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Exploring Perspectives of the Validity, Legitimacy and Acceptability of Environmental Valuation using Q Methodology

Rob Tinch
eftec

Isaac Ankamah-Yeboah
University of Ghana

Claire Armstrong
The Arctic University of Norway

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1. INTRODUCTION

There is increasing interest from research providers, policy makers and private sector decision makers in using economic valuation of ecosystem goods and services to improve decision making (Austen *et al.*, 2019). Market systems and economic appraisal methods offer powerful tools for supporting decisions about the allocation of scarce resources (Tinch *et al.*, 2019). However, there are many important aspects of human activity that are not fully reflected in market prices. These include our impacts on the natural world and our dependence on the many valuable goods and services provided by ecosystems. Assessing the values of these impacts, goods and services in monetary terms, combined with various tools of economic analysis and appraisal, could help environmental management.

However, this extension of economic methods to the natural world remains controversial and viewed by some as unethical (O'Neill, 1997). This results in disagreements within and between research, conservation and policy communities regarding the appropriate role of valuation and appraisal methods in informing policy and decision-making. The ecosystem services framework can help to structure information and thinking about the ways in which humans depend on ecosystems. The ability to value some of these services can be useful for communicating their importance and potentially for informing decisions about trade-offs between different uses of the environment, including conservation. On the other hand, some reject the legitimacy of these approaches to assessing ecosystems, and/or see the estimates as invalid measurements that fail to capture the real values at stake (Flyvbjerg, 2009; Spangenberg and Settele, 2010). These divergent points of view make it harder to know whether, how and under what conditions valuation evidence should be generated and used in marine policy and decision-making processes.

The research reported here was carried out under the ATLAS project[1] to assess the different points of view that exist in marine research, management and policy communities regarding the estimation of monetary values for marine ecosystems and services and their use in appraisal and policy settings. We used Q-method (Stephenson 1935), a statistical approach to 'discourse analysis' which identifies

[1] www.eu-atlas.org

the ways in which people think about an issue and looks for shared perceptions and common ground between individuals, as well as key differences in perspectives. Q analysis is used to group individuals into distinct 'social discourses' based on their shared perceptions and commonalities (Barry and Proops, 1999). A particular discourse "rests on assumptions, judgements, and contentions that provide the basic terms for analysis, debates, agreements, and disagreements" (Dryzek, 2005). Previous applications in environmental policy research have included, for example, forest management (Steelman and Maguire, 1999), climate change (Lorenzoni *et al.*, 2007), values in conservation (Sandbrook *et al.*, 2011) and the appropriate role of private land in conservation policy (Kamal and Grodzinska-Jurcak, 2014). Our research helps to develop a better understanding of how and why perspectives on valuation differ, and how they are similar. This provides insights into when and how valuation approaches might be useful in practical settings, and regarding how differences in opinion might be discussed, respected and perhaps in some cases reduced. Strictly speaking, the results are specific to the marine setting, but may nevertheless have wider relevance since the issues are relatively general.

The next section presents the rationale for valuation, the mainstream approach to it, and the main criticisms and concerns raised. Section 3 explains how we applied the Q-sort method to these issues. The results are presented in section 4, which is followed by a concluding discussion focussing on the implications of the results for the use of valuation in policy and decision processes, and the potential for building on areas of consensus to develop a common understanding and approach to valuation.

2. VALUATION: RATIONALE, METHODS AND CRITIQUES.

Ongoing loss of biodiversity and ecosystems is widely recognised. Studies such as the Millennium Ecosystem Assessment (MA, 2005), various National Ecosystem Assessments and The Economics of Ecosystems and Biodiversity (TEEB)[2], have made a direct link between biodiversity loss and environmental damage on the one hand and economic losses and decline in human wellbeing on the other. This has

[2] http://www.teebweb.org/

led to policy-driven research to make these links and values more visible, for example in Europe via the MAES and KIP-INCA initiatives[3].

The ecosystem services framing, popularized and systematized by the Millennium Ecosystem Assessment (MA, 2005), places nature in an anthropocentric setting, where the functions and processes of ecosystems interact with human inputs to supply services providing a broad range of human well-being.

The numbers of papers and projects using the ecosystem services framework have risen dramatically and the concept is now ingrained in policy across the world, at least in principle. The European Environment Agency (EEA) has led work to develop the Common International Classification of Ecosystem Services (CICES)[4] and the US Environment Protection Agency (EPA) has developed the Final Ecosystem Goods and Services Classification System (FEGS-CS)[5]. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) was set up in 2012 to assess the state of biodiversity and of the ecosystem services it provides to society, in response to requests from decision makers[6].

Alongside these developments, a growing number of original economic valuation studies, meta-analyses (*e.g.*, Brouwer *et al.*, 1999; Brander *et al.*, 2012) and economic valuation databases[7] has consolidated the evidence base and facilitated the transfer of economic value estimates to new contexts. The mainstreaming of economic valuation is demonstrated by the development by the International Standards Organisation of ISO 14007 "Environmental management: Determining environmental costs and benefits – Guidance"[8] and ISO 14008

[3] https://ec.europa.eu/environment/nature/capital_accounting/index_en.htm https://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm

[4] http://cices.eu/

[5] https://www.epa.gov/eco-research/final-ecosystem-goods-and-services-classification-system-fegs-cs

[6] www.ipbes.net/about

[7] See in particular the Environmental Valuation Reference Inventory (EVRI) (www.evri.ca), the TEEB valuation database (http://es-partnership.org/services/data-knowledge-sharing/ecosystem-service-valuation-database/; de Groot *et al.*, 2012), the Envalue database (http://marineecosystemservices.org/explore) and the Marine Ecosystem Services Partnership's (MESP) Valuation Library (http://marineecosystemservices.org/explore).

[8] https://committee.iso.org/sites/tc207sc1/home/projects/ongoing/iso-14007.html

"Monetary valuation of environmental impacts and related environmental aspects"[9].

Nevertheless, valuation has not been universally accepted. Although there is growing consensus that some form of 'characterizing' the value of ecosystem services is essential for designing effective policy (Allen and Moore 2016), controversy and uncertainty remains regarding how the multiple values of ecosystem services should be identified, measured and incorporated in policy processes. The validity/legitimacy of monetary valuation and value transfer methods remain a particular subject of controversy (see *e.g.* Ravenscroft, 2019). Below, we present the mainstream approach to valuation and a brief overview of the main criticisms and possible responses to these.

2.1. Valuation framework and applications

The theory behind valuation is grounded in expected utility theory (von Neumann and Morgenstern, 1944) and its more recent developments. The theory forms an analytical framework used to explain people's decisions under uncertainty, based on the assumption that decisions stem from, and therefore reveal information about, individuals' preferences. In neoclassical economics, individual 'total economic value' (TEV) represents all the ways that goods and services influence individual utility (Pearce *et al.*, 1989). This is revealed through the decisions or preferences of an individual, acting under a budget constraint, and expressed as their 'willingness to pay' (WTP).

For a particular ecosystem or natural 'asset', TEV can be thought of as the sum of all the ways the ecosystem functions, services and goods influence the utility of individual humans, as reflected by their WTP values, again either as a simple sum or following a weighting scheme. Integrating TEV over time, using discounting to convert future values to present day equivalents, gives the net present value of these flows. Assuming calculable risk about future flows, these values are often expressed as expected values, and cost-benefit analysis (CBA) compares the expected values of different courses of action. Other treatments and decision rules may also be used, for example to implement some degree of risk-aversion in the calculations (Wegner and Pascual, 2011).

[9] https://committee.iso.org/sites/tc207sc1/home/projects/ongoing/iso-14008.html

This offers a potentially useful framework for thinking about ways that humans might value aspects of nature. Although the framework is grounded in individual preferences, it nevertheless allows for non-selfish preferences, described in the framework as 'non-use' values that an individual is willing to pay but not associated with any personal use of the resource. Furthermore, there is recognition of uncertainty about future preferences and uses, via option and insurance values.

Similarly, ecosystem services frameworks[10] provides a useful checklist of ways in which natural systems provide benefits to humans. There is no claim that these values and benefits provide an *exhaustive* representation of natural values; rather, the frameworks provide a minimum set of things to consider.

There are many different purposes and uses for valuation and CBA evidence, generally in combination with other sources of evidence or decision support methods. These include:

- Understanding, communication, and advocacy
- Demonstrating 'Value for Money', seeking funding
- Project appraisal, policy appraisal and impact assessment
- Prioritisation of investments
- Planning and location decisions
- Pricing decisions: fees, payments, compensation for damages
- Monitoring and review of decisions

Each of these may call for different methods and requirements for accuracy and research expenditure, commensurate with the decision context and the spatial and temporal scale of application (Barton *et al.*, 2018). Different applications in different social and political contexts may also evoke different ethical and practical objections.

The least stringent requirements are for 'awareness raising', based on broad estimates of (large) absolute values of natural ecosystems and services (*e.g.*, Costanza *et al.*, 1997, Costanza *et al.*, 2014). For appraisal purposes, demonstrating whether discounted benefit flows are greater than discounted costs is often

[10] Of which there are now many: see Daily (1997), and developments in the MEA, TEEB, and CICES, compared on https://biodiversity.europa.eu/maes/ecosystem-services-categories-in-millennium-ecosystem-assessment-ma-the-economics-of-ecosystem-and-biodiversity-teeb-and-common-international-classification-of-ecosystem-services-cices.

relatively straightforward, but it can be much harder to establish which option is the most efficient – here, valuation methods need to be accurate enough to be able to rank alternative options in terms of the absolute value of the changes in ecosystem services and other impacts. And for determining economic liability and compensation, valuation methods need to "stand up in court".

2.2. Critiques of valuation

There are many well-recognised theoretical and practical problems with environmental valuation approaches. These problems include myopic preferences and regret (Hoch and Loewenstein, 1991), bounded rationality: (March and Simon, 1958), preference construction (Slovic, 1995), interpersonal comparability (d'Aspremont and Gevers, 2002) and optimism and hypothetical bias (Mackie and Preston, 1998; Penn and Hu, 2018), to mention a few (see Knetsch, 1994 and Harrison; 2006 for more general overviews). Researchers are generally well aware of the limitations; valuation and CBA guidance always calls for sensitivity analysis, full reporting of assumptions, weaknesses, omissions and so on. However, this might not carry over to the ways in which decision-makers use results in decision processes.

Many of the same criticisms apply (with varying force) to other possible decision-support and collective choice methods, and to the market institutions on which our economies depend, and indeed economists give considerable attention to market failures, possible remedies, and the costs associated with intervention. But the use of market values to account for goods and services traded in markets (including ecosystem goods such as food or timber production) is *relatively* uncontroversial – disagreements are mostly about market rules and interventions, not the use of markets per se. But the estimation and uses of economic values for services such as biodiversity protection or cultural significance – or education, or health – can evoke very strong responses from different perspectives. In effect, the use of non-market valuation methods extends market thinking and tools to areas where property rights are not fully defined. This can be very contentious, both on fundamental ethical principles, and for practical reasons. For example, there is justifiable concern that valuation of the environment could support policies that are regressive, because it may appear more 'efficient' economically to cluster environmental 'bads' Criticism that monetary values provide an inadequate proxy for the multitude of values underlying the many ecosystem services produced by

healthy functioning ecosystems leads some authors to outright rejection of economic valuation, or at least rejection of its usefulness in environmental management (McCauley, 2006). Others see scope "to incorporate a multitude of methods and knowledge systems into ecosystem service valuation for the sake of informing policy" (Brondízio *et al.*, 2010), recognising the potential role of valuation as part of a broader process (Felipe-Lucia *et al.*, 2015; Spangenberg and Settele, 2010; Suter and Cormier, 2015). Hence, there is a flourishing literature on value pluralism, the role of institutional structures in the expression of values, and the importance of participation and inclusivity in valuation and decision-making processes.

Ainscough *et al.*, (2018) note that the institutional structures in valuation play a significant role in how values are expressed. The complexity of ecosystem services, and the potential for incommensurability of different value types, mean that the ways in which people form and express their values under different contexts are important. Vatn (2009) calls for institutional arrangements geared towards social learning and communicative action, while Kenter and co-authors call for rigorous processes of deliberative value formation that allow for consideration of the nature of the good/service and its relationship with people's broad principles or 'transcendental values' (Kenter *et al.*, 2015; Raymond and Kenter, 2016).

Valuation is certainly not essential: there are alternative ways of carrying out appraisal (MCA, collective decision methods), for example, and even environmental taxation could be implemented without using valuation to set the tax rates. But does it make these processes easier, more defensible, more transparent, more (cost-)effective? Are arguments for recognising the importance of the natural world more convincing (for some decision makers, in some contexts) if they're expressed in monetary value terms? Does valuation evidence help decision makers to take full account of environmental factors, and does this result in better decisions about trade-off?

Alongside that, we need to consider whether there are any unintended results, over time. This is where concerns about 'crowding out' of non-market motives and values are important (see *e.g.*, Rode *et al.*, 2015). Similarly, is there a risk that expressing values in monetary terms provides a drive for those values to be 'captured' via market creation (*i.e.*, defining new property rights and bringing the environmental goods and services inside the 'productive boundary' of national accounts) and/or introduction of new environmental tax bases? And what would be

the distributional impacts of that? Does use of valuation evidence create further demand for such evidence, locking decision processes into a particular approach (see *e.g.*, Mathieu et al, 2016)?

These questions probably don't have single answers: rather, the extent to which valuation is useful will be dependent on environmental, economic, and social/political contexts, and there will always be bounds on the appropriate uses of values. Hence the key issue is not whether monetary valuation is 'accurate', 'complete' or 'true', but rather to determine the conditions under which monetary valuation may be useful, and the risks of worsening outcomes or decisions due to using – or not using – valuation in any given context. Divergent views on these issues may be an important barrier to attempts to use valuation to improve decision processes. Understanding these views may help to overcome these barriers, whether by assuaging fears or designing improved methods and protocols. To address these issues, we employed Q method, as explained in the following section.

3. APPLYING Q METHOD

3.1. Defining the "concourse" and Q-sample

The first step in Q is to assess or develop the concourse, which is the overall set of concepts, ideas, or ways of thinking about the issue(s) under consideration (Albalá 2015), drawing on a wide range of spoken and written sources to ensure coverage of all viewpoints (Barry and Proops 1999, McKeown and Thomas 2013). We used informal discussions and interviews to guide the broad areas for analysis, with the bulk of the concourse being based on a wide range of published material, including academic papers, 'grey' reports, websites and journalism, regarding the strengths and weaknesses of environmental valuation in a practical context.

The concourse is then refined to form a set of statements that are broadly speaking "representative" of the breadth of views represented (Brown 1980). This can be done through structured or unstructured sampling, though in practice this is more a continuum than a binary choice (Albalá 2015). Structured Q-samples are composed and gathered systematically by clustering statements according to different categories and subcategories, aiming to represent each combination in a theoretical conceptualisation of the topic (du Plessis 2005), while unstructured Q-samples compile statements considered to be relevant, without particular focus on

covering all possible sub-issues (Watts and Stenner 2012). Though easier, this creates a risk of bias through under- or over-sampling certain aspects (McKeown and Thomas 2013). We adopted a structured approach in which arguments from the literature were collected in a spreadsheet then classified according to the main themes identified in the review as both interesting and suitable for inclusion[11].

After the clustering, representative statements were developed – in some cases these were direct quotes from the literature/database, in others we edited the quotes or combined the essence of several quotes into a single statement. Previous studies have used as many as 100 statements (Barry and Proops 1999) but since the number "should not overwhelm participants, and the Q-sorting process should not be too time-consuming" (Albalá 2015), lower numbers are preferred. Based on previous experience, we used 34 statements, with an estimated time to complete the online survey of 15-20 minutes[12]. Clarity in drafting statements was important[13]. Several iterations were used to refine and simplify the statements and iron out any ambiguities, including refinements after preliminary testing of the survey instrument. The final set of statements (see Table 2) sought to cover the identified themes with an even balance of positive and negative framings and a gradient including some more extreme views as well as milder formulations.

3.2. Recruiting participants

There is no agreed ideal number of participants in a Q-study, beyond ensuring enough variability to capture a wide range of thoughts, beliefs, and viewpoints. The idea is not to sample large numbers (and there is no attempt to quantify what *proportion* of people think in each way), and some researchers (*e.g.*, Valenta and Wigger 1997, Watts and Stenner 2012) suggest working with a smaller number of participants than items in the Q-set, however usually there are slightly more participants.

[11] Some interesting themes were not suitable for inclusion because they demanded too much technical knowledge/expertise for the target audience.

[12] This appears to be broadly correct, though many participants took a little longer. It is hard to be precise about this however: the software recorded time to complete, but we cannot know if respondents took a break for other tasks during the time measured.

[13] Noting that for many participants English is a second language.

For our purposes we needed people with some involvement in marine environmental or conservation research, management, or policy. To understand the statements, all respondents needed to be aware of the basic ideas of ecosystem services, valuation in monetary terms, and economic appraisal, but did not need any direct experience of valuation or appraisal. We combined some targeted invitations, including partners within the ATLAS consortium to cover the research community as well as specific individuals involved in European marine management and policy, as well as wider recruitment through marine management mailing lists. Not everyone who agreed to participate was able to complete the survey, but a final sample of 61 completed Q-sorts was achieved, covering a wide range of academic backgrounds, nationalities, roles and experience.

3.3. Implementing the Q-sort

The Q-sorting process involves each participant independently sorting the statements according to how much they agree/disagree with the views expressed - a subjective exercise based on their own points of view (Brown 1980). The Q sort can be based on a forced-choice or a free-sort distribution (du Plessis 2005). A forced-choice requires sorting the statements into a pre-determined set of categories with a specified number of statements for each category. Free sorting does not impose this restriction. Analysis and comparison of typical sorts are facilitated by a forced-sort approach, and we used the following scheme:

- 2 each in “least agree” & “most agree”
- 3 each in “much less agree” & “much more agree”
- 4 each in “less agree” & “more agree”
- 5 each in “little less agree” & “little more agree”
- 6 in “intermediate”
- Total: 34 statements

The survey was implemented online using QSortWare[14]. The survey started with three introductory screens: text to explain the ATLAS project and the purpose of the survey; an explanation of data protection and ethical approval issues; and detailed instructions for completing the survey.

[14] http://www.qsortware.net/

The Q-sort proper was conducted in two stages. The first was a rough sort of the 34 statements into three categories: tend to agree, tend to disagree, and neutral. The second sorted the statements from those three columns into the final Q-sort with 9 categories. This was followed by several debriefing questions with free text entry, both to check any issues relating to statements that respondents found unclear, ambiguous or difficult to classify (and how they had dealt with that), and more general commentary on the procedure and reactions to the issues raised. Brief information was also requested on the extent of educational background in economics, and on professional role(s) and experience.

4. ANALYSIS OF RESULTS

Q analysis seeks to cluster the ways people think about and perceive the issues as revealed by their sorts (van Exel and de Graaf 2005). Factor analysis is used to find relatively homogeneous groups of variables representing clusters of perspectives or beliefs. The correlation matrix expressing the overall variability of the Q-sorts is calculated, and factor analysis is used to extract factors with eigenvalues higher than 1 based on the Kaiser criterion (Kaiser 1960). The factors show where each statement is placed on the "typical" Q-sort representing the factor. This often reveals several possible factors with small numbers of associated Q-sorts, and there is an element of judgement in determining how many groups to retain for analysis: several sources recommend that the ideal number of factors to be extracted for final analysis should not exceed 3 or 4 (Brown 2004, du Plessis 2005, Watts and Stenner 2012, McKeown and Thomas 2013).

Our data were analysed using R[15] and the package "qmethod" (Zaballa 2014; Zaballa *et al.*, 2018). Following the literature, a Principal Component Analysis (PCA) was carried out using a varimax rotation to categorize all Q sorts by the factors identified, with up to 6 factors extracted (Table 1). However, the fifth and sixth factors have only three and two loading Q-sorts respectively and have high standard errors for the factor scores. It is not possible to draw useful conclusions about how these small groups differ from the others. Overall, the most interesting results can be obtained from the three-factor model, with some additional nuance obtainable by considering four factors as a possible extension. The three-factor

[15] http://www.r-project.org

version is attractive in having a larger number of loading sorts overall, and especially in the third factor, with a lower standard error. The four-factor model is primarily a splitting of that third-factor in two parts with very little shift in factors 1 and 2. In all models, the clearest distinction is from factor 1, with factors 3 and 4 being in some respects variants on factor 2, principally in terms of divergent views on a small number of contentious items. Below, we look first at the consensus areas and then at the characteristic views of the factors identified. References to S# hereafter represents the statement number as shown in Table 2.

Table 1: Results of analysis of 6, 4 and 3 factors model

6-Factor Model	f1	f2	f3	f4	f5	f6	Sum
Average reliability coefficient	0.80	0.80	0.80	0.80	0.80	0.80	
Number of loading Q-sorts	12	13	6	5	3	2	41
Eigenvalues	9.76	8.72	6.28	5.51	4.23	3.07	
Explained variance (%)	16	14.29	10.29	9.04	6.93	5.04	61.59
Composite reliability	0.98	0.98	0.96	0.95	0.92	0.89	
Standard error of factor scores	0.14	0.14	0.20	0.22	0.28	0.33	
4-Factor Model							
Average reliability coefficient	0.80	0.80	0.80	0.80			
Number of loading Q-sorts	20	20	6	6			52
Eigenvalues	10.5	10.42	5.83	5.41			
Explained variance (%)	17.21	17.08	9.56	8.86			52.71
Composite reliability	0.99	0.99	0.96	0.96			

Standard error of factor scores	0.11	0.11	0.20	0.20	
3-Factor Model					
Average reliability coefficient	0.8	0.8	0.8		
Number of loading Q-sorts	22	20	14		56
Eigenvalues	10.81	10.66	7.4		
Explained variance (%)	17.71	17.48	12.14		47.33
Composite reliability	0.99	0.99	0.98		
Standard error of factor scores	0.11	0.11	0.13		

Table 2 Statement scores for the three- and four-factor model

		Three Factor			Four Factor			
Statements		Sceptics	Acceptors	Enthusiasts	Sceptics	Acceptors	Pragmatic	Ideological
1	Beneficiaries should pay money for the services they receive from natural ecosystems.	-2	1	3	-2	1	0	4
2	Biodiversity should be protected for its intrinsic worth, irrespective of any value for humans.	4	4	4	4	4	4	1
3	Cost-benefit analysis organizes disparate information coherently and can improve policy analysis and outcomes.	-1	3	3	-1	3	2	0
4	Commoditization of nature reinforces existing extractive, exploitative and unjust neoliberal capitalist relations.	2	-3	1	2	-3	4	-2
5	Decision makers need good information about the value of ecosystem services to evaluate possible policy actions.	0	2	4	0	2	3	3
6	Deliberative methods that focus on negotiation and consensus provide greater legitimacy in assessing values.	2	0	0	1	0	1	1
7	Despite decades of valuation evidence, monetary values for environmental services are little used by decision makers.	0	1	-1	0	1	-2	3
8	Damaging the marine environment is acceptable so long as it is compensated for, with no overall loss of biodiversity.	-4	-3	-4	-4	-4	-4	-4
9	Economic arguments lead decision makers to give less attention to impacts not expressed in monetary terms.	3	0	2	3	-1	2	4
10	Individual preferences are of very little relevance to decisions about societal norms and values.	-1	-3	-3	-1	-3	-4	-2
11	Monetary valuation can only contribute to informing, not determining, policy decisions.	2	3	-3	2	3	-3	-1
12	Estimating the total economic value of the goods and services provided by oceans would support their conservation.	-2	2	3	-2	2	3	1
13	Monetary values are inadequate proxies for the many values underlying the services produced by healthy ecosystems.	4	-1	-2	4	0	-3	0

14	Given the dominance of the neoliberal economy, monetary valuation of nature may – alas – be one of the most effective ways of saving biodiversity.	-3	1	2	-3	1	3	-1
15	If policy makers demand theoretically meaningless monetary values, on grounds of pragmatism, they need to be challenged rather than pandered to.	3	-1	-1	3	-1	-1	0
16	Lack of public understanding of marine ecosystems means stated preference estimates of non-use values for marine biodiversity are largely meaningless.	-1	-1	-1	-1	-1	-1	1
17	Failure to use valuation is a key cause of the observed degradation of ecosystems and the loss of biodiversity.	-4	0	1	-4	0	2	0
18	Laypersons cannot judge the importance of biodiversity–ecosystems–functions–services relationships: decisions are better left to experts.	-2	-2	-2	-2	-2	0	-2
19	Many environmental entities belong to a moral category beyond monetary relations: to offer a price is an act of bribery, to accept a price is an act of betrayal.	1	-4	-2	1	-3	0	-3
20	Markets are not sources of human freedom and prosperity, but rather of alienation, exploitation, and impoverishment.	0	-4	-1	0	-4	0	-3
21	There is increasing recognition that ecosystems can be viewed as economic assets that produce a flow of beneficial goods and services over time.	-1	3	1	-1	3	1	0
22	Monetary valuation will encourage policies that place the impacts of environmental damage disproportionately on the poor.	1	-2	0	2	-2	0	2
23	Thinking in terms of ecosystem services will weaken non-economic and intrinsic motivations for protecting nature.	0	-2	-3	0	-2	-2	-4
24	Most decision-makers give little or no attention to arguments based on emotional, cultural or spiritual values of nature.	0	0	0	0	0	-2	2
25	Stated preference surveys have an important role in revealing values held by the average citizen for marine ecosystems.	-1	2	0	-1	2	-1	-1
26	The belief that environmental outcomes will improve if we can only produce better and more convincing value evidence is very naïve.	2	-1	-2	2	-1	-1	-1
27	The need to understand the benefits of marine ecosystems in economic terms has never been more pressing.	-3	2	1	-3	2	1	-1

28	The protection and long-term sustainability of diverse ecosystems will only be possible if all ecosystem services are economically accounted for.	-3	-1	-1	-3	-1	0	-2
29	The values that inform environmental choices are plural and incommensurable and cannot be captured by any single monetary or non-monetary measure.	3	1	2	3	1	2	3
30	Framing discussion around the values of ecosystem services supports awareness, learning and exchanges of perception that lead to a deeper understanding of important issues.	0	4	1	0	4	1	0
31	Any particular component of an ecosystem cannot be understood - or valued - separately from its contribution to the functioning whole.	1	1	2	1	1	1	2
32	There is reasonable scientific understanding of the supporting and regulatory services provided by marine ecosystems.	-2	0	0	-2	0	-1	1
33	Too little is known about the ecosystems of the deep sea to determine what is sustainable and resource-efficient, and what is not.	1	0	0	1	0	-2	2
34	Monetary valuation of environmental goods and services is neither necessary nor sufficient for making good decisions about environmental management.	1	-2	-4	1	-2	-3	-3

4.1. Areas of consensus

One of the clearest and most interesting findings relates to the areas of broad consensus that cut across all the perspectives identified. The strongest consensus was disagreement with S8, closely followed by agreement with S2. These are not consensus views in the strict Q-sort sense (because it is possible to detect a statistically significant difference in the strength of feeling across the factors: see the three-factor model z-score plot in Figure 1 where statements/items are ordered by standard deviation of z-scores). Nevertheless, these two statements represent a strong shared perspective that places avoiding damage to marine biodiversity and ecosystems as a fundamental obligation, that cannot be overcome by compensation for damages.

The second strongest nexus relates to the role of laypersons with respect to their views and preferences regarding marine management. There is broad agreement that decisions should not be "left to experts" (S18) and that individual preferences are relevant in the context of determining social norms and values (S10).

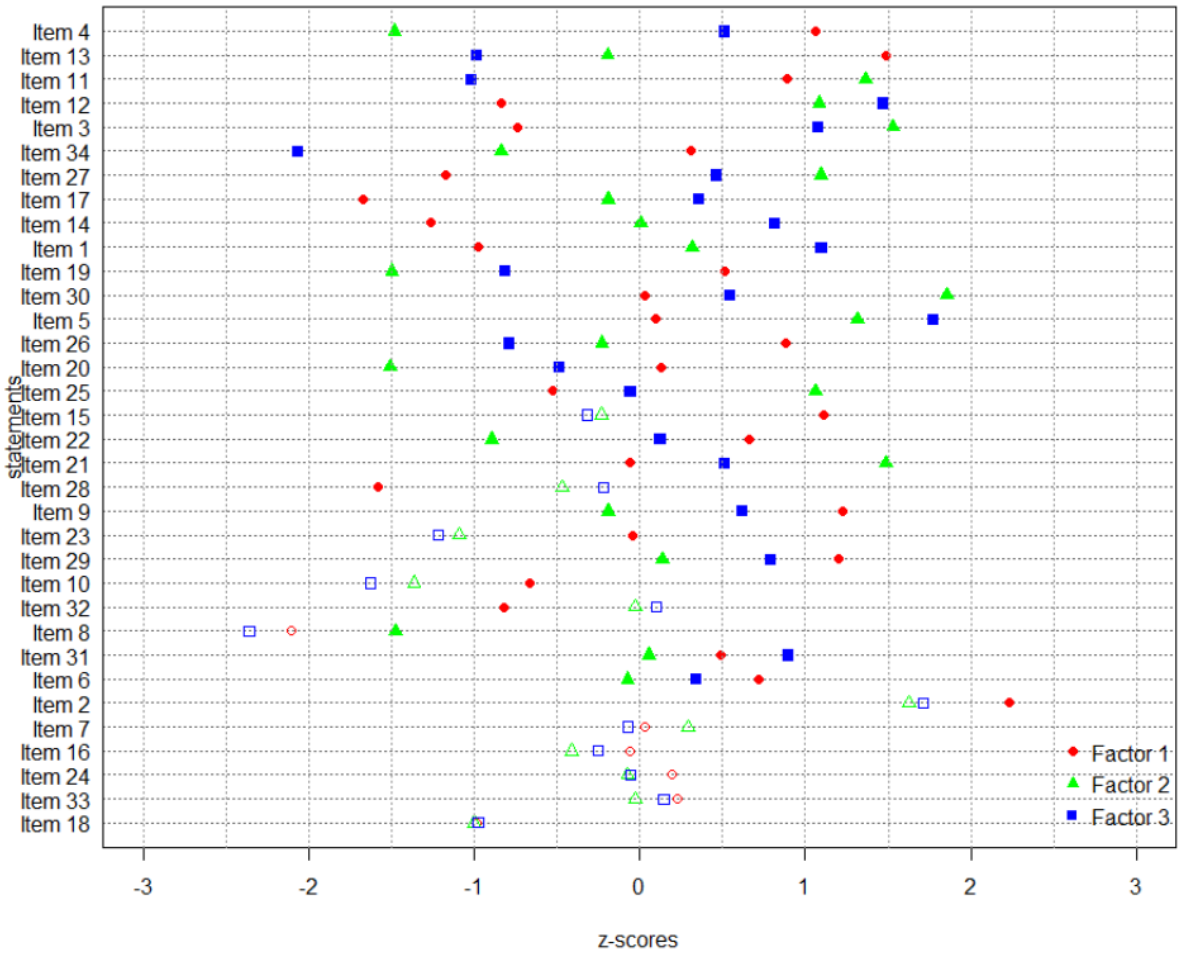

Figure 1: Plot of Z-scores: statements ordered by standard deviation of z-scores for three factors

4.2. Perspectives Identified

The distinguishing features of each perspective (factor) are described below, first for the three-factor model and then for the four-factor extension.

4.2.1. Valuation Sceptics

The first perspective is sceptical both of the framing of human-environment relations in terms of ecosystem services and of the use of economic appraisal and valuation tools in this context. Monetary values cannot capture the many values of ecosystem services (S13); indeed, values cannot be traded off or reduced to any single measure (S29). The idea that the absence of valuation could itself be a cause of environmental damage or loss (S17) is strongly rejected, as is the idea that accounting for ecosystem services in economic terms is a prerequisite for sustainable management (S28). The idea that beneficiaries should pay for ecosystem services (S1) also tends to be rejected.

Consequently, there is strong rejection of the idea that monetary valuation could be an effective tool for saving biodiversity (S14). People from this perspective feel that using monetary values would crowd out or distract attention from other aspects (S9), and that any policy demand for monetary values for marine environments or services should be resisted (S15). Instead, deliberative methods, negotiation and consensus building should be favoured (S6).

4.2.2. Valuation Acceptors

This group holds very different views on markets and valuation. There is strong rejection of the idea that markets in general, and their extension to environmental services in particular, lead to unfair outcomes (S20). Ecosystems can be viewed as economic assets (S21) and using price mechanisms for environmental goods and services is acceptable (S8). Consequently, there is strong agreement that the tools of monetary valuation and appraisal can be useful, both in organising information about human uses of ecosystems (S3), and as a way of promoting learning, understanding and debate about human-environment relations (S30).

Importantly, however, this group also strongly agrees that monetary valuation should inform, but not determine, policy decisions (S11) and tends to reject the idea that decisions are better left to experts (S18). Hence while this group clearly sees valuation as a useful tool, it is not seen as a panacea.

4.2.3. Valuation Enthusiasts

This group is strongly in favour of valuation, perceiving it as essential to enable decision-makers to understand and evaluate the results of policies and decisions (S5) and ultimately necessary to achieving sustainability (S12). At the same time, this group thinks that beneficiaries should pay for ecosystem services (S1) and rejects the "crowding out" idea that ecosystem services thinking will weaken other motives for conservation (S23). Like the "acceptors", however, the "enthusiasts" are not without reservations regarding valuation, tending to agree that environmental values are

plural and incommensurable (S29) and that ecosystems need to be understood and valued holistically, not as separable parts (S31). The fairly enthusiastic acceptance of valuation and appraisal methods seems to be a pragmatic issue, summarised by the agreement that given the dominance of the neoliberal economy, monetary valuation of nature may – alas – be one of the most effective ways of saving biodiversity (S14).

4.2.4. Extension to four factors

As noted above, there is some nuance possible in moving to a 4-factor model. This nuance relates essentially to a deeper understanding of variability within the third factor – moving from the 3-factor to 4-factor model leaves the first two factors largely unchanged. Essentially, the third factor can be split into the following two groups, that agree on many things, but with some specific differences relating to how and why they believe environmental valuation is "a good thing".

Pragmatic Enthusiast

This group is on the "pragmatic" side of the argument – despite considering that commoditisation of nature reinforces unfair outcomes (S4), valuation and appraisal tools are seen as necessary to achieve sustainable management of oceans (S12). The group tends to agree that underuse of valuation is a key cause of biodiversity loss (S17) – although this is also the only group that tends to disagree with the idea that monetary values are little used by decision makers (S7).

Ideological Enthusiast

The key difference from the Pragmatic Enthusiasts is that this fourth group takes a rosier view of markets. They strongly reject the critical view of markets as sources of unjust and exploitative outcomes (S20), even when extended to commoditization of nature, and reject the idea that pricing environmental features is akin to bribery/betrayal (S19). This is the only group to consider strongly that beneficiaries should pay for ecosystem services (S4), and the only group to show only weak support for protecting biodiversity for intrinsic reasons (S2).

However, this group also agrees that the complexity of environmental choices cannot be reduced to any simple figure (S29). Information about values is nevertheless seen as important to evaluate policies (S5), because most decision-makers give little or no attention to arguments based on emotional, cultural or spiritual values of nature (S24) and economic arguments dominate over impacts not expressed in monetary terms (S9). Overall, this group is happy with the idea of using markets and pricing in environmental management, and indeed considers this essential if decision-makers are to consider the environment fully, but feels this is not done enough at present (S7) and remains ambivalent regarding prospects for improving decisions.

4.3. Differences between perspectives

Differences between the perspectives offer insights into how valuation and appraisal are perceived, and implications for using valuation to inform and improve policy and management. Figures 2-4

below show scatterplots of statement scores for the divergent perspectives of economic valuation and possible clustering between sceptics and non-sceptics.

4.3.1. Divergence on fundamental principles

The roots of the principal perspectives identified can be traced back to divergent views on fundamental principles regarding human relationships with ecosystems. Views on whether beneficiaries should pay for ecosystem services (S1), and on whether or not some environmental entities should be "beyond monetary relations" (S19) show a stark split (Figure 2 -left). Those in the non-sceptical groups tend to reject quite strongly the idea of environmental entities being off limits to monetary valuation and trade-off, whereas the sceptics tends to accept this proposition. Coherent with that, sceptics also tend to reject the idea of payment for services, where others are more divided, though broadly more favourable, especially the enthusiasts. This response pattern can be seen to reflect a general difference in how monetization of human-environment interactions is perceived.

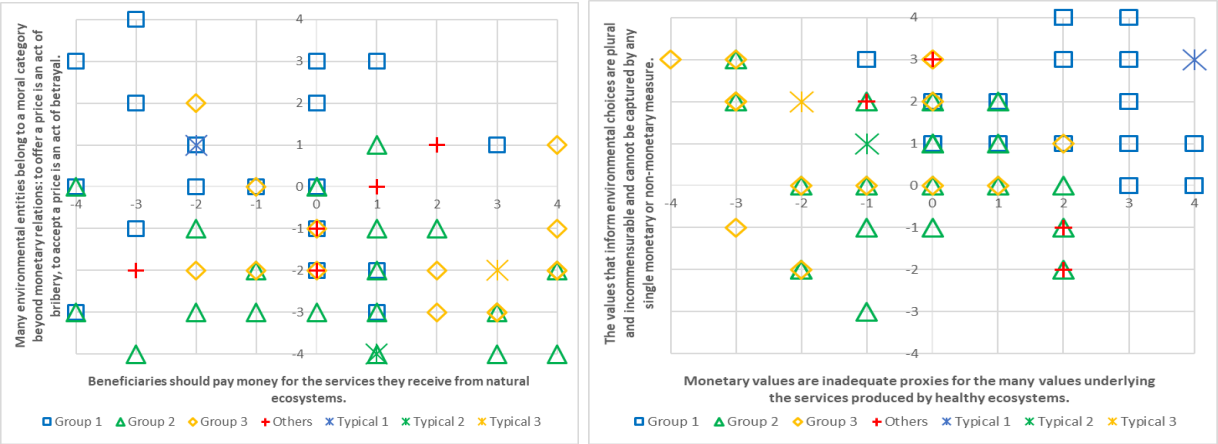

Figure 2: Views on paying for ecosystem services and on commodification (left), and reducing complex values to monetary measures (right)

The groups split along similar lines regarding the validity of expressing the complexity of the values underlying human-nature relationships in terms of simple monetary or quantitative indicators (S13, S29) (Figure 2-right). A typical sceptical perspective holds strongly that such indicators are inadequate across the board whereas acceptors are much more ambivalent. Enthusiasts recognise the plural nature of values but nevertheless reject the notion that monetary values are inadequate proxies for ecosystem services. These positions are not necessarily contradictory: it is quite possible to contend that there are certain aspects of our ethical obligations to nature (for example, to conserve for intrinsic reasons and to seek to avoid damage wherever possible) that cannot be reduced to monetary or quantitative figures, while still maintaining that monetisation is valid for certain values related to the services and benefits humans derive from nature. Indeed, this distinction is crucial in seeking a potential convergence between the perspective in terms of whether valuation could have a role to play in improved environmental management, as we discuss below.

4.3.2. Divergence on practical impacts

There are similarly divergent views on the practical impacts of using monetary valuation. These start with different perspectives on how market mechanisms impact on society (S20, S22) (Figure 3 - upper left). The acceptor perspective strongly rejects condemnation of markets mechanisms and reject the idea that valuation would encourage regressive policies. Sceptics are ambivalent regarding the role of markets and have some sympathy with the view that regressive outcomes may arise from policies encouraged by valuation. On these issues, the enthusiasts tend to agree with the sceptics, and the evidence may back them up: economists recognise that many market-based instruments (including environmental taxes and payments for ecosystem services) would often have regressive impacts (*i.e.*, represent larger proportions of income for poorer groups) – and while it would be possible to use the revenues to compensate for this redistributive effect, there is no guarantee that this would occur. Furthermore, while institutions have aided great progress in human society historically, it is increasingly recognised that these advances are being achieved at a growing cost in terms of increasing inequality within and between nations and exposure to environmental degradation and risks.

This extends to divergent views regarding how valuation might influence understanding of and thinking about human-ecosystem relationships (Figure 3 upper-right). Acceptors and enthusiasts see the potential to improve understanding, awareness, and learning by using valuation within an ecosystem services framework (S30) and agree that this frame of thinking need not weaken wider and intrinsic motives for protection (S23). Sceptics are overall ambivalent on both issues.

Views on the ways valuation influences decision makers also vary in similar ways (Figure 3 bottom-left). Acceptors and enthusiasts consider that decision makers need valuation information to evaluate the consequences of policy actions (S9); sceptics are not convinced. The sceptics also fear that use of economic arguments reduces the emphasis placed on arguments expressed in other terms (S5). Enthusiasts agree with them: to understand this, note that the argument cuts two ways: on the one hand, the idea that monetary arguments detract attention from other factors can be seen as a rationale for staying away from valuation methods. But on the other hand, if we recognise that decision processes almost inevitably involve some form of monetary argument, even if only an estimate of the financial costs of an action, the argument can be interpreted as a driver for valuation precisely to increase the attention on non-marketed services, by ascribing monetary value to them.

Following on from the above observations, there is a clear split regarding views on the "bottom line" issues (Figure 3 bottom-right). Sceptics strongly reject the notion that failure to use valuation is a key cause of biodiversity loss (S17), and more generally reject the idea that valuation supports conservation (S12). Others remain ambivalent or mildly supportive of these contestations. The argument in favour revolves around the ideas of externalities and free-riding, noting that the absence of markets and prices mean individual actors have not had (economic) incentives to consider the full impacts of their activities, or their dependence on services provided "free" by ecosystems. The argument against holds that common property resources can be well-managed by community institutions without the need for market prices, and that introducing valuation methods and prices risks destroying these non-market motives for conservation. In principle these issues

regarding the actual impacts of different approaches could be resolved empirically. There is something of a gap here in the economics literature: it is hard to demonstrate a counterfactual or to carry out proper controlled experiments. Nevertheless, the evidence base is slowly increasing and offers hope of better assessing in future the conditions under which valuation and appraisal methods, and/or market instruments, have beneficial or detrimental impacts.

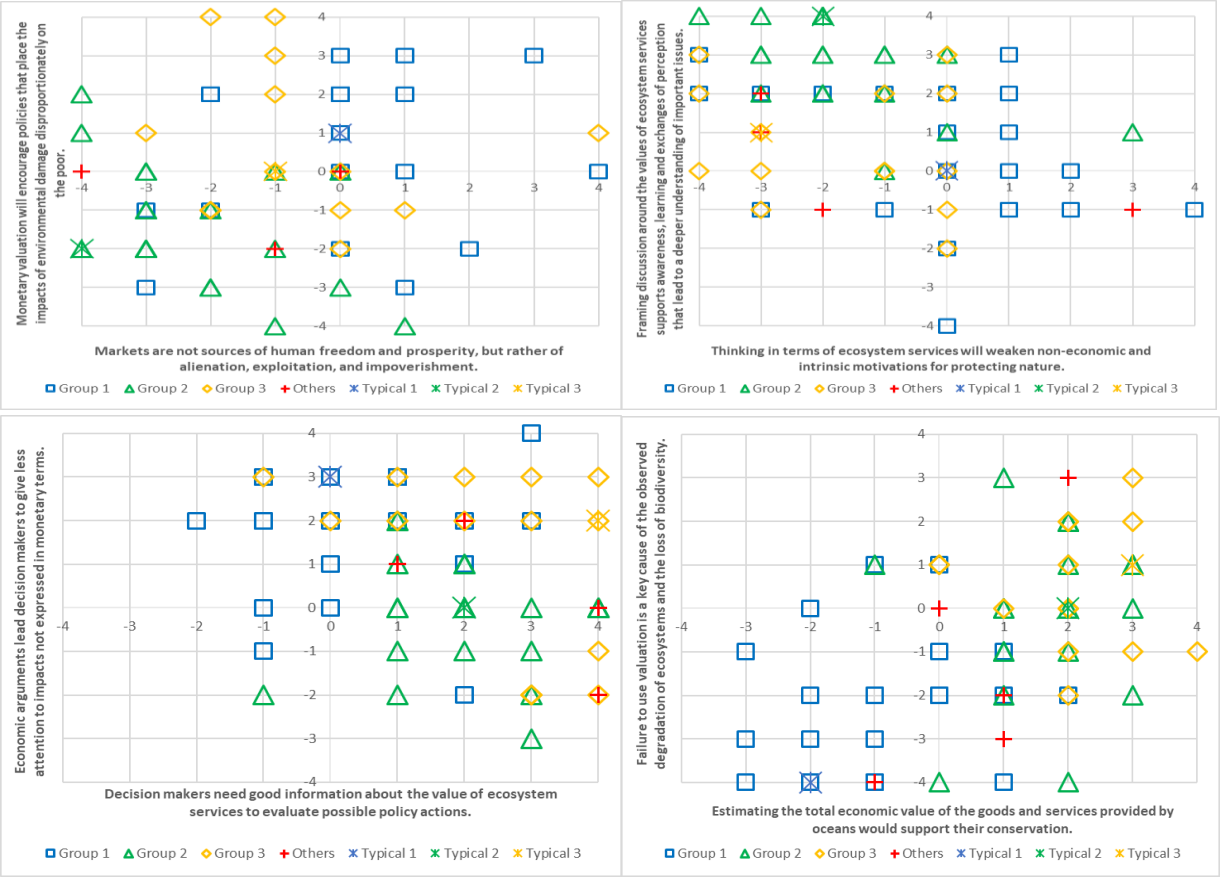

Figure 3: Views: on market, values, social equity and poverty (upper left); on how valuation could impact on understanding of human-environment relations and on wider motivations for conservation (upper right); of influence of monetary valuation on decision makers (lower left) and on role of valuation in supporting conservation (bottom right).

4.3.3. Divergent views on role of valuation

Combining the divergent views on the underlying ethical framework with those on the practical consequences of using valuation helps to explain the different overall perspectives on the appropriate role for valuation in marine environmental management.

One clear distinction concerns views on the role of CBA (S3, S11) (Figure 4 – left). Sceptics are unconvinced that CBA can help organise information and think it should not determine decisions. Enthusiasts tend to the opposite view, with CBA seen as useful, and decision-making driven by CBA results as acceptable. Acceptors are more nuanced, seeing CBA as useful, but

recognising that other factors need to be considered in reaching decisions. Leading on from this, we reach the divergent overall assessment of valuation in terms of its practical role in achieving sustainable environmental management (S14, S26) (Figure 4 – right). From the sceptical perspective, valuation is not essential, is not an effective way to save biodiversity, and better valuation evidence would not in itself lead to improved environmental outcomes. Acceptors and especially enthusiasts disagree, seeing valuation as a potentially useful tool that, in the practical context of the modern world, may well have an important role to play if we are to achieve sustainability.

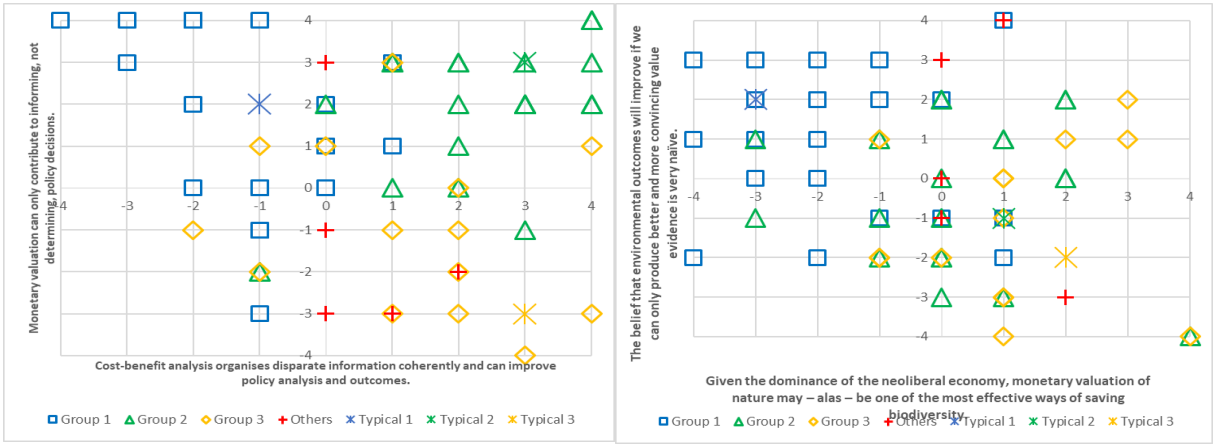

Figure 4: Perspectives on role of valuation and appraisal in decision-making (left), and summary of views on the role of valuation in environmental management (right).

5. DISCUSSION AND CONCLUSION

Environmental valuation is one manifestation of a model of how aspects of the natural world influence human wellbeing. Like any model, the important issue is not whether it is 'right' or 'true', but rather whether it is 'useful'. Thinking about it in terms of attempting to represent an underlying truth is not particularly useful: it makes for rather an easy straw man, but as most of the identifiable problems also apply in varying degrees to alternative approaches, this does not help much. It is much more interesting to consider whether valuation is useful for particular purposes in different contexts.

Although the above presentation of the divergent perspectives identified in the survey may seem to reveal a huge gulf in views on this question, there are some areas that could be explored for constructive dialogue and possible convergence in viewpoints.

Firstly, although there are disagreements at quite a fundamental level, there are nevertheless points of general agreement that could be used as a basis for building trust – notably associated with strongly supporting conservation for intrinsic reasons and rejection of the idea that compensation makes damage acceptable. These points represent, firstly, a strong set of boundaries that could put limits on the scope of applicability for valuation and appraisal methods, and secondly, a shared view or common purpose regarding a non-negotiable commitment to achieving effective marine conservation. In other words, the disagreements are about the effectiveness of

different tools for achieving the goal, but pretty much everyone is broadly agreed on what the goal should be. That at least is a good place from which to start.

In fact, some important limits are already well recognised in the economics literature/profession, with respect to the over-riding need to protect "critical natural capital", and more generally recognition that values change with quantities (Costanza *et al.*, 1997). The severity of error associated with imprecise valuation depends on the rate at which that function changes (in technical terms, the elasticity of demand): risks are low where elasticity is low; where elasticity is high, rapidly changing values make the consequences of small quantity changes significant, so valuation and market-based instruments are riskier; for 'critical natural capital', elasticity is effectively infinite, marginal valuation is inappropriate, and the Precautionary Principle should apply (Farley, 2008).

Furthermore, although broadly supportive of valuation methods and their potential for aiding decision making, the acceptor and even enthusiast perspectives do not view valuation as a panacea. At the same time, even within the sceptics there is some acceptance that ecosystems can in some respects be seen as assets providing a flow of services to humans. It is possible to recognise the potential usefulness of valuation and appraisal as tools, while also acknowledging that they are imperfect for both fundamental and practical reasons. It is a pragmatic stance: as noted above, all tools and models are imperfect in some ways, the relevant issue is determining under what conditions they can be useful. Stressing the use of appraisal methods for their information-structuring role, coupled with recognition that it is not possible to express all costs and benefits in monetary terms, is familiar ground for economic experts, but might surprise others who may tend to think of economic appraisal as a "black box" approach leading to a single "bottom line" figure and a binary decision, and distrust it on those grounds.

In terms of seeking convergence, therefore, valuation and appraisal approaches that focus on learning opportunities and open exchange of information, and that stress the existence of wider motivations and values that are not fully represented in monetary figures, may be treated with less hostility than approaches that take a top-down approach and/or that fail to make the appropriate caveats regarding what is and is not claimed regarding the figures estimated, what they represent, and how they may, and may not, be interpreted.

Better communicating the ways in which economists recognise the limits of the tools they use might also go some way towards assuaging fears regarding the uses of valuation methods. This could be helped by more research/evidence regarding the actual impacts of using valuation and appraisal methods. As noted above, this is challenging, as it is generally difficult to demonstrate the counterfactual (*i.e.*, how would the decision process or behaviour have been different if it had/had not used valuation evidence?) and some fears relate to highly subjective matters that are difficult to observe (*e.g.*, the concern that value evidence leads decision makers to focus less on the non-monetised impacts). Nevertheless, the evidence that is available on these matters can be helpful in allowing people from both perspectives to develop a more nuanced appreciation of when valuation evidence may, and may not, be useful.

There is also support for a plurality of approaches. Different decision makers, in different contexts, will prioritize some views over others. This is important because it offers another route forwards: all groups have negative scores for the idea that thinking in terms of ecosystem services will weaken non-economic and intrinsic motivations for protecting nature (S23), and all groups have positive scores for the idea that environmental values are plural and incommensurable and cannot be captured by any single monetary or non-monetary measure (S29). This is not to understate the disagreements between the perspectives identified, which are significant. But the main disagreements are connected rather to concerns about misuse of methods: considering monetary estimates to cover all sources of value, rather than being partial estimates of certain types of value; or treating appraisal as necessary and sufficient to determine decisions, rather than one option for structuring certain forms of information as one input to decision processes.

Despite decades of progress in environmental valuation, and a growing evidence base, economic valuation of biodiversity remains challenging and contested. But, in terms of the perspectives identified in this study, the rather stark "valuation can cover all values and appraisal can replace deliberation" view that is most rejected by sceptics is not in fact a representation of how acceptors or even enthusiasts think. And the sceptics are not rejecting ideas of ecosystem service thinking or valuation out of hand, but rather expressing understandable concerns about applicability and appropriate uses that are to some extent recognised by the other groups as well. There is room, then, for dialogue and learning on both sides that may well lead to some softening of views or compromise.

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