Valuing the Recreational Benefits of Bore and Hellestø Beaches

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Valuing the Recreational Benefits of Bore and Hellestø Beaches

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Preface

This paper constitutes 30 credits, and marks the end of our two-year education programme. It is a mandatory part of the MSc in Business Administration, which has been carried out at the University of Stavanger. This paper is written within the field of environmental valuation. The purpose of the research is to estimate the recreational value of two Norwegian beaches, and look at the effect of hypothetical scenarios in terms of a quality reduction.

It has been a very educational, exciting and demanding process. Fortunately, we have received good help and support along the way. First of all, a special thanks to Gorm Kipperberg for good guidance and support. His engagement, ideas and support has been of great value during the process. We are also truly grateful for Jæren Friluftsråd and the County Governor of Rogaland who provided us with useful information about the Jæren beaches. Lastly, thanks to Ana Faria Lopes for good input and help, and to those who participated in the focus group that was held.

Abstract

The main purpose of this study is to estimate the non-market value of Bore and Hellestø beaches in Norway, and the change in value under different hypothetical scenarios that might affect beach recreation. Information on the economic value of non-market goods, such as beaches, is necessary for optimal decision-making regarding coastal issues and policies that affect recreational value.

Combining an individual travel cost model with contingent behaviour questions, this paper estimates the individual demand for recreation for two Norwegian beaches. Using a panel data approach, which compares both fixed effects and random effects models, we estimate the consumer surplus for status quo and for hypothetical quality changes. The consumer surplus estimates illustrate how the value of the beaches are negatively affected in the case of an environmental deterioration such as an oil spill or an activity restriction in the sand dunes.

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1. Introduction

Valuing non-market goods such as beaches, is important for policymakers and analysts concerned with coastal issues that often need to evaluate policies, or make decisions about actions that affect beach recreation (Lew & Larson, 2015a). Bore and Hellestø beaches are part of Jæren beaches which represent a 7 miles long stretched beach area along the coastline of Jæren, in the south-west part of Norway. The beaches are well known landmarks and popular recreational areas for the local population.

Recreational facilities are only one of the several important services the environment provides us with (Perman et al., 2011). Recreation is an activity of leisure, and recreational activities are often done for the pleasure/amusement they provide. Outdoor recreation is open to the public and does not require an entrance fee or other costs for the right to use the recreation site. The benefits provided by the recreational activity is nevertheless important for society, and are therefore of interest to estimate quantitatively in monetary terms. The use of environmental valuation provides important information to help guide decision-making and facilitate efficient allocation of resources (Hanemann, 1994). The results found in this paper could be utilized in a cost-benefit analysis by policy analysts interested in knowing the value of recreation, and the economic impacts of changes in the quality of the recreation site.

In this paper, the travel cost method combined with contingent behaviour questions is applied in order to estimate the recreational value of Bore and Hellestø beaches. Among the large empirical literature studying the recreational value of beaches, this is one of the few that studies the effect of an environmental deterioration. In addition, this is one of the few studies conducted in Norway. The main research question of this paper is:

What is the value of beach recreation on the coast of south-west Norway?

In addition, we seek to answer the following questions:

1. *Do environmental accidents such as oil spills lead to a loss in recreational value?*
2. *Will activity restrictions in the sand dunes lead to a loss in consumer welfare?*

The first research question is based on a hypothetical scenario where an oil spill occurs. An oil spill would cause a degradation of the environmental quality, which is generally thought of as a public good. Oil spills do not only include economic market cost, but also lost non-use values and recreational values. Therefore, it is important to estimate the damage in terms of lost value that an oil spill would cause recreational users of Bore and Hellestø beaches.

Human activity influences the factors causing beach erosion, and excessive use of the beaches can lead to changes of sand dunes and vegetation loss (Dvorák & Novák, 1994). Natural sand dunes are important since they protect the shores and coastal developments against flooding of low-ground areas. If the government fears that an irreversible erosion (movement in the sand dunes) might occur, they could implement a new policy that would restrict movement in the sand dunes. It could therefore be of interest to estimate the lost recreational value associated with such a restriction, and include this as a cost when considering implementing the policy. This has been the focus of the second research question.

The rest of the paper proceeds as follows: Chapter 2 covers the background theory in terms of both the Jæren beaches and previous literature. Chapter 3 describes the methods of environmental valuation, while chapter 4 describes the modeling of recreation demand. Chapter 5 reviews the survey design, questionnaire, as well as data collection and data processing. Chapter 6 presents descriptive statistics of the respondents, while chapter 7, 8 and 9 covers the econometric models, model application and regression results, respectively. Lastly, a brief discussion is included as chapter 10, followed by a conclusion given in chapter 11.

2. Background Theory

2.1 The Jæren Beaches

The Jæren beaches represent a 7 miles long stretched beach area along the coastline of Jæren, in the southwestern part of Norway. Approximately 25 kilometers contains sandy beaches and dunes, while the remainder includes coarse pebble beaches and rocky coastline. The beaches are well known landmarks, and the coastline is among the most popular recreation areas of the Stavanger Region. The characteristics of these beaches are large sand dunes with a particular and extraordinary flora and fauna, in addition to their long sand beaches and clear water (Rakke, 2017). They provide a unique cultural landscape in both national and international contexts (Fylkesmannen i Rogaland, 2010, del 1).

The coastal sand dunes are probably the most known characteristic of the beaches at Jæren. Beaches with particular nice areas with dunes include Ogna, Orre, Bore, Hellestø and parts of Sola. These types of landscape are extremely dynamic and affected by sea, wind and vegetation (Fylkesmannen i Rogaland, 2010, del 1). This research project studies the value of Bore and Hellestø beaches. Because of their beautiful landscape and delicate sand dunes, these were appropriate choices given the hypothetical scenarios and the estimated effect on recreation value if certain circumstances would damage the landscape or threaten the use of the sand dunes.

The coast of Jæren offers many opportunities for a varied and rich outdoor life. The beaches are visited by people from home and abroad in the interest of outdoor recreation. Surveys show that outdoor recreation on the coast are very popular among inhabitants of the Nordic countries (Skauge, 2001, p. 37). A focus group was held prior to the data collection to reveal the most common forms of outdoor activities at the Jæren beaches. The most common are walking, swimming and sunbathing, and the play of various ball games. In addition, there are many people who use the beach for horse riding. More equipment-intensive recreational activities are also becoming more prevalent, such as windsurfing, surfing, volleyball, play with radio-controlled aircraft and boating. Organized camp activity and various private outdoor events increase the pressure on these beach areas (Skauge, 2001, p. 192). Recently, there was a European championship in surfing at the Jæren beaches. Around 8000 spectators were present in the sand dunes to watch the surfers compete in Eurosurf, which took place in October 2017. This championship is an example of an event that led to the destruction of sand dunes and vegetation in the vulnerable landscape. It was not done a good enough job to keep people away from the most vulnerable parts of the beach (Klippenberg, 2017).

2.1.1 Protected Landscape Area

Parts of the Jæren beaches are protected landscape areas. The protected area is about 7 miles long, and stretches from Tungevågen in Randaberg in the north to Sirevåg in Hå in the south. Some areas in between this stretch are non-protected areas. The beaches were first protected on September 2, 1977. New revised protection came on December 12, 2003. The protected landscape area includes features of significant geological, botanical, zoological and cultural heritage value. The purpose of the protection is to preserve this unique nature and cultural landscape of the beaches.

The beaches at the coastline of Jæren are some of the most visited nature conservation areas in Norway. This outdoor life has significant value for well-being, physical and mental health among the population. Thus, the public right of access gives people the right to use the beaches for recreational purposes. However, the public right of access shall evaluate consequences for vulnerable natural and cultural values, and agriculture. Some areas of the beaches are protected and there is, among others, a ban on picking flowers. Where the vegetation is vulnerable, regulations on protected areas are useful for preserving the nature (Fylkesmannen i Rogaland, 2010, del 1).

2.1.2 Beach Erosion

The Jæren beaches is an attractive recreation site. Frequent visits and recreational activities could lead to severe damages. The use of the beaches is therefore a major concern for agriculture and environmental organizations. A day at the beach does not involve any actual consumption of the resource. However, excessive use of a beach area can induce changes in its character, as with the erosion of sand dunes following vegetation loss caused by human activity (Perman et al., 2011). The plant cover is trampled down, which makes the terrain more exposed to wind and water erosion. The vegetation cover is important to prevent the sand to move inwards. As a result of the cover to disappear, the width of the dune landscape increases and it prevents new vegetation from establishing itself (Skauge, 2001, p. 191).

This study estimates the effect of a protection program to prevent beach erosion. By imposing respondents to a hypothetical scenario of activity restriction in the sand dunes, it is possible to estimate costs to current uses of such protection measure.

2.1.3 Oil Spills

Oil production and shipping are important sources of oil pollution at the coast. The environment is constantly exposed to oil leaks, and there is always the risk of greater unexpected oil spills. Acute oil pollution that are related to unpredictable accidents and emissions are the biggest threats for outdoor recreations. Oil spills on beaches can cause long term problems. Getting rid of oil spill in the beach area is a lot more complicated than cleaning it up in open water (Skauge, 2001, p. 175). In addition to the economic costs such as the cost of clean-up, an oil spill is likely to lead to lost passive use values and recreational values.

Oil spills can have catastrophic environmental, economic, and social consequences for society. An approximate measure of the lost values associated with an oil spill is important for decisions regarding environmental policy, as well as the appropriate compensation for damages on natural resources. To evaluate the economic harm caused by oil spills, appropriate methods are required for governmental agencies who carry out damage assessments due to such accidents. The valuation of damages can be in monetary terms or in non-monetary terms, depending on what the guiding legislation asks for (Parsons, 2008). In this paper, a hypothetical oil spill scenario is studied in order to address the possible negative effect an oil spill can have on the recreation value of the beaches, and the corresponding negative effect that may arise on the consumer welfare.

2.2 Literature Review

There is a large empirical literature studying the recreational value of beaches. A full representation is provided in table 9, appendix 1. Different studies consider different aspects of the overall topic, using various methods. Prayaga (2016) estimates the recreational use value of beaches particularly for the locals in the Capricorn Coast region of the Great Barrier Reef in Queensland. Typically, the locals have different visitation rates and patterns than tourists and those living further away, in addition to low or no travel costs. Bell & Leeworthy (1990), on the other hand, focus their attention on tourists that come from significant distances who must incur substantial travel costs before recreating. Landry, Keeler & Kriesel (2003) research the relative economic efficiency of three distinct beach erosion management policies for Tybee Island beaches. Blackwell (2007) measures the recreation value of a beach visit and compares it to other outdoor recreation sites, like national parks and forests. Interestingly, he finds that beaches appear to have higher passive-use values than national parks or forests. In this paper, the focus is on two hypothetical scenarios, where one is hypothetical activity restrictions in the sand dunes, while the other is a hypothetical oil spill. These scenarios are studied in order to see if they have an effect on the recreational value and the consumer welfare.

Previous literature on non-market valuation includes more than just beach recreation studies. National parks, lakes and rivers are some other popular recreation sites valued (Adamowicz, Louviere & Williams, 1994; Amoako-Tuffour & Martínez-Espiñeira, 2012; Beal, 1995; Cameron et al., 1996; Eiswerth et al., 2000; Fleischer & Tsur, 2003; Fleming & Cook, 2008; Martínez-Espiñeira & Amoako-Tuffour, 2008; Richardson & Loomis, 2004; Vesterinen et al., 2010). These studies are relevant for this research, in addition to the beach recreation studies, as they use the same methodologies and models.

Table 9 in appendix 1 summarizes 57 studies reviewed in this paper. The table consists of seven columns. The first column provides the author, year and journal. The second column tells the location of the study, while the third describes the purpose of the paper. Further, the fourth and fifth column provide the methods used. The sixth column includes information about the type of survey conducted, and the last column shows the result of the study.

The previous studies take place in 17 different countries around the world, where the U.S. is the dominating country with a total of 26 studies. The U.S. is followed by Australia with a total of only seven studies. Based on continents, 32 studies are located in America. Europe is the second most common location with ten studies, followed by Oceania, Asia and Africa with seven, four and three studies, respectively. When it comes to type of survey, the most used among the literature is on-site survey. On-site survey is the basis for this study. 22 of the studies collect data on-site alone, while 3 studies combine on-site sampling with a telephone survey (Silberman, Gerlowski & Williams, 1992; Whitehead et al., 2008; Whitehead et al., 2011). In addition, one study uses an on-site survey with a follow-up postcard (Landry, Keeler & Kriesel, 2003). Mail-survey and telephone-survey are the second and third most commonly used surveys, with 8 and 7 studies, respectively. The remaining types of surveys summarized in the table consists of, among others, web-surveys, postcards and combinations of different survey types.

There are several approaches to use when valuing non-market goods. These can be divided into Revealed Preference (RP) methods and Stated Preference (SP) methods. In the literature reviewed, 27 of the studies use the RP method represented by different approaches of the Travel Cost Method (TCM). 5 studies use the SP method represented by the Contingent Valuation Method (CVM), and 19 studies are a combination of the two methods. Also, one of the valuation studies reports both RP and SP results without combining the models (Andersson, 2006). The TCM is, as shown, a frequently used method when valuing beach recreation. Ballance, Ryan & Turpie (2000) argue that they prefer to use this method over other techniques because it uses actual values, it is restricted to direct, non-consumptive use valuation, and it is easy to administer. In their paper, they investigate the role of litter on beach users in the Cape Peninsula in South Africa. The TCM is typically used to estimate the recreational value of sample beaches. However, this method says nothing about the value of individual beach attributes such as cleanliness, unless it is a discrete choice TCM. To determine the relative importance of selected attributes, they asked visitors to rank them. They also use an interview survey including questions like how far residents would be prepared to travel for different levels of cleanliness. This helps to determine the importance of beach cleanliness to beach users.

Based on the previous research, there is an increasing interest of combining the TCM with contingent behaviour (CB) data (Alberini, Zanetta & Rosato, 2007; Anderson & Plummer, 2017; Cameron et al. 1996; Eiswerth et al., 2000; Englin & Cameron, 1996; Huang, 2017; Hynes & Greene, 2013; Kragt, Roebelling & Ruijs, 2009; Landry & Liu, 2009; Parsons et al., 2013; Poor & Breece, 2006; Rolfe & Gregg, 2012; Rosenberger & Loomis, 1999; Whitehead et al., 2008). Including CB data in count data models makes it possible to estimate values for hypothetical changes in the conditions that affect recreational activities. Most of these studies measure improvements and changes in the environment in general, while only a few focuses on environmental deterioration alone (Anderson & Plummer, 2017; Eiswerth et al., 2000; Rolfe & Gregg, 2012). In this study, extending the individual TCM with CB data can help estimate the change in the recreational value due to environmental deteriorations like an oil spill and beach erosion.

The fifth column in the summary table shows that there are several different econometric methods used in previous literature. The two most popular econometric models, which are also applied in this study, are the Poisson model and the negative binomial model. 15 studies use the Poisson, while 14 use the negative binomial. Seven of the studies reviewed use ordinary least squares regression in their analysis (Andersson, 2016; Beal, 1995; Bell & Leeworthy, 1990; Blackwell, 2007; Chen, 2004; Fleming & Cook, 2008; Richardson & Loomis, 2004). Other different logistic and probit regression models are also frequently used in the literature. Multinomial logit, mixed logit, conditional logit, nested logit, and probit model with panel data, to mention some.

The studies results are summarized in the last column in the summary table. The literature reviewed consists of many different types of studies This causes the results to vary, both in shape and currencies. The majority reports the results using consumer surplus (CS) as welfare measure. The studies vary between calculating CS per trip per person, CS per day, CS per month, and aggregated CS. Willingness to pay (WTP) is another popular welfare measure used, with a total of six studies reporting this value (Anderson & Plummer, 2017; Biervliet, Roy & Nunes, 2006; Carson et al., 2003; Landry, Keeler & Kriesel, 2003; Loureiro & Loomis, 2013; Whitehead et al., 2011). Compensating variation and equivalent variation are measures found among the results as well, but in a less extent. Some of the previous studies measure the changes in the welfare as a result of, for example, changes in the quality of various factors. Whitehead et al. (2008) gives an estimate of a CS of $90 under status quo, and an increase in CS due to parking improvements and beach width improvements of $25 and $7, respectively. Parsons et al. (2013) reports a loss for narrowing beaches to a quarter current width of about $5, and a gain from widening to twice current width of about $2.75.

The study by Parsons & Massey (2003) is noteworthy in that it was the first to apply RUM to value beach erosion losses, in addition to consider two scenarios close to those studied in this paper. They estimate recreation losses associated with some hypothetical erosion scenarios, as well as hypothetical beach closures as a result of oil spill. They found a mean loss of $5.27 as a result of beach closure due to an oil spill, while a significantly smaller loss was found as a result of the scenario involving beach erosion. The biggest loss was at the Northern beaches with a loss of $1.46. Other research addressing beach erosion are those considering beach erosion control programs (Huang, Poor & Zhao, 2007; Landry Keeler & Kriesel, 2003) and the ones especially focusing on changes in beach width to provide shore protection and recreation benefit (Landry & Liu, 2009; Parsons et al., 2013; Whitehead et al., 2008).

When it comes to the sample of previous literature with an oil spill focus, the majority are ex post studies (Bell, 2002; Carson et al., 2003; Hausman, Leonard & McFadden, 1995; Loureiro & Loomis, 2013), while there are three ex ante studies (Biervliet, Roy & Nunes, 2006; Parsons, 2008; Parsons & Massey, 2003). Biervliet, Roy & Nunes (2006) estimates the loss of non-use values resulting from different oil spill scenarios along the Belgian coast. Parsons (2008) focus on hypothetical closure of six beaches due to oil spills. Deacon & Kolstad (2000), on the other hand, stands out by reviewing methods that can be used to estimate the loss in use value associated with saltwater beach recreation in the case of an environmental accident, such as oil spills.

As seen from the literature reviewed, there are a number of possible directions to go when valuing beach recreation. In this paper, different scenarios are studied to see how these may affect the recreational value and estimated consumer welfare. In resemblance to many of the recent studies reviewed in this summary, this research combines the traditional TCM with CB questions to find the value of two local beaches. What separates this study from the ones reviewed is that it estimates the effect of an hypothetical environmental deterioration, unlike most studies looking at an environmental improvement. Of the studies included in the literature review, this paper is the only paper to consider recreation sites located in Norway. It might be interesting to see if Norwegians value recreation sites similar to other nationalities. For the estimation, the panel data models random- and fixed effect Poisson will be used, unlike the basic Poisson regression performed by many of the previous studies.

3. Valuing the Environment

The role of economics in the field of natural and environmental resources has had an increasing importance in the past few decades (Gunatilake, 2003). A substantial part of environmental economics is concerned with how economies might avoid inefficiencies in the allocation and use of natural and environmental resources. Monetary valuation of environmental goods allows for better decisions in terms of policy-making and allocation of scarce resources. Environmental valuation is commonly used to incorporate the value of non-market goods into cost-benefit analysis for policy recommendations.

3.1 Environmental Values

In the field of economics the term value represents the change in wellbeing or utility. A person's wellbeing is a blend of different values. It is therefore common to use the term total economic value to account for the different types of value that the natural resources and environment provides us with (Pendleton, 2009). Total economic value is a broader concept of value, which incorporates values derived from other sources than through direct consumption. Total economic value is commonly divided into use values and non-use values.

Although there is no uniform way of classifying economic values, Perman et. al. (2011) divide the use values into two categories; consumptive use and non-consumptive uses. Consumptive use values involve direct consumption of the natural resource, for example such as when natural resources are used as inputs in production of food. The consumptive use values are values associated with using up the natural resource, and damaging the environmental good in the process. Non-consumptive goods on the other hand, are when individuals derive value from the environment without necessarily damaging or draining the resource. Non-consumptive uses include values from direct uses such as recreational activities, or indirect use values such as watching a documentary about the resource. Gunatilake (2003) also includes option values as a non-consumptive use value, which is the value individuals receive from having the option to use the resources at any given time.

Non-use values refer to the value consumers derive from environmental goods and resources they may never use. Such values are existence values and bequest values. Existence value refers to the value individuals receive simply from the continued existence of the resource. Bequest value is the value of leaving use and non-use values for future generations.

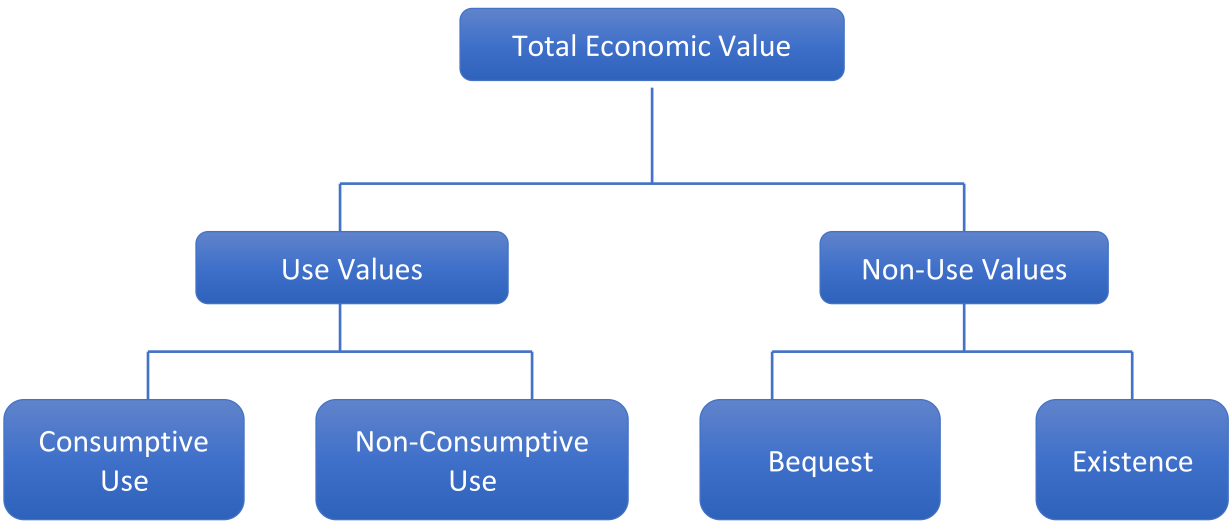

Figure 1: Total economic value

3.2 Overview of Valuation Methods

Through different techniques of environmental valuation economists attach economic values to the un-priced services and goods that the natural environment provides. There are different methods of environmental valuation depending on which values one seeks to measure. A common distinguish is made between environmental valuation based on observable behaviour and hypothetical behaviour. These methods are known as revealed preference methods and stated preference methods, respectively (Freeman et al., 2014).

3.2.1 Revealed Preference Methods

RP methods are based on actual behaviour and use observable data to measure use-values. RP methods take advantage of the relationship between a private good and the environmental good in question (Nyborg, 1996). The value of the environmental good is deduced from the consumption of private goods and/or services that is connected to the use of the environmental good being valued. The most common methods of RP are the travel cost method and hedonic pricing (Freeman et al., 2014).

Hedonic pricing utilize peoples' preferences to estimate the environmental component of goods and services. Such models use multiple regression analysis to estimate the implicit prices associated with goods and services that are seemingly the same, yet not perfectly homogenous (Bishop & Timmins, 2011). Hedonic models measure individuals' marginal WTP for small changes in an attribute. Thus, it is possible to estimate environmental values based on the effect the change has on market prices.

The *Travel cost method* estimates the recreational value of a site by using the travel costs as a measure of the price of a site visit. A crucial assumption is that individuals will react to changes in the travel costs in the same way they would react to changes in an admissions fee (Martinez-Espineira & Amoako-Tuffour, 2008). By linking visitation rates and travel cost it is possible to estimate individual demand for recreation.

3.2.2 Stated Preference Methods

SP methods use individuals' responses to hypothetical questions to measure value (Freeman et al., 2014). These methods do not require observable data, and therefore have the advantage of being applicable to measure both use values and non-use values. SP methods are all methods of valuation that is based on survey-instruments, where respondents are asked questions that reveal information about their preferences or values. Although there are several different methods within the category of SP models, they are commonly grouped into choice experiments, contingent behaviour methods and contingent valuation (Freeman et al., 2014; Tietenberg, 2006).

Contingent behaviour is a method that combines data on both actual and intended behaviour (Huang, 2017). Whereas contingent valuation is based on hypothetical WTP, contingent behaviour is based on hypothetical behaviour. Individuals are asked how their visitation rate to the site in question will change in the case of a change in an environmental amenity at the site (Freeman et al., 2014). Such questions enable construction of a measure for environmental quality changes that may or may not occur. For this study a RP method combined with CB questions is employed. This way, it is possible to estimate the effect on recreation demand in the case of an environmental degradation such as an oil spill, or the lost use values occurring in the case of an activity restriction in the sand dunes.

3.2.3 Combining Revealed and Stated Preference Methods

The combination of RP and SP methods has gained increasingly attention in the field of environmental valuation. Several publications have been made where SP and RP methods have been combined, with the prevalent methods being an ITCM combined with CB questions or a RUM combining SP and RP data (Beaumais & Appéré, 2010; Kragt et al., 2009; Hanley et al., 2003; Parsons et al., 2013). Previous literature suggests that combining revealed- and stated preference models may improve the quality of estimates (Adamowicz et al., 1994). Both methods have their own strengths and weaknesses. By combining data from both methods in a pooled demand model it is possible to take advantage of both methods' advantages, and avoid the common biases and sources of error associated with one or the other.

One of the major drawbacks with RP methods is that they can only be used to measure use-values. Non-use values cannot be inferred from observed behaviour, and thus, requires data of a more hypothetical nature to be estimated. By combining data from SP and RP methods it is possible to estimate use-values based on actual data, and at the same time infer estimates of non-use values by including SP data.

Another common problem with RP methods is that they may suffer from multi-collinearity (Freeman et al., 2014). In environmental valuation, there may be many factors influencing the value estimate. The problem with multi-collinearity makes it difficult to correctly estimate the effect of one singular variable on the value of the environmental good. Adamowicz et al. (1994) combined SP and RP data to reap the benefits of joint estimation, by carefully designing and including SP questions to reduce the presence of multi-collinearity among the dependent and independent variables. This way, they could study the effect of environmental attributes that were previously weakly identified due to presence of multi-collinearity.

SP methods use hypothetical scenarios and questions to estimate how much consumers would be willing to pay or accept in compensation for a change in the environmental good being valued (Adamowicz et al., 1994). The hypothetical nature of the SP methods is grounds for criticism due to the many possible biases and sources of error (Nyborg, 1996). This issue would be reduced when combining SP and RP methods. By including RP data the validity and precision of estimates is improved because it is possible to control for more variables, and the measurement technique is improved.

Environmental valuation is commonly used to estimate welfare changes from a change in environmental quality. RP methods are limited in their ability to measure quality changes. Whitehead et al. (2000) and Huang (2017) both used a RP method in combination with SP data to value quality changes at a single site. The inclusion of respondents' answers to hypothetical questions allowed for estimation of quality changes. They also found that combining SP and RP data improved the efficiency of their estimate as it detected changes in demand that would occur in the presence of a quality change at the site.

By combining the TCM with CB questions it is possible to estimate the effect of a hypothetical scenario such as activity restrictions in the sand dunes or an oil spill. A questionnaire for the TCM gathers information on trips and costs under status quo. For this research, SP questions for current environmental quality and for a hypothetical change in quality are included. This provides information on the expected loss of an environmental degradation.

4. Valuing Recreation

In economics a consumer's welfare is given by his or her utility function. In accordance with the basic consumer choice model, consumers seek to maximize utility in terms of the goods they consume, subject to a budget constraint (Snyder & Nicholsen, 2012). For simplicity, it is often assumed that utility comes from consumption of market goods and services. However, consumers may also derive value from non-market goods such as natural resources and the environment.

The natural environment is an important source of recreational and amenity services. The purpose of this study is to find an estimate of the benefits consumers derive from Bore and Hellestø beaches, which are two beaches commonly used for recreational activities. These two beaches are common resources, and therefore accessible for all who wishes to use them. Recreational resources such as beaches are used, but not traded in a market, and will therefore lack a market price (Perman et al., 2011). The use of environmental valuation techniques does however allow us to place a monetary value on these non-market goods.

4.1 Recreation Demand

Recreation demand is an estimate of consumers' participation in recreational activities at a specific time and place (Haas et al., 2007). In this study the TCM is applied to estimate individual demand for recreational activities at Bore and Hellestø beaches. By using visitors' travel cost to the recreation site, the demand curve can be estimated as the relationship between their incurred travel costs and visitation rates. In turn, this forms the basis for calculating the CS for the recreation site.

The TCM for recreation demand is derived from consumers' utility function, where they choose the number of visits to maximize their utility. The consumer's utility is determined by the number of visits (r), a consumption bundle (x), and the quality of the recreation site (q) (Perman et al., 2011). The consumer seeks to maximize his or her utility, as described by the utility function in equation (1):

(1) $$U = U(x, r, q).$$

In this utility maximization problem the consumer faces budget constraints both in terms of time and money. The consumer can only afford a certain amount of goods, given his or her income. This constraint is given by equation (2):

(2) $$m + wt_w = x + cr,$$

where m is non-labour income, w is the hourly wage, t_w is hours of work, x is a bundle of consumption goods/services, c is the trip cost and r is the number of visits the consumer takes. The sum of non-labour income and labour income must be equal to the consumer's consumption of goods and services (x), and the product of number of visits (r) and the monetary cost (c) associated with them. The time constraint on the other hand is given by equation (3), which represents a trade-off between hours of work and time available for recreational activities.

(3) $$t = t_w + (t_1 + t_2)r,$$

where t is time available for the consumer, t_1 is the total travel time for undertaking the visit to the recreation site, and t_2 represents the time spent at the recreation site (Freeman et al., 2014). Equation (4) is the result of substituting the time constraint in (3) into the money constraint in (2).

(4) $$m + wt = x + [c + w(t_1 + t_2)]r,$$

which is the sum of the time constraint and budget constraint. The term within the brackets represents the price of each recreational visit, which can be rewritten as:

(5) $$p = c + w(t_1 + t_2),$$

which simplifies equation (4) to:

(6) $$m + wt = x + pr.$$

By maximizing the utility function in equation (1) subject to the money and time constraint in (6), the first-order condition for optimality is obtained. The consumer chooses number of visits such that utility is maximized, given his or her budget constraint. This occurs when the value of the last trip is equal to its price. Under the assumption that each individual faces differing travel costs, the demand for recreation can be estimated. The demand curve for the recreation site is then given by the Marshallian demand function (Whitehead et al., 2000):

(7) $$r = r(m, w, p, q),$$

where the visitation rate (r) is a function of non-labour income (m), wage (w), the price (p) of a visit, including both travel cost and opportunity cost of time, and the quality of the site (q).

The demand function can also be extended to account for the presence of substitutes, as well as consumer preferences as represented by their demographics (Smith & Kaoru, 1990).

(8) $$r = r(m, w, p, p_s, d, q).$$

Here p_s is the price of the substitute site, and d is the demographic characteristics of the individual. An important objective of modelling recreation demand is to value a given recreation site. The demand curve is used to estimate the CS provided by that site (Refsdal & Lohaugen, 2016).

4.2 Welfare Measures

In welfare economics, welfare is some aggregation of individuals' utilities. The theory is based on the assumption that individuals have well-defined preferences for both market and non-market goods, and that these goods can be substituted without reducing the consumers' utility (Freeman et al., 2014). The property of substitutability implies that value can be measured in terms of how much money the individual is willing to substitute for a good. Such measures are usually expressed as willingness to pay, or willingness to accept compensation.

In economic theory we assume that an individual's willingness to pay for a good is an adequate measure of the value that good provides the consumer. The social welfare benefits associated with recreation sites can therefore be defined as the sum of consumers' WTP for the recreational activity, net actual expenditures. In the TCM, estimates of consumers' WTP are derived from the number of trips taken, and the travel costs associated with a visit.

The value provided by the recreation site, as measured by the consumer surplus, is defined as the area under the estimated demand curve and above the current price. By taking the integral of the demand function from the average travel cost to the choke price, the expected consumer surplus for a given individual can be calculated as:

(9) $$CS_i = \int_{p_0}^{p^c} r_i(\cdot)\, dp_i,$$

where the choke price (p^c) is the price that would result in zero visits to the recreation site and p_0 is the individual price. R_i is the expected visitation rate for consumer i, and is a function of travel cost for individual i, as well as his or her individual characteristics.

The CS can be used to measure changes in welfare for a change in the quality of the good. A change in the quality of the environmental good being valued will affect the consumers' wellbeing. If the quality of the site is reduced from q_0 to q_1, the demand curve will shift inwards due to lower demand. The difference between the original demand curve (d_0) and the demand curve after the environmental deterioration (d_1) is a precise measure of the change in consumer welfare from a change in environmental quality (Huang, 2017). The relationship between visitation rate (r), and the quality of the site is depicted in figure 2. When quality declines, such as in the case of an oil spill, the number of trips is reduced from r_0 to r_1. The decreased visitation rate causes an inward shift in the demand curve from d_0 to d_1.

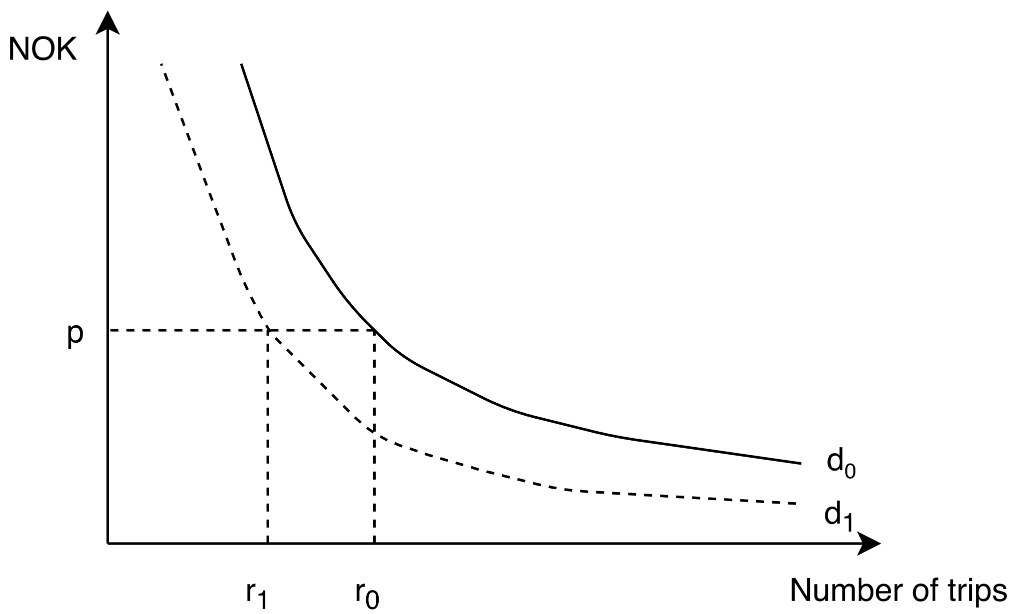

Figure 2: Trip demand at current and reduced quality.

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The change in CS from the environmental deterioration is calculated by subtracting the original CS from the CS under the new environmental quality (q_1).

(10) $$\Delta \boldsymbol{CS} = \int_{p_0}^{p^c} r_i(\,\cdot\,, q_0) dp_i - \int_{p_0}^{p^c} r_i(\,\cdot\,, q_1)\, dp_i.$$

4.3 The Travel Cost Method

Many natural resources are used for recreational activities, and are usually not allocated through a marketplace (Freeman et al., 2014). However, consumers who visit recreational sites such as beaches and parks incur both an explicit cost (transportation costs) and an implicit opportunity cost of time, when undertaking the visit. Consumers are faced with differing travel length and thereby differing travel costs. This in turn, causes varying visitation rates assuming law of demand holds (Perman et al., 2011). The variation in travel costs and number of visits to the recreation site can be used to build a demand curve based on how visitors react to changes in travel costs (Voltaire et al., 2017). Based on the demand for recreation it is possible to find the benefits of the site in economic terms by estimating a consumer surplus for the site in question.

The TCM is often used to assess the value of public areas such as beaches, parks and lakes that are commonly used for recreational purposes. Due to its usefulness and effectiveness the TCM has become a popular method to value recreational benefits, and can be traced all the way back to 1949 (Perman et al., 2011). The first publication using the TCM was in the 60's and the methodology has since then been broadly used and refined (Clawson & Knetsch, 1966). The TCM is an indirect, observable method to value recreational benefits from the environment (Tietenberg, 2006). It is observable because it involves data on actual behaviour, and indirect because it infers the value of a recreational resource by using information on travel cost to estimate individual demand.

Within the travel cost literature it is useful to separate those models that estimate demand for a single site, and those that estimate demand for multiple sites (Parsons, 2003). Single site models are useful for estimating the current value of a site, and include the zonal travel cost model (ZTCM) and the individual travel cost model (ITCM). Multi-site models are generally preferred when valuing changes in one or multiple sites, or the current value of several sites simultaneously. By combining travel cost data from different sites with different levels of quality it is possible to use multi-site models to estimate the value of changes in site quality (Perman et al., 2011). The multi-site models include ZTCM, ITCM and random utility models (RUM).

The ZTCM starts with a definition of different zones in proximity to the site being valued, and data on the number of visits from each zone. By calculating visitor rates, travel distance, travel time and travel costs, it is possible to estimate the relationship between visitation rates and total travel costs (Brainard et al., 1997). From the estimated relationship on visits and costs one can predict visitation rates with different hypothetical entrance fees for the average visitor. The total number of visitors is then calculated across all zones. The demand curve is calculated based on visitation rates given various hypothetical admission fees, and facilitates the calculation of a benefit estimate (Perman er al., 2011).

The ITCM is based on individual data on number of visits to the site being valued. Data is collected by either off-site or on-site surveys to find the number of visits, within a given time frame (Perman et al., 2011). The dependent variable is number of visits. Thus, the dependent variable is a non-negative integer for off-site surveys, and a strictly positive integer for on-site surveys (Shrestha et al., 2002). It is therefore appropriate to use count data models for analyzing demand, and estimating a consumer surplus (Simões et al., 2013).

RUM is harder to execute than the previously described models, but has the benefit of being able to measure the value of changes in quality and site characteristics (Perman et al. 2011). The RUM is a discrete-choice model, and assumes that individuals will choose the site that maximizes utility. A conditional logit framework allows researchers to predict both the choice to undertake the recreation activity or not, and what factors determine the choice of site.

4.4 Common Biases and Shortcomings with the TCM

The TCM makes several assumptions when modelling recreation demand, which might influence or bias the estimated value of a recreation site. Some common shortcomings with the TCM is how to treat the cost of time, multiple purpose trips, the role of substitute sites and omitted variable bias.

4.4.1 The Cost of Time

In the TCM the value of time is an important factor in determining the value of a recreation site. Time spent traveling to and from the recreation site is time that could have been spent otherwise, the opportunity cost of travel, and thus represent a real cost for the individual (Lew

& Larson, 2005b). Failure to accurately account for time costs in economic models of recreation demand has been shown to lead to biased benefit estimates (Cesario & Knetsch, 1970; Bishop & Heberlein, 1979).

The majority of previous research assumes that time can be valued at the wage rate, or some fraction of the wage rate (Lew & Larson, 2005b). Although such an informal rule for the treatment of time cost would simplify the estimation procedure, it could lead to biased estimates. Valuing the opportunity cost of time at the wage rate, or a fraction of the wage assumes that individuals trade leisure time for work, and that time spent at work is neither liked nor disliked. Another problem with this method is how to deal with those out of the workforce or students, which may not have an observable wage rate (Feather & Shaw, 1999).

Despite the stringent assumptions required for a time valuation based on the wage, it is still the preferred method of choice (Smith & Kaoru, 1990). Since the majority of the population work a fixed number of hours, assuming that leisure time is freely substitutable for work hours would clearly overestimate the opportunity cost of time. Therefore it is common to use a fraction of the wage rate as a measure of time cost. The common measure of time cost is a fraction k, which takes a value between one-fourth and one half the wage rate as suggested by Cesario (1976). There have also been attempts to improve the quality of the estimated consumer surpluses by allowing the fraction k to vary among individuals to account for different preferences, and different perceptions of the time cost (McConnel & Strand, 1981; Amoako-Tuffour & Martinez-Espineira, 2008).

4.4.2 The Role of Substitute Sites

Another factor that has been found to have a large impact on the estimated values in travel cost studies is the role of substitute sites (Smith & Kaoru, 1990). If substitute sites exist it is likely that the visitation rate to the site in question will depend on both the price of the site being valued, as well as the price of the substitute site. Omitting the price of substitute sites would lead to biased welfare estimates (Rosenthal, 1987; Freeman et al., 2014).

Based on previous literature there is no uniform way to treat substitute sites (Smith & Kaoru, 1990). Due to the difficulty of including substitute prices, as well as the difficulty of identifying which sites serves as substitutes, substitutes are often excluded from the model. However, attempts have been made to include substitute prices and improve measures of consumer surplus. Rosenthal (1987) developed three different types of TCMs to find the effect of omitting substitutes. He found that omitting substitute sites would lead to biased estimate. The estimates from a traditional TCM with substitute prices included, and a discrete choice model specified as a logit model were similar, and both proven effective.

Willis (1991) combined the TCM with contingent valuation questions to estimate the effect of substitute sites. Although the existence of substitutes reduced WTP for the site in question, the variable was not statistically significant. He claimed that excluding substitute sites did not lead to biased estimates. The effect of substitutes on CS will depend on the location of the site being valued relative to substitutes, and the characteristics of them. If good substitutes are present a biased estimate due to exclusion of substitutes would be more likely (Rosenthal, 1987).

4.4.3 Multiple Purpose Trips

A common assumption in the TCM is that the sole purpose of the trip is to visit the site in question (Freeman et al., 2014). However, many consumers of the recreation site may combine the recreational visit with other recreation sites, visits to friends or family, or errands. In this case parts of the travel costs should be allocated toward the other purposes of the trip. The difficulty of allocating joint costs has led to two simplifying solutions to the problem, both likely to cause biased estimates (Voltaire et al., 2017). One alternative is to exclude the multi-purpose visitors from the sample, which may cause downward-biased estimates (Common et al., 1999). The other solution is to include all visitors as if they were single-purpose visitors. Such a solution can cause both substantial overestimation as well as underestimation (Chae et al., 2012; Martinez-Espineira & Amoako-Tuffour, 2009).

Attempts have been made to improve the treatment of multiple purpose trips in recreation demand models. Some approaches are based on ex ante adjustment of the CS estimate, while others are based on ex post adjustments. In either case the travel costs are adjusted using a multi-purpose weighting approach (Voltaire et al., 2017; Martinez-Espineira & Amoako-Tuffour, 2009). Although there is no consensus approach on the treatment of multi-purpose trips, the previous literature on the topic suggests that the degree of bias in the estimates will vary depending on the site being valued. The problem of multiple-destination trips is especially present in valuations of national recreation sites, where consumers may have travelled longer distances to visit the site (Haspel & Johnson, 1982). This would likely overestimate the CS. For some recreation sites however, multi-destination trips may be a statistically insignificant variable and the lack of adjustment due to multiple purpose visits may be justified (Loomis et al., 2000).

5. Data

The TCM is based on quantitative research, and relies on actual visitation data. The necessary data can be collected either through an on-site survey, or a survey targeting the general population (Meisner, Wang & Laplante, 2008). The data-analysis for this study is based on an on-site survey performed at Hellestø and Bore beaches.

5.1 Survey Design

Before the data collection took place some preparatory work was required to ensure that the questionnaire was well-written and user-friendly. The questionnaire employed in the study was previously developed and employed by Bui and Sæland (2017), building on the survey of Lohaugen & Refsland (2016), which can be further traced back to Loomis (2001; 2009) and Whitehead et al. (2006; 2016). Previous experiences with employing the questionnaire gave grounds for improvements. Some questions were removed as they were deemed unnecessary, while others were reformulated. The SP section was also changed to include the relevant scenarios for this study. The first draft was sent to several experts to ensure that the questionnaire was well formulated, easy to understand and that the CB questions were formulated in the best possible way to ensure accurate responses.

Expert meetings and a focus group were held prior to developing the SP section of the questionnaire. The expert meetings were with Jæren Friluftsråd and the County Governor of Rogaland. They possess great amounts of information about the Jæren beaches, and were helpful in shedding light on the current conditions of the Jæren beaches. The importance of the real threats and challenges facing the Jæren beaches were presented and formed the basis for the hypothetical scenarios of this study. The scenarios were developed according to the real threats of the Jæren beaches so that the respondents would be able to relate to the scenarios, and see the importance of them. For the focus group, a total of eight individuals participated. Here, information was gathered about the general populations information about, and relationship and attitudes towards the Jæren Beaches. The importance of different attributes to the consumers were discussed, as well as preferred activities while visiting the Jæren beaches. This was necessary to form an image of what activities the Jæren beaches are used for, and how the general population values them.

5.2 The Questionnaire

The questionnaire was developed and modeled to fit the relevant research questions for this study, and the sites being valued. It was developed such that data could be gathered on actual number of trips taken, future trips under status quo as well as in the case of a hypothetical scenario, travel costs associated with the visit, and demographic variables. The full questionnaire is reproduced in appendix 2.

5.2.1 The Revealed Preference Section

The RP section contained questions on actual visitation rates for last year to the site in question, as well as all of the substitute beaches. For the visited recreation site it also contained trip count questions on the number of trips taken last month, and the expected number of visits for this year. Although the latter is not a RP question, it was included in this section for practical reasons.

The respondents were asked to rate the importance of different characteristics associated with the Jæren beaches on a scale of 1-5. They were then asked to rank how the beach they were currently visiting scored on those same characteristics. Next, they were asked about their main activities at the Jæren beaches, and what the main activity of their current beach visit was. Lastly, there were some questions regarding their current day trip such as whether the visit was the main purpose, travel distance to the beach, travel mode, time spent at the beach and who they traveled with. These last questions are important inputs in the TCM, and are crucial for the calculation of total recreation value of the sites.

5.2.2 The Stated Preference Section

The SP section of the questionnaire included CB questions regarding future trips. These questions were included to estimate values for hypothetical changes in the conditions affecting the recreational visits. The respondents were first asked what beach they would travel to if the one they were currently visiting became unavailable, i.e. their substitute beach. Second, they were asked how the number of trips undertaken would change given a doubling in travel cost, and a doubling in travel time. Lastly, the respondents were asked to state their behaviour in the case of two different hypothetical scenarios. The first being activity restrictions in the sand dunes, and the second being an oil spill.

For the sand dune scenario, the illustration in figure 3 was provided, along with a brief explanation of the scenario. The adjoining questions were phrased as follows: *Imagine you could still use the beach you are currently visiting (or last visited), but all activity in the sand dune area were forbidden except on marked trails leading to the sea. Suppose none of the other beaches at Jæren were affected. 1) How many fewer (or additional) annual trips to the beach you are currently visiting would you then take? 2) How many fewer (or additional) annual trips to the other beaches would you then take?*

Figure 3: Illustration sand dune scenario.

For the oil spill scenario, the respondents were given a short explanation of the scenario, following the illustration in figure 4 below. The questions were phrased as follows: *Imagine an oil spill from a shipping accident resulted in the beach you are currently visiting (or last visited) closed for four months, from May to August this year (2018). Suppose none of the other beaches at Jæren were affected. 1) How many fewer (or additional) annual trips to the beach you are* *currently visiting would you then take? 2) How many fewer (or additional) annual trips to the other beaches would you then take?*

Figure 4: Illustration oil spill scenario. Photo: Anders Fehn, NRK (2017).

5.2.3 The Demographic Section

The last section of the survey included questions on different demographic variables such as age, education, income, gender, employment status, postal code, household size and number of children. Some of these are important to reveal different characteristics of the population, while others, such as income and postal code are crucial inputs in the calculation of total travel costs. Lastly, the respondents were asked if they were members of an organized hiking association or environmental organization in order to see if this had any effect on trip count, both under current conditions, and after an environmental deterioration.

5.3 Data Collection

The data collection started late March 2018 and ended early April the same year, which coincided with the Easter holiday. During the sampling period several days were spent at both Hellestø and Bore beaches, varying both the time of the sampling, and whether it was a weekday or weekend in order to get a representative sample. During the sampling period a total of 198 individuals responded. The respondents were given the choice between filling out the survey immediately on site, or taking it home in a pre-paid envelope and mail them back on a later occasion. 118 respondents answered the questionnaire on site, whereas 188 respondents wished to take it home with them. Out of the 188 surveys handed out, 80 were returned. Of the 198 responses received, 119 were from Hellestø and 79 from Bore.

5.4 Data Processing

Before the regression and analysis took place, some data processing was necessary to ensure that the dataset was ready for the regression. In addition to transferring the responses from paper format to Microsoft Excel, there was also the issue of correcting for missing variables and the calculation of the total travel cost.

5.4.1 Correcting for Missing Values

The survey dataset contained some respondents with missing values. For these, the missing values were substituted by the mean sample values, or the answer option with the highest proportion of the respondents from the available observations. For example, for those who did not report their household income, the empty spaces were substituted with the mean household income. For gender, female was chosen as the majority of respondents were women. For those with missing values on the postal code of their home, it was assumed that the postal code they reported coming from when traveling to the beach, was the same as the postal code of their home.

5.4.2 Calculating Total Travel Cost

In order to calculate the total travel costs of each respondent one needs to find the respondents' opportunity cost of travel time based on his/her income, travel time, and the cost of travel from the respondents' home to the recreation site.

Travel distance and time it took for the respondent to take a round-trip to the recreation site and the substitute site from home was calculated using a travel distances package in the statistical computing programme R. Some postal codes and beaches were however not included in the package. For these respondents Google Maps was used to calculate the fastest route to find exact estimates for distance and travel time both to the recreation site chosen, and to the substitute site.

The explicit travel costs, TC, were calculated using the following equation:

(11) $$TC = cd + f,$$

where c is the fuel cost per kilometer, d is the round-trip travel distance, and f is road fees. When calculating TC for each respondent, the fuel cost and road fees were adjusted to the respondents' mode of transportation. For petrol- and diesel car the estimated fuel cost per kilometer is 0.91 NOK and 0.71 NOK respectively, and for electric- and hybrid cars it is estimated at 0.2 NOK (Bui & Sæland, 2017). For the road fees it was used a conservative estimate and assumed that all visitors had AutoPASS and therefore paid a minimum of 16 NOK per passage.

The time spent traveling to and from the recreation site is time that could have been spent otherwise, and thus represents an opportunity cost of travel time. To find the respondents' opportunity cost of time, the stated household income was divided by the number of adults in the household. This gave an estimate of annual disposable income, which was further divided by 1950 annual hours of work, which is standard for Norwegian full-time employees. In correspondence to previous literature on this topic, one third of hourly wage was chosen as an appropriate opportunity cost of travel time (Cesario, 1976; Lew & Larson, 2005b). Opportunity cost of travel time for each respondent was calculated using equation (12).

(12) $$OCT = \frac{1}{3}wt,$$

where w is the hourly wage rate and t is the round-trip travel time.

The total travel costs, TTC, herein both explicit and implicit costs were calculated as the sum of both: TTC = TC + OCT. For further estimation the TTC was used as the full travel cost for the respondents from their home to the site they visited.

6. Descriptive Statistics

To get an overview of all the respondents who participated in this survey, some descriptive statistics summary tables and charts are presented. In this part, the raw data are used without manipulations. The statistics is separated between the full sample (N=198) and the corrected sample (N=188). The corrected sample is excluding respondents with trip counts higher than 150, respondents with missing information, and out-of-towners.

The sample of respondents provides a wide range in terms of age. 60 different years of birth were reported, where the youngest respondent was 15 years old, while the oldest was 84 years old. There was also a good variety when it came to level of education. Among the respondents, 3% reported that their highest level of education were junior high school, while 21% answered high school. The higher education groups were the most frequently reported among the consumers. 33% had higher education less than four years, and 42% reported higher education more than four years as their highest level of education. Lastly, 0.5% answered the option named other.

60% of the respondents were fully employed and 8% were employed part time. 17% reported being pensioners, while students, jobseekers and homemakers accounted for 7, 3 and 3% of the sample, respectively. The last 2% include respondents who stated that they were on sick leave, temporarily laid off, soldier or self-employed.

Table 1 depicts some of the respondent characteristics in average terms. Out of the 198 respondents, 58.25% were female. The average age was 48.66 years, and 68.53% of the sampled individuals were employed. Further, the most common education grouping was higher education above four years, with a total of 42.05% of the respondents. Average household size was 2.59 persons, with an average household income of 865 526 NOK. Lastly, table 1 provides that 24.10% of the respondents were members of a tourist association, while only 8.76% reported being members of an environmental organization.

Table 1: Respondent characteristics.

Respondent Characteristics	Full Sample (N=198)	Corrected Sample (N=188)
Female (%)	58.25	60.00
Average age (years)	48.66	48.58
Employed (%)	68.53	68.62
Higher education, >4 years (%)	42.05	41.94
Household size (mean, pers.)	2.59	2.59
Household income (mean, NOK)	865 526	850 276
Member of a tourist association (%)	24.10	25.27
Member of an environmental org. (%)	8.76	9.19

Although people were only asked to state the postal code of their home, the respondents were grouped into their municipalities for simplicity. Figure 5 gives an illustration of where the 198 respondents resided. As to be expected, the three municipalities with the highest number of representatives are also the three largest ones in terms of population. Stavanger with the highest number of 37%, Sandnes on second place with 24%, followed by Sola with 12%. Since some of the data were collected during the Easter holiday, some respondents who were currently only visiting was encountered. These were placed together in the group named other, which had a total of 9% of the respondents. The remaining 18% resided in close-by municipalities, namely Gjesdal, Hå, Klepp, Randaberg and Time.

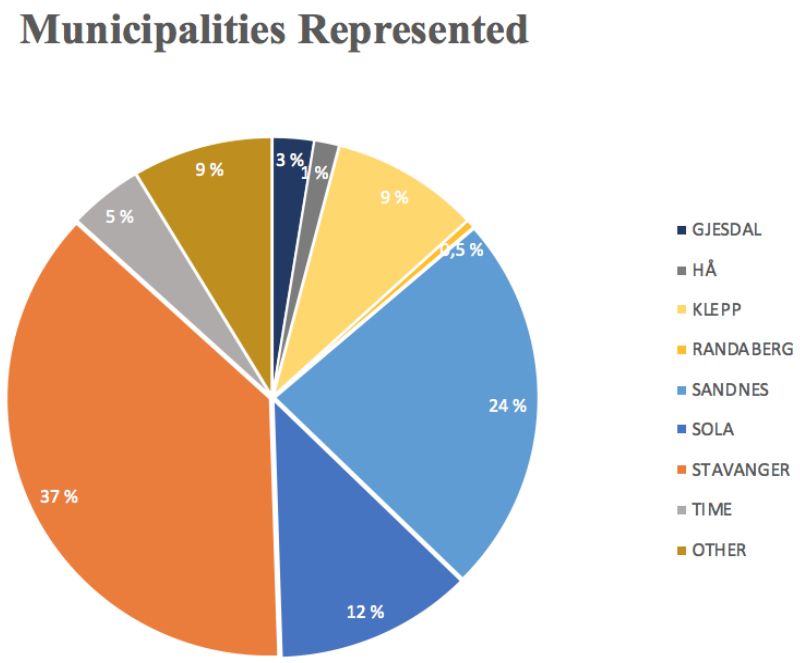

Figure 5: Municipalities represented among the full sample.

Figure 6 presents the different modes of transportation to the beaches reported among the respondents. 47% of the beach visitors travelled by diesel car, which was the most used transportation mode among the respondents. 35% travelled by gasoline car, while 18% reported using electric or hybrid car. One respondent, or 0.5% of the sample, travelled by a motorhome. Of all the 198 respondents, only 0.5% of the sample walked to the site. Given that the survey took place in the parking lot, there might have been some walking users that were not intercepted.

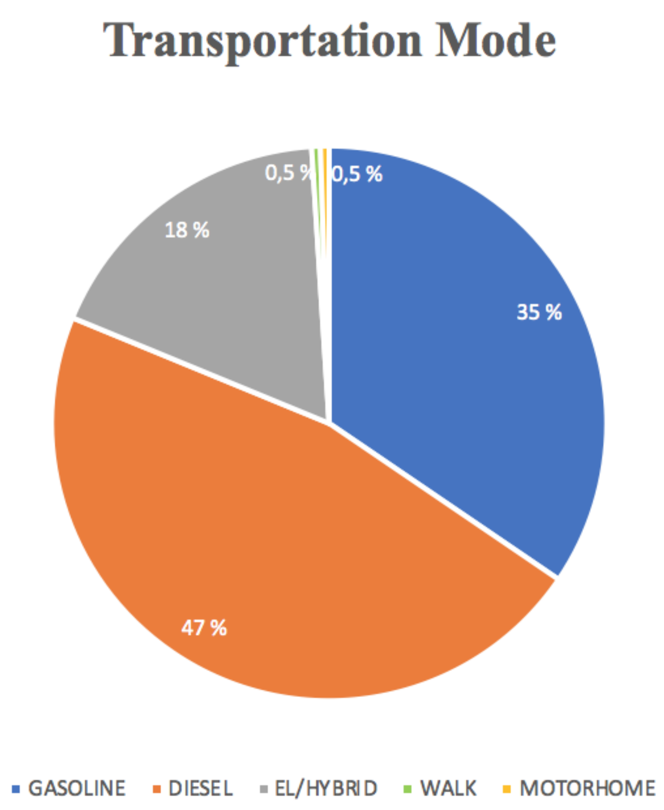

Figure 6: Transportation modes among the full sample.

Table 2 gives a summary of visitation statistics, in which one part deals with the characteristics of the beach trip, and the other part is about the number of trips taken. The average travel time and distance are low, with an average of 16.85 km and 23.24 minutes among the full sample. This is to be expected given that most visitors are locals. The average total travel cost, which include both time and cost, was NOK 159.31 among the full sample, and NOK 137.93 among the corrected sample. The lower amount among the corrected sample may be due to the exclusion of the out-of-towners, with higher travel costs and travel time. On average, the respondents travelled in groups of 2.39 persons and they spent 88.69 minutes at the beach, which corresponds to almost 1.5 hours. However, there was a wide time frame ranging from 15 minutes at the least to four hours at the most.

In the RP section the respondents were asked to state how many trips they took during the last month, last year, and expected number of trips this year. The average visitation rate for the given time span were 3.45, 23.49 and 23.35, respectively. In the SP section respondents were asked to state how the number of trips this year would change under different scenarios. If travel cost and travel time would double, the average respondent reported that he/she would take 19.14

and 19.12 trips, respectively. A doubling in cost or time had the least effect on number of trips of all the scenarios, with a reduction in trip count by only 4.21 and 4.23 trips. If the government were to implement activity restrictions in the sand dunes, this would also lead to a reduced number of annual trips with new trip count of 18.93 trips on average. The largest effect on trip count, however, was the oil spill scenario. This would lead to 7.84 fewer annual trips, with a total of 15.51 visits on average. Given that the oil spill scenario led to beach closure, a reduction in trips is to be expected as a closure would force trip count to zero for the closure period.

Table 2: Visitor statistics.

	Full Sample (N=198)		**Corrected Sample (N=188)**	
	Mean	**Std.dev.**	**Mean**	**Std.dev.**
Characteristics of the Beach Trip				
Travel				
Average one-way travel time to site (min)	23.24	15.96	22.78	13.96
Average one-way travel distance to site (km)	16.85	11.88	16.75	10.36
Average total travel cost to site	159.31	7.69	137.93	2.44
Visitation				
Time spent on site (min)	88.69	47.02	90.02	47.50
Group size (pers.)	2.39	1.42	2.36	1.42
Trips Taken				
Revealed (per person)				
Last month	3.45	4.51	3.04	3.55
Last year, 2017	23.49	47.03	16.64	21.92
This year, 2018	23.35	42.27	17.90	20.09
Stated (per person)				
Double cost	19.14	38.72	14.48	18.47
Double time	19.12	40.39	13.93	18.99
Activity restrictions in the sand dunes	18.93	38.48	14.25	17.30
Oil spill	15.51	34.29	10.92	16.55

A summary of beach characteristics and scores is provided in table 3. The respondents were asked to rank how important different beach characteristics are on a scale from 1 to 5, where 1 was not important and 5 was very important. They were then asked to rank how the beach they were currently visiting scored on the same characteristics, where 5 was very good and 1 was very bad. Starting with the characteristic of most importance to the ones least important, these characteristics were: low pollution/waste ranking 4.24, available parking space, unspoilt nature and wildlife, short travel distance from home, quality of trails, uncrowded, available toilet, kid friendly, opportunity for water sports, and café/snackbar as the least important scoring 1.51.

Having ranked how important the characteristics was, the respondent were then asked to rate the same characteristics of the beach they were currently visiting. When looking at the different scores, the parking availability got the highest rating with a mean of 4.48, which is high considering 5 being the maximum. Since none of the beaches had a café or snackbar, it is not surprising that the characteristic with the lowest score was café/snackbar with a mean of 1.73. The remaining factors all got a mean value between 3 and 4, with the exception of quality of trails with a mean score of 4.10.

Table 3: The importance and ratings of beach characteristics.

	General Importance		**Ratings of the Beaches**	
Characteristics	***Mean***	***Std.dev.***	***Mean***	***Std.dev.***
Short travel distance from home	3.18	1.16	3.67	1.12
Available parking space	4.17	1.00	4.48	0.71
Quality of trails	2.88	1.21	4.10	0.89
Child-friendly	2.16	1.29	3.92	1.13
Not crowded	2.88	1.16	3.33	1.02
Available toilet	2.63	1.27	3.05	1.38
Café/snackbar	1.51	0.89	1.73	1.16
Low pollution/waste	4.24	1.03	3.96	0.95
Opportunity for water sports	1.94	1.28	3.79	1.26
Unspoilt nature and wildlife	3.67	1.17	3.73	0.99

Table 4 depicts the different recreational activities the respondents used the beach for. They were allowed to choose up to two activities each. 75% of the respondents reported that the purpose of their current beach visit was hiking, followed by dog-walking with 20.92%. 16.33% went there to relax, 6.63% wanted to enjoy the bird- and wildlife and 5.61% went surfing. The least common activities were running, sunbathing and swimming, and the collect category, others, which all had 1.53% each.

Table 4: Beach activities.

Beach Activities	Percent of Full Sample
Dog-walking	20.92
Enjoy the bird- and wildlife	6.63
Fishing	1.02
Hiking	75.00
Relaxing	16.33
Running	1.53
Sunbathing and swimming	1.53
Surfing	5.61
Other	1.53

Note: The respondents were allowed to choose up to two activities each.

7. Econometric Models

When analyzing recreation demand the dependent variable is the number of visits to the site. Given the non-negative nature of the dependent variable it is best modelled as a count variable. Count data models are popular when valuing recreational goods because they treat the dependent variable as a non-negative integer, and because they assume a semi-log demand functional form (Pattiz, 2009). The parameters for the count data models are estimated using a maximum likelihood estimation (MLE) procedure (Hellestein, 1991). Based on previous literature where the TCM is applied to value recreational sites, the two preferred models of count data for recreational valuation are the Poisson model and negative binomial model (Englin et al., 2003).

7.1 Poisson

The most common single-parameter count data model in recreational demand analysis is the Poisson distribution **(**Bin et al., 2005; Blackwell, 2007; Eiswerth et al., 2000; Englin & Cameron, 1996; Huang, 2017; Landry et al., 2011; Marvasti, 2013; Parsons et al., 2013; Poor & Breece, 2006; Rosenberger & Loomis, 1999; Voltaire, 2017; Whitehead et al., 2008; Whitehead et al., 2011; Whitehead, Haab & Huang, 2000; Zhang et al., 2015). The basic Poisson model assumes that Y_i, the *i*th observation of the number of recreational trips, follows a Poisson distribution given by:

(13) $$Prob(Y_i = k) = \frac{e^{-\lambda}\lambda^k}{k!}.$$

In the model, λ is both the mean and the variance of the distribution and k = 0, 1, 2, …, n (Grilli et al., 2017). A count data regression based on the Poisson distribution is specified by letting λ vary over observations according to a specific function of a set of explanatory variables. The demand function for trips as depicted by Rolfe & Gregg (2012) is:

(14) $$\lambda = exp(\beta_0 + \beta_{TC} + \beta_n X_n).$$

The Poisson model can also be used to calculate the consumer surplus for a given recreation site (Haab & McConnel, 2002). Since it is common to specify λ as an exponential function the CS is calculated as:

(15) $$\text{CS/trip} = \frac{-1}{\beta_{TTC}}.$$

The Poisson model captures the discrete and nonnegative nature of the dependent variable. However, the Poisson model also implies that the variance of the distribution of y equals its mean, commonly known as equidispersion. In general, this restrictive property does not describe recreation count data well. Data on recreational demand is often characterized by a variance exceeding the mean, also known as overdispersion (Sarker & Surry, 2004). Overdispersion occurs when highly frequent users are present in the data set, which leads to underestimated standard errors. For this reason, the negative binomial model is often more appropriate (Grilli et al., 2017).

7.2 Negative Binomial

The negative binomial allows for a more flexible relationship between the variance and the mean than the standard Poisson does, and can therefore be used to deal with the problem of overdispersion in count data models. There are many versions of the negative binomial model, but the most common version is a Poisson model with a gamma distributed error term in the mean (Haab & McConnell, 2002). Such a generalized version of the Poisson, for which the probability that individual *i* undertakes a certain number of trips *t*, was depicted by Grilli et al. (2017) as:

(16) $$\Pr[T = t] = \frac{\Gamma(\alpha^{-1}+t)}{\Gamma(\alpha^{-1})\Gamma(t+1)} \times \left(\frac{\alpha^{-1}}{\alpha^{-1}+\mu}\right)^{\alpha^{-1}} \times \left(\frac{\mu}{\alpha^{-1}+\mu}\right)^{t},$$

where Γ is the gamma distribution function and α is a parameter describing the overdispersion.

7.3 Panel Data

When combining RP and SP questions in the same questionnaire it is common to use either pooled or panel data models (Hanley et al., 2003). For this study a panel data approach was used, since it allows for differences in individual behaviour. This will allow observations from CB questions to be combined with observations of actual behaviour from the same individual. Responses to both SP and RP questions will likely be correlated, due to the individual's characteristics, attitudes, and preferences (Hynes & Greene, 2013). The standard count models fail to account for this correlation of responses from the same individual. Therefore, it is appropriate to use panel estimators such as fixed and random effects Poisson and negative binomial models. A basic model for panel data as depicted by Greene (2012) is given in equation (17).

(17) $$Y_{it} = \alpha_i + \beta' x_{it} + \varepsilon_{it},$$

for i =1,...,N, t =1,...,T_i, and α_i representing the individual effect.

7.4 Correcting for On-Site Sampling

This analysis relies upon intercept surveys to collect data about the recreation demand of Bore and Hellestø beaches. When relying on on-site survey the respondents are guaranteed users of the site(s) being valued. In addition to the problem of overdispersion in recreation demand as mentioned above, two additional problems arise when relying on on-site survey data. These are endogenous stratification and truncation (Egan & Herriges, 2006).

7.4.1 Endogenous Stratification

When performing an on-site survey the likelihood of being included in the sample depends on the frequency of visits to the recreation site. Frequent users are more likely to be included in the data set and could potentially bias the chosen sample, because it may not reflect the WTP and preferences of the entire population.

7.4.2 Truncation

Truncation refers to the problem of only including respondents with positive demand for the recreation site. In an on-site survey only active users are encountered, and the data is therefore truncated at positive demand (Hynes & Greene, 2013). Therefore, only information on the current users of the site at the time of the data collection is included, and information on previous and/or future users is neglected.

7.4.3 Methods of Correction

Failure to correct for truncation and endogenous stratification could bias the estimation results (Hellerstein, 1991). A common method to correct for both truncation and endogenous stratification is to run a standard Poisson regression on the dependent variable, and modify it by subtracting 1 from each value (Martínez-Espiñeira & Amoako-Tuffour, 2008). This method relies on the assumption of equidispersion. If overdispersion of the dependent variable is significant, however, this method is unvalid and the negative binomial model should be used instead.

A negative binomial model that corrects for both overdispersion, endogenous stratification, and truncation has been derived by Englin and Shonkwiler (1995), and has since then been frequently used in literature on recreation demand in different variants (Martínez-Espiñeira & Amoako-Tuffour, 2008; McKean et al., 2003). This model represents the preferences and characteristics associated with the general population, and not just the users encountered when performing an on-site survey.

In panel data models combining CB with the standard TCM, few attempts have been made to correct these problems associated with on-site sampling. However, Egan & Herriges (2006) developed a Multivariate Poisson Lognormal (MPLN) model for joint estimation. Beaumais & Appéré (2010) corrected for these issues using a random-effect Poisson gamma model, which is an alternative to the MPLN. Other models that could be used are the random effects negative binomial (RENB) and the discrete factors method (Landry & Liu, 2009; Hanley et al., 2003).

8. Model Application

For the regression those respondents who were tourists, had missing information in the questionnaire, or an actual trip count above 150 were excluded. A panel data model with 6 observations on trip count for each respondent was used, which gave a total of 1044 trip observations for the corrected sample. Panel 1 was the RP panel, which represented actual number of trips for 2017. Panel 2 through 6 represented the SP questions, and included stated trip count for 2018, as well as trip count under different hypothetical scenarios, herein doubling of travel cost, doubling in travel time, activity restrictions in the sand dunes, and an oil spill with an associated beach closure.

8.1 Model Specification

To estimate the demand for beach recreation, the random- and fixed effects Poisson models with panel data were applied. In addition to a comparison of random and fixed effects estimates, two different models were run. The first one was a basic model with the corrected sample, given in equation (18). The second model corrected for the on-site sampling issues of truncation and endogenous stratification by subtracting the value 1 from the trip count, as suggested by Englin & Shonkwiler (1995). A trip count restriction of trips<50 was also added. This model is given in equation (19).

(18)
$$\ln(TRIPS_{it}) = \beta_0 + \beta_1 TTC_{it} + \beta_2 STC_{it} + \beta_3 FULLINC_{it} + \beta_4 TTC\_DSP_{it} + \beta_5 TTC\_DSP4_{it} + \beta_6 TTC\_DSP5_{it} + \beta_7 DSP_{it} + \beta_8 DSP4_{it} + \beta_9 DSP5_{it} + \beta_{10} TIMEONSITE_{it} + \beta_{11} DFEMALE_{it} + \beta_{12} AGE_{it} + \beta_{13} EDU_{it} + \beta_{14} DPURP_{it} + \beta_{15} DENVORG_{it} + \beta_{16} DRECORG_{it} + \varepsilon_{it}$$

(19)
$$\ln(TRIPS\_C_{it}) = \beta_0 + \beta_1 TTC_{it} + \beta_2 STC_{it} + \beta_3 FULLINC_{it} + \beta_4 TTC\_DSP_{it} + \beta_5 TTC\_DSP4_{it} + \beta_6 TTC\_DSP5_{it} + \beta_7 DSP_{it} + \beta_8 DSP4_{it} + \beta_9 DSP5_{it} + \beta_{10} TIMEONSITE_{it} + \beta_{11} DFEMALE_{it} + \beta_{12} AGE_{it} + \beta_{13} EDU_{it} + \beta_{14} DPURP_{it} + \beta_{15} DENVORG_{it} + \beta_{16} DRECORG_{it} + \varepsilon_{it}$$

Trip count for the respondent (TRIPS) was modeled as the dependent variable in the first equation, while trip count with corrections (TRIPS_C) was used as the dependent variable in the second equation. 16 different independent variables were included in the models to see if they had an influence on the demand for, and value of the beaches. Table 5 below lists and describes all variables included in the regression models, in addition to the corresponding expected signs. TTC is the own-site total travel cost variable. STC is the substitute-site total travel cost variable. Further, FULLINC is the full income variable which includes both household income, as well as the monetized time budget assuming available hours are 365*(24-8). DSP is a dummy variable indicating hypothetical trip observations, whereas the dummy variables DSP4 and DSP5 are indicators for trips under the sand dunes scenario, and trips under the oil spill scenario, respectively. Interaction variables between the total travel cost and the dummy variables for hypothetical scenarios TTC_DSP, TTC_DSP4 and TTC_DSP5 were included. These were incorporated to see if the hypothetical scenarios would imply changes in the slope of the demand curve.

A variable on time spent at the beach (TIMEONSITE) was included to see if this had an effect on the number of trips taken. In order to get a more comprehensive regression model, the socio-economic factors gender (DFEMALE) and age (AGE) were included. Lastly, dummy variables on trip purpose (DPURP), member of environmental organization (DENVORG), and member of outdoor recreation organization (DRECORG) were added to the model.

Table 5: Variable description.

Variable	Description	Expected Sign
TRIPS	Trip count for the respondent.	
TRIPS_C	Trip count for the respondent with corrections.	
TTC	Total travel cost, herein both time and cost.	(-)
STC	Travel cost to the respondent's substitute-site.	(+)
FULLINC	Annual household income for the respondent.	(+)
TTC_DSP	Interaction between TTC and DSP.	
TTC_DSP4	Interaction between TTC and DSP4.	
TTC_DSP5	Interaction between TTC and DSP5.	
DSP	Dummy for SP trips with hypothetical scenarios.	(-)
DSP4	Dummy for SP trips with hypothetical scenario on activity restrictions in the sand dunes.	(-)
DSP5	Dummy for SP trips with hypothetical scenario on oil spill.	(-)
TIMEONSITE	Time spent at the site.	
DFEMALE	Dummy variable for gender. 1 = female, 0 = male.	(+ / -)
AGE	Respondent's age.	(+ / -)
DPURP	Dummy variable for trip purpose. 1 = beach trip as main-/one of the main purposes, 0 = beach trip as one of many purposes.	
DENVORG	Dummy for member of environmental organization.	
DRECORG	Dummy for member of outdoor recreation organization.	

8.2 Hypothesis Specification

The purpose of this paper is to find the recreational value of two Norwegian beaches. In accordance to economic theory, a falling demand curve is to be expected. An environmental deterioration, changes in income, or changes in the price of substitutes is expected to have an impact on the demand for recreation at the site(s) being valued. Previous literature suggests that a recreational site follows the law of demand, such that when the price (TTC) increases the quantity demanded will decrease. If this is the case, then the demand curve will be falling, which is consistent with economic theory.

It is to be expected that the Jæren beaches are substitutes. Given this assumption, STC is expected to have a positive effect on the number of trips taken each year. A rising travel cost to the substitute site, all else equal, would cause an increase in demand of the site(s) being valued. This assumes that recreation at that beach is a normal good. Due to the assumption of a normal good, it is expected that the coefficient for household income (FULLINC) is positive. A rise in income would lead to a positive shift in demand, all else held constant.

In comparison of trips under status quo and SP trips with a quality reduction, both the oil spill scenario (DSP5) and sand dune scenario (DSP4) is expected to cause a shift in demand. In addition, it is also expected that the two hypothetical scenarios will affect visitors price sensitivity and therefore cause a rotation of the demand curve. Testing the significance of the SP dummy variables, as well as the interaction variables (TTC_DSP4) and TTC_DSP5), captures the expected impact of the hypothetical scenarios both in terms of elasticity and trip demand. An environmental deterioration such as these scenarios will likely cause a decline in number of trips, a more elastic demand curve, and a lower CS estimate.

9. Estimation Results

In total, four panel regressions were run in order to analyze the different independent variables' effect on trip counts. Both random effects and fixed effects Poisson were applied in the regression. The regression results were also used for the estimation of CS for both RP and SP data.

9.1 Regression Results

Table 6 shows the regression results, where one column gives the results from the random effects models and the other column shows the results from the fixed effects models. Model 1 and 3 are basic models with corrected sample, using regression equation (18). Model 2 and 4 are models with correction for on-site sampling and trip count restriction. For these models, regression equation (19) given above was used. Table 6 lists the different variable coefficients with the corresponding standard deviations. The four bottom rows gives estimates of the alpha, log likelihood, number of observations, and the number of individuals represented in the models.

The estimated coefficient on TTC is negative and statistically significant at the 0.01 level for all four models, which is consistent with the law of demand. The coefficient on FULLINC is positive, but close to zero, and indicates that beach recreation is neither a normal nor an inferior good. STC is positive and insignificant. There is lacking evidence to support the alternative hypothesis, and it cannot be concluded that the travel cost to a substitute site effects trip demand.

The variable DSP, which refers to trip count for the hypothetical scenarios, is positive and significant at the 0.01 level for all four models. The positive sign indicates that demand is higher in the SP data, all else equal. This confirms the possible hypothetical bias of overstatements in SP trips. Controlling for this possibility by including the DSP variable in the regression provides unbiased estimates for the other results. The coefficient on the interaction between DSP and TTC is negative and significantly different from zero for at least the 0.05 level, for all models. These results indicate a shift, as well as an inward rotation of the demand curve in the case of the SP scenarios.

The dummy variable DSP4 accounts for the potential change in trip demand if a hypothetical scenario were to restrict all activity in certain areas of the sand dunes at the beach. Regression equation (18) and (19) have conflicting results. DSP4 is positive in model one and three, and negative and significant in model two and four. The results indicates that for less frequent visitors, as represented by the corrected regression equation (19), where trip count<50, a sand dune restriction will cause an inward shift in demand. Differences in elasticities are represented by interacting DSP4 with TTC (TTC_DSP4). The coefficient on TTC_DSP4 is negative in all four models, and significantly different from zero at the 0.01 level in model 1 and 3. These results indicate that for model 1 and 3 an activity restriction in the sand dunes will cause a change in elasticities of the recreation demand as the quality of the site is reduced.

For the dummy variable on SP trips in the case of an oil spill (DSP5), the coefficient is negative and significant at the 0.01 level in all four models. Reduction in trip demand is estimated to be somewhere between 36.76% and 41.73% when comparing all four models. This supports the hypothesis that an oil spill will cause an inward shift in demand, due to the quality reduction of the site. The interaction variable between own-price and DSP5 (TTC_DSP5) is negative in all four models, but only significant in model 2. The conflicting results indicates that it cannot with certainty be concluded that an oil spill will affect the elasticity of recreation demand, thereby causing a rotation of the demand curve.

Although all 16 independent variables given in equation (18) and (19) were included in all four models, some are dropped from the regression in the fixed effects models since they are constant across the sample. This includes the variables on substitute travel cost, household income, time spent at the site, gender, age, education, trip purpose and the two membership variables. The last seven of these variables had little effect in the random effects model, but were included in the regression nevertheless. With the exception of DPURP which was significant at the 0.05 level in model 2, none of the others variables were significant. Therefore, it cannot be concluded that any of these variables influence the demand for recreation.

Table 6: Random- and fixed effects Poisson regression results.

Estimation Results	**Random Effects**		**Fixed Effects**	
Variable	***Model 1***	***Model 2***	***Model 3***	***Model 4***
CONSTANT	1.8888*** (0.7290)	1.4291* (0.7591)		
TTC	-0.0023*** (0.0005)	-0.0034*** (0.0006)	-0.0023*** (0.0005)	-0.0033*** (0.0007)
STC	0.0028 (0.0019)	0.0026 (0.0018)		
FULLINC	0.0004 (0.0002)	0.0004* (0.0002)		
TTC_DSP	-0.0012*** (0.0003)	-0.0009** (0.0004)	-0.0012*** (0.0003)	-0.0010** (0.0004)
TTC_DSP4	-0.0018*** (0.0005)	-0.0004 (0.0005)	-0.0017*** (0.0005)	-0.0003 (0.0006)
TTC_DSP5	-0.0007 (0.0005)	-0.0020*** (0.0006)	-0.0007 (0.0005)	-0.0019 (0.0006)
DSP	0.1762*** (0.0445)	0.2538*** (0.0563)	0.1769*** (0.0446)	0.2548*** (0.0563)
DSP4	0.0345 (0.0521)	-0.1148* (0.0654)	0.0337 (0.0521)	-0.1217* (0.0654)
DSP5	-0.4152*** (0.0586)	-0.3676*** (0.0747)	-0.4173*** (0.0586)	-0.3825*** (0.0751)
TIMEONSITE	0.0012 (0.0019)	0.0018 (0.0019)		
DFEMALE	0.1617 (0.1642)	0.1731 (0.1750)		
AGE	-0.0026 (0.0052)	-0.0085 (0.0055)		
EDU	0.0185 (0.0423)	0.0279 (0.0450)		
DPURP	0.2644 (0.2131)	0.5753** (0.2297)		
DENVORG	-0.1318 (0.2830)	-0.0995 (0.2967)		
DRECORG	-0.0657 (0.1817)	-0.0652 (0.2016)		
Alpha	1.069*** (0.1009)	1.1948*** (0.1177)	-	-
Log likelihood	-3734.40	-2921.35	-2736.65	-2015.26
Number of observations	1 044	974	1 026	932
Number of individuals	187	184	184	171

Note: Significance levels: 1% (***), 5% (**), 10% (*). Standard deviation is reported in the parentheses.

9.2 CS Estimates

Given the semi-log functional form of demand, the per trip consumer surplus (CS) can be calculated using equation (15). Further, annual CS can be calculated as follows:

(20) $$Annual\ CS = E(TRIPS) \cdot \beta_{TTC}^{-1},$$

where $\beta_{TTC} = \beta_1$ (from equation 18) when computing last year's CS for RP. The appropriate TTC coefficient in the CS for SP is $\beta_1 + \beta_4$. The revealed preference own-price elasticity is found with the formula:

(21) $$Own - price\ elasticity = \beta_{TTC} \cdot TTC,$$

with the appropriate TTC coefficient (β_{TTC}) being β_1.

Table 7 gives a summary of both revealed- and stated preference CS measures, as well as RP elasticities, for all four models under status quo. The CS estimates in model 1 and 3 are somewhat higher than in model 2 and 4. This is a result of not correcting for on-site sampling issues, which causes the CS estimates to be overvalued in model 1 and 3. The result of not correcting for endogenous stratification is consistent with previous findings (Haab & McConnell; Hynes & Greene, 2013; Martínez-Espiñeira & Amoako-Tuffour, 2008). In all models, the CS estimates for RP are higher than the SP estimates.

CS per trip under RP is highest in model 3 with a mean CS of NOK 445.54, while the lowest CS of NOK 293.44 is estimated in model 2. In model 1 and 4, mean CS is NOK 430.65 and NOK 302.53 per trip, respectively. In the SP data, the CS per trip have a lower variation in the estimates where it ranges from NOK 230.02 in model 2, to NOK 282.84 in model 3. When it comes to annual CS estimates, the CS in RP is highest in model 3 with a CS of NOK 10 290.29, and lowest in model 2 with a CS of NOK 6 777.47. The annual SP estimates of CS, though a small difference in amount, is quite similar to the RP estimates. The CS means range from NOK 6594.96 (model 2) to NOK 10 013.19 (model 3).

The elasticity is calculated based on RP trips, and varies between -0.31 at the highest, and -0.47 at the lowest value. For all four models the price elasticity is negative and supports our findings of a downward sloping demand curve. For every percentage point increase in the price of a visit, as measured by TTC, the quantity demanded decreases by roughly ⅓ to ½ percentage point, depending on the model of choice.

Table 7: Summary of CS (NOK) and elasticities under status quo.

Model Predictions	**Model 1**	**Model 2**	**Model 3**	**Model 4**
CS/trip - RP	430.65	293.44	445.54	302.53
CS/trip - SP	282.84	230.02	287.39	234.40
Annual CS - RP	9946.56	6777.47	10290.29	6987.32
Annual CS - SP	9678.71	6594.96	10013.19	6799.16
Elasticity - RP	-0.32	-0.47	-0.31	-0.45

9.3 Economic Impact of Scenarios

In addition to getting measures of the CS under status quo, the estimates under the two scenarios, as well as the subsequent changes in CS, are also of interest. The CS equations (15) and (20) are used in order to get CS measures under the sand dune scenario and the oil spill scenario. Here, $\beta_{TTC} = (\beta_1 + \beta_5)$ is used when computing CS under the sand dune scenario, and the CS under the oil spill scenario is computed using $\beta_{TTC} = (\beta_1 + \beta_6)$.

Table 8 reports CS estimates in the case of the two hypothetical scenarios, as well as the differences in CS caused by the scenarios using RP as a base. The CS per trip under the dune scenario are quite similar in all four models. Model 1 has the lowest CS of NOK 244.78, and the highest mean estimate of NOK 278.42 is found in model 4. The CS per trip estimates under the oil spill scenario are higher in the two uncorrected models 1 and 3, than in the corrected models 2 and 4. CS per trip is NOK 327.11 and NOK 339.45 in model 1 and 3, and NOK 183.67 and NOK 190.93 in model 2 and 4, respectively.

Model 1 has the lowest calculated annual CS under the sand dune scenario, with a mean CS of NOK 4 511.50. The highest annual CS is NOK 5 131.61 calculated in model 4. The annual CS estimates under the oil spill in model 2 and 4 are a bit lower than the estimates in model 1 and 3. The lowest annual CS is calculated in model 2, with a mean of NOK 2649.27. The highest amount is calculated in model 3 with a mean CS of NOK 4896.34.

Due to overlapping confidence intervals (see appendix 3) between the CS under the scenarios and under status quo, it cannot be said with certainty by looking at these estimates that the hypothetical scenarios lead to changes in the welfare. However, by looking at the changes in CS for both scenarios reported in table 8, it can be concluded that both the sand dune and oil spill scenario have a negative effect on CS. The difference in CS is calculated using the following formula:

(22)
$$\Delta CS = \frac{-TRIPS1}{\beta_{TTC}} - \frac{-TRIPS2}{\beta_{TTC} + \beta_{TTC\_DSPX}},$$

where *TRIPS1* is the mean trips for the base, *TRIPS2* is the mean trips under the scenario, and β_{TTC_DSPX} is interaction variable between TTC and the dummy variable for the appropriate scenario.

According to model 1 and 3, the annual CS is NOK 5435.06 and NOK 5658.44 less in the case of a hypothetical sand dune scenario. The difference in CS is smaller in the corrected models 2 and 4, with changes in CS of NOK 1904.47 and NOK 1855.71. The differences in annual CS in the case of a hypothetical oil spill is NOK 5228.18 and NOK 5393.95 in model 1 and 3, while it is NOK 4128.20 and NOK 4233.29 in model 2 and 4. Thus, according to model 1 and 3, the sand dune scenario has a more negative effect on the CS than the oil spill scenario. Model 2 and 4, on the other hand, reports a bigger difference in CS in the case of an oil spill than if there were activity restrictions in the sand dunes.

Table 8: Summary of CS and the change in CS (NOK) for the scenarios.

Model Predictions	Model 1	Model 2	Model 3	Model 4
CS/trip - dune	244.78	264.39	251.31	278.42
CS/trip - oil	327.11	183.67	339.45	190.93
Annual CS - dune	4511.50	4873.00	4631.85	5131.61
Annual CS - oil	4718.38	2649.27	4896.34	2754.02
ΔCS dune (RP base)	5435.06	1904.47	5658.44	1855.71
ΔCS oil (RP base)	5228.18	4128.20	5393.95	4233.29

As seen from table 7 and 8 the models that are not corrected for on-site sampling issues (model 1 and 3) tend to give overvalued CS estimates. In addition, as reported in table 6, the models with the highest log likelihood are the fixed effects models. Hu (2002) argues that the fixed effects model is beneficial in that the population distribution of q does not have to be specified, and thereby avoiding inconsistency which might be the case for misspecified random effect models. While the random effects model assume that the individual effects are uncorrelated with the other independent variables, the fixed effects model gives consistent estimation in any cases. Based on the overvaluation in model 1 and 3, in addition to the log likelihoods, and the advantages of the fixed effects model, model 4 is considered as the most appropriate model.

10. Discussion

For model 4, which was chosen as the superior model, the coefficient for travel cost is negative and significant at the 0.01 level. This supports the economic theory, and our hypothesis of a downward sloping demand curve. Demand for recreation follows the law of demand. The further away a person lives the fewer the trips, all else held constant.

The results from model 1 and 2 contradicts the assumption previously made, that beach recreation is a normal good. There is lacking evidence to support that income has effect on the number of trips taken. These results are the same for the substitute travel cost variable, which cannot with certainty be said to effect recreation demand. Due to the ambiguous effect of income and substitute price on recreation demand, there is lacking consensus in previous literature. In this study, the results support the findings of Martínez-Espiñeira & Amoako-Tuffour (2008); Voltaire et al. (2017), but contradicts the findings of Huang (2014); Whitehead et al. (2000); Landry & Liu (2009). Marvasti (2010) on the other hand, found significant effect of travel cost to the substitute site, but income was not found to have a significant effect.

In this paper, the particular field of interest was to value the recreational benefits of Bore and Hellestø beaches, and determine whether an environmental deterioration had any effect on demand. The techniques used and findings presented here should be of particular interest to economists and policymakers for several reasons. First, due to the limitations of RP methods to value quality changes, this research includes SP data to find the reduction in recreation value caused by an oil spill, and an activity restriction in the sand dunes. The use of RP data combined with SP data could improve the quality of estimates, as compared to only RP or SP data (Adamowicz et al., 1994).

A second contribution to the empirical literature is that this is one of few papers that researches the effect of an environmental deterioration, as opposed to an improvement. All four models in this paper show a reduction in welfare due to the two hypothetical scenarios. According to model 1 and 3 both scenarios have approximately equal impact on consumer welfare, while model 2 and 4 indicate that the sand dune scenario has much less effect than the oil spill scenario. Model 4, which was chosen as the most appropriate model, gives estimates of NOK 1855.71 from the sand dune scenario and NOK 4233.29 from the oil spill scenario. Thus, a hypothetical sand dune scenario would lead to a reduction in annual welfare of NOK 1855.71. In the case of a hypothetical oil spill, the reduction in CS would be more than twice as much as with hypothetical activity restrictions in the sand dunes. An oil spill would cause severe damage to the beach and wildlife, whereas the activity restriction would merely force users to walk elsewhere. An oil spill would also cause a beach closure during the cleanup face, causing the recreational value to decline. Many of the consumers only use the marked trails that lead to the beach, and then walk along the sea. For those consumers the activity restriction in the sand dunes would have zero effect on recreation demand.

Lastly, this is one of few studies valuing recreation in Norway. The corrected fixed effect Poisson model provides a per trip CS of NOK 302.53. With an average group size of 2.36, CS per person per trip is calculated at NOK 128.19. Bui & Sæland (2017) found a CS of NOK 112.51 in their study of two different beaches at Jæren. The CS estimates from these two Norwegian studies are lower than most CS estimates found in the international beach recreation literature reviewed (Fleischer & Tsur, 2003; Landry et al., 2011; Landry & Liu, 2009; Rolfe & Gregg, 2012; Whitehead et al., 2008; Whitehead, Haab & Huang, 2000; Zhang et al., 2015).

This low welfare estimate in Norway compared to other countries can be for several reasons. Norway is known for its beautiful natural surroundings with a lot of beaches, waters, mountains and other recreational sites easily accessible. With so many possibilities and substitutes, the locals may travel more often to the beaches nearby. The visitor frequency will therefore be higher and the chance of meeting these respondents will increase. This in turn will result in a lower CS than countries where there may be fewer accessible recreation sites, and where people need to travel far to get to a nice site.

10.1 Limitations

As with all empirical models, the results in this paper depends on previous theory as well as researchers discretion. Assumptions and simplifications are made when choosing model input such as road fee and the value of time. It is therefore important to stay critical to some of the estimates since this could potentially lead to over- or underestimation. For this paper, the opportunity cost of time was calculated as one third of the wage rate. This assumption may cause over- or underestimation if it is not consistent with how the consumers value time. For instance, different users may have different preferences causing the time value to vary among them. Martínez-Espiñeira & Amoako-Tuffour (2008) states that the estimate is improved when allowing the opportunity cost of time to vary depending on consumer preferences. They also argue that for many users, the opportunity cost of time is generally much lower than one third of the wage rate, causing CS estimates to be overestimated.

Another assumption that was made is that all users passed at least one toll plaza on their way to the beach. Several of the most frequent visitors lived nearby and did not pass a toll plaza on their way to the beach. This would imply overestimated travel cost for those consumers, which in turn causes an upward biased CS estimate.

During the sampling period, several respondents had a problem with question 9 in the questionnaire. This question was not used for the estimation, and could easily have been dropped from the questionnaire. However, including the alternative to choose “not important”, as well as specifying the choices and attributes more thoroughly could have removed the problems associated with this question.

The hypothetical scenarios in the questionnaire also seemed problematic for some respondents. It clearly stated to write the number of (fewer/more) trips they would take in the case of the scenario. However, some checked the box for fewer trips instead of writing the number of fewer trips. This problem was to a less extent present for those who took the survey with them home. This could be due to the fact that those who filled out the questionnaire at home might have spent more time on reading it. Whereas those who filled it out on-site rushed it, and missed that part of the information. Making respondents take the questionnaire online, where numerical value could be forced, would remove this problem completely.

The data collection took place over a 10 day period, overlapping with the Easter holiday. This may imply higher contribution of the general population than at regular times. Workers generally have more leisure time during the holiday, which can then be used for recreational activities which may not normally be undertaken. The Easter holiday probably also led to a few non-frequent visitors with higher than average travel cost to be included in the sample.

10.2 Implications for Future Work

The results derived above provides an estimate of the value provided by two of the Jæren beaches. To ensure optimal decision-making and resource allocation, this paper provides valuable information regarding consumers' demand for recreation. They also estimate the economic impacts from oil spill, and the effect of a policy restricting movements in the sand dunes at certain areas of the beaches.

This paper only measures the use values associated with a recreational beach day. Future research might be interested in estimating the non-use values associated with the beaches. Beaches provide several other values than recreational use value, such as bequest value, option value and existence value. To get an accurate measure of the total economic value provided by Bore and Hellestø beaches, it might be interesting to capture these values in the estimation results as well.

For further research it might have been interesting to use the stacked RP-SP econometric models for site-frequency demand estimation explored by Landry & Liu (2009). These models include Multivariate Poisson-Gamma (MPG), Random Effects Negative Binomial (RENB), Multivariate Poisson-Lognormal (MPLN) and Discrete Factors Method (DFM). In this paper the MPG is used, also referred to as FE Poisson. However, it could be of interest to estimate recreational benefits using the remaining three models as well. Unlike other RE count data models the RENB model uses a common factor to the conditional dispersion, instead of an additive common factor to the conditional mean trips. Some other characteristics of RENB is that dispersion is allowed to vary randomly across individuals, while cross-equation correlations for an individual is not allowed. MPLN and DFM, on the other hand, are more flexible models when it comes to the three factors discussed. Applying these four different models in one future study could be of interest to see if there would be differences in the results.

The limitations of this research provides valuable building blocks for potential improvements in further research on the topic. Another noteworthy addition to future work could be an off-site study, as opposed to the on-site survey utilized in this paper. On-site surveys only target current users, whereas a general survey would capture the preferences of the general population. It would also include future or past users. Lastly, the time scope of this assignment was rather narrow, thereby causing the data collection period to be rather short. A longer time frame for data collection would improve estimates and potentially reduce bias in the sample.

11. Conclusion

This study combines the TCM and CB questions in order to estimate the recreational value of Bore and Hellestø beaches. Two hypothetical scenarios are included to measure the possible effect of an environmental deterioration. The random- and fixed effects Poisson model was applied in the analysis, which are two preferred models of count data for recreational valuation. A panel data approach, which stacks observations, was implemented. This allowed observations from CB questions to be combined with observations of actual behaviour from the same individual.

The regression results presented in this paper is in consistence with economic theory. The beach recreation sites have a falling demand curve. There is a lack of evidence to support that Bore and Hellestø beaches are normal goods, and that the travel cost to a substitute site affects trip demand. However, with more respondents both these variables would likely have been significant and the coefficients would have the expected signs.

The mean CS was estimated at NOK 302.53 per trip or NOK 128.19 per person per trip. This result is showed to be lower than most beach recreation studies from other countries. The two hypothetical scenarios had a negative effect on consumer welfare, as to be expected in the case of an environmental deterioration. A hypothetical oil spill and hypothetical restrictions in the sand dunes will lead to both an inward shift and rotation of the demand curve. The scenario that had the greatest effect on welfare was the hypothetical oil spill. A loss in mean annual CS of NOK 4233.29 per group was found in the case of a hypothetical oil spill, whereas a hypothetical activity restriction in the sand dunes led to a mean CS loss of NOK 1855.71.

The estimated recreational benefits provided by Bore and Hellestø beaches reveal use values and preferences that provide helpful information to managers of local beaches. The lost consumer welfare caused by a hypothetical oil spill or a hypothetical policy restriction could serve as useful information in a cost-benefit analysis. In the context of non-market valuation, this paper contributes with the estimation of recreational benefits, and analyzing demand for two Norwegian beaches. The results found here provides important information, and represents grounds for comparison for future research on the topic.

12. References

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Appendix 1: Literature review

Table 9: Literature review.

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Adamowicz, Louviere & Williams (Journal of Environmental Economics and Management, 1994)	Southwestern Alberta, Canada.	Estimates the economic benefit of improvement in environmental quality associated with flow scenarios for two rivers.	Combining RP and SP methods. Discrete choice models based on random utility theory, choice experiment.	*RP model*; multinomial logit. *SP model*; conditional logit models. *Joint estimation*; maximum likelihood process.	Telephone survey.	*SP model*: from $4,33 to $8.06 per trip. *RP model*: from $0,46 to $3,99. *Joint model*: from $0,21 to $4,15.
Agnello & Han (Marine Resource Economics, 1993)	Long Island in New York, USA.	Exploring the problems of site definition and substitution, and determining CS and the marginal value of catch for individual recreational anglers.	TCM	Semilog model.	On-site survey.	*CS without substitution:* $22.23 per trip. *CS with substitution*: $18.20 - $19.32 per trip.
Alberini, Zanatta, & Rosato (Ecological Economics, 2007).	Lagoon of Venice, Italy.	Estimates the value of sports fishing in the Lagoon of Venice. Looks at different scenarios with improved catch rate and higher prices.	Combining single-site TCM and CB method.	GLS	Mail survey.	Aggregate CS of €3.4 million at current conditions, and surplus change of €2.4 million/year if catch rates improve.
Amoako-Tuffour & Martínez-Espiñeira (Journal of Applied Economics, 2012).	Gros Morne National Park, Canada.	Examines how estimates of the value of travel time to recreational sites affect the efficiency of the estimation of recreation demand models and the size of estimates of CS.	Individual TCM.	NBM	On-site survey.	CS per persontrip: $403.11-$581.67.
Anderson & Plummer (Northwest Fisheries Science Center, 2017).	Puget Sound in Washington, USA.	Estimates the demand for recreational trips, quantifying the economic value lost to harvesters when beaches are closed due to pollution or biotoxins.	Individual TCM and CB.	NBM	Mail survey.	*Daily WTP*: $128. *Annual WTP*: $386 to avoid a pollution closure.
Andersson (Ecological Economics, 2006).	Zanzibar and Mafia islands, Tanzania.	Measures the welfare loss of an ecological damage at an internationally visited recreational site.	CVM and TCM.	Probit, truncated regression, OLS.	On-site survey.	*SP*: WTP 300 USD less for access to Zanzibar and 110 USD less to Mafia, after the bleaching of the reefs. *RP*: Annual loss due to coral bleaching: USD 254-1780 per visitor (mean).

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Ballance, Ryan & Turpie (South African Journal of Science, 2000).	Cape Peninsula, South Africa.	Measures the value of clean beaches to users and the socioeconomic impacts of beach litter on the region.	TCM and CB.	Statistical analysis. No regression reported.	On-site survey.	Total annual recreational value is between R3 million and R23 million.
Beal (Review of Marketing and Agricultural Economics, 1995)	Queensland, Australia.	Measures the value of the recreational use of the Carnavon Gorge National Park.	TCM	Multiple linear regression, OLS.	Postcards to selected campers.	CS of $2.4m.
Bell (Florida Coastal Environmental Resources, 2002).	Treasure Island Beach on the Gulf of Mexico, North America.	Estimates the dollar damages of the oil spill on residents who would normally have used the affected beaches but incurred additional costs to travel elsewhere.	RUM	No regression, secondary data.	Telephone survey.	Average damage estimate of $22.75 per visit.
Bell & Leeworthy (Journal of Environmental Economics and Management, 1990).	Florida, USA.	Measures the CS of a beach day, dealing with tourists that come from significant distances to use principally beach resources.	Alternative approach to the TCM (modified Pearse-Gibbs-Green model).	OLS	Face-to-face interviews.	Daily CS of $33.91 per person.
Biervliet, Roy & Nunes (2006).	The Belgian North Sea coast.	Estimates the loss of non-use values resulting from different oil spill scenarios along the Belgian Coast.	CVM	Turnbull likelihood estimation approach. Logit regression model.	Random route sample drawing.	Welfare loss ranges from 120 million Euro to 606 million Euro. Average WTP varies from 88 Euro to 112 Euro per household.
Bin et al. (Marine Resource Economics, 2005).	North Carolina, USA.	Provides estimates of CS for two user groups and seven beaches in North Carolina.	Individual single-site TCM.	Poisson	On-site survey.	CS ranges between $11 and $80 for those who make day trips and between $11 and $41 for users that stay onsite overnight.
Blackwell (Economic Analysis & Policy, 2007).	Queensland, Australia.	Values a recreational visit to surf beaches within the local urban setting of Mooloolaba beach.	Individual TCM.	OLS, Poisson and NBM.	On-site survey.	CS of $119,95 per person. Annual benefits of $862 million.

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Cameron (Land Economics, 1992).	USA.	Estimates jointly both the parameters of the underlying utility function and its corresponding ordinary demand function. (The nonmarket demand for access to recreational fishery).	TCM and CVM.	Discrete choice model. Probit model.	In-person survey.	Mean EV for a complete loss of access is $3,451. For an across-the-board 10 percent reduction in fishing days, average utility loss is $35. Sample mean CV for a complete loss of access is $3.560.
Cameron et al. (Journal of Agricultural and Resource Economics, 1996).	The Columbia River Basin, North America.	Develops the recreation demand model for nine specific waters to determine the role of water levels in determining participation at and frequency of trips taken to various federal reservoirs and rivers.	Individual TCM and the use of CB data.	Probit model with panel data.	Mail survey.	CS varying from about $13 to $99 (monthly amounts).
Carson et al. (Environmental and Resource Economics, 2003).	USA.	Develops a valid survey instrument to measure lost passive use values due to the natural resource injuries caused by the Exxon Valdez oil spill.	CVM	The Turnbull nonparametric approach and the Weibull spike model.	Face-to-face interviews.	*Turnbull*: Lower-bound mean WTP: $53.60. Aggregate lost passive use: 4.87 billion dollars. *Weibull*: Maximizing the likelihood function gives mean WTP: $97. Aggregate lost passive use: 7.19 billion dollars.
Chen et al. (China Economic Review, 2004)	Eastern coast of Xiamen Island, China.	Values the recreational benefits of a beach along the eastern coast of Xiamen.	Zonal TCM.	Multiple linear regression, OLS.	On-site survey.	Per visitor, per visit CS: $16.9. Aggregate recreational benefits: $53.5 million.
Curtis (Journal of Environmental Planning and Management, 2003).	Ireland.	Examines the demand for water-based leisure activity in Ireland. Focuses on the demand for day-trips in sea angling, boating, swimming, and other beach/sea trips.	TCM	Poisson	Telephone survey.	TNB mean CS per person ranges from £8.91 for boating to £57.28 for swimming.

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Cushman et al. (Tourism Economics, 2004).	Southern Thai Island, Thailand.	Documents the extent of the congestion and resource degradation effects produced and experienced by tourists visiting Southern Thai Island.	RUM	Logistic regression model.	On-site survey.	Small increase in trash on the beach gives an aggregate welfare loss of $2.25 million for the entire group. Increased noise gives an aggregate loss of $68.68 million.
Deacon & Kolstad (Journal of Water Resources Planning and Management, 2000)	-	Reviews methods that can be used to estimate the loss in use value associated with saltwater beach recreation in the case of an environmental accident such as an oil spill.	-	-	-	The literature on valuing beach recreation places the value of a beach day in the $1-$4 range.
Eisworth et al. (Water Resources Research, 2000).	Great Basin in western Nevada, USA.	Estimates recreation values for preventing a decline in water levels at a large western lake that is drying up. Researching hypotetical scenarios with different changes in water levels.	A pooled RP (TCM) and CB model.	Pooled poisson models.	Mail survey.	CS of $88 per trip (includes CB variables in the model). CS of $120 per trip (omits the CB variables). CS loss of $12-$18 per person per year for each 1-foot drop in water level.
Englin & Cameron (Environmental and Resource Economics, 1996).	Nevada, USA.	Proposes CB survey questions as a valuable supplement to observed data in travel cost models of non-market demand for recreational resources.	TCM and CB.	Standard and fixed effects poisson model.	Mail survey.	*Standard Poisson:* Pooled model: seasonal CS of $1104. Differentiated model: CS is $1205 (using CB data) and $2865 (using OB). *Fixed effects Poisson*: Pooled model: CS of $1082. Differentiated model: CS is $1152 (using CB) and $752 (using OB).
Fezzi, Bateman & Ferrini (Journal of Environmental Economics and Management, 2014).	Italy.	Estimates the value of travel time to recreation sites.	Individual TCM.	Nested logit model. Mixed logit model.	On-site survey.	Average value of travel time: between €8.4/h and €9.4/h, or around 3/4 of the average wage rate.
Fleischer & Tsur (Journal of Agricultural Economics, 2003).	Israel.	Estimates the recreational value of three types of open spaces (beaches, urban parks and national parks) in Israel.	RUM	Multinominal logit model. Nested multinominal logit model.	Telephone survey.	Average CS per beach trip: NIS 106.50 (MNL model) and NIS 82.10 (NMNL model).

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Fleming & Cook (Tourism Management, 2008).	Fraser Island, Australia.	Estimates the recreational use value of Fraser Island and Lake McKenzie for Australian-resident, independent visitors.	Zonal TCM.	Multiple linear regression, OLS.	Surveys with pre-paid self-addressed envelopes attached.	CS of $1461.73 per-person per-visit for Fraser Island. CS of $243 per-person per-visit for Lake McKenzie.
Hausman, Leonard & McFadden (Journal of Public Economics, 1995).	Alaska, USA.	Estimates the welfare losses suffered by recreational users due to the Exxon VaMez oil spill.	A utility-consistent, combined discrete choice and count data model.	Multinominal logit model and nested multinominal logit model.	Large-scale survey (telephone and mail).	*MNL model*: CS per trip ranges from $49 to $227. Recreational use loss due to the spill: about $4 million. *NMNL model:* CS per trip ranges from $148 to $402. Welfare loss: about $3.1 million.
Huang (Agricultural Economics, 2017).	Tien-Wei Highway Garden in Taiwan.	Measures environmental effects and recreational benefits under different hypothetical scenarios with quality improvements.	TCM and CB. A panel recreation demand model with pooled data.	Poisson	On-site survey.	Aggregated CS: NT$ 62,263 million. Improved quality increases CS with NT$ 11,63 billion.
Huang, Poor & Zhao (Marine Resource Economics, 2007).	States of New Hampshire and Maine, USA.	Obtains invidividual choices of beach erosion control programs that can potentially cause multiple effects on beach environment.	Choice-based conjoint analysis.	The conditional logit and mixed logit models.	Mail survey.	-
Huhtala & Lankia (Journal of Environmental Planning and Management, 2012).	Finland.	Estimates the extent of the recreation benefits obtained from visits to second homes.	TCM	NBM	Mail and online survey.	The recreation value: €170-205 per trip. The aggregate non-market benefits of the use of the current summer home stock of €500 million per annum.
Hynes & Greene (Journal of Agricultural Economics, 2016).	Weast coast of Ireland.	Analyses revealed and contingent recreational trip decision-making of a group of beachgoers.	Individual TCM.	Random parameters NBM. Latent class NBM.	On-site survey.	Mean CS per trip is estimated with 95% confidence to be between €18.97 and €69.24.
Hynes & Greene (Land Economics, 2013).	Silverstrand Beach, Ireland.	Study of recreational demand at Silverstrand Beach.	Individual TCM and CB.	Latent class NBM.	On-site survey.	Mean CS per trip for latent class corrected NB model is with 95% confidence between €16.93 and €27.21.

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Kragt, Roebeling & Ruijs (Agricultural and Resource Economics, 2009)	Great Barrier Reef, Australia.	Estimates the effect of reef degradation on demand for recreational dive and snorkel trips.	Individual TCM and CB.	NBM	On-site survey.	CS: A$185 per trip.
Kuriyama, Hilger & Hanemann (Environmental Resource Economics, 2013).	Southern California, USA.	Estimates the CV associated with a decrease or an increase in expected catch rates for a recreational shoreline sportfishing trip.	RUM	Logit model.	Choice-based on-site survey.	*CV of a 50% decrease in expected catch rates*: -$2.80 per angling trip. *CV of a 50% increase in expected catch rates*: $3.54 per trip.
Landry & Liu (Journal of Environmental Economics and Management, 2009).	North Carolina, USA.	Estimates RP and SP beach recreation demand simultaneously.	Individual TCM and CB.	Discrete factor method. NBM.	Telephone survey.	*Annual CS for RP demand:* $1521.35. *Annual CS for SP demand*: $2076.84 for current conditions, $2738.03 for improved beach access, and $2279.83 for increased beach width.
Landry et al. (Marine Resource Economics, 2016).	Cape Hatteras National Seashore, USA.	Examines economic value and economic impacts of visitors to Cape Hatteras National Seashore.	TCM	NBM	On-site survey.	*Poisson*: CS of $329 per trip (uncorrected model) and $362 (avidity corrected model). *NB2:* CS of $398 (uncorrected) and $403 (avidity-corrected). *GNB*: CS of $1,171 (uncorrected) and $9,483 (avidity-corrected).
Landry et al. (Resource and Energy Economics, 2011).	The northeastern coastal counties in North Carolina, USA.	Examines the impact of offshore wind turbines on local coastal tourism and recreation for residents of the northeastern coastal counties in North Carolina.	TCM, combining RP and SP methods. RUM.	Random effects Poisson model.	Telephone and web survey.	*CS, RP data*: $1082 per household per year, or $94 per trip. *CS, SP data:* $1068 per household per year, reduced to $1051 under the wind scenario.

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Landry, Keeler & Kriesel (Marine Resource Economics, 2003)	Tybee Island in Georgia, USA.	Researches the relative economic efficency of three beach erosion management policies.	Choice experiments.	Logistic regression.	On-site survey with a follow-up postcard.	Daily mean marginal WTP: Similar shoreline armoring: $6.75. Minimal shoreline armoring: $8.45. Minimal shoreline armoring (beach nourishment): $9.92. Minimal shoreline armoring (retreat policy): $9.08.
Lew & Larson (Coastal Management, 2005a)	San Diego, California, USA.	Values recreation and amenities at San Diego County Beaches.	RUM	Mixed logit model.	Telephone-mail-telephone survey.	Value of a beach day: $28.27 per trip.
Loureiro & Loomis (Environmental and Resource Economics, 2013).	Spain, UK and Austria.	Focuses on economic valuation of the environmental damages caused by the prestige oil spill to three European countries in terms of their passive use values lost.	CVM	Logit model.	Online survey.	Mean WTP in Spain is about 124.37€ per household, 80.87€ per household in the UK, and 89.08€ per household in Austria.
Martínez-Espiñeira & Amoako-Tuffour. (Environmental management, 2008).	Gros Morne National Park, Canada.	Examines the consequences of allocation travel costs to a recreational site when the trip was really a multiple purpose/destination trip.	Individual TCM.	NBM	On-site survey.	CS per trip ranging from $1,734 to $2,528.
Marvasti (Ocean and Coastal Management, 2013).	Galveston Island in Texas, USA.	Estimates the parameters of a single site recreation demand model for visiting a beach.	Zonal TCM.	Poisson. NBM.	On-site survey.	-
Parsons (2008).	Texas Gulf coast, America.	Estimates economic values in monetary and non-monetary terms for beach closures that may result from an oil spill.	RUM	Mixed logit model.	Phone-mail-phone survey.	Estimated mean per trip losses of $10.03 for all six beaches.

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Parsons & Massey (The New Economics of Outdoor Recreation, 2003).	Mid-Atlantic region of USA.	Values losses associated with beach closures and beach erosion.	RUM	A simple multinomial and a mixed logit model.	Mail survey.	Beach closure due to hypothetical oil spill at the largest beach; mean loss of $5.27 per person per trip. Loss scenario involving beach erosion: Northern beaches loss of $1,46 and for the Bethany group the loss is $0.73.
Parsons et al. (Marine Resource Economics, 2013).	Delaware, USA.	Combines RP and SP data to value beach width for recreational use in Delaware.	Pooled single-site TCM.	Poisson	On-site survey.	CS loss for narrowing beaches to a quarter current width: $5.00 per day. Gain from widening to twice current width: $2.75 per day. Annual access value at all seven beaches: $1,756,000.
Poor & Breece (Journal of Environmental Planning and Management, 2006).	Chesapeake Bay, USA.	Estimates welfare measures for charter fishing participants with regard to a hypothetical improvement in water quality.	Individual TCM and CB.	Truncated Poisson count model.	On-site survey.	Average individual CS model 1 (travel time cost based on income is included): $200. Individual CS model 2 (not included): $117. Individual CS for improved water quality is $75 for model 1 and $44 for model 2.
Prayaga (Economic Analysis and Policy, 2016).	The Great Barrier Reef Marine Park, Australia.	Estimates the recreational use value of beaches for the locals.	TCM	NBM. Latent class model.	Telephone survey.	CS per person (Latent class 1): $14.09. CS per person (Latent Class 2): $9.36
Preez, Lee & Hosking (Economics and Econometrics, 2011).	Nelson Mandela Bay beaches, South Africa.	Estimates welfare measures for the loss of access to Blue Flag status beaches and relative value of selected features of the Nelson Mandela Bay beaches.	RUM	Conditional logit and nested logit models.	Personal interviews.	The total recreational value of Blue Flag loss for all the beaches: R55 264 539.

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Richardson & Loomis (Ecological Economics, 2004).	Rocky Mountain National Park in Colorado, USA.	Estimates the impact of climate change on national park visitation and to test for the relative significance among climate scenarios and resource variable.	Contingent visitation.	OLS	Mail survey.	-
Rolfe & Gregg (Ocean & Coastal Management, 2012).	The Queensland coast, Australia.	Estimates recreation values for beaches over approximately 1400 km of coastline, and studies the impacts on the values from a hypothetical decline in water quality.	Individual TCM and CB.	NBM	Web-based survey.	The value of a single beach visit: $35.09 per person. Beach recreation values per annum: $587.3 million.
Rosenberger & Loomis (Growth and Change, 1999).	Routt County in Colorado, USA.	Measures the benefits to tourists associated with ranch open space in a resort area in Colorado.	TCM. CB model.	Random effects Poisson.	On-site survey.	Average CS per group-trip: $1,132, with existing ranch open space.
Silberman, Gerlowski & Williams (Land Economics, 1992).	New Jersey, USA.	Estimates the existence value for respondents who intend to use the beach to be nourished and those who do not.	CVM	Tobit model.	On-site and telephone survey.	-
Vesterinen et al. (Journal of Environmental Management, 2010).	Finland.	Models recreation participation and estimates the benefits of water quality improvements. Estimates the CS of a water recreation day.	Hurdle model. TCM.	NBM	Telephone and mail survey.	CS ranges from €6.30 to €18.98, depending on which travel cost measure used.
Voltaire et al. (Applied Economics, 2017)	Mont-Saint-Michel in France.	Values recreational trips to Mont-Saint-Michel.	Zonal TCM.	Poisson model with robust Ses.	On-site survey.	*CS when excluding opportunity cost of time*: €183. *CS with OCT*: €204. *Aggregate CS*: €154 mill (ex. OCT) and €172 (with OCT).

Paper	Location	Research	Valuation Method	Econometric Method	Survey	Result
Whitehead et al. (Marine Resource Economics, 2008)	North Carolina, USA.	Estimates the demand for beach recreation using both RP and SP data in order to estimate the benefits of improvements in beach access and beach width.	Single-site TCM. Contingent valuation method.	Poisson	On-site and telephone survey.	*CS per trip under status quo*: $90. *Parking improvements*: increase in CS per trip of $25. *Increase in beach width*: increase in CS per trip of $7.
Whitehead et al. (Marine Resource Economics, 2011).	North Carolina, USA.	Values the economic costs of bag limits incurred by anglers on charter boat trips.	A joint RP and SP demand model.	Fixed effects Poisson model.	On-site survey with a follow-up telephone survey.	The WTP per angler per trip: $273. The WTP per angler per trip to avoid a one-fish reduction in the snapper-grouper bag limit: $10.
Whitehead, Haab & Huang (Resource and Energy Economics, 2000)	North Carolina, USA.	Combining revealed and stated behavior estimation method to measure recreation benefits of fixed quality improvement.	Panel recreation demand model .	Poisson	Telephone survey.	*CS current quality*: $64.14 per trip. *CS improved quality*: $84.99 per trip.
Zhang et al. (Ecosystem Services, 2015).	Gold Coast, Australia.	Estimates the recreational use value of Gold Coast beaches.	Individual TCM.	NBM	On-site survey.	Value of a single beach visit: $19.47 per person. $402 million per year for residents. $117 million per year for visitors.

Appendix 2: Questionnaire

JÆRSTRENDENE
Hva synes du?

DINE MENINGER ER VIKTIGE!

Takk for at du hjelper oss med denne spørreundersøkelsen, som er en del av et forskningsprosjekt om kystsoneforvaltning finansiert av Norges Forskningsråd og utført av Universitetet i Stavanger. **Temaet for spørreundersøkelsen er nærmere bestemt hvilket forhold folk her i området har til strendene på Jæren.**

Svarene du gir oss kan gi lokale og nasjonale myndigheter en bedre forståelse av folks bruk av og holdninger til vern av strendene på Jæren, og dermed bidra til en mer helhetlig forvaltning av kystsonen.

Vi er kun interessert i dine erfaringer og meninger. Det finnes ingen riktige eller uriktige svar. Som deltaker i undersøkelsen er du helt anonym. Vi er hovedsakelig interessert i sammenfatninger av svarene over alle respondentene.

Det vil ta deg rundt 15 minutter å svare på alle spørsmålene i undersøkelsen. *Det er viktig at alle som blir invitert til å delta i spørreundersøkelsen - både de som er interessert i temaet og de som ikke er det - svarer så* ***fullstendig*** *på undersøkelsen som mulig.*

Ta gjerne kontakt skulle du ha spørsmål angående dette spørreskjemaet eller forskningen vår generelt. **På forhånd, takk for din deltakelse!**

Med vennlig hilsen,

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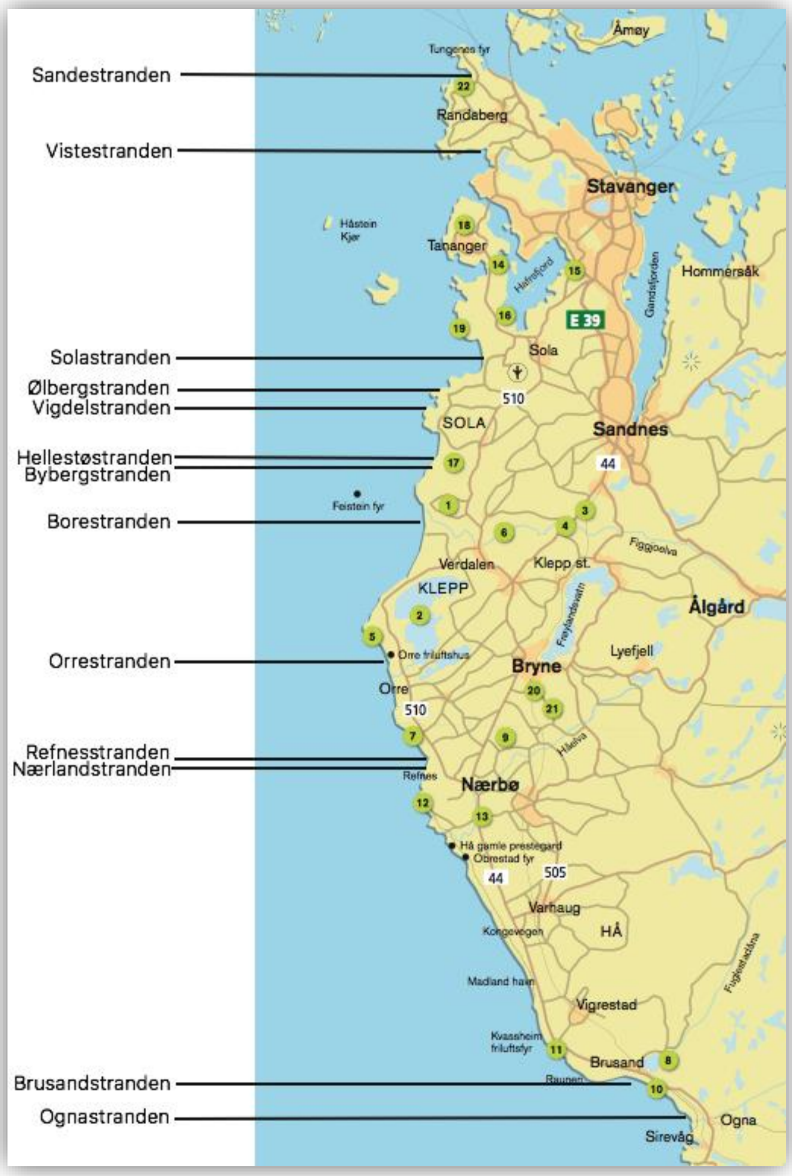
OM DAGENS STRANDTUR

1. **Hvilken strand er du på NÅ? Vennligst oppgi den stranden du var på sist hvis du svarer på spørreundersøkelsen hjemmefra.** *[Kryss av den det gjelder i listen under kartet.]*



O SANDE
O VISTE
O SOLA
O ØLBERG
O VIGDEL
O HELLESTØ
O BYBERG
O BORE
O ORRE
O REFSNES
O NÆRLAND
O BRUSAND
O OGNA
O ANNEN STRAND, vennligst oppgi: ______________________________________

2. **Hvilket postnummer og poststed kom du fra på denne strandturen?**

POSTNUMMER: ______ POSTSTED: ______________

3. **Når du teller med dagens tur, hvor mange ganger har du vært på <u>den stranden du er på nå</u> (eller den du var på sist) i løpet av <u>den siste måneden, altså de siste 30 dagene</u>?** *[Vennligst oppgi tall i boksen nedenfor.]*

____ TURER

4. **Omtrent hvor mange ganger var du på <u>den stranden du er på nå</u> (eller den du var på sist) <u>i fjor, altså gjennom hele 2017</u>?** *[Vennligst oppgi tall i boksen nedenfor.]*

____ TURER

5. **Hvor sikker er du på at det antallet turer du oppga for i fjor (2017) er korrekt?** *[Kryss av ett alternativ.]*

VELDIG USIKKER				HELT SIKKER
1.	2.	3.	4.	5.
○	○	○	○	○

6. **Omtrent hvor mange turer hadde du til hver av de andre strendene i fjor, altså gjennom hele 2017?** *[Vennligst gi oss dine beste anslag i boksene nedenfor, og fyll inn «0» for de strendene du IKKE besøkte i 2017.]*

___ SANDE	___ BORE
___ VISTE	___ ORRE
___ SOLA	___ REFSNES
___ ØLBERG	___ NÆRLAND
___ VIGDEL	___ BRUSAND
___ HELLESTØ	___ OGNA
___ BYBERG	___ ANDRE STRENDER

7. **Omtrent hvor mange turer forventer du å ta til <u>den stranden du er på nå</u> (eller den du var på sist) <u>i inneværende år, altså i løpet av hele 2018</u>?** *[Vennligst gi oss ditt beste anslag i boksen nedenfor.]*

____ TURER

8. **Hvor viktig er de følgende faktorene for deg når du skal dra på tur til Jærstrendene?** *[Vennligst sett ett kryss for hver av faktorene nedenfor, «kort vei hjemmefra» osv.]*

	1 = Helt uviktig	**2**	**3**	**4**	**5 = Svært viktig**
Kort vei hjemmefra	☐	☐	☐	☐	☐
Parkeringsmuligheter	☐	☐	☐	☐	☐
Kvalitet på stier	☐	☐	☐	☐	☐
Barnevennlig	☐	☐	☐	☐	☐
Lite folk	☐	☐	☐	☐	☐
Tilgjengelige toaletter	☐	☐	☐	☐	☐
Åpen kiosk/snacksutsalg	☐	☐	☐	☐	☐
Lite forurensning/avfall	☐	☐	☐	☐	☐
Mulighet for vannsport	☐	☐	☐	☐	☐
Uberørt natur og dyreliv	☐	☐	☐	☐	☐

9. **Hva synes du om <u>stranden du er på nå</u> (eller den du var på sist) med tanke på disse faktorene?** *[Vennligst sett ett kryss for hver av faktorene nedenfor, «kort vei hjemmefra» osv.]*

	1 = Veldig dårlig	**2**	**3**	**4**	**5 = Svært bra**
Kort vei hjemmefra	☐	☐	☐	☐	☐
Parkeringsmuligheter	☐	☐	☐	☐	☐
Kvalitet på stier	☐	☐	☐	☐	☐
Barnevennlig	☐	☐	☐	☐	☐
Lite folk	☐	☐	☐	☐	☐
Tilgjengelige toaletter	☐	☐	☐	☐	☐
Åpen kiosk/snacksutsalg	☐	☐	☐	☐	☐
Lite forurensning/avfall	☐	☐	☐	☐	☐
Mulighet for vannsport	☐	☐	☐	☐	☐
Uberørt natur og dyreliv	☐	☐	☐	☐	☐

10. Hva pleier du å gjøre når du er på Jærstrendene? *[Velg opptil fire aktiviteter.]*

- ☐ Soling og bading
- ☐ Jogging
- ☐ Kiting
- ☐ Camping
- ☐ Surfing
- ☐ Fiske
- ☐ Se på fugle- og planteliv
- ☐ Gå tur med hund(er)
- ☐ Turgåing
- ☐ Avslapping (lunsj, bål, piknik, grilling, nyte naturen/landskapet)
- ☐ Annet, vennligst oppgi: ___________________________________

11. Hva var hovedaktiviteten(e) på strandturen i dag (eller den du var på sist)? *[Velg opptil to aktiviteter.]*

- ☐ Soling og bading
- ☐ Jogging
- ☐ Kiting
- ☐ Camping
- ☐ Surfing
- ☐ Fiske
- ☐ Se på fugle- og planteliv
- ☐ Gå tur med hund(er)
- ☐ Turgåing
- ☐ Avslapping (lunsj, bål, piknik, grilling, nyte naturen/landskapet)
- ☐ Annet, vennligst oppgi: ___________________________________

12. Hvor fornøyd er du alt i alt med denne strandturen? *[Kryss av ett alternativ.]*

VELDIG MISFORNØYD				VELDIG FORNØYD
1.	2.	3.	4.	5.
○	○	○	○	○

NOEN FLERE SPØRSMÅL OM DAGENS STRANDTUR

13. Strandturen var......*[Kryss av ett alternativ.]*

- ○ DET ENESTE FORMÅLET da jeg reiste hjemmefra i dag.
- ○ HOVEDFORMÅLET da jeg reiste hjemmefra i dag.
- ○ ETT AV FLERE FORMÅL da jeg reiste hjemmefra i dag.

14. Omtrent hvor mange kilometer måtte du reise (en vei) for å komme deg til <u>den stranden du er på nå</u> (eller den du var på sist)? *[Vennligst gi oss ditt beste anslag på reisedistanse.]*

[____] KILOMETER (en vei)

15. Omtrent hvor lang tid tok det å komme deg til stranden (en vei)? *[Vennligst gi oss ditt beste anslag på reisetid.]*

[____] TIMER & [____] MINUTTER (en vei)

16. Hvilket transportmiddel brukte du for å komme deg til stranden? *[Vennligst kryss av ett alternativ.]*

- ○ DIESELBIL
- ○ BENSINBIL
- ○ ELBIL / HYBRIDBIL
- ○ TOG
- ○ BUSS
- ○ SYKKEL
- ○ GIKK TIL FOTS
- ○ Annet, vennligst spesifiser: ______________________________

17. Hvor lenge kommer du til å være (eller var du) på stranden? *[Vennligst gi oss ditt beste anslag på besøkslengde.]*

[____] TIMER & [____] MINUTTER

18. Hvem er/var du sammen med på stranden? *[Kryss av ett alternativ.]*

- ○ FAMILIE
- ○ VENN(ER)
- ○ EKTEFELLE/PARTNER
- ○ KOLLEGA(ER)
- ○ ALENE
- ○ ANNEN, vennligst spesifiser: ________________________________

19. Hvor mange personer (inkludert deg selv) reiste du sammen med til stranden? *[Vennligst oppgi antall i boksen nedenfor.]*

[____] PERSONER

I DE NESTE SPØRSMÅLENE BER VI DEG BESKRIVE DIN BRUK AV JÆRSTRENDENE UNDER ULIKE ENDRINGER

20. **UTILGJENGELIGHET:** Hvilken strand ville du valgt å dra til om **stranden du er på nå** (eller den du var på sist) var **utilgjengelig**? *[Kryss av ett alternativ.]*

○ SANDE	○ VISTE	○ SOLA
○ ØLBERG	○ VIGDEL	○ HELLESTØ
○ BYBERG	○ BORE	○ ORRE
○ REFSNES	○ NÆRLAND	○ BRUSAND
○ OGNA		

○ ANNEN STRAND, vennligst oppgi: ____________________________________

○ ANNET FRILUFTSOMRÅDE, vennligst oppgi: __________________________

○ VILLE IKKE DRATT PÅ FRILUFTSTUR

21. **ØKT REISEKOSTNAD:** Se for deg at **reisen til den stranden du er på nå** (eller den du var på sist) **kostet deg dobbelt så mye som normalt** (for eksempel som følge av økte bomavgifter og/eller dyrere drivstoff).

Hvor mange **færre** (eller flere) turer til denne stranden ville du da ha tatt i løpet av et år?

____ **FÆRRE** ÅRLIGE TURER

____ **Flere** årlige turer

○ **Uforandret** antall årlige turer

*Vennligst oppgi endring i antall turer med et **tall** i relevant boks (eller kryss av for uforandret).*

22. **ØKT REISETID:** Se for deg at **reisen til den stranden du er på nå** (eller den du var på sist) **tok deg dobbelt så lang tid som normalt** (for eksempel på grunn av endrede fartsgrenser og/eller veiarbeid).

Hvor mange **færre** (eller flere) turer til denne stranden ville du da ha tatt i løpet av et år?

____ **FÆRRE** ÅRLIGE TURER

____ **Flere** årlige turer

○ **Uforandret** antall årlige turer

*Vennligst oppgi endring i antall turer med et **tall** i relevant boks (eller kryss av for uforandret).*

FORBUD MOT FERDSEL I SANDDYNENE: På grunn av Jærstrendenes stadig stigende popularitet kan myndighetene komme til å innføre flere restriksjoner på bruken av enkelte strender. Formålet med slike restriksjoner vil være å beskytte dyrelivet på Jærstrendene samt å forhindre skade på sårbare plantearter og erosjon av sanddynene.

Se for deg at du fortsatt kunne benytte deg av **den stranden du er på nå** (eller var på sist), men at det - med unntak av på oppmerkede stier ned til sjøen - ble **forbudt å bevege seg i sanddynene**. Anta at ingen av de andre Jærstrendene ble påvirket.

23. Hvor mange **færre** (eller flere) turer til **denne stranden** ville du da ha tatt i løpet av året?

____ **FÆRRE** ÅRLIGE TURER

____ **flere** årlige turer

○ **Uforandret** antall årlige turer

*Vennligst oppgi endring i antall turer med et **tall** i relevant boks (eller kryss av for uforandret).*

24. Hvor mange **færre/flere** turer til **de andre strendene** ville du da ha tatt i løpet av året?

____ **FÆRRE** årlige turer til andre strender

____ **FLERE** årlige turer til andre strender

○ **Uforandret** antall årlige turer til andre strender

*Vennligst oppgi endring i antall turer med et **tall** i relevant boks (eller kryss av for uforandret).*

OLJEUTSLIPP: Hvert år passerer omtrent 10 000 store skip Jærkysten. Selv om skipsulykker er sjeldne, er de likevel en av de hyppigste årsakene til oljeutslipp. Et oljeutslipp langs Jærkysten kan få alvorlige følger for kvaliteten på fritidsaktiviteter langs kysten av Jæren, slik som turgåing, svømming, båtturer og fiske. I tillegg vil et oljeutslipp føre til skader på dyre- og fugleliv.

NESTEN PÅ GRUNN. Lasteskipet «Tide Carrier» fikk motorstopp utenfor Jærkysten i 2017.
Foto: Anders Fehn / NRK

Se for deg at oljeutslipp fra en skipsulykke førte til at **den stranden du er på nå** (eller den du besøkte sist) ble **stengt i fire måneder, fra mai til august i år (2018)**. <u>Anta at ingen av de andre Jærstrendene ble påvirket.</u>

25. Hvor mange **færre** (eller flere) turer til **<u>denne stranden</u>** ville du da ha tatt i løpet av året?

[____] **FÆRRE** ÅRLIGE TURER

[____] **flere** årlige turer

○ **Uforandret** antall årlige turer

*Vennligst oppgi endring i antall turer med et **<u>tall</u>** i relevant boks (eller kryss av for uforandret).*

26. Hvor mange **færre/flere** turer til **<u>de andre strendene</u>** ville du da ha tatt i løpet av året?

[____] **FÆRRE** årlige turer til andre strender

[____] **FLERE** årlige turer til andre strender

○ **Uforandret** antall årlige turer til andre strender

*Vennligst oppgi endring i antall turer med et **<u>tall</u>** i relevant boks (eller kryss av for uforandret).*

TIL SLUTT LITT DEMOGRAFISK INFORMASJON. *Svarene du gir oss på disse spørsmålene er bare for statistisk klassifisering, slik at vi kan forsikre oss om at utvalget av respondenter er representativt for den generelle befolkningen.*

27. Hva er ditt kjønn? *[Kryss av ett alternativ.]*

- ○ KVINNE
- ○ MANN

28. Hva er ditt fødselsår? ____________

29. Hva er ditt høyeste utdanningsnivå? *[Kryss av ett alternativ.]*

○ BARNESKOLE	○ HØYERE UTDANNING (1-4 år)
○ UNGDOMSKOLE	○ HØYERE UTDANNING (> 4 år)
○ VIDEREGÅENDE	○ ANNET, vennligst oppgi:____________________

30. Hva beskriver best din nåværende arbeidssituasjon? *[Kryss av ett alternativ.]*

○ JOBB FULLTID	○ PENSJONIST
○ JOBB DELTID	○ HJEMMEVÆRENDE
○ JOBBSØKER	○ STUDENT

○ ANNET, vennligst oppgi: ______________________________________

[Hvis du ikke er i jobb full-/ deltid på nåværende tidspunkt kan du nå hoppe til spørsmål 33 på siste side.]

31. Tar du deg noen gang fri fra jobb for å delta i utendørs fritidsaktiviteter? *[Kryss av ett alternativ.]*

- ○ JA
- ○ NEI

32. Hvor mange uker ferie pleier du vanligvis å ta ut i løpet av et år?

_____ UKER

33. Vennligst oppgi <u>postnummer</u> for ditt bosted:

POSTNUMMER FOR BOSTED: ______

34. Hvor mange medlemmer er det i din husstand (inkludert deg selv)? *[Bokollektiv regnes ikke som husstand.]*

______ MEDLEMMER

35. Hvor mange i din husstand er under 18 år?

______ BARN

36. Omtrent hva var totalinntekten for din husstand før skatt (brutto årsinntekt) i 2017? *[Vennligst kryss av det alternativet som passer best.]*

○ MINDRE ENN Kr 100 000
○ 100 000 - 300 000
○ 300 000 - 500 000
○ 500 000 - 700 000
○ 700 000 - 900 000
○ 900 000 - 1 100 000
○ 1 100 000 - 1 300 000
○ 1 300 000 - 1 500 000
○ 1 500 000 - 2 000 000
○ MER ENN Kr 2 000 000

37. Er du medlem i en organisert turforening, f.eks. Stavanger Turistforening (STF)? *[Kryss av ett alternativ.]*

○ JA
○ NEI

38. Er du medlem av en miljøorganisasjon? *[Kryss av ett alternativ.]*

○ JA
○ NEI

TUSEN TAKK FOR AT DU TOK DEG TID TIL Å SVARE PÅ DENNE SPØRREUNDERSØKELSEN!

Appendix 3: Tables

Table 10: Summary of CS (NOK) and elasticities under status quo, with 95% confidence interval.

Model Predictions	Model 1			Model 2			Model 3			Model 4		
	Mean	***95% LB***	***95% UB***	***Mean***	***95% LB***	***95% UB***	***Mean***	***95% LB***	***95% UB***	***Mean***	***95% LB***	***95% UB***
CS/trip - RP	430.65	243.61	617.70	293.44	186.16	400.72	445.54	242.19	648.88	302.53	186.39	418.67
CS/trip - SP	282.84	230.94	334.75	230.02	186.43	273.61	287.39	232.87	341.91	234.40	188.14	280.63
Annual CS - RP	9946.56	5626.42	14266.70	6777.47	4299.69	9255.25	10290.29	5593.76	14986.82	6987.32	4304.85	9669.79
Annual CS - SP	9678.71	5474.91	13882.51	6594.96	4183.91	9006.02	10013.19	5443.12	14583.25	6799.16	4188.92	9409.40
Elasticity - RP	-0.32	-0.46	-0.18	-0.47	-0.63	-0.29	-0.31	-0.45	-0.17	-0.45	-0.62	-0.28

Table 11: Summary of CS and the change in CS (NOK) for the scenarios, with 95% confidence interval.

Model Predictions	Model 1			Model 2			Model 3			Model 4		
	Mean	***95% LB***	***95% UB***	***Mean***	***95% LB***	***95% UB***	***Mean***	***95% LB***	***95% UB***	***Mean***	***95% LB***	***95% UB***
CS/trip - dune	244.78	154.77	334.78	264.39	135.55	393.23	251.31	155.22	347.40	278.42	133.33	423.52
CS/trip - oil	327.11	161.63	492.59	183.67	118.65	248.68	339.45	159.05	519.85	190.93	119.50	262.36
Annual CS - dune	4511.50	2852.58	6170.42	4873.00	2498.40	7247.60	4631.85	2860.86	6402.851	5131.61	2457.31	7805.91
Annual CS - oil	4718.38	2331.48	7105.29	2649.27	1711.50	3587.05	4896.34	2294.22	7498.461	2754.02	1723.64	3784.41
ΔCS dune (RP base)	5435.06	2349.42	8520.38	1904.47	-718.15	1929.94	5658.44	2295.22	9021.65	1855.71	320.95	3390.46
ΔCS oil (RP base)	5228.18	2451.18	8005.17	4128.20	2295.15	5961.25	5393.95	2398.73	8389.16	4233.29	2266.17	6200.42