Tourist' valuation of climate change impacts on the Dutch Wadden Sea

A travel cost method and choice experiment

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1201194-003

Deltares

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Client	Project	Reference	Pages
European Commission	1201194-003	1201194-003-ZKS-0003	52

Summary
Ecosystems are constantly changing. Capturing the value of these changes across different states of ecological disturbance will support the ability of decision makers to make rational choices. One of the most prominent sectors in the marine environment is tourism, without qualitative good marine ecosystems this sector would be less widespread. Therefore, this study aims to estimate tourists' willingness to pay for changes in marine ecosystems due to several climate induced effects on the marine environment. The results can be used for the development of marine and coastal policy in the Wadden Sea as well as for climate change policy.

This study is conducted within the European Commission Seventh Framework Programme Vectors project, which aims to improve our understanding of how environmental and man-made factors are impacting marine ecosystems now and how they will do so in the future. Therefore, we determined the value of changes in the Wadden Sea ecosystem. This study employs two methods:

1. The travel cost method to value the current (use) value of the Wadden Islands to tourists;
2. A choice experiment to estimate the (use and non-use) value tourists ascribe to the projected change in ecosystem services.

The changes were presented by five attributes: number of birds, seals, pacific oysters, the presence of wind turbines and tourist tax. The selection was based on the motivations of tourists visiting the Wadden Sea (Raad voor de Wadden, 2008; Stichting Recreatie, 2003; Stenden Instituut Service Management, 2010) and the expectation that the attributes will be affected by climate change. In addition, we estimated the current value of the Wadden Sea for tourists in order to compare the results with the changes in value. Therefore, we conducted a survey on the Wadden Island Ameland, where we questioned 550 respondents to state their travel characteristics and their willingness to pay to avoid the impacts due to two different climate change scenarios.

The results show that the current value of the Dutch Wadden Islands is approximately 450 million euro while the consumer surplus, representing the net benefits for tourists, is approximately 130 million euros. The estimated WTP values show that avoiding a decreasing number of birds, seals and the placement of wind turbines causes substantial non-market benefits for tourists. In other words, tourists are willing to pay a significant amount to prevent the effects of climate change on the ecosystem in the Wadden Sea. The WTP is the highest for a stable trend in number of birds, followed by a stable number of seals and wind turbines located far away, suggesting e.g. that from a tourist's perspective it is more beneficial to avoid a large decrease in number of birds than a decrease in number of seals. In addition, we aggregated the values of the respondents to obtain the willingness to pay values for all Wadden Islands, indicating that the non-market marginal benefits of avoiding the effects of the strong climate scenario is approximately 80 million euros per year. Comparing the willingness to pay of German and Dutch respondents, we found that the two nationalities differ significantly in attitude towards wind turbines. One of the causes may lie in Germany's policy on renewable energy, resulting that Germans are more familiar with and positive towards wind energy. Therefore, we argue that the preferences of tourists of different nationalities have to be taken into account to optimize policies.

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The empirical results provide important information for policy makers, responsible for developing tailor-made policies to avert climate change impacts on the marine environment in this area. Furthermore, the research shows the need for future research using choice experiments to estimate the impacts of climate change on ecosystems. However, we argue that more attention has to be given to translate the output of ecological models into understandable effects for tourists and in addition to include effects of different climate scenarios. Especially, capturing the value of different ecological states due to climate change will be important within decision making (Turner et al, 2003). One of the difficulties of the method is that most effects cannot be allocated to just one driving force. Therefore, we propose to invite experts for making an estimated guess about the percentage a driver is responsible for a change.

Versie	Datum	Auteur	Paraaf	Review	Paraaf	Goedkeuring	Paraaf
	apr. 2014	Femke Schasfoort		Jarl Kind		Lucas Janssen	
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Content

1 Introduction

Marine ecosystems are constantly going through gradual changes. One of the main causes are extensive human activities in the marine environment impacting the ecosystem, varying from direct impacts such as fisheries, shipping, offshore gas drilling to indirect impacts as a result of multiple causes such as climate change and land subsidence. The deterioration due to these impacts is severe, for instance approximately 50% of the salt marshes and 29% of sea grasses in the world are lost or degraded (Waycott et al, 2009; UNEP, 2006). This deterioration affects economic sectors using marine ecosystems as well as the well-being of humans using the marine environment. Decision making needs information about the impact of such changes on the human welfare. This suggests that it is important to understand both the current value of marine ecosystems and the effect of changes on these values (Barbier et al, 2011). Traditionally, marine management has mainly focused on current impacts, without giving much attention to possible future impacts (Rosenberg and McLeod, 2005; Levin et al., 2009; Staudinger et al, 2013). Although future impacts of the main driving forces in the marine environment are still not well-presented in marine management, it is apparent that ignoring these is disadvantageous for coastal management and planning. This study is conducted within the European Commission Seventh Framework Programme Vectors project, which aims to improve our understanding of how environmental and man-made factors are impacting marine ecosystems now and how they will do so in the future. One of the objectives is identifying recreational activities, estimating the market value of corresponding ecosystem services and understanding how these values will change due to changes in the marine environments. This study will contribute to this objective.

One of the most prominent sectors in the marine environment is tourism. The coastal and marine tourism sector account for a substantial share of GDP in many countries. The sector does comprise beach and coastal tourism, as well as marine tourism such as cruising, boating, sportfishing and many water sports. Without qualitive good marine ecosystems, these activities would be less widespread, indicating that marine ecosystems contribute through tourism to human welfare. Literature describes these as (cultural) ecosystem services, which are the benefits people obtain from ecosystems (MEA, 2005; TEEB, 2010). The benefits that tourists obtain from marine ecosystems or changes in marine ecosystems can be economically valued. It is a key step in demonstrating how drivers of change alter ecosystem structures and functions and consequently its value.

One of the important drivers of change of our times is climate change. Since climate change adaptation and mitigation policies are comprising a growing part of a country's environmental policy, justification of this policy as well as the need for more efficient policy is becoming more pronounced. Therefore, we are specifically interested in the effect of climate change on the marine ecosystem and subsequently the benefits tourist obtain from this ecosystem. This will help to increase the understanding of the (regional) welfare impacts of climate change on the tourist sector. However, the reality is that ecosystems will change due to more drivers. This study will focus just on one driver assuming that other drivers are kept constant in order to capture just the value change due to climate change.

In short, the purpose of this study is to determine the changing value of the marine ecosystem for tourists due to climate change. In addition, we want to estimate the current value of the Wadden Sea in order to compare the results with the changes in value. This corresponds well with the aim of the Vectors project.

The total economic value of recreation in coastal and marine areas includes both use and non-use values. Use values are the values individuals attach to the usage of a given environmental asset. Additionally individuals can still attach an intrinsic value, bequest value or existence value to a certain environmental asset even when they never saw or used the asset, this is what we call non-use values (Turner et al, 2003). Valuing the last is challenging, because it is not reflected in market transactions (Freeman, 2003). Consequently, we need to make use of valuation techniques capable of capturing such values for measuring the welfare impact of changing marine ecoystems. Stated preference methods, as opposed to revealed preference methods, are still one of the few methods that are able to value these hypothetical changes of non-market values (Freeman,2003; Hensher, 2005), examples are contingent valuation (Mitchell & Carson, 1989) and choice experiment methods. Since Adamowitz et al (1998) showed that choice experiments (CE) are in general preferred above contingent valuation methods, CE methods became the state of the art in the field of non-market valuation studies (Hoyos, 2010). Since this study will value hypothetical future changes of mainly non-market values, a choice experiment will be an appropriate method. In addition, the method can make a distinction between independently changing attributes (Hensher, 2005). This is important in order to include the effects of climate change under different scenarios. With the choice experiment we will estimate the willingness to pay of tourists to avoid certain effects of climate change, consequently we will estimate the marginal value of the changes. An individual travel cost method will be used to estimate the current recreational value. This method is widely accepted to identify use values of tourist destination (Rolfe and Dyack, 2010; Freeman, 2003). Note that the travel cost method will not capture non-use values.

After a period where aquatic and marine valuation studies attracted little attention (Turner et al, 2003), the last years there has been a larger interest about valuing coastal and marine ecosystem services. This is maybe best illustrated by the large collection of coastal and marine valuation studies provided by the Marine Ecosystem Services Partnership (MESP, 2014). Currently, there is also a growing amount of literature available about valuing coastal and marine recreation (Windle & Rolfe, 2013; Liguete et al, 2013; Ghermany & Nunes, 2013; Gee & Burkhard, 2010). Most literature estimates the value of the marine or coastal ecosystem for a particular user, such as scuba divers (Parsons & Thur, 2006). However, these studies did not capture the changes in values across different states of ecological disturbance, while especially this type of analyses are important for taking decisions to conserve ecosystems or allow changing situations (Turner et al, 2003). This paper contributes to the literature by providing willingness to pay estimates of tourists for changes in marine ecosystems due to climate change based on empirical data. Few studies are available on the effect of climate change on the value of ecosystem services (Fleischer & Sternberg, 2006; Ding, 2011; TEEB, 2009). Even though both Ding (2011) and Rounsevell et al (2010) developed a framework to value changes in biodiversity and ecosystem services due to climate change, they did not produce/collect new data.

Additionally, applications of choice experiments to value ecosystem changes for tourists due to climate change are not present. Interesting is that we make an attempt to value the effects of one driver. This study explores if this is (easily) applicable. The results of this study are valuable for the development of marine and coastal policy in the Wadden Sea as well as for climate change policy. For example, it could be used to prioritize through cost benefit analysis or for justifying certain policies. Furthermore, this study recognizes the difference in preference of visitor types by grouping German and Dutch tourists (Hynes et al, 2013; Ressurreicao et al, 2012). Most tourist destinations do attract tourists from various countries, therefore it may be important for optimizing policies to distinguish between the preferences of tourists of different nationalities.

2 Case-study description

The Dutch part of the Wadden Sea is a coastal tidal wetland comprising some deep basins, tidal gullies, sand and mudflats and saltmarshes (Crosato & Stive, 2000). It is an ecologically rich area accommodating several habitats and a variety of species, including shellfish, birds, fish and seals. The Wadden Sea functions as a nursery for North Sea fish and is an internationally important stopover and hibernation location for migrating birds (Wolf *et al*, 2010). As well as being an UNESCO world heritage site since 2009, the Wadden Sea is protected as national park and Natura 2000 area. The unique properties of the ecological system make the Wadden Sea area attractive for tourism and recreation. Tourism is, with approximately 2.15 million visitors a year, one of the most important sectors of this region, its main activities are concentrated on the five Dutch Wadden Sea Islands and alongside some parts of the coast (Stenden Instituut Service Management, 2010; Statistics Netherlands, 2010). With an estimated turnover around 450 million euro per year, tourism is the largest sector on the islands.

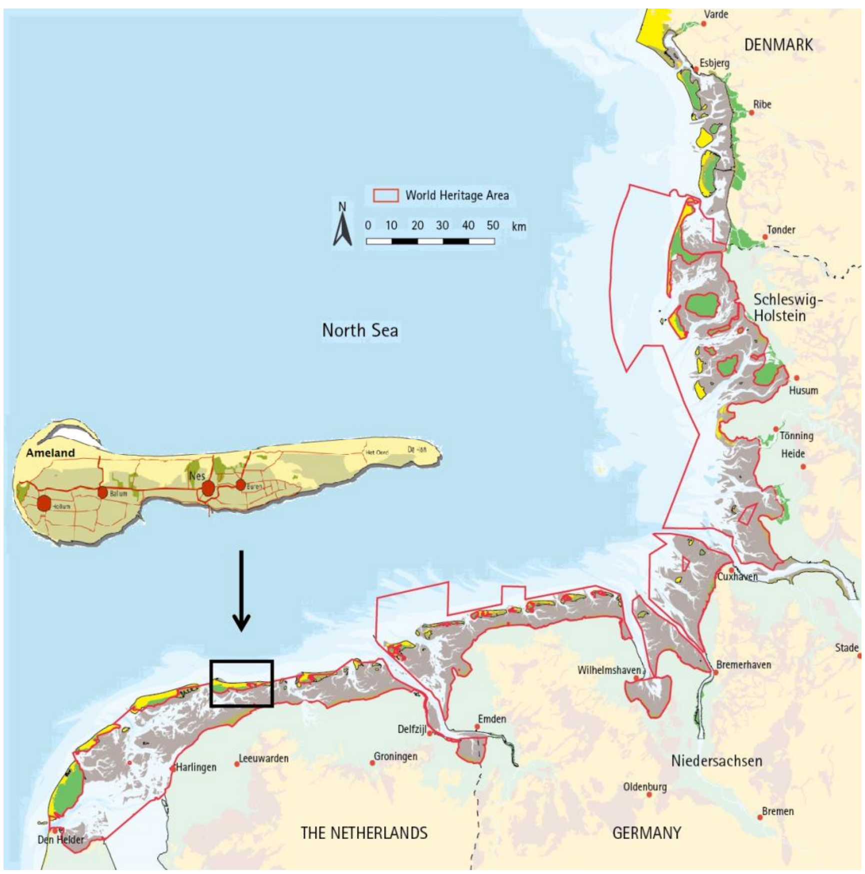

Figure 1: Study area

With climate change, the Wadden Sea area will face several challenges. Prospective sea level rise may substantially influence the morphological and ecological system potentially threatening the habitat of several species, such as birds and seals (Van Goor et al, 2003). However, there is no agreement yet about the critical level and pace of sea level rise nor about the extent of ecological consequences (Zang et al, 2012). Also other effects of climate change such as temperature rise and more extreme weather events may affect the Wadden Sea system. On the one hand higher temperatures will reduce both phytoplankton blooms and the abundance of shellfish such as mussels, cockles and the Baltic Macoma, on the other hand it will increase the growth of herbivorous zooplankton (Reise and Van Beusekom, 2008). Also the Wadden Sea will face more introductions of southern warm water species due to warmer climatic circumstances (Ravel & Olden, 2008). The effects of climate change have potentially a direct impact on the nature and tourism related activities on the island. As a result, tourists that visit the island may be negatively impacted.

The Dutch Wadden Island Ameland is our case study location, assuming that this case study area is representative for the other Wadden Islands (see figure 1). The average surface area, number of visitors and amount of nature based tourism on Ameland are comparable to the other four Dutch Wadden Islands. The island accommodates approximately 520 000 tourists per year of which 61% has the Dutch nationality and 36% the German (Stichting recreatie, 2003).

3 Methodology

This study aims to determine both the current value of the Wadden Islands and the non-market value of a change in attributes of users, linked to a change in climate. Therefore this study employs two methods to elicit the valuation of tourists regarding changes in the marine environment on Ameland due to climate change:

1. The travel cost method to value the **current** (use) value of the Wadden Islands to tourists
2. A choice experiment to estimate the (use and non-use) value tourists ascribe to the **projected change** in ecosystem services.

With the travel cost method we will estimate the use value of the current state of the recreational destination. Besides the current state of the ecosystem goods and services, this method captures other reasons for tourists visiting a destination e.g. the quality of the recreational properties, hotels, food industry and good marketing. The projected change in ecosystem services is shown in the conceptual DPSIR model in figure 2. In this model climate change is the driver that through the state of the ecosystem and its ecosystem goods and services will impact the value tourists attribute to the Wadden Island.

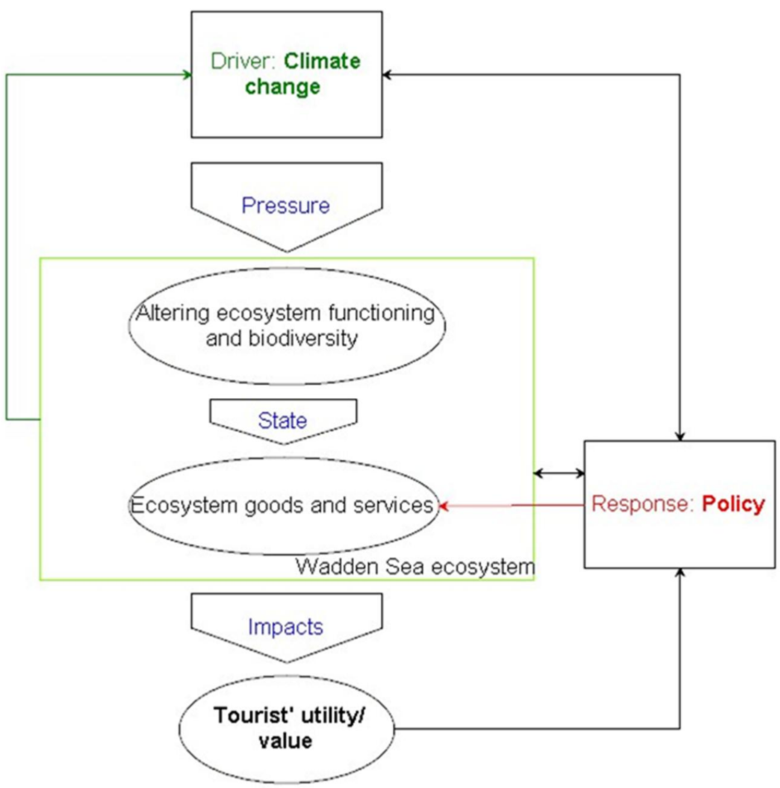

Figure 2: DPSIR model showing the impact of climate change on the tourist value of a destination (based on Ding, 2011).

3.1 Travel cost model design

The individual travel cost method can be seen as the basic model in the field of travel cost studies. It assumes that there is only one site available and that all the visits have the same duration (Freeman, 2003). Travel costs and other relevant characteristics have to be collected with a survey. Before stating the questions we have to make some assumptions about the travel costs, the value of time, substitute destinations and multi-purpose visits. The first three assumptions are explained in the next section, other assumption can be found in appendix B.

Travel costs

Basic travel cost models explain the dependent variable just with the independent variable travel costs, assuming that the cost of traveling to a site is an important component of the full costs of a visit (Freeman, 2003). For example, Nunes and Van den Bergh (2004) and Chae et al (2012) incorporate only direct travel cost calculations, including opportunity costs of time. However, in theory all the extra expenditures that tourists would not spend at home, are part of the travel expenditures. This supports the argument to include accommodation costs, guides, dining fees and other extra costs as beach toys. Examples of studies including total cost of visits are Liu et al (2009), Iamtrakul et al (2005) and Blakemore & Williams (2008). Since there are difficulties with measuring the (expected) full cost of a visit, estimating only travel costs and possibly accommodation costs may produce the most constant unbiased results (Ward & Beal, 2000). Therefore, we will use this method. More details about the travel cost and accommodation cost estimations are presented in appendix B.

Travel time

Time valuation is a controversial subject in scientific literature. Although most economists are convinced about the need of time valuation, the method to obtain a time value is heavily discussed (Earnhart, 2004; Freeman, 2003; Ward & Beal, 2000). Time costs are included in travel costs estimations, because an individual traveling to a recreation site cannot do something else. As a result, the opportunity costs are lost. Cesario (1976) was the first mentioning the currently most common method to value travel time. He found evidence that revealed opportunity cost of time was perhaps one-third of the market wage. This shadow price of time became the standard in recreation demand analysis (Freeman, 2003).

However, there are two issues concerning travel time, the first is: did visitors give up an income earning opportunity in order to travel? If they did not, what are the costs of their scarce time? The second is, did tourists derive utility from traveling to the site? (Freeman, 2003). To deal with the first issue, Earnhart (2004) divided respondents in three groups: unemployed, employees with a fixed schedule and employees with a flexible schedule. He estimated for every group a different value of travel time, respectively 6.3 percent, 18 percent and 9 percent of their average income an hour. This study will show the results of the travel cost model of three methods: a model without travel time, a model with the one-third of the market wage method and the method of Earnhart.

Substitutes

In the real world, there is not just a single site to go on holiday. Therefore, the number of visits to a certain site will not only depend on its price but also on both the price and quality of substitute sites. Omitting these characteristics will bias the estimates (Freeman, 2003), therefore they will be included in the utility function.

3.2 Choice experiment design

Currently, a choice experiment is one of the few methods that can value hypothetical situations (Freeman, 2003). In a choice modelling questionnaire, respondents are asked to select their preferred environmental outcome from a range of possibilities (Hensher, 2005). The choices consist of a number of attributes or characteristics including the costs of the chosen alternative. Therefore, the selection of the attributes and attribute levels determines the type of experiment. In this study, several visitor studies were used to generate a preliminary list of attributes (Raad voor de Wadden, 2008; Stichting Recreatie, 2003; Stenden Instituut Service Management, 2010; Sijtsma et al, 2012).

The most important motivation to visit the island is the presence of beach and sea, followed by recreation possibilities, nature and open view (Stenden Instituut Service Management, 2010). Five attributes were selected that both affect these motivations and that are affected by climate change (see table 1). The number of attributes is restricted to five to limit the cognitive burden for the respondents (Hensher, 2005).

Three attribute levels were used representing a high climate change scenario, a low climate change scenario and the current trends. The high scenario is comparable with the IPCC A2 SRES scenario (IPCC, 2007) that is further detailed within the Vectors project (see figure 3). In this rapid economic growth scenario the temperature rises between 2 and 5.4 degrees Celsius in 2100, whereas the sea level rises globally between 23 and 51 cm. The low scenario is comparable with the more environmental friendly B1 SRES scenario. This scenario comprises a temperature rise between 1.1 and 2.9 degrees Celsius and a sea level rise in between 18 and 28 centimetres.

A2 Protected Markets / National Enterprise (national / consumerist) • Modest local environmental policy • Limited global environmental policy • Intermediate economic growth	B2 Local Communities/Responsibilities (National / Environmental) • Ambitious local environmental policy • Modest global environmental policy • Low economic growth
A1 World Markets (global / consumerist) • Modest local environmental policy • Modest global environmental policy • High economic growth	B1 Global Community (Global / Environmental) • Ambitious local environmental policy • Ambitious global environmental policy • Intermediate economic growth

Figure 3: General characteristics of VECTORS scenarios. Scenarios in grey have been used within this project (based on the scenarios developed in the Vectors project).

Since there was limited information available about the effect of climate change on the attributes, several experts estimated these impacts. Together with the available literature, the result was an indication of the vector of change for every attribute, see table 1.

The attributes Pacific Oyster, Bird species, Seals and Wind turbines were finally chosen to be incorporated in the study. The pacific oyster is an invasive species that will potentially grow in number due to higher temperatures. Abundance of pacific oysters hinders mud flat walkers, since areas of the Wadden Sea will be impassable for mud flat walkers as the risk of injuries due to falling on the oysters increases. Seals are characteristic species in the Wadden Sea, a decrease will potentially impact tourism. Also the high number of birds is typical for the Wadden Sea, climate change may have an impact on the hibernating places and food availability of these birds (Roomen et al, 2012; Clausen et al, 2013). A reduction in number will potentially impact tourism. The last attribute is the presence and location of wind turbines. Currently, no wind turbines are present in the Wadden Sea. However, both Vectors scenarios include wind turbines and currently there is a political discussion about placement of Wind turbines in the Wadden Sea. Wind turbines affect the open landscape of the Wadden Sea, which is a highly appreciated and important factor for tourism.

The third attribute level is the status quo and is referred to as 'situation without measures' and had a fee of zero. It represents the situation affected by high climate change scenario without human interventions. In this study it includes a large decrease in number of birds, a decrease in number of seals and placement of wind turbines close by the coast. This is the only choice with a label, other choice options were unlabelled. Since both scenarios include wind turbines, we choose to vary the distance of wind turbines to the coast. This is an interpretation that has to be kept in mind interpreting the results.

Table 1: Description of the attributes and the attribute levels included in the choice experiment. The first attribute level presents the current trends, the second a low climate change scenario and the third a high climate change scenario (status quo).

Attribute	Definition	Attribute levels
Pacific oyster	Area of the Wadden Sea covered with pacific oysters, which will cause an increase in number of mudflat walkers injured	1. 1 on 1000 mudflat walkers injured
		2. 1 on 500 mudflat walkers injured
		3. 1 on 100 mudflat walkers injured
Birds	Number and diversity of birds	1. Stable number and diversity
		2. Small decrease in number and diversity (~10%)
		3. Large decrease in number and diversity (~50%)
Seals	Number of seals	1. Increase in abundance (with 2.500 to 7.500 seals)
		2. Stable number of seals (~10.000)
		3. Decrease in abundance (with 2.500 to 7.500)
Wind turbines	Appearance and location of wind turbines	1. No wind turbines
		2. Wind turbines far away from the coast
		3. Wind turbines close by the coast.
Tourist tax	Extra tourist tax per adult per day	€0, €2, €4, €6, €8, €10, €12

3.3 Survey design

The questionnaire was set up with help of experts in the field, pilot tests and a final pre-test. The final version of the questionnaire consisted of three main sections. The first section comprised questions necessary for the travel cost model such as the duration of the stay on the island, way of transportation, the reason to visit the island, quality of nature on the island

and substitute destinations. The latter was included to prevent ignorance of substitution possibilities, since ignoring may lead to overestimating WTP (Boxall et al, 1996). The second section began with two questions about climate change to get information about preferences of the respondents for either climate mitigation or climate adaptation, followed by the choice experiment. Before the actual choice experiment exercise a detailed description of the attributes was given in the questionnaire to ensure an effective form of communication (Hensher, 2005). The third and last section contained questions to identify the socio-economic characteristics of the individuals, such as age, wage and political preference.
To introduce the choice experiment an overview was given of the possible changes of attributes due to climate change and the possible actions of the government to reduce these changes. The respondents were asked to state on a test choice card the extra amount of tourist tax that they are willing to pay to avoid the situation impacted by a high climate scenario. After the test choice card, the respondents had to answer six different choice cards. On every choice card, they could choose between three different situations. After this experiment the respondents were asked to rank the attributes on importance and state freely their willingness to pay to avoid the situation impacted by high climate change. If the respondents were not willing to pay anything, they had to answer another question about the reason why they were not willing to pay.
An orthogonal fractional design was created which incorporated only the main effects and no interaction effects. Subsequently, an experimental design was created where dominant choice sets were filtered out. The labelled alternative 'situation without measures' was kept stable on every choice card, this is the status quo alternative. The choice sets were randomized in order to reduce a potential learning effect. Therefore twenty different versions of the choice experiment were constructed.

Pictures of the attributes were used to help respondents visualize the attribute levels, by using these every respondent is expected to interpret the attributes in the same way (Hensher et al, 2005). The background of the pictures is kept the same where possible in order to limit the influence of the pictures characteristics. The levels of the extra tourist tax were derived using a combination of the current tourist tax on the Wadden Islands, feedback from the focus group and reactions of respondents in the pre-test. The attributes and their levels are reported in table 1, an example of a choice card can be found in appendix A.

Survey characteristics
The face-to-face survey was carried out on tourists visiting Ameland. The survey was conducted all over the island, but mainly on touristic locations such as the port, the beach and the lighthouse this provided a convenient sample for the study. The sample analysed in this paper consisted of 550 completed questionnaires of which 121 were completed by German tourists and 429 by Dutch tourists. The response rate was with 82 percent quite high. After data cleaning and removal of protest voters, the database included 479 useable responses. The descriptive statistics of both groups are presented in table 2. Figure 4 shows the routes taken by the Dutch respondent. See appendix C for more results of the questionnaire.

Table 2: Descriptive statistics of German and Dutch respondents in the sample

	Dutch	Germans
Percentage of respondents	78	22
Average age	48	42
Percentage of female respondents	54%	54%
Percentage of male respondents	46%	46%
Average size of household	3.26	2.66
Education (university or university of applied science)	45%	56%
Percentage with no paid work	23	32
Average gross income per month	€4760.30	€4407.80
Percentage that are member of a nature organisation	43%	9%
Average duration of stay in days	5.7	4.5
Visits per year	1.18	0.74
Percentage spending an overnight	91%	89%
Visiting the island at the first time	23%	35%
Average mark for nature (1-10)	8.2	8.6
Most important reason to visit the island – beach and sea	37.6%	38.5%
Most important reason to visit the island – nature	10.7%	10.3%
Most important reason to visit the island – open view	4.7%	4.3%
Recreational activity – bird watching	5%	14%
Recreation activity – mud flat walking	7%	7%
In favour of climate change mitigation measures	36%	51%
WTP to avoid status quo (situation without measures) and have the current trends instead	€4.54	€5.32

Figure 4: The routes that Dutch tourists took to visit Ameland used to estimate the travel costs. Estimated by combining a Dutch zip code file with the zipcodes of the respondents in the ArcGIS Network analyst. The routes of respondents of other nationalities are calculated with an international route planner.

4 Econometric Specification

The econometric specification and assumptions of both the choice experiment and the travel cost model are presented in the following sections.

4.1 Travel cost method

The most frequently used method to estimate the current value of a tourist destination is a count model. Since OLS regression often incorrectly analyses count data, count models are mostly preferred (Coxe *et al*, 2009). However, before using this model we have to make some assumptions. Firstly, we have to set up a utility function for a tourist. The utility depends on the site characteristics such as quality of the site and possible leisure activities as well as on the price of a visit, quality and price of alternative sites and the travel time. Therefore, we created the following tourist demand function. = (Ward & Beal, 2000).

The tourist demand function will consist of:

$$Y_i = f(TC_i, A_i, R_i, N_i, S_i, SD_i)$$

Where Y_i are the number of visits of individual i, TC_i are the travel costs (with or without travel time valuation), A_i the most important recreational activity of individual i, R_i is the reasons of visit, N_i is the nature quality, S_i the travel costs to a substitute, SD_i the demographic and social-economical characteristics of the respondent.

4.1.1 Count data model

This study will show the results of the travel cost model of three methods: a model without travel time, a model with one-third of the market wage method and the method of Earnhart.
The dependent variable in travel cost studies is a count variable, this is a nonnegative variable reflecting the number of visits in a fixed period of time. This specification makes count models an applicable method for analysing travel cost data. Another advantage is that the model, unlike normal regression models, allows for a non-normal distribution of data and a low mean (Coxe *et al*, 2009).

The two most common count models are 'Poisson' regression and 'negative binomial' regression. A Poisson regression uses the Poisson distribution (see formula 1); this is a discrete distribution taking a probability value for nonnegative numbers.

$$P(Y = y \mid \mu) = \frac{\mu^y}{y!} e^{-\mu} \qquad (1)$$

It gives the probability of observing a given value y, of variable Y that is distributed following a Poisson distribution with parameter μ. This μ is the mean and the variance of the distribution. $y!$ is the factorial taking zero and positive integers. The Poisson regression function has a Poisson distribution error structure and a natural log, which can be depicted as:

$$\ln(\hat{\mu}) = b_0 + b_1 X_1 + b_2 X_2 + ... + b_p X_p \qquad (2)$$

where $\hat{\mu}$ is the predicted count on the outcome variable. The predicted score is not a count but the natural logarithm of the count, which can be examined as a 1-unit increase in X results in b unit increase in $\ln(\hat{\mu})$ holding all other variables constant (Coxe *et al*, 2009).

If there is more variance in the counts than expected (overdispersion[1]), the negative binomial model is preferable above the Poisson model. This model assumes that there is unexplained variability among respondents who have the same predicted value. The negative binomial model uses the Gamma distribution to represent the distribution of means. The error function is a mix of the Gamma and Poisson distribution (Coxe *et al*, 2009). If there is either an absence or high number of zero counts, both Poisson and negative binomial regression can add an additional function that account for this (Coxe *et al*, 2009).

The three functional forms, respectively log-linear OLS, Poisson and negative binomial will be tested to estimate the travel cost model. The best fitting unbiased functional form will be chosen to present the results. Therefore, we will test for overdispersion and compare both the log likelihood and BIC scores of the models (Famoye, 2010).

4.1.2 WTP estimation

The total willingness to pay of visiting a recreational destination includes the consumer surplus and the actual costs of the trip (mostly travel costs) as depicted in formula 3.

$$WTP = \hat{C} + TC \qquad (3)$$

The consumer surplus represents the non-market benefits next to those already indicated by the travel costs (Chae *et al*, 2011), which can be estimated by assessing the area under the individual's compensated demand curve. The calculation of the consumer surplus per trips is given by (Creel & Loomis, 1990):

$$\hat{C} = -\frac{1}{\hat{B}_1} * \hat{Y} \qquad (4)$$

where $\hat{C}$ is the estimated consumer surplus, $\hat{Y}$ the number of trips and $\hat{B}_1$ the estimated regression coefficient of travel costs in a count model. To estimate the total consumer surplus per year for a recreational area, the consumer surplus per visit needs to be multiplied by the average number of trips a year and the number of visitors per year.

4.2 Choice experiment

There are different methods to analyze data of choice experiments. The most widely used method is the multinomial logit model. This model is derived under the assumption of an independent and identically distributed error term (McFadden, 1974). This means that unobserved factors are not correlated over alternatives, as well as having the same variance for all alternatives (Train, 2009).

[1] To test whether there is overdispersion or not, the negative binomial model presents an alpha score. If this alpha score is higher than one, over dispersion is present and the negative binomial model will fit better.

Some other models are developed to avoid the assumption of independence of errors like the Generalized Extreme Value models, probit models and mixed logit models. Generalized Extreme Value models are – as the name suggests – based on a generalization of the extreme value distribution. It allows correlation in the unobserved factors over alternatives. However, if the correlation is zero it collapses to a logit model (Train, 2009). The mixed logit model allows the unobserved factors to follow any distribution. The unobserved factors can be specified into a part that contains the correlation and heteroskedasticity, and another part that follows the assumptions of an independent and identically distributed error term.

In this analysis we first estimate the multinomial logit model as the general specification. Since this model has some limitations, we test the more flexible nested logit model and mixed logit model in the second phase. However, the nested logit model collapsed back to the MNL model, indicating that the standard deviations of the random error components in the utility expressions are similar across the groups of alternatives (Hensher & Greene, 2000). Therefore, we will only discuss the multinomial and the mixed logit model.

4.2.1 Multinomial logit

The multinomial logit model (McFadden, 1974) is used for choice situations where the alternatives have no natural order (Smidheiny, 2007, Hoffman, 1988). The assumption is that the individual chooses the alternative only if it offers the highest value of (indirect) utility. The choice is not based on the absolute level of utility, but on the difference in utility between the alternatives. The model assumes that the error term follows an identically and independently extreme value distribution. The main advantage of this model is its ease and speed in estimating coefficients.

Multinomial logit models have two large limitations. The first one is that logit cannot represent random taste variation or unobserved heterogeneity (these are differences in taste that cannot be linked to observed characteristics) (Amaya-Amaya *et al*, 2008). Secondly, the model assumes independence from irrelevant alternatives (IIA), this means that ‘addition or subtraction of any option from the choice set will not affect relative probability of individual *i* choosing any other option’ (Bergmann *et al*., 2006, p. 1007). The last assumption is realistic in some situations, but inappropriate in others. When this assumption is not met, it may overestimate the probability of certain alternatives (Train, 2009).

Note that the parameters of unlabeled choice experiments should be treated as generic parameter estimates. Including alternative specific constants (ASC) will therefore violate the meaning of an unlabeled experiment. Hence, we only introduce an alternative specific constant for the ‘situation without measures’ (Hensher et al, 2005).

4.2.2 Mixed logit model

Mixed logit models are flexible models that relax the IIA assumption of the multinomial logit model. The model can approximate any random utility model, as well as, allowing for random taste variation, unrestricted substitution patterns and unobserved factors (McFadden and Train, 2000; Train, 2009). The flexibility is specified by allowing the slope of the utility to be random (which means β to be random). The random coefficients can be specified in any type of distribution, based on the behavior of the coefficients (Train, 2009). The following formula shows the probability if the utility is linear in β (Train, 2009):

$$P_{ij} = \int \left(\frac{e^{\beta' x_{ij}}}{\sum_k e^{\beta' x_{ik}}} \right) f(\beta) d\beta \qquad (5)$$

Where, P is the choice probability, $f(\beta)$ is a density function, here a mixing distribution and $\beta' x_{ij}$ the observed portion of the utility. This formula shows the mixed logit probabilities, which are the integrals of standard logit probabilities over a density of parameters. It is a weighted average of the logit formula evaluated at different values of the parameter β, with the weights given by the density f(β) (Train, 2009).

4.2.3 Willingess To Pay (WTP) estimations

This study estimates the willingness to pay of tourists to avoid a change of the current situation. The willingness to pay tells us something about the marginal change in value of a certain change in attributes. The method to measure WTP depends on both model specification and the econometric model. If a linear indirect utility is assumed, the WTP can be calculated as the ratio of two parameter estimates (*ceteris paribus*) (Amaya-Amaya *et al*, 2008). Calculation is only possible if one of the parameters is measured in monetary units. Additionally, it is important that both attributes to be used in the calculation are statistically significant, otherwise the WTP will be meaningless. As such, the implicit price that is an equivalent to the marginal willingness to pay may be calculated as follows (Hensher et al, 2005):

$$WTP = -\frac{\beta_2}{\beta_1} \qquad (6)$$

Where, WTP is the willingness to pay, β_1 is the price coefficient and β_2 the coefficient of one of the attributes incorporated in the model.

However, the mixed logit model controls for error terms that might be correlated over the choices people made (using the panel structure) and for the fact that the cost factor might differ across individuals. Within this model a suitable distribution for the β_1 parameter is chosen. The normal distribution is the distribution that is the most easy to estimate. However, it has the drawback that the zero is part of the distribution and therefore it might obtain both positive and negative WTP estimates. Daly et al (2011) indicated that the distribution of the WTP has no finite moments when using a normally distributed costs (tax) parameter. Therefore, in order to avoid the drawbacks, we have to use the log-normal distribution. Consequently, the distribution of the WTP can be stated as follows:

$$\begin{aligned} &WTP = \frac{\beta_2}{\beta_1} \quad with \quad \beta_1 \sim \log\text{-N}\left(\mu, \sigma^2\right) \\ &\frac{1}{\beta_1} \sim \log\text{-N}\left(-\mu, \sigma^2\right) \\ &\frac{\beta_2}{\beta_1} = WTP \sim \log\text{-N}\left(-\mu + \ln\left(\beta_2\right), \sigma^2\right) \end{aligned} \qquad (7)$$

The parameters β_2, mu and sigma are estimated using Biogeme. In combination with the analytical expression for the distribution of the willingness to pay, the mean, median and variance of the WTP can be found.

$$\text{mean WTP} = e^{-\mu+\ln(\beta_2)+\frac{1}{2}\sigma^2} \quad (8)$$

$$\text{median WTP} = e^{-\mu+\ln(\beta_2)}$$

$$\text{variance WTP} = e^{-2\mu+2\ln(\beta_2)+\sigma^2}\left(e^{\sigma^2}-1\right)$$

The WTP from a mixed logit model is normally given by the ratio of one or two randomly distributed terms. This can lead to heavily skewed WTP distributions. One of the approaches to deal with this problem is specifying a fixed price component. However, in this analysis the price variable is a random component, hence, it is irrational to assume that all individuals have the same preference for price (Meijer and Rouwendal, 2006). Louviere discusses that ignoring the possibility that the standard deviation of the unobserved utility can vary over observations can lead to erroneous interpretations and conclusions (Louviere, 2003). One of the alternative approaches is to specify a log-normal distribution, as done in this study. Still the distribution can be heavily skewed resulting in unrealistic estimates of the means of the WTP. Therefore we use, in accordance to Paterson et al (2008) and Hole (2008), the median WTP.

5 Estimation results

5.1 Travel cost estimates

Before estimating the consumer surplus, we calculated both the travel costs and travel time of the respondents (see table 3). The table shows that the travel costs of German respondents have a larger variation and are on average slightly higher than the travel costs of Dutch respondents, since Ameland is farther away for Germans than for Dutch this has been expected. Comparing the maximum travel costs without travel time with the travel costs with normal travel time, we observe that the second is approximately two times the costs of the first, showing that travel time can take a large share of the total travel costs. The minimum travel cost of zero is due to the inclusion of respondents that were paid a ticket. The variations of the travel costs without travel time, with normal travel time and with Earnhart travel time indicates that different calculations of travel time produce different results.

Table 3: The travel costs estimations of households under different assumptions of travel time. The different calculations of travel time, the longer travel time and distance of German and tourists explain the observed differences in results.

Subsample	Travel costs	Minimum	Maximum	Mean	Standard deviation
Dutch	Without travel time	€ 0.00	€ 234.98	€ 100.85	€54.28
	With normal travel time	€ 9.94	€ 503.82	€ 123.99	€66.28
	With Earnhart travel time	€ 1.88	€ 287.94	€ 111.15	€58.72
German	Without travel time	€ 0.00	€ 359.64	€ 103.68	€73.58
	With normal travel time	€ 16.73	€ 437.50	€ 138.60	€90.83
	With Earnhart travel time	€ 4.38	€ 380.66	€ 119.23	€80.30

The next step is analysing the distribution of the travel costs. We estimated three models: Normal OLS, Poission loglinear model and a negative binomial model. The results show that the distribution is positively skewed and has a relative small mean and variance. In this case normal OLS can cause unstable results. Additionally, the high alpha indicated a problem of overdispersion, the negative binomial model can correct for this. Comparison of the BIC values of the three models indicates that the negative binomial model has the best fit[2]. Therefore we present the results of the negative binomial model only.

5.1.1 Negative binomial model

The negative binomial model was estimated including three different calculations of travel time, see table 4. The parameter coefficients of travel costs of all the three models relates all significantly and negatively with the number of visits, indicating that an increase in travel costs will reduce the number of visits to Ameland. The Chi square test shows that all three models are statistically significant. The McFadden's pseudo R-squared is relatively low, representing

[2] *We used goodness of fit statistics such as the Bayesian Information Criterion (BIC) and the Akaike Information Criterium (AIC) to test the models. The Poisson model fitted poorly (BIC: 5742.963) in comparison with the other count model (BIC: 352.254) and the log-linear model (-1123.968).*

about 6[3] of the proportional reduction in variation. Although the indicator is useful to compare the same type of models, pseudo R-squared is often not an appropriate goodness of fit indicator for negative binomial logit models, (UClA, 2011; Cameron & Windmeijer, 1996). Therefore, we have to treat this indicator with caution, better is to use BIC, AIC or log likelihood as goodness of fit indicators (Famoye, 2010).

The three different models show relatively similar coefficients and standard errors. However, the log likelikhood values indicate that the travel cost model with normal travel time performs the best. The similar significant levels and signs of the models are suggesting that the pattern of relations among these variables is quite robust.

Besides travel costs, the model includes the significant non-multicollinear [4] socio-economic characteristics and preferences that may predict the number of current trips. The variables travel costs, German nationality and sex is woman, are negatively correlated, this indicates for example that if the nationality is German the respondent undertook less trips to Ameland in the last ten years. The independent variables age, gross income, length of stay, sea and beach quality, walking (rec_walking), sea and beach activities (rec_sbact) and bird watching (rec_bird watching) have positive coefficients indicating that for example an older respondent made more trips to Ameland in the last ten years. Respondents visited Ameland more frequently when there most important reason to visit is walking, bird watching or doing sea/beach activities, suggesting that this are the attractive aspects of Ameland. Respondents that visited the island more frequently made on average longer trips.

Gross income is significant and has a positive coefficient, suggesting that high-income groups visit the island more frequently, which is consistent with other travel cost studies and economic theory.

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[3] Interesting is that the pseudo r-squared estimations of the poisson and log-linear model are approximately 0.3, while this models perform worse at other goodness of fit indicators.

[4] *We did not include significantly multi collinear variables (> 0.25), except for the variable gross income and travel costs we allow for this variables a multi collinearity of maximum 0.35. The gross income is included, because in most travel cost studies this is an important variable.*

Table 4: Estimation of the negative binomial including different calculations of travel time. Before running the model 90 respondents were removed (39 respondents because their most important reason to visit the island was visiting family, 49 respondents because missing zip codes or income data and 2 respondents because of outliers). The variables age, sea beach quality and length of visit are continuous variables, the remaining are dummies with code 0 or 1. The variables rec_sbact, rec_ bird watching, rec_walking and rec_mud flat walking represent the respondents' main recreational activity on the respectively island sea beach activity, bird watching, walking and mud flat walking. FV_less presents the respondents that are expecting to visit the island less frequently and FVS_samen presents the respondents that expect to visit the island even as often if the situation without measures will become true.

	1. Travel cost model without travel time		2. Travel cost model with normal travel time		3. Travel cost model with Earnhart travel time	
Variables	*Coefficient*	*Standard error*	*Coefficient*	*Standard error*	*Coefficient*	*Standard error*
Travel Costs	-0.00537***	0.0008	-0.00513***	0.0007	-0.00536***	0.0008
Nationality	-0.42***	0.14	-0.35**	0.141	-0.39***'	0.14
Sex	-0.39***	0.11	-0.39***	0.106	-0.39***	0.11
Age	0.016***	0.0043	0.015***	0.0043	0.015***	0.0043
Gross Income	0.000044**	0.000021	0.000069***	0.000022	0.000056***	0.000021
Sea beach quality	0.26***	0.061	0.25***	0.059	0.26***	0.06
Rec_Walking	0.46***	0.12	0.44***	0.12	0.45***	0.12
Rec_Mud flat walking	-0.27	0.29	-0.26	0.29	-0.25	0.29
Rec_Sbact	0.76***	0.22	0.74***	0.22	0.74***	0.22
Rec_Bird watching	1.06**	0.49	1.01**	0.48	1.03**	0.48
Length of stay	0.018**	0.0076	0.018**	0.0075	0.017**	0.0076
FV_less	0.4*	0.23	0.43*	0.23	0.42*	0.23
FVS_same	0.59***	0.12	0.59***	0.12	0.58***	0.12
Constant	0.19	0.57	0.28	0.56	0.24	0.56
Alpha	1.12***	0.07	1.11***	0.07	1.11***	0.07
Observations	460		460		460	
Pseudo R-squared	0.0604		0.0631		0.0618	
LR Chi2	194.96 P<0.00		203.29		199.35	P<0.00
Log likelihood	-1517.1749		-1512.6955		-1514.8902	
Significance levels	***p<0,01	**p<0,05	*p<0,1			

In addition, we estimated the travel cost model separately for Dutch and German respondents (see table 5). Since the model which includes normal travel time seems to perform the best, we will use this travel costs to estimate the travel cost model separately for German and Dutch respondents.

Both models are statistically significant, have a significant chi squared and have a pseudo R-squared of respectively 0.054 and 0.131. The higher R-squared may be due to the small sample size. Since count models are not well applicable to small sample sizes, the results have to be interpreted carefully. The Dutch estimation is comparable with the estimation of the whole sample. However, there are some notable differences in between the samples. Firstly, in the German sample the coefficient of the travel cost is significantly lower, secondly gross income is not significant in the German sample and surprisingly in the Dutch sample the variable reason of visit is nature is negatively correlated. This suggests that tourists who especially come for nature favour other Wadden Islands or locations above Ameland.

Table 5: Estimation of the negative binomial model for German and Dutch respondents including travel costs with normal travel time estimation.

	Dutch		German	
Variables	*Coefficient*	*Standard error*	*Coefficient*	*Standard error*
TC1	-0.00589***	.000797	-0.00297**	0.0015
Sex	-0.41***	0.12	-0.59***	0.22
Age	0.02***	0.005	-0.003	0.009
Gross income	0.00008***	0.00003	0.000011	0.00004
Sea beach quality	0.27***	0.07	0.13	0.10
Recreation value nature	-0.94***	0.20	-0.0097	0.42
Rec_Walking	0.45***	0.13	0.67**	0.31
Rec_Mudflat walking	-0.17	0.31	-0.65	0.97
Rec_Sea beach activity	0.72***	0.26	0.89**	0.37
Rec_Bird watching	0.57	0.51	1.07	1.01
Length of stay	0.01*	0.01	0.11***	0.04
FV_ less	0.20	0.27	0.840**	0.42
FVS_same	0.50***	0.13	0.93***	0.23
Constant	0.29	0.68	1.16	0.94
Alpha	1.16***	0.08	0.60***	0.11
Observations	368		90	
Pseudo R-squared	0.054		0.131	
LR Chi2	143.77 P<0,00		71.67 P<0,00	
Log likelihood	-1255.77		-237.64	
*** p<0.01, ** p<0.05, * p<0.10				

5.1.2 Willingness to Pay

The estimated coefficients derived from the negative binomial model can be used to estimate the consumer surplus. Together with both travel and accommodation costs this results in a willingness to pay of tourists to visit the island. However, as the trip did incur costs, the net economic benefit is the consumer surplus only (Cae et al, 2012). Table 6 shows the consumer surplus, the travel costs, accommodation costs and the willingness to pay. The estimated consumer surplus ($\hat{C}$) was the highest for the model with normal travel time, followed by Earnhart travel time and the model without travel time.

The accommodation costs are on average € 313.35 per household, while the travel costs varies between € 100 and € 130 depending on the inclusion of travel time. As a result, the WTP for a trip is in between € 601-€ 635. Finally, we calculated the total recreation value of Ameland by first estimating the WTP per person per year where after we multiply this value by the number of visitors. As shown in table 7 the total recreation value of Ameland ranges from € 105 million to € 111 million, when transferring the value to all Wadden Islands the range becomes: € 435-460 million. The values are obtained by multiplying the WTP of Ameland (divided by the average household size) with the total number of visitors per year.

Table 6: Consumer surplus and WTP estimates for different travel cost calculations including accommodation costs, per household.

	Without travel time	**With normal travel time**	**With Earnhart travel time**
Consumer surplus per visit	€ 186	€ 195	€ 187
Travel costs + accommodation costs per household per visit	€ 415	€ 440	€ 426
WTP per household per visit	€ 601	€ 635	€ 613
WTP per household per year	€ 648[5]	€ 685	€ 661

Table 7: Total recreational value estimates of respectively Ameland and all the Wadden Islands (Vlieland, Terschelling, Ameland, Texel and Schiermonnikoog) including accommodation costs, per household

Total recreation value	**Without travel time**	**With normal travel time**	**With Earnhart travel time**
Total recreation value Ameland	€ 105,000,000	€ 111,000,000	€ 107,000,000
All Wadden islands	€ 435,000,000	€ 460,000,000	€ 443,000,000

When estimating the consumer surplus and the travel costs for German and Dutch respondents separately, we find that the consumer surplus is higher for German respondents than for Dutch (see table 8). Since Germans have on average a lower wage and higher travel costs, this result is expected. The total WTP is € 596 for Dutch respondents and € 833 for German respondents per household per visit. In general, Dutch respondents visiting the island on average more frequently than German respondents, therefore the WTP per year is lower for Germans than for Dutch. Aggregating these values for all Wadden Islands, we get a recreation value of respectively € 362 million and € 97 million (see table 9). When adding these, the total is comparable with the total recreation value presented in table 7. The values found are comparable with the estimated turnover of the Wadden Islands of approximately 450 million a year. However, recall that the aggregated values not include all extra costs of a holiday, such as restaurant costs and entrance fees, indicating that the actual WTP can be even higher.

[5] *WTP per household per visits times the average number of visits per year (1.08 per year).*

Table 8: Willingness to Pay of travel cost model including accommodation costs and normal travel time for German and Dutch respondents, per household.

	Dutch	German
Consumer surplus per visit	€ 170	€ 337
Travel costs per household per visit	€ 426	€ 497
WTP per household per visit	€ 596	€ 833
WTP per household per year	€ 703	€ 617

Table 9: Total recreation value estimates for German and Dutch respondents

Total recreation value	Dutch	German
Ameland	€ 69,000,000	€ 35,000,000
All Wadden Islands	€362,000,000	€ 97,000,000

5.2 Choice experiment

The estimates of the MNL models are based on the observed choices of 550 tourists presented in table 10. The estimates of the mixed logit panel model used to (account for unobserved taste heterogeneity) are presented in table 11.

5.2.1 Multinomial logit

The MNL model performed satisfactory, the pseudo r-squared was 0.25, all parameters had the expected sign and most parameters were significant at the 1% level. The coefficients of the parameters can be interpreted in respect to the status quo alternative, the 'situation without measures'. The coefficients show that respondents have a positive preference towards a stable or small decrease in bird population in respect to a large decrease in bird population, a preference for an increase or stable seal population in respect to a decrease in seal population and rather having wind turbines far away or none than having them close by. The attribute Pacific Oysters is insignificant, which indicates that this attribute does not explain the choices of the respondents. Since the coefficient levels have to be interpreted relatively, an order of the attributes cannot be given yet. As expected, the only attribute that is negative is preference for paying extra tourist tax.

The ASC captures the average effect on utility of all factors that are not included in the model (Train, 2009). In this model, the constant is negative and significant indicating that respondents have some willingness to vote for one choice over another for reasons that are not captured in the model. Therefore, we include socio-economic characteristics and preferences in a second model.

The second model including socioeconomic characteristics and preferences performs slightly better, demonstrated by a higher final log likelihood and pseudo r-squared. The model includes only the significant non-multicollinear[6] socio-economic characteristics and preferences, which can be interpreted as the differential impact of the variable on the utility of the status quo alternative in comparison to alternative 1 and 2 (Train, 2009; Quinn et al, 1999). For example, this suggests that a higher number of past visits have a negative impact on the utility (preference for) of the status quo in comparison to alternative 1 and 2, while

[6] *We did not include significantly multi collinear variables (> 0.25).*

having a left wing political preference has a positive impact on the utility of the status quo. Respondents, who prefer climate mitigation measures, give higher marks for nature quality, are willing to pay more [7]and have higher travel costs have less preference for the status quo, confirming our hypotheses.

To test for the IIA restriction of the MNL mode we performed a Hausman test. The results showed that IIA was violated. In other words, these results indicate that the outcomes can be substituted with another outcome (Hausman & McFadden, 1984; Louviere et al, 2000). This shows the need for a more flexible model.

*Table 10: Estimates of the MNL model based on the observed choices of 550 tourists with and without socio-economic characteristics *p<0.1 **p<0.05 *** p<0.01*

		Model 1: MNL		Model 2: MNL with socio-economic characteristics	
Attribute	*Attribute level*	*Value*	*Std err*	*Value*	*Std err*
ASC	Status quo	-1.220***	0.107	1.86***	0.732
Birds	Small decrease	0.778***	0.066	0.794***	0.067
	Stable	1.03***	0.067	1.05***	0.067
Oysters	1/1000	0.0021	0.062	0.0075	0.063
	1/500	0.084	0.064	0.095	0.065
Seals	Stable	0.657***	0.064	0.662***	0.064
	Increase	0.508***	0.066	0.515***	0.066
Wind turbines	Far away	0.407***	0.064	0.413***	0.065
	None	0.395***	0.064	0.402***	0.065
Tax	Per day	-0.169***	0.0087	-0.173***	0.009
Climate change	Mitigation			-0.604***	0.141
Nature quality				-0.126**	0.058
Past visits				-0.014***	0.005
WTP				-0.377***	0.031
Political pref.	Left-wing			0.377***	0.134
Number of observations		2874		2874	
Number of individuals		479		479	
Init log likelihood		-4.389.210		-4.389.210	
Final log likelihood		-2.355.153		-2.222.457	
Likelihood ratio test		1.604.517		1.869.910	
Pseudo R-squared		0.254		0.296	
Iterations		7		24	

[7] *This variable is based on the contingent valuation question, where people were asked to state their WTP to avoid the status quo.*

5.2.2 Mixed logit

Random variables in the mixed logit model cause the flexible nature of the model. In the dataset all attributes were firstly specified as random using a normal distribution. The parameters of most attributes had insignificant standard deviations. These results were used as the basis for selecting the random parameters (Hensher et al, 2005), only the attributes with a significant standard deviation were assumed to be random (Train, 2009). As a result, the only random attribute is tourist tax, indicating that there seemed to be some unobserved taste heterogeneity within the group of respondents. Thereafter, we adopt a log-normal distribution in order to avoid that the WTP estimates will have no infinite moments (Daly et al, 2011). Different numbers of halton draws were explored, the number of draws when no further significant progress is possible lies in between 25.000 and 110.000 draws.

Model three shows a significant better model fit than the multinomial logit model, since the goodness of fit indicators log likelihood and r-squared are both higher than the statistics in the first two models. In addition, all estimated mean coefficients were found to have the expected sign. The standard deviation of the tax attribute is highly significant representing the parameter for which preferences vary the most.

The fourth model shows a mixed logit model including the same socio-economic characteristics and preferences as the second MNL model. Although the expectation was estimating similar significant coefficients as in the MNL, some of the characteristics appeared to be insignificant. The significant coefficients indicate the deviation of the utility of on the one hand the two unlabelled alternatives and on the other hand the status quo. The signs are the same as for the coefficients of the multinomial logit. The model performs slightly better than the third model.

Table 11: Estimates of the mixed logit model based on the observed choices of 550 tourists with and without socio-economic characteristics

		Model 3: Mixed logit				Model 4: Mixed logit including socio-economic characteristics			
Attribute	*Attribute level*	*Value*	*T-stat*	*St. deviation*	*T-stat*	*Value*	*T-stat*	*Standard deviation*	*T-stat*
ASC	Status quo	-2.540***	-16.29			1.82*	1.69		
Birds	Small decrease	0.881***	12.38			0.883***	12.39		
	Stable	1.190***	16.31			1.18***	16.19		
Oysters	1/1000	0.004	0.05			0.00906	0.13		
	1/500	0.095	1.38			0.0975	1.41		
Seals	Stable	0.727***	10.47			0.725***	10.44		
	Increase	0.500***	7.01			0.509***	7.12		
Wind turbines	Far away	0.462***	6.62			0.468***	6.69		
	None	0.430***	6.2			0.432***	0.0695		
Tax	Per day	-1.870***	-19.83	1.2***	15.27	-1.84***	-20.27	1.14***	14.18
Climate change	Mitigation					-0.789**	-2.69		
Nature quality						-0.169	-1.39		
Past visits						-0.0161*	-1.95		
Take home						0.0577	0.19		
WTP						-0.314***	-5.06		
Political preference	Left wing					0.542*	1.99		
Number of observations		2874				2874			
Number of individuals		479				479			
Init log likelihood		-15.899.473				-15.887.958			
Final log likelihood		-2.066.879				-2.030.615			
Likelihood ratio test		2.181.066				2.253.594			
R-squared		0.345				0.351			
Number of Halton draws		25.000				110.000			

5.2.3 Individual specific WTP estimates

The parameter estimates derived from the mixed logit model can be used to estimate individual specific WTP estimates. In this analysis we will only present the WTP estimates derived from the mixed logit model, due to the violation of the IIA assumption in the MNL model. Table 12 shows the median of this WTP estimates derived from the mixed logit model with and without covariates. The estimates derived from the mixed logit model without covariates are slightly higher than the estimates from the model with covariates, due to a smaller variance in the WTP results. Although the Mixed logit WTP estimates are higher in comparison with the WTP estimates of the MNL model, the rank of the attributes is the same. The results show that the respondents are willing to pay the most to avoid a large decrease in number of birds and the least to avoid the placement of wind turbines. The attribute levels are all significantly different from each other, except for the attribute levels concerning the location of wind turbines far away and none, indicating that respondents are not willing to pay significantly more for no wind turbines than for wind turbines far away.

Table 12: WTP estimates derived from the mixed logit model. The estimates present the WTP to avoid the status quo, for example to obtain a small decrease in number of birds instead of a large decrease. The first attribute level of every attribute presents the expected changes in a situation with a low climate change scenario (for example birds: small decrease), the second attribute level of the attribute presents the current situation (for example birds: stable). After applying a t-test we found that all the attributes are significantly different, except for the attribute levels wind turbines far away and none.

Attribute	Attribute level	Mixed logit	Mixed logit with socio-economic characteristics
Bird	Small decrease	€5.72	€5.56
	Stable	€7.72	€7.43
Seals	Stable	€4.72	€4.56
	Increase	€3.24	€3.20
Wind turbines	Far away	€3.00	€2.95
	None	€2.79	€2.72

WTP estimates are convenient to make relative comparisons and rankings of attributes (Hole & Kolstad, 2006). To confirm our findings, we compared the WTP results with the ranking of the attributes stated by the respondents through a separate survey question, see figure 5. It is remarkable that although the WTP estimate for seals is lower than the WTP for birds, 30% of the respondents ranked seals as most important attribute in the survey, while only 22% ranked birds as most important. The differences in attribute levels can be a possible explanation, since the attribute levels of seals start with an increase and end with a decrease whereas the levels of bird start with a stable population and end with a large decrease. Expected was the low ranking of the attribute pacific oyster, just 2.5% of the respondents ranked this attribute as most important in the survey.

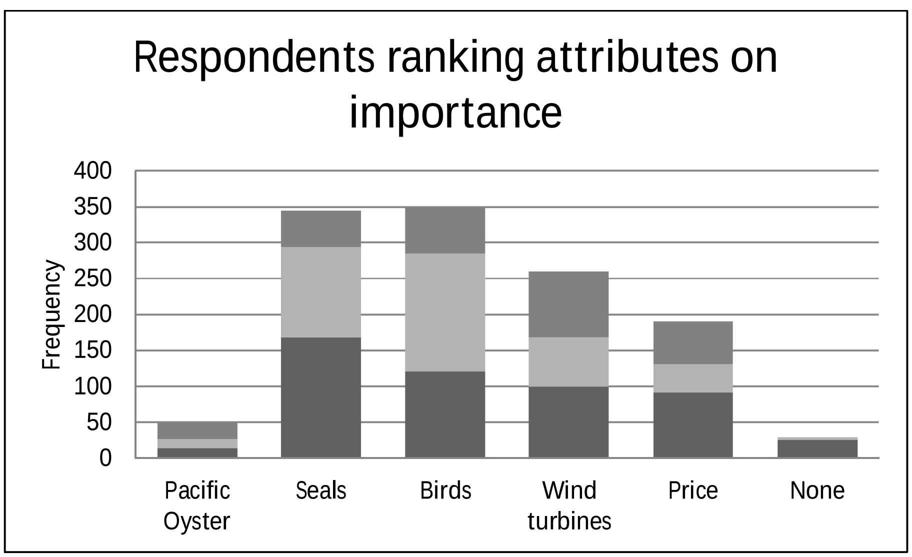


Figure 5: The ranking of the attributes by the respondents. The dark grey color shows the most preferred attribute, the light grey color the second preferred attribute and the remaining color the third preferred alternative.

WTP values can be expected to be sensitive to variations in culture of the respondents (Hynes et al, 2013; Ressurreicao et al, 2012). The results show that the WTP estimates of the Dutch and German respondents are similar, except for the WTP for the location of wind turbines (see figure 6). Whereas Dutch respondents' WTP is indifferent between wind turbines far away and no wind turbines at all, German respondents are willing to pay much less (approximately 0.50 euro in comparison to the 3.50 euro Dutch are willing to pay) to avoid wind turbines in the Wadden Sea, indicating a different attitude of Dutch and Germans towards wind turbines.

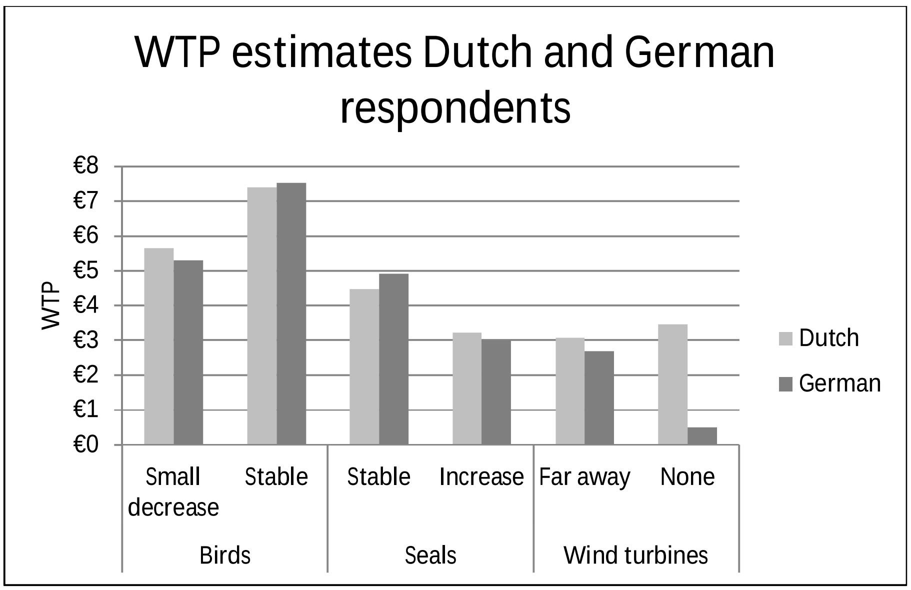


Figure 6: WTP estimates of Dutch and German respondents, the WTP estimates are similar except for the attribute level wind turbines none.

Since situating wind turbines in the Wadden Sea is a climate mitigation measure, we tested whether there are differences in WTP between respondents that favour climate adaptation and respondents that favour climate mitigation measures. The results show that respondents who are in favour of climate mitigation measures are significantly willing to pay less to avoid locating wind turbines in the Wadden Sea, indicating that the respondents' personal opinion towards addressing climate change influences the WTP estimates (see figure 7).

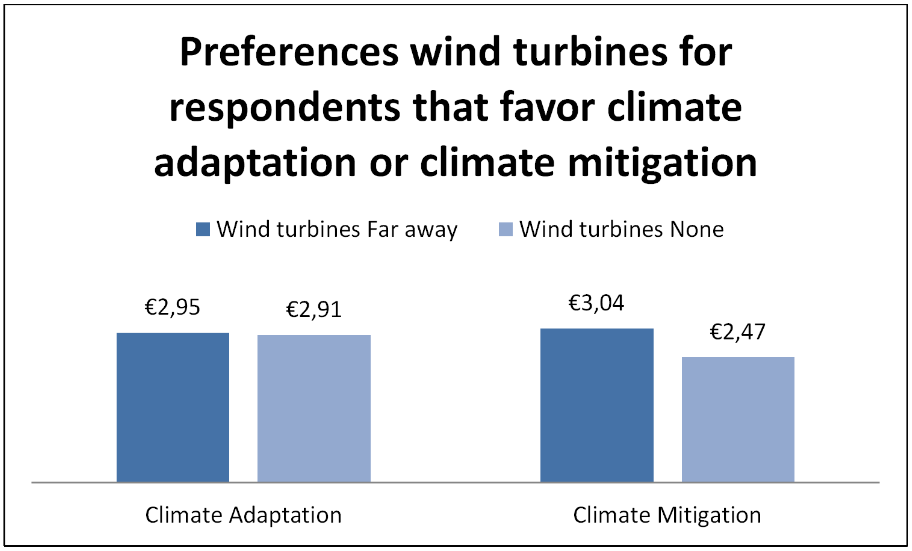


Figure 7: The preferences for wind turbines of tourists that favor either climate adaptation or climate mitigation. Only the WTP of 2.47 euro is statistically different from the other WTP estimates.

Table 13 shows the WTP to avoid the status quo for Dutch, Germans and both groups per household per year. Since German and Dutch respondents have a different number of visits per year, number of adults in a household and length of stay, the WTP estimates show large differences between the two groups. When summing the attribute levels of the current situation, we obtain the WTP per household per year to avoid the effects of the high climate scenario (status quo). This suggests that respondents are willing to pay approximately 115 euro to avoid a high decrease in number of birds, decrease in number of seals and location of wind turbines close by the Wadden islands. This is two times more than the respondents stated to pay in a contingent valuation question in the same survey. [8]

To obtain better understanding of the benefits for the tourism sector in the Wadden Sea region, we aggregate the value for the non-market benefits of the attribute levels of the Ameland survey for the tourism sector on all Wadden islands (see table 14). Therefore, the WTP estimates have to be summed over the total number of tourists visiting the Wadden Islands, indicating that the non-market benefit of avoiding the status quo scenario is approximately 77.5 million euros per year. When summing the aggregated values attributed to avoid the status quo scenario and obtain the low climate scenario (small decrease in number of birds, stable number of seals and wind turbines far away), we find a total value of approximately 76 million euro. This indicates that the low climate scenario and the current trend do not differ significantly in non-market benefits. However, for finding the range of changes in value, we sum per attribute all lowest and highest values, obtaining a range of 67-87 million euros, which represents the non-market benefit to avoid the status quo scenario. When comparing this with the estimated turnover of tourist sector on the Wadden Islands of approximately 450 million per year, the results show that the non-market benefits to avoid the

[8] After the choice experiment we asked the respondents to state their WTP to avoid the status quo scenario. On average respondents were willing to pay €4.71 per adult per day (Dutch respondents €4.54 and German respondents €5.32). Correcting this for the socio-economic characteristics of both respondent groups result in an average WTP per year per household of €45.43 euro, whether the German respondents had a WTP of €28.13 p.a.p.y and the Dutch respondents of €47.69 p.a.p.y.

status quo are a substantial amount (approximately 17%). Comparing the travel cost estimates of German respondents with the WTP to avoid the status quo, we see that the percentage that they are willing to pay to avoid the status quo is lower (approximately 9%) than the percentage for Dutch respondents (approximately 19%). Nevertheless, we should be cautious with comparing these estimates, since non-market benefits include option values, bequest values and existence values, while market benefits just include the values incorporated in the market.

Table13: The WTP per household per year to avoid the status quo.

Attribute	Attribute level	Dutch	German	Average
Birds	Small decrease	€54	€27	€48
	Stable	€71	€39	€65
Seals	Stable	€43	€25	€40
	Increase	€31	€15	€28
Wind turbines	Far away	€30	€14	€26
	None	€33	€3	€24

Table14: Aggregated average values of the respondents. The WTP values of tourists on Ameland are aggregated for all Dutch Wadden Islands. The aggregated value of the impacts due to a high climate change scenario is approximately 77,5 million euro, while the aggregated value to avoid the impact of a high climate change scenario and get the impacts of a low climate change scenario is 76 million euro (Birds: small decrease, Seals: stable. Wind turbines: far away).

Attribute	Attribute level	Aggregate values
Birds	Small decrease	€32,000,000
	Stable	€43,000,000
Seals	Stable	€27,000,000
	Increase	€19,000,000
Wind turbines	Far away	€17,000,000
	None	€16,000,000

6 Discussion

The purpose of this study is to estimate tourists' willingness to pay for changes in marine ecosystems due to several climate induced effects on the marine environment. The estimated WTP values show that avoiding a decreasing number of birds, seals and the placement of wind turbines causes substantial non-market benefits for tourists. In other words, tourists are willing to pay a significant amount to prevent the effects of climate change on the ecosystem in the Wadden Sea. The empirical results provide important information for policy makers, responsible for developing tailor-made policies to avert climate change impacts on the marine environment in this area. Furthermore, the research shows the need for future research using choice experiments to estimate the impacts of climate change on ecosystems. Both research contributions are discussed in more detail below.

6.1 Implications for decision makers

A better understanding of tourists' preferences and their dependence on tourists characteristics, aids policy makers to manage natural resources, plan marine areas and position the recreational sector more effectively (Beharry-Borg & Scarpa, 2010). This study showed that the current value of the Wadden Islands is approximately 450 million euros, and that the consumer surplus representing the net benefits for tourists is approximately 128 million euros. These estimates are comparable with individual estimates of similar studies (Chae et al, 2012; Rosenberger & Loomis, 2001). For example, Chae et al (2012) estimated the non-market benefits gained by visitors of the island Lundy. He found a consumer surplus of 229 pound per trip and travel costs in between 360 and 575 per trip, which is comparable to the consumper surplus found in this study of approximately 190 euro and the willingness to pay of approximately 630 euro per visit.

The choice experiment revealed that the presence of a high number of birds in the Wadden Sea area is an important attribute for tourists. The high WTP of tourists to avoid a strong decrease in number of birds shows that policy makers need to make significant efforts to avoid this decrease. The non-market benefits for tourists to avoid a decrease in number of seals are lower, but still substantial. Remarkable is the preference of tourists for the stabilization of the seal population instead of growth, suggesting that tourists prefer a balanced ecosystem to the possibility to see a seal more frequently. Neglecting tourists' signals of their appreciation of these attributes in combination with climate induced deterioration of the number of seals and birds, potentially reduces the value that tourists assign to the Wadden Sea. In the long run this might result in a decreasing number of tourists visiting the Wadden Islands and substantial indirect economic effects to the Dutch economy. Avoidance of an increase in number of Pacific oysters did not lead to significant non-market benefits. A possible explanation may be the relative unfamiliarity of the respondents with the Pacific oyster in comparison with the other attributes, since many respondents indicated it would be very unlikely to be injured due to a fall on a Pacific Oyster. Another explanation could be the growing potential for tourists to harvest and consume the Pacific oyster.

Besides the valuation of the individual attributes, we aggregated the values for the whole Wadden Sea. The results showed that there is a small difference in tourists' preferences to maintain the current situation compared to the status quo or the low climate change scenario. This suggests that the Wadden Islands will lose substantial value for tourists in a situation of strong climate change, illustrated by a strong decrease in birds a moderate decrease of seals and by wind turbines that will be placed close by the islands. Since placement of wind turbines close by or far away from the coast is not explicitly part of the climate change scenarios, we can couple these attribute levels to the opposite scenario as well. However, this will not result in significantly different aggregated values, because the values of both attribute levels of wind turbines are comparable (respectively 17 million and 16 million). The aggregated value (approximately 450 million euro) of the travel cost study is comparable to the estimated turnover of the tourist sector on the Wadden Islands (as well 450 million euro). However, the total value will be probably higher than estimated, since not all the extra expenditures of tourists such as restaurant visits and museum visits are incorporated in the value of the travel cost study.

The possibility to consider every attribute both independent and part of a scenario is an advantage of using choice experiments, making us able to find the range in value and ranking of individual attributes. The ranking of the attributes tells us that WTP is the highest for a stable trend in number of birds, followed by a stable number of seals and wind turbines located far away. The range in value of individual attributes shows the benefits of a different state of the ecosystem, which may aid decisions e.g. whether or not to take measures to conserve certain attributes in an ecosystem. These results indicate that it is more beneficial to avoid changes in some attributes than in others. For example, the results of this study suggest that from a tourist’s perspective it is more beneficial to avoid a large decrease in number of birds than a decrease in number of seals. Additionally, the joint valuation of attributes representing a climate change scenario can show the benefits of avoiding a particular scenario.

One of the aims of the study was recognizing the difference in preference of visitor types. The results of this study indicated that the attitude towards wind turbines differs between Dutch and German respondents. The contrast is much larger than the difference in preferences for seals and birds between these two groups. Ressurreicao et al (2012) suggested already that valuation of components of marine biodiversity may be driven by the culture of each location. However this not explains the large difference in preference for wind turbines between German and Dutch respondents. One of the possible explanations is Germany’s current policy on renewable energy, Germany has long been an environmentally progressive country that supported the development and deployment of renewable energies. Since 2010 the German government rolled out a long-term initiative to shift from fossil fuels to renewable energy (Stegen et al, 2013). Therefore, it is likely that Germans are more familiar with and positive towards wind energy. Another explanation may be the fact that the wind turbines will be located on Dutch territory. Since wind turbines will not be located in their country, German respondents may have less strong feelings about locating wind turbines in the Wadden Sea than Dutch respondents. Currently, in the Netherlands is a heavy debate going on about the impact of wind turbines on the tourist sector. The results of this study can contribute to this debate. Corresponding with Ressureicao et al (2012) and Hynes et al (2013) the results show that cultural differences have to be taken into account while formulating policy.

Additionally, we tested whether respondents who are more in favor of climate mitigation measures are willing to pay less for the avoidance of wind turbines. This appeared to be the case. This indicates that when more tourists preferring climate mitigation above adaptation, the WTP to avoid wind turbines in the Wadden Sea will be lower. However, this effect will be limited, since the difference between the willingness to pay between tourists favoring mitigation and adaptation is relatively small.

6.2 Methodological implications

Currently choice experiments are one of the best methods in the field to measure changes in willingness to pay due to hypothetical changes in attributes (Freeman, 2003). However, it is difficult to ascribe these changes to one driver such as climate change, land subsidence or gas drilling. In this study we attempted to value possible changes in the Dutch Wadden Sea due to effects of climate change. The attributes were chosen based on this driver and the preferences of tourists visiting the Wadden Islands. Although the changes of the attributes can be ascribed to climate change, other drivers, e.g. pollution, shipping and fishery may have impact on the attributes as well.

Another well-known limitation is the possibility to include just a limited number of attributes, which does not allow including all possible important changes (Hensher et al, 2005). Therefore, a choice experiment is in most cases not the appropriate method to value the changes due to one driver. Improving the understanding of complex socio-ecological systems including the impact of different drivers will contribute to improved value estimation. We propose two solutions to harness this problem and that should be explored in future studies. First, we argue that valuation studies should use ecological models to predict ecological effects under different different scenarios more frequently. Second, we propose to invite experts for making a well-informed guess about the percentage a driver is responsible for a change. Then the WTP multiplied by the percentage of change will be the value allocated to the driver. However, it should be kept in mind that respondents are asked to state their WTP to avoid effects due to climate change, the WTP could be different considering a different change.

Tourist tax appeared to be the only random attribute in this analysis, which complicates the calculation of the average WTP. Therefore, we estimated the median WTP from a log-normal distribution. Since the variance of the median WTP is much smaller than the variance of the average WTP, the estimates seemed to be more realistic than the average WTP estimates. Additionally, the order of the estimates is comparable with the WTP estimates from the MNL model. Therefore, this seems to be a good method in cases if only the price component is random. The results of the WTP estimation showed as well that the WTP distribution became less skewed due to the inclusion of socio-economic characteristics, which indicates that inclusion leads to more sound average and median WTP estimates.

In the study, we compared the choice experiment with the ranking of the attributes and with the results of a contingent valuation question. The results showed that tourists are willing to pay the most to avoid a decrease in number of birds, followed by seals and the placement of wind turbines. However, the ranking of attributes demonstrated different results, in that analysis seals were most preferred. This shows that the rank of the attributes cannot be confused with the rank in WTP of the attribute levels. Furthermore, the results showed a large difference between contingent valuation and choice experiment estimates. Since we asked the respondents with a contingent valuation question to state their WTP to avoid the status quo, the results support the finding that for a bundle of attributes choice experiments give significantly larger values than contingent valuation studies (Foster & Mourato, 2002; Ryan & Watson, 2009; Hoehn and Randall, 1989; Hoehn and Loomis, 1993). In this situation contingent valuation studies probably underestimate the values.

In this study, we transfer the case study results from one Wadden Island to all five Dutch Wadden Islands, assuming that the largest part of the tourist sector in the Wadden Sea is situated on the Wadden Islands. Benefit transfer methods are widely discussed, since large transfer errors may arise when transferring values to different sites and scales (Rolfe et al, 2013; Bocksteal et al, 2000). According to Bateman et al (2011) the aggregation of unit values is appropriate when applied to relatively similar sites. Since Ameland is in size, tourist numbers and marine environment representative for the other four islands in the Wadden Sea, we assume that no large transfer errors will appear.

6.3 Conclusions

In summary, this paper showed that using a choice experiment to value effects due to climate change is possible. The results showed that the current value of the Wadden Islands is approximately 450 million euro. The estimations of the change in value present that tourists visiting the Wadden Islands willing to pay the most for the avoidance of a strong decrease in birds, followed by decrease in seals and location of wind turbines close by the coast, indicating that the protection of a strong decrease in birds will avoid the most decrease in value of tourists. Decision makers can use the aggregated values to obtain an idea about the loss in value of a change in certain attributes, which can be used in preventing those changes. Comparing the willingness to pay of German and Dutch respondents, we found that they differ significantly in attitude towards wind turbines. Therefore, we argue that the preferences of tourists of different nationalities have to be taken into account to optimize policies.

Also we argue that more attention has to be given to translate the output of ecological models into understandable effects for tourists and in addition to include effects of different climate scenarios. Especially, capturing the value of different ecological states due to climate change will be important for decision makers (Turner et al, 2003). One of the difficulties of the method is that most effects cannot be allocated to just one driver. Since choice experiments basically measure the change in effects of certain attributes, the choice of the attributes determine to what extent the effects can be allocated to one driver. Therefore, we propose to invite experts for making an estimated guess about the percentage a driver is responsible for a change.

7 Literature

Adamowicz, W., Boxall, P., Williams, M., et al. 1998. Stated preference approaches for measuring passive use values: Choice experiments and contingent valuation. American journal of agricultural economics 80 (1); pp. 64-75.

Amaya-Amaya, M., Gerard, K., Ryan, M., 2008. Discrete choice experiments in a nutshell. In: Ryan, K., Gerard, M., Amaya-Amaya, M., Using discrete choice experiments to value health and health care. Springer, Dordrecht The Netherlands.

Barbier, E.B., Haker, S.D, Kennedy, C., Koch, E.W., Stier, A.C., Sillman B.R. 2011. The value of estuarine and coastal ecosystem services. Ecological Monographs, 81(2); pp. 169-193.

Bateman, I., Brouwer, R., Ferrini, S., Schaafsma, M., Barton, D., Dubgaard, A., Hasler, B., Hime, S., Liekens, I., Navrud, S., De Nocker, L., Ščeponavičiute, R., and Semeniene, D. 2011. Making benefit transfers work: Deriving and testing principles for value transfers for similar and dissimilar sites using a case study of the non-market benefits of water quality improvements across Europe. Environmental and Resource Economics 50; pp. 365–387.

Beharry-Borg, N., Scarpa, R., 2010. Valuing quality changes in Carribean coastal waters for heterogeneous beach visitors. Ecological Eeconomics 69 (5); pp. 1124-1139.

Bergmann, A., Hanley, N., and Wright, R., 2006. Valuing the attributes of renewable energy investments. Energy Policy 34(9), pp. 1004-1014.

Blakemore, F., Williams, A., 2008. British Tourists' valuation of a Turkish beach using contingent valuation and travel cost studies. Journal of Coastal Research 24, pp. 1469-1480.

Bockstael, N. E., Freeman, A. M., Kopp, R. J., Portney, P. R., and Smith, V. K., 2000. On measuring economic values for nature. Environ. Sci. Tech. 34 (8); pp. 1384-1389.

Cameron, A.C., Windmeijer, F.A.G., 1996. R-squared measures for count data regression models with applications to health-care utilization. Journal of Business & Economic statistics 14 (2); pp. 209-220.

Cesario, F.J., Knetsche, J.L., 1970. Time bias in recreation benefit estimates. Water resources research 6, 700-704.

Chae, D.R., Wattage, P., Pascoe, S., 2012. Recreational benefits from marine protected areas: A travel cost study analysis of Lundy. Tourism management 33, 971-977.

Clausen, K.K., Stjernholm, M., Clausen, P. 2013. Grzing management can counteract the impacts of climate change-induced sea level rise on salt marsh-dependent waterbirds. Journal of applied ecologie 50 (2); 528-537.

Coxe, S., West, S.G., Aiken, L.S., 2009. The analysis of count data: A gentle introduction to Poisson regression and its alternatives. Journal of personality assessment 91, 121-136.

Creel, M.D., Loomis, J.B., 1990. Theoretical and empirical advantages of truncated count data estimators for analysis deer hunting in California. American Journal of Agricultural Economics 72, 434-441.

Crosato, A., Stive, M.J.F., 2000. Morphology and morphodynamics of the Wadden Sea. Delft Cluster, Theme 3 rivers and coasts, projects coasts and ecomorphology.

Daly, A., Hess, S., Train, K. 2011. Assuring finite moments for willingness to pay in random coefficient models. Transportation.

Ding, H., 2011. Economic Assessment of Climate Change Impacts on Biodiversity, Ecosystem Services and Human Wellbeing: An Application to European Forest Ecosystems, Doctoral dissertation submitted in January 2011 to the Department of Economics, Ca'Foscari University of Venice, Italy.

Earnhart, D., 2004. Time is money: Improved valuation of time and transportation costs. Environmental and resource economics 29, pp. 159-190.

Famoye, F., 2010. On the bivariate negative binomial regression model. Journal of applied statistics 37 (6); pp. 969-981.

Fleisher, A., Sternberg, M., 2006. The economic impact of global climate change on Mediterranean rangeland ecosystems: A space-for-time approach. Ecological economics 59 (3); pp. 287-295.

Foster, V., Mourato, S., 2002. Elicitation format and sensitivity to scope: Do contingent valuation and choice experiments give the same results? Environmental and Resource economics 24 (2); pp. 141-160.

Freeman III, M. A. 2003. The measurement of environmental and resource values, theory and methods, second edition. Resources for the Future, Washington DC.

Gee, K., Burkhard, B., 2008. Cultural ecosystem services in the context of offshore wind farming: A case study from the west coast of Schleswig-Holstein. Conference: International workshop on ecosystems services – solutions of problems of a problem that needs solution location.

Ghermandi, A., Nunes, P.A.L.D., 2013. A global map of coastal recreation values: Results from a spatially explicit meta-analysis. Ecological Economics 86; pp. 1-15.

Hausman, J. A., and D. McFadden . 1984. Specification tests for the multinomial logit model. Econometrica 52: 1219-1240.

Hensher, D.A., Greene, W.A., 2002. The mixed logit model: The state of practice. Working Paper, Institute of Transport studies, ITS-WP-02-01.

Hensher, D.A., Rose, J.M., Green, W.A., 2005. Applied choice analysis, A primer. Cambridge University Press, Cambridge.

Hensher, D.A., Rose, J.M., Greene, W.H., 2005. Applied choice analysis, a primer. Cambridge University press, New York.

Hoehn, J.P., Loomis, J.B., 1993. Substitution effects in the valuation of multiple environmental-programs. Journal of environmental economics and management 25 (1); pp 56-75.

Hoehn, J.P., Randall, A., 1989. Too many proposals pass the benefit cost test. America economic review 79 (3); pp. 544-551.

Hoffman, S.D., Duncan, G.J., 1988. Multinomial and conditional logit discrete-choice models in demography. Demography 25 (3), pp. 415-427.

Hole, A. R., 2008. Modelling heterogeneity in patients' preferences for the attributes of a general practitioner appointment. Journal of Health Economics 27, 1078-1094.

Hole, A.R., Kolstad, J.R., 2012. Mixed logit estimation of willingness to pay distributions: a comparison of models in preference and WTP space using data from a health-related choice experiment. Empirical economics 42 (2); pp. 445-469.

Hoyos, D., 2010. The state of the art of environmental valuation with discrete choice experiments. Ecological economics 69 (8); pp. 1595-1603.

Hynes, S., Norton, D., Hanley, N. 2013. Adjusting for cultural differences in international benefit transfer. Environmental & Resource economics 56(4); pp. 499-519.

Iamtrakul, P., Teknomo, K., Hokao, K., 2005. Public park valuation using travel cost method. Procceedings of the eastern Asian society for transportation studies 5; pp. 1249-1264.

IPCC, 2007. Climate Change 2007. Synthesis report. , IPCC, Geneva, Switzerland.

Levin, S. A., and J. Lubchenco. 2008. Resilience, robustness, and marine ecosystem-based management. Bioscience 58:27–32.

Liu, X., Wirtz, K.W., 2009. Managing coastal area resources by stated choice experiments. Estuarine, Coastal and Shelf science 86, pp. 512-517.

Louviere, J. 2003. 'Random utility theory-based stated preference elicitation methods: Applications in health economics with special reference to combining sources of preference data', Working Paper, Faculty of Business, University of Technology, Sydney.

Marine ecosystem service partnership, 2014. Explore ecosystem services [online]. http://marineecosystemservices.org/explore.

McFadden, D., 1974. Conditional Logit Analysis of Qualitative Choice Behavior. Frontiers of Econometrics. Academic Press, U.S.A.

McFadden, D., Train, K. 2000. Mixed MNL models for discrete response. Journal of applied econometrics 15 (5); 447-470.

Meijer, E., Rouwendal, J., 2006. Measuring welfare effects in models with random coefficients. Journal of applied econometrics 21 (2); pp. 227-244.

Millennium Ecosystem Assessment, 2005. Ecosystems and human well-being, synthesis. Island Press, Washington, DC.

Mitchell, R.C. and Carlsson, R.T. 1989. Using surveys to value public goods, the contingent valuation method. RFF Press, Washington.

Nunes, P.A.L., Bergh van den, J.C.J.M., 2004. Can people value protection against invasive marine species? Evidence from a joint TC-CV survey in the Netherlands. Environmental & Resources Economics 28, 517-532.

Parsons, G.R., Thur, S.M. 2008. Valuing changes in the quality of coral reef ecosystems: A stated preference study of SCUBA diving in the Bonaire National Marine Park. Environmental & Resource economics 40 (4); pp 593-608.

Paterson, R. W., Boyle, K. J., Parmeter, C. F., Neumann, J. E. and Civita, P. d., 2008. Heterogeneity in preferences for smoking cessation. Health Economics 17, 1363-1377.

Quinn, K.M., Martin, A.D., Whitford, A.B., 1999. Voter choice in multi-party democracies: a test of competing theories and models. American Journal of Political Science 43, 1231–1247.

Raad voor de Wadden ,2008. Recreatie en toerisme in het Waddengebied, toekomstige ontwikkelingsmogelijkheden en hun effecten op economie, duurzaamheid en identiteit. Analyserapport behorende bij advies 2008/05.

Rahel, F.J., Olden, J.D., 2008. Assessing the effects of climate change on aquatic invasive species. Conservation biology 22 (3), pp. 521-533.

Reise, K., and Beusekom, van, J.E.E., 2008. Interactive effects of global and regional change on a coastal ecosystem. Helgoland Marine Research 62, pp. 85-91.

Ressurreicao, A., Gibbons, J., Kaiser, M., Dentinho, T.P., Zarzycki, T., Bentley, C., Austen, M., Burdon, D., Atikins, J., Santos, R.S., Edwards-Jones, G., 2012. Different cultures, different values: The role of cultural variation in public's WTP for marine species conservation. Biological conservation 145; pp. 148-159.

Rolfe, J., Dyack, B. 2010. Valuing recreation in the Coorong, Australia, with the Travel cost and Contingent Behaviour models. The economic record, Vol. 87, No. 277.

Rolfe, J., Windle, J., Bennett, J. and Mazur, K. 2013. Calibration of values in benefit transfer to account for variations in geographic scale and scope: Comparing two choice modelling experiments. Paper presented at the 57th Annual conference of the Australian Agricultural and Resource Economics Society, February5-8th, Sydney.

Roomen, van M., Laursen, K., Turnhout van, C. et al, 2012. Signals from the Wadden Sea: Population declines dominate among waterbids depending on intertidal mudflats. Ocean & coastal management 68; pp. 79-88.

Rosenberg, A.A., and K.L. McLeod. 2005. Implementing ecosystem-based approaches to management for the conservation of ecosystem services. Marine Ecology Progress Series 300:270–274.

Rounsevell, M.D.A., Dawson, T.P., Harrison, P.A., 2010. A conceptual framework to assess the effects of environmental change on ecosystem services. Biodiversity & Conservation 19 (10); pp. 2823-2842.

Ryan, M., Watson, V., 2009. Comparing welfare estimates from payment card contingent valuation and discrete choice experiments. Health Economics 18 (4); pp. 389-401.

Sijtsma, F.J., Daams, M.N., Farjon, H., et al, 2012. Deep feelings around a shallow coast. A spatial analysis of tourism jobs and the attractivity of nature in the Dutch Wadden area. Ocean & Coastal management 68; pp. 138-148.

Smidheiny, K., 2007. Multinomial choice (Basic Models) [online]. Cited at October 17th, < http://kurt.schmidheiny.name/teaching/multinomialchoice2up.pdf>.

Statistics Netherlands, 2010. Toerisme in Nederland, het gebruik van logiesaccomodaties 2009. Den Haag/Heerlen 2010.

Staudinger, M.D., Carter, S.L., Cross, M.S, Dubois, N.S, Duffy, J.E., Enquist, C., Griffis, R., Hellmann, J.J., Lawler, J.J., O'lear, J., Morrison, S.A., Sneddon, L., Stein, B.A., Thompson, L.M., Turner, W., 2013. Biodiversity in a changing climate: a synthesis of current and projected trends in the US. Front Ecol Environ 11(9): 465-473.

Stegen, K.S., Seel, M., 2013. The winds of change: how wind firms assess Germany's energy transition. Energy policy 61; pp. 1481-1489.

Stenden instituut Service Management, 2010. Consumentenonderzoek toerisme 2009. Stenden hogeschool, Leeuwarden.

Stichting recreatie, 2003. Recreatie in, op en rond de Waddenzee. Stichting recreatie, kennis- en innovatiecentrum, February 2003.

Stichting recreatie, 2003. Recreatie in, op en rond de Waddenzee. Stichting recreatie, kennis- en innovatiecentrum, February 2003.

TEEB, 2010. The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB.

Train, K., 2009. Discrete choice methods with simulation. Cambridge University Press.

Turner, R.K., Paavola, J., COooper, P., Farber, S., Jessamy, V., Georgiou, S. 2003. Valuing nature: lessons learned and future research directions. Ecological Economics 46 (3); pp. 493-510.

UNEP 'United Nations Environment Programme'. 2006. Marine and coastal ecosystems and human wellbeing: A synthesis report based on the findings of the Millennium Ecosystem Assessment. UNEP, Nairobi, Kenya.

Van Goor, M.A., Zitman, T.J., Wang, Z.W., Stive, M.J.F., 2003. Impact of sea-level rise on the morphological equilibrium state of tidal inlets. Marine Geology 202, pp. 211-227.

Ward, F.A., Beal, D., 2000. Valuing nature with travel costs models, a manual. Edward Elgar, Cheltenham UK.

Waycott, M., et al. 2009. Accelerating loss of seagrasses across the globe threatens coastal ecosystems. Proceedings of the National Academy of Sciences USA 106; pp. 12377–12381.

Windle, J., Rolfe, J. 2013. Estimating nonmarket values of Brisbane (state capital) residents for state based beach recreation. Ocean & Coastal management 85 (A); pp. 103-111.

Wolff, W.J., Bakker, J.P., Laursen, K., Reise, K., 2010. The Wadden Sea Quality Status Report - Synthesis Report 2010. Wadden Sea Ecosystem No. 29. Common Wadden Sea Secretariat, Wilhelmshaven, Germany, pp. 25 - 74.

A Example choice card

This study used 20 versions of 6 different choice cards. Figure A1 shows an example. Originally the choice cards were set up in Dutch. We translated the choice card in German for the German respondents.

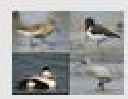
	Situation 1	Situation 2	Situation: Without measures
Pacific Oyster	**1 on 1000 injured** 	**1 on 100 injured** 	**1 on 100 injured** 
Trend: Number of seals	**Decrease** 	**Increase** 	**Decrease** 
Trend: Number of birds and bird species	**Small decrease** 	**Stable** 	**Strong decrease** 
Wind turbines	**None** 	**Far away** 	**Close by** 
Extra Tourist tax	**€ 8 per adult a day**	**€ 6 per adult a day**	**€ 0 per adult a day**

Figure A1: Example of a choice card (translated)

B Assumptions travel cost study

Travel cost estimations

The travel costs calculation is divided into two parts, the costs of a return trip from the respondent's home address to the port in Holwerd and the costs of the boat ticket. Since the island is relatively small and the study focus will be on the economic value of the whole Wadden Island, the travel costs to the interview location on the island are not measured. To obtain total travel costs, first the travel distance to Ameland needs to be estimated. For Dutch respondents this was done with ArcGIS. The central point in a zip code area is defined, after which the shortest route to the port of Holwerd is calculated. We measured the travel distance of the German respondents with the website routenet.nl, the option shortest route possible is chosen. Secondly, the fuel costs of the respondents need to be estimated. Assumptions were made about the fuel costs per 100 km, this is done with information about the fuel and car type of the respondents. Both factory information on fuel use per car category and average car fuel prices on May first are collected to calculate the travel costs per 100 km. One extra liter per 100 km is added to the fuel use to correct for the frequently lower gasoline use communicated by the car factory than the real use. For all respondents the average fuel price of Germany and the Netherlands is taken (table B1). The corresponding travel costs per 100 km times the distance of a return trip are the total travel costs of a respondent. When the respondent came by train the total travel costs are calculated at the Dutch railway website. Since the travel costs of other modes of transport are directly stated in the questionnaire, no special assumptions need to be made.

On-site time

The standard method incorporates on-site time in the travel cost demand function. However, this will result in dealing with the same problems as mentioned in the last paragraph. Consequently, Cesario and Knetsch (1970), Wilman (1980) and Bockstael *et al* (1987) exclude on-site time from their models. The difficulties with on-site time inclusion are due to the difference in perceptions of costs by consumers. Since people are even willing to travel to a site, the assumption can be made that time spent on the site gives people the same or a higher utility than the time costs (Ward & Beal, 2000). Hence, on-site time is not included in the total travel costs demand function of this study.

Multi-purpose trips and multi destination trips

Another difficulty in estimating travel costs are multi-purpose trips and multi destination trips. When a visit to a site is part of a longer holiday destination or the visit has another purpose, the travel costs cannot be in total allocated to a site. Therefore, theoretically a correction needs to be made for these visitors. Since there is no common approach to account for multi-purpose visits or multi destination visits, different authors proposed a range of methods. The most common approaches can be classified in two categories: The first is based on both Stoeckl (1993) and Hanley and Ruffel (1992). According to this approach costs should be allocated according to the time spent on a site as part of the whole trip or by using people's preferences. The second approach models multi-purpose visits and single purpose visits as different commodities. However, according to Kuosmanen *et al* (2004) and Beal (1995) the treatment of multi-purpose trips/multi destination trips as single trips may not cause a bias. Therefore, the third approach is treating multi-purpose trips/multi destination trips as single trips. This study chose to allocate travel costs of multi destination visits following the method of Stoeckl (1993). In this method the number of nights spent on the island in proportion of the total number of night spent on holiday is determining the allocated total travel costs.

Substitutes
In the real world, there is not just a single site to go on holiday, but there are several sites available. Therefore, the number of visits to a certain site will not only depend on its price but also on the price of substitute sites. Not only does the price matter, but as well the quality, available accommodation and recreational activities available. Omitting the price of a substitute site will bias the estimates. When the sign of the correlation between the travel cost and the substitute travel costs is positive, than omitting the substitute travel cost biases the own price elasticity to zero. When the correlation is negative the opposite will happen, the price elasticity of demand for visits is biased upward. In this study substituting sites are determined by asking the respondent's comparable holiday sites (Freeman, 2003).

Length of visit
The length of visit may have implication for both the costs of the trip and the utility derived from each trip. For example, the expectation is that people who travelled a long distance will stay longer. One solution can be treating the varying lengths of stay in groups to estimate separate demand curves in order to account for lengths in visit (Ward & Beal, 2000).

Table B1: The first table presents the price in euro of driving 100 km per car category in the Netherlands, the second table presents the price of driving 100 km per car category in both the Netherlands and Germany. The car categories are divided according to the inofficial car categories used by car rental companies. The car category A+B presents the smallest cars (Fiat Punto/Renault Twingo), the category C+D presents midsize cars (Ford Focus/Audi A4), category E+F presents the larger more luxury cars (Audi A6/Mercedez Benz E-category) and the last category the four wheel drives and sportmodels.

	Petrol	*Diesel*	*Gas*	*Unknown*
A+B	11,1	7,0	6,5	9,0
C+D	12,4	8,2	8,0	10,2
E+F	19,2	11,0	9,4	14,9
Other	20,3	12,1	12,6	16,0
Unknown	15,8	9,6	9,1	12,5

	Petrol	*Diesel*	*Gas*	*Unknown*
A+B	10,6	6,9	6,5	8,7
C+D	11,8	8,1	7,9	9,9
E+F	18,3	10,9	9,3	14,4
Other	19,4	12,0	12,4	15,5
Unknown	15,0	9,5	9,0	12,1

The additional boat costs are added to the travel costs. When the respondent brought a vehicle on the boat, these costs are added as well.

The type of accommodation the respondent spends the night and the cost of this accommodation is asked in the questionnaire. These results were used to estimate the accommodation costs per day. Finally these costs were added to the travel costs.

Since a family or household is sharing their income, the decision to visit Ameland will be in most cases made together. Consequently, the travel costs of an individual traveling with family are not directly comparable with somebody traveling with friends. Hence, the travel costs of a household are taken as the standard travel costs. In case of a different composition of the travel group, the travel costs are calculated in respect to the number of persons of the household that are visiting Ameland. The costs of children (under the age of 18) are divided between the adults in the household.

C Other results questionnaire

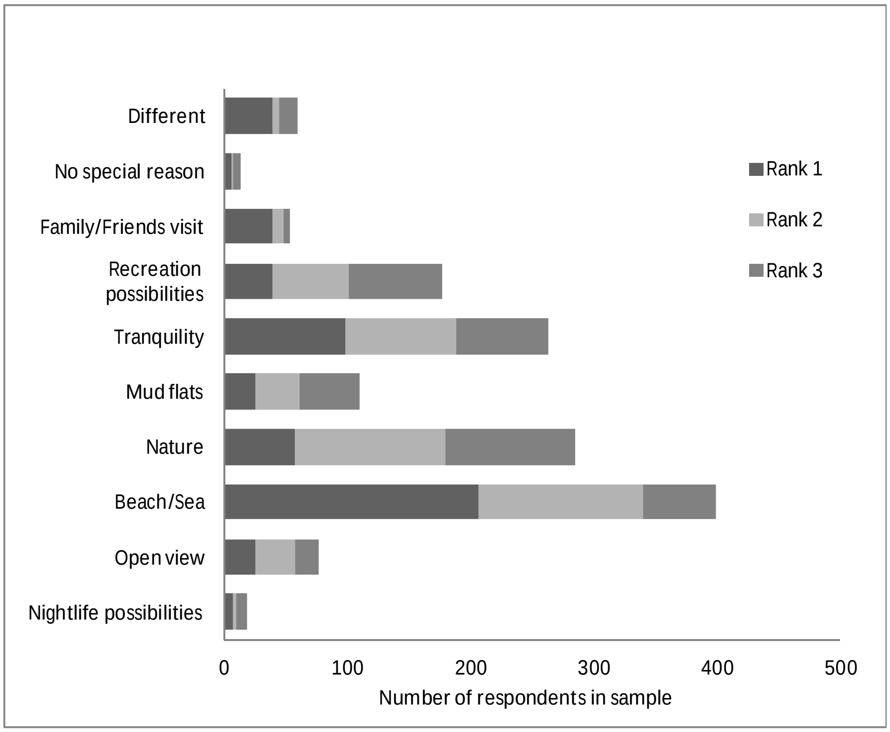


Figure C1: Reasons for visiting Ameland of the sample respondents. Rank 1 shows the most important reason to visit, rank 2 the second and rank 3 the third most important reason to visit the island. The chi-squared test did not show a significant difference between the German and Dutch sample (Pearson Chi-squared; 12,94, significance 0,187). The most frequently mentioned answers of the different category are: nice accommodation (n=4), free accommodation (n=3), child friendly location (n=4), and being on an island (n=5).

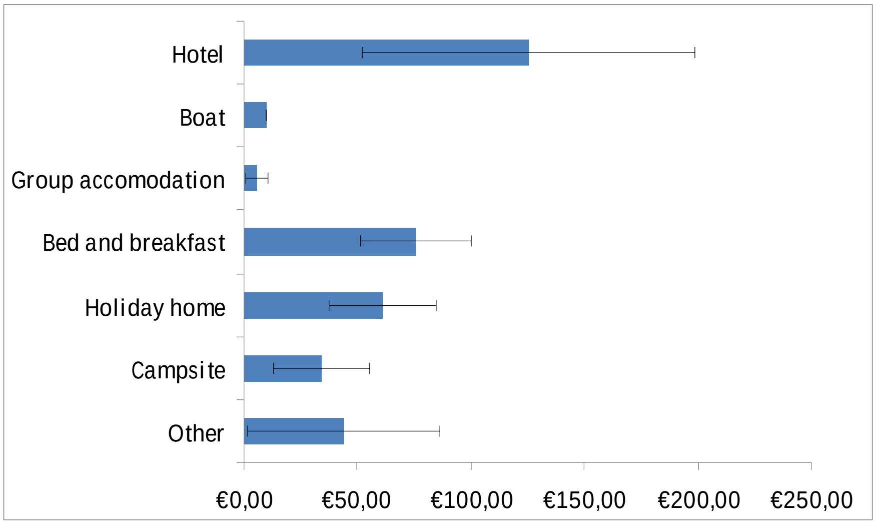


Figure C2: Average costs per day per household per accommodation type. Derived from the average price respondents paid per accomodation type. The error bars depict the standard deviation. There is no significant difference in accommodation type between Dutch and German respondents (Pearson chi-squared; 10,9, significance 0,092). In addition, there is no significant difference in costs per accomodation type in between Dutch and Germen respondents (T-test without equality of variances; t=-1,28, df=115, significance=0,204).

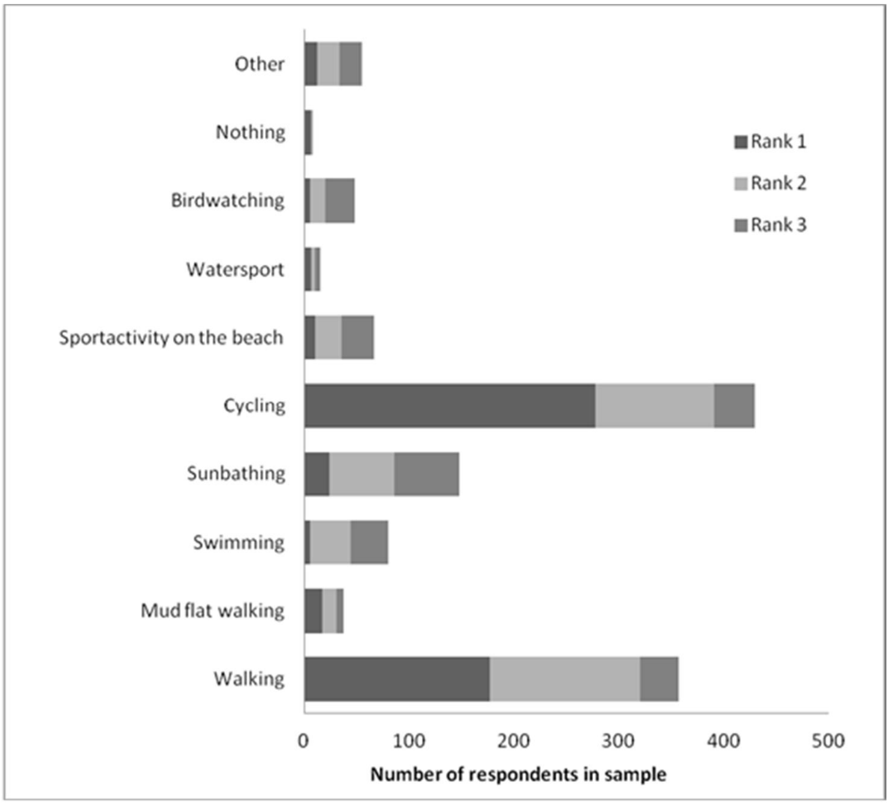
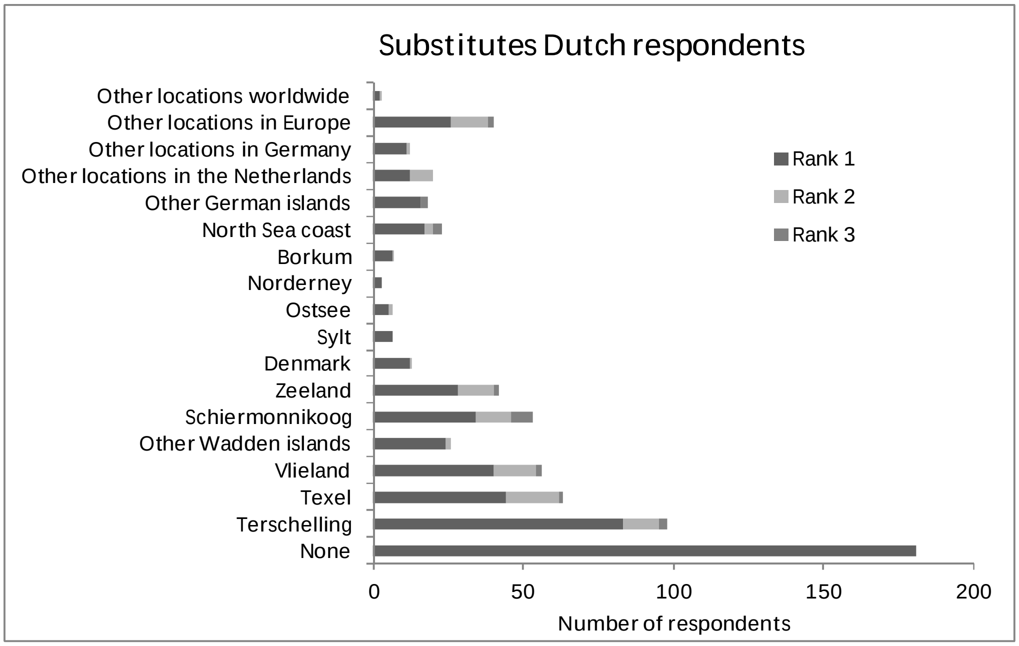


Figure C3: Most important recreational activity of the respondents. Rank 1 shows the most important recreational activity, rank 2 the second and rank 3 the third most important recreational activity. The chi-squared test showed a significant difference between German and Dutch respondents (Pearson chi-squared; 32,59, significance 0,00. Cramer's V; 0,244, significance 0,00).



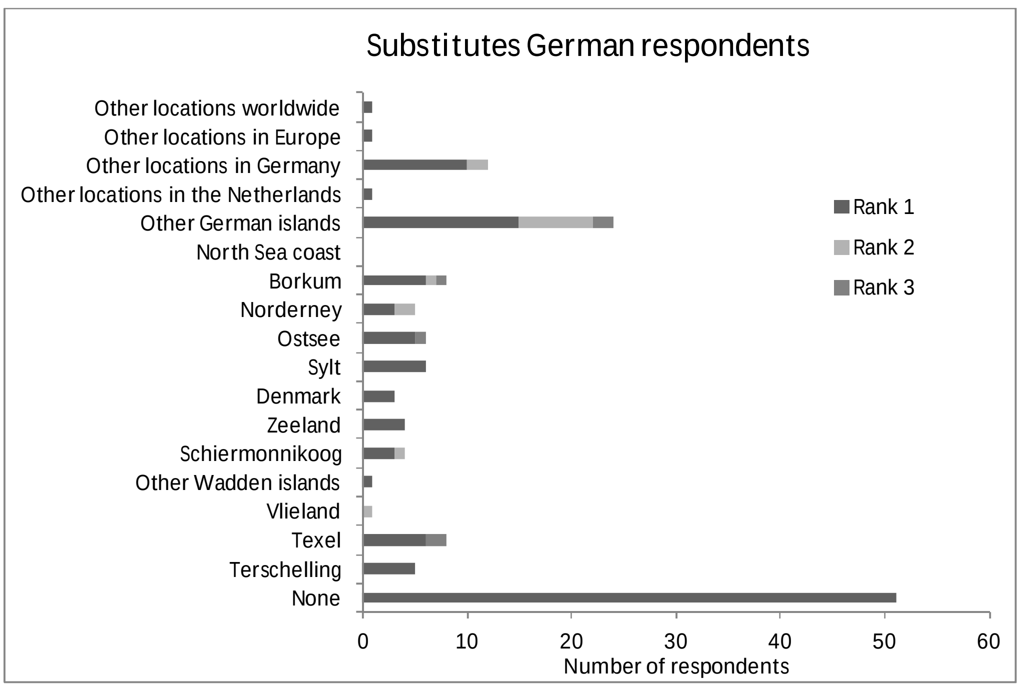


Figure C4: Substitutes of German and Dutch respondents. As expected substitutes differ between the two nationalities (Pearson chi-squared; 199,7, significance 0,00 and Cramer's V; 0,603, significance 0,00).