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

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Abstract

The world's largest concentration of cold-water coral (CWC) is found off the Norwegian coast. Most CWC discoveries are recent, posing new challenges for Norwegian coastal and fisheries authorities regarding the management of deep-sea resources. Scientific knowledge of CWC is limited, and many citizens have not even heard about them. This creates problems for the application of stated preference methods to capture their economic value, and very few such studies have been conducted. To fill this gap, we designed a discrete choice experiment, which was implemented in a valuation workshop setting in order to derive estimates of participants' willingness to pay (WTP) for increasing the protection of CWC. Despite the fact that marine industries such as oil/gas and fisheries could be adversely affected by CWC protection, this did not reduce the respondents' willingness to pay for further protection. The possibility that CWC play an important role as habitat for fish was the single most important variable to explain respondents WTP for CWC protection. The survey revealed a high degree of preference heterogeneity, whilst we found an average WTP for CWC protection in the range of EUR 274-287.

JEL: Q51, Q 57

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

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Abstract

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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 the Millennium Ecosystem Assessment (MEA, 2005). Over recent decades, increasing awareness of the benefits our oceans provide has raised an interest in assessing the economic value of these goods and services, although due to their “hidden” nature, many of these benefits go un-noticed until they diminish (Stewart and Smout, 2013). Notwithstanding this, a number of studies have recently emerged which quantify the economic benefits of protecting marine species (Jobstvogt et al., 2014; Rogers, 2013; Hynes et al., 2013; Ressurreicao et al., 2011).

Tropical corals 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 global biome with the highest valued ecosystem services in aggregate (de Groot et al., 2012). Their deep-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). Moreover, there are many more gaps in scientific knowledge of deep-sea ecosystems than for most terrestrial and coastal ecosystems (Ramirez-Llodra et al., 2011). Indeed, until quite recently our scientific knowledge about CWC and their functions in the deep-sea was very limited. The lack of scientific knowledge of CWC is reflected in the lower degree of public awareness of this resource, and less political pressure to conserve CWC compared to tropical corals. Nonetheless, during the last ten years, a substantial number of CWC protected areas have been established worldwide (Armstrong et al., 2014).

Although there are indications that CWC may provide habitat for some fish species (Stone 2006, Edinger et al., 2007), our knowledge about how CWC ecosystems function is far from complete. These knowledge gaps clearly complicate economic valuation of CWCs, as illustrated by the discrete choice experiment (DCE) study conducted by Glenn et al. (2010). Participants showed a low level of knowledge of CWC, which may partly explain the lack of statistical significance of the price attribute. Due to this statistically insignificant cost parameter, the authors stop short of estimating WTP for the attributes. In general, the participants in the Glenn et al. (2010) survey had a positive attitude towards protecting CWC areas, and preferred protecting all known and potential CWC areas as opposed to protecting only the known CWC areas. Further, the results showed that whereas the participants wanted to ban all trawling in CWC areas, they did in general not want to ban all fishing activities in these areas. Trawling is a particularly damaging form of fishing for CWC.

In a related study, Jobstvogt et al. (2014) value both non-use and use values attached to deep-sea environments around the coast of Scotland. They do not explicitly focus on CWC, although these habitats are found within their study area. The authors describe this deep-sea environment by attributes comprising the potential for organisms to contribute to the development of new medicines, and biodiversity expressed as number of marine species, which are protected. The authors argue that preferences for conserving such species represent non-use values.[1] They show that there is a positive WTP on the part of Scottish residents for both attributes, and that WTP for the "best" protection option is in the range of £ 70 – 77 per household per year.

We carried out our study 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 research institutions, has uncovered many CWC occurrences and reefs. According to the most recent assessments, 1100 CWC occurrences have been identified within the Norwegian exclusive economic zone (IMR 2012). These marine surveys have 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, oil and gas exploration, mining and aquaculture. Today, as more CWC reefs have been discovered, the percentage of CWC sites found to be impacted may 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 still are being adversely impacted by 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. At the same time, it is also necessary to present the social costs of further protection, which for the moment are potential losses in value added for the oil industry and the fisheries.

[1] This attribute is described in the survey as follows: "Animals such as deep-sea fish, starfish, corals, worms, lobsters, sponges, and anemones would benefit most from the protection."

This paper reports the results of a stated preferences (SP) study valuing further protection of CWC off the Norwegian coast in order to better include these types of resources in ocean management. The objective of the study is twofold: (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. A valuation workshop is a meeting of sampled participants, who complete choice tasks individually whilst learning about the good to be valued (MacMillan et al., 2006). This setting was chosen to reduce the challenges posed by the unfamiliarity of the good to be valued. Applying the Total Economic Value (TEV) framework we identified indirect use values of CWC connected to their role as providing a habitat for fish (and other marine organisms). We also identified non-use values connected to the role CWC play for biodiversity and as an organism, which people might value for its own sake. However, we cannot neatly disentangle the values people hold for CWC due to their role as habitat and the value related to their mere existence. In section 2 we present the attributes of the DCE, and give 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

CWC is a good unfamiliar to most people. In order to overcome problems connected to the fact that people are not well informed about the good they are about to value, it was decided to use the valuation workshop method of SP data collection, instead of postal, internet or face-to-face interviews.[2] A valuation workshop departs from interviews and postal/web surveys by more extensive provision of information about the good to be valued, by the fact that data collection takes place in a group setting, often with repeated valuation procedures, and time to think and deliberate between the valuation tasks (Macmillan et al., 2002; MacMillan et al., 2006; Colombo et al., 2013). Valuation workshops are usually performed within a geographically concentrated area. Our study covers the whole country (Norway), and in order to be manageable, each respondent was only asked to state their value on one occasion (although this included the completion of multiple choice sets).

[2] See e.g. Macmillan et al. (2002) and Christie et al. (2006) for problems connected to stated preference studies of unfamiliar goods conducted using face-to-face interviews or mail shots. Valuation workshops are also sometimes called the market stall method (Macmillan et al., 2002).

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 questionnaire. Each workshop lasted about 2 hours.

In the selection of the choice attributes we used results from existing literature and expert interviews. Foley et al. (2010) showed that identified ecosystem services connected to CWC are i) as raw material and ornamental resources (direct use and option values), ii) habitat functions, including refuge and nursery functions (indirect use values), and iii) non-use values. In the only previous SP survey which has been implemented on CWC (Glenn et al., 2010), the effects of CWC-protection on off-shore industrial activities was included. As there is substantial off-shore industrial activity in the form of oil and gas extraction and fisheries taking place along the Norwegian coast, we found that including this aspect in our survey was timely. Thus, it was decided to initially include “size of protected area” to represent non-use values of CWC, “habitat for fish” to represent indirect use values, and “raw material in medicinal products” to represent direct use and option values. Assuming that protection would imply a total ban of all industrial activities in the protected area, we used the attribute “attractive for industrial activities” to represent the societal costs of CWC protection. In addition there was a private-cost attribute.

Prior to the final design of the survey we implemented 3 focus groups with experts and 2 focus groups with “the general public”, each consisting of 5-10 participants to get feedback on the selection of attributes. Whereas none of the groups opposed the choice of attributes, all groups commented on the rather complex choice situation with 5 attributes, some of which taking more than two levels. Based on this feedback it was decided to reduce the number of attributes, and their levels. The use of CWC as input in medicinal products is the most speculative value connected to CWC, and therefore this attribute was removed. This yielded a design with two attributes representing the benefits we may attach to CWC and two attributes representing costs to society and the individual of further CWC protection. Table 1 shows the four attributes and the levels they take.

(Table 1 about here)

At the time of writing, nine CWC areas are legally protected in Norwegian waters, covering a total of 2445 km^2. This area is used as the reference level for the attribute *Size*. In addition to CWC reefs, these sites also encompass buffer zones around the reefs. The attribute *Size* refers to the *total* protected area, not the additional area protected. It takes two alternative levels; 5000 km^2 and 10000 km^2, where the former expresses a realistic estimate of how large areas of CWC could easily be protected as of today, and the latter represents an upper limit for CWC area which could realistically be protected. Note that the size of protected area encompasses both the CWC occurrences and buffer zones.

The most important off-shore commercial activities along the Norwegian coast which pose the largest threats to CWC are commercial fisheries and oil and gas extraction. The area presently protected includes some locations, which are attractive for the oil industry and for the fisheries, and some which are not. The attribute *commercial* thus distinguishes between whether areas eligible for future protection are attractive to these commercial activities or not.[3]

Scientists observe varying amount of fish on the different CWC reefs. The *habitat* attribute distinguishes between reefs with large amounts of fish and which thus are defined as “important as a habitat for fish”, and reefs with smaller amounts of fish and which are defined as “not important as habitat for fish”. Finally, whereas the cost of maintaining the present size of protected CWC area is set to zero, increasing the area of protection is assumed to imply an additional cost. The cost attribute takes four possible levels, and varies between NOK (Norwegian kroner) 100 and 1000 per household annually.[4] The payment vehicle we used is 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 a multinomial logit model (Scarpa and Rose 2008). The design was updated after the pilot and twice throughout the main study, in order to utilize more precise

[3] Although we merged the two industries into one attribute in the choice card, the two industries were given individual attribute levels (important/not important area) such that they could easily be separated into two dummy variables in the statistical model (see table 1 for the levels for this attribute).
[4] The nominal exchange rate for Euro against Norwegian kroner is 8.4 (July 2014).

information about respondents' preferences as informative priors. An example of a choice card is provided in Appendix A.

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

The theoretical foundation for DCE is random utility theory, which assumes that the utility a person derives from CWC protection depends on observed characteristics and unobserved idiosyncrasies, represented by a stochastic component (McFadden, 1974). When the survey respondents are indexed *n*, the alternative *j*, and the choice situation *t*, the utility to individual *n* of choosing alternative *j* in situation *t* can be expressed by

$$V_{njt} = \alpha_n p_{njt} + \boldsymbol{b}_n' \boldsymbol{X}_{njt} + e_{njt} , \qquad (1)$$

where the utility expression is separable in price, p_{njt}, and other non-price attributes, $\boldsymbol{X}_{njt}$, and e_{njt} is a stochastic component allowing for unobservable factors to affect individuals' choices.

Two things in the above specification need to be noted. First of all, $\boldsymbol{\alpha_n}$ and $\boldsymbol{b}_n$ are individual-specific, thus allowing for heterogeneous preferences amongst respondents and leading to a mixed logit model (MXL).[6] Assuming that they are the same for all respondents implies homogenous preferences and leads to the basic multinomial logit model (MNL), which although very restrictive, is typically a starting point for econometric analysis of DCE data.

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[5] The questionnaire is available from the corresponding author upon request.

[6] Is it typically assumed that individual parameters follow a particular, possibly multivariate, distribution allowing for non-zero correlation of model parameters.

Secondly, the stochastic component of the utility function (e_{njt}) is of unknown, possibly heteroskedastic variance $\left(\operatorname{var}\left(e_{njt}\right)=s_n^2\right)$. Identification of the model is typically assured by normalizing this variance, such that the error term $\varepsilon_{njt}=e_{njt}\cdot\frac{\pi}{\sqrt{6}s_n}$ is identically and independently extreme value type one distributed (with constant variance $\operatorname{var}\left(\varepsilon_{njt}\right)=\pi^2/6$), leading to the following specification:

$$U_{njt}=\sigma_n\alpha_n p_{njt}+\sigma_n\boldsymbol{b}_n{}'\boldsymbol{X}_{njt}+\varepsilon_{njt}\,. \tag{2}$$

where $\sigma_n=\pi/\sqrt{6}s_n$. Note that due to the ordinal nature of utility, this specification still represents the same preferences. The estimates $\sigma_n\alpha_n$ and $\sigma_n\boldsymbol{b}_n$ do not have direct interpretation, but if interpreted in relation to each other the scale coefficient σ_n cancels out.

Finally, given the interest in establishing estimates of WTP for the non-monetary attributes $\boldsymbol{X}_{njt}$, it is convenient to introduce the following modification which is equivalent to using money-metric utility function (aka estimating the parameters in WTP space; Train and Weeks, 2005):

$$U_{njt}=\sigma_n\alpha_n\left(p_{njt}+\frac{\boldsymbol{b}_n}{\alpha_n}{}'\boldsymbol{X}_{njt}\right)+\varepsilon_{njt}=\sigma_n\alpha_n\left(p_{njt}+\boldsymbol{\beta}_n{}'\boldsymbol{X}_{njt}\right)+\varepsilon_{njt}\,. \tag{3}$$

Note that under this specification the vector of parameters $\boldsymbol{\beta}_n=\boldsymbol{b}_n/\alpha_n$ is now (1) scale-free and (2) can be directly interpreted as a vector of implicit prices for the attributes $\boldsymbol{X}_{njt}$. Also, in MXL models an additional advantage of this specification is that we are able to specify a particular distribution of WTP in the sample (by specifying the distribution of $\boldsymbol{\beta}_n$) rather than the distribution of the underlying taste parameters ($\boldsymbol{b}_n$). These taste parameters are later divided by a price coefficient, often leading to implausible assumptions about the distribution of the WTPs.

Estimation of the model parameters is through maximum likelihood techniques. An individual will choose alternative *j* if $U_{njt}>U_{nkt}$, for all $k\neq j$, and the probability that alternative *j* is chosen from a set of *C* alternatives is given by

$$P\left(j|C\right)=\frac{exp\left(\sigma\alpha_n\left(p_{njt}+\boldsymbol{\beta}_n{}'\boldsymbol{X}_{njt}\right)\right)}{\sum_{k=1}^{C}exp\left(\sigma\alpha_n\left(p_{nkt}+\boldsymbol{\beta}_n{}'\boldsymbol{X}_{nkt}\right)\right)}\ . \tag{4}$$

In the simple (fixed parameter) multinomial logit (MNL) model the *n*-subscript of all parameters can be suppressed so that the estimated parameters are no longer individual specific. In the MXL specification, since the probability is conditional on the random terms the unconditional probability is obtained by multiple integration, and there exists no closed form expression of (4). Instead, it can be simulated by averaging over *D* draws from the assumed distributions (Revelt and Train, 1998). As a result the simulated log-likelihood function becomes:

$$\log L=\sum_{n=1}^{N}\log\frac{1}{D}\sum_{d=1}^{D}\prod_{t=1}^{T_i}\frac{\exp\left(\sigma\alpha_n\left(p_{njt}+\boldsymbol{\beta}_n'\boldsymbol{X}_{njt}\right)\right)}{\sum_{k=1}^{C}\exp\left(\sigma\alpha_n\left(p_{nkt}+\boldsymbol{\beta}_n'\boldsymbol{X}_{nkt}\right)\right)} \tag{5}$$

Whereas the model above yields estimates for marginal WTPs for the attributes, we are also interested in the total WTP for the protection alternatives relative to no further protection. This corresponds to the compensating surplus (variation) of protection, which can be calculated using the Hanemann (1984) and Small et al. (1981) approaches with minor modifications for WTP-space models. As the size attributes are mutually exclusive, we present the welfare measures associated with two cases denoted 'small' protection and denoted 'large' protection. They differ only in size whilst the other choice attributes except cost take the same (positive) level.

2.2 Data

A professional survey firm was employed to recruit the workshop participants. In the recruitment process the targeted persons were told that the survey was about management of marine resources, but not that it was about CWC. In addition, they were told that there was a payment of NOK 500 (about EUR 60) for each participant who completed the survey. In order to secure statistical representativeness with respect to gender and age, each group is representative with respect to gender and age for their respective municipality. To secure geographic coverage we sampled municipalities across the whole country. Altogether 24 valuation workshops (including 2 pilots) in 22 municipalities were conducted. Each workshop had between 12 and 23 participants.

The sample characteristics are given in table 2.

(Table 2 about here)

The sample has a somewhat lower female share (46.5%) compared to the national average (49.8 %). The age distribution of our sample is very close to the national age distribution, but we have a lower share in the youngest group (18-25 years) and a slightly higher share in the middle aged group (46-55 years). Based on postal code we calculated the percentage living in coastal areas (63%) and in urban areas (73%). Both are somewhat higher compared to the national average. About 63% of the survey sample belongs to the labor force, whereas the national share is 73%. Occupationally, the survey sample is biased. Of those working in the private sector, the sample contains a higher share of those belonging to the oil/gas industry, fisheries and aquaculture (8%), 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 marine resources, and therefore may be perceived as more relevant for those employed in marine industries. The respondents were divided into ten income groups, each of an interval of NOK 100k (EUR 11.9k) and eight household income groups, each of an interval of NOK 200k (EUR 23.8k) except the first and last group. The survey has a lower percentage of low income people compared to the national average. The sample is biased towards more educated people, 57% had more than 12 years in school compared to the national average on 26%. Finally, only about 10% of the survey participants were members of an environmental NGO.

As part of the survey all participants were asked to answer a quiz with eight questions. The quiz was given immediately after the PP-presentation of CWC, and the quiz questions referred to information 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 PP-presentation was reasonably effective in informing people about the aspects of CWC relevant for the valuation exercises, compared for example with respondents in Glenn et al. (2010).

3 Results

In the DCE, the status quo was chosen in 25% of the choices, and in the remaining 75% of the choices protecting a larger area was chosen. Table 3 shows the estimation results for the MXL model with correlations and, for comparison, for the MNL model. All models are formulated in WTP-space and hence the parameter estimates for all non-price attributes are given in monetary units. In the MXL model we assumed that the marginal WTPs are normally distributed, whereas the cost attribute is assumed to be log-normally distributed.[7]

(Table 3 about here)

Table 3 shows that in the MXL model all attributes are significant and so are their associated standard deviations, which is an indication of respondents' unobserved preference heterogeneity. The *habitat* attribute had the highest WTP. Respondents were willing to pay EUR 166 more for protection when the protected area was important habitat for fish compared to when it was not. The estimated WTP for the *oil/gas* and the *fish* attributes were positive, which means that if the area was attractive for the fisheries and/or for the oil industry people were willing to pay EUR 39 and EUR 16 respectively more for its annual protection, compared to if it was not attractive to these off-shore industries. Finally, regarding the *size* of the protected area, respondents were willing to pay EUR 53 for extending the protected area from the current 2445 km^2 to 5000 km^2, and EUR 66 for an extension from 2445 to 10 000 km^2. The MNL model, on the other hand, yields significant WTPs for only three of the attributes in addition to *cost*; *size* (large), *fish* and *habitat*. The *size* attributes in this model have far lower marginal WTPs compared to the MXL model, indicating that these were the attributes which had the highest correlation with other attributes (the results from the MXL model without correlation were closer to the MNL results for these attributes than to the MXL model with correlation).

We also estimated an MNL and an MXL model in which the choice attributes are separately interacted with each of the socio-demographic (SD) variables. This allows us to identify gross effects of each SD variable, i.e. without controlling for differences in the SD variables. These results are

[7] We have made our dataset and codes available at the home pages of the authors in order for others to be able to replicate our results.

included in appendix B.[8] Most of the parameters for the interaction variables are not significant. Among the significant effects we find that unemployed persons, older persons and persons in households with higher total household income were more likely to choose the SQ alternative. Retired persons were more likely to choose further protection in the case of small size protection, and people working part time were less likely to choose further protection if the protected areas were attractive for industrial activities. Male respondents and those with higher personal income were willing to pay more for the fish attribute, members of an ENGO had higher WTP for the oil/gas and habitat attributes, and students had lower WTP for the fish attribute. People working in the oil industry and in the public sector and people living at the coast were willing to pay more for the habitat attribute. There were no statistically significant differences between respondents living in urban areas compared to rural households, and education and household size had no effects on the WTP for further CWC protection.

Next, we illustrate our results by simulating WTP for two protection scenarios. We call these “small” and “large”, and arrange it so that they differ only in the size of newly protected CWC, but in both cases the areas are important for commercial activities (oil/gas and fisheries) and as habitat for fish. The procedure we used took uncertainty with respect to model parameters into account. Table 4 presents the mean, standard error (approximated with the standard deviation) and 95% confidence interval (approximated with the 95% inter-quantile range) of the welfare measures of the two scenarios described above for the MNL model and the MXL model with correlations respectively.

(Table 4 about here)

[8] Due to the huge amount of parameters the models where the attributes are interacted with the SD for work and for occupation are the MXL model without correlations. For all other interaction models the MXL model with correlations is applied.

The simulated WTP for a small and a large degree of protection of cold water corals equals EUR 274 and EUR 287 per household per year respectively.[9] The WTP for the two protection scenarios resulting from the MNL model is lower, but reasonably close to that for the MXL model.

4 Discussion

There may be trade-offs between protecting CWC and the benefits which society derives from other services provided by the marine environment, such as commercial deep-sea fisheries and petroleum. From a management and policy perspective, it is thus of considerable interest to identify types of ecosystem service values to which CWC may contribute and their economic significance. Foley et al. (2010), applying the TEEB framework (The Economics of Ecosystems and Biodiversity; TEEB, 2010),[10] identify several ecosystem services (ES) that CWC provide. Whereas we have derived significant estimates on peoples' WTP for CWC protection, it is hard to match these values to specific ecosystem services that this resource provides. The most obvious ecosystem service provided by CWC is as habitat for fish and other marine organisms, which is an intermediate or supporting ecosystem service. The largest single value for CWC off the coastline of Norway is people's WTP for protecting CWC because of this importance as a habitat for fish, perhaps due to preferences related to the consumption of fish. The single value attached to the attribute *habitat* is four times higher than the value attached to the *fish* attribute and two to three times higher than the *size* attributes. The *habitat* attribute may, however, also relate to non-use values for fish.

This interpretation arises from the fact that the attribute *fish* has a positive sign. This means that even if protecting CWC will imply reduced fisheries activities, and thus less fish for consumption, people are still willing to pay for protecting CWC. Hence, people are not only willing to pay for protecting CWC because then we get more fish to *eat*; they may also be willing to pay for protecting CWC because there will be more fish regardless of whether we eat them or not. So, people value CWC due to its role as habitat for fish not only because fish provides food (and generate income) for them, but also because they care about the existence of fish. We are not able to disentangle these

[9] Note that the WTP for an aggregate scenario is not a simple sum of WTP for separate attributes, since the parameters in the MXL model could be correlated. In order to calculate the WTP we applied a two-tier simulation procedure described in Czajkowski et al. (2015).

[10] TEEB in turn applies the TEV (Total Economic Value) to categorize the ecosystem services to be valued.

two motives for WTP. The *size* attributes (small and large) have significant WTP estimates. Although it could be tempting to let these attributes represent peoples' valuation of CWC for its pure existence (non-use) values, this attribute could also represent the fact that a larger protected area means that there is more habitat for fish and other marine organisms. As such, the *size* attributes may also encompass intermediate (indirect) ecosystem service values. 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 safely assume that CWC will continue to exist in Norwegian waters, and that it will continue to provide habitat for fish stocks in the future.

Including the socio-demographic characteristics as interactions in the model provided a few significant results. Men and those with higher income tended to have higher WTP for the *fish* attribute, whereas households with higher total income were less likely to choose further protection. The latter can partly be explained by the fact that some households were shared houses, and where each person did not earn very much. People living on the coast and people working in the oil industry had a higher WTP for the *habitat* attribute. We did not find statistically significant effects of the rural-urban gradient, which has been shown to be a significant explanatory variable in other valuation studies (Martin-Lopez et al., 2012).

Wilson and Howarth (2002) point to a paradox that, whereas most ecosystem services are public goods, the methods applied to elicit how people value them are based on responses from individuals in private settings. In contrast, group settings can encourage people to share their knowledge, which in turn increases the likelihood of more informed choices than would be the case if the decision were left to single individuals (Winquist and Larson, 1998, referred to in Wilson and Howarth, 2002, p.439). This may be especially relevant in cases with unfamiliar (public) goods, such as CWC. Spash (2002) adds nuances to this viewpoint by showing that additional information mainly contributes to inform respondents' preferences rather than changing them. Group discussion of the trade-offs which society faces in environmental management decisions can also produce more consensus over actions, even when preferences are elicited on an individual basis. The fact that previous studies of CWC protection have ended up inconclusive due to a non-significant cost attribute (Glenn et al., 2010) was a strong signal that the "minimum information" modes of WTP elicitation, such as postal, internet, or even in-person surveys may not be sufficient to derive useful WTP estimates for CWC management, since this is such an unfamiliar good (Czajkowski et al., 2015).

Given this background, we chose a valuation workshop approach, which worked well in the sense that it gave us a robust dataset and significant attribute estimates. This said, it must be admitted that the costs of the survey were significant. Recent experiences have shown that an identical survey, but where all information was provided by the use of videos, can be implemented by the use of internet for only a fraction of the valuation workshop costs (Sandorf et al., 2014). The question is, however, whether such an internet survey could have been implemented without the experiences from the valuation workshops? As we see it, the benefits from implementing valuation workshops were not solely more robust and better informed WTP estimates, but also a learning process for SP-practitioners when valuing unfamiliar (environmental) goods. Whereas focus groups provide information about how to present the good to be valued, and the pilot(s) control for how respondents manage to make “reasonable” choices, nowhere in the process of designing an SP-survey do researchers have the opportunity to be informed about how people actually understand the questions they are asked to respond to.

Valuation workshops do not come without drawbacks. Although the sample is relatively representative for the Norwegian adult population with regard to socioeconomics and geography, two issues may still make the sample unrepresentative of the general public. First, prior to the choice experiment the participants were given information about CWC, and second, the survey participants were allowed to ask questions regarding CWC and deliberate on the issues around protecting such sites. These issues obviously imply that the survey sample on average is more informed about CWC than the Norwegian public in general. This is important since results from the valuation literature show a positive correlation between the level of knowledge of a good and the WTP for the same good (Spash 2002, LaRiviere et al., 2014). In addition we have the so-called “social desirability” effect, which states that people tend to increase their stated WTP for a good when given in a social setting compared to when they are surveyed in social isolation (List et al., 2004, Leggett et al., 2003).

Based on the results from the survey reported above, the message to Norwegian coastal authorities is that people do care for CWC *per se*, and especially if it constitutes an important habitat for fish. Also, they are willing to accept that commercial fishing and the oil industry are adversely affected by CWC protection. Norwegian coastal authorities and managers emphasize the importance of implementing policy, which to the extent possible, is accepted by those who are subject to these rules and regulations (pers. comm. Egil Lekven, Norwegian Directorate of Fisheries, 28.09.2012).

Hence, the authorities are particularly sensitive to the feedback from fishers and other people working in marine industries. Our results show that people working in the oil industry and/or fisheries/aquaculture had a higher WTP for the habitat attribute compared to people working in other industries. In addition, 54% of the respondents working in these marine industries state that industrial activities off shore must be executed with care in order to make as little damage to CWC as possible. The remaining 46% of respondents working in the marine sector state that we have to accept that some CWC may get lost due to industrial activities. The corresponding numbers for respondents not working in the marine industries are 68% and 32%. Hence, although respondents from marine industries are to a larger degree willing to accept that CWC are destroyed due to industrial activities, a majority still are of the opinion that such activity must be executed with outmost care in order to avoid damage to 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 8% of the respondents belong to the marine sector, and given the problems of self-selection and the knowledge bias, this result must be interpreted 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. The results presented in this paper show that further protection of CWC is regarded as a benefit for which people have a positive and significant WTP. In addition, although not yet rigorously scientifically proven, scientists suspect that CWC is important habitat for many commercially important fish species. These aspects make CWC important from a management perspective. The aim of this paper is to derive monetary estimates for peoples valuation of CWC, and to determine the motivations behind the derived WTP. The results revealed that people value CWC due to the fact that CWC provide habitat for fish, and for its pure existence. However, we were not able to disentangle the values people attach to CWC due to its role as habitat for fish compared to its pure existence.

There are challenges in valuing intangible, and for most people unheard of, organisms. In the worst case, we may end up with an invalid dataset, because the respondents have not understood what they were responding to. To avoid this pitfall, we implemented the survey as a type of valuation workshop instead of a traditional stated preferences survey. Whereas this rendered the survey highly valid, it came at the cost of possible sample bias due to self-selection and knowledge acquisition and the social desirability effect.

This paper presents the first direct monetary valuation of CWC. Such a valuation of an intangible and relatively unknown good poses several methodological and practical challenges as described above. On the other hand, it has provided insights, which can be useful in the management of marine resources in Norway. First, we show that people in Norway derive welfare from knowing that CWC exists. Second, assuming that CWC plays a role as habitat for fish, we show that people are not only motivated to protect CWC because they consume fish, but also that they value the fact that fish have good and sufficient living conditions. Our results indicate that such considerations should be given significant weight in Norwegian resource management. Finally, our work illustrates the challenges inherent in the alignment of the MEA (2005) classification of ecosystem services with the older concept of Total Economic Value (TEV).

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Appendix A

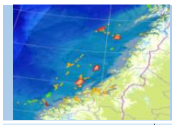
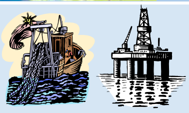
Attribute		*Alternative 1*	*Alternative 2*	*Alternative 3 (SQ)*
Size of protected area (total)		*5.000 km^2*	*10.000 km^2*	*2.445 km^2*
Attractiveness for commercial activities		*No, not attractive for any commercial activities*	*Attractive for oil/gas and fisheries*	*Somewhat attractive for oil/gas 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

Table A1 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents' gender. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	-1.5995	73.0686***	202.4771***
	(14.8912)	(15.5776)	(20.1415)
Large-size	40.8928***	99.5739***	233.0997***
	(14.8719)	(15.6675)	(20.7660)
Oil/gas	23.3791**	16.9129	98.2431***
	(9.8471)	(9.3039)	(8.3238)
Fish	13.3119	11.8287	105.7522***
	(10.1590)	(8.3010)	(8.5319)
Habitat	175.3952***	159.5201***	216.9765***
	(16.9902)	(15.1114)	(20.9028)
Small-size*sex	-21.7111	-3.1876	235.1352***
	(20.1577)	(26.8175)	(30.7155)
Large-size*sex	-38.3644	-24.4888	239.5579***
	(20.4352)	(29.1217)	(31.8762)
Oil/gas*sex	-21.3664	-4.6147	71.8871***
	(13.4468)	(13.3909)	(12.7528)
Fish*sex	28.7139**	32.2458**	91.7690***
	(14.0689)	(12.9890)	(15.4364)
Habitat*sex	-2.0932	-6.2462	173.1844***
	(14.9574)	(20.0993)	(25.0731)
Price (in preference space)	77.1318***	72.7213***	110.6386***
	(6.4918)	(8.8205)	(10.5950)
N	4683		4683

MXL: LogLikelihood = -3436.4736, AIC/n = 1.5011, pseudo-R2 = 0.3232

MNL: LogLikelihood = -4753.2124, AIC/n = 2.0347, pseudo-R2 = 0.0639

Table A2 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents' age. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	-13.5099	70.5853***	195.9980***
	(10.7219)	(11.2409)	(17.5720)
Large-size	20.1592**	94.3738***	244.5683***
	(10.2078)	(10.6125)	(17.6969)
Oil/gas	12.1197	10.0268	99.6192***
	(6.6846)	(6.4176)	(7.2143)
Fish	28.5993***	32.2083***	83.1564***
	(7.2107)	(6.5782)	(7.2185)
Habitat	174.7904***	171.2393***	179.2935***
	(15.1408)	(10.8648)	(11.5037)
Small-size*age	-13.4279	-36.9049**	141.6803***
	(9.8424)	(14.9835)	(12.8237)
Large-size*age	4.3452	-30.6872**	162.8627***
	(10.1029)	(14.5679)	(13.1355)
Oil/gas*age	-3.7324	-1.5660	71.3797***
	(6.7090)	(8.8682)	(8.4283)
Fish*age	-23.3623***	-11.1317	76.3940***
	(7.2304)	(8.6255)	(9.1968)
Habitat*age	1.2050	-1.9804	102.1625***
	(7.4303)	(12.4740)	(10.5120)
Price (in preference space)	77.0821***	81.2627***	143.4064***
	(6.5041)	(9.8300)	(12.1669)
N	4683		4683

MXL: LogLikelihood = -3431.8084, AIC/n = 1.4991, pseudo-R2 = 0.3241

MNL: LogLikelihood = -4747.098, AIC/n = 2.0321, pseudo-R2 = 0.0651

Table A3 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents being members of environmental non-government organizations. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	-20.1593 (11.2388)	117.7439*** (28.0724)	447.9022*** (30.1173)
Large-size	12.6377 (10.6727)	141.5694*** (32.0601)	546.0535*** (33.1778)
Oil/gas	8.5732 (7.0188)	-14.5818 (14.5727)	215.7564*** (15.8888)
Fish	27.4969*** (7.5175)	38.2639*** (14.4332)	223.2581*** (18.7970)
Habitat	165.2576*** (14.6236)	272.6947*** (20.3554)	288.6605*** (19.0193)
Small-size*ENGO	133.3908*** (41.2960)	181.6581 (228.1544)	811.7918*** (233.8388)
Large-size*ENGO	140.4976*** (41.0388)	297.2851 (226.0584)	686.6019*** (229.1828)
Oil/gas*ENGO	33.7738 (22.0476)	154.6288** (77.7581)	330.3966*** (52.1123)
Fish*ENGO	11.2708 (22.9338)	57.3823 (58.3164)	349.5534*** (51.8084)
Habitat*ENGO	93.1677*** (26.8177)	527.2370*** (151.0529)	502.0589*** (101.2198)
Price (in preference space)	77.3265*** (6.5145)	292.4895*** (28.3375)	525.2049*** (37.2360)
N	4683		4683

MXL: LogLikelihood = -3209.7012, AIC/n = 1.4042, pseudo-R2 = 0.3679

MNL: LogLikelihood = -4718.3075, AIC/n = 2.0198, pseudo-R2 = 0.0708

Table A4 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with the number of adults in respondents' household. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	-11.8140 (10.6661)	25.7892*** (9.8439)	200.4595*** (15.3289)
Large-size	21.6590** (10.1674)	35.1875*** (9.8943)	262.2640*** (15.8401)
Oil/gas	11.9676 (6.6731)	13.4038 (7.3299)	106.3659*** (7.2783)
Fish	28.5654*** (7.1847)	21.0283*** (7.3327)	97.6329*** (6.6465)
Habitat	173.9335*** (15.0483)	163.3156*** (10.9335)	154.2273*** (11.0068)
Small-size*hha	-25.3816** (10.7765)	-4.9400 (18.2107)	122.4152*** (23.0915)
Large-size*hha	-32.7543*** (10.8326)	-20.9364 (20.0943)	149.1938*** (24.8135)
Oil/gas*hha	0.7950 (7.1545)	3.5770 (12.5101)	59.7082*** (12.1311)
Fish*hha	-0.1698 (7.4223)	2.3496 (10.3457)	63.6251*** (11.9274)
Habitat*hha	-1.4092 (8.0611)	-11.7137 (15.2722)	132.9072*** (17.8534)
Price (in preference space)	77.0887*** (6.4900)	82.7339*** (8.5124)	111.8290*** (11.0080)
N	4683		4683

MXL: LogLikelihood = -3442.8638, AIC/n = 1.5038, pseudo-R2 = 0.322

MNL: LogLikelihood = -4746.7894, AIC/n = 2.032, pseudo-R2 = 0.0652

Table A5 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents' number of children in the household. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	-13.3010	53.1869***	164.2629***
	(10.7211)	(10.2026)	(15.7049)
Large-size	20.4785**	76.2262***	227.5745***
	(10.1857)	(10.0514)	(16.2270)
Oil/gas	12.0069	19.5160***	70.7980***
	(6.6786)	(6.5856)	(7.1950)
Fish	28.7149***	27.3992***	93.9699***
	(7.1968)	(6.4849)	(7.7029)
Habitat	174.3056***	151.9601***	180.9822***
	(15.0928)	(11.4279)	(12.1278)
Small-size*hhc	-21.1655**	-17.5428	154.5121***
	(10.5523)	(15.1447)	(16.5092)
Large-size*hhc	-15.6699	-8.8567	164.9145***
	(10.3815)	(16.2101)	(16.8007)
Oil/gas*hhc	4.6687	6.7790	79.0411***
	(6.8014)	(9.2063)	(8.7229)
Fish*hhc	7.1066	7.1389	66.4795***
	(7.1383)	(8.3740)	(10.8303)
Habitat*hhc	5.4087	13.8456	120.4279***
	(7.7207)	(14.3369)	(14.5313)
Price (in preference space)	76.9809***	90.1376***	128.1923***
	(6.4867)	(8.6879)	(10.7849)
N	4683		4683

MXL: LogLikelihood = -3436.0707, AIC/n = 1.5009, pseudo-R2 = 0.3233

MNL: LogLikelihood = -4757.3993, AIC/n = 2.0365, pseudo-R2 = 0.0631

Table A6 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents' personal income level. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	-10.8229	55.8112***	179.8279***
	(10.6811)	(6.4389)	(12.9113)
Large-size	22.4657**	68.8861***	217.8179***
	(10.1992)	(6.2275)	(13.5462)
Oil/gas	11.6468	26.6931***	68.0622***
	(6.6842)	(5.1228)	(6.3027)
Fish	28.1360***	42.0193***	94.7217***
	(7.1917)	(6.2412)	(5.9729)
Habitat	174.3198***	173.6742***	170.3706***
	(15.0923)	(10.6594)	(10.6996)
Small-size*pincome	23.7176**	-6.4925	87.6955***
	(10.3797)	(14.8224)	(13.9267)
Large-size*pincome	32.6957***	-1.2910	132.0466***
	(10.4923)	(14.2723)	(10.9578)
Oil/gas*pincome	4.2861	12.0139	87.0703***
	(6.5967)	(7.8879)	(7.6481)
Fish*pincome	13.3946	22.4610***	67.3082***
	(6.9835)	(7.9653)	(8.8072)
Habitat*pincome	4.5116	20.3780	94.8509***
	(7.4466)	(11.0017)	(12.2034)
Price (in preference space)	77.0632***	90.6151***	157.6493***
	(6.4886)	(10.4568)	(13.2144)
N	4683		4683

MXL: LogLikelihood = -3434.8275, AIC/n = 1.5004, pseudo-R2 = 0.3235

MNL: LogLikelihood = -4736.1811, AIC/n = 2.0274, pseudo-R2 = 0.0673

Table A7 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents' household income level. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	-13.3661 (10.7271)	35.0046*** (8.7921)	219.7241*** (17.0922)
Large-size	20.4588** (10.1862)	51.5938*** (9.6956)	290.3487*** (18.9990)
Oil/gas	11.9487 (6.6821)	10.6724 (6.2237)	92.8634*** (6.4229)
Fish	28.7103*** (7.1988)	19.4476*** (7.2791)	106.0714*** (7.4993)
Habitat	174.4173*** (15.1024)	163.5352*** (10.3174)	162.0451*** (10.3414)
Small-size*hincome	-21.5045** (10.0943)	-64.8025*** (19.5461)	136.2588*** (16.2863)
Large-size*hincome	-15.3735 (10.0542)	-69.4303*** (21.0146)	153.1686*** (17.1366)
Oil/gas*hincome	0.0982 (6.6196)	3.6705 (8.6577)	51.3623*** (9.5468)
Fish*hincome	3.7842 (6.8867)	-0.3982 (9.4339)	65.2110*** (9.7769)
Habitat*hincome	9.3989 (7.5010)	24.3025 (13.1462)	99.8747*** (11.5908)
Price (in preference space)	76.9715*** (6.4854)	98.3476*** (9.0473)	129.4465*** (11.3568)
N	4683		4683

MXL: LogLikelihood = -3424.7189, AIC/n = 1.4961, pseudo-R2 = 0.3255

MNL: LogLikelihood = -4757.0199, AIC/n = 2.0363, pseudo-R2 = 0.0632

Table A8 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents' education levels. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
	-55.6833	52.9145	231.6006
Small-size	(38.5251)	(115.0683)	(143.3534)
	-66.3401	30.6446	204.2161**
Large-size	(41.3738)	(111.4714)	(99.6714)
	-19.9318	1.0044	129.3993**
Oil/gas	(27.6183)	(44.5224)	(53.1411)
	55.0835	35.9603	214.1792**
Fish	(29.1112)	(59.3785)	(105.0010)
	131.7686***	108.6970	325.3339**
Habitat	(31.8890)	(90.5374)	(142.6970)
	37.0288	6.9116	262.7415***
Small-size*edu2	(41.4678)	(122.4868)	(86.8379)
	16.7393	-42.1792	401.1912***
Small-size*edu3	(42.7366)	(143.9835)	(120.8627)
	80.2271	140.9109	344.3777***
Small-size*edu4	(42.2388)	(129.7440)	(90.2168)
	49.7075	19.3465	285.9476***
Large-size*edu2	(44.2281)	(122.3543)	(78.0617)
	71.3299	13.0773	450.0153***
Large-size*edu3	(45.3378)	(132.5640)	(118.3907)
	155.5929***	216.5508	380.1734***
Large-size*edu4	(45.6179)	(127.4247)	(98.6408)
	31.9527	17.1055	190.1547***
Oil/gas*edu2	(29.8401)	(50.8481)	(46.1540)
	21.5652	-12.8341	308.1728***
Oil/gas*edu3	(30.7015)	(65.8962)	(80.3226)
	44.7154	8.6895	313.6960***
Oil/gas*edu4	(29.9018)	(59.3535)	(59.8571)
	-8.4257	11.8284	275.6093***
Fish*edu2	(31.0900)	(63.9837)	(88.2622)
	-27.8989	-13.7492	437.4155***
Fish*edu3	(32.1424)	(87.4261)	(103.7406)
	-48.3876	-45.1519	318.6273***
Fish*edu4	(31.2872)	(69.1979)	(89.0861)
	60.3600	83.4939	400.8256***
Habitat*edu2	(33.3612)	(93.1402)	(132.8616)
	41.1101	138.3391	620.5718***
Habitat*edu3	(34.1317)	(122.3494)	(141.3993)
	30.1602	108.0396	451.9211***
Habitat*edu4	(33.0277)	(98.4263)	(126.5175)
Price (in preference	78.0016***	108.1200***	261.5705***

space)	(6.5179)	(22.7911)	(27.6411)
N	4683		4683

MXL: LogLikelihood = -3292.3705, AIC/n = 1.5199, pseudo-R2 = 0.3516

MNL: LogLikelihood = -4725.1207, AIC/n = 2.027, pseudo-R2 = 0.0694

Table A9 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents living in coastal areas. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	6.2126	74.4385***	238.1861***
	(12.7402)	(14.4840)	(21.5538)
Large-size	41.5929***	75.5606***	324.8072***
	(12.4917)	(16.6944)	(23.9982)
Oil/gas	19.6872**	1.4302	101.9891***
	(8.3170)	(8.6984)	(8.0898)
Fish	27.0160***	30.2755***	90.3740***
	(8.7904)	(8.1645)	(7.5614)
Habitat	157.6426***	145.5596***	138.2143***
	(14.9098)	(11.3516)	(10.2727)
Small-size*coast	-52.7171**	-54.7066	213.6329***
	(21.1806)	(35.8184)	(38.7826)
Large-size*coast	-57.2663***	-26.2789	183.5715***
	(21.4707)	(37.7308)	(36.4916)
Oil/gas*coast	-21.7808	14.4083	162.9807***
	(14.0368)	(18.0372)	(21.1854)
Fish*coast	4.6669	13.6939	137.0991***
	(14.4294)	(21.3065)	(17.6839)
Habitat*coast	45.4377***	97.4720***	229.7873***
	(16.1126)	(30.9601)	(32.7702)
Price (in preference space)	77.2147***	67.5253***	116.1603***
	(6.4935)	(9.1344)	(11.3757)
N	4683		4683

MXL: LogLikelihood = -3433.7759, AIC/n = 1.4999, pseudo-R2 = 0.3238

MNL: LogLikelihood = -4749.9514, AIC/n = 2.0333, pseudo-R2 = 0.0645

Table A10 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents living in urban areas. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	1.4810	76.3176***	226.6086***
	(11.9904)	(10.4458)	(17.1932)
Large-size	42.5906***	76.3361***	314.1618***
	(11.6284)	(11.5579)	(18.8765)
Oil/gas	11.0700	-11.8093	109.4171***
	(7.6741)	(7.0352)	(7.6410)
Fish	28.2822***	18.8630***	103.2025***
	(8.1878)	(6.6138)	(6.4224)
Habitat	170.1934***	150.6411***	145.9575***
	(15.2815)	(9.7687)	(10.1637)
Small-size*urban	-52.1100**	-59.1299	263.9154***
	(22.6521)	(40.4203)	(57.7426)
Large-size*urban	-81.5140***	-53.9697	250.3831***
	(23.8207)	(47.9150)	(52.6989)
Oil/gas*urban	3.6153	17.9266	111.0886***
	(15.2150)	(20.9906)	(26.7661)
Fish*urban	1.3837	9.7533	165.2332***
	(15.7980)	(27.2714)	(29.7026)
Habitat*urban	12.5922	43.6612	181.9871***
	(17.0277)	(37.8565)	(32.8401)
Price (in preference space)	77.4920***	84.5579***	123.8630***
	(6.4826)	(9.4224)	(11.0872)
N	4683		4683

MXL: LogLikelihood = -3427.2631, AIC/n = 1.4971, pseudo-R2 = 0.325

MNL: LogLikelihood = -4748.8291, AIC/n = 2.0328, pseudo-R2 = 0.0648

Table A11 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents' work status. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
	0.8243	-4.4598	99.4286***
Small-size	(53.8145)	(5.5013)	(7.0368)
	-22.6067	28.4999***	139.5364***
Large-size	(55.3865)	(6.0846)	(7.4995)
	-9.3276	13.8304***	103.5741***
Oil/gas	(38.1438)	(5.3624)	(6.3692)
	46.5242	9.0967	89.6548***
Fish	(39.1668)	(4.9518)	(5.4167)
	115.8885***	150.7982***	177.7242***
Habitat	(42.3707)	(8.7956)	(9.7333)
	-59.0539	-42.3140	91.1195***
Small-size*work2	(77.7055)	(21.7354)	(15.2229)
	-63.7765	-109.9586***	194.0534***
Small-size*work3	(73.3517)	(23.7990)	(29.9280)
	30.0249	26.7925	78.0235***
Small-size*work4	(71.5272)	(14.8291)	(13.1569)
	-40.4722	-97.7921	56.4045
Small-size*work5	(59.4563)	(199.0386)	(155.3539)
	-23.1881	37.0603***	41.3516***
Small-size*work6	(57.0929)	(11.1199)	(6.5993)
	3.2946	-84.2646**	130.0512***
Small-size*work7	(56.0285)	(33.3054)	(23.5257)
	-99.1758	-85.1258***	97.9256***
Large-size*work2	(83.5497)	(15.6630)	(10.4383)
	-32.4732	-72.2749***	103.0552***
Large-size*work3	(74.7649)	(24.1403)	(29.0060)
	96.7611	25.3062	55.4858***
Large-size*work4	(71.6394)	(15.3285)	(9.1889)
	43.5072	-290.5297	10.0404
Large-size*work5	(60.3195)	(172.6677)	(112.2723)
	49.2485	-12.2220	65.9354***
Large-size*work6	(58.3403)	(10.2900)	(10.1995)
	51.6266	-214.1708***	89.9138***
Large-size*work7	(57.6741)	(40.8379)	(32.8634)
	28.8488	-36.8899***	45.9670
Oil/gas*work2	(56.7293)	(14.2722)	(25.6822)
	9.1289	-22.2731	77.0666***
Oil/gas*work3	(50.3809)	(22.4920)	(24.5642)
	-38.2853	-22.5833	47.9016***
Oil/gas*work4	(48.2553)	(11.9559)	(12.3098)
	-2.5635	-62.7264	50.8726
Oil/gas*work5	(41.8109)	(121.2017)	(92.4557)

	38.5565	-14.4654	88.3497***
Oil/gas*work6	(40.1814)	(7.5714)	(10.8367)
	28.4994	-80.1940**	225.3366***
Oil/gas*work7	(39.6318)	(35.9440)	(51.0156)
	-50.2946	-53.4141***	15.7781
Fish*work2	(58.1704)	(12.5191)	(29.0962)
	31.7633	19.9546	86.3783***
Fish*work3	(53.0338)	(16.1842)	(11.2102)
	15.3837	-40.5906***	13.5980
Fish*work4	(49.5680)	(12.7157)	(11.0613)
	-27.7626	107.7791	10.3423
Fish*work5	(42.9195)	(154.8238)	(130.2092)
	-23.8860	39.8645***	82.0739***
Fish*work6	(41.1161)	(8.9579)	(7.2864)
	-18.0226	95.5073***	23.5889
Fish*work7	(40.5592)	(26.4269)	(25.0750)
	145.4365**	-15.0874	99.3458***
Habitat*work2	(65.7442)	(13.1524)	(15.1267)
	92.1813	94.2700**	197.3185***
Habitat*work3	(56.6761)	(44.0982)	(45.9819)
	81.8422	-45.9610***	3.9604
Habitat*work4	(53.9822)	(15.0920)	(6.2831)
	57.5358	-160.0537	9.9769
Habitat*work5	(46.0944)	(162.5293)	(118.2894)
	65.2822	-43.7796***	95.7271***
Habitat*work6	(44.2724)	(10.8374)	(7.3684)
	47.7620	240.2054***	170.0890***
Habitat*work7	(43.4363)	(46.9806)	(32.4517)
Price (in preference space)	76.9657***	99.4778***	129.0380***
	(6.5106)	(9.4338)	(9.8407)
N	4683		4683

MXL: LogLikelihood = -3627.5998, AIC/n = 1.5805, pseudo-R2 = 0.2856

MNL: LogLikelihood = -4735.9952, AIC/n = 2.0381, pseudo-R2 = 0.0673

Table A12 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models including interactions with respondents' occupation type. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	MXL model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
	0.8243	40.0654	75.1364***
Small-size	(53.8145)	(28.9481)	(7.4301)
	-22.6067	-17.8618	112.3242***
Large-size	(55.3865)	(37.7711)	(7.3381)
	-9.3276	1.8871	64.8042***
Oil/gas	(38.1438)	(30.3730)	(6.3397)
	46.5242	-3.7888	83.4676***
Fish	(39.1668)	(36.5764)	(5.4995)
	115.8885***	63.2686	143.6640***
Habitat	(42.3707)	(39.9699)	(7.8136)
	-59.0539	-62.8797	150.5327
Small-size*occ2	(77.7055)	(94.4512)	(306.1169)
	-63.7765	-73.0461	48.6550
Small-size*occ3	(73.3517)	(61.5627)	(68.1144)
	30.0249	-3.6943	109.7413**
Small-size*occ4	(71.5272)	(54.0475)	(44.8146)
	-40.4722	-81.9716**	37.1030
Small-size*occ5	(59.4563)	(33.1342)	(20.0224)
	-23.1881	-14.0227	69.2227***
Small-size*occ6	(57.0929)	(30.6159)	(9.7131)
	3.2946	-13.0255	59.5792***
Small-size*occ7	(56.0285)	(29.9436)	(11.3611)
	-99.1758	-18.6939	99.7828
Large-size*occ2	(83.5497)	(140.4622)	(374.2790)
	-32.4732	-11.9533	108.4073
Large-size*occ3	(74.7649)	(60.1130)	(121.8136)
	96.7611	51.9102	114.1404**
Large-size*occ4	(71.6394)	(60.2978)	(47.3959)
	43.5072	36.9308	103.7293***
Large-size*occ5	(60.3195)	(43.4449)	(23.6780)
	49.2485	55.1878	110.7137***
Large-size*occ6	(58.3403)	(39.1985)	(13.9700)
	51.6266	28.3444	86.5913***
Large-size*occ7	(57.6741)	(37.9817)	(10.6756)
	28.8488	47.7096	157.2712
Oil/gas*occ2	(56.7293)	(249.9466)	(147.0846)
	9.1289	-68.3551	147.1971
Oil/gas*occ3	(50.3809)	(63.2195)	(78.9228)
	-38.2853	-46.6308	4.6825
Oil/gas*occ4	(48.2553)	(44.8319)	(47.1852)
Oil/gas*occ5	-2.5635	-22.2961	120.2258***

	(41.8109)	(37.6613)	(20.9903)
	38.5565	10.0195	112.9328***
Oil/gas*occ6	(40.1814)	(32.2823)	(12.2452)
	28.4994	-4.7238	69.9387***
Oil/gas*occ7	(39.6318)	(31.5316)	(7.9691)
	-50.2946	24.8506	72.6734
Fish*occ2	(58.1704)	(86.4067)	(48.7868)
	31.7633	77.3235	90.7642
Fish*occ3	(53.0338)	(68.9325)	(88.9028)
	15.3837	64.3431	52.3107
Fish*occ4	(49.5680)	(56.8906)	(51.8468)
	-27.7626	11.3251	63.5381***
Fish*occ5	(42.9195)	(39.3054)	(17.5203)
	-23.8860	3.4640	97.7757***
Fish*occ6	(41.1161)	(37.8580)	(17.9779)
	-18.0226	32.7861	64.1400***
Fish*occ7	(40.5592)	(37.3949)	(8.7673)
	145.4365**	158.6720	132.1360
Habitat*occ2	(65.7442)	(169.1785)	(275.8064)
	92.1813	160.5170**	49.2630
Habitat*occ3	(56.6761)	(62.8941)	(52.9652)
	81.8422	104.3213	70.1460
Habitat*occ4	(53.9822)	(62.8461)	(122.1107)
	57.5358	58.2237	77.0704**
Habitat*occ5	(46.0944)	(45.3086)	(33.6302)
	65.2822	96.2504**	207.7326***
Habitat*occ6	(44.2724)	(42.0687)	(20.5507)
	47.7620	62.2234	53.2077***
Habitat*occ7	(43.4363)	(40.7806)	(9.6610)
Price (in preference space)	76.9657***	97.9444***	134.0622***
	(6.5106)	(8.9500)	(11.9855)
N	4683		4683

MXL: LogLikelihood = -3633.0413, AIC/n = 1.5828, pseudo-R2 = 0.2845

MNL: LogLikelihood = -4735.9952, AIC/n = 2.0381, pseudo-R2 = 0.0673

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Table 1 *Attributes and attribute levels*

Attribute	Size of protected area (km²)	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		1000

Table 2 *Individual specific variables overview*

	Lowest value	*Highest value*	*Mean*	*Number of observations*
Gender	0 (male)	1 (female)	0.465	394
Age	18 years	88 years	46.6years	395
ENGO	0 (not ENGO member)	1 (ENGO member)	0.1	394
Education	1 (only obligatory)	4 (higher deg. Univ.)	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 3 *Marginal willingness to pay (WTP) estimates in Euro resulting from the MNL and MXL models. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.*

	MNL model	*MXL* model	
	Coefficient (s.e.)	Mean (s.e.)	Std.dev. (s.e.)
Small-size	-13.3056	53.0080***	227.0873***
	(10.7111)	(10.1943)	(14.8310)
Large-size	20.4293**	66.5562***	286.4626***
	(10.1842)	(10.4839)	(16.7408)
Oil/gas	11.9665	16.3399**	100.2334***
	(6.6797)	(6.5881)	(6.3774)
Fish	28.6764***	39.0565***	107.5751***
	(7.1949)	(7.0045)	(6.3688)
Habitat	174.3036***	166.1023***	165.9122***
	(15.0876)	(10.1651)	(9.4697)
Price (in preference space)	76.9370***	59.5790***	77.3143***
	(6.4839)	(7.0086)	(8.4814)
N	4683		4683

MXL: LogLikelihood = -3483.1453, AIC/n = 1.4992, pseudo-R^2 = 0.3140.

MNL: LogLikelihood = -4759.7336, AIC/n = 2.0353, pseudo-R^2 = 0.0626.

Table 4 Total WTP per household per year in EUR for small and large protection scenario. ***, ** and * indicate estimates significant at 1%, 5% and 10% level, respectively.

	MNL model		MXL model	
	WTP (s.e.)	95% c.i.	Mean WTP (s.e.)	95% c.i.
Small protection scenario	201.58*** (15.05)	172.09 - 231.08	274.05*** (15.86)	242.98 - 305.17
Large protection scenario	235.28*** (16.55)	202.83 - 267.73	287.37*** (16.57)	254.92 - 319.84