkbox"/> In the Top 10 <input type="checkbox"/> Below the Top 10

This demographic information about **yourself and your household**, including children, on this trip will be treated with the strictest of confidentiality

		PERSON 1 (YOURSELF)	PERSON 2	PERSON 3	PERSON 4	PERSON 5
5.1	Gender <i>Please tick:</i> M = Male F = Female	M. <input type="checkbox"/> F. <input type="checkbox"/>				
5.2	Age <i>Please state in full years</i>					
5.3	Race * (this information is purely for statistical analysis purposes)					
5.4	Highest level of education completed <i>Please tick as appropriate:</i> 0 = completed less than Grade 12 1 = Matric. certificate (or equivalent) 2 = Trade certificate, Diploma or equivalent 3 = Bachelors or Honours Degree (or equivalent) 4 = Masters Degree or higher 5 = Other	0. <input type="checkbox"/> 1. <input type="checkbox"/> 2. <input type="checkbox"/> 3. <input type="checkbox"/> 4. <input type="checkbox"/> 5. <input type="checkbox"/>	0. <input type="checkbox"/> 1. <input type="checkbox"/> 2. <input type="checkbox"/> 3. <input type="checkbox"/> 4. <input type="checkbox"/> 5. <input type="checkbox"/>	0. <input type="checkbox"/> 1. <input type="checkbox"/> 2. <input type="checkbox"/> 3. <input type="checkbox"/> 4. <input type="checkbox"/> 5. <input type="checkbox"/>	0. <input type="checkbox"/> 1. <input type="checkbox"/> 2. <input type="checkbox"/> 3. <input type="checkbox"/> 4. <input type="checkbox"/> 5. <input type="checkbox"/>	0. <input type="checkbox"/> 1. <input type="checkbox"/> 2. <input type="checkbox"/> 3. <input type="checkbox"/> 4. <input type="checkbox"/> 5. <input type="checkbox"/>

Ask for an extra sheet if you are travelling with more than 5 persons from your household!!

THANK YOU SO MUCH FOR YOUR TIME
Enjoy the rest of your trip!!

Individual Consumer Surplus Derivations (Models 2-5)

Model 2:

$$\text{Direct demand function, } TV = \exp(\beta_0 + \beta_2(\text{larger trip}) + \beta_3(\text{property}) + \beta_4(\text{nature}) + \beta_5(\text{shark cage}) + \beta_6(\text{inc1}) + \beta_7(\text{inc2}) + \beta_8(\text{inc3}) + \beta_9(\text{inc4}) + \beta_{10}(\text{inc5}) + \beta_{11}(\text{inc6}) + \beta_{12}(\text{inc7}) + \beta_{13}(\text{misexp})) (TC)^{\beta_1}$$

$$\text{Individual CS} = \int_{(TC)_i}^{\text{choke}} e^{(\beta_0 + \beta_2(\text{larger trip}) + \dots + \beta_{13}(\text{misexp}))} (TC)^{\beta_1} d(TC)$$

$$\text{Individual CS} = e^{(\beta_0 + \beta_2(\text{larger trip}) + \dots + \beta_{13}(\text{misexp}))} \left[\frac{1}{(\beta_1 + 1)} (TC)^{\beta_1 + 1} \right]_{(TC)_i}^{\text{choke}}$$

$$\text{Individual CS} = e^{(\beta_0 + \beta_2(\text{larger trip}) + \dots + \beta_{13}(\text{misexp}))} \left[\frac{1}{(\beta_1 + 1)} \left[(\text{choke})^{\beta_1 + 1} - (TC_i)^{\beta_1 + 1} \right] \right]$$

Model 3:

$$\text{Individual CS} = \int_{(TC)_i}^{\text{choke}} \left[\beta_0 + \beta_1(\ln(TC)) + \beta_2((\ln(TC))^2) + \beta_3(\text{first visit}) + \beta_4(\text{total party}) + \beta_5(\text{property}) + \beta_6(\text{nature}) + \beta_7(\text{activities}) + \beta_8(\text{inc1}) + \beta_9(\text{inc2}) + \beta_{10}(\text{inc3}) + \beta_{11}(\text{inc4}) + \beta_{12}(\text{inc5}) + \beta_{13}(\text{inc6}) + \beta_{14}(\text{inc7}) + \beta_{15}(\text{misexp}) \right] d(TC)$$

$$\text{Individual CS} = \left[\left[\beta_0 + \beta_3(\text{first visit}) + \beta_4(\text{total party}) + \beta_5(\text{property}) + \beta_6(\text{nature}) + \beta_7(\text{activities}) + \beta_8(\text{inc1}) + \beta_9(\text{inc2}) + \beta_{10}(\text{inc3}) + \beta_{11}(\text{inc4}) + \beta_{12}(\text{inc5}) + \beta_{13}(\text{inc6}) + \beta_{14}(\text{inc7}) + \beta_{15}(\text{misexp}) * ((\ln(TC))) \right] + \left[\frac{(\beta_1)}{2} (\ln(TC))^2 \right] + \left[\frac{(\beta_2)}{3} (\ln(TC))^3 \right] \right]_{(TC)_i}^{\text{choke}}$$

$$\text{Individual CS} = \left[(\beta_0 + \beta_3(\text{first visit}) + \dots + \beta_{15}(\text{misexp})) * (\ln(\text{choke}) - \ln(TC_i)) \right] + \frac{(\beta_1)}{2} \left[(\ln(\text{choke}))^2 - (\ln(TC_i))^2 \right] + \frac{(\beta_2)}{3} \left[(\ln(\text{choke}))^3 - (\ln(TC_i))^3 \right]$$

Model 4:

Direct demand function, $TV = \exp(\beta_0 + \beta_1(TC) + \beta_2(\text{larger trip}) + \beta_3(\text{property}) + \beta_4(\text{nature}) + \beta_5(\text{shark cage}) + \beta_6(\text{inc1}) + \beta_7(\text{inc2}) + \beta_8(\text{inc3}) + \beta_9(\text{inc4}) + \beta_{10}(\text{inc5}) + \beta_{11}(\text{inc6}) + \beta_{12}(\text{inc7}) + \beta_{13}(\text{misexp}))$

$$\text{Individual CS} = \int_{(TC)_i}^{\text{choke}} e^{(\beta_0 + \beta_1(TC) + \beta_2(\text{larger}) + \dots + \beta_{13}(\text{misexp}))} d(TC)$$

$$\text{Individual CS} = \left[\frac{1}{\beta_1} e^{(\beta_0 + \beta_1(TC) + \dots + \beta_{13}(\text{misexp}))} \right]_{(TC)_i}^{\text{choke}}$$

$$\text{Individual CS} = \frac{1}{\beta_1} \left[(e^{\beta_0 + \beta_1(\text{choke}) + \dots + \beta_{13}(\text{misexp})}) - (e^{\beta_0 + \beta_1(TC_i) + \dots + \beta_{13}(\text{misexp})}) \right]$$

Model 5:

$$\text{Individual CS} = \int_{(TC)_i}^{\text{choke}} \left[\beta_0 + \beta_1(\ln(TC)) + \beta_2(\text{total party}) + \beta_3(\text{enjoy travel}) + \beta_4(\text{larger trip}) + \beta_5(\text{property}) + \beta_6(\text{nature}) + \beta_7(\text{inc1}) + \beta_8(\text{inc2}) + \beta_9(\text{inc3}) + \beta_{10}(\text{inc4}) + \beta_{11}(\text{inc5}) + \beta_{12}(\text{inc6}) + \beta_{13}(\text{inc7}) + \beta_{14}(\text{misexp}) \right] d(TC)$$

$$\text{Individual CS} = \left(\left[\beta_0 + \beta_2(\text{total party}) + \beta_3(\text{enjoy travel}) + \beta_4(\text{larger trip}) + \beta_5(\text{property}) + \beta_6(\text{nature}) + \beta_7(\text{inc1}) + \beta_8(\text{inc2}) + \beta_9(\text{inc3}) + \beta_{10}(\text{inc4}) + \beta_{11}(\text{inc5}) + \beta_{12}(\text{inc6}) + \beta_{13}(\text{inc7}) + \beta_{14}(\text{misexp}) * (TC) \right] + \left[\beta_1 (TC (\ln(TC) - 1)) \right] \right)_{(TC)_i}^{\text{choke}}$$

$$\text{Individual CS} = \left[(\beta_0 + \beta_2(\text{total party}) + \dots + \beta_{14}(\text{misexp})) * (\text{choke} - TC_i) \right] + \beta_1 \left[\left[\text{choke} (\ln(\text{choke}) - 1) \right] - \left[TC_i (\ln(TC_i) - 1) \right] \right]$$

References

- Bellù L. and Cistulli V. (1997), Economic valuation of forest recreation services in the Liguria region (Italy). CSERGE Technical Paper 97-08, University of East Anglia, Norwich, and University College, London.
- Carr L. and Mendelsohn R. (2003), Valuing coral reefs: a travel cost analysis of the Great Barrier Reef. *Royal Swedish Academy of Sciences*. Vol. 32, No. 5, pp. 353-357.
- Cesario, F. J. and Knetsch, J. L. (1970), Time bias in recreation benefit estimates. *Water Resources*. Vol. 6, pp. 700-704.
- Cesario, F. J. and Knetsch, J. L. (1976), A recreation site demand and benefit estimation model. *Regional Studies*. Vol. 10, No. 1, pp. 97-104.
- Clawson, M. (1959), *Methods of measuring the demand for and the benefits of outdoor recreation*. Reprint number 10, Brookings Institutions, Washington D.C.
- Clawson, M and Knetsch, J. (1966), *Economics of outdoor recreation*. John Hopkins University Press, Baltimore.
- Common M. et al. (1997), The travel cost method: an empirical investigation of Randall's difficulty. CRES, Working Papers in Ecological Economics, Number 9705, ANU.
- Cowling R. M. and Richardson D. M. (1995), *Fynbos: South Africa's unique floral kingdom*. Fernwood Press, Cape Town.
- Freeman A. M. (1993), *The measurement of environmental and resource values: theory and methods*. Resources for the future, Washington D.C.
- Garrod G. and Willis K. G. (1999), *Economic valuation of the environment: methods and case studies*. Edward Elgar, UK.
- Gelderblom C. M. et al (2003), Turning strategy into action: implementing a conservation action plan in the Cape Floristic Region. *Biological Conservation*. Vol. 112, pp. 291-297.

Hotelling, H. (1949), "Letter to the National Park Service (Dated 1947): an economic study of the monetary evaluation of recreation in the national parks." U.S. Department of the Interior, Washington, D.C.

Kling C. (1989), The importance of functional form in the estimation of welfare. *Western journal of Agricultural Economics*. Vol. 14, no. 1, pp. 168-174.

Lochner P. et al. (2003), Aligning the diverse: the development of a biodiversity conservation strategy for the Cape Floristic Region. *Biological Conservation*. Vol. 112, pp. 29-43.

Markandya, A. et al. (2002), *Environmental economics for sustainable growth: a handbook for practitioners*. Edward Elgar, UK.

Martínez-Espiñeira R. and Amoaka-Tuffour J. (2009), Multi-destination and multi-purpose trip effects in the analysis of demand for trips to a remote recreational site. *Environmental Management*. Vol. 43, pp. 1146-1161.

Nardi, P. M. (2006), *Doing survey research: a guide to quantitative methods*. Pearson, Boston.

Pence G. et al. (2003), Evaluating combinations of on- and off-reserve conservation strategies for the Agulhas Plain, South Africa: a financial perspective. *Biological Conservation*. Vol. 112, pp. 253-273.

Rea, L. M. and Parker. R. A. (2005), *Designing and conducting survey research: a comprehensive guide*. Jossey-Bass, San Francisco.

Rosenthal D. H. (1987), The necessity for substitute prices in recreation demand analyses. *American Journal of Agricultural Economics*. Vol. 69, No. 4, pp. 828-837

Rouget M. (2003), Measuring conservation value at fine and broad scales: implications for a diverse and fragmented region, the Agulhas Plain. *Biological Conservation*. Vol. 112, pp. 217-232.

Smith, V. K. (1988), Selection and recreation demand. *American Journal of Agricultural Economics*. Vol. 70, pp. 29-36

Turpie, J. and Joubert. A. (2001), Estimating potential impacts of a change in river quality on the tourism value of Kruger National Park: An application of travel cost, contingent and conjoint valuation methods. *Water SA*. Vol. 27, No. 3, pp. 387-398.

Turpie J. K. (2003), Economic value of terrestrial and marine biodiversity in the Cape Floristic Region: implications for defining effective and socially optimal conservation strategies. *Biological Conservation*. Vol. 112, pp. 233-251.

Walsh, R. G. et al. (1989), Issues in non-market valuation and policy application: a retrospective glance. *Western Journal of Agricultural Economics*. Vol. 14, pp. 178-188

Ward F. A. and Beal D. (2000), *Valuing nature with travel cost models: a manual*. Edward Elgar, UK.

Woolridge, J. M. (2009), *Introductory econometrics: a modern approach*. South-Western Cengage Learning, International offices.

Younge A, and Fowkes S. (2003), The Cape Action Plan for the Environment: overview of an ecoregional planning process. *Biological Conservation*. Vol. 112, pp. 15-28.

Ziemer R. F. et al. (1980), Recreation demand equations: functional form and consumer surplus. *American Journal of Agricultural Economics*. Vol. 62, No. 1, pp. 136-141.