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Visitor preferences and willingness to pay for coastal attributes in Barbados

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ABSTRACT

Coastal and marine resources in Barbados supply a wide range of goods and services including seafood, numerous recreation opportunities, wildlife habitat, and coastal protection. These resources also serve as the foundation of the Barbados tourism product and provide indirect economic support via employment, income, and tax revenues. Despite their obvious importance to the economy and culture of Barbados, the economic value of many aspects of coastal and marine resources have not been directly studied. An understanding of preferences and willingness to pay for coastal and marine characteristics can be useful in terms of developing efficient, cost-effective natural resource policies, particularly with regard to tourism, the principle economic driver in Barbados. This research summarizes the results of an economic valuation study aimed at understanding visitor perceptions of environmental quality, preferences for coastal amenities and willingness to pay for changes in coastal lodging attributes. Results indicate that visitors to Barbados have strong preferences for beach-front lodging and a strong aversion to beach litter. Differences in willingness to pay to avoid litter at the lower end of the litter spectrum illustrate the potential for significant economic gains to be realized through beach cleanup efforts. Tourists also display an aversion to narrow beaches, but do not seem to place much value on additional width beyond a threshold width of 8–10 m.

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1. Introduction

Travel and tourism is the second largest and fastest growing industry in the world, directly contributing 10 percent of 2014 global GDP (over US\$7.6 trillion) and employing over 277 million people (WTTC, 2015a). In terms of the relative importance of travel and tourism's total contribution to GDP, the Caribbean is the most tourism-dependent region in the world (WTTC, 2015b). The country of Barbados is no exception, ranking in the top twenty countries in the world in terms of the relative importance of travel and tourism to GDP, employment, capital investment and exports (WTTC, 2015c).

As is the case with many Caribbean destinations, tourists are drawn to Barbados by the beauty of the coastal and marine environment. It is estimated that 95 percent of tourism areas in

Barbados are located in the coastal zone (IDB, 2013) and over 70 percent of hotels are located along the coastline (Cashman et al., 2012). In spite of their importance to the economy of Barbados, coastal resources are under considerable pressures (Government of Barbados, 2010, p. 108). Anthropogenic factors such as over-fishing and coastal development (and the accompanying sedimentation and pollution) threaten to diminish the quality of coastal and marine resources, jeopardizing the viability of the tourism product. The effects of climate change in terms of land loss, beach erosion, and damage to reefs are also of particular concern as the associated impacts on tourism are expected to extend throughout the economy (Cashman et al., 2012). The challenge of coastal management in tourist destinations is to provide both protection of the natural environment and a level of sustainable development that facilitates accommodation and recreation (Semeoshenkova and Newton, 2015).

Tourism-based development in the coastal zone brings an array of market activities that often impose negative externalities on the environment. For example, the tourism industry plays a significant

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role in the amount of litter that is dispersed along coastlines with the amount of litter on beaches linked to visitor density and tourism activities (Fillmann et al., 2005). Data from the International Coastal Cleanup, collected in Barbados since 1989, shows the vast majority of marine litter (nearly 80 percent) comes from the shoreline and recreation activities of the local population and visitors. This litter includes beverage caps and lids, cups, plates, plastic utensils, bags and food containers. The presence of litter in marine and coastal areas can result in economic losses due to reductions in visitation rates and tourist spending, diminished net economic value to visitors through reduced satisfaction and opportunity costs associated with private and public spending for beach cleanup and maintenance (Ofiara and Brown, 1999; Ten Brink et al., 2009). The United Nations General Assembly formally recognized the problems associated with marine debris in 2005 with Resolution A/60/L.22 “Oceans and Law of the Sea”, which, in part, notes a lack of information and data on marine debris and calls for further examination of the scope of the effect of marine debris on the marine environment and associated economic loss (United Nations General Assembly, 2005).

Beach erosion and sea level rise have long been recognized as a social and economic concern for coastal communities, especially those vulnerable to the effects of coastal storms and dependent upon tourism. Like all coastlines, the beaches in Barbados are dynamic, with the volume of sand present at any particular beach often changing significantly over time (Fish et al., 2008). Shoreline erosion in Barbados is estimated to be occurring at a rate of 15 m per 100 years, or approximately one half-foot per year (Government of Barbados, 2010, p. 108). While much of this change is attributable to natural causes, increased density of coastal development, combined with the destruction of reef habitat from long term pollution and runoff have most likely exacerbated the degree of beach erosion (Mycoo, 2006). Concern over the effects of coastal erosion on economic development and tourism lead to the creation of the Coastal Conservation Project Unit (CCPU) charged with overseeing the island's first coastal conservation study in 1982. In 1995 the CCPU was designated as a permanent government agency and renamed the Coastal Zone Management Unit (CZMU).

The effects of erosion are of particular concern on the island's south and west coasts where the majority of tourism development is located. Moore et al. (2010) report that the long-term projected rise in sea levels (on the order of 0.5–1 m) are likely to impact more than 40 percent of hotels on the island. To mitigate damages from the changing character of the beaches, Barbados has selectively employed man-made erosion-control structures, including revetments, breakwaters, groynes, seawalls and gabions to varying degrees of success (Brewster, 2007). Barbados also has a setback requirement of 30 m from the high water mark. The continued use of such measures including beach nourishment through sand replacement is the subject of ongoing debate.

Assessments of the economic profile of the coast can aid in the development of efficient, cost-effective policies for sustainable coastal zone management (Ramsey et al., 2015). Yet, despite their great importance to the economy and culture of Barbados, most of the components of the economic value of coastal and marine resources have not been studied and remain unknown. Exceptions include work by Mahon et al. (2007), Waterman (2009), Schuhmann et al. (2013), and Gill et al. (2015).

1.1. Valuing beaches and coastal amenities

According to Pendleton et al. (2007) beaches have been valued more often in the non-market valuation literature than any other coastal or marine asset. Revealed preference approaches, such as

hedonic pricing and the travel cost method (TCM), are the most commonly employed valuation methods for understanding the economic value of shoreline amenities such as proximity and beach width. Hedonic pricing valuations of beach proximity and width to property owners consistently demonstrate that closer and wider beaches convey greater economic value. Examples include Pompe and Rinehart (1994), Pompe and Rinehart (1995), Pompe and Rinehart (1999) and Landry et al. (2003). Espinet et al. (2003), Hamilton (2007) and Rigall-I-Torrent et al. (2011) find that coastal proximity is associated with higher prices for accommodation. Numerous TCM and random utility studies suggest that wider beaches provide more recreational economic value. Examples include Parsons et al. (1999), Landry et al. (2003), Shivlani et al. (2003), Kriesel et al. (2004), Whitehead et al. (2008), Pendleton et al. (2012) and Parsons et al. (2013).

Marine litter is an important concern for coastal managers. Litter imposes significant economic costs to society through reduced tourism revenues, damage to vessels, impaired ecosystems and effects on human health (Hardesty et al., 2015; Williams and Tudor, 2001; Santos et al., 2005). Litter on beaches has been shown to detract from visitor satisfaction (Ballance et al., 2000; Jędrzejczak, 2004; Santos et al., 2005; Blakemore and Williams, 2008; Leggett et al., 2014), adversely affect the probability that beach users will return (Ivar do Sul and Costa, 2007; Beharry-Borg and Scarpa, 2010; Leggett et al., 2014) and result in economic losses to coastal communities (Ballance et al., 2000; Somerville et al., 2003; Tudor and Williams, 2003; Leggett et al., 2014).

Despite the seemingly universal understanding that people prefer to visit beaches that are clean and free of litter, and the straightforward connection between beach cleanliness and economic returns via tourism, the literature contains relatively few studies that attempt to empirically measure the economic value of beach cleanliness or the economic losses associated with beach litter, data that can facilitate the assessment of the benefits of investment in beach sanitation. Exceptions include Smith et al. (1977) who estimate annual willingness to pay (WTP) to control and clean up marine debris on beaches in New Jersey and North Carolina, Loomis and Santiago (2013) who estimate the willingness to pay for the absence of trash on beaches in Puerto Rico, and Leggett et al. (2014) who estimate the economic value of reducing of marine debris at sandy beaches in California.

Other studies associate beach litter with economic value through impacts on visitation and analysis of preferences. Blakemore and Williams (2008) find the most popular complaint by British tourists on a Turkish beach was the presence of litter, with 41% of respondents noting its negative appeal. Ballance et al. (2000) examine the impact of beach litter on foreign and domestic tourists in the Cape Peninsula, South Africa, reporting litter densities in excess of 10 large items per meter of beach would deter 40% of foreign tourists, and 60% of domestic tourists from returning to Cape Town beaches. Birdir et al. (2013) estimated visitors' willingness to pay for beach improvements at Turkish beaches, finding that more than 90 percent of visitors were willing to pay a daily fee for improvements, with over half of respondents indicating litter removal as the preferred way to improve beaches. Similar results were found by Ünal and Williams (1999).

Empirical examinations of the economic value of beach cleanliness in the Caribbean are especially limited. Beharry-Borg and Scarpa (2010) use a choice experiment administered to a sample of 284 tourists and locals in Tobago to estimate the willingness to pay for 7 attributes related to coastal and marine quality, including the number of plastic fragments encountered per 30 m of beach length. Results suggest that willingness to pay a beach entrance fee to reduce beach litter ranged from \$2.32 to \$7.72. Loomis and Santiago (2013) estimate the willingness to pay for four beach

amenities including the absence of trash on beaches in Puerto Rico using both contingent valuation and a choice experiment. The absence of trash and water clarity were found to be significant determinants of willingness to pay. Incremental values were estimated to be approximately \$100 per user per day for removing trash from beaches.

Our research adds to this literature. We employ a choice experiment (CE) framework to estimate the value of three beach amenities to visitors: beach width, proximity of lodging to the beach, and litter on the beach. In addition to estimating willingness to pay for changes in these attributes, we explore the relative importance of these beach amenities and the non-monetary tradeoffs that visitors are willing to accept. In addition to adding to the literature on the value of beach litter, this is the first application (to our knowledge) of the choice experiment methodology to value beach proximity and width. Data for this study were collected prior to the economic recession, from which tourism in Barbados and the Caribbean are only recently recovering. Recent evidence suggests that the economic viability of the Caribbean tourism product is dependent on the provision of superior non-price factors relative the offerings of competing destinations (Laframboise et al., 2014). This research provides information that should prove valuable to coastal management decisions that can help speed the pace of economic recovery as tourism in Barbados returns to pre-recession levels.

The rest of the paper is structured as follows: Section 2 describes the choice experiment, including survey development, experimental design and model specifications. Section 3 presents results and a discussion of the findings. Section 4 concludes the paper with our interpretation of the results and policy recommendations for Barbados.

2. Materials and methods

2.1. The choice experiment

Choice Experiments (CE) allow for multidimensional attribute changes to be valued simultaneously and can be used to generate estimates of the relative value of different attributes (Huybers, 2004), allowing for an understanding of tradeoffs that individuals are willing to make between those attributes. Beaches are multidimensional systems providing an array of functions valued by people (Chen and Bau, 2016). Tourists choose between alternative destinations with different attributes. These features make CE an appealing valuation method for the purposes of understanding visitors' preferences for coastal destinations.

The data for a CE analysis is obtained from a survey designed to elicit preferences by guiding the respondent through a series of alternative "goods" (e.g. lodging alternatives), each described in terms of different levels of attributes that comprise the good (e.g. beach attributes). Respondents are asked to rank alternatives, rate them or choose between them. Surveys involving choices between two or more alternatives can be used to simulate market behavior and estimate the monetary value of attributes via the multinomial logit model (Haider and Rasid, 2002).

The descriptions of alternative goods in the CE vary across scenarios (and potentially across respondents) on the basis of an experimental design intended to maximize the efficiency of estimating preferences for attributes of the goods and the effect of the attributes on respondent choices (Huybers, 2004). Specifically, using the discrete choices as a dependent variable and levels of the attributes as the independent variables, multinomial logit regression can be employed to estimate the relative importance of attributes and levels within attributes. This measure of relative importance, referred to as the *marginal rate of substitution*, shows

consumers' willingness to trade one attribute level for another. If one of the attributes is price, the marginal rate of substitution between other attribute levels and price can be considered a measure of value or willingness-to-pay (WTP) for that attribute level.

2.2. The questionnaire

A questionnaire was developed in order to elicit visitor preferences and willingness to pay for coastal attributes such as beach width and beach cleanliness. Departing visitors at the Grantley Adams International Airport (GAIA) were asked to complete the questionnaire in the last weeks of May, June and July 2007, by survey workers from the Caribbean Tourism Organization (CTO). In addition to a CE (described below), the survey solicited a range of information pertaining to respondent demographics, expenditures and recreational activities. Respondents were also asked to rate several aspects of coastal and marine quality on a 5-point Likert scale, including beach width, beach cleanliness, sand quality, and the ease of access to the sea. Over 3200 visitors completed at least some of the questionnaire, and approximately 2000 (roughly 63 percent) completed the choice experiment. We focus on this subsample for the remainder of the paper. As detailed in Hanley et al. (2001), there are several steps involved in the design of a choice experiment. First, attributes of the good to be valued should be selected based on policy concerns and/or interviews with focus groups. To ease the cognitive burden on respondents, it is important to keep the attributes and levels to a manageable number.

In order to ascertain the attributes that travelers considered important, a short survey instrument was designed and administered to approximately 130 departing tourists at GAIA in early 2007. Respondents to this initial survey were presented a list of 30 beach and lodging attributes and asked to rate the importance of each attribute in influencing their Caribbean destination choice on a scale of 1–5. Respondents were also asked to indicate which single attribute was the most important for their destination decisions. Price and the level of service provided by the lodging staff were identified as the two most important attributes, closely followed by cleanliness of the beach nearest to the lodging. Cleanliness of the sea water, distance from lodging to the beach, type of lodging, quality of the sand, ease of access to the sea and the presence of shade comprised the remainder of the top-ten most important attributes identified by respondents. Beach width, a priority attribute for the coastal managers in Barbados, was the 18th most important attribute identified.

Policy variables of concern to visitors and stakeholders took precedence in our choice of attributes for the CE; hence beach width, beach cleanliness and price were selected for analysis. Although identified as highly important to travelers, staff service quality was not a primary concern of this study. The cleanliness/visibility of sea water, while also important to visitors, was deemed beyond the scope of this study. Hence, we selected proximity of the lodging to the sea and type of lodging as the final two attributes for inclusion in the CE.

Levels for the attributes in a CE should be realistic and should span the range of respondent preferences (Hanley et al., 2001). The range of beach widths in Barbados was identified using data from the Coastal Zone Management Unit. Levels for beach litter were based on physical counts at sample beaches across the island as well as data from the International Coastal Cleanup. Lodging attributes, including prices, types and distances to the sea were identified through Internet searches and consultation with tourism officials. A full list of attributes and levels is presented in Table 1.

The CE attributes and levels were combined to create alternative versions of a Caribbean lodging destination, and paired into alternative choices to be presented to respondents. Five attributes with

Table 1
Destination choice attributes and levels.

Attributes	Levels
Price (\$US/night)	\$75, \$150, \$225, \$300
Lodging type	Small hotel, Large hotel, Apartment hotel, Villa
Beach width (meters)	3–5 m, 8–10 m, 13–15 m, 18–20 m
Distance to beach	Beachfront, 2–3 min walk, 6–8 min walk, 18–20 min walk
Beach litter (pieces per 25 m)	0, 5, 10, 15

four levels yielded 1024 possible combinations of attributes and levels. A subsample of 96 pairs from this “full factorial” were selected so as to maintain statistical power in estimating the effects of the attributes and their levels on choices (“main effects”), and were blocked into 16 sets of six paired choices using the % choiceff and %mktblock macros in SAS (Kuhfeld, 2002). To more accurately replicate actual market decisions, a “neither option” alternative was also included for each choice. In summary, each respondent faced six scenarios depicting the choice between two alternative Caribbean lodging options, and could select “neither trip” for each of the six choices. Exhibit 1 shows an example of a single paired choice.

2.3. Model specification

Analysis of CE data is based on the assumptions of the general discrete choice model or random utility model (RUM) first introduced by McFadden (1973), which recognizes that an individual’s satisfaction or “utility” from a given choice is a function of observable and unobservable characteristics. From the perspective of the researcher, the utility derived by an individual from a particular alternative (i) can be represented by a function that contains a deterministic component (Vi) and a random component (ei):

$$U_i = V_i + \epsilon_i \tag{1}$$

Given a set of mutually exclusive alternatives, an individual’s choice of alternative (i) over another alternative (j) implies that the utility from the former outweighs that from the latter:

$$U_i > U_j.$$

Since the utilities include a stochastic component, we can describe the probability of choosing alternative (i) as:

$$P\{i\} = P\{V_i + \epsilon_i > V_j + \epsilon_j\} \tag{2}$$

Assuming the stochastic elements of the choice alternative utilities follow a Gumbel distribution, the standard multinomial logit (MNL) model can be used to estimate the probability of

choosing alternative (i) (McFadden 1973; Ben-Akiva and Lerman 1985):

$$P\{i\} = \exp(V_i) / \sum \exp(V_j) \tag{3}$$

Estimation of the model outlined above requires the specification of a functional form for the indirect utility function (1) and the identification of observable variables which are likely to influence the choice in question, such as the five attributes described in Table 1. With regard to model specification, we assume that the indirect utility function is linear (additive) in the attributes.

By specifying a baseline level for each attribute, MNL regression allows the estimation of unique coefficients for the remaining levels. These coefficient estimates are referred to as “part-worth utilities”, and represent the utility derived from a particular attribute level compared to a baseline (omitted) level. For this analysis, baseline levels are the second levels for each attribute, permitting estimation of WTP for positive and negative change and to closely approximate the conditions experienced by respondents in our sample: large hotel, 2–3 min walk to the beach, 5 pieces of litter per 25 m and 8–10 m beach width. For valuation of the non-price attributes, the price variable is treated as a continuous variable. Following Cooper et al. (2012), effects coding was used such that non-baseline levels are set to –1 rather than zero to indicate the presence of the baseline level. Using responses from the choice experiment, we estimate equation (1) as:

$$U_i = \beta_1(\text{Price}_i) + \beta_2(\text{lodging type}_i) + \beta_3(\text{distance to beach}_i) + \beta_4(\text{beach width}_i) + \beta_5(\text{litter}_i) \tag{4}$$

Where:

- lodging type = Small hotel, Apartment hotel, Villa
- distance to beach = 0 min walk (beachfront), 6–8 min walk, or 12–15 min walk,
- beach width = 3–5 m, 13–15 m, or 18–20 meters,
- and litter = 0 pieces, 10 pieces, or 15 pieces.

Because beach width, litter and distance were described using quantitative measures, we can also create continuous versions of these variables, using midpoints of ranges where necessary. This allows for an understanding of the utility associated with incremental changes in these attributes (rather than discrete movements between levels), and values of these attributes between the levels used in the CE (Hensher et al., 2005, pp. 291). Continuous coding also facilitates the simulation of the impacts of incremental changes in quality on the choice probabilities in (3) and permits the estimation of the marginal rate of substitution between these non-price attributes.

The coefficient on price represents the marginal utility of

Exhibit 1
Example of a single paired choice.

Suppose that you could only choose from the lodging options below (trip A, trip B or neither trip). If all other factors were equal, which would you prefer?

Attributes	Option A	Option B
Price (\$US)	\$75	\$225
Lodging type	Small hotel	Apartment/Apartment hotel
Beach width	3-5 m wide	13-15 m wide
Distance to beach	12-15 min walk	6-8 Min walk
Beach litter	0 Pieces litter per 25 m	10 Pieces litter per 25 m
I prefer ... (check <u>one</u> box below)		
I would not take either trip	Trip A	Trip B

income and can be used to derive the value or willingness to pay (WTP) for a level of the non-price attributes relative to the baseline level or the WTP for an incremental change as:

$$\text{WTP for attribute level } a = -\beta_a/\beta_1 \quad (5)$$

Applying equation (5) to the coefficients for beach litter, beach width and proximity to the beach reveals the average willingness to pay for each level of these attributes relative to the baseline scenario.

We estimated equation (1) using conditional logit (CL), mixed logit (ML) and latent class (LC) specifications. The CL specification treats the coefficients for each level as constant parameters across members of the sample, while the ML specification treats the coefficients as random parameters,¹ allowing preferences for attribute levels to be heterogeneous across the sample (Train, 1999; interacting attribute levels with demographic characteristics in the CL or by using the LC specification).

Latent class estimation assigns individuals in the sample to a finite number of preference groups and estimates the probability of choosing an alternative and the utility coefficients separately for each group (Greene and Hensher, 2003; Beharry-Borg and Scarpa, 2010). Membership in preference groups is unknown *a priori*, hence the appropriate number of classes is determined by the researcher based on statistical criterion such as the Bayesian Information Criterion (BIC) or Akaike Information Criterion (AIC) (Greene and Hensher, 2003; Milon and Scrogin, 2006) coupled with assessment of model parsimony, class probabilities, and the plausibility of parameter estimates and standard errors (Provencher and Bishop, 2004; Scarpa and Thiene, 2005; Hilger and Hanemann, 2006; Domanski and von Haefen, 2010). An underlying assumption of the LC specification is that each individual in a particular class follows the same decision making process (e.g. choosing the most preferred alternative, choosing randomly, choosing based on a subset of the attributes) when choosing between alternatives (Morey and Thacher, 2012). Factors associated with preference group membership can be identified by estimating a class probability model using individual characteristics as covariates. Specifically, the class membership likelihood function for individual k and group c is given by:

$$M_{kc} = \lambda_c Z_k + \varepsilon_{kc} \quad (6)$$

where λ_c represent the contributions of individual characteristics, Z_k to the probability of membership in class c (Kikulwe et al., 2011) which is found for each individual k as:

$$P\{kc\} = \exp(\lambda_c Z_k) / \sum \exp(\lambda_c Z_k) \quad (7)$$

3. Results and discussion

Relative to annual arrivals from Barbados' main source markets in 2007, visitors from the United States and the United Kingdom were overrepresented in our sample (35% and 43% in our sample vs. 23% and 40% annual arrivals in 2007), while visitors from Canada

and the Caribbean were underrepresented (5% and 10% in our sample vs. 9% and 17% annual 2007 arrivals).² To correct for differential response rates by country of origin, we balance the data by randomly under-sampling from the over-represented main markets. The dataset retained for analysis is comprised of 1139 individuals, each of whom made 6 choices in the CE.³

Summary statistics for respondent demographics and travel characteristics are presented in Table 2. The majority of respondents stayed in large (41 percent) or small hotels (19 percent). Respondents predominantly stayed beachfront (69 percent), or within a 2–3 min walk to the beach (13 percent) and generally viewed beaches as being of high quality. Of interest for this study, beach width was rated lower than other beach characteristics and was the only characteristic rated below 4 on a 5-point Likert scale. Respondents reported viewing an average beach width of roughly 12.5 m and viewed an average of 2.73 pieces of litter per 25 m of beach length.

3.1. Conditional logit results

Four specifications of the conditional logit model (estimates of equation (4)) are shown in Table 3. All coefficients are of the expected sign and all coefficients are statistically significant with the exception of the coefficients on 13–15 m beach width and hotel lodging.⁴ Villa lodging is preferred to hotels, but visitors do not appear to differentiate between different types of hotels or between the two mid-level beach widths. The magnitude of the beach width, beach litter and distance from the beach coefficients change in the expected direction – visitors derive higher utility from wider beaches, lower levels of litter and shorter distances from their lodging to the beach.

The effects on utility from changes in litter and proximity of lodging to the beach are non-linear. This result is apparent by examining the differences in coefficients between levels in Model 1. Estimation of the CL using linear (results not shown) and quadratic versions (Model 2) of these attributes confirms the nonlinear impact on utility of changes in litter and distance from the beach. In particular, the most pronounced differences in marginal utility are at the lower end of the litter spectrum. That is, once a beach is “dirty”, the loss in utility per unit of additional litter is smaller than when litter is added to a relatively clean beach. Similarly, the incremental loss in utility associated with being farther from the beach is higher at lower values of distance; farther distances are less preferred, but adding additional distance detracts less from utility as distance increases.

3.2. Conditional logit with interaction effects

To investigate preference heterogeneity, we interact respondent-specific variables with the CE attributes, which permits a description of how utility (and willingness to pay) might vary among different categories of visitors. Interaction effects that are

¹ Mixed logit estimation requires the selection of a distribution for the parameters that are assumed to be random, and uses simulated maximum likelihood to approximate the probabilities in equation (3) based on that distribution (see Greene and Hensher, 2003). In this study, various models were estimated assuming normal, uniform and triangular distributions for all non-price parameters using a range of 100–1000 draws from a Halton quasi-random sequence for the simulation (SAS Institute, 2008; Train, 1999).

² These discrepancies may be due to the timing of the survey (arrivals from the U.S. tend to be above average in the summer months while arrivals from Canada tend to be lower) or could be due to differences in the willingness to complete questionnaires across nationalities.

³ We also created balanced data by randomly oversampling from under-represented main markets. Numerous balanced samples were created. Empirical results for all balanced samples were equivalent with regard to signs, significance and magnitudes of coefficients, with one exception, noted in the discussion. We present results using data that produces coefficient estimates that lie near the median values for all trials.

⁴ In one of the 10 balanced samples examined the coefficient on the widest beach width was also insignificant.

Table 2
Demographics and travel characteristics.

Variable	n	Mean	Std dev	Minimum	Maximum
Age	1139	40.14	12.98	19	70
Male ^a	1131	0.47	0.50	0	1
Married	1139	0.54	0.50	0	1
Income (USD)	854	110,789	79,187	3,174	360,000
Purpose of visit: vacation ^a	1139	0.74	0.44	0	1
Purpose of visit: business ^a	1139	0.22	0.41	0	1
First visit to Barbados ^a	1139	0.57	0.50	0	1
Times to Barbados	1138	2.51	8.56	0	145
First visit to Caribbean ^a	1113	0.40	0.47	0	1
Times to Caribbean	1131	4.80	13.46	0	107
Nights in Barbados	1133	8.88	9.63	0	180
Hours travelled to Barbados	1077	8.25	6.42	0	72
Stayed in large hotel ^a	1139	0.41	0.49	0	1
Stayed in small hotel ^a	1139	0.19	0.39	0	1
Stayed in apartment hotel ^a	1139	0.17	0.37	0	1
Stayed in villa ^a	1139	0.09	0.29	0	1
Beach width viewed ^b	1136	12.52	6.19	4	21
Amount of litter viewed ^c (per 25 m)	1061	2.74	3.73	0	15

^a Mean values of indicator variables correspond to the percentage of the sample that meets the indicated criteria.

^b Beach width was defined as the distance in meters from the high water mark to the vegetation line, and was presented to respondents in categories (3–5 m, 8–10 m, 13–15 m, 18–20 m and more than 20 m). Data were coded using midpoints of these ranges and 21 m for the last category.

^c Respondents were asked to identify the amount of litter typically encountered per 25 m of beach length on the beach nearest to their lodging, which was presented in the following categories: 0 pieces per 25 m, up to 5 pieces, up to 10 pieces and 15 or more pieces. Data were coded as 0, 5, 10 and 15 for each category respectively.

Table 3
Conditional logit coefficient estimates. Standard errors in parentheses.

Attribute	Level	Model 1	Model 2	Model 3	Model 4
Price	Continuous	–0.0019*** (0.0002)	–0.0019*** (0.0002)	–0.0019*** (0.0002)	–0.0019*** (0.0002)
Beach litter (baseline = 5 pieces per 25 m)	0 pieces per 25 m	0.5809*** (0.0310)		0.5194*** (0.0406)	0.5200*** (0.0406)
	10 pieces per 25 m	–0.3213*** (0.0341)		–0.2622*** (0.0433)	0.2631*** (0.0433)
	15 pieces per 25 m	–0.4600*** (0.0357)		–0.3946*** (0.0442)	–0.3945*** (0.0442)
Beach litter ²	Continuous		–0.1032*** (0.0117)		
	Continuous		0.00198*** (0.0008)		
Beach width (baseline = 8–10 m)	3–5 m	–0.0980*** (0.0346)		–0.1013*** (0.0346)	–0.1008*** (0.0346)
	13–15 m	0.0364 (0.0311)		0.0376* (0.0312)	–0.0383 (0.0311)
	18–20 m	0.0704** (0.0321)		0.0687** (0.0321)	0.0121 (0.0463)
Beach width	Continuous		0.0105** (0.0035)		
	Continuous				
Lodging type (baseline = large hotel)	Small hotel	–0.0032 (0.0314)	–0.0018 (0.0311)	–0.0065 (0.0315)	–0.0073 (0.0315)
	Apartment hotel	–0.0308 (0.0328)	–0.0366 (0.0326)	–0.0326 (0.0328)	–0.0322 (0.0328)
	Villa	0.1486*** (0.0326)	0.1560*** (0.0157)	0.1480*** (0.0326)	0.1493*** (0.0326)
Distance from beach (baseline = 2–3 min. walk)	Beachfront	0.5532*** (0.0306)		0.3585*** (0.0556)	0.3575*** (0.0556)
	6–8 min walk	–0.1907*** (0.0337)		–0.1988*** (0.0337)	–0.1987*** (0.0337)
	12–15 min walk	–0.5412*** (0.0358)		–0.3132*** (0.0607)	–0.3124*** (0.0607)
Distance from beach ²	Continuous		–0.1518*** (0.0157)		
	Continuous		0.0051*** (0.0011)		
Vacation* high litter				–0.1590** (0.0717)	–0.1572** (0.0717)
Vacation* long walk				–0.3184*** (0.0704)	–0.3173*** (0.0704)
Vacation* beachfront				0.2704*** (0.0640)	0.2702*** (0.0640)
Canadian* high litter				–0.1920* (0.1162)	–0.1928* (0.1162)
Stayed hotel* wider beach					0.0900*** (0.0529)
Trip A	Alternative specific constant	0.08984* (0.0508)	1.1608*** (0.0775)	0.1573*** (0.0575)	0.1569*** (0.0575)
Trip B	Alternative specific constant	0.0544 (0.0514)	1.1097*** (0.0770)	0.1231** (0.0579)	0.1220** (0.0579)
Log likelihood		–6921.77	–6928.78	–6906.62	–6905.17
Pseudo R2		0.074	0.072	0.076	0.076

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

found to be robust to specification are shown in Table 3, Models 3 and 4. There is a significant negative interaction effect between those who visited Barbados for the purpose of vacation and the highest two levels of litter and the highest distance from the beach, and a significant positive interaction between staying beachfront and travelling for the purpose of vacation. Vacationers appear to derive more than average utility from proximity to the beach and avoiding litter. Visitors from Canada appear to be more averse to the higher levels of litter. Importantly, the observed preference for the widest beaches (18–20 m) appears to be restricted to visitors that stayed in hotels. When an indicator variable indicating that the

respondent stayed in a hotel is interacted with the highest beach width level, the coefficient on that level becomes insignificant (Model 4).⁵

⁵ This result is also found when the interaction term combines the two highest beach width levels. We find no interaction effects between the CE attributes and gender, age, prior visitation history or quality ratings. We do find a negative and significant interaction between income and the highest levels of litter – those with higher incomes are more averse to litter – though respondent reluctance to reveal income limits the sample size with which this specification can be estimated.

Table 4
Mixed and latent class logit coefficient estimates. Standard errors in parentheses.

Attribute		Mixed logit			2-Class LC		
Baseline level	Variable level				Class 1	Class 2	
Price	Continuous	Mean	−0.0020*** (0.0002)	−0.0022*** (0.0003)	−0.0022*** (0.0005)	−0.0020*** (0.0003)	
5 pieces of litter per 25 m	0 pieces of litter	Mean	0.6175*** (0.0399)		0.9777*** (0.0575)	0.4031*** (0.0466)	
	10 pieces of litter	Mean	−0.3411*** (0.0379)		−0.4538*** (0.0686)	−0.2555*** (0.0452)	
	15 pieces of litter	Mean	−0.4927*** (0.0426)		−0.8679*** (0.0855)	−0.3380*** (0.0458)	
	Continuous	Mean		−0.0975*** (0.0078)			
		S.D.		0.0769*** (0.0167)			
8–10 m beach width	18–20 m	Mean	0.0665* (0.0340)		0.1453** (0.0593)	0.0469 (0.0435)	
	13–15 m	Mean	0.0415 (0.0336)		0.0275 (0.0574)	0.0595 (0.0418)	
	3–5 m	Mean	−0.0970*** (0.0369)		−0.1902*** (0.0661)	−0.0694 (0.0462)	
	Continuous	Mean		0.0125*** (0.0042)			
		S.D.		0.0003 (0.0233)			
2–3 min walk	Beach-front	Mean	0.5837*** (0.0372)		0.9936*** (0.0573)	0.3603*** (0.0449)	
	6–8 min walk	Mean	−0.2081*** (0.0361)		−0.3524*** (0.0689)	−0.1325*** (0.0443)	
	18–20 min walk	Mean	−0.5774*** (0.0440)		−0.9078*** (0.0803)	−0.42021*** (0.0458)	
	Continuous	Mean		−0.1219*** (0.0111)			
		S.D.		0.1150*** (0.0197)			
Large hotel	Small hotel	Mean	0.0438 (0.0445)	0.04133 (0.0467)	0.0283 (0.0601)	−0.0306* (0.0424)	
	Apartment hotel	Mean	−0.0218 (0.0427)	−0.0379 (0.0446)	−0.0310 (0.0593)	−0.0052 (0.0453)	
		S.D.	0.4199* (0.2479)	0.4572 (0.3119)			
	Villa	Mean	0.1510*** (0.0434)	0.1803*** (0.0455)	0.0568 (0.0623)	0.2066*** (0.0443)	
		S.D.	0.5475** (0.2171)	0.4711 (0.3119)			
ASCs	Trip A	Mean	0.0438 (0.0613)	1.2585*** (0.0973)	−1.1952*** (0.1110)	2.250*** (0.1258)	
	Trip B	Mean	0.0183 (0.0593)	1.2083*** (0.0970)	−1.1593*** (0.1117)	2.181*** (0.1250)	
Class Probability					0.547	0.453	
Log likelihood			−6920.13	−6926.42	−6152.41		
McFadden pseudo R-squared			0.0783	0.0774	0.1805		
AIC			13.874	13.883	12.366		

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

3.3. Mixed and latent class logit results

To further investigate potential heterogeneity in preferences for the CE attributes, we estimate both mixed (ML) and latent class (LC) logit specifications using effects-coded and continuous versions of the attributes. Results from ML estimation when all non-price attributes are effects coded and treated as random suggest that visitors' preferences for different levels of the CE attributes are relatively homogenous, with the exception of preferences for apartment and villa lodging. This result is consistent with the actual distribution of visitors across lodging types (Table 2), although the lack of identifiable interaction effects in the CL suggests that choice of lodging type is not readily associated with other visitor characteristics. In Table 4 we present results from a model where only these two levels of the hotel attribute are treated randomly, assuming a normal distribution and using 1000 draws for the simulation.⁶

When the beach width, beach litter and proximity attributes are coded as continuous variables, the ML coefficients indicate preference heterogeneity for both litter and proximity (i.e. the standard deviations for these attributes are statistically significant). The ML results therefore suggest that visitors may have relatively homogenous preferences within levels of the attributes, but have heterogeneous preferences between levels of the attributes. For example, aversion to the highest level of litter is homogenous – when presented with choices involving this level of litter, there is no significant variation in visitor preferences. However, along the entire spectrum of litter present on Barbados' beaches, preferences do indeed vary across the sample. This is consistent with the finding of interaction effects for vacationers and Canadian visitors

in the CL.

In the LC specification, we first attempt to identify the number of preference groups and subsequently investigate factors associated with group membership using characteristics that were found to create interaction effects in the CL specification (e.g. Canadian citizenship, visitors who were on vacation and visitors who stayed in hotels) as covariates in a class probability model (Equation 6). Results from the LC model estimation suggest 2 or 3 preference classes exist in the sample. While measures of fit (AIC, BIC, pseudo R-squared) appear marginally favorable for higher numbers of classes, only the 2-class model produces parameter estimates that are consistent with economic theory and have reasonable standard errors. For example, only one class in the 3-class and 4-class models has a negative and significant coefficient on price. Given the estimated class probabilities, these larger models suggest that more than half of the sample either ignores the price attribute or has preference for higher prices. It might be reasonable to assume that individuals in these classes made choices based on heuristics that ignore a subset of the CE attributes ("attribute non-attendance"), however, the positive price coefficient precludes the possibility of WTP estimation for those classes. Further, fewer classes seems more consistent with the results of the CL and ML specifications which suggest relative homogeneity of preferences for most attribute levels.

In the 2-class specification, members of class 1 appear indifferent to lodging type, but have strong preferences for minimal beach litter and proximity to the beach (Table 4). This group derives nearly equal utility from changes in litter and proximity. Beach width is important to this group, but not as important as litter and proximity. Again we see an aversion to the lowest levels of beach width and a preference for the widest beaches, but little delineation in preferences for beach widths at the two middle levels. Members of class 2 have a strong preference for villa lodging and appear indifferent to beach width. This group also favors both low levels of litter and proximity to the beach, but has weaker preferences for

⁶ Assuming uniform and triangular distributions produced quantitatively and qualitatively similar results. We present results from the normal distribution for parsimony.

these attributes than members of class 1. Intuitively, and in line with the CL and ML results, a class probability model suggests that vacationers and visitors who stayed in hotels are more likely to be in class 1, the preference group that puts more weight on litter and beach proximity and has a clear preference for wider beaches. The signs on the alternative specific constants indicate that members of class 1 were more likely to opt-out (choosing neither trip option) suggesting that members of this class may be more selective in their choices, all else equal. We present results from the 2-class LC model (Table 4), and note that these two classes may include preference subgroups.

In summary, visitors to Barbados have clear and significant preference for beachfront lodging and minimal litter. Wider beaches appear to contribute more to utility than narrow beaches, but beach width is much less important than beach proximity and cleanliness. Evidence of preference heterogeneity exists for some types of lodging and for the litter and proximity attributes when treated as continuous variables.

3.4. Willingness to pay

Coefficients in Tables 3 and 4 were used to estimate willingness to pay (WTP) for each attribute level relative to the baseline level (Equation 5) in terms of the price per night for a double-occupancy lodging room in the Caribbean.⁷ Standard errors were generated using the Wald procedure (Delta method) in NLOGIT 5.0. Average WTP and 95% confidence intervals are shown in Table 5. For the discrete versions of the attributes, positive willingness to pay values represent the monetary value of moving from a lower (baseline) level of quality to higher quality. Negative values can be interpreted as willingness to pay to avoid declinations in quality from the baseline level, or the price change needed to exactly offset the change in market share created by a change from the baseline level of an attribute to a less preferred level (Louviere et al., 2000, pp. 280). For context, the average and median reported price paid per night were approximately \$167.00 and \$188.00 respectively.⁸

Differences in willingness to pay values between non-baseline levels can be interpreted as the incremental value of the difference between levels. For example, using the results from the conditional logit model, the willingness to pay to avoid a beach that has the highest level of litter relative to a beach with 10 pieces of litter is approximately US\$73.00. For the continuous versions of the attributes, WTP values represent the monetary value of an incremental (one-unit) change in the attribute. For example, respondents would need to be compensated approximately \$45.00 for each additional unit of beach litter encountered and approximately \$56.00 per additional minute walking distance from the beach.

The values in Table 5 suggest that visitors to Barbados are willing to pay significantly more for lodging options near beaches that are free of litter. Visitors are willing to pay approximately the same amounts to avoid walking to the beach and to avoid litter. Willingness to pay to avoid narrow beaches is significant, but is clearly less valued than litter and beach proximity.

Examination of the WTP values allows for an understanding of the non-monetary tradeoffs that visitors would be willing to make. For example, while visitors strongly prefer beachfront lodging, they derive approximately the same satisfaction from a 2–3 min walk to

a clean beach and beachfront lodging at a marginally dirty beach. Similarly, it appears that visitors would be more satisfied with a 6–8 min walk to a clean beach relative to staying beachfront at a beach with a high level of litter. These tradeoffs can also be seen using the coefficient on the continuous proximity variable as the numeraire attribute in equation 5, which yields respondents' willingness to trade other attributes for a minute of walking time. For example, using the coefficients on the continuous attributes in the ML suggests that respondents are willing to walk approximately 0.8 min to avoid each additional unit of litter encountered per 25 meters.

4. Discussion and conclusions

Data for this study were collected in the year prior to the start of the global financial crisis. Since that time, the contribution of travel and tourism to Caribbean GDP and employment has declined, only reaching pre-recession levels in 2015 (WTTC, 2015b). Tourism in Barbados was not immune to the impacts of the recession. Monthly visitor arrivals in Barbados remained below April 2007 levels until December 2014, and while showing signs of full recovery, annual arrivals remain below those achieved in 2007.⁹

Recent work by the IMF (Laframboise et al., 2014) suggests that the nominal cost of an "average" beach holiday in the Caribbean (lodging, transport, food and drink) is higher than in other parts of the world. To ensure economic viability of the tourism product, the authors suggest that non-price factors need to be superior to those offered by competing destinations. Laframboise et al. (2014) also find that since the recession, the price elasticity of demand for high-end destinations such as Barbados is statistically insignificant and suggest that in order to avoid declining tourist arrivals and the intended adverse economic impacts, public and private investment must support the delivery of a high end tourism product.

This research reveals several notable conclusions that can help achieve this end and provide valuable input to coastal management decisions. First, there is a clear and significant link between the quality of the coastal and marine environment, visitor satisfaction, and willingness to pay for accommodation. With regard to beach width, our results suggest a general aversion to the narrowest beaches and a preference for the widest beaches that is most evident for visitors who stayed in hotels. Because beaches near hotels are likely to have higher levels of aggregate use, this apparent preference for wide beaches may simply be an aversion to crowding. Visitors do not seem to place much value on additional beach width beyond 8–10 m, especially when compared to the value of beach cleanliness. This result should not be interpreted as suggesting that wider beaches do not convey economic value, or are not important to visitors of Barbados. Indeed, wide beaches provide valuable protection for coastal property and are critical for sea turtle nesting (Fish et al., 2008). A true understanding of the economic importance of wider beaches requires additional research into these components of value.

It is clear that cleaner beaches yield more economic value to visitors. Approximately half of the sample reported viewing beach litter. Based on this analysis, we can conclude that litter on Barbados beaches results in significant loss in economic value to visitors, especially tourists on vacation, and likely diminishes their

⁷ For the CL with interaction effects, we use Model 3.

⁸ We note that these may be underestimates of actual lodging prices paid. Respondents were asked to indicate the price paid per night for a double-occupancy room and were given 5 categories to choose from. These categories ranged from "\$0 to \$75" to "more than \$300" and were coded using the midpoints of the ranges, with the exception of the highest price which was coded as \$301.

⁹ Relative to 2007, the percentage of visitors from the UK in recent years is slightly lower than in 2007, while the percentage of visitors from Canada and other European nations is slightly higher. Balancing the sample to replicate arrivals by main market in 2014/2015 produces results that are quantitatively and qualitatively similar those presented here, with the exception of a slight decrease in the importance of beach width.

Table 5
Willingness to pay for attributes in the choice experiment.

Attribute	Level	Willingness to pay (USD) (95% confidence interval)				
		CL	CL with interactions	Mixld Logit	LC class 1	LC class 2
Beach litter baseline = 5 pieces per 25 m	0 pieces per 25 m	\$304.35*** (227.34, 381.35)	\$269.86*** (195.46, 344.26)	\$308.13*** (228.75, 387.51)	\$455.30*** (252.37, 658.24)	\$198.24*** (123.86, 272.62)
	10 pieces per 25 m	-\$168.31*** (-219.98, -116.64)	-\$136.51*** (-190.19, -82.83)	-\$170.19*** (-223.22, -117.15)	-\$211.31*** (-322.24, -100.38)	-\$125.66*** (-181.14, -70.18)
	15 pieces per 25 m	-\$241.00*** (-306.89, -175.11)	-\$204.74*** (-269.19, -140.29)	-\$245.85*** (-313.87, -177.83)	-\$404.16*** (-591.31, -217.02)	-\$166.23*** (-234.11, -98.35)
Continuous change in liter WTP to avoid additional unit				\$44.93 (-56.82, 33.04)		
Beach width baseline = 8–10 m	3–5 m	-\$51.36*** (-89.24, -13.48)	-\$52.32*** (-89.99, -14.66)	-\$48.39*** (-86.84, -9.94)	-\$88.57** (-161.07, -16.06)	-\$34.12 (-80.18, 11.93)
	13–15 m	\$19.07 (-13.33, 51.47)	-\$19.86 (-12.32, 52.04)	\$20.70 (-12.71, 54.11)	\$12.79 (-39.92, 65.50)	\$29.26 (-12.16, 70.69)
	18–20 m	\$36.86** (3.41, 70.29)	\$6.30 (-40.76, 53.36)	\$33.16* (-0.61, 66.94)	\$67.66*** (8.09, 127.23)	\$23.06 (-19.01, 65.14)
Continuous change in width WTP for additional meter				\$5.76*** (1.86, 9.66)		
Lodging type baseline = large hotel	Small hotel	-\$1.68 (-33.91, 30.56)	-\$3.39 (-35.36, 28.57)	\$21.83 (-21.70, 65.37)	\$13.20 (-42.57, 68.96)	-\$15.05 (-55.48, 25.37)
	Apartment hotel	-\$16.12 (-50.31, 18.08)	-\$16.93 (-50.89, 17.03)	-\$10.85 (-52.93, 31.22)	-\$14.43 (-69.45, 40.58)	-\$2.55 (-46.29, 41.19)
	Villa	\$77.85*** (40.66, 115.05)	\$76.87*** (40.08, 113.66)	\$75.36*** (30.36, 120.37)	\$26.45 (-31.41, 84.32)	\$101.60*** (50.33, 152.88)
Distance to beach baseline = 2–3 min walk	Beach- front	\$289.83*** (218.67, 360.99)	\$185.51*** (115.75, 255.75)	\$291.25*** (218.66, 363.84)	\$462.68*** (263.32, 662.04)	\$177.22*** (110.73, 243.72)
	6–8 min walk	-\$103.22*** (-144.84, -61.61)	-\$103.09*** (-144.37, -60.81)	-\$103.83*** (-146.12, -61.54)	-\$164.12*** (-259.27, -68.96)	-\$65.18*** (-111.00, -19.35)
	12–15 min walk	-\$283.55*** (-358.61, -208.49)	-\$162.13*** (-234.63, -89.62)	-\$288.12*** (-365.57, -210.67)	-\$422.76*** (-616.21, -229.30)	-\$206.69*** (-283.79, -129.59)
Continuous WTP to avoid extra minute				\$56.18*** (-71.46, -40.90)		

***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

probability of return. Losing potential return visitors can impose real economic costs for the economy of Barbados. By extension we can conclude that beach clean-up and litter prevention efforts can create significant economic value and may accelerate the pace of economic recovery as tourism returns to pre-recession levels.

The most pronounced differences in willingness to pay to avoid litter are at the lower end of the litter spectrum, indicating that once a beach is dirty, the loss in value per unit of additional litter is smaller than when litter is added to a relatively clean beach. This suggests that beach clean-up efforts should not be limited to beaches where litter is most apparent. Yet, the magnitude of willingness to pay estimates from the LC model suggest that once litter reaches a high level, some visitors will likely choose alternative destinations. That is, the amount that visitors would have to be compensated to accept the litter disamenity exceeds the typical price paid for lodging. This suggests that beaches with exceptionally high amounts of litter should also be targeted for clean-up efforts. An improved understanding of the location and sources of beach litter therefore appears to be a critical area for further research to improve waste management practices and policy.

In addition to WTP estimates that can be used as inputs into cost-benefits analysis or for benefits transfer applications at other destinations, this research also highlights non-monetary tradeoffs that Caribbean visitors are willing to accept. For example, the willingness to pay to stay beachfront relative to a short (2–3 min) walk is approximately equal to the willingness to pay to stay on a clean beach relative to a beach with a small amount of litter. Understanding such tradeoffs may have important implications for coastal development policy. Recognizing that continued or additional beachfront development is limited by land availability and may in itself be detrimental to the coastal and marine environment, policy makers should recognize that visitors appear willing to forgo the beachfront amenity in exchange for beaches that are free of litter. As noted in Fish et al. (2008), to the extent that long term coastal realignment can be accomplished through the modification of setback regulations in Barbados, coastal managers should give careful consideration to the possibility of rebuilding further back from the water when coastal structures are inevitably replaced. Increasing the setback requirement for future properties will allow for improved protection of valuable coastal and marine assets from potential wave and storm damage or sea level rise, and our results suggest that such actions are unlikely to adversely affect visitation provided that other amenities such as cleanliness and views are maintained. Given that the maintenance or enhancement of beach widths appears to be of relatively low (direct) importance to visitors, and that renourishment and armoring efforts are costly and may have adverse impacts on proximate beaches and ecosystem function (Pilkey and Wright, 1988; Defeo et al., 2009), policy actions to mitigate shoreline change for the benefit of tourism should proceed only with careful consideration of the full range of costs and benefits.

Perhaps the most salient takeaway from this research is that, of the policy-relevant attributes examined, maintaining the cleanliness of beaches via clean-up efforts, targeted waste policy or education and outreach seems to hold the highest promise for significant short term economic net gains vis-à-vis tourism demand. The results of this study should be considered in light of the Laframboise et al. (2014) finding that demand for high end Caribbean tourism products is highly price inelastic. Given the role that the tourism industry likely plays in the generation of beach litter, and the illustration of visitor willingness to pay for clean beaches shown here, the proposition put forth by Newman, et al. (2015, p. 377) that investments in litter prevention and removal could be financed using modest tourism taxes or fees appears to be well suited for Barbados.

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References

- Ballance, A., Ryan, P.G., Turpie, J.K., 2000. How much is a clean beach worth? The impact of litter on beach users in the Cape Peninsula, South Africa. *South Afr. J. Sci.* 96 (5), 210–213.
- Beharry-Borg, N., Scarpa, R., 2010. Valuing quality changes in Caribbean coastal waters for heterogeneous beach visitors. *Ecol. Econ.* 69 (5), 1124–1139.
- Ben-Akiva, M., Lerman, S.R., 1985. *Discrete Choice Analysis: Theory and Application to Travel Demand*. MIT Press.
- Birdir, S., Ünal, Ö., Birdir, K., Williams, A.T., 2013. Willingness to pay as an economic instrument for coastal tourism management: Cases from Mersin, Turkey. *Tour. Manag.* 36, 279–283.
- Blakemore, F., Williams, A., 2008. British tourists' valuation of a Turkish beach using contingent valuation and travel cost methods. *J. Coast. Res.* 1469–1480.
- Brewster, L., 2007. Coastal erosion risk mitigation strategies applied in a small island developing state: the Barbados model. In: *Proceedings of the United Nations Framework for the Convention on Climate Change Expert Meeting on Adaptation for Small Island Developing States (SIDS)*. Kingston, Jamaica.
- Cashman, A., Cumberbatch, J., Moore, W., 2012. The effects of climate change on tourism in small states: evidence from the Barbados case. *Tour. Rev.* 67 (3), 17–29.
- Chen, C.L., Bau, Y.P., 2016. Establishing a multi-criteria evaluation structure for tourist beaches in Taiwan: a foundation for sustainable beach tourism. *Ocean Coast. Manag.* 121, 88–96.
- Cooper, B., Rose, J., Crase, L., 2012. Does anybody like water restrictions? Some observations in Australian urban communities. *Aust. J. Agric. Resour. Econ.* 56 (1), 61–81.
- Defeo, O., McLachlan, A., Schoeman, D.S., Schlacher, T.A., Dugan, J., Jones, A., Lastra, M., Scapini, F., 2009. Threats to sandy beach ecosystems: a review. *Estuar. Coast. Shelf Sci.* 81 (1), 1–12.
- Domanski, A., von Haefen, R.H., 2010. *Estimation and Welfare Analysis from Mixed Logit Models with Large Choice Sets*. Working Paper. North Carolina State University.
- Espinet, J.M., Saez, M., Coenders, G., Fluvia, M., 2003. Effect on prices of the attributes of holiday hotels: a hedonic prices approach. *Tour. Econ.* 9 (2), 165–177.
- Fillmann, G., Friedrich, C., Santos, I., Wallner-Kersanach, M., 2005. Influence of socio-economic characteristics of beach users on litter generation. *Ocean Coast. Manag.* 48, 742–752.
- Fish, M.R., Cote, I.M., Horrocks, J.A., Mulligan, B., Watkinson, A.R., Jones, A.P., 2008. Construction setback regulations and sea-level rise: mitigating sea turtle nesting beach loss. *Ocean Coast. Manag.* 51 (4), 330–341.
- Gill, D.A., Schuhmann, P.W., Oxenford, H.A., 2015. Recreational diver preferences for reef fish attributes: economic implications of future change. *Ecol. Econ.* 111, 48–57.
- Government of Barbados, 2010. *Barbados National Assessment Report of Progress Made in Addressing Vulnerabilities of SIDS through Implementation of the Mauritius Strategy for Further Implementation (MSI) of the Barbados Programme of Action*. The Ministry of the Environment, Water Resources and Drainage, p. 123.
- Greene, W.H., Hensher, D.A., 2003. A latent class model for discrete choice analysis: contrasts with mixed logit. *Transp. Res. Part B Methodol.* 37.
- Haider, W., Rasid, H., 2002. Eliciting public preferences for municipal water supply options. *Environ. Impact Assess. Rev.* 22 (4), 337–360.
- Hamilton, J.M., 2007. Coastal landscape and the hedonic price of accommodation. *Ecol. Econ.* 62 (3), 594–602.
- Hanley, N., Mourato, R.E., Wright, G., 2001. Modelling recreation demand using choice experiments: climbing in Scotland. *Environ. Resour. Econ.* 22 (3), 449–466.
- Hardesty, B.D., Good, T.P., Wilcox, C., 2015. Novel methods, new results and science-based solutions to tackle marine debris impacts on wildlife. *Ocean Coast. Manag.* 115, 4–9.
- Hensher, D.A., Rose, J.M., Greene, W.H., 2005. *Applied Choice Analysis: a Primer*. Cambridge University Press.
- Hilger, J., Hanemann, M., 2006. Heterogeneous Preferences for Water Quality: a Finite Mixture Model of Beach Recreation in Southern California. *California Sea Grant College Program*.
- Huybers, T., 2004. Destination choice modeling: to label or not to label?. In: *Paper Presented at the Conference 'Tourism Modelling and Competitiveness: Implications for Policy and Strategic Planning'*, October/November 2003, Paphos, Cyprus.
- IDB, 2013. *The Smart Fight against Beach Erosion and Natural Disasters in Barbados*.

- Inter-American Development Bank Web stories. March 4.
- Ivar do Sul, J.A., Costa, M.F., 2007. Marine debris review for Latin America and the Wider Caribbean Region: from the 1970s until now, and where do we go from here? *Mar. Pollut. Bull.* 54 (8), 1087–1104.
- Jędrzejczak, M.F., 2004. The modern tourist's perception of the beach: is the sandy beach a place of conflict between tourism and biodiversity? *Coastline Rep.* 2, 109–119.
- Kriesel, W., Keeler, A., Landry, C., 2004. Financing beach improvements: comparing two approaches on the Georgia coast. *Coast. Manag.* 32 (4), 433–447.
- Kuhfeld, W.F., 2002. Multinomial Logit, Discrete Choice Modeling: an Introduction to Designing Choice Experiments, and Collecting, Processing, and Analyzing Choice Data with SAS, TS-677E. SAS Institute, Cary, N.C. U.S.A.
- Kikulwe, E.M., Birol, E., Wesseler, J., Falck-Zepeda, J., 2011. A latent class approach to investigating demand for genetically modified banana in Uganda. *Agric. Econ.* 42 (5), 547–560.
- Laframboise, M.N., Mwase, N., Park, M.J., Zhou, Y., 2014. Revisiting Tourism Flows to the Caribbean: what Is Driving Arrivals? (No. 14-229). International Monetary Fund.
- Landry, C.E., Keeler, A.G., Kriesel, W., 2003. An economic evaluation of beach management alternatives. *Mar. Resour. Econ.* 18, 105–127.
- Leggett, C., Scherer, N., Curry, M., Bailey, R., Haab, T., 2014. Assessing the Economic Benefits of Reductions in Marine Debris: a Pilot Study of Beach Recreation in Orange County, California. Industrial Economics Inc., Cambridge, MA, USA, p. 45.
- Loomis, J., Santiago, L., 2013. Economic valuation of beach quality improvements: comparing incremental attribute values estimated from two stated preference valuation methods. *Coast. Manag.* 41 (1), 75–86.
- Louviere, J.J., Hensher, D.A., Swait, J.D., 2000. *Stated Choice Methods: Analysis and Applications*. Cambridge University Press.
- Mahon, R., Parker, C., Snickler, T., Willoughby, S., Johnson, J., 2007. The Value of Barbados' Fisheries: a Preliminary Assessment. CERMES, UWI Cave Hill, Barbados.
- McFadden, D., 1973. Conditional choice analysis of qualitative choice behavior. In: Zarembka, P. (Ed.), *Frontiers of Econometrics*. Academic Press, New York, pp. 105–142.
- Milon, J.W., Scrogin, D., 2006. Latent preferences and valuation of wetland ecosystem restoration. *Ecol. Econ.* 56, 162–175.
- Moore, W.R., Harewood, L., Grosvenor, T., 2010. The Supply Side Effects of Climate Change on Tourism. MPRA Paper, 21469.
- Morey, E.R., Thacher, J.A., 2012. Using choice experiments and latent-class modeling to investigate and estimate how academic economists value and trade off the attributes of academic positions. Working paper. University of Colorado, Boulder.
- Mycio, M., 2006. Sustainable tourism using regulations, market mechanisms and green certification: a case study of Barbados. *J. Sustain. Tour.* 14 (5), 489–511.
- Newman, S., Watkins, E., Farmer, A., ten Brink, P., Schweitzer, J.P., 2015. The Economics of Marine Litter. In *Marine Anthropogenic Litter*. Springer International Publishing, pp. 367–394.
- Ofiara, D.D., Brown, B., 1999. Assessment of economic losses to recreational activities from 1988 marine pollution events and assessment of economic losses from long-term contamination of fish within the New York Bight to New Jersey. *Mar. Pollut. Bull.* 38 (11), 990–1004.
- Parsons, G.R., Massey, D.M., Tomasi, T., 1999. Familiar and favorite sites in a random utility model of beach recreation. *Mar. Resour. Econ.* 14, 299–315.
- Parsons, G.R., Chen, Z., Hidrue, M.K., Standing, N., Lilley, J., 2013. Valuing beach width for recreational use: combining revealed and stated preference data. *Mar. Resour. Econ.* 28 (3), 221–241.
- Pendleton, L., Atiyahb, P., Moorthy, A., 2007. Is the non-market literature adequate to support coastal and marine management? *Ocean Coast. Manag.* 50, 363–378.
- Pendleton, L., Mohn, C., Vaughn, R.K., King, P., Zoulas, J.G., 2012. Size matters: the economic value of beach erosion and nourishment in Southern California. *Contemp. Econ. Policy* 30 (2), 223–237.
- Pilkey, O.H., Wright III, H.L., 1988. Seawalls versus beaches. *J. Coast. Res.* 41–64.
- Pompe, J.J., Rinehart, J.R., 1994. Estimating the effect of wider beaches on coastal housing prices. *Ocean Coast. Manag.* 22, 141–152.
- Pompe, J.J., Rinehart, J.R., 1995. Beach quality and the enhancement of recreational property values. *J. Leis. Res.* 27 (2), 143–154.
- Pompe, J.J., Rinehart, J.R., 1999. Establishing fees for beach protection: paying for a public good. *Coast. Manag.* 27, 57–67.
- Provencher, B., Bishop, R., 2004. Does accounting for preference heterogeneity improve the forecasting of a random utility Model? A case study. *J. Environ. Econ. Manag.* 48, 793–810.
- Ramsey, V., Cooper, J.A.G., Yates, K.L., 2015. Integrated coastal zone management and its potential application to Antigua and Barbuda. *Ocean Coast. Manag.* 118, 259–274.
- Rigall-I-Torrent, R., Fluvia, M., Ballester, R., Saló, A., Ariza, E., Espinet, J.M., 2011. The effects of beach characteristics and hotel location with respect to the beach on hotel prices. *Tour. Manag.* 32, 1150–1158.
- Santos, I.R., Friedrich, A.C., Wallner-Kersanach, M., Fillmann, G., 2005. Influence of socio-economic characteristics of beach users on litter generation. *Ocean Coast. Manag.* 48 (9), 742–752.
- SAS Institute, 2008. *SAS ETS 9.2 Users Guide*. SAS Publishing, SAS Institute Inc., Cary, North Carolina, USA.
- Scarpa, R., Thiene, M., 2005. Destination choice models for rock climbing in the Northeastern Alps: a latent-class approach based on intensity of preferences. *Land Econ.* 81 (3), 426–444.
- Schuhmann, P.W., Casey, J.F., Horrocks, J.A., Oxenford, H.A., 2013. Recreational SCUBA divers' willingness to pay for marine biodiversity in Barbados. *J. Environ. Manag.* 121, 29–36.
- Semeoshenkova, V., Newton, A., 2015. Overview of erosion and beach quality issues in three Southern European countries: Portugal, Spain and Italy. *Ocean Coast. Manag.* 118, 12–21.
- Shivlani, M.P., Letson, D., Theis, M., 2003. Visitor preferences for public beach amenities and beach restoration in South Florida. *Coast. Manag.* 31 (4), 367–385.
- Smith, V., Zhang, X., Palmquist, R., 1977. Marine debris, beach quality, and non-market values. *Environ. Resour. Econ.* 10, 223–247.
- Somerville, S.E., Miller, K.L., Mair, J.M., 2003. Assessment of the aesthetic quality of a selection of beaches in the firth of forth. *Scott. Mar. Pollut. Bull.* 46 (9), 1184–1190.
- Ten Brink, P., Lutchman, I., Bassi, S., Speck, S., Sheavly, S., Register, K., Woolaway, C., 2009. Guidelines on the Use of Market-Based Instruments to Address the Problem of Marine Litter. Institute for European Environmental Policy (IEEP), Brussels, Belgium, and Sheavly Consultants, Virginia Beach, Virginia, USA, p. 60.
- Train, K.E., 1999. *Halton Sequences for Mixed Logit*, Working Paper. University of California at Berkeley.
- Tudor, D.T., Williams, A.T., 2003. Public perception and opinion of visible beach aesthetic pollution: the utilisation of photography. *J. Coast. Res.* 1104–1115.
- Ünal, Ö., Williams, A.T., 1999. Beach visits and willingness to pay: Cesme Peninsula, Turkey. In: Ozhan, E. (Ed.), *Proceedings of the MEDCOASTEMCS 99 Joint Conference, Land-ocean Interactions: Managing Coastal Ecosystems*. Middle East Technical University Press, Ankara, pp. 1149–1162.
- United Nations General Assembly, 2005. Sixtieth Session Agenda Item 75 (A) Oceans and the Law of the Sea.
- Waterman, T., 2009. *Assessing Public Attitudes and Behaviour Toward Tourism Development in Barbados: Socio-Economic and Environmental Implications*. Central Bank Barbados.
- Whitehead, J.C., Dumas, C.F., Herstine, J., Hill, J., Buerger, B., 2008. Valuing beach access and width with revealed and stated preference data. *Mar. Resour. Econ.* 23 (2), 119–135.
- Williams, A.T., Tudor, D.T., 2001. Temporal trends in litter dynamics at a pebble pocket beach. *J. Coast. Res.* 137–145.
- WTTC, 2015a. *Travel and Tourism Economic Impact 2015: World*. World Travel and Tourism Council, London, UK.
- WTTC, 2015b. *Travel and Tourism Economic Impact 2015: Caribbean*. World Travel and Tourism Council, London, UK.
- WTTC, 2015c. *Travel and Tourism Economic Impact 2015: Barbados*. World Travel and Tourism Council, London, UK.