WORKING PAPER ON MANAGEMENT IN ENVIRONMENTAL PLANNING

Take your swim suit along… — the value of improving urban bathing sites in the metropolitan area of Berlin

By

Jürgen Meyerhoff, Alexandra Dehnhardt, Volkmar Hartje

022/2008

Working Paper on Management in Environmental Planning 22/2008

Arbeitspapiere zum Management in der Umweltplanung 22/2008

Contact: Dr. Jürgen Meyerhoff
Meyerhoff@imup.tu-berlin.de
Institute for Landscape and Environmental Planning
Technische Universität Berlin
Straße des 17. Juni 145
D- 10623 Berlin

ABSTRACT

Bathing in lakes and rivers is a recreational activity enjoyed by many inhabitants of the metropolitan area of Berlin. However, so far no data exist about who goes bathing and what quality bathers expect from bathing sites. Using an online survey during the bathing season 2007 we asked people at which sites they go bathing, about their ratings of factors that affect their bathing experience and presented them a choice experiment concerning the quality of bathing sites. Quality of the bathing sites is mainly affected by the bathing water quality but also by facilities such as showers or presence of a lifeguard, for example. As the bathing sites vary considerably in terms of their quality, we expect that bathers exhibit significant taste heterogeneity. Therefore, this paper uses a finite mixture logit to investigate preference heterogeneity. The results reveal that taste heterogeneity is present among bathers. While some attributes such as cleanliness of the bathing site seem to be important for all bathers, presence of a lifeguard is valued very differently. Also the individual-specific welfare measures show that bathing water quality and cleanliness attract the highest marginal willingness to pay. A test for preference consistency, i.e. monotonicity, revealed only a small number of respondents who choose the dominated alternative indicating that online-surveys may not lead to more severe problems than traditional survey methods.

Keywords: bathing, choice experiment, dominate alternative, latent class analysis, online-survey, urban recreation

1. Introduction

Bathing is an important recreational activity in Berlin and its metropolitan region. There are more than 140 monitored bathing sites at lakes and rivers. However, although it is an important recreational activity so far neither the user population nor their preferences for the quality of the bathing sites are known. The water quality of the lakes in this area has been improved considerably in the past 15 years, but the ecological conditions of the lakes make them vulnerable to short term pollution episodes in the summer. There is little information how the users adjust to these conditions and to the variety of the amenity quality of the bathing sites and how users value efforts to improve the quality further. There is evidence from the public officials and in the media that there are differences among the users about which level of water quality and amenity composition they prefer. Furthermore, the additional reduction of storm water discharges requires costly investments so that the valuation of the resulting benefits will provide valuable information for the policymakers.

The application of random utility models (RUM), i.e. choice based models, to recreation allows taking into account the heterogeneity of site characteristics for different activities, but the heterogeneity of the preferences of the users has only recently gained attention for recreational activities with the use of finite and continuous mixture. Water related recreation has played a prominent role in the economic reasoning about the benefits of water pollution control. The economic valuation of water related recreation already has a considerable tradition if one takes into account that a first survey of the empirical evidence was undertaken in 1993 (Freeman 1995). While Freeman has reviewed only four studies concerning beach use or swimming as the analysed activity, most of the empirical evidence relates to fishing. Fifteen years later, the number of studies covering beach use has increased considerably with RUM becoming the most commonly used method of estimating recreational benefits and the impact of water quality. Most of the sites analyzed are beaches located in the USA, from beaches in Boston area (Hanemann 1978; Bockstael et al.1986) and beaches in Chesapeake Bay (Bockstael et al. 1988) to beaches in the Mid-Atlantic region (Parsons & Massey 2003), and beaches in southern California (Lew & Larsons 2005). Beaches at freshwater lakes received less attention, but there is already a body of knowledge, however mostly restricted to US water bodies: lakes in New Hampshire were analyzed with an emphasis on the level water quality (Needelman & Kealy 1995), with different specifications about the effect of quality on recreational choice in Iowa (Egan 2003; Jeon et al. 2005) and the beaches at Lake Erie were valuated with respect to water quality advisories (Murray & Sohngen 2000).

In Europe, there have been fewer studies: The EU Bathing Water Quality Directive from 1976 provided the anchor for health benefits related studies of beach users with a focus on the willingness to pay for improved water quality, but less attention given to the site characteristics. Georgiou et al. (1996, 2000) estimated the willingness to pay (WTP) of beach users and non users to improve the bathing water quality in East England with a contingent valuation (CV) design. Hanley et al. (2003) use a combined stated preference and revealed preference approach to estimate the WTP and trip frequency for users of seven beaches in West Scotland. In both cases, the sites characteristics were not the focus. Machado and Mourato (1999) provided a RUM with choice cards to beach users of the Estoril coasts from Lisbon

with respect to water quality and amenities. Mourato et al. (2007) employed a choice experiment to elicit the benefits for the population of England and Wales for a revised Bathing Water Directive. They considered bathing water quality improvements, provision of more information to the public, absence of litter and dog mess and the presence of amenities. Random utility models focusing on marine recreation were also applied for beach recreation at the Swedish coast with a policy perspective focusing on water quality at the sites (Sandström 1996) and for all types of recreation at beaches on the west coast of Sweden with a policy perspective of improving water quality as well (Eggert & Olsson 2004). None has investigated freshwater bathing which is surprising considering the fact that more than 6000 of the monitored sites in the EU are located in freshwater areas.

Moreover, there have few studies applying finite mixture models to recreational activities dealing with preference heterogeneity (e.g. climbing in the Alps, Scarpa & Thiene 2005), but we are only aware of one to marine recreation in Southern California (Hilger & Hanemann 2006) and one to freshwater recreation, i.e. recreation along the Columbia river (Shonkwiler & Shaw 2003). To our knowledge no comparable studies concerned with freshwater recreation investigating taste heterogeneity exist for Europe.

In this paper, we apply the continuous and finite mixture model to identify heterogeneity among bathers' preferences for freshwater lakes with respect to water quality and recreational amenities in the metropolitan area of Berlin. In the summer 2007 we conducted an online survey asking respondents whether they had been bathing prior to the interview, where they went bathing and how they rate factors that may affect the bathing experience. The survey also comprised a choice experiment in order to determine whether respondents would value improvements of bathing sites and which attributes would be more important than others.

The remainder of the paper summarizes in Section 2 the situation of bathing in the freshwater lakes in the area of Berlin and its regulatory situation. In the next section, we introduce the econometric specification of the conditional and finite mixture models. Then, we discuss the merits and drawbacks of internet surveys for market valuation and their implication for the results of our own survey. The next section presents the design of the survey and the data collection. Finally, the results of the analysis are presented before the discussion concludes.

2. Bathing in the metropolitan area of Berlin

The bathers in Berlin and Brandenburg − an area located 200 miles away from the German Baltic coasts harbouring the closest saltwater beaches − have a choice of a large number of sites at (freshwater) lakes and lowland rivers to bathe in a natural environment. The lakes and the rivers are located within the city boundaries and cover also a large share of the surrounding state of Brandenburg (see Map 1 in the appendix). Bathing is here understood as the combination of two sets of activities: Swimming in a freshwater lake and visiting a waterside besides beaches (Leeworthy et al. 2005). Brandenburg is used intensively for day excursions including bathing recreation, but there is no national outdoor recreation survey in Germany, only the total and broad activity categories were estimated once in 2005 (Maschke

2005), revealing a total participation rate in all specific outdoor activities of 20%. As access to most of the sites is without charge, the total number of bathers is unknown, but there is considerable evidence that bathing constitutes a very important outdoor activity in the Berlin Brandenburg region as well.

The waters for swimming in lakes and rivers in the Berlin-Brandenburg area, as all freshwaters (and coastal waters) in the European Union (EU), are specifically regulated to protect swimmers and bathers against health hazards based on microbiological contamination and other pollutants. The Bathing Water Quality Directive (76/160/EEC) has been in force since 1976 and, thus, constitutes one of the earliest water pollution control instruments of the EU. It has been quite broad in terms of covered pollutants, but relatively unspecific with respect to the instruments to be applied by the member states. The Directive had been complemented by other Directives covering water pollution sources more specifically, e.g. the Urban Wastewater Directive and the Nitrate Directive. Despite a number of implementation problems, the efforts in improving the nutrients discharges have been intensified, particularly after 1990, and achieved a considerable reduction of discharges, resulting in a high degree of compliance with mandatory and guide values of the Directive. But the high number of dams and locks reducing the flow velocity of the rivers and the high share of lakes still lead to a general water quality situation which is unfavourable for bathing water quality, particularly in the summer: high oxygen variability, increasing nutrient concentrations and algal blooms. These conditions are mainly responsible for the actual problems of bathing water quality, microbiological contamination, low sight depth and algal bloom, but the guide values of the EU Directive are surpassed only in cases of short term concentration of bathers and as a result of short term storm-water situations. In Berlin and Brandenburg, the responsible water management agencies focus their attention on a set of efforts to reduce the risks of storm-water management.

The 1976 Directive has been replaced by the Directive 2006/7/EC concerning the management of bathing water quality which reduces the parameters covered to those dealing with microbiological contamination and it broadens and specifies the responsibilities of the member states concerning the information of the public about bathing water quality and short term pollution (advisory notice system).

The member states have implemented the 1976 Directive by national laws according to their organisation of responsibilities. Due to the federal allocation of water management authority to the Laender in Germany, the EU Bathing Water Quality Directive in the Berlin-Brandenburg area has been implemented by the two Laender, Berlin and Brandenburg, with separate ordinances. Their respective bathing water ordinances cover the declaration (or identification) of bathing sites, the organisation of the monitoring of bathing water quality and the measures to be taken in case of short term pollution, i.e. information of the public and in severe repeated cases prohibition of bathing. The base load of water pollution has been addressed by a number of other laws and ordinances which deal directly with the sources of pollution.

Among these sites, the responsible state agencies designate bathing sites for which they collect the quality data, provide the public with bathing advisories and report the results to the

EU Commission. The list of designated bathing sites is considerable shorter than the total potentially suitable sites as a consequence of the requirements in the EU Directive restricting the monitoring of those sites where a large number of bathers are expected by the local authorities. Furthermore, sites unsuitable for bathing because of permanent pollution or because of other (shipping) uses even if bathing takes place do not have to be reported. Thus, Berlin reports 41 and Brandenburg 229 sites, monitored and reported by state agencies. In Brandenburg, an additional total of 221 sites are monitored by municipal agencies at a lower frequency.

As already established by other studies, bathers, however, are not only interested in the water quality, but a number of others amenity qualities of the bathing sites, e.g. transportation access, cleanliness of the land area, availability of showers, other services, availability of life guards, congestion and the presence of dogs. Land access depends on land ownership of the shoreline, which is provided by a combination of public (state and municipal) and private ownership. The sites vary considerably in terms of their quality, ranging from a full service, often congested site close to the city of Berlin which generated the refrain of a popular song in the 50ies used in the first part of the title of this paper, to pristine natural lakes without facilities and eventually no other bathers.

3. Taste heterogeneity among bathers – finite mixture

As the bathing sites in Berlin and Brandenburg vary considerably in terms of their quality it is expected that bathers exhibit significant taste heterogeneity because they are expected to choose the bathing sites they visit in accordance with their interests ranging from, for example, solely sunbathing to sportive swimming or a desire for “pristine” nature. The economic literature has presented, in addition to recognising observed heterogeneity via descriptors of an individual or their contextual setting (Hensher et al. 2005), two broad ways of modelling unobserved heterogeneity: random parameter logit (RPL, continuous mixture) and latent class models (LCM, finite mixture) (Swait 2006). While in the former individuality of preferences is reflected in individual-specific departures from the mean values of utility parameters, in the latter the population is segmented into groups of individuals with identical preferences.

In a random utility model (RUM) the indirect utility an individual *n* receives from choosing an alternative *i* (U_{ni}) consists of a systematic component (V_{ni}) and a random error component (ε_{ni}) resulting in the following indirect utility function:

$$U_{ni} = V_{ni} + \varepsilon_{ni} . \qquad (1)$$

Moreover, it is assumed that individual *n* selects an alternative *i* from the choice set C_n if the indirect utility of alternative *i* is greater than the utility of any other alternative *j*:

$$P_{ni} = \Pr ob(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj}), \forall i, j \in C, j \neq i . \qquad (2)$$

Assuming that the error components are distributed independently and identically (IID) and follow the Gumbel distribution, the probability that alternative *i* is chosen is calculated in the *conditional logit* model (CL) as follows:

$$P_{ni} = \frac{\exp[V_{ni}]}{\sum_{j \in C} \exp[V_{nj}]}, \tag{3}$$

where the scale parameter of the error distribution is normalized to one, and omitted. The systematic part of utility of the *i*th alternative is assumed to be a linear function of attributes:

$$V_{ni} = ASC + b_k X_{ki} + b_z I_n, \tag{4}$$

where β_k is the vector of preference parameters associated with attribute k, X_{ik} is attribute *k* of alternative *i*, β_z is the vector of socio-economic variables (I), and ASC is an alternative specific constant which captures the influence of unobserved attributes on choice relative to specific alternatives (Train 2003). Changes in welfare due to a marginal change in a given attribute can be computed using the marginal willingness to pay measure. It is defined as the maximum amount of income a person will pay in exchange for an improvement in the level of a given attribute provided. The measure is calculated by dividing the parameter of the attribute of interest $\beta_{attribute}$ by the parameter for the price attribute β_{money} that represents the marginal utility of income, i.e.

$$\text{marginal willingness to pay} = -\frac{\beta_{attribute}}{\beta_{money}}. \tag{5}$$

However, the conditional logit has various limitations such as not allowing for random taste variation, not for unrestricted substitution patterns, and not for correlation in unobserved factors over time (Train 2003). An approach to overcome the limitations of the CL is the *latent class model* (LCM). It requires, unlike the RPL, few assumptions about the distribution of preferences. Following the LCM approach it is assumed that S segments exist in the population, each with a different preference structure. And individual *n* belongs to one of the segments s(1, …., S). The indirect utility function (1) is expressed as $U_{ni|s} = \beta_s X_{ni} + \varepsilon_{ni|s}$ with β_s the segment specific vector of coefficients, X_{ni} the vector of attributes associated with each alternative and $\varepsilon_{ni|s}$ the random component of utility for each segment. The probability of choosing alternative *i* depends on the segment *s* an individual *n* belongs to. It can be expressed as

$$P_{ni|s} = \frac{\exp(\beta_s X_{ni})}{\sum \exp(\beta_s X_{nj})}. \tag{6}$$

The utility function is in this application solely specified as a function of the attributes, i.e. we do not estimate a segment membership function. However, the panel character of the data is

recognized in the model estimation, i.e. the coefficients vary randomly across individuals but are fixed across choice occasions for a given individual, and the marginal willingness to pay is computed for each attribute within each segment separately.

4. Online surveys in non-market valuation

Mail, telephone or face-to-face interviews are widely used in non-market valuation such as stated preference studies. The development of the internet − technical means as well as access rates and usability − provides opportunities to conduct such surveys in a time and cost reducing manner, and might therefore be considered as a practical and efficient alternative to traditional means of data collecting. Thus, the amount of online-surveys in different contexts (market research, political surveys, and scientific purposes) increased in recent years and online-surveys become more and more an important tool in empirical social research; that poses the question, whether online-surveys might provide a promising alternative for non-market valuation purposes for achieving valid results.

Some stated preference studies using the Internet have been conducted recently (e.g., Olsen 2007; Iragüen & de Dios Ortúzar 2004; Thurston 2006). Particularly, for the valuation of non-market benefits or assessment of environmental policy options the internet technology provides unique possibilities for a comprehensive description of the good in question – by showing photographs, displaying pictures or videos, providing links to other web pages for detailed descriptions and further information (cf. Thurston 2006). Furthermore, apart from the reduced time and costs of conducting the survey, possible mistakes in transforming data in an electronic format are eliminated by response coding and digitising automatically, response speeds are increased and depending on the design, the researcher can keep the respondents making answers conditional on previous or following questions (Zhang 1999; Iragüen & de Dios Ortúzar 2004; Olsen 2007). Also additional information which might be interesting for evaluating the interviews is provided when data are captured computer-based, such as the measurement of the time needed for answering single questions, for example, which might indicate possible 'learning effects' of the respondents when answering different choice cards. Another possibility related to the technical mean within the scope of online-interviews refers to the identification of the internet pages from where the questionnaire has been accessed. A potential manipulation of the survey by announcing the questionnaire in discussion forums of certain interest groups might be identified.

The potential of web-based surveys is associated with drawbacks and possible biases as well. Following Thurston (2006, 265) "…the conclusions drawn by the study are constrained by the survey's sample", which refers to the most severe disadvantage of online-surveys: the sampling procedure that is responsible for the potential biases. Couper and Coutts (2004) comprehensively discuss the main factors of biases in surveys, such as coverage errors, sampling errors, non-response and measurement errors. The most serious drawbacks with respect to generalising the results rely on biased samples. Coverage errors result from the

problem, that an (unknown) part of the target population is not covered by the sampling frame. Following Couper and Coutts (2004) web-based surveys are particularly susceptible to coverage errors, because the sampling frame cannot be identified reliably. The population the researcher wishes to sample is in most cases not equal to the population with an internet access. This problem might decrease as the internet access rates increase, but even if an internet access is available, the actual usage and individual ability to use it remains unclear. Most of the studies concerning internet usage show, that some groups remain underrepresented in online- surveys: basically, a 'typical' internet user is male, higher educated, has a higher income and is younger than the average of the population (Zhang 1999; Couper & Coutts 2004; Thurston 2006). Thus, the findings from internet surveys are not representative to population or even to a − mostly unknown − target sample. Another reason for getting a biased sample might be based on sampling errors. Since the sampling in internet surveys is in most cases not determined randomly a self-selection bias might occur. The results from surveys with self-selected respondents will probably differ in a relevant, but not predictable manner from the population (Couper & Coutts 2004). Meanwhile, different ways exist to avoid such sampling issues, like the use of a random digit dialling (RDD) telephone contact method (comparable to a common procedure in telephone) to identify potential respondents in an initial step.

To conclude, Couper and Coutts (2004) discusses the validity and representativeness of findings based on internet surveys and those with self-selected respondents in particular very critically. Other studies that have been conducted in the context of non-market valuation in particular, judge more positive (Iragüen & de Dios Ortúzar 2004; Thurston 2006). Olsen (2007), for example, specifically compared the findings of to similar choice experiments, one conducted by internet and one by mail. We thus conclude with Olson (Olsen 2007, 1) that the stated preference study using an internet survey "… does not introduce any additional major biases that are not already present in the traditional paper-and-pencil surveys."

5. Design of the survey and data collection

5.1 Structure of the questionnaire

Respondents who decided to proceed with the interview after they had read the introductory screen were asked how often they go in general bathing during the summer and whether they have already been bathing prior to the interview in the 2007 season. Respondents who answered positively were guided to a map showing the bathing sites that were subject of the survey (see Map 1 in the appendix) and were asked which bathing site they had visited most recently. Afterwards, questions followed concerning whether they go always to this bathing site, how long they stay on average at the bathing site and which means of transport they had used in order to get to the site (walking, bicycle, car, public transport). Those who have not been bathing prior to the survey in the 2007 season were also directed to the map but were asked to which bathing site they would probably go if they decide to go bathing until the

end of the bathing season. Moreover, they were also asked whether they always go to this site, how long they would probably stay and which means of transportation they would use.

Next, all respondents were asked to rate eight factors that might effect the quality of their beach experience on a scale from 1 to 10, with 1 indicating a factor that is not at all important to their bathing experience and 10 being extremely important to their bathing site experience (Table 1, see Table 3 for results). The following question then asked whether respondents use the information provided on web sites, e.g., maintained by the Berliner Senatsverwaltung, about the bathing water quality at the bathing sites.

Table 1: Factors affecting bathing experience

1) How important is the bathing water quality for you?
2) How important are parking facilities close to the bathing site for you?
3) How important is the cleanliness of the beach and the lawn for you?
4) How important is the availability of showers and restrooms for you?
5) To what extent do you perceive dogs at the bathing site disturbing?
6) How important are kiosks, bars restaurants at the bathing site for you?
7) To what extent do you find congestion of a bathing site disturbing?
8) How important is a public transport connection at the bathing site for you?

The third section of the questionnaire comprised the choice experiment. People were asked first whether they are in principle willing to pay something in order to increase the quality of bathing sites. Only those who responded positively were directed to the choice experiment that is described in Section 5.2. Our concern was that respondents who were not willing to pay but had to pass through the sequence of choice cards may cancel the interview before answering the socio-demographic questions and would therefore be lost for analysis. Therefore, these respondents were directed straight to the question asking for their reasons for not being willing to pay. Those who respondent that they are willing to pay were directed to a web page explaining the attributes of the choice experiment and afterwards started answering the choice cards. After the last card they were asked to state those three attributes that have been the most important with respect to their choices. Finally, socio-demographics were requested from both groups.

5.2 Design of the choice experiment

Table 2 shows the selected attributes and their levels. Five of the six attributes describe different characteristics of the bathing sites. These are number of days with bad bathing water quality (swimming advisory recommends to restrain from bathing or forbids it), presence of a lifeguard, up to date information about water quality at bathing site, cleanliness of the beach and sunbathing lawn at the site, and the availability of showers and restrooms. The sixth attribute included in the choice experiment is a monetary one. It represents the amount of

money a person would have to pay as a surcharge to an already existing entrance fee at managed bathing sites or as a newly introduced entrance fee at so far unmanaged bathing sites.

Table 2: Choice attributes of the bathing sites

Attribute	Definition	Levels
Number of days with poor bathing water quality	Bathing advisory recommends to restrain from bathing or forbids it	0, 7, 14, 21
Lifeguard	Lifeguard is present at bathing site during season or not	yes, no
Advisory notice system	Up to date information about water quality is available at bathing site	yes, no
Bathing site cleanliness	Mainly absence from litter on beach and sunbathing lawn	satisfactory, good
Showers and Restrooms	Showers and restrooms are available at bathing site	yes, no
Price per visit in €	Surcharge to entrance fee (at managed bathing sites) or amount of newly introduced entrance fee (unmanaged bathing sites)	0.5, 1.0, 2.5, 4.5

A main effect design based on D-optimality was obtained using SAS macros (Kuhfeld 2005). To avoid dominant alternatives a restriction was imposed on the macro such that no alternative on a choice card should have lower levels of all non-monetary attributes than the other alternative but a higher price. The design resulted in 24 choice cards (D-efficiency score 93.24 percent). During the online interview each respondent who was willing to pay for improving the bathing sites was presented a row of four choice cards. Each time one of the 24 choice sets was randomly selected by the survey software. An example of a choice card is presented in Figure 1. The choice cards each time showed the two experimentally designed alternatives, “Bathing site A” and “Bathing site B”. Also each card offered the alternative not to choose (“I choose neither bathing site A nor B”).

Figure 1. Example of a choice card

Please choose between bathing site A and B or none of both.		
	Bathing site A	**Bathing site B**
Number of days with swimming advisory "no swimming"	14	7
Life guard at bathing site	No	Yes
Advisory notice system	Yes	Yes
Cleanliness of beach and lawn	Satisfactory	Satisfactory
Showers and restrooms	Yes	No
Price per visit in €	0.5	2.5
I choose bathing site A	☐	
I choose bathing site B	☐	
I choose neither bathing site A nor B	☐	

5.3 Test for preference consistency

Scarpa et al. (2007) suggest including tests for internal validity in choice experiments in order to check respondents 'rationality', i.e. identify respondents with inconsistent preferences (see also Miguel 2002; Miguel et al. 2005). In their survey they employed tests for "preference stability" and "monotonicity" (more is preferred to less). For the former they presented respondents the same choice card twice, i.e. repeated a card from the beginning at the end of the choice card sequence, and in the latter they presented respondents a choice card on which one alternative was dominated by the other alternative. They found that in one of their choice experiments 28% of the respondents did not choose the same alternative on the last card as on the first, i.e. they did not pass the stability test, and that in their second choice experiment 21% of the respondents selected the dominated alternative.

To test how frequently inconsistent preferences would occur at an online-survey we included a test for monotonicity. Therefore, in addition to the four choice cards resulting from the experimental design respondents were presented a fifth choice card at the end of the sequence of cards. On this card alternative A (bathing site A) was a dominant alternative, i.e. it was at least as good as alternative B in terms of every attribute.[1]

[1] The dominant alternative has the same levels for the attributes "number of days with bad water quality", "lifeguard" and "information about water quality", higher levels for the attributes tidiness and toilettes/showers but requires a lower fee per visit.

5.4 Sampling process

The online survey was realised with the Enterprise Feedback Suite (EFS) survey module by GLOBALPARK (www.globalpark.com). It provides a broad range of tools for designing questionnaires and checking the quality of the data, for example rejecting implausible entries. Moreover, the software also allows restraining people from answering the survey more than once in order to influence results. The questionnaire was accessible from mid of July to mid of September by going to its web address directly or by following links from the homepage of the Technische Universität Berlin. The link was also posted on the homepages of the government agencies in Berlin and Brandenburg that are responsible for testing the bathing water quality and regularly publish the results, and the homepage of the Berliner Bäder Betriebe, a public corporation that owns and operate baths in Berlin, that encompass professional bathing sites at lakes and rivers in Berlin. The questionnaire was announced by the press office of the TU Berlin on the date it was accessible; the resonance was remarkable: around eight daily newspapers published articles about the project and the web address of the questionnaire and posted links on their homepages as well. Accordingly, four main access routes for answering the interview can be distinguished: The main group of people (40%) followed the links posted on the authorities' homepages, the second group (37%) came across the page from different ways, or by 'surfing the net', etc., the third group of people (14%) came from the homepage of the TU Berlin, and the fourth group (9%) followed the links on daily newspaper homepages.

6. Results

6.1 Descriptive statistics

Overall 2057 people visited the first page of the survey. Of these people 583 (28.3%) did not proceed to the second page on which the questionnaire actually started. The second biggest drop out took place on the second web page. Here 258 (12.5%) people cancelled the survey. Probably these people were curious because of the newspaper articles and wanted to take a closer look at the survey but may then have decided that they were not interested in participating. On the following pages drop outs strongly decreased to generally single-digit numbers. In the end 943 (45.8%) respondents finished the interview. As not all of them had answered all questions (some answers were not defined as obligatory), 921 (44.8%) questionnaires were useable for further analysis. Among them 420 respondents (45.6% of the useable sample) were in principle willing to pay in order to improve the quality of the bathing sites. Therefore, they were presented the choice experiment. The following analysis is confined to this subsample. Table 3 reports the descriptive statistics for some socio-demographics and the ratings of factors affecting bathing site experiences for these respondents.

Table 3: Descriptive statistics

		Mean	SD	Median	Min	Max
Age		37.81	12.00	36.00	18.00	75.00
Income*		2198.66	1395.59	1985.44	250.00	6250.00
Sex (0=male)		0.49	0.50	0.00	0.00	1.00
People per household (n)		2.25	1.17	2.00	1.00	9.00
People younger than 18 per household (n)		0.39	0.77	0.00	0.00	4.00
Bathing activity						
Bathing 2007 (yes/no)		0.84	0.37	1.00	0.00	1.00
Bathing per year (number)		19.17	25.23	11.00	0.50+	90.00
Duration of stay# (hours)		3.43	1.95	3.00	0.50	8.00
Factors affecting bathing site experience						
Rank						
1	Cleanliness of the beach and lawn	9.00	1.36	9.00	1.00	10.00
2	Bathing water quality	8.92	1.49	9.00	1.00	10.00
3	Congestion at the bathing site	7.83	1.99	8.00	1.00	10.00
4	Dogs present at the bathing site	7.59	2.78	8.00	1.00	10.00
5	Public transport connection	6.49	3.04	7.00	1.00	10.00
6	Availability of showers and restrooms	6.36	2.87	7.00	1.00	10.00
7	Parking availability	5.10	3.12	5.00	1.00	10.00
8	Availability of kiosk, bar or restaurant	4.58	2.66	5.00	1.00	10.00

N = 420; * 21 respondents had not sated their income; the missing values were imputed using the STATA command "impute", the imputation was done based on income, age, people per household, and occupation; # n = 352 because 68 people have not been bathing prior to the interview, + less than one time per year

As the figures in the lower part of Table 3 show, the two factors most strongly affecting the bathing experience are cleanliness of the beach and the lawn (mean = 9.00) and water quality (mean = 8.92). Next, congestion (mean = 7.83) and dogs present at the bathing site (mean = 7.59) follow. Less significance have public transport connection (mean = 6.49) and availability of showers and restrooms (mean = 6.36). The faintest influence on the bathing

experience do have the availability of parking (mean= 5.1) and availability of kiosks, bars or restaurants (mean = 4.58).

6.2 Preference consistency

Table 4 summarizes the responses to the additional choice card testing for monotonicity. Of the 420 respondents 92 (21.9%) choose neither Bathing site_A or Bathing site_B. Therefore, for these respondents we do not have information on whether or not their preferences comply with monotonicity. Among the remaining respondents, 322 (76.7%) choose the dominant alternative and solely 6 (1.4%) choose the dominated alternative.

Table 4: Number of times dominant alternative was chosen

Alternative	Number of choices	Percentages
Bathing site A (dominant alternative)	322	76.7
Bathing site B (dominated alternative)	6	1.4
No bathing site	92	21.9
Total	420	100.0

Compared to the results reported by Scarpa et al. (2007) the number of only six respondents violating the monotonicity test is very low. In their survey 21% of the respondents choose the dominated alternative. However, we do not have a clue so far why the present survey resulted in such a low number of inconsistent responses. The complexity of the choice cards used is in both surveys at least similar. The total number of choice cards in the Scarpa et al. study is four respectively five plus the card testing monotonicity or stability. In the present study the number is four plus the fifth card testing monotonicity. The number of attributes is higher in the present study (six compared to five) but Scarpa et al. had on average more levels per attribute. A more salient difference is that Scarpa et al. used pictures on their choice cards[2]. This might have increased complexity. Another reason could be that in the present survey respondents were more interested in the good in question because of the stronger self-selection process at the beginning of the interview, i.e. the decision to participate. As the number of respondents with inconsistent preferences was low we finally opted for leaving these responses in the sample (see also Lanscar & Louviere 2006 for a discussion of whether to delete “irrational” responses or not).

[2] See http://rep-scheme-valuation.tripod.com/ML_S_FT_CH.pdf for an example of their choice cards.

6.3 Conditional logit and latent class model

To guide selection of the number of segments, we used the Akaike's ρ^2, the Bozdogan Akaike Information Criterion (AIC3) and the Bayesian Information Criterion (BIC)[3]. Table 5 reports the results for the LCMs estimated with a varying number of segments ranging from one to five. Based on these figures we opted for a three segment model. Except for the BIC criterion this model shows a better fit as the model with two classes. The BIC criterion suggests a two class model. On the other hand, model fit does not increase strongly when we move from a three to a four segment model.

Table 5: Criteria for determining the optimal number of segments

Number of segments	Number of parameters	Log Likelihood (LL)	$\overline{\rho}_s^2$	AIC3	BIC
1	7	-1589.98	0.13	3200.97	1615.97
2	15	-1483.47	0.18	3014.93	1542.87
3	23	-1467.77	0.19	3007.54	1556.89
4	31	-1454.59	0.19	3005.17	1573.41
5*	39	-1427.14	0.20	2974.28	1575.67

N = 1680 observations respectively 420 individuals; * high standard errors indicating identification difficulties.

The parameters have in the CL the expected sign and are all significant apart from the parameter for the attribute lifeguard (Table 6). Fewer days with a swimming advisory "not recommended/forbidden", advisory notice system at the bathing site, improved cleanliness, and the availability of showers and restrooms positively influence respondents' utility. Presence or absence of a lifeguard is not significant. In the LCM, the picture is somewhat different. In all three segments the price parameter is significant and negative as expected a priori. Moreover, all other attribute parameters in the first and third class are positively significant indicating that respondents prefer bathing sites that provide higher levels of the corresponding attributes. In segment two we find negative parameters for the attributes lifeguard and information. Respondents assigned to this segment seem to prefer bathing sites without "lifeguards" and without "advisory notice system". The second segment also differs with respect to the attribute "showers and restrooms" as the parameter is not significant. The ASC represents the no choice option that could be interpreted as opting for the present situation. In the CL and in the first segment of the LCM the negative parameter of the ASC indicates that people would derive utility from moving away from the present situation. In contrast, the

[3] $\overline{\rho}_s^2 = 1 - (\mathrm{AIC}_s / 2 * \log \mathrm{L}_0)$, AIC3 = $-2\log \mathrm{L}_s^* + 3\mathrm{K}_s$ and BIC = $-\log \mathrm{L}_s^* + (\mathrm{K}_s * \log \mathrm{N})/2$ were $\log \mathrm{L}_s^*$ represents the log likelihood at convergence with s classes and K the number of parameters.

ASC is in the second and third segment positive but not significant. Comparing the models with respect to the fit measures reveals that the LCM performs better than the CL.

Table 6: Model results

Attribute	CL	LCM		
		Segment 1	Segment 2	Segment 3
ASC(no bathing site)	-1.397***	-2.657***	0.257	0.424
Bathing water quality	0.059***	0.057***	0.176***	0.114***
Lifeguard	0.061	0.0296	-0.769***	0.447***
Advisory notice system	0.167***	0.163***	-1.237***	0.843***
Cleanliness	0.534***	0.507***	1.345***	1.049***
Showers and restrooms	0.384***	0.417***	0.142	0.780***
Price	-0.402***	-0.466***	-0.749***	-0.189***
Marginal willingness to pay				
Bathing water quality	0.15 (0.12 – 0.18)	0.12 (0.09 – 0.15)	0.24 (0.11 – 0.36)	0.60 (0.25 – 0.95)
Lifeguard	n.s.	n.s.	-1.03 (-1.80 – -0.26)	2.37 (0.71 – 4.03)
Advisory notice system	0.42 (0.21 – 0.63)	0.35 (0.11 – 0.59)	-1.65 (-2.37 – -0.93)	4.47 (1.52 – 7.41)
Cleanliness	1.33 (1.09 – 1.58)	1.09 (0.82 – 1.35)	1.80 (1.06 – 2.54)	5.56 (2.28 – 8.83)
Showers and restrooms	0.96 (0.73 – 1.19)	0.89 (0.64 – 1.15)	n.s.	4.13 (1.51 – 6.76)
N	1680	1128	220	332
LL_0	-1.841.31			-1841.31
LL_{Model}	-1.598.98			-1467.77
MCFadden	0.13		0.19	
AIC3	3200,97		3007.54	
BIC	1615.97		1556.89	

*** p < 0.001, ** p < 0,01, p < *0,05; for the marginal prices based on the CL also the 95%-confidence interval is reported, for the ML and the LCA the values in parentheses report the range of the individual specific values

The marginal WTP values are presented in the midsection of Table 6. According to the CL people would be willing to pay € 0.15 per visit to avoid a day with poor water quality. The presence of an advisory notice system at the bathing site and presence of showers and rest-rooms is worth € 0.42 respectively € 0.96 to bathers per visit. The highest marginal WTP is for an improvement of the cleanliness from satisfactory to good. Bathers would pay € 1.33 per visit. The marginal WTP values from the LCM show some interesting differences be-

tween the three segments. Overall, segment one has the lowest WTP values for all attributes except for the advisory system because the WTP for this attribute is negative in segment two. Moreover, the values are more or less close to those from the CL. The marginal values for bathing water quality and cleanliness in the second segment are between the first and third segment, but those for lifeguard and information are negative indicating that people may experience disutility from the presence of a lifeguard or an advisory notice system at the bathing site. Evidently higher, and always positive, are the WTP values for the third segment. For all five attributes the values are higher than the mean values in the first and second segment. The values indicate that the third segment contains respondents who have stronger preferences for improving the quality of bathing sites. The highest WTP appears for the attribute cleanliness of the bathing site.[4] Bathers in this segment would be willing to pay € 5.6 per beach visit in order to improve cleanliness from satisfactory to good. However, the marginal WTP value for cleanliness is in all segments and in the CL each time the highest WTP value indicating that cleanliness is an import issue for all bathers in the present sample.

Table 7 reports the descriptive statistics according to the three segments of the LCM. To test whether the samples are from the same population the Pearson Chi square test or the Kruskal-Wallis test were used. As the results show, among the socio-demographics only income is significantly different, i.e., income is higher in segment three compared to the first and the second segment. Also the variables describing the individual bathing behaviour differ not significantly among the three segments. More significant differences arise among the factors that affect the quality of beach experiences. People in the first segment rate bathing water quality as slightly less important compared to those in the remaining segments. The same applies to cleanliness. On the other hand, those who are in the third segment favour kiosks, bars or restaurants at the bathing site more strongly than those in first and second segment. Only with respect to the rating of showers and restrooms all three segments differ significantly from each other. This equipment seems to be most important for respondents in third segment and least important for those in the second segment.

Summarizing, Segment 1 seems to assemble bathers who are interested in improvements but who have on average only a modest willingness to pay. Moreover, people in this segment are not willing to pay for the presence of a lifeguard. Therefore they are labeled here as “Modest quality seekers”. In contrast, the utility of respondents in Segment 2 is solely affected by higher water quality and improved cleanliness at the bathing site. Accordingly, they are labeled “Pristine seekers”. Finally, Segment 3 seems to comprise those bathers with higher income who are seeking for higher comfort at the bathing site. They are labeled “Comfort and security seekers” because they are not only willing to pay for an improved water quality but also for improvements with respect to all other attributes including presence of a lifeguard.

[4] As the total willingness-to-pay for bathing water quality depends on the reduced number of days with swim advisory not recommending or forbidding bathing the willingness-to-pay for this attribute could be higher in absolute terms.

Table 7: Descriptive statistic according to segments of LCM

	Modest quality seekers Segment 1	**Pristine Seekers** Segment 2	**Comfort and security seekers** Segment 3	**Total**
People in segment	282.00	55.00	83.00	420.00
Socio-demographics				
Age	36.62	39.00	41.07	37.81
Income	2080.14	2151.98	2632.29*	2198.66
Sex (0=male)	0.49	0.45	0.53	0.49
People per household	2.22	2.25	2.35	2.25
People age < 18 per household	0.39	0.33	0.43	0.39
Bathing				
Bathing 2007 (yes/no)	0.85	0.87	0.76	0.84
Bathing per year	17.61	21.02	23.26	19.17
Duration of stay (hours)	3.48	3.69	3.01	3.43
Factors affecting beach experience				
Cleanliness	8.90*	9.25	9.13	9.00
Bathing water quality	8.79*	9.29	9.12	8.92
Congestion	7.81	7.82	7.90	7.83
Dogs at bathing site	7.53	7.80	7.64	7.59
Public Transport	6.69	5.56	6.40	6.49
Showers and restrooms	6.27*	5.47*	7.25*	6.36
Parking	4.93	4.98	5.75	5.10
Kiosk/Bar/Restaurant	4.50	4.11	5.14*	4.58

* Null hypothesis that samples are from the same population is reject at 5% level.

7. Discussion

A main objective of the present study was to investigate the preferences of bathers in the metropolitan region of Berlin for increasing the quality of bathing sites. During the summer bathing is an important recreational activity in Berlin enjoyed by many inhabitants. However, so far no data are available about who goes how often to which bathing sites and about what preferences people have with respect to the quality of the bathing sites. During the last summer, i.e. between mid July and mid September, we therefore conducted an online survey asking respondents about their use of bathing sites, about the factors that affect their bathing experience and about their preferences for quality improvements using a choice experiment.

This paper presented results with respect to those 420 respondents (45.6% of the useable sample) who stated that they were willing to pay in order to increase the quality of the bathing sites. Only they were presented the choice experiment during the online-survey.

On average people within that sample bath 19 times during a season and stay longer than three hours per visit. Among the factors affecting the bathing experience the cleanliness of the beach and lawn as well as bathing water quality rank highest. Considerably less important are facilities such as showers and restrooms at the site or the availability of bars and restaurants, for example. However, taste heterogeneity is present amid respondents as the latent class model indicates. It highlights the variation in the importance of some bathing site attributes for a diverse sample of bathers. While some attributes are important to all bathers, i.e. water quality and cleanliness, others are only important for single segments. This applies especially to the "presence of a lifeguard" and an "advisory notice system" at the bathing site. Therefore, the latent class analysis provides valuable information for decision makers as it reveals different segments with distinct preferences ("modest quality seekers", "pristine seekers", and "comfort and security seekers"). The marginal willingness to pay estimates are clearly different between the three segments.

Overall, the results show that under budget constraints online surveys are a suitable alternative to the traditional survey methods. Moreover, online surveys provide valuable additional information, for example the time respondents need to answer questions or to choose an alternative on the choice cards. With respect to preference consistency the results do not reveal salient problems. The number of people who showed inconsistent preferences is rather low. However, we only included a test for monotonicity in the present survey. Future online surveys therefore should use further tests of preference consistency such as the one suggested by Scarpa et al. (2007) for testing preference stability. On the other hand, sample selection is probably a problem of this survey. Based on the sample process we employed it is unlikely that the respondents represent the user population of bathers in Berlin. Moreover, we do not know how many of those belonging to the user population have internet access. The only fact we know is that Berlin has with an access rate of 68% the highest rate among the Laender in Germany, the access rate for Germany as a whole is around 60% (Der Tagesspiegel, 26. Juni 2007). But as the target population is completely unknown, i.e. we do not know how many percent of the population go bathing and how many of these have internet access, the present survey seems to be an appropriate first step in investigating bathers' preferences.

Among the topics for further analysis and future studies the following are particularly of interest: First, individual characteristics can be incorporated in the models in order to investigate how they influence heterogeneity respectively membership of a certain segment. Second, it would be interesting to connect the information about membership in a segment with geographical information, for example using a GIS. Decision makers might be interested in such links between preferences and locations because this would enable to treat bathing sites target group specific. Third, further studies comparing online surveys and traditional

survey methods are needed to judge whether online surveys are suitable tools for non-market valuation. Questions are, among others, whether a self selection bias is present, how strongly he influences results, and if it could be mitigated by using, for example, telephone surveys to screen the target population prior to the online survey.

Acknowledgement

We gratefully acknowledge the support of the government agencies in Berlin and Brandenburg — Berliner Senatsverwaltung für Umwelt, Gesundheit und Verbraucherschutz; Berliner Landesamt für Gesundheit und Soziales; Ministerium für Ländliche Entwicklung, Umwelt und Verbraucherschutz (MLUV) — and the Berliner Bäder Betriebe. Also we would like to thank Mikolaj Czajkowski for valuable comments on an earlier version of this paper.

References

Birol, E., K. Karousakisb, and P. Koundouric. (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.

Bockstael, N. E., W. M. Hanemann, and I. E. Strand. (1986). Measuring the Benefits of Water Quality Improvements Using Recreation Demand Models. Report to the U.S. Environmental Protection Agency. College Park, MD, University of Maryland.

Bockstael, N. E., I. E. Strand, and K. McConnell. (1988). Benefits from Improvements in Chesapeake Bay Water Quality. Benefit Analysis Using Indirect and Imputed Market Methods Washington D.C., U.S. Environmental Protection Agency.

Campbell, D. (2007). Willingness to Pay for Rural Landscape Improvements: Combining Mixed Logit and Random-Effects Models. Journal of Agricultural Economics 58(3): 467-483.

Carlsson, F., P. Frykblom, and C. Liljenstolpe. (2003). Valuing Wetland Attributes: An Application of Choice Experiments. Ecological Economics 47(1): 95-103.

Couper, M. P., and E. Coutts. (2004). Probleme und Chancen verschiedener Arten von Online-Erhebungen. Kölner Zeitschrift für Soziologie und Sozialpsychologie Sonderheft 44/2004: 217-243.

Der Tagesspiegel, 26. Juni 2007. Berlin ist schon drin. Hauptstadt liegt bei der Internetnutzung vorne. 60 Prozent der Deutschen sind mittlerweile online.

Egan, K. J., J. A. Herriges, C. L. Kling, and J. A. Downing. (2004). Recreation Demanmd Using Physical Measures of Water Quality. WP 04-WP 372. Ames, Iowa, Center for Agricultural and Rural Development.

Eggert, H., and B. Olsson. (2004). Heterogenous Preferences for Marine Amenities: A Choice Experiment Applied to Water Quality. Working Papers in Economics. Göteborg, Department of Economics: 36.

Freeman III, A. M. (1995). The Benefits of Water Quality Improvements for Marine Recreation: A Review of the Empirical Evidence. Marine Resource Economics 10: 385 - 406.

Georgiou, S., I. J. Bateman, I. H. Langford, and R. J. Day. (2000). Coastal Bathing Water Health Risks: Developing Means of Assessing the Adequacy of Proposals to Amend the 1976 EC Directive. Risk, Decision and Policy 5(1): 49-68.

Georgiou, S., I. H. Langford, I. J. Bateman, and R. K. Turner. (1996). Determinants of Individuals' Willingness to Pay for Reductions in Environmental Health Risks: A Case Study of Bathing Water Quality. Working Paper GEC 96-14. Norwich, CSERGE.

Greene, W. H. (2007). NLOGIT Version 4.0. Reference Guide. New York, Econometric Software, Inc.
Greene, W. H. and D. A. Hensher (2003). A Latent Class Model for Discrete Choice Analysis: Contrasts with Mixed Logit. Transportation Research Part B 37: 681-698.
Hanemann, W. M. (1978). A Methodological and Empirical Study of the Recreation Benefits from Water Quality Improvements. Cambridge, Mass., Harvard University Ph.D. thesis.
Hanley, N., D. Bell, and B. Alvarez-Farizo (2003). Valuing the Benefits of Coastal Water Quality Improvements Using Contingent and Real Behaviour. Environmental and Resource Economics 24: 273-285.
Hensher, D. A., and W. H. Greene. (2003). The Mixed Logit model: The State of Practice. Transportation 30: 133-176.
Hilger, J., and M. Hanemann. (2006). Heterogeneous Preferences for Water Quality: A Finite Mixture Model of Beach Recreation in Southern California. Paper Econ 06-01. San Diego, University of California: 38.
Iragüen, P., and J. de Dios Ortúzar. (2004). Willingness-to-pay for reducing fatal accident risk in urban areas: an Internet-based Web page stated preference survey. Accident analysis and prevention 36: 513-524.
Jeon, Y., J. A. Herriges, C. L. Kling, and J. Downing. (2005). The Role of Water Quality Perceptions in Modeling Lake Recreation Demand. Working Papers Series # 05032. Ames, Iowa, Iowa State University. Department of Economics
Kuhfeld, W. F. (2005). Marketing Research Methods in SAS. Experimental Design, Choice, Conjoint, and Graphical Techniques. Cary, NC, SAS-Institute TS-722.
Lanscar, E., and J. Louviere. (2006). Deleting 'Irrational' Responses from Discrete Choice Experiments: A Case of Investigating or Imposing Preferences? Health Economics 15: 797-811.
Leeworthy, V. R., J. M. Bowker, J. D. Hospital, and E. A. Stone. (2005). Projected Participation in Marine Recreation: 2005 and 2010. National Survey on Recreation and the Environment 2000. Silver Spring, Md., NOAA.
Lew, D. K., and D. M. Larson. (2005). Valuing Recreation and Amenities at San Diego County Beaches. Coastal Management 33: 71-86.
Maschke, J. (2005). Tagesreisen der Deutschen. München, DWIF.
Machado, F., and S. Mourato. (1999). Improving the Assessment of Water Related Health Impacts: Evidence from Coastal Waters in Portugal. CSERGE Working Paper GEC 99-09. Norwich, University of East Anglia. Norwich.
Miguel, F. S., M. Ryan, and M. Amaya-Amaya. (2005). 'Irrational' Stated Preferences:A Quantitative and Qualitative Investigation. Health Economics 14(3): 307-322.
Miguel, F. S., M. Ryan, and A. Scott. (2002). Are Preferences Stable? The Case of Health Care. Journal of Economic Behaviour & Organization 48(1): 1-14.
Mourato, S., A. Provins, E. Özdemiroglu, G. Stavros, and J. Newcombe. (2007). Is it Worth Revising the European Bathing Water Directive? A Choice Experiment. In: D. Pearce (Ed.). Environmental Valuation in Developed Countries: Case Studies. Cheltenham, Edward Elgar: 343-362.
Murray, C., B. Sohngen, and L. Pendleton. (2001). Valuing Water Quality Advisories and Beach Amenities in the Great Lakes. Water Resources Research 37(10): 2583-2590.
Needelman, M. S., and M. J. Kealy. (1995). Recreational Swimming Benefits of New Hampshire Lake Water Quality Policies: An Application of a Repeated Discrete Choice Model. Agricultural and Resource Economic Review 24: 78-87.
Olsen, S. B. (2007). Internet versus mail - Are stated preferences affected by the mode of sampling in a choice experiment? European Association of Environmental and Resource Economists (EAERE) - 15th Annual Conference Thessaloniki.
Parsons, G. R., and D. M. Massey. (2003). A Random Utility Model of Beach Recreation. The New Economics of Outdoor Recreation. N. Hanley, W. D. Shaw and R. E. Wright. Cheltenham, Edward Elgar: 241-267.

Sandström, M. (1996). Recreational Benefits from Improved Water Quality: A Random Utility Model of Swedish Seaside Recreation. Working Paper No. 121. Stockholm, Stockholm School of Economics.

Scarpa, R., D. Campbell, and W. G. Hutchinson. (2007). Benefit Estimates for Landscape Improvements: Sequential Bayesian Design and Respondents' Rationality in a Choice Experiment. Land Economics 83(4): 617-634.

Scarpa, R., and M. Thieme. (2005). Destination Choice models for Rock Climbing in the Northeast Alps: A Latent-Class Approach based on Intensity of Participation. Land Economics 81(3): 426-444.

Scarpa, R., K. G. Willis, and M. Acutt. (2004). Individual-Specific Welfare Measures for Public Goods: A Latent Class Approach to Residental Customers of Yorkshire Water. Econometrics Informing Natural Resources Management. P. Koundouri. Cheltenham, Edward Elgar: 316-337.

Shonkwiler, J. S., and W. D. Shaw. (2003). A Finite Mixture Approach to Analysing Income Effects in Random Utility Models: Reservoir Recreation along the Columbia River. The New Economics of Outdoor Recreation. N. Hanley, W. D. Shaw and R. E. Wright. Cheltenham, Edward Elgar: 241-267.

Swait, J. D. (2006). Advanced Choice Models. Valuing Environmental Amenities Using Stated Choice Studies. B. Kanninen. Dordrecht, Springer. 8: 229-293.

Thurston, H. W. (2006). Non-market valuation on the internet. A Handbook on Contingent Valuation. A. Alberini and R. Kahn. Northampton, Edward Elgar.

Train, K. E. (1998). Recreation Demand Models with Tase Differences Over People. Land Economics 74(2): 230-239.

Train, K. E. (2003). Discrete Choice Methods with Simulation. Cambridge, Cambgridge University Press.

Zhang, Y. (1999). Using the Internet for Survey Research: A Case Study. Journal of the American Society for Information Science 51(1): 57-68.