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Public willingness to pay for alternative management regimes of remote marine protected areas in the North Sea

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ABSTRACT

Despite increasing attention paid to the value of marine resources, in particular marine protected areas (MPAs), their economic valuation focuses mainly on use values of ecosystem services such as fishery and tourism. Furthermore, most MPA related studies are carried out for coastal ecosystems, especially tropical coral reefs. The valuation of remote marine ecosystems is rare. The main objective of this paper is to estimate public willingness to pay (WTP) for alternative management regimes of a network of offshore MPAs in the North Sea under the Marine Strategy Framework Directive (MSFD). In a baseline valuation study carried out just before the adoption of the MSFD, beach visitors and a random sample of coastal and non-coastal residents were asked for their preferences for two alternative management options of three remote, ecologically sensitive areas with multiple use conflicts. Despite the lack of public awareness and familiarity with the offshore marine areas, a majority of 70% is willing to pay extra tax for their protection. Using a conservative value elicitation procedure, Dutch households are willing to pay on average maximum 0.25% of their annual disposable income to ban access and economic use. This serves as an indicator of what a network of remote MPAs in the MSFD is allowed to cost according to the Dutch tax payer.

1. Introduction

In Marine Protected Areas (MPAs), marine habitats receive legal and regulatory protection and human activities are restricted to reduce, prevent or reverse ongoing declines in marine biodiversity [25]. MPAs are believed to generate substantial benefits for both marine ecosystems and human well-being (e.g. [33]). Demand for their economic valuation to support marine spatial planning, in particular in the context of the European Marine Strategy Framework Directive (MSFD), is therefore increasing (e.g. [3,7]). However, many of the socio-economic benefits fall outside existing markets and empirical evidence quantifying these non-market benefits from MPAs is limited [32].

Most economic valuation studies of marine resources focus on beach and coastal recreation (for an overview see for example [24]) and coral reef marine parks (for an overview see for example [8]). Contrary to the valuation of coastal ecosystems, the valuation of remote offshore marine ecosystems is rare. In the context of the EU MSFD, which aims to protect the marine environment across Europe by achieving and maintaining Good Environmental Status (GES) of EU marine waters by 2020, it is especially non-use values associated with remote offshore marine ecosystems that are considered of most importance because of the fewer use opportunities [5]. These non-use values, i.e. human benefits that are not directly related to any particular use of marine resources such as their existence value or their conservation value for future generations, can only be captured with the help of stated preference surveys, which measure public willingness to pay (WTP).

Apart from valuation studies of coastal ecosystems such as beach and coral reef tourism and recreation, only a very few studies examine public WTP more generally for marine habitat protection in MPAs [38–40]. Using contingent valuation (CV),

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Ressurreição et al. [34] estimate, for example, the use and non-use values of species loss in open sea around the Azores archipelago. In addition, a few choice experiments (CEs) have been carried out to estimate the non-use values of offshore marine areas, in particular in the United Kingdom (UK) and Ireland. For a more detailed description of the applicability of CE in the context of MPAs, see for example Glenn et al. [17]. Examples of CEs valuing remote marine areas include McVittie and Moran [28] who valued the non-use values of proposed marine conservation zones in the UK, Jobstvogt et al. [20] who estimated the existence value of Scottish deep-sea species, Norton and Hynes [29] who estimated the non-use values related to reaching the MSFD's GES in Irish marine waters, and Börger et al. [7] who valued the non-use values of a remote sublittoral sandbank in the UK, that extends into Dutch and German marine waters.

Without a full understanding of the economic value of marine resources, it is difficult for policy makers to determine efficient levels of spending and investment in marine protection and management (e.g. [16]). In this paper we therefore present an empirical application of a CV study of MPAs in the context of the implementation of the EU MSFD in the North Sea. Besides the strip along the Dutch coast protected under the European Habitats and Birds Directives, a network of three ecologically vulnerable remote areas in the Dutch part of the continental North Sea shelf has been identified as MPAs: Dogger Bank, Frisian Front and Cleaver Bank [26]. Together these three areas cover 15% of the Dutch part of the continental North Sea shelf. European member states fishing in these ecologically vulnerable areas have agreed to discuss and identify possible measures in 2015 to reduce the impacts of fishing on the seabed ecology. Linking the three MPAs, including their international counterparts, to form a network can be an important tool for resolving the economic trade-offs between conservation and especially fisheries management [15]. However, spatial zoning to balance multiple marine resource uses, including biodiversity protection, is expected to result in significant economic costs. Particularly in view of the other economic interests in the continental North Sea shelf besides fisheries, such as commercial shipping, sand, gas and oil extraction, and wind farms.

Given these trade-offs and the public nature of the associated conservation benefits, the main objective of the study presented here is to elicit public preferences for alternative management options of the three MPAs and estimate public WTP for comparison with the estimated costs of their establishment in the context of the MSFD. To this end, a large scale CV survey was carried out in the Netherlands, through in-person interviews and mail, before the adoption of the EU MSFD in 2008 to obtain a baseline valuation point. CV was used instead of a CE in view of the limited number of management regimes considered in the analysis. The study is only published now because of the perceived policy sensitivity at the time it was carried out by the Dutch Ministry commissioning the study. Although several years old, the results are still highly relevant in view of the ongoing discussion about restricting economic use in offshore MPAs in the North Sea, in the Netherlands and other countries bordering the North Sea.

The remainder of the paper is organized as follows. The case study area is first described in more detail in Section 2. This is followed by an outline of the overall methodological approach and survey design in Section 3. Section 4 presents the valuation results, Section 5 discusses the usefulness of the results in a broader valuation and policy context and Section 6 concludes.

2. The North Sea

The North Sea is one of the world's major marine shelf areas and fish producing ecosystems in the world. It is a relatively shallow semi-enclosed basin of continental shelf water with a depth ranging from about 30 m on average in the southeast to 200 m in the northwest. Eight countries border the North Sea: France, Germany, Belgium, The Netherlands, Norway, Sweden, United Kingdom, and Denmark. The Dutch part of the continental shelf sea has a surface area of 58,000 km^2, which is equal to 1.5 times the land area of the Netherlands.

Anthropogenic impacts on the shelf water have been significant for many years (e.g. [16]). The marine ecosystems are under intense pressure from fishing, nitrogen input (from air and major rivers draining into the North Sea, such as the Rhine), recreational use and habitat loss. The seabed is rich in oil and gas, and sand extraction provides valuable material for the construction industry. All these resources are intensively exploited. Recent developments include offshore wind farms and aquaculture, competing with existing commercial shipping interests for space in the North Sea.

Over the past decades, there has been an increasing awareness and concern for the impaired state of several of the North Sea's commercially important fish stocks, as well as the impact of fisheries on other parts of the marine ecosystem. Current spatial management and planning of the North Sea shelf is laid down in the Integrated Management Plan of the North Sea 2015 [19], paying specific attention to the allocation and designation of the available space to ecologically sensitive areas, wind energy, land reclamation, sand extraction, military activities, cables, pipes, drilling platforms, shipping lanes, and fishery. An inventory of the range of different ecosystems in the Dutch part of the North Sea, including seabed sediments, just before the adoption of the MSFD resulted in the identification of unique ecosystem aspects in the Dogger Bank, Frisian Front and Cleaver Bank, which were considered worth conserving and protecting as MPAs [26].

So far, protection has been achieved mainly through the establishment of Special Protected Areas (SPAs) for birds which were put in place through the Birds Directive (79/409/EEC) and Special Areas of Conservation for habitats and species as a result of the implementation of the Habitats Directive (92/43/EEC). Since the adoption of the MSFD, the Netherlands has submitted 5 Natura 2000 areas in the North Sea to the OSPAR Commission to be designated as MPAs [31]. Three of these are coastal areas for which management plans already exist, the other two are the remote offshore areas Dogger Bank and Cleaver Bank. These two areas are partly protected from fishery practices that affect the seabed's ecology. The same applies to the Frisian Front where fishery activities are currently forbidden during certain time periods. European member states fishing in these areas have agreed to discuss possible measures to reduce the impacts of fishery activities on the seabed ecology in 2015.

The Dogger Bank is a relatively shallow sandbank located furthest away from the Dutch coast. The area is well known for its high diversity of benthic fauna, but is also important for birdlife and fish. The slopes between −30 and −40 m depth are especially valuable. The Dogger Bank MPA borders the same MPA designated in the German part of the North Sea shelf under the Habitats Directive.

The Cleaver Bank is the smallest MPA with an exceptional variation in benthic sediment structure comprising of gravel combined with very specific flora and fauna. It is the only area in the Dutch part of the North Sea shelf with a natural hard seabed. The area is also valuable for birdlife. The area complies with the Habitats Directive and includes the intersecting gulley Botney Cut. The area borders a similar UK MPA area.

Finally, the Frisian Front has not officially been designated yet as a MPA under the EU MSFD. It is nevertheless a third unique region where the sea bed slopes get steep and the sea is deep, characterized by high biomass and large diversity in benthic fauna. Specific birds