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Assessing the maintenance costs of marine ecosystems in the context of the MSFD: the French experience

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Abstract

This short paper presents the approach which has been implemented in France for estimating the costs of ecosystem degradation in the context of the Marine Strategy Framework Directive (MSFD). Among the possible approaches, forgone benefits assessment or maintenance costs assessment, France decided to use the latter. The paper contains an introduction, a section which explains how to choose an economic approach coherent with the MSFD rationale, a section which exposes the methodology developed for implementing the approach, and a section on the main results.

1. Introduction

The Marine Strategy Framework Directive (MSFD) represents the environmental component of the European integrated marine approach and establishes a legislative framework for community action in the area of marine environmental policy. The aim is in the end to design a program of environmental measures to achieve a good environmental status (GES) by 2020. The MSFD is founded on an initial assessment of the current environmental status of national marine waters and a socio-economic analysis of human activities in these waters, which had to be completed by 2012 (MSFD, 2008/56/EC). As stated by the MSFD article 8, the initial assessment includes a socio-economic analysis of the costs of degradation of the marine environment.

However, no indication is provided as regards the method to be used for implementing such an assessment. There are two possible ways for assessing the costs of environmental degradation: as the costs associated with the loss of benefits resulting from the degradation of natural capital (Barbier et al. 2009, EPA 2009), and as the maintenance costs required to compensate for the actual or potential degradation of natural capital (Bartelmus 2009, SEEA 2003). The first of these methods is based on the Total Economic Value (TEV) of benefits forgone because of the depletion of ecosystem services delivered by marine biodiversity. The second method is based on the costs required to maintain a good state of marine biodiversity which makes it possible to deliver ecosystem services. This short paper gives an illustration of the second approach.

2. Why not calculate the loss of benefits due to marine ecosystem degradation[1]

Economics are not a unified science: economists may propose different approaches and methods which are more or less adapted to the issue at stake and the context. When it is proposed to estimate the "economic" value of Nature, different purposes may be pursued. This economic value may be used for convincing people that environmental damages lead to welfare losses for society: in that case "economic value" means monetary value of the benefits provided by ecosystems, and this economic value is expected to raise awareness and therefore strengthen demand for Nature conservation. But this economic value may also be used for implementing an environmental policy: in such a situation, the society is already convinced that Nature conservation is a goal to be achieved, and the question to be addressed by economist is to estimate the means which are required in order to improve Nature conservation. In that case, economic analysis may in particular be used to estimate what the cost of existing ecosystem preservation measures is, in the prospect of improving the cost-efficiency ratio of future environmental policies adopting higher targets.

This perspective provides a first argument for choosing the maintenance costs approach when assessing the "cost of the degradation of marine waters", as required by MSFD Article 8. Suppose that the cost of the degradation of marine waters would be estimated by the loss of benefits approach: this would be useful for demonstrating the impact of marine ecosystem degradation on social welfare and would attract peoples' attention to the need of a marine conservation policy… Yet, would such benefit loss estimates be worth in the MSFD context? The MSFD is the environmental pillar of the European maritime integrated policy; it sets strong nature conservation targets through the GES concept, provides a schedule with strict time constraints and requires each Member State to start implementing a Programme of Measures for marine ecosystem preservation in 2016. Thus, is it now the time to raise awareness and strengthen demand for an ambitious marine preservation policy, or should we consider that this policy will be *de facto* the MSFD, which thus calls now for the assessment of the actual costs of current marine preservation measures in order to prepare for future additional and more efficient measures?

The second argument concerns the feasibility of the loss of benefits approach. Basically, this approach searches for changes in the Total Economic Value (TEV) of environmental assets. The TEV encompasses benefits from direct consumptive uses, direct non-consumptive uses, indirect uses, but also option values, associated with benefits individuals expect from possible future uses, and non-use values (Pearce & Turner 1990). Non-use values include bequest value, ethical value and existence value, which depend on the satisfaction obtained from respectively the fact that future generations will have access to ecosystem benefits, the fact that other people have access to ecosystem benefits and the fact that ecosystems exist. It has to be emphasized that the TEV approach for Nature valuation is valid only for measuring the change in people's preferences under small or marginal changes in ecosystems and the goods and services they provide (Pascual & Muradian 2010).

1 This title refers to the article written by Michael Toman (1998) as an introduction to a special issue of the journal *Ecological Economics*, whose intent was to criticize the famous paper by Costanza et al. (1997) previously published in *Nature*; Toman reveals in his paper that the journal *Nature* refused at that time to print any follow-up correspondence to Costanza's controversial essay.

Since the first attempt to estimate the TEV of natural capital and ecosystem services at very broad scales (Costanza et al. 1997), the pitfalls, internal discrepancies and lack of usefulness of this approach have been demonstrated by environmental and ecological economists (Toman 1998). Indeed, estimating a TEV for all natural assets is really difficult and questionable for the following reasons: the lack of data on interactions between changes in ecological functions or ecosystem services production and changes in well-being; the high level of uncertainty regarding some of the values based on support services or cultural services; the controversies around the benefit-transfer method for extrapolating local values to a regional or national scale; the controversies around the stated preferences analysis for capturing non-use, indirect use, and non-market use values; ethical issues regarding the commensurability and monetisation of nature (Levrel et al. 2014).

The third and last argument deals with the vision of the sustainability of the relationships between nature and human societies that each economic paradigm assumes. Neoclassical ("standard") economics uses the maximum of welfare criterion because it assumes that all natural assets are substitutable and all damage to the environment is reversible; putting a monetary value on each ecosystem is possible and can be used in a cost-benefit analysis to decide whether it has to be preserved or not. Ecological economics emphasizes that in a situation where those assumptions are no longer valid, the changes of an ecosystem which would result from the decision to protect it or not are no longer small or marginal, and the consecutive changes in social preferences can no longer be estimated by monetary values. This is the reason why, when natural capital become scarce and produces decreasing ecosystem services, the value that society grants to nature is sky-rocketing: the closer ecosystems are to the critical resilience thresholds, the higher the values attributed to the benefits of healthy ecosystems, especially non market benefits which are the less tangible (Figure 1). And when ecosystems are closed to resilience thresholds, the issue at stake is no longer to estimate their value, which may tend toward infinity, but to analyze the costs and efficiency of the measures required for improving ecosystem status. Considering the MSFD rationale, it is doubtful that TEV could give relevant information for implementing a policy which targets strong sustainability goals.

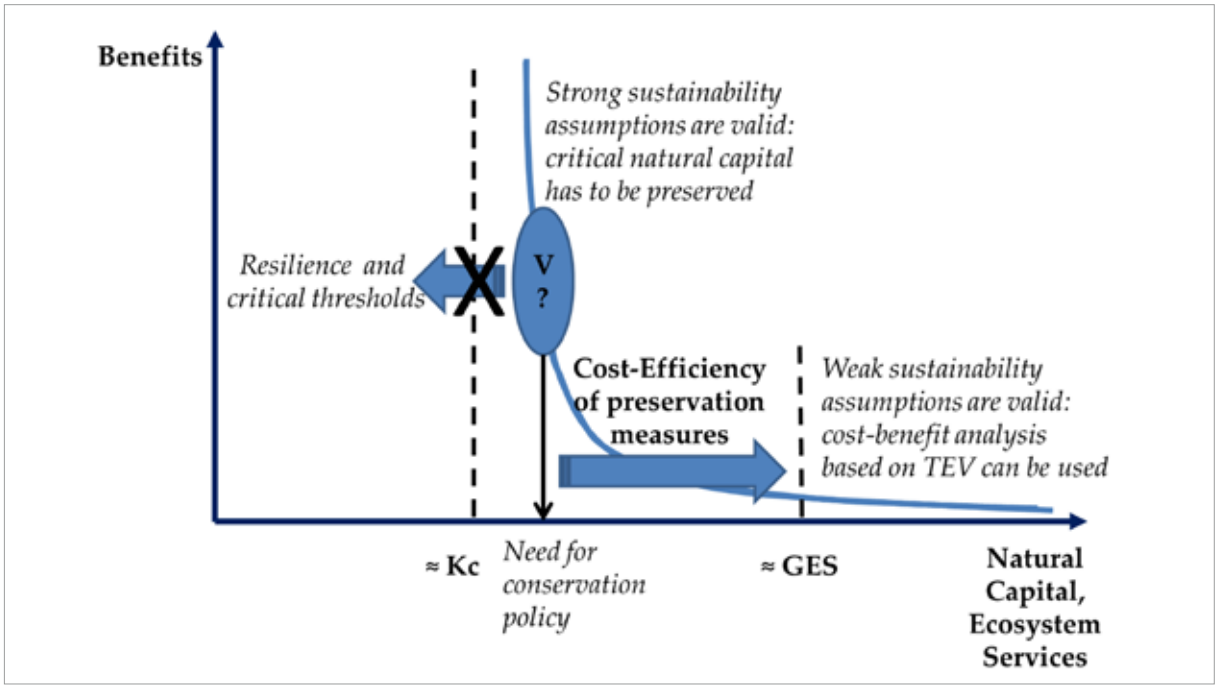

Figure 1: Marginal benefits of ecosystem preservation (after Pearce 2007).

Finally, in the context of the MSFD, it seems inappropriate to provide a judgment on marine ecosystems based on forgone benefits due to changes in their TEV. TEV is obtained from aggregated individual preferences, and the consecutive decisions use should target the maximum of welfare, a normative principle which is different from the one adopted within the MSFD, namely the ‚good environmental status' (GES). In addition, the assumptions of the TEV approach do not stand when ecosystems are closer to critical sustainability thresholds than to GES; thus, estimating a TEV would mean assuming that marine ecosystems are close to the GES, an implicit statement which dismisses the very rationale of the MSFD. On the other hand, it might seem meaningful to know the current maintenance costs devoted to marine environmental ecosystem management, considering the gap between the present situation and the GES goal. Indeed, achieving GES will require improving and complementing existing marine environmental management measures, which will generate additional costs. From this perspective, the maintenance cost approach will also provide the basis for a future cost-effectiveness analysis of the complex management system which will result from the Programme of Measures recommended by the MSFD[1] (Levrel et al. 2014).

3. Materials and method

Recognising the limits of the TEV approach, Pearce (2007) has proposed paying attention to the real costs borne by society to provision and maintain ecosystem services – that is, the costs of conservation policies. Bartelmus (2009) also suggests paying attention to the maintenance costs of a given environmental state: "Maintenance cost is applied to environmental degradation. The SEEA reviews maintenance costing critically as the hypothetical cost of avoiding pollution or restoring the polluted environment (SEEA 2003). Maintenance cost can be seen, however, as the weights for actual environmental impacts 'according to society's obligation and capacity for dealing with environmental concerns'". In contrast to the TEV, "such costing is indeed more practical than the assessment of elusive damage effects from environmental impacts" (Bartelmus 2009).

The maintenance costs which have been calculated in the initial assessment of the Marine Strategy Framework Directive (MSFD) in France are divided into three categories (Figure 2): 1) Costs of monitoring and information, which aim at improving information and coordination levels relative to conservation of the marine environment; 2) Costs of preventing or avoiding environmental degradation, which represent the costs of specific investment in preventing and avoiding environmental impact. 3) Costs of environmental restoration and remediation, which represent the costs of restoration and remediation after an environmental damage or an ecological accident. Despite the implementation of the above mentioned measures, residual impacts are still observed: providing a description of these impacts will give a proxy of the efficiency of current marine ecosystem preservation policies. The estimation adopts a problem-oriented approach and addresses nine problem areas corresponding to nine sources of environmental degradation.

Each source of environmental degradation is linked to either a GES descriptor of the MSFD or to a component of the "pressures-impacts" analysis. The nine problems for which degradation costs have been estimated are described hereafter. "Marine litter" refers to descriptor 10 of

1 On the opposite, the forgone benefits approach would prepare for cost-benefit analyses of marine ecosystem preservation measures, which in turn could lead to demonstrate that no additional preservation is needed.

the MSFD, and also to the related components of OSPAR and Barcelona Conventions and the EU Waste Water Treatment Regulation and the Water Frameword Directive. “Chemical compounds” refers to descriptors 8 “contaminants and pollution, ecological effects” and 9 “contaminants in food” of the MSFD, as well as the corresponding aspects of the REACH Directive and of the EU Waste Water Treatment Regulation, the Water Framework Directive and the Bathing Water Regulation. “Microbial pathogens” refers to the pressure-impact topic “introduction of microbial pathogens”, as well as the EU Waste Water Treatment Regulation, the Water Framework Directive, the Bathing Water Regulation and the Regulation on Animal Products for Human Consumption (Food Legislation). “Oil spills and illegal discharges” refers to the MSFD descriptors 8 “contaminants and pollution, ecological effects” and 9 “contaminants in food”, as well as the related aspects of the International Convention for the Prevention of Pollution from Ships (MARPOL), the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution (FIPOL), the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) and the Barcelona Convention. “Eutrophication” refers to the descriptor 5 “eutrophication” of the MSFD as well as the EU Nitrate Directive. “Non-native invasive species” refers to the descriptor 2 “non-native species” of the MSFD as well as the Ramsar, CITES, Berne, Bonn, Biodiversity, Barcelona, OMI Conventions. “Biological degradation of exploited natural resources”, which is split into 2 sub-problems, aquaculture and fisheries, refers to the MSFD descriptor 3 “status of species exploited” as well as the European common fisheries policy. “Loss of biodiversity” refers to the MSFD descriptors 6 and 1 regarding “biodiversity and integrity of the marine substrates” and descriptor 4 “Foodwebs”, as well as the Convention on Biological Diversity, the European Strategy on Biodiversity, and the French Strategy on Biodiversity. “Introduction of energy into the environment and changes in water regime” refers to the MSFD descriptors 11 “energy” and 7 “hydrography”, as well as the EU Environmental Impact Assessment Directive.

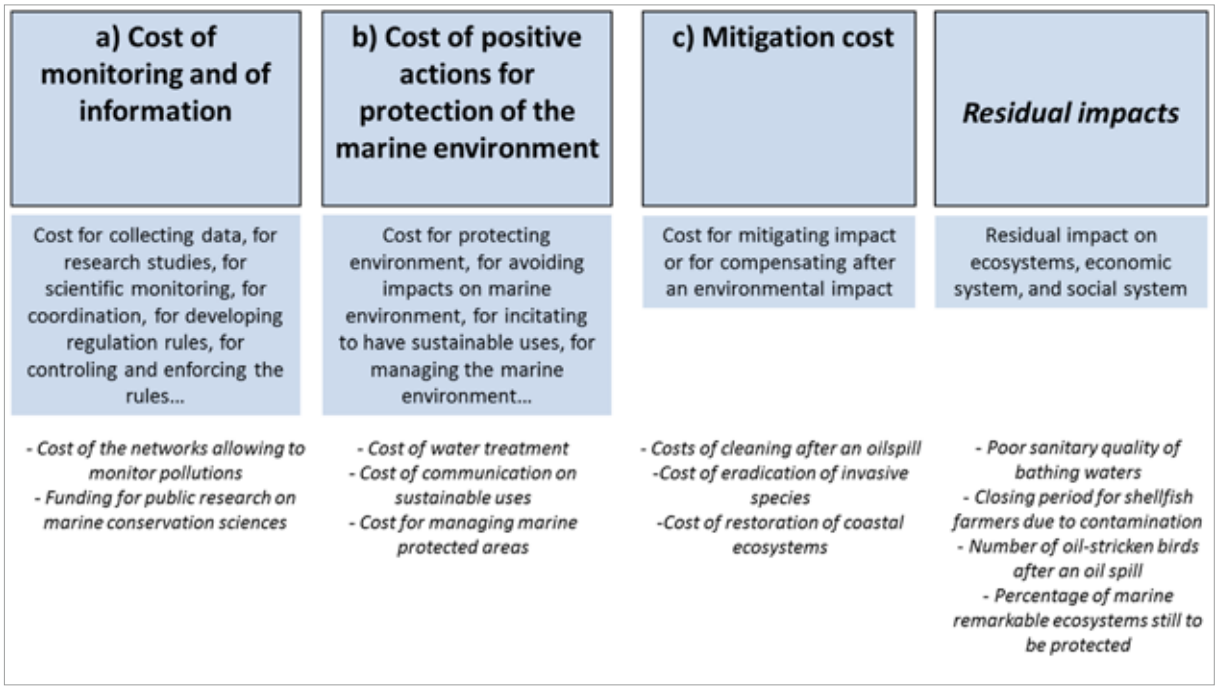

Figure 2: Typology of maintenance costs for marine ecosystems.

For each thematic, a researcher was in charge of reviewing the literature, contacting experts and identifying data sources. Data were collected during the first semester 2011, the reference year being 2010 for the initial assessment (time-series were also used when available).

Depending on the thematic, between 5 (introduction of energy) to 130 organisations (loss of biodiversity) were contacted; the response rate was between 60 % (eutrophication) and 100 % (degradation of aquaculture resources, microbiological pathogens). Data were not significant regarding two themes, “marine litter” and “introduction of non-native invasive species”, which were removed from the analysis. In addition to the response rate, we encountered some difficulties regarding the format or even the interpretation of the data, for instance as regards the degradation of fishery resources: in particular, it was sometimes complicated to allocate public expenses to specific measures, and some expenses raised the problem of ‘damaging subsidies’.

4. Results

The results give a total figure for these degradation costs (around 2 billion EUR). A significant proportion of these costs (1,247 million EUR) was related to preventing marine water degradation by microbial pathogens, and took the form of enforcement of water quality standards. The second highest was the chemical compounds category, with costs associated with prevention of chemical pollution amounting to 347 million EUR. In both cases, the main goal is protection of human health, which explains the size of this expenditure. The following two positions are associated with loss of biodiversity and decrease of fish stocks, 148 and 133 million EUR respectively. The high costs associated with fishing are due to the increasing erosion of fish stocks and the need for more sustainable management of these stocks (67 % of costs). The costs linked to biodiversity loss are mainly related to monitoring and reporting (52 % of costs), which indicate substantial interest in these issues and a serious lack of scientific data. There are three problems for which the costs of environmental degradation are much lower: eutrophication (47.4 million EUR), oil pollution (47.3 million EUR), and degradation of exploited resources related to aquaculture (30 million EUR).

The results for France could be compared with those of other Member States who have taken similar approaches in the context of the MSFD. Nevertheless, it is not really possible yet to make meaningful comparisons at this stage, since the methods of data collection and the nature of the costs are very different. This situation highlights the heterogeneity of methods based on cost assessments, in contrast to conventional monetary economic valuations which have been discussed for a long time and are more stabilized. However, the “cost-based approach” could easily be improved if common criteria are adopted for the expenditures to be taken into account, for the standardization of the scope and target of policy measures, and for the calibration of accounting costs (salaries, investments, etc.). This emphasizes the need to develop such assessments in a standardized way. Such improvements of the approach could be targeted during the implementation of the second cycle of the MSFD, whose preparatory phase should start in 2018.

Finally, this French experience in implementing the maintenance cost approach reminds that economic valuation methods are not neutral: some of them are typical of the ‘weak sustainability’ approach, which is not necessarily coherent with the rationale of an environment preservation policy such as the MSFD. The arguments for not applying the forgone benefits approach in the initial assessment are still valid when considering the further steps of the MSFD. Cost-benefit analysis, which uses the TEV and is based on the ‘welfare maximization’ paradigm, assumes substitutability and reversibility: these assumptions are not in line with the general objective of reaching the GES. This is the reason why, when assessing the Programme

of Measures, it should be recommended to first define priority and non-priority targets: then, the choice of measures for priority targets should be based on cost-effectiveness analyses, while measures for non-priority targets only could be submitted to cost-benefit analyses, which could demonstrate that the measure is not beneficial. In conclusion, considering the internal rationale of the MSFD, we argue that a marine protection policy which targets strong conservation goals should prefer the maintenance costs approach for the initial diagnosis and the cost-effectiveness analysis for selecting operational measures.

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