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A multi-attribute trade-off approach for advancing the management of marine wildlife tourism: a quantitative assessment of heterogeneous visitor preferences

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ABSTRACT

1. Wildlife tourism can be prone to unmitigated development to promote visitor satisfaction that is all too often progressed at the cost of ecological integrity. A manager is thus faced with the dual task of enhancing the tourist experience and protecting the wildlife species. Accordingly, this mandate requires research into how tourists would respond to proposed wildlife-management plans.
2. This study examines the heterogeneity of tourist preferences for wildlife management at a stingray-feeding attraction in the Cayman Islands, using a latent class stated preference choice model. A sample of visitors to Stingray City Sandbar (SCS) evaluated hypothetical wildlife viewing experiences in a discrete choice experiment. Its scenarios were characterized by seven attributes such as animal-feeding and handling rules, ecological outcomes, social crowding, and management cost (defined as a conservation access fee).
3. The latent class segmentation identified two groups in the population: approximately 68% preferred the implementation of fairly strict management rules, while the other 32% valued more the maintenance of status quo with its intensive human—wildlife interactions. Despite the differences between the 'pro-management' and the 'pro-current' segments, both exhibited a preference for the continuation of feeding and handling the stingrays (albeit at different levels of intensity) suggesting that one effective way to implement any management actions is to alter the promotional and marketing strategies for SCS. Other survey questions on trip experience, conservation values, and socio-demographics were used to define these classes further, with the main distinguishing trait being the level of concern for potential impacts occurring at SCS. The discrepancies between the two segments became most obvious when calculating their respective market shares of support for alternative management strategies.
4. This approach to determining visitor preferences can help explain how the various segments will be affected by management options, and therefore can provide the basis for developing feasible strategies that will assist wildlife managers in maximizing tourist satisfaction while achieving wildlife-protection goals.

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INTRODUCTION

Wildlife tourism, as one particular form of non-consumptive tourism, can be embroiled in conflicts between conservation, animal welfare, visitor satisfaction, and economic profitability (Reynolds and Braithwaite, 2001). Wildlife tourism can also be considered a type of 'soft' ecotourism (Weaver, 2001); it is characterized by being a short-length component of a multi-

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purpose trip in which travellers, reliant on interpretation, expect a high level of comfort and services. The wildlife tourist is typically part of a larger group that is physically passive, and usually leaves the area in the same, or somewhat degraded condition. Given the similar characteristics in terms of volume, purpose of travel, and reliance on infrastructure of services, wildlife tourism can be regarded as a form of mass tourism (Weaver, 2001). As a type of mass tourism, wildlife tourism is of special concern in the Caribbean, a region of unique flora and fauna and with a large cruise-tourism industry. In 1998 the Caribbean received 50% of total world capacity of cruise tourism placement, and many established Caribbean destinations now receive more cruise ship passengers than stopover tourists (Johnson, 2002). However, cruise tourism may lead to congestion at traditional destination venues and specifically at 'soft' eco-tourism attractions. Indeed, in the absence of deliberate management intervention, wildlife tourism attractions can evolve over time to the detriment of both the visitor experience and the focal wildlife species (Duffus and Dearden, 1990; Higham, 1998; Garrod and Fennell, 2004). Consequently, managers of wildlife tourism face the dual mandate of catering to the needs of the visitor and of conservation of the natural resource base. When balancing these conflicting objectives it can be very useful to understand the tourist's relationship with the wildlife resource (Duffus and Deardon, 1990). Among the many possible research directions in the human dimensions of wildlife management, the investigation of user preferences for any proposed management alternative of the wildlife-tourism attraction is one option with direct management implications.

While wildlife tourists may all be participating in a common activity — i.e. photographing, touching, feeding or experiencing wildlife, they may not necessarily be one homogeneous group in terms of their beliefs, values or expectations (Duffus and Dearden, 1990), and may not fit one rather generic typology/description as proposed in some ecotourism typologies (Lemelin and Smale, 2005). Instead of characterizing a single user type, research into the human dimensions of wildlife has found that within and across attractions, wildlife-tourists differ by ethics, values, motivations, levels of specialization, and desired wildlife experiences. All of these aspects affect their expectations of and experiences with their respective wildlife interaction (Martin, 1997; Moscardo, 2000; Higham and Carr, 2002; Scott and Thigpen, 2003; Curtin and Wilkes, 2005; Dearden *et al*., 2006). Consequently, it is not unreasonable to assume that wildlife tourists may also be heterogeneous in their preferences for the intensity and type of site management proposed.

Research in other areas of tourism and recreation has indeed demonstrated divergent visitor preferences for the management of recreation activities in parks (Borrie *et al*., 2002; Kempermann and Timmermans, 2006), the management of congestion in wilderness areas (Michael and Reiling, 1997; Boxall *et al*., 2003), and recreational fisheries (Oh and Ditton, 2006). Although tourist preferences for the management of non-consumptive, or appreciative, wildlife tourism attractions have been investigated (Davis *et al*., 1997; Birtles *et al*., 2002a; Lewis and Newsome, 2003; Parsons, 2003), to date no study has explored heterogeneous preferences for the management of wildlife viewing and/or interaction. However, such information would be essential to develop and adapt products and facilities, as well as to make decisions about permitted activities, levels and types of use (Moscardo, 2000). Such detailed information would allow managers to more accurately anticipate how the various tourist profiles might react to new strategies or management policies (Davenport *et al*., 2002), and to establish whether each respective tourist type is compatible with the resource capabilities (Wall, 1993). Without such an understanding, inappropriate products or services may be offered, resulting in reduced visitor satisfaction, or in possible detrimental impacts on the natural resource base. As such, implementing a management plan that can satisfy the desires and expectations of a heterogeneous tourist demand and can simultaneously maintain ecological integrity is a challenging, yet crucial task.

Lately, multivariate methods have been introduced to human dimensions research which are especially well suited to uncover the preferences for management options in more detail (Aas *et al*., 2000; Hunt, 2005). Stated preference research in the form of discrete choice experiments constitutes a significant alternative to the traditional approach of investigating single-item questions. In a stated choice survey, respondents choose between two or several hypothetical management scenarios that are composed of various attributes of differing levels. Heterogeneity of preferences can be tested on individual visitor segments that have been defined a priori by the researcher (i.e. segments may be predefined or determined by cluster/factor analysis) and then followed by a between-segment statistical comparison. For this purpose, segmentation criteria may be socio-demographic characteristics, or behavioural traits and antecedents as proposed by social psychological theory (e.g. crowd-tolerance, recreation specialization, activity commitment, etc.) (Arnberger and Haider, 2005; Oh and Ditton, 2006). An alternative method is to uncover segments directly from the stated choice responses in underlying (latent) classes and test if these groupings differ in their management support. For this purpose latent class models are the most commonly applied types (Greene and Hensher, 2003; Train, 2003), which have also found application in recreation and human dimensions research (see Hunt *et al*. (2005) for a random parameters logit approach; and Oh and Ditton (2006) and Boxall and Adamowicz (2002) for latent class applications). These latent typologies can then be further described using numerous exogenous psychographic and socio-economic variables (Boxall and Adamowicz, 2002). A latent class approach will be the focus of this paper.

This study differs from previous research of wildlife-tourism management in two ways. First, existing studies asked management-preference questions to tourists either in single-item format or in a ranking format, but they did not allow tourists to consider tradeoffs they might make between alternatives. As such, these studies are unable to conclusively determine the manner in which the tourist's experience would be affected, or whether management actions would change tourist behaviour. Second, these studies have not explored at all whether the sampled population possessed heterogeneous preferences for the various management options.

The overall purpose of this study was to understand and predict preferences and degree of support for management options of feeding marine life in the Cayman Islands. The most popular tourist site in the Cayman Islands (CI) is Stingray City Sandbar (SCS), a warm, shallow water (1.6 m maximum

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depth) sandbar in the North Sound, approximately 7740 m^2 in area and located roughly 300 m inside the fringing reef. It is here that stingrays congregate to be fed frozen squid by tourists and tour-boat operators. Due to its massive popularity, SCS supports over 50 local snorkel and dive tourism operations and hosts approximately one million visitors a year, almost half of all visitors to the Islands. The numbers have more than doubled since 2000 (CI MoT, 2002). A day-long activity which first began in the mid-1980s (Shackley, 1996), a maximum of 2500 tourists can now be present at a given time at the shallow sandbar, engaged in unsupervised feeding, touching, and holding of stingrays as part of their marine tourism experience. Some tour operators provide only the most rudimentary information, while others provide an informative session in-water. The organized trip also provides photo opportunities, with some tour operators holding the ray in or out of the water, or placing it on people's backs and heads while the picture is taken. Without any management or codes of practice, the site has become congested, and all stakeholders (government officials, tour operators, tourists and locals) express concern about the long-term sustainability of the attraction (Gina Ebanks-Petrie, CI Director of the Environment, pers. commun.; C.A.D.S., pers. obs.). Since 2003, a management plan has been drafted for the site, but without any information on tourist acceptance or confirmed ecological necessity, stakeholders are unsure of its utility.

This study sought to ascertain whether any management of the human—wildlife interaction would significantly impact visitor preferences. The specific objectives were to: (1) determine tourist preferences for proposed management actions using stated-preference choice modelling and testing for latent heterogeneity in management choices; (2) investigate visitor profiles around trip experience, motivations, and conservation values; (3) identify and describe the latent classes using these visitor-profiles as explanatory variables, and lastly; (4) demonstrate the value of elucidating heterogeneous preferences by examining their differences in supporting alternative management policies with a decision-support tool.

METHODS

The latent class choice model

A stated-preference method, the discrete choice experiment (DCE) was used to determine hypothetical management preferences for SCS. A DCE attempts to estimate the utility associated with individuals' evaluations of a designed set of multi-attribute management scenarios (McFadden, 1974; Ben-Akiva and Lerman, 1985). The analysis of DCEs is based on the assumptions of the general discrete choice model (McFadden (1974)—also referred to as the random utility model), and assumes consumers seek to maximize utility when they make choices (Hunt *et al.*, 2005). The random utility theory suggests that each individual holds a deterministic (observable) component, and a random (unobservable, or error) component of utility:

$$U_i = V_i + \varepsilon_i \quad (1)$$

where U_i is the overall utility of an attribute *i*, and is composed of V_i, a deterministic parameter vector of attributes, and ε_i, the random component for the non-deterministic component of a respondent's choice. An individual will choose alternative *i* if $U_i > U_j$ for all $j \neq i$. Although it is assumed that this type of choice behaviour is deterministic on the individual level, modelling is conducted as an aggregate stochastic process, in which the probability of choosing alternative *i* is:

$$\text{Prob } \{i \text{ chosen}\} = \text{prob } \{V_i + \varepsilon_i > V_j + \varepsilon_j; \ \forall j \in C\} \quad (2)$$

where *C* is the set of all possible alternatives. Choice models are typically analysed with a multinomial logit model (MNL) to produce regression estimates, known as part-worth utility (PWU) parameters for each attribute, the sum of which represents respondent preferences as a whole:

$$P(i|i \in M) = \frac{\exp(X_i, \beta)}{\sum_{j=M} \exp(X_j, \beta)} \quad (3)$$

where the probability of choosing alternative *i* from all scenarios included (*M*) equals the exponent of all the measurable elements of alternative *i* (i.e. *X*, the vector of explanatory variables, and β, the parameter vector to be estimated) over the sum of the exponent of all measurable elements of all alternatives, *j*.

To account for preference heterogeneity in respondent choice the basic MNL form can be expanded to a mixed logit form, such as a latent class formulation. In the latent class model (LCM), the population is assumed to consist of a finite number of heterogeneous groups of individuals (i.e. segments) that are each characterized by relatively homogeneous preferences that differ substantially in their preference structure from each other (Birol *et al.*, 2006). Class membership depends on the unobserved social, attitudinal and motivational characteristics of the respondents, and therefore the number of segments is determined endogenously by the data. The latent class choice model assumes that respondent characteristics affect choice indirectly through their impact on segment membership, and thus accordingly combines a choice model with a probabilistic approach for determining the unobserved (i.e. latent) class membership of individuals (Boxall and Adamowicz, 2002; Vermunt and Magidson, 2005).

Latent class models assume discrete changes in parameters across different classes that are distinguished by individual heterogeneity (Breffle *et al.*, 2005). For each class, the model estimates a separate set of choice model parameters (PWUs), and it is these different parameter estimates for each class that account for preference heterogeneity in the choice model. Within a class the choice probabilities for all scenarios included (*M*) are assumed to be generated by the mixture conditional logit model:

$$P(\textit{choice j by individual i in choice situation t}|\textit{class c}) = \frac{\exp(X_{it,j}\beta_c)}{\sum_{j=M}^{J_i} \exp(X_{it,j}\beta_c)} \quad (4)$$

where β is the class-specific vector *j*th alternative, and *j* and *X* are defined as above (see Greene and Hensher, 2003 and Morey *et al.*, 2006 for more details on the LCM). The latent class parameter functions were estimated using maximum likelihood estimation in Latent Gold Choice 4.0 (Vermunt and Magidson, 2005; Statistical Innovations, Inc.). The maximum likelihood analysis produces regression estimates (PWUs), standard errors and *z*-scores for each attribute level, and statistical differences are assessed using the Wald statistic.

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In the design of a discrete choice experiment, two or more hypothetical profiles are combined in choice sets, and respondents choose the most preferred alternative (profile) from each set they are asked to evaluate (Louvière *et al*., 2000). The hypothetical management scenarios crafted for SCS were described in terms of several attributes related to trip quality, tourist—stingray regulations, and ecological consequences (Table 1). These attributes were defined a priori as being (1) important features for management, (2) relevant to tourist satisfaction and stingray fitness, and (3) within the influence of managers. The levels for each attribute provided sufficient variation to matter for tourists and to allow for the simulation of current and potential conditions. Each attribute consisted of four levels, with one level representing the current level of management (i.e. no management). All other levels represented less congestion, stricter regulations, or lower negative ecological impacts. Although we could have chosen more ecologically intrusive attributes (e.g. higher congestion, or more lenient interaction rules, which would be rather unlikely), we were primarily interested in gauging respondents' management preferences as drafted by the Caymanian stakeholders as opposed to attributes contributing to a positive or negative tourism experience. To make the scenarios realistic, an attribute was included to describe a potential conservation access fee that would be charged to help cover the cost of implementing management initiatives at the attraction (Figure 1). The inclusion of such a 'payment vehicle' is common practice in DCEs (Louvière *et al*., 2000). All attributes were effects coded except the cost attribute, which was linear and quadratic coded (Louviere *et al*., 2000). In the final model the quadratic term was dropped as it was not significant at the 90% confidence level.

The hypothetical scenarios in the choice experiment were generated by using a 7×4 orthogonal fractional factorial design, which permitted estimation of all main effects. In such a design, all of the levels of attributes in the choice alternatives are varied systematically (Raktoe *et al*., 1981). Sixteen versions of four choice sets were generated by this design for a total of 64 choice sets. Each respondent evaluated one of these versions. In each choice set, respondents were asked to choose the most preferred outcome among three identified alternatives: current scenario, management scenario '1', and management scenario '2'. The 'current' scenario served as base and was present in all choice sets, and its levels were also included in the management scenario description.

Extensions of the DCE: hypothetical management scenarios

It is important for planners and managers to be able to predict user support for management alternatives composed of all possible combinations of attribute levels (Aas *et al*., 2000). A decision support tool (DST) was consequently created as a forecasting tool to estimate which management scenario (and its subsequent potential ecological outcome) would garner the most and least support among respondents of each latent class. A feasible management scenario was also included to examine how the classes would differ in their support for a plan that could readily be implemented by Caymanian officials. This overall evaluation of the hypothetical management scenarios is based on the calculation of the probability of choice for one alternative over any other alternative(s) (Haider and Rasid, 2002). The predicted probabilities were calculated substituting the PWUs into Equation (3). Part-worth utilities were estimated without including the intercepts in the model so that the base scenario and the latent class were given equal

Table 1. Attributes and levels used in the stated preference discrete choice experiment

Attribute	Description	Level
Number of boats	Average number of boats tourist experiences at any one time	1. **40** 2. 30 3. 20 4. 10
Number of people	Average number of people tourists encounter at any one time	1. **1000** 2. 750 3. 500 4. 250
Feeding rules	Who is allowed to feed?	1. **Operator and tourist** 2. Operator only 3. No feeding on this trip 4. No feeding at all
Handling rules	Who is allowed to hold rays?	1. **Operator and tourist hold ray out of water** 2. Operator and Tourist hold in water 3. Operator only hold in water 4. No holding of ray
Number of surrounding stingrays	Number of stingrays tourist will be able to see definitively and up close	1. **55** 2. 40 3. 25 4. 10
Risk of injury to stingrays	Injuries caused by boat collisions, other aggressive rays, and people	1. **High** 2. Medium 3. Low 4. None
Conservation access fee	Fee for accessing SCS in addition to the cost of the trip itself. Proceeds are earmarked for the improvement of the tourism experience and stingray health	1. 20$ USD 2. 10$ USD 3. 5$ USD 4. **None**

Bolded levels represent the current situation of no management.

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A. If you had the opportunity to return to Stingray City Sandbar, please choose the one management scenario that would maximize your experience if there were only these 3 options:

Please check one box only: ☐ ☐ ☐

Site Characteristics	Current	Scenario #1	Scenario #2
# Boats allowed	40	20	30
# People allowed	1000	250	500
Stingray Feeding By:	Operator and Tourist	No feeding on this trip	Operator only
Stingray Handling By:	Operator and Tourist hold out of water	Operator and Tourist hold in water	Operator only hold in water
Number of surrounding stingrays	55	55	10
Risk of Injury to Stingrays	High	None	Medium
Conservation Access Fee	No fee	10$ US	20$US

Figure 1. One of the 128 choice sets used in the discrete choice experiment.

market share in the DST (i.e. that choosing any alternative is equally likely). Deviations from this market share are calculated as the percentage of relative changes in demand over 'no management'. This type of DST modelling is possible because the current base levels were included in the descriptions of each choice set, and was done to remove any bias related to current experience.

Survey design

The survey was divided into four main sections: (1) attitudinal questions regarding the trip experience; (2) motivational questions to ascertain the importance of wildlife tourism attributes and concern for certain wildlife tourism impacts; (3) questions to establish socio-demographic and trip characteristics of the respondent; and (4) a discrete choice experiment to determine tourist preferences for wildlife-tourism management. The purpose of questions in (1) – (3) was to explain the latent groups from the DCE in a decision-tree analysis, CHAID. In the 'trip experience' section of the survey, respondents were presented with 13 items (to be rated on a Likert scale) comprising visual amenity, learning, cost, crowding issues, and stingray interactions, and asked how well their expectations were met for each component. They were also given a traditional rating question of overall satisfaction with their trip to SCS. In the next section the 'conservation values' were measured; for instance, respondents' level of importance conferred to wildlife and environmental conservation, their self-perceived level of knowledge about current conservation issues concerning wildlife and the natural environment, and their membership of conservation or environmental organizations. A further question asked about the contribution of eight specific activities (rated on a Likert scale) towards a satisfying wildlife-tourism experience, from interacting with animals with varying degrees of proximity, to learning, contributing and minimizing wildlife impacts. Concern about the potential effects of tourism at SCS (rated on a Likert scale) referred to specific health effects on the stingray, the surrounding environment, and to tourist safety. Questions were based, in part, on work by Birtles *et al.* (2002b), who conducted surveys with day-use visitors on minke whale-watching excursions, and Lewis and Newsome's (2003) work on stingray-feeding in Hamelin Bay, Western Australia, as well as concerns identified by local Caymanian stakeholders. The third section of the survey consisted of the standard socio-demographic questions and trip characteristics, such as the number of previous visits to SCS, the time of day the excursion took place, and the number of docked cruise ships the day of the trip.

Data collection

The survey was conducted in July and August 2004 in Grand Cayman. A pretest was administered to Department of Environment research officers and to a subset of cruise line passengers who visited SCS, to test for applicability, survey duration, and level of understanding. The final questionnaire version was targeted at cruise ship passengers only, as these make up over 85% of visitors to SCS (the others being tourists to the Cayman Islands). SCS visitors were intercepted at the tour-boat dock, immediately after their return from their boat trip to SCS. The self-administered surveys were handed out on the buses that would return the tourists to the ferry tender in Georgetown, an approximately 20 min trip. No more than 15 surveys were distributed on a given bus, and respondents were strategically selected (i.e. no one below the age of 18 was chosen, and surveys were given to only one person that appeared to be part of a family to minimize pseudo-replication). All other selection criteria were applied randomly. A small minority of tourists (approximately 5%) refused to take part in the survey when asked.

RESULTS

General respondent characteristics

Of the 744 questionnaires completed and returned, 612 contained completed choice sets (i.e. a total of 2448 choice sets), and were subject to the subsequent analyses. Generally, respondents were divided somewhat equally between sexes (61% female), were predominantly from the USA (>95%), had a median age range of between 30 and 39, a median education level of completed university, were mostly employed

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as opposed to self-employed, and had a median income range between \$70 000 and \$89 000. Most respondents sailed on Carnival Cruises' boats (80%), with Royal Caribbean Cruise Line (15%), Celebrity Cruises (3.5%) and Holland America (1.5%) supplying the remaining respondents. Ship volume ranged from one to four cruise ships in port, during surveying times. The majority of respondents were intercepted when three ships were docked (50%). Respondents were sampled equally between 8:30 a.m. and 2:00 p.m., and only 11% of respondents were repeat visitors to SCS.

In terms of respondent trip experiences, the mean overall satisfaction among the tourists surveyed was a very high 6.14 out of 7 (0.92 S.D.). With regards to their conservation values, 87% of respondents strongly agreed with the statement that conservation of wildlife and the natural environment is very important. However, less than 10% strongly regarded themselves as very informed about current conservation issues concerning wildlife and the natural environment; only 50% somewhat agreed with this statement, 24% were neutral, and the remainder either somewhat or strongly disagreed. Only 11.6% of the respondents belonged to organizations primarily concerned with the conservation of wildlife or the natural environment.

The decision tree analysis, CHAID, which will be used later to explore the characteristics of the latent classes, relies on categorical variables; therefore it was decided to reduce the survey questions with multiple items into single categorical indicator variables which are amenable to CHAID analysis and interpretation. For instance, the questions related to the concerns of potential impacts occurring at SCS (eight items rated on a Likert scale) were added to an overall concern score, and then grouped into three categories. About one quarter of respondents (26%) had 'very high concern', while about half (52%) voiced a 'mild concern' and 22% had a 'very low concern'. Principle component and subsequent cluster analyses (after Légeré and Haider, 2008) were used for the questions elucidating visitors' expectations regarding their trip to SCS, and the importance of various wildlife-tourism attributes for a satisfying wildlife experience. For the 'trip expectations' question, the analysis of the 13 items (rated on a Likert scale) produced three meaningful segments: 'crowd-sensitive' (46% of respondents) to people and boats, 'ray interaction was not a highlight' (18%), and 'everything novel, and learned much' (36%). The second analysis of the eight items evaluating the importance of wildlife-viewing activities produced two segments: those who desire wildlife-tourism features to bring them 'up close and personal' to the wildlife (85%), and others who feel 'learning and contributing' (15%) are features of a more satisfying wildlife experience.

Latent class choice model

In estimating the latent class models, 1, 2, 3, and 4-segment solutions were assessed. All statistical indicators (i.e. log likelihood at convergence, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC)), suggested that latent classes improved the model compared with the single segment model, thus supporting the existence of heterogeneity in the data. The optimal number of segments was chosen at two, as it represented the lowest BIC and the lowest marginal change in AIC ($BIC_{2\text{-segment}} = 4347.42$; $AIC_{2\text{-segment}} = 4157.86$), which are the standard statistical criteria for comparing the various model solutions (Swait, 1994; Bhat, 1999).

The results of the DCE are presented in Table 2 and Figure 2. For simplicity the overall model is not shown, but only the part-worth utility estimates for the two-class latent class model. The interpretation of the classes is in part a function of the statistically significant intercept, revealing that Class 1 (68% of respondents) very much favours any kind of management intervention over the status quo, while Class 2 (32%) is indifferent between the average managed scenarios and the base alternative. Further interpretation of the classes can be made by looking more closely at the attributes themselves and at the individual levels. All variables, except the number of boats, are statistically significant in both classes, indicating that they significantly affect a respondent's choice of alternatives (Table 2: Wald Statistic I); and all estimates point to the intuitively correct direction. A quick overview of the estimates (Figure 2) also shows some significant differences between segments on several variables (Table 2: Wald Statistic II), as well as statistical differences in levels between classes (Table 2: *t*-statistic), but in no case do they contradict themselves in their fundamental directions. While fewer people are preferred overall (Wald I), a high density of people affect Class 1 respondents more negatively when compared with the average. Both classes also feel that too few encountered rays would detract from the experience, but the highest number of rays is more strongly preferred by Class 2 when compared with Class 1. Similarly, a reduction in the risk of injury to stingrays is preferred, but a high risk is strongly disfavoured and no-risk is strongly favoured by Class 1 respondents. The main class differences, all of which are statistically significant (Wald II), however, occur between variable levels relating to animal welfare and the conservation access fee. Class 1 is amenable to having its feeding and handling regulations with the rays regulated, whereas Class 2 is not; furthermore, Class 1 is more willing to pay a conservation access fee despite the price; Class 2 strongly prefers an inexpensive fee. In sum, Class 1 shows concern about animal welfare and ecological consequences, is in favour of implementing regulatory frameworks, and is willing to pay a conservation fee; therefore, it has been labelled 'pro-management'. Class 2 clearly favours the status quo with regards to feeding and handling regulations, and consequently has been labelled 'pro-current'.

The next question worth exploring is whether these two segments differ significantly on some of the other survey variables. Given the fact that these exogenous variables are categorical variables, and are potentially correlated with each other, CHAID (chi-squared automatic interaction detection analysis) was applied to explore potential relationships between latent class membership as the dependent variable, and psychographic, socio-demographic, and trip characteristics variables as independent variables. A chi-square goodness-of-fit test screens out and subsequently selects a set of predictors and their interactions that optimally predict the dependent variable, i.e. class membership (Magidson and Vermunt, 2005). For this analysis, all external variables were added and a maximum tree depth of 10 levels was specified, with the minimum number of cases in the initial and terminal nodes set at 25 and 5, respectively (SPSS v.14, SPSS Inc., Chicago, Ill.). Of the 14 external variables entered into CHAID, six related to the two latent groups in a significant way (Figure 3): extent of concern for potential impacts occurring at SCS, their attribute

Table 2. Part-worth utility parameter estimates (*z*-statistics) for the two-class latent class model

Variable	Levels	Segment 1 'Pro-management'	Segment 2 'Pro-current'	*t*-statistic
Number of boats	40 boats	−0.115 (−1.643)	−0.029 (−0.163)	−0.443
	30 boats	0.022 (0.303)	−0.131 (−0.680)	0.784
	20 boats	0.142* (−2.045)	−0.004 (−0.018)	0.810
	10 boats	−0.049 (−0.703)	0.163 (0.954)	−1.314
Number of people[1]	1000 people	−0.394* (−5.567)	−0.166 (−0.790)	−1.106
	750 people	0.015 (0.16)	−0.004 (−0.019)	0.145
	500 people	0.268* (3.657)	0.243 (1.329)	0.006
	250 people	0.114 (1.521)	−0.074 (−0.362)	0.976
Feeding rules[1,2]	Operator and tourist feed	0.470* (6.544)	1.532* (9.288)	**−5.824**
	Operator feeds only	0.126 (1.771)	−0.265 (−1.187)	1.777
	No feeding on this trip	−0.273* (−3.743)	−0.589* (−2.468)	1.097
	No feeding at all	−0.322* (−4.551)	−0.679* (−2.794)	1.456
Handling rules[1,2]	Operator and tourist hold ray out of water	−0.046 (−0.653)	0.753* (4.289)	**−4.421**
	Operator and tourist hold ray in water	0.568* (7.898)	0.416* (2.416)	0.735
	Operator only holds ray in water	0.102 (1.386)	0.012 (0.062)	0.485
	No holding of ray	−0.6239* (−8.6805)	−1.181* (−4.658)	**2.238**
Number of surrounding rays[1]	55 surrounding rays	−0.0211 (−0.291)	0.353* (2.013)	**−2.121**
	40 surrounding rays	0.2452* (3.268)	0.285 (1.646)	−0.295
	25 surrounding rays	0.158* (2.19)	−0.062 (−0.335)	1.185
	10 surrounding rays	−0.382* (−5.086)	−0.576* (−2.646)	0.959
Risk of injury to rays[1]	High injury risk to ray	−0.972* (−12.273)	−0.486* (−2.549)	**−2.497**
	Medium injury risk to ray	0.125 (1.837)	0.143 (0.834)	−0.105
	Low injury risk to ray	0.474* (6.622)	0.399* (2.487)	0.417
	No injury risk to ray	0.373* (5.316)	−0.056 (−0.319)	**2.456**
Conservation access fee[1,2]	0$ −20$ (numerical)	−0.021* (−3.850)	−0.059* (−3.794)	
Intercept[1]	Management Scenarios 1 and 2	0.306 (4.09)	0.033 (0.203)	
	Current, No Management Scenario	−0.306 (0.138)	−0.033 (−0.241)	
Observations	2448			
Log likelihood	−2056.0			
Rho-squared$_{Overall}$	0.403			

Attribute levels were effects coded (except conservation fee), and underlined levels represent situations which correspond to the current state of no management. Bolded *t*-statistics denote significant difference between class levels.
*Denotes levels with significantly different z-scores; i.e. the level is significant with respect to the reference point, which in effects coding, is defined as the negative sum of the estimated coefficients.
[1] Indicates the attribute has a significant impact on respondent choice of alternatives at the 5% level (Wald Statistic I).
[2] Indicates the attribute parameter estimates are significantly different between segments at the 5% level (Wald Statistic II).

preferences for a satisfying wildlife tourism attraction, membership in wildlife conservation organizations, previous site visits, trip experience at SCS, and gender. The first split, based on 'concern for potential impacts' occurring at SCS, does not come as any surprise. Respondents with low concern for impact belonged predominantly to the status quo class (57% out of 105 respondents), while at the other end of the spectrum, the vast majority of high-concern respondents belonged to the pro-management class (82% of 126). These two relationships are so strong that no further splits emerged as significant, and therefore they represent terminal nodes. However, the vast majority of respondents ($N = 381$) belonged to the 'mild concern' category, which contained a similar relative proportion of the two latent classes. Here, CHAID produced interesting further insights during subsequent rounds of splitting. A small terminal group of respondents was interested in learning of and contributing to the wildlife tourism experience, with very few individuals representing the

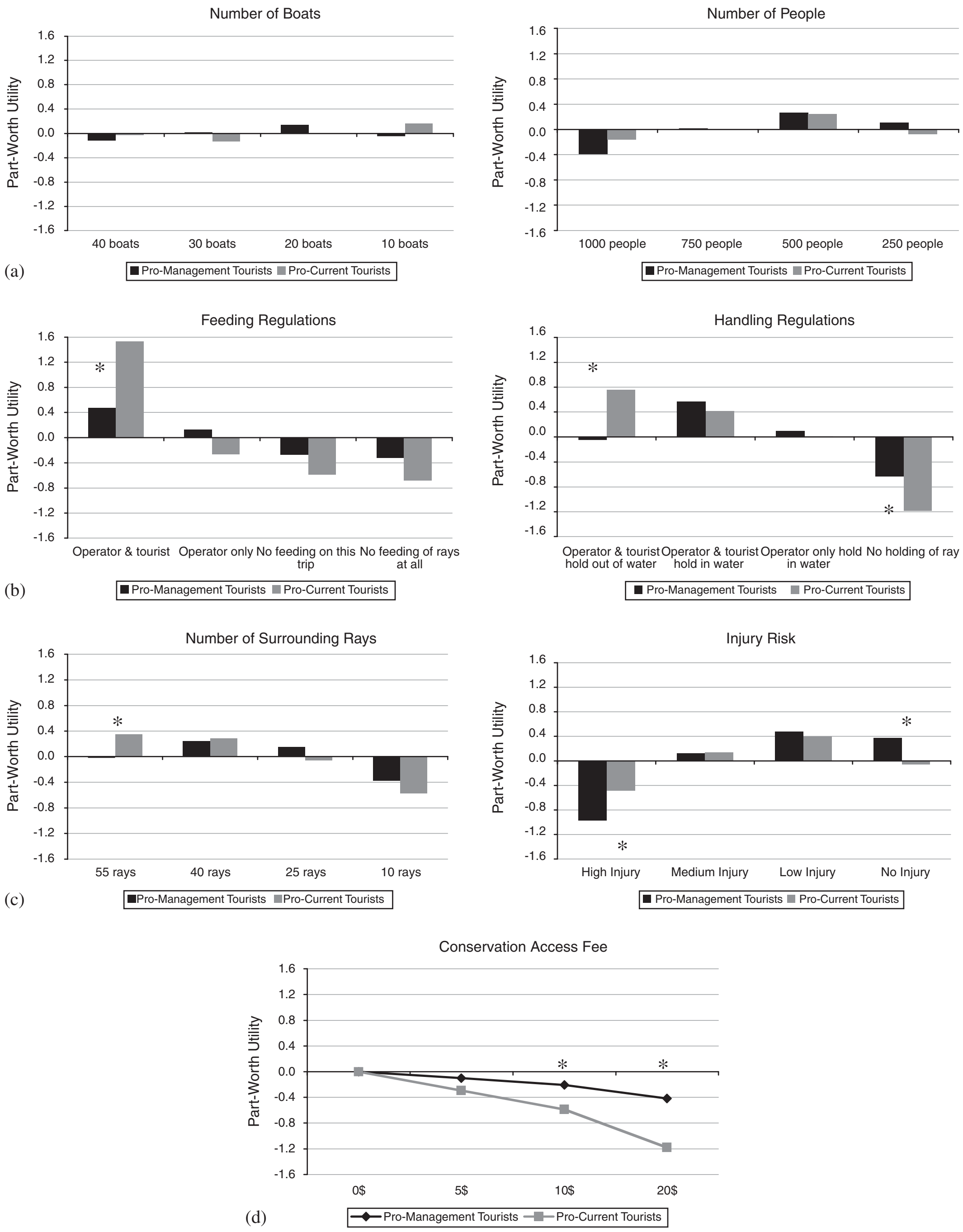

Figure 2. Part-worth utilities (PWUs) estimated from the latent class discrete choice experiment of management options for Stingray City Sandbar, in particular, a. Trip Quality; b. Regulatory Framework; c. Ecological Consequence; and d. Willingness-to-Pay. 'Pro-management' refers to the latent segmentation of tourists who prefer some form of management to be implemented at Stingray City Sandbar, while 'pro-current' tourists are in support of no management measures. * Denotes levels that are significantly different between classes.

pro-current segment, and is contrasted by a large group interested in getting up close and personal with the stingrays. In a further split among this latter assemblage, a small terminal group represents members of conservation organizations who were mostly pro-management, while the majority had no such membership. Next, a small terminal group represents repeat visitors, of whom more than half belonged to the pro-current class. Most of the first-time visitors to SCS belonged to the pro-management class, with the exception of males whose trip experience was characterized by a novel learning environment: this small, terminal node belongs to the pro-current segment (6.2%).

Extensions of the LCM: management scenario analyses

Three possible future scenarios are described and evaluated in Table 3. The first two scenarios (i.e. attribute combinations of the DCE) describe profiles that would produce the highest and

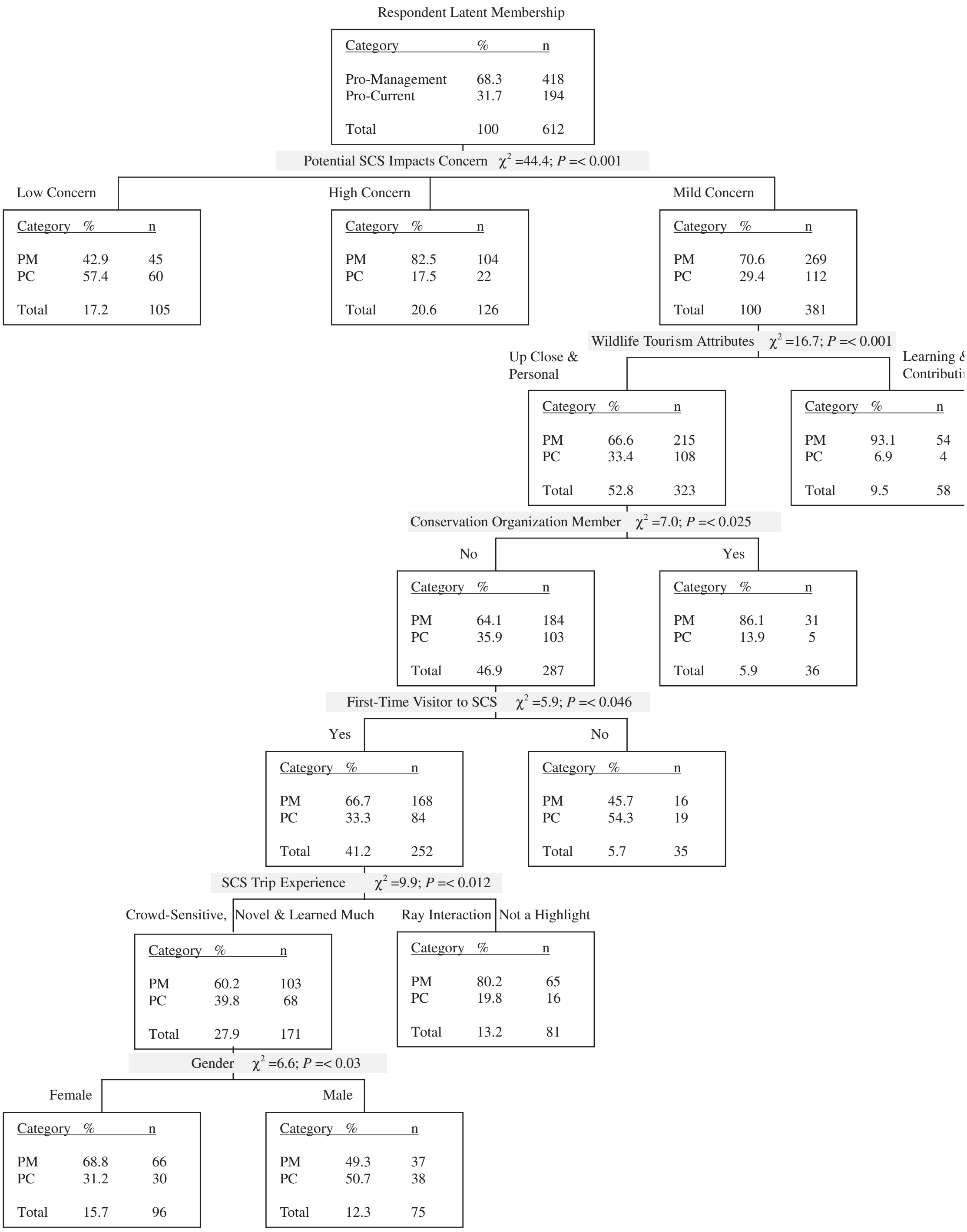

Figure 3. CHAID classification of probabilistically-categorized Pro-management and Pro-current respondents from the latent class choice model for identification and predictive purposes.

lowest support from the respondents' perspective, and the third column represents an attribute combination of a feasible management plan from a manager's perspective. The last row of the table indicates the support these scenarios would garner when compared with the status quo of 'no management' (the comparison is based on the contrast between the status quo situation and the respective profile, and reports the percentage of relative change from the original 50% situation of initial equal market share). This comparative assessment shows that 'pro-management' and 'pro-current' respondents behave rather similarly when confronted with the least popular management scenario (declines of −68.5% and −99.7%, respectively vis-à-vis the current situation). The management scenario that both groups would prefer most results in a similar magnitude of relative change, but in the positive direction (+96.7% for 'pro-management' tourists and +68.3% for 'pro-current'). While these two latent segments apparently more or less agree with their evaluations of the best

Table 3. Decision support tool

Attribute	Best-case scenario		Worse-case scenario		Feasible management plan	
	PM	PC	PM	PC	PM	PC
Number of boats	20	10	40	40	20	20
Number of people	500	500	1000	1000	500	500
Feeding rules	Operator and Tourist	Operator and Tourist	No feeding at all	No feeding at all	Operator only	Operator only
Handling rules	Operator and Tourist hold in water	Operator and Tourist hold out of water	No handling at all	No handling at all	Operator only holds in water	Operator only holds in water
Number of surrounding stingrays	40	55	10	10	40	40
Risk of injury to stingrays	Low	Low	High	High	Low	Low
Conservation access fee	None	None	$20	$20	$5	$5
Relative change in support (%) over 'no management'	+96.7	+68.3	−68.5%	−99.7	+94.5	−61.6

Relative change in support of various hypothetical management scenarios per latent segment when compared with the base scenario (No Management) given equal market share (i.e. that choosing any alternative is equally likely). 'Best' and 'worse-case scenarios' are derived from the respondents' perspective, and 'feasible management plan' from the managers'.

and worst scenarios, they differ fundamentally in their preferences for scenarios in between. The scenario representing a feasible management plan consists of a reduction in the congestion variables, an 'operator only' wildlife-interaction rule, a resultant drop in the number of rays and their injury risk, as well as a $5 fee (in US currency). Whereas support for this management option drops by only about 2% to 94.5% for the 'pro-management' respondents, it changes from +68% to −62% for 'pro-current' tourists; i.e. this segment would rather stay with the current, no-management situation.

DISCUSSION

Tourists visiting Cayman Islands' 'Stingray City Sandbar' are not homogeneous. Instead, when they are divided into two latent groups based on their responses to the stated choice task, they seem to divide around management preferences: one group, representing approximately two-thirds of the respondents, was labelled as 'pro-management' as they prefer actions that reduce congestion, impacts on stingrays, and the number of stingrays present. This group is also amenable to the payment of a conservation fee, and is concerned about a dramatic reduction in the risk of injury to rays. The second group of about one-third of respondents was labelled as 'pro-current' as they would support a small access fee but strongly desire to continue directly interacting with the stingrays and engaging in potentially injurious activities. Congestion reduction is of no importance, and the excitement of being surrounded by a multitude of rays would be diminished with fewer animals.

Although it might be expected that all tourists would be sensitive to crowds, as they indicated in a separate question on 'trip expectations' (46% were crowding sensitive), the sensitivity of the PWUs for the number of people (250 to 1000) and boats (10 to 40) allowed was comparatively low compared with other attributes. This somewhat surprising result might be influenced by the high density situation on cruise ships, as well as the short amount of time visitors are allocated for sightseeing trips. Overcrowding behaviour on day-tours and its resultant effect on cruise ship passenger satisfaction is a rather neglected area of research with potentially important implications for nature-based tourism product development for cruise lines (Thurau *et al*., 2007).

Two attributes in the DCE were purposefully chosen to reflect activities that both can have fitness impacts on wildlife and contribute to tourist satisfaction: feeding and handling of animals. Results show that management plans designed to strictly limit these activities—and therefore lessen potential impacts on stingrays—produced the largest negative part-worth utilities and hence the lowest support among the tourist groups (for pro-current more so than pro-management respondents). Again, the result may reflect the nature of the attraction, as getting close to the stingray is a major part of tourists' expectations, and affects the quality of their experience accordingly. The attraction of getting close to a focal animal is not unique and has been documented by others: swimming with whales and whale sharks (Davis *et al*., 1997; Valentine *et al*., 2004); and stingray feeding in Western Australia (Lewis and Newsome, 2003). Moscardo (2006) recommends that for the long-term success of wildlife tourism, more research be directed into this type of consumer satisfaction, as wildlife-based tourism is rarely considered a tourism service. An interesting upshot of this study is that although a low risk of injury to the animal is acceptable by the majority of participants, tourists are largely unaware of the potentially negative risks involved in feeding and handling wildlife in general (Orams, 2002), and specifically at SCS (Semeniuk and Rothley, 2008), as they still wish to have direct interactions with the rays, Furthermore, half of the respondents were characterized as having mild concern for potentially undesirable impacts occurring at SCS (52%), and in the CHAID analysis, 71% of these respondents were labelled 'pro-management', which seems to be in contradiction to their strong desire to minimize the risk of injury to stingrays in the DCE. This discrepancy might be a consequence of a lack of information concerning the actual impacts of these interactions on the stingrays and are discussed further below.

The attribute 'number of surrounding rays' was chosen as an ecological outcome to reflect either stingray emigration or death, without being explicit about the cause (and hence biasing respondents' choice). Fewest number of rays (10) was least preferred by both classes, although a slight reduction from the current estimate (40) was preferred by 'pro-management' respondents. In other studies, wildlife tourists confer importance on the number and variety of wildlife seen for a satisfying wildlife experience (e.g. birders (Scott and Thigpen, 2003) scuba divers (Rudd and Tupper, 2002), and wildlife viewers in National Parks (Hammitt *et al*., 1993)). The somewhat contrary results of this study may in part have been influenced by the large number of stingrays already encountered; the lowest level in this attribute (10 rays) represents an 80% reduction from what is currently experienced, which may be perceived as undesirable by some. In contrast, in a similar stingray-feeding site in Western Australia, the average number of rays seen was 6.7, and garnered a satisfaction rating of 4.65 (out of 5) (Lewis and Newsome, 2003). First-time visitors to the site are likely to have no prior expectations, and because only 11% of visitors are return visitors, a reduction in rays may not be too influential to the overall quality of the tourist experience.

Lastly, the payment-cost attribute demonstrates that an imposed conservation access fee of $5 (US) or less would not be regarded as unfavourable by the vast majority of cruiseship passengers. Typical tourism and outdoor recreational valuation studies focus on use values to determine consumer surplus either for investment purposes or non-market value assessments (Nunes and van den Bergh, 2001). Very few valuation studies assess tourists' willingness-to-pay for the management of nature tourism, especially those that are wildlife-based (although see Davis and Tisdell, 1998; Walpole *et al*., 2001; and Sorice *et al*., 2007 for WTP studies on the management of komodo-dragon, whale-shark, and scuba tourism, respectively). The willingness to pay any additional amount (in the form of an access fee) comes as some surprise for this mass tourism product (Tremblay, 2001). The mass tourism character of this stingray-feeding attraction is indeed confirmed by the small percentage of respondents who are interested in learning of and contributing to the wildlife tourism experience in contrast to the majority who wish to partake in direct interactions with the animals (Weaver, 2001). Garrod (2002) attributes the lack of valuation studies in ecotourism to a wariness of planners and managers to accept valuation studies as these have been inefficient in supporting the fundamental goals of ecotourism. In this present study, the WTP attribute was embedded in a multi-attribute scenario, forcing respondents to simultaneously assess tradeoffs between several variables. This grounding in realistic options should lead to less biased WTP estimates and hence be of interest to managers.

In 2003, the Cayman Island stakeholders convened a committee to agree upon a set of detailed rules for crowding alleviation and stingray protection for Stingray City Sandbar. Regulations included limits of a maximum of 100 people per boat, a 20-boat maximum at any one time, and 1500 people in the water at any one time; restrictions on feeding the stingrays (details are undetermined at this point); prohibitions on taking marine life of any kind, including the removal of stingrays from the water; and the nature and collection mechanisms for a proposed access fee. Issues that needed to be addressed, however, were the acceptability of the proposed management plan to tourists, the pricing structure for trips to SCS (although a $0.25 to $1 fee per visitor has been discussed), and the effect, if any, these plans would have on both stingray fitness and visitor response.

Within the scenarios presented, tourists seemed relatively unconcerned about crowding conditions. In addition, alleviating crowding will not be sufficient to offset the decrease in visitor satisfaction if managers at SCS are intent on implementing tourist-stingray regulations. Despite the relevancy of these results from a tourist perspective, alleviating crowding conditions for stingrays is essential, as research has shown a high rate of physical trauma to the rays as a consequence of boat collisions (Semeniuk and Rothley, 2008). According to Newsome *et al*. (2005), policy priority for wildlife tourism must be given to ecological sustainability. Feeding and handling stingrays can have negative impacts on their fitness (Newsome *et al*., 2004; Semeniuk *et al*., 2007; Semeniuk and Rothley, 2008); and although tourists are unwilling to have their interactions with stingrays severely limited, explaining to and informing tourists of the conservation purpose of these regulations and the ecological outcomes to be expected (i.e. fewer, but healthier stingrays), may increase support for the plan, since any reduction in the risk of stingray injury is strongly favoured by both latent classes (i.e. a teleological approach; Garrod and Fennell (2004)). Nevertheless, the marketing and promotion of the Cayman Island stingray attraction cultivates an expectation of being able to feed and touch the stingrays and of being surrounded by a multitude of animals. Wildlife tourism marketing is essential in order to inform prospective tourists what the experience has to offer, as well as persuade them to visit it (Kibicho, 2006). A crucial management initiative, therefore, may be to alter the marketing and operation of Stingray City Sandbar, including more realistic imagery of what one can expect (including a decrease in the number of surrounding rays). Finally, the unanimous acceptance of tourists to pay a conservation access fee has promising implications. The cruiseline industry has a large stake in Caribbean tourism, and may be reluctant to allow any form of tax imposed on its clientele (Lester and Weeden, 2004), or permit changes in the price structuring of the SCS trip as most packages are sold on-board (Tapper, 2006). With the findings that strongly support the feasibility of a fee of up to $5

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(regardless of tourist typology) which could either improve the incomes for tour operators, or be declared a conservation fee to support management and conservation actions, the Cayman government can demonstrate to the cruise industry the acceptability of the access fee as well as its conservation-related purpose.

PWUs, however, send an even more powerful message to management if they are used in a decision support tool (DST), which calculates the change in visitor support for a scenario compared with the status quo (Table 3). It becomes clear that the two segments would react fundamentally differently to the most feasible management plan as proposed by CI. The 'pro-management' respondents would prefer this plan over status quo, while 'pro-current' respondents would strongly oppose it and their support would decrease relatively by 62%. What appears to be driving the divergent support is the restriction of handling and feeding rays by 'the tour operator only'. Opposition to this regulation is so strong by the 'pro-currents' group that no other feasible attribute levels can compensate for it, while in the case of the 'pro-management' segment, the loss of one desirable attribute level is offset by other variables, especially the reduction in risk of stingray injury. Of course, this hypothetical behaviour suggests that implementation of this feasible management plan in SCS will lead to a shift in user characteristics over time, with 'pro-current' typologies being usurped almost completely by 'pro-management' visitors; the assumption behind this argument is a displacement process of pro-current visitors by additional pro-management tourists. The findings from our DST demonstrate the need for information on the sample of the population using the natural resources, especially when sensitive decisions concerning trip experience are being considered (Jurowski *et al*., 1995).

In identifying the latent segments to target, a range of psychographic, trip characteristic and socio-demographic variables was used. Models using respondent characteristics to describe latent heterogeneity in individuals' preferences among alternatives have recently been introduced in recreation research (Boxall and Adamowicz, 2002; Hunt *et al*., 2005; Morey *et al*., 2006). The decision-tree CHAID analysis revealed that psychographic typologies were more important overall than demographic variables in explaining the latent class membership. These results are consistent with previous research that showed psychographic information to be more powerful in understanding nature-tourists' behaviour (Mehmetoglu, 2007). Concern for potential impacts at SCS was the most important distinguishing factor of the latent classes (Figure 3). Although an attitudinal segment, it is nonetheless an actionable one, since education of tourist consequences can be used to increase support for the proposed management plan (as discussed above). In the attempt to split the 'mild concern' sub-group into further definable segments, it was found that 'pro-current' respondents were more likely to be male (by a small percentage) and also more likely to return to SCS. This latter finding suggests that these visitors' previous trip behaviours and motivations significantly affected their preferences for certain management characteristics, a result consistent with previous research (Woodside and Dubelaar, 2002). Considering that the 11% repeat visitors belong mostly to the pro-current segment (from CHAID), the likelihood that any management plan imposed at SCS may cause a decline in 'pro-current' tourists increases further. Consequently, this visitor reaction is most likely a desirable outcome for managers.

Summarizing, the existence of divergent preferences from the study suggests several implications for the Caymanian resource managers charged with the responsibilities of protecting the environment and providing recreational opportunities: (1) different groups may require different management practices; (2) communication and education through various forms of media may play a key role in resolving conflicting preferences; and (3) the wildlife tourism attraction may need to undergo marketing and promotional restructuring in order to implement the desirable changes. The results of this study strongly suggest that not all visitors will be affected equally, and therefore an understanding of the various segments of tourist preferences for management actions and their ecological outcome at SCS is essential. This consideration will consequently enable resource managers to formulate practical management guidelines that would garner support over the status quo, initiate regimes that would be acceptable to all segments, or design wildlife experiences that are preferred by the targeted segments (Kibicho, 2006).

The purpose of the study was to evaluate visitor preferences for wildlife-tourism management options. It is acknowledged, however, that this study is not without its limitations. The sample is composed of predominantly American tourists in the summer. While it is considered that low season results are conservative, further research is needed to determine whether tourists during the high season (i.e. mainly UK residents in winter) differ significantly in their preferences for management. Furthermore, the respondents were cruise ship passengers only. However, tourists who actually stay on the islands make up less than 15% of the visitors to SCS (CI MoT, 2002), but it would be equally informative if their preferences were explored, especially if Cayman Island managers decide to launch a marketing campaign to increase the representation of these visitors to SCS. Another limitation of the study is the omission of other exogenous variables that could explain variability in the data. Management preference may be influenced by contextual and situational variables such as type of weather, water conditions, and tourist state of mind (e.g. sea-sickness). A more detailed data collection and analysis would be required. Lastly, it is stressed that this case study represents a rather unique tourist attraction with an associated set of tourist types not necessarily found in other tourism wildlife destinations, and therefore generalizations should be made with caution.

CONCLUSION

Marine tourism is one of the fastest growing market segments in the tourism industry (Orams, 1999), and marine wildlife tourism, a component of the wider ecotourism sector, is considered to be growing rapidly in both volume and value (Cater, 2003). As demand for wildlife interaction experiences increases in most countries with coastlines, so does the need to develop wildlife tourism attractions that meet tourist demand and shape the tourism experience while maintaining environmental quality and wildlife health.

Nonetheless, it has been demonstrated that a detailed understanding of tourist preferences and tradeoffs is an

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essential component of wildlife tourism management. Studies such as this can assist in describing the composition of the tourist population of interest, in explaining who will be affected by management planning and how, and in suggesting conceivable strategies that can satisfy the sometimes conflicting goals of wildlife health and visitor satisfaction. By allowing respondents to evaluate and trade-off several attributes simultaneously, the discrete choice survey provided a more comprehensive assessment of visitor preferences than traditional opinion surveys that ask respondents about attributes one at a time. Furthermore, a latent class approach to the DCE estimated segments that were behaviour-based, providing a richer interpretation of results that allow for the effective targeting of the consumer population, as discussed above. This study is the first to date to demonstrate preference heterogeneity for wildlife-tourism management, using a latent class approach to a discrete choice experiment, and employing exogenous tourist typologies to identify these preference classes. Due to the quantitative nature of the study that incorporates both social and ecological attributes, further research can include the integration of these findings with biological studies on wildlife fitness, for example, in a simulation model that predicts the outcome of various management plans on tourist population numbers, stingray population size, and stingray life expectancy; this is the focus of ongoing research.

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REFERENCES

Aas Ø, Haider W, Hunt L. 2000. Angler responses to harvest regulations in Engerdal, Norway: a conjoint based choice modeling approach. *North American Journal of Fisheries Management* **20**: 940–950.

Arnberger A, Haider W. 2005. Social effects on crowding preferences of urban forest visitors. *Urban Forestry and Urban Greening* **3**: 125–136.

Ben-Akiva M, Lerman S. 1985. *Discrete Choice Analysis: Theory and Application to Travel Demand*. The MIT Press, Cambridge, MA.

Bhat C. 1999. *Quasi-random maximum simulated likelihood estimation of the fixed multinomial logit model*. University of Texas, Austin.

Birol E, Karousakis K, Koundouri P. 2006. Using a choice experiment to account for preference heterogeneity in wetland attributes: the case of Cheimaditida wetland in Greece. *Ecological Economics* **60**: 145–156.

Birtles RA, Arnold PW, Dunstan A. 2002a. Commercial swim programs with dwarf minke whales on the northern Great Barrier Reef, Australia: some characteristics of the encounters with management implications. *Australian Mammology* **24**: 23–38.

Birtles RA, Valentine AP, Curnock M, Arnold P, Dunstan A. 2002b. Incorporating visitor experiences into ecologically sustainable dwarf minke whale tourism in the northern Great Barrier Reef. CRC Reef Research Centre Technical Report No 42, CRC Reef Research Centre Ltd, Townsville.

Borrie WT, Freimund WA, Davenport MA. 2002. Winter visitors to Yellowstone National Park: their value orientations and support for management actions. *Research in Human Ecology* **9**: 41–48.

Boxall PC, Adamowicz WL. 2002. Understanding heterogeneous preferences in random utility models: a latent class approach. *Environmental and Resource Economics* **2002**: 421–446.

Boxall P, Rollins K, Englin J. 2003. Heterogeneous preferences for congestion during wilderness experience. *Resource and Energy Economics* **25**: 177–195.

Breffle W, Morey E, Thacher J. 2005. Combining attitudinal and choice data to improve estimates of preferences and preference heterogeneity: a FIML, discrete-choice, latent-class model. Online discussion paper, available at: http://www.colorado.edu/economics/morey/papers/JLCBreffle MoreyThacher12022005.pdf

Cater E. 2003. Between the devil and the deep blue sea: dilemmas for marine ecotourism. In Garrod B and Wilson JC (eds), *Marine Ecotourism*: *Issues and Experiences*. Channel View: Clevedon; 37–47.

Cayman Islands Ministry of Tourism (CI MoT). 2002. '*Focus for the Future*'*- A Tourism Policy Framework for the Cayman Islands*. The Tourism Company: London.

Curtin S, Wilkes K. 2005. British wildlife tourism operators: current issues and typologies. *Current Issues in Tourism* **8**: 455–478.

Davenport MA, Borrie WT, Freimund WA, Manning RE. 2002. Assessing the relationship between desired experiences and support for management actions at Yellowstone National Park using multiple methods. *Journal of Park and Recreation Administration* **20**: 51–64.

Davis D, Tisdell CA. 1998. Tourist levies and willingness to pay for a whale shark experience. *Tourism Economics* **5**: 161–174.

Davis D, Banks S, Birtles A, Valentine P, Cuthill M. 1997. Whale sharks in Ningaloo Marine Park: managing tourism in an Australian marine protected area. *Tourism Management* **18**: 259–271.

Dearden P, Bennett M, Rollins R. 2006. Implications for coral reef conservation of diver specialization. *Environmental Conservation* **33**: 353–363.

Duffus DA, Dearden P. 1990. Non-consumptive wildlife-oriented recreation: a conceptual framework. *Biological Conservation* **53**: 213–231.

Fredline E, Faulkner B. 2001. Wildlife Tourism Research Report No. 22, Status Assessment of Wildlife Tourism in Australia Series, International Market Analysis of Wildlife Tourism. CRC for Sustainable Tourism, Gold Coast, Queensland.

Garrod B. 2002. Monetary valuation as a tool for planning and managing ecotourism. *International Journal of Sustainable Development* **5**: 353–371.

Garrod B, Fennell DA. 2004. An analysis of whalewatching codes of conduct. *Annals of Tourism Research* **31**: 334–352.

Greene WH, Hensher DA. 2003. A latent class model for discrete choice analysis: contrasts with mixed logit.

DOI: 10.1002/aqc

Transportation Research Part B: *Methodological* **37**: 681–698.

Haider W, Rasid H. 2002. Choice modeling for public involvement in environmental assessment (EA): assessing municipal residents' preferences for water supply options. *Environmental Impact Assessment Review* **22**: 337–360.

Hammitt WE, Dulin JN, Wells GR. 1993. Determinants of quality wildlife viewing in Great Smoky Mountains National Park. *Wildlife Society Bulletin* **21**: 21–30.

Higham JES. 1998. Tourists and albatrosses: the dynamics of tourism at the Northern Royal Albatross Colony, Taiaroa Head, New Zealand. *Tourism Management* **19**: 521–531.

Higham J, Carr A. 2002. Profiling tourists to ecotourism operations. *Annals of Tourism Research* **29**: 1171–1174.

Hunt LM, Haider W, Bottan B. 2005. Accounting for varying setting preferences among moose hunters. *Leisure Sciences* **27**: 297–314.

Johnson D. 2002. Environmentally sustainable cruise tourism: a reality check. *Marine Policy* **26**: 261–270.

Jurowski C, Uysal M, Williams DR, Noe FP. 1995. An examination of preferences and evaluations of visitors based on environmental attitudes: Biscayne Bay National Park. *Journal of Sustainable Tourism* **3**: 73–86.

Kempermann ADAM, Timmermans HJP. 2006. Heterogeneity in urban park use of aging visitors: a latent class analysis. *Leisure Sciences* **28**: 57–71.

Kerstetter D, Hou J, Lin C-H. 2004. Profiling Taiwanese ecotourists using a behavioural approach. *Tourism Management* **25**: 491–498.

Kibicho W. 2006. Tourists to Amboseli National Park: a factor-cluster segmentation analysis. *Journal of Vacation Marketing* **12**: 218–231.

Légeré AM, Haider W. 2008. Trend analysis of motivation based clusters at the Chilkoot Trail National Historic Site of Canada. *Leisure Sciences* **30**: 158–176.

Lemelin RH, Smale B. 2005. Wildlife viewer archetypes: are they all ecotourists? *Proceedings from the 11th Canadian Congress on Leisure Research. The Two Solitudes*: *Isolation or Impact?* Malaspina University-College, Nanaimo, BC.

Lester J-A, Weeden C. 2004. Stakeholders, the natural environment and the future of Caribbean cruise tourism. *International Journal of Tourism Research* **6**: 39–50.

Lewis A, Newsome D. 2003. Planning for stingray tourism at Hamelin Bay, Western Australia: the importance of stakeholder perspectives. *International Journal of Tourism Research* **5**: 331–346.

Louviere J, Hensher D, Swait J. 2000. *Stated Choice Methods: Analysis and Applications in Marketing, Transportation and Environmental Valuation*. Cambridge University Press.

Magidson J, Vermunt JK. 2005. An extension of the CHAID tree-based segmentation algorithm to multiple dependent variables. In Weihs C, Gaul W (eds), *Classification*: *The Ubiquitous Challenge*. Springer: Heidelberg.

Martin SR. 1997. Specialization and differences in setting preferences among wildlife viewers. *Human Dimensions of Wildlife* **2**: 1–18.

McFadden D. 1974. The measurement of urban travel demand. *Journal of Public Economics* **3**: 303–328.

Mehmetoglu M. 2007. Typologising nature-based tourists by activity—theoretical and practical implications. *Tourism Management* **28**: 651–660.

Michael JA, Reiling SD. 1997. The role of expectations and heterogeneous preferences for congestion in the valuation of recreational benefits. *Agricultural and Resource Economics Review* **27**: 166–173.

Morey E, Thacher J, Breffle W. 2006. Using angler characteristics and attitudinal data to identify environmental preference classes: a latent-class approach. *Environmental and Resource Economics* **34**: 91–115.

Moscardo G. 2000. Understanding wildlife tourism market segments: an Australian marine study. *Human Dimensions of Wildlife* **5**: 36–53.

Moscardo G. 2006. Is near good enough? Understanding and managing customer satisfaction with wildlife-based tourism experiences. In Prideaux B (ed.), *Managing Tourism and Hospitality Services*: *Theory and International Application*. CABI Publishing: Oxfordshire; 38–53.

Newsome D, Lewis A, Moncrieff D. 2004. Impacts and risks associated with developing, but unsupervised, stingray tourism at Hamelin Bay, Western Australia. *International Journal of Tourism Research* **6**: 305–323.

Newsome D, Dowling RK, Moore SA. 2005. *Wildlife Tourism*. Channel View Publications, Clevedon, UK.

Nunes PALD, van den Bergh JCJM. 2001. Economic valuation of biodiversity: sense or nonsense? *Ecological Economics* **39**: 203–222.

Oh C-K, Ditton RB. 2006. Using recreation specialization to understand multi-attribute management preferences. *Leisure Sciences* **28**: 369–384.

Orams M. 1999. *Marine Tourism—Development, Impacts and Management*. Routledge: New York.

Orams MB. 2002. Feeding wildlife as a tourism attraction: a review of issues and impacts. *Tourism Management* **23**: 281–293.

Parsons ECM. 2003. Seal management in Scotland: tourist perceptions and the possible impacts on the Scottish tourism industry. *Current Issues in Tourism* **6**: 540–546.

Raktoe BL, Hedayat A, Federer WT. 1981. *Factorial Designs*. John Wiley and Sons: New York.

Reynolds PC, Braithwaite D. 2001. Towards a conceptual framework for wildlife tourism. *Tourism Management* **22**: 31–42.

Rudd MA, Tupper MH. 2002. The impact of Nassau grouper size and abundance on scuba diver site selection and MPA economics. *Coastal Management* **30**: 133–151.

Scott D, Thigpen J. 2003. Understanding the birder as tourist: segmenting visitors to the Texas hummer/bird celebration. *Human Dimensions of Wildlife* **8**: 199–218.

Semeniuk CAD, Speers-Roesch B, Rothley KD. 2007. Using fatty acid profile analysis as an ecological indicator in the management of tourist impacts on marine wildlife: a case of stingray-feeding in the Caribbean. *Environmental Management* **40**: 665–677.

Semeniuk CAD, Rothley KD. 2008. Costs of group-living for a normally solitary forager: effects of provisioning tourism on southern stingrays *Dasyatis americana*. *Marine Ecology Progress Series* **357**: 271–282.

Shackley M. 1996. *Wildlife Tourism*. International Thomson Business Press: London.

Sorice MG, Oh C-K, Ditton RB. 2007. Managing scuba divers to meet ecological goals for coral reef conservation. *AMBIO* **36**: 316–322.

Swait JR. 1994. A structural equation model of latent segmentation and product choice for cross-sectional revealed preference choice data. *Journal of Retailing and Consumer Services* **1**: 77–89.

Tapper R. 2006. Wildlife watching and tourism: a study on the benefits and risks of a fast growing tourism activity and its impacts on species. Report prepared for United Nations Environment Program (UNEP) and the Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

Thurau BB, Carver AD, Mangun JC, Basman CM, Bauer G. 2007. A market segmentation analysis of cruise ship tourists visiting the Panama Canal Watershed:

DOI: 10.1002/aqc

opportunities for ecotourism development. *Journal of Ecotourism* **6**: 1–18.
Train K. 2003. *Discrete Choice Methods with Simulation*. Cambridge University Press: Cambridge.
Tremblay P. 2001. Wildlife tourism consumption: consumptive or non-consumptive? *International Journal of Tourism Research* **3**: 81–86.
Valentine PS, Birtles A, Curnock M, Arnold P, Dunstan A. 2004. Getting closer to whales ? Passenger expectations and experiences, and the management of swim with dwarf minke whale Interactions in the Great Barrier Reef. *Tourism Management* **25**: 647–655.
Vermunt JK, Magidson J. 2005. *Latent GOLD 4.0 User's Guide*. Statistical Innovations Inc: Belmont, MA.
Wall G. 1993. Towards a tourism typology. In Nelson JG, Butler R, Wall G (eds), *Tourism and Sustainable Development*: *Monitoring*, *Planning*, *Managing*. Heritage Resources Centre: Waterloo, Ontario; 45–58.
Walpole MJ, Goodwin HJ, Ward KGR. 2001. Pricing policy for tourism in protected areas: lessons from Komodo National Park, Indonesia. *Conservation Biology* **15**: 218–227.
Weaver DB. 2001. Ecotourism as mass tourism: contradiction or reality? *Cornell Hotel and Restaurant Administration Quarterly* **April**: 104–112.
Woodside AG, Dubelaar C. 2002. A general theory of tourism consumption systems: a conceptual framework and an empirical exploration. *Journal of Travel Research* **41**: 120–132.