Willingness to pay for unfamiliar public goods: Preserving cold-water corals in Norway.

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Abstract

The worlds' largest concentration of cold-water corals (CWC) is found off the Norwegian coast. Most of the registered discoveries of CWC are recent, and this has motivated Norwegian coastal and fisheries authorities to reconsider the management of the deep sea and its resources. However, scientific knowledge of CWC is limited, and many citizens have not even heard about them, which poses potential problems for the application of stated preference methods to measure their economic value. To fill this gap, we designed a discrete choice experiment which was implemented in a valuation workshop setting in order to derive the willingness to pay (WTP) for protection of CWC among the Norwegian population. The survey showed a median WTP for CWC protection in the range of 37-77 Euros per household per year. As of today CWC has no use-values. The formulation of the survey, however, enabled us to distinguish between a direct non-use value for CWC, and non-use values for CWC due to the fact that it is important for the existence of fish, and due to the fact that it is important for fish, which in turn is important livelihood for people. A crucial result of the survey is that non-use values outperform use-values. This may have consequences for future management of marine resources.

JEL: Q51, Q 57

Key words: cold-water corals, willingness to pay, unfamiliar public good, discrete choice experiment, natural resource management

1 Introduction

Marine organisms have long fascinated humans, as well as being of crucial importance for our well-being. Marine ecosystems provide supporting, provisioning, regulating and cultural ecosystem services as defined in Millennium Ecosystem Assessment (MEA, 2005). The recent decades' increasing awareness of the goods and services which our oceans provide has raised an interest in valuing these goods and services, although due to their "hidden" nature, many of these benefits go unnoticed until they diminish (Stewart and Smout, 2013).

Tropical corals, a very visible and tangible marine organisms, have been subject to a series of economic valuation studies (see e.g. Spurgeon, 1992, Pendleton, 1995, Parsons and Thur, 2007, Sarkis et al., 2012), and have been identified as the biome with the highest valued ecosystem services (de Groot et al., 2012). Their deep-water sea cousins, cold-water corals (CWC) have, by contrast, so far been subject to only one valuation effort, which was largely inconclusive (Glenn et al., 2010). In part, this lack of scientific knowledge of CWC is reflected in the lower degree of public awareness of this resource and the lack of political pressures to conserve CWC. Indeed, until quite recently our scientific knowledge about CWC and their functions in the deep-sea was very limited.

Although there are indications that CWC may provide habitat for some fish species (Stone 2006, Edinger et al., 2007), our knowledge about how the CWC ecosystem functions is far from complete. These knowledge gaps clearly complicate valuation, as illustrated by the discrete choice experiment (DCE) study conducted by Glenn et al. (2010). Due to statistically insignificant cost parameters the authors stop short of estimating WTP for the attributes. In general, the participants of the survey were positive towards protecting CWC areas, and preferred protecting all known and potential CWC areas to protecting only the known CWC areas. Further, the results show that whereas the participants wanted to ban all trawling in the CWC areas, they did in general not want to ban all fishing activities in these areas. However, participants in this survey showed a low level of knowledge of CWC, which may partly explain the lack of statistical significance of the price attribute.[1] Jobstvogt et al. (2014) value both non-use and use values attached to deep-sea environments around the coast of Scotland. They describe this environment by attributes comprising the potential for organisms contributing to new medicines, and biodiversity expressed as number of protected species. The latter represents the non-use values, and one of the exemplified deep sea species is CWC. They show that there is a positive WTP for both attributes and the WTP for the "best" protection option is in the range of £ 70 – 77 per household per year.

The study presented in this paper was carried out in Norway, which has one of the highest densities of CWC in the world (IMR 2012). The exploration of the sea-bed off the Norwegian coast, partly by oil companies and partly by scientists in a large sea-bed mapping project (MAREANO), has uncovered many CWC occurrences and reefs. According to the most recent assessments 1100 CWC occurrences have been identified within the Norwegian economic zone (IMR 2012). This research has also shown that many CWC reefs are being adversely affected by human activities: at an early stage of the exploration, scientists estimated that 30-50% of the known CWC reefs had been damaged or impacted (Fosså et al 2002). Threats to CWC include deep sea trawling, mining, and oil and gas exploration. Today, as more CWC reefs have been discovered, this percentage CWC impacted may be found to be lower, since CWC sites are now legally protected from bottom trawling as soon as they are identified. However, it is a fact that CWC have been and are still being adversely impacted by

[1] Glenn et al (2010) note «Prior to the survey almost three quarters of survey respondents (70%) were unaware of Irish cold-water corals, with only 22% indicating any awareness. A greater percentage still (83%) indicated that they had never come across the deep-sea fish species associated with the reefs (Orange Roughy, Grenadier and Black Scabbard).» (page 427).

commercial sea-bed operations, of which bottom trawling is the main culprit. Hence, improvements to the management of the ecosystem services provided by such biogenic habitats are of vital importance for at least two reasons. First, in order to manage our commercial fish and crustacean species optimally, we should take into consideration that CWC may be important as habitat for some of these species. Such links can be identified in a production function model of indirect benefits of protection as carried out by Foley et al (2010). Second, although nowhere near as well-known as tropical corals, there may be people who derive utility from the knowledge that CWC exists, both for its pure existence, and for its importance as habitat (a home) for other species.

For these benefits connected to CWC, it is necessary to disentangle the different ways CWC may have value to people. First; it is important to be aware that for the time being people in general can only hold non-use values for CWC *per se*, as use is beyond the reach for most of us. In the MEA (2005) ecosystem services framework non-use values such as existence and bequest values are part of the cultural values. However, through its role as habitat (a supporting service) for fish, CWC has additional value to us because people a) value the existence of fish (a cultural ecosystem service) and b) regard fish as a livelihood (a provisioning ecosystem service).

This paper reports the results of a Norwegian stated preferences study valuing protection of CWC off the Norwegian coast. The objectives of the paper are: (i) to derive people´s WTP for protection of CWC reefs in Norway, and (ii) to analyze what determines people's WTP for CWC protection. We conducted a discrete choice experiment (DCE) in a valuation workshop setting. This setting was chosen to reduce the challenges posed by the unfamiliarity of the good to be valued, and thus increase the validity of the survey and reliability of the WTP estimates. The paper is organized as follows: Section 2 gives an introduction to the methods used and the dataset. Section 3 presents the results, section 4 discusses the results and section 5 concludes.

2 Methods and data

2.1 Methods

We conducted 24 valuation workshops across Norway. Each workshop involved the following steps: 1) a 30-minute power point presentation concerning CWC, where the participants could ask clarifying questions regarding CWC or the survey, 2) participants individually completed the DCE questionnaire. Each workshop lasted about 2 hours.

In the DCE we used four attributes to describe aspects of the protection of CWC. The attributes and the levels they take are given in table 1.

(Table 1 about here)

As of today 2.445 km^2, consisting of nine CWC areas, are legally protected, and this was used as the reference level for “Size of protected area”. In addition to CWC reefs, this area also encompasses buffer zones around the reefs. The protected domain covers areas, some of which are attractive for oil and gas exploration and for fisheries activities, and some which are not. They also cover some CWC areas which are of considerable importance as habitat for fish, and some which are of less importance.

The attribute “Size” refers to the *total* protected area, not the additional area protected. This attribute took two alternative levels; 5.000 km^2 and 10.000 km^2, in addition to the reference level. Both levels are realistic given the amount of CWC that has been mapped along the Norwegian coast. The most important off-shore commercial activities along the Norwegian coast, which poses the largest threats to CWC, are oil and gas extraction and commercial fisheries. The “commercial” attribute thus distinguishes between whether areas eligible for further protection were attractive to these commercial activities or not.[2] The "habitat" attribute distinguishes between areas being highly important as habitat for fish, and areas being of less importance. Whereas the costs to maintain the present size of protected CWC area are set at zero, increasing the protection will imply a positive additional cost. This cost attribute took four possible levels, and varied between 100 and 1000 NOK.[3] The payment vehicle we used was a uniform nominal increase in the annual federal tax.

Our DCE design included 12 choice tasks per respondent. We prepared the choice sets by maximizing the expected Bayesian d-efficiency of the multinomial logit model (Scarpa and Rose 2008). The design was updated after the pilot and twice throughout the main study, in order to take the more precise information about respondents' preferences as more informative priors. An example of a choice card is provided in Appendix A.

Altogether, 402 persons, including the pilot groups, were surveyed. Of these 5 did not complete any of the choice cards, and were thus eliminated from the sample. The remaining 397 respondents provided us with 4683 choices observations. In addition to the choice cards, the questionnaire also contained information about individual characteristics (gender, age, place of residence, education, participation in the labor force, occupation, household size and personal and household income), and questions regarding attitudes towards environmental protection in general.[4]

The theoretical foundation for the DCE is the random utility theory, which assumes that the utility a person derives from CWC protection depends on the characteristics of the protection alternative

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[2] Although we presented this as one attribute in the choice cards, we separated it into two dummy variables of oil/gas exploration and fisheries respectively, in the statistical model.
[3] The nominal exchange rate for Euro against Norwegian kroner is 8.4 (6.February 2014).

[4] The questionnaire is available upon request.

(attributes), individual characteristics, and the unobserved idiosyncrasies, represented by a stochastic component. The DCE data indicated the presence of substantial preference heterogeneity, and thus we applied the mixed (random parameter) logit model. The description of the theoretical framework we applied for deriving respondents' WTP is provided in Appendix B.

2.2 Data

A professional recruiting firm was employed to recruit the groups, with the objective that each group should be representative with respect to gender and age for the municipalities in which the survey took place. To secure geographic coverage we sampled municipalities across the whole country. Figure 1 shows where the group interviews were conducted. Altogether 24 valuation workshops in 22 municipalities encompassing between 12-23 participants in each workshop were conducted, including 3 pilots. The recruitment of participants to the group interviews was based on the national distribution of people on seven predefined regions. Sample deviations from the national average are thus due to the fact that some of the recruited participants did not show up to the interview. Figure 1 shows the national and the survey sample share of people in each of the seven regions.

(Figure 1 about here)

394 respondents answered the question about gender, and the sample contains 183 (46,5%) females and 211 (53,5%) males. The national gender distribution is 50.2% men and 49.8% women. The age limit for when a person is considered an adult is 18 years in Norway. Hence, only persons above the age of 18 were recruited to the survey, and the youngest participant was 18 years old. The oldest participant was 88 years old. The age distribution of our sample is very close to the national age distribution. The only exceptions are that 11% of the people are 18-25 years old and 20% of the people belong to the age group 46-55 years; whereas in the national population these age groups

make up 14 and 17 %, respectively. For all other age groups our sample is perfectly representative of the national population.

In Norwegian public statistics the lower limit for being registered as an employee is 16 years, and thus the age classes in the public statistics and our survey are not perfectly overlapping. Dividing the individual survey sample into people belonging to the labor force and those outside the labor force shows that 65% belong to the labor force. The corresponding national share is 73%. The main difference is to be found among the share on social security, including people in retirement, which in our survey is 23%, whereas the national share is 18%. When it comes to occupation, the survey sample is more biased. Whereas 46% of the survey participants who are working full or part time work in the public sector, this share is only 34% at the national level. Of those working in the private sector, the sample contains a higher share of those belonging to the oil/gas industry, fisheries and aquaculture, whereas it is lower for all other industries, including services. This self-selection into the sample is as expected as the topic for the survey is of a marine character, and therefore may be perceived as more relevant for those employed in marine industries. Finally, we recorded household size, personal and household income. Figure 2 shows that the survey has a lower share of low income people compared to the national average. One reason for this is that the lower age limit for survey participation was 18 years, whereas the national data on income encompass all persons 16 years and above. The low-income group will typically contain most of the persons between 16-18 years.

(Figure 2 about here)

Regarding household size and composition the survey sample contains 23% single person households, whereas the national average is 40%. In the survey sample about 1/3 lived in households with children below 18 years, the national average being below 30%. Hence, the sample survey contains a larger share of people living in families with children compared to the national average.

Less than 10% of the survey participants (37 persons) were members of an environmental NGO (ENGO). Of the survey participants 57% had higher education (more than 12 years in school), whereas only 7% had only obligatory schooling. The corresponding national shares are 26% and 30%. Hence, our sample is biased towards more educated people.

As part of the survey all participants were asked to answer a quiz with eight questions. The quiz was given immediately after a presentation of CWC off the Norwegian coast, and the quiz question concerned information which was given during the presentation. Almost 30% of the participants achieved a full score, whereas another 28% scored 7 out of 8, and 25% scored 6 out of 8. Hence, only about 20% got 5 or less of the 8 quiz questions correct. This shows that the power-point presentation was reasonably effective in informing people about the aspects of CWC relevant for the valuation exercises (compared with Glenn et al., 2010).

3 Results

3.1 Discrete choice experiment

In the DCE, the status quo was chosen in 25% of the choices made and extended protection was chosen in the remaining 75% of instances. Table 2 shows the mean parameter estimates and standard deviations resulting from the mixed (random parameter) logit model with and without attribute correlations, and the accompanying attribute WTPs. We present the median WTPs because we allow people to have heterogeneous preferences also for the cost attribute. This means that the marginal value of money is allowed to differ across participants, which is a reasonable assumption given the very strong indication of preference heterogeneity in the data set. However, it makes the calculation of the mean of the WTPs difficult.

(Table 2 about here)

All standard deviation parameter estimates are significant, which emphasizes the fact that preferences across the survey participants are indeed heterogeneous with respect to all attributes. All parameters except that for oil/gas activities are significant. The attribute for fisheries activities has a somewhat lower significance level compared to the large-size, habitat and cost attributes, and in the no correlation model the small-size attribute is significant only at a 5% level. Habitat and cost have significantly higher part-worth values, which imply that changes in these attributes affect the probability for choosing extended protection of CWC to a greater degree compared with changes in the other attributes.

The WTP for a protection scenario is found by adding the WTPs for the attributes. We define two protection scenarios; one small and one large, and arrange it so that in both scenarios the protected areas are important for commercial activities (oil/gas and fisheries) and as habitat for fish. Table 3 shows the calculated WTP for the two scenarios based on results from the two models (mixed logit with and without correlation).

(Table 3 about here)

The WTP varies from 37 Euro per household per year for small protection of CWC to 42 Euro for large protection of CWC when we use the results from the model without correlations. WTP increases significantly if we use the results from the model with attribute correlations, to 68 Euros for a small protection and 77 Euros for a large protection. The main reason for these large differences is that the latter model takes into account that a change in the level of one attribute will have consequences for the level of other attributes. In turn, this is taken into account when assessing how the change in the original attribute affects the probability for choosing an alternative different form the SQ.

All Individual Specific Characteristics except the number of household members are treated as factors; either dummies (gender, member of ENGO, labor force participation, occupied in marine industries, living in coastal areas, living in rural areas), or taking continuous, non-negative digits (age group, education, personal income, household income). Table 4 shows the ISCs included in the analysis, the lowest and highest value, the mean value and number of observations.

(Table 4 about here)

We have divided the respondents into 6 age groups, each of an interval of 10 years except the first and the last group. The first group included persons between 18-25 years, and the last group those above 65 years. We divided the respondents into 10 personal income groups, each of an interval of 100K Norwegian kroner (23.81K Euros), except the first and last group. The first income group consisted of those earning less than 200K NOK, and the last income group consisted of those earning more than 1 million NOK. Further, we divided the respondents into 8 household income groups, each of an interval of 200K NOK, except the first and the two last groups. The second last household income group covered those earning between 1.2-1.5 mill NOK. Finally, based on postal code we divided the respondents into groups according to whether they lived in coastal areas or interior parts of the country, and whether they lived in urban or rural areas.

To explore the effects of the individual specific characteristics (ISCs) we ran a logistic regression with a dummy which took the value 1 if a respondent chose the status quo and 0 if not, as the dependent variable, and the ISCs given in table 4 as explanatory variables. Including an intercept shows that this is highly significant (table 5), indicating that there are explanatory variables other than the ISCs relevant for explaining the respondents choices. Including an intercept, ISCs like gender, living in coastal areas and household income became insignificant. Without the intercept the ISC “living in coastal areas” became highly significant, whereas gender became significant at 10% level. Table 5 shows that without an intercept all parameter estimates except personal income are negative, which implies that the higher value of the ISC the less likely that a person will choose the status quo, i.e. not to protect more CWC. Hence, women, older people and higher educated people are more likely to choose further CWC protection than are men, younger and less educated people. Being a member of an ENGO increases the probability that the person will protect more CWC, and the same is the case for being part of the labour force and working in the marine industries. Living in coastal areas and in urban areas increases the probability that a person will protect more CWC. Increasing personal income does not increase the probability that a person will protect more CWC. On the contrary, higher income increases the probability that a person will choose the status quo. On the other hand, increased household income contributes to increase the probability for further CWC protection, but this effect is not significant. It is likely that personal and household income are correlated, so we removed household income. This did not change the sign of the personal income parameter estimate. Finally, increasing the household size increases the probability that a person will protect more CWC. Including the intercept implies that the sign of the household size parameter changes, such that larger household size means that a person is more likely to choose the status quo.

(Table 5 about here)

4 Discussion

The DCE data showed that the survey participants had heterogeneous preferences when it came to the effect of the attributes on their probability for choosing extended CWC protection. On average, they cared little about whether the areas to be protected were attractive for the oil industry. This implies that the fact that areas are attractive to the oil industry (implying that oil companies perceive the probability of discovering oil in these areas as higher compared to the average expectation) plays no role in their decision to extend the protection of CWC or not. What they cared most about was whether the areas to be protected were important as habitat for fish. The part-worth value of this attribute was 2.5 and 4 times higher, depending on the statistical model, compared to the attribute with the second largest part-worth value, which was large-size protection of CWC. They also cared about whether the areas to be protected were important for the fisheries. However, contrary to our expectation, this attribute contributed positively to the probability for increased protection. In other words, if an area was an important fishing ground, it increased the probability that the survey participants would choose to protect the area in order to preserve CWC.

We had expected that the participants might be more reluctant to protect areas important for the fisheries as this could reduce the fisheries activities and thus the income of the fishing industry. The fact that the reaction is quite the opposite must be explained by the participants' care for fish. This necessitates disentangling intertwined effects regarding the WTP to protect CWC. People have a WTP to protect CWC per se, which is motivated by CWC's non-use (existence and bequest values) and expressed by the attribute size (large and small) in the survey. In addition, people are willing to pay to protect CWC because CWC is important to fish. This is motivated both by use and non-use values for fish. The non-use value for fish is taken into consideration by the habitat attribute. This attribute points to the possibility that CWC is important habitat for fish as they may provide spawning areas, shelter, and hiding places especially for juvenile fish. Hence, protecting CWC implies providing better living conditions for fish, regardless of whether this fish is a provisioning service or not. The use value of fish is taken into consideration by the attribute commercial activities, which point to fish (and oil/gas) as a provisioning service, or part of our livelihood.

Hence, the total WTP for CWC protection consists of non-use values for CWC, expressed by the size of the protected area (a direct existence value), and use and non-use values for fish, expressed by habitat (non-use value for fish), and commercial activities (use values for fish). Then it is clear that the non-use values dominate the use values when it comes to what motivates people to choose further protection of CWC. This is as expected when we take into consideration the intangible character of CWC. It is, however, more surprising that when taking the role CWC plays for fish into consideration, it is the non-use value of fish which dominates people's WTP to protect CWC, and not the fact that fish supplies an important livelihood for us. One explanation of the strong emphasis on non-use values could be the fact that in the survey about 1/3 of the respondents lived in households with children younger than 18 years. This share is below 30% on a national basis. Bequest values are sometimes mentioned as a separate value, which, together with existence values, constitute non-use values. The relatively high share of respondents living with children may contribute to explain the high non-use values resulting from the surveys, as they may hold significant bequest values.

Applying the MEA (2005) framework, dividing ecosystem services into supporting, provisioning, regulating and cultural services, the results above means that we have identified two ecosystem services people attach to CWC. First, CWC provides a cultural service, as cultural services encompass non-use values such as existence and bequest values. In addition, CWC provides a supporting service, which encompasses CWC's role as habitat for fish. This means that if to be applied in a cost-benefit analysis (CBA), one should be wary of including the aggregate of the attribute WTPs for CWC. The WTP for the attribute "size", which expresses the existence value of CWC (a cultural service) can be used as the value for CWC in such an analysis. The WTP for the other two attributes could be included in a CBA only if the value of the provisioning and/or cultural ecosystem services connected to fish dependent on CWC as habitat are not included in the same CBA. This in order to avoid double counting.

One of the uses of the results presented above is to explore what the fact that people hold existence values for CWC implies for the optimal management of CWC. As mentioned in the introduction, CWC has only quite recently been detected in large amounts off the coast of Norway. Hence, the management of Norway's marine resources has not yet taken into consideration the two-sided value this resource may provide to society. In addition to being important as habitat for commercial fish species, the pure existence of CWC and the possibility to leave it to future generations, according to the results of our survey, also contributes to the welfare of the Norwegian population. This welfare is expressed by the WTP for the attribute size (small and large). By plugging in this WTP value in a bio-economic model encompassing the habitat-fish stock dynamics, the optimal amount of CWC (and the fish stock) can be derived. This can in turn serve as one input to Norwegian authorities in their work deciding whether to extend the existing protection (area) of CWC off the Norwegian coast.

Norwegian coastal authorities and managers emphasize the importance of implementing a policy, which, as far as possible, is accepted by those who are subject to these rules and regulations (pers. comm. Egil Lekven 28.09.2012). Hence, the authorities are especially sensitive to the feedback from fishers and other persons working in marine industries. The results from our analysis show that those respondents working in marine industries are less likely to choose the status quo, and more likely to choose further protection of CWC. Such a result is of interest for the authorities, as it indicates that protecting areas with CWC from, first and foremost, bottom trawling may gain support from those who have to live with the consequences of the regulations. On the other hand, as only 7% of the respondents belong to the marine sector, the result must be handled with care.

5 Conclusions

An increasing awareness that human welfare crucially depends on ecosystem services beyond our daily experiences renders information about these unfamiliar and inconspicuous goods and services highly important. In this paper we show that CWC enhances the welfare of the Norwegian population by its mere existence. In addition, although not yet scientifically proven, one suspects that CWC is important habitat for many commercially important species, such as redfish and saithe. This makes CWC important from a management perspective.

Trying to quantify the "value" this intangible and for most people unheard of organism raises some challenges. Hence, instead of implementing a traditional stated preferences survey, which is often distributed to the respondents by mail or via the web, we organized 24 valuation workshops across Norway. Providing the participants with information about CWC and time to think, we collected individual data from about 400 respondents and estimated the WTP for protecting this unfamiliar good. The results showed that people had positive WTP for protecting CWC beyond the present protection. The motives for further CWC protection were partly their mere existence for present and future generations, and partly the fact that they (probably) play a role as habitat for fish. The largest share of the WTP for CWC protection was due to its role as habitat for fish. However, contrary to what we expected, people did not first and foremost want to protect CWC because it was important for fish and that fish in turn constitute part of our livelihood. No, people valued CWC as habitat for fish motivated by non-use (existence and bequest) values for fish.

In a management perspective this is of importance. First, we showed that people in Norway derive welfare from knowing that CWC exist. This should be taken into consideration by Norwegian coastal authorities when deciding the extension of CWC protection. Second, assuming that CWC plays a role as habitat for fish, we showed that people's welfare from fish not only is motivated by the fact that fish is part of our livelihood. The survey results show that the largest contribution of fish to people's welfare is through its existence value for present and future generations. People value the fact that fish exist, and can continue to exist, more than they value the livelihood fish provides them. For managers such results indicate that the existence of not only CWC, but also the fish they support, should be considered in the management of the deep sea resources. Given the relatively high welfare level of most people in Norway, it is not unlikely that immaterial concerns play a significant role in peoples' preferences. One such immaterial concern is to live with the certainty that the fish stocks Norway manages, and other marine resources such as CWC, exists and will continue to do so also for the next generations. Our results indicate that such considerations should be given significant weight in Norwegian resource management.

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Appendix A

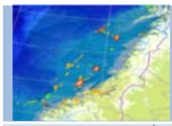
Attribute		*Alternative 1*	*Alternative 2*	*Alternative 3 (SQ)*
Size of protected area (total)		*5.000 km²*	*10.000 km²*	*2.445 km²*
Attractiveness for commercial activities		*No, not attractive for any commercial activities*	*Attractive for oil/gas and fisheries*	*Some attractive for oil/gas and fisheries*
Importance as habitat for fish		*Important*	*Not important*	*Some importance*
Costs per household per year		*100 kr/year*	*1000 kr/year*	*0*
I prefer				

Figure A1 Choice card used in the DCE

Appendix B

The random utility model

Let the utility to an individual of choosing alternative j be expressed by

$$U_j = V_j + e_j \qquad \text{(B1)}$$

where V_j is the deterministic part of the utility, and e_j is a stochastic component allowing for other factors than those included in V_j to affect the person's utility. V_j contains all attributes of the good, in addition to a set of individual specific characteristics (ISC).

An individual will choose alternative j if $U_j > U_k, for\ all\ k \neq j$, and the probability that alternative j is chosen is given by

$$prob(j\ chosen) = prob\left(V_j + e_j > V_k + e_k, \forall\ k\ \in C\right) \qquad \text{(B2)}$$

where C is the set of all possible alternatives.

Assuming an extreme value distribution (Gumbel) for the stochastic term, the probability for choosing alternative j can be expressed as

$$\frac{exp^{sVj}}{\sum_k exp^{sVk}} \qquad \text{(B3)}$$

where s is a scale parameter.

The deterministic part of the utility is given by

$$V_j = a_j + bX_j + gZ \qquad \text{(B4)}$$

where a_j is an alternative specific constant, X_j is the vector of attributes, Z is a vector of individual characteristics, which is constant over the alternatives, and *b* and *g* are parameters to be estimated.

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Table 1 Attributes and attribute levels

Attribute	Size of protected area (km^2)	Protected area attractive for Oil/gas and fisheries activities?	Protected area important as habitat for fish?	Additional costs of protection
Reference level	2.445	Partly	Partly	0
Level 1	5.000	Attractive for the fisheries	Not Important	100
Level 2	10.000	Attractive for oil/gas activities	Important	200
Level 3		Attractive for both fisheries and oil/gas activities		500
Level 4		Neither attractive for fisheries nor for oil/gas activities		1.000

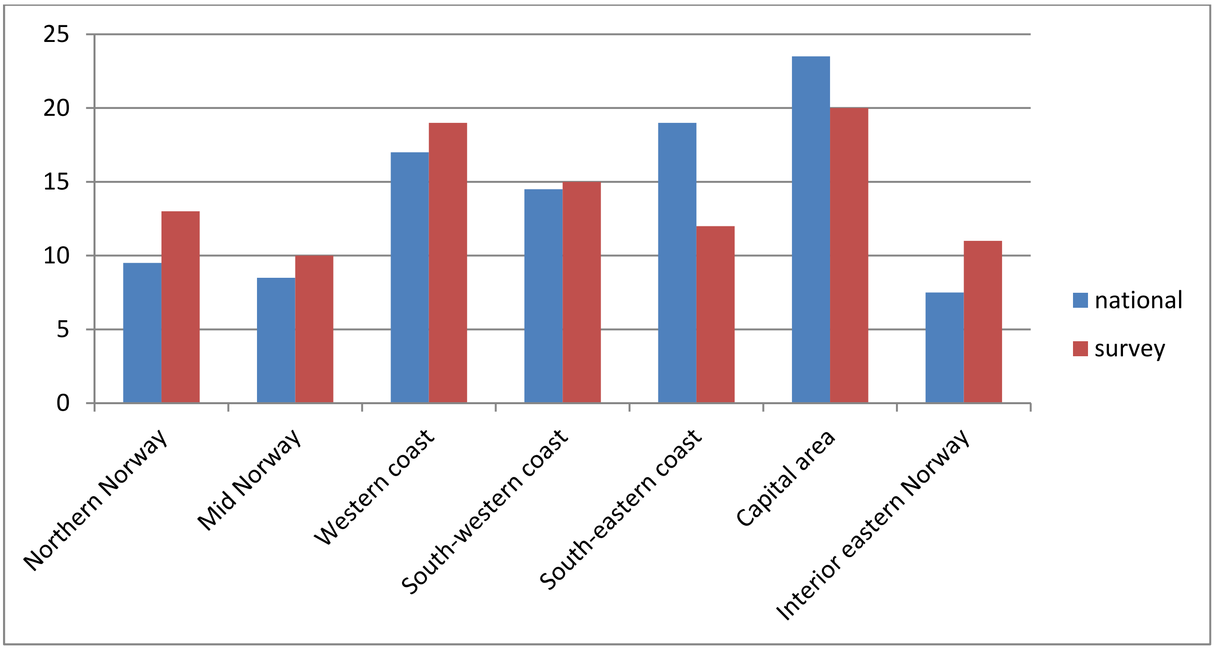

Figure 1 *National share and survey sample share of the population in each of seven pre-defined Norwegian regions.*

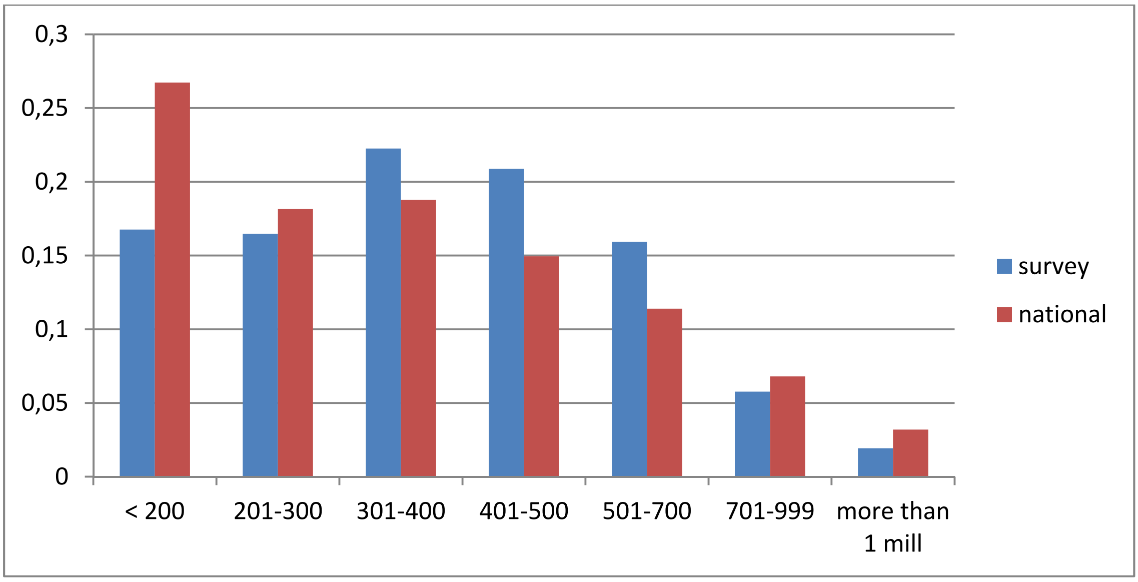

Figure 2 *Share of population above 16 (18) years in the national population and in the survey sample (y-axis) with income according to specified income intervals (x-axis).*

Table 2 *Estimated attribute parameters, standard deviation, and median WTP measured in Euro (standard error in parenthesis) for the mixed logit model with and without correlations respectively. ***, ** and * indicates significant estimates at 0.1%, 1% and 5% levels respectively.*

Attribute	Mixed logit without attribute correlation			Mixed logit with attribute correlation		
	Mean	*St.dev.*	*Median WTP*	*Mean*	*Standard dev.*	*Median WTP*
Small-size	0.27*	1.92***	3.3 (1.6)	0.83***	3.92***	14.75 (10)
Large-size	0.61***	-2.26***	7.75 (2.05)	0.95***	4.52***	19.3 (12.2)
Oil/gas	-0.07	-1.75***	-0.85 (1.4)	-0.13	1.61***	-0.95 (6.5)
Fish	0.26**	-1.80***	3.3 (1.57)	0.32**	1.75***	5.95 (6.75)
Habitat	2.31***	-2.45***	32.85 (3.7)	2.36***	2.42***	50.5 (15.3)
Cost	-2.50***	-4.43***		-2.42***	3.66***	

Mixed logit without correlations: Max logLikelihood = -3422, AIC/n =1,47, logLikelihood ratio (pseudo R^2) = 0.33.

Mixed logit with correlations: Max logLikelihood = -3249, AIC/n =1,4, logLikelihood ratio (pseudo R^2) = 0.36.

Table 3 Median WTP per household per year in Euro for small and large protection scenario and 95% confidence interval (CI).

	Mixed model without attribute correlation		*Mixed model with attribute correlation*	
	Median	95% CI	Median	95% CI
Small protection scenario	37.4	28.1-47.4	68.2	32-125.35
Large protection scenario	42.4	31.67-54.5	76.9	35.4-137.5

Table 4 Individual specific characteristics included in the analysis

Individual specific characteristic	Lowest value	Highest value	Mean value of ISC	Number of observations
Gender	0 (male)	1 (female)	0.465	394
Age	1 (18-25 years)	6 (over 67 years)	3.64	395
ENGO	0 (not ENGO member)	1 (ENGO member)	0.1	394
Education	1 (only obligatory)	4 (higher degree University)	2.84	394
Labor force participation	0 (not in labor force)	1 (in labor force)	0.63	393
Working in the marine sector	0 (other industries)	1 (the marine sector)	0.08	391
Household size (cont. var.)	1	8	2.5	397
Personal income	1 (below 200K NOK)	10 (above 1 mill NOK)	3.5	388
Household income	1 (below 200K NOK)	8 (above 1.5 mill NOK)	3.8	385
Coastal areas	0 (interior areas)	1 (coastal areas)	0.63	397
Urban areas	0 (rural areas)	1 (urban areas)	0.73	397

*Table 5 Estimated individual characteristics parameters (coefficients) and standard deviation resulting from a regression with SQ as the dependent variable and the individual specific characteristics as independent (explanatory) variables. ***, **, * and ● indicates significant estimates at the 0.1%, 1%, 5% and 10% levels respectively.*

Explanatory variables	Including intercept		No intercept	
	Coefficient	*St.dev.*	*Coefficient*	*St.dev.*
Intercept	*-1.8****	*0.16*		
Gender	*-0.03*	*0.07*	*-0.12●*	*0.07*
Age	*-0.07****	*0.02*	*-0.21****	*0.018*
ENGO	*-0.99****	*0.15*	*-1.07****	*0.15*
Education	*-0.14****	*0.04*	*-0.34****	*0.03*
In the labor force	*-0.21***	*0.08*	*-0.42****	*0.07*
Marine sector	*-0.28**	*0.13*	*-0.31**	*0.135*
Personal income	*0.08****	*0.026*	*0.13****	*0.03*
Household income	*0.004*	*0.028*	*-0.03*	*0.029*
Coastal areas	*-0.1*	*0.07*	*-0.26****	*0.06*
Urban areas	*-0.22***	*0.07*	*-0.44****	*0.07*
Household size	*0.067***	*0.025*	*-0.04●*	*0.025*