Participatory Framework for Valuation of Marine and Coastal Ecosystem Services

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Methodological Challenges: Economics and Ecology: transdisciplinary conversations

Abstract

Recent initiatives at a policy level are exposing marine and coastal ecosystems to different kind of pressures making these systems more vulnerable. The complex nature of marine and coastal ecosystems, their specificities and the inaccessibility/invisibility of the majority of their goods and services leads to the need of new methodologies capable to support decision making processes in these environments.

This paper presents a participatory framework for the valuation of marine and coastal ecosystems in order to integrate their values in decision-making processes. With the participatory approach it is fostered the integration of different values attributed by stakeholders to a specific ecosystem service and how it is affected by a given decision.

This work discusses the transdisciplinary character of marine and coastal ecosystems policies showing the need to involve all the interested parties in order to achieve a sustainable management of natural resources.

Keywords

Public and Stakeholder Participation; Valuation of Ecosystems Goods and Services; Marine and Coastal Ecosystems

1. Introduction

Marine and coastal ecosystems are increasingly under pressure, with many of its goods and services threatened. Coastal ecosystems are the most productive systems

concerning the services linked to human wellbeing (MEA, 2005). Several initiatives have been emerging at a policy level in different fields of knowledge, converging to the importance of a sustainable management of marine and coastal ecosystems. Indeed, the European Integrated Maritime Policy and the European Biodiversity Strategy to 2020 (COM, 2007; COM, 2011) call for new methods to identify and quantify the services of these ecosystems in order to integrate that information in decision-making processes. These initiatives are an attempt to improve the management and conservation of natural resources. From an economic perspective, *blue growth* has been presented as long-term strategy to support growth in the maritime sector, highlighting the importance of marine and coastal zones.

Valuation and accounting of ecosystem services is an increasingly studied subject, which is gaining more and more attention in the scientific and policy arenas. The Millennium Ecosystem Assessment (MEA, 2005) and The Economics of Ecosystems and Biodiversity (TEEB, 2009) are two of the large-scale studies that have looked into the consequences of ecosystem changes for human wellbeing and provide the scientific basis for action needed to enhance the conservation and sustainable use of those systems. However, there is still a scarcity of studies pointing the benefits and costs of biodiversity conservation, especially at regional and local levels, which contributes to an insufficient allocation of resources for conservation. This fact is particularly evident in maritime and coastal ecosystems. Hence it is important to identify the type of decisions where this approach is potentially relevant and how each stakeholder group involved in maritime decisions understands them.

Economic valuation approaches have pointed to limitations in the valuation of ecosystem services (de Groot et *al.*, 2002; Kumar and Kumar, 2008; Spangenberg and Settele, 2010; Ulgiati et *al.*, 2011), calling for new methodologies that integrate economic, ecological and social values underlying ecosystems services. It is therefore important not to limit assessments to monetary values, but to include qualitative analyses and physical indicators as well. In this way, valuing ecosystems services requires the integration of ecology, society, sociology and economics in an interdisciplinary framework. Furthermore, in order to address the problem of integration and value articulation, a participatory approach plays an important role since it allows a more comprehensive integration of perceptions and values. This is supported by the recent maritime policies (*e.g.* Green Paper towards a maritime policy

for the Union, EU Integrated Maritime Policy), which highlight the importance of active stakeholder participation in policy development and assessment processes.

In this paper we present a conceptual framework for the valuation of ecosystems services through a participatory and cyclic process to support sustainable management of marine and coastal ecosystems. The research aims to support the determination of values that different stakeholder groups place on marine and coastal ecosystems services and how these may be incorporated in decision-making processes.

The paper concludes with a discussion on factors influencing the framework implementation, as well as a reflection on critical issues such as aggregation and/or articulation of different value dimensions. Thus, the proposed contribution will address key success factors for the implementation of recent maritime policies, facilitating the identification of ecosystem services that underlie crucial maritime decisions and promoting the involvement of different stakeholder groups in the valuation of their associated benefits.

The paper is organized as follows. The first section introduces the background on the topic of marine and costal ecosystem services, while the second section discusses the main issues dealing with policy-making, assessment and participation in maritime decisions. In section three, the proposed conceptual framework is presented and discussed. The paper finalizes with a reflection on prospects for implementation and further development of the framework.

2. Marine and Coastal Ecosystems

2.1 Relevance

We can find in the literature three main definitions of ecosystems services: "the conditions and processes through which natural ecosystems and the species that make them up, sustain and fulfil human life" (Daily, 1997); "the benefits human populations derive, directly or indirectly from ecosystems functions" (Costanza et *al*., 1997); "the benefits people obtain from ecosystems" (MEA, 2005).

Ecosystems goods and services are extremely important for human wellbeing and for the achievement of sustainable development. The way ecosystems are affected by

both political decisions and stakeholder actions, have been influencing in a negative way the supply of goods and services (MEA, 2005).

The Environmental European Agency highlighted the current state of oceans and seas emphasizing the growing threats like over-exploitation and climate change (EEA, 2010). The major drivers of change, degradation, or loss of marine and coastal ecosystems and services are mainly anthropogenic (UNEP, 2006).

Seventy-one percent of the earth's surface is ocean. According to Costanza (1999) because of the vastness of oceans, these ecosystems have been neglected to scientific exploration during too much time. Similarly, coastal ecosystems are also responsible for the provision of a large share of ecosystem goods and services (MEA, 2005). The services that these ecosystems provide to us are essential for human planet life continuity. The main services provided by marine and costal ecosystems are presented in Table 1.

Table 1 – Examples of ecosystem services provided by different marine and coastal habitats (adapted from MEA, 2005 and UNEP, 2006).

Provisioning Services	**Regulating Services**	**Supporting Services**	**Cultural Services**
Food	Biological regulation	Biochemical	Cultural and amenity
Fibre, timber, fuel	Freshwater storage and retention	Nutrient cycling and fertility	Recreational
Medicines, other resources	Hydrological balance		Aesthetics
	Atmospheric and climate regulation		Education and research
	Human disease control		
	Waste processing		
	Flood/storm protection		
	Erosion control		

There is a knowledge gap regarding the consequences on human well-being of changes in ecosystems, which emphasizes the need for policy responses to address several uncertainties, including the benefits and costs of degradation and conservation (UNEP, 2006).

2.2 Policy Initiatives

Policy initiatives for marine and coastal ecosystems have been expanding at international, European and national levels. Global concerns regarding protection of marine environments have been realized into United Nations Conventions on Sea Law (UNCLOS) in 1982 (UN, 1982). Later emerged in the Convention for the protection of the marine environment of the northeast Atlantic (OSPAR) (OSPAR, 1992), an instrument to guide international cooperation in the protection of Atlantic Northeast marine environment. Since then, and more recently, the European Commission intensified its efforts to relaunch the debate around these issues through the Integrated Maritime Policy (COM, 2007).

Portugal has a long tradition on coastal and maritime activities with an important weight in Portuguese economy (Carneiro, 2007), which have been evolving over time, going through the age of discoveries, fisheries, nautical sports, aquaculture and more recently renewable energy. Nowadays, the importance of maritime activities in national context has been increasing. These activities could lead to more conflicts of uses, which combined with problems faced at a global level, like climate change or sea acidification could lead to an unsustainable use of marine resources. Therefore the need of measures and polices capable to address these issues and managing these areas with their resources is essential.

The national context is suitable for the development of new methodologies that could help the sustainable management of marine and coastal ecosystems. In 2006, Portugal was pioneer in presenting a National Strategy for the Sustainable Development of the Ocean – ENM (EMAM, 2006) that gave rise to the maritime spatial planning (INAG, 2012). Following the recommendation of European Union (EU) for a good preservation and management of coastal zones, it was developed the National Strategy for Coastal Zone Integrated Management (INAG, 2009). All these initiatives emphasise the importance of participatory involvement of all interested parties, allowing the achievement of main goals in the protection of these systems.

Table 2 summarizes some of the highlights of the policy initiatives identified above.

Table 2 – Policy initiatives at international, European and national level regarding marine and coastal ecosystems.

International Level			
Initiative	Year	Main Goal	Important Issues
UNCLOS	1982	The Law of the Sea Convention defines the rights and responsibilities of nations in their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. The convention set the limit of various areas, measured from a carefully defined baseline.	Establishes the basis for discussions on environmental protections in the international maritime world. The convention also safeguards imperilled marine habitats by strengthening state sovereignty over the enforcement of resource management and environmental regulations in each state's Exclusive Economic Zone (EEZ) up to 200 miles offshore.
OSPAR	1992	The OSPAR Convention is the current legal instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic. Work under the Convention is managed by OSPAR Commission, made up of representatives of the Governments of 15 Contracting Parties and the European Commission representing the European Union.	OSPAR has first developed, and is implementing, a suite of five thematic strategies to address the main threats that it has identified within its competence (the Biodiversity and Ecosystem Strategy, the Eutrophication Strategy, the Hazardous Substances Strategy, the Offshore Industry Strategy and the Radioactive Substances Strategy), together with a Strategy for the Joint Assessment and Monitoring Programme, which assesses the status of the marine environment and follows up implementation of the strategies and the resulting benefits to the marine environment. These six strategies fit together to underpin the ecosystem approach.
European Level			
Initiative	Year	Main Goal	Important Issues
Green Paper Towards a future Maritime Policy for the Union: A European vision for the Oceans and Seas	2006	To launch a debate about a future Maritime Policy for the EU that treats the oceans and seas in a holistic way.	Stakeholders participation as an important issue
European Integrated Maritime Policy	2007	Europe's capacity to face the challenges of globalisation and competitiveness, climate change, degradation of the marine environment, maritime safety and security, and energy security and sustainability. It must be based on excellence in marine research, technology and innovation	This integrated, inter-sectorial approach was strongly endorsed by all stakeholders. Applying it will require reinforced cooperation and effective coordination of all sea-related policies at the different decision-making levels.

Maritime Strategy Framework Directive	2008	The Marine Directive is the environmental pillar of the cross-cutting Integrated Maritime Policy. The overall objective is to achieve or maintain Good Environmental Status of the EU's marine waters by 2020, thus protecting the resources on which marine-related economic and social activities depend.	The Directive foresees an ecosystem-based approach to the management of all human activities that have an impact on the marine environment.
National Level (Portugal)			
Initiative	Year	Main Goal	Important Issues
National Strategy for the Sea	2006	To define the main paths and to create a coordinating structure for ocean affairs that suits a maritime country such as Portugal and makes it possible to explore the full potential of the ocean, for the present and future generations.	Active involvement of stakeholders
National Strategy for Integrated Coastal Zone Management	2009	To establish a strategic framework for a comprehensive, integrated and participatory coastal zone management to ensure sustainability conditions for its development. ENGIZC's mission is to ensure the articulation and coordination of policies and instruments to a sustainable development of coastal zone.	Values behind the vision for the Portuguese Coastal Zone: Sustainability; cohesion and equity; prevention and precaution; systemic approach; participation.
Maritime Spatial Planning Plan	2012	The Maritime Spatial Plan emerges from the National Strategy of the Sea, in order to sort the present and future uses and activities of the maritime space, in close coordination with the coastal zone management, ensuring the sustainable use of resources, preservation and restoration, enhancing the efficient use of marine space, within an integrated and inter-sectorial approach, and fostering economic, environmental and social importance of the sea.	This plan is an instrument of spatial planning that should "ensure an overview based on the principles of sustainable development, the precautionary and ecosystem approach."

These initiatives demonstrate the need to look for new ways to identify and assess ecosystem goods and services. Bingham et *al*. (1995) argue that decision makers need good-quality information concerning the value of ecosystem services to enable them to consider the advantages and disadvantages of actions capable to affect ecosystems.

Despite recent attention given to monetary valuation of ecosystems services that do not have a market value, integration of this type of value in decision-making processes has been limited (MEA, 2005). This suggests the importance of exploring not only the valuation methods but also providing policy makers with a supporting deliberative context for a decision-making process.

2.3 Valuation of Ecosystems Goods and Services

The concept of ecosystem services value has been submitted to a scientific debate in recent years (de Groot, 2002; Spangenberg and Settele, 2010). The valuation of ecosystems goods and services is a step to promote conservation, which requires an identification and classification of those benefits.

Bingham et *al.*, (1995) proposed a categorization of ecosystems services starting from a classification of Kellert and Clark (1991). Later, the study Millennium Ecosystem Assessment (MEA, 2005) assessed the consequences in human well-being promoted by changes in ecosystems. The study also considered the scientific basis for action needed to enhance the conservation and sustainable use of ecosystems. Since then, some authors tried to define ecosystem services and how they should be considered for evaluation (Boyd and Banzhaf, 2007; Fisher and Turner, 2008). The debate around classification issues has been intensified as a bridge to different valuation approaches. In this context, economic valuation expanded its dissemination with many different authors supporting its application to ecosystems goods and services (Costanza et *al.*, 1997; Daily et *al.*, 2000; Farber et *al.*, 2002; TEEB, 2009).

Other authors have also suggested that economic valuation in itself is not sufficient, highlighting some of the major problems of this approach. They recognized a need for new methods capable to move beyond and capturing more than what the economic value may contain (Bingham et *al*. 1995; Martinez-Alier et *al*., 1998; de Groot at *al.*, 2002)

Monetary valuation could draw attention to the importance of natural resources, particularly in marine and coastal ecosystems, which might be less directly visible to people than other ecosystems. Hawaii's coral reef ecosystems were valued in monetary terms (Cesar and van Beukering, 2004). However, despite the conclusions emphasized the positive influence of these ecosystems in welfare of Hawaii, the value did not reflect the threats to coral reefs due to climate change, ocean acidification, pollution and/or overfishing. TEEB (2009), notwithstanding its economic approach, showed that only a few part of the world ecosystems services could be evaluated in monetary terms.

Another criticism of economic valuation is its static nature. According to Spangenberg and Settele (2010) the fact that it refers to a current situation, ignoring

future trends, is a limitation. They also stressed the risk of the application of economic instruments becoming an end in itself, gaining primacy compared to ecosystem services protection. The lack of interconnections when making the valuation process is also obvious; often when the service is isolated, the entire context is lost.

Despite the importance and the achievements of economic valuation of ecosystem services, the limitations of this approach have been potentiating the development of new methodologies based on different concepts (Odum, 1988; Costanza et *al*., 1989; Odum, 1996; Knowler et *al*. 2009; Ulgiati et *al.*, 2011). That is why it is important that valuation of ecosystems services emerges in a decision-making context, and to study how to integrate different values. According to Wallace (2012), there is a need to develop quantitative and qualitative methods for exploring, documenting and eliciting values, taking into account that effective stakeholder engagement still represents a challenge.

2.4 Participation

In order to address the problem of integration and articulation we argue that a participatory approach could play an important role in a way that allows a more comprehensive integration of perceptions and values.

Different actors in different situations depend strongly on ecosystems services, so they should arguably be involved in valuation processes. The World Business Council for Sustainable Development (WBCSD) produced a set of guidelines for the identification of business risks and opportunities emerging from ecosystem changes (WBCSD, 2011). The proposed tool focuses on the importance and the strong dependence of business on ecosystems goods and services.

In another perspective, governments have the main role in regulating several activities that affect ecosystems. They represent sovereign states in international negotiations and in the integration of international environmental agreements that directly regulate the way resources are managed (MEA, 2005).

According to Berghofer et *al.* (2008) the integration of humans in ecosystem concept implies value judgments that can be produced in more or less formal arenas. Society

should decide, but how to do this is the central question.

Wallace (2007) refers that in order for a decision-making process to be successful it should identify and involve all stakeholders in the valuation process. In this line of thought, a series of participatory approaches have been emerging as an answer to the existent difficulties in this field. Videira et *al.* (2010) developed a participatory modelling approach to support integrated sustainability assessment process, which allowed the participation of different stakeholders and the integration of different methods and tools. Antunes et *al*. (2009) also integrated different techniques in order to support decision making for sustainable development.

Curtis (2004), developed an innovated method for environmental evaluation, based on economic valuation theory and property rights as well as substitute markets, combining a multicriteria analysis with Delphi method. Kenter et *al.* (2011) developed a participatory and deliberative approach of choice experiment aimed to define the value attributed to ecosystem services in Solomon Islands. They showed how a participatory process could be helpful to find solutions and how important it is to the valuation of a complex good in developed and developing economies. Through more pluralistic approaches, it is arguably possible to achieve fair procedures with legitimacy. The deliberative processes could help to formulate values (Robards et *al.*, 2011).

Although the evident benefits of participatory approaches in valuation of ecosystems goods and services, its application has been poorly developed. Table 3, shows a set of different studies regarding marine and coastal ecosystems goods and services analysing the level of participation used. This analysis is not intended to be an extensive review. It rather serves to illustrate practical examples and relate them to the type of decisions where valuation processes have been used.

Table 3 – Examples of marine and coastal ecosystem services valuation.

Study	Authors	Year	Objectives	Decision	Type of Valuation	Methods	Participation	Results
Assessing prospects for shrimp culture in the Indian sundarbans: A combined simulation modelling and choice experiment approach	Knowler, D., Philcox, N., Nathan, S., Delamare, E., Haider, E. And Gupta, K.	2009	Analysis of the expansion shrimp production in aquaculture	Evaluate several policy scenarios(4 policy scenarios were constructed for the Analysis is based on a review of the policy context governing shrimp aquaculture in India)	Non-monetary valuation	Simulation model for the evaluation of different scenarios. Choice modelling for the identification of stakeholders preferences relating different policy scenarios.	Analysis of social acceptance of built scenarios combining quantitative and qualitative techniques. Semi structured interviews, Focus group and informal interviews.	The ecological model supports severe restrictions to shrimp production in aquaculture. However local stakeholders prefer a diversified strategy. It was clear that a shrimp production in aquaculture in large scale is less desirable.
The value of recreational fishing in the great barrier reef, Australia: A pooled revealed preference and contingent behaviour model	Prayaga, P., Rolfe, J. and Stoeckl, N.	2010	To estimate the value of recreational fishing in Capricorn Coast in Queensland centre	Protecting natural assets in the Great Barrier Reef Marine Park in Australia	Monetary valuation	Travel cost to estimate the value of recreational fishing. Contingent behaviour models to estimate a change in the value attributed to recreational fishing relating to a variation in initial conditions.	Surveys to anglers	The results indicate that there are high values associated with recreational fishing. They concluded that the demand for recreational fishing is inelastic and that attributed values are insensitive to changes in catch rate.
Valuing the recovery of over exploited fish stocks in the context of existence and option values	Ojea, E. And Loureiro, M.L.	2010	Identification of individual preferences relating different levels of recovery overexploited stock fishes	Fish stock recovery	Monetary valuation	Contingent valuation applied to a sample of consumers and non consumers	Individual interviews	The results show that a recovery of Analysis stocks will increase the local well being.

The value of marine biodiversity to the leisure and recreation industry and its application to marine spatial planning	Rees, S.E., Rodwell, L.D., Attrill, M.J., Austen, M.C. And Mangi, S.C.	2010	Evaluation of maritime industry of leisure and recreation as an argument to the sustainable use of rich marine biodiversity areas.	marine planning	monetary and non-monetary valuation	Surveys make to four interest groups in monetary and non-monetary terms. Geographical Information Systems to the Analysis of reference spots.	Surveys	The results show that the leisure and recreation industry is dependent on the diversity of sites
Improving the recreational value of Ireland's coastal resources: A contingent behavioural application	Barry, L., van Rensburg, T.M. and Hynes, S.	2011	Understanding people willingness to pay for the introduction of a trail to allow them to walk along the coast.	Improvement to a coastal recreational site.	Monetary valuation	Contingent behaviour method. Combining questions of revealed preferences relating the number of travels with questions express preferences relating hypothetical changes in the number of travels if the alteration occurs.	Surveys to visitors	The study revealed that willingness to pay for the introduction of a trail increase, which lead to more visitors what may cause good impact on the local economy. Hypothetical improvements in coastal access have a positive effect on the number of planned trips by those who take part in water sports activities
Economic valuation of species loss in the open sea	Ressurreiçã o, A., Gibbons, J., Dentinho, T.P., Kaise, M., Santos, R.S. E Edwards-Jones, G.	2011	Estimate the willingness to pay for avoid the loss of marine species in Azores archipelago, as well as analyse the perceptions and people knowledge and economic preferences relating marine conservation.	information for marine management and conservation (in a broader sense)	Monetary valuation	Contingent evaluation	Surveys to residents and visitors	The results suggested a willingness to pay to preserve all the marine taxa as a whole higher than individual conservation. Although results show a significant difference between mammals and fishes when compared with birds, algae and invertebrates the differences are not as big as expected.

According to Maguire et *al.* (2011) the public nature of the marine environment and its multiple uses creates the potential for a range of stakeholders that may vary according to their interest, perception of constraints and opportunities, and views about the needs for management.

The complex nature of marine and coastal ecosystems together with recent policy initiative, that call for more inclusive participatory processes, support the objectives of this work. The underlying hypothesis is that through a participatory approach that facilitates the integration of different tools and methods, it is possible to better articulate different values attributed by stakeholders to maritime and coastal ecosystem goods and services.

2.5 Marine and Coastal Decisions

Decisions over marine and coastal ecosystems, and their respective ecological impacts, are manifold, including the construction of offshore pipelines (Wilday et *al.*, 2011; Koorneef et *al.*, 2012), aquaculture production (Merino et *al.*, 2010), location of maritime ports (Hommes et *al.*, 2009), conflict of uses in marine and coastal areas (Bess and Rallapudi, 2007; Douvere, 2008), among others. On the other hand, the positive impacts of specific decisions have also been highlighted, like the establishment of a marine protected area (Angulo-Valdés and Hatcher, 2010).

But how these negative and positive impacts have been considered when taking a decision? Has the value of ecosystems goods and services been integrated to reach a conclusion? How the articulation of the different values that people attribute to ecosystems goods and services had been promoted? These questions are the basis for the identification of methodological needs in what concerns valuation of marine and coastal ecosystems services to support decision-making.

For example, ports are often located in highly valuable and vulnerable natural areas, hosting endangered habitat and species. In Italy (Su ports, 2011) some of the ports are located in areas of ornithological importance (type and number of species) and near Special Conservation Zones (EU Bird Directive). When the decision of ports construction was made it did not take into account different values of marine and coastal ecosystems. But now there is the need for port authorities to integrate new

goals in their management decisions and create awareness over the values of the surrounding natural areas (SuPorts, 2011).

Some economic projects, such as tourist ventures, were implemented in Network 2000 (*e.g.* Portuguese coastal zone - Herdade do Pinheirinho) overlapping environmental interests. Decisions like this could lead to a change or the loss of some services provided by these ecosystems.

In Portugal it was developed a Strategy for Integrated Coastal Zone Management which was accompanied by a Strategic Environmental Assessment. Although this study had considered the maritime and coastal ecosystem services it did not promote the discussion of the results with the stakeholders, failing in integrating the value people place on those services (Partidário, 2010).

Emerging technologies, such as renewable energy offshore and CO_2 storage and transportation offshore could bring more challenges regarding decision-making in marine and coastal environments. It is of high importance to address the issues related with the changes that these initiatives could have on ecosystems services. On the other hand trade-offs should be discussed in order to understand the added value these options could offer.

The examples above show the urgency of the identification and integration of ecosystem values in decision-making process. This brings forward the need for new approaches capable to address these issues.

3. Conceptual Framework

The conceptual framework presented in this section suggests that valuation of marine and coastal ecosystems services should be conducted through a participatory and iterative process. This proposal aims to support the determination of values that different stakeholder groups attribute to marine and coastal ecosystems services and how they may be incorporated in decision-making processes.

3.1. Decision Making Process

Decision-making involves the selection of a course of action among different possible alternatives in order to arrive at a solution for a given problem. It has to be a

continuous and dynamic process and it implies choice in all of the cycle steps. Here we present a stylized decision-making process based on integrated environmental management for marine and coastal environments, adapted from Antunes and Santos (1999).

The first phase, *problem identification*, is where the recognition of a problem occurs. Here the problem could be the overexploitation of marine resources or the decline of fish stocks. This is followed by *problem analysis*, which will allow discussing different alternative solutions and the possible scenarios. At this stage it is important to formulate questions such as: is it important to restrict the area? Will fish stocks collapse if nothing is to be done? When all the alternatives are analysed, it becomes possible to select the best solution and convert the option(s) into actions through different methods and instruments, for example through the establishment of a marine protected area. In the *monitoring phase*, the aim is to follow the development of the choices made, e.g. monitoring of a marine protected area management plan.

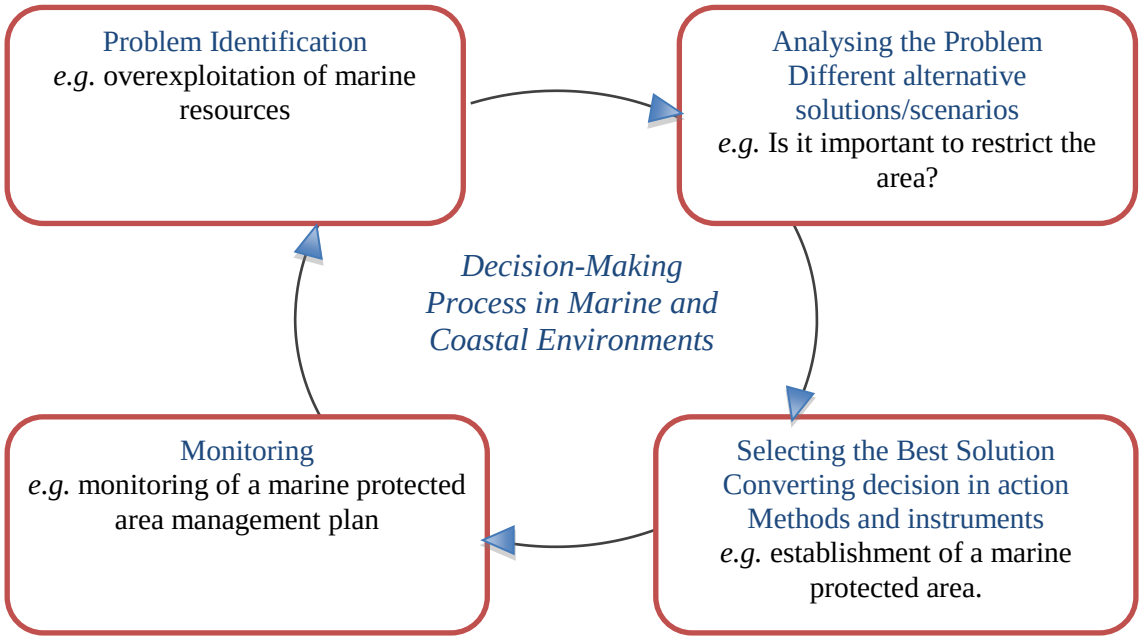

Figure 1 – Decision-making process in marine and coastal environments (adapted from Antunes and Santos, 1999).

The decision-making process should lead to the problem resolution, stakeholders' acceptance and provide benefits that compensate the costs. In order to address this we propose a participatory framework to assess the value of marine and coastal ecosystem services to support the different phases of decision-making process.

3.2 Framework to Valuation of Marine and Coastal Ecosystem Services

The conceptual framework presented in Figure 2 comprises three major stages to provide a coherent base for the identification and valuation of ecosystems services. Below it is illustrated how each stage should be developed and which are the methods and the tools that may be deployed.

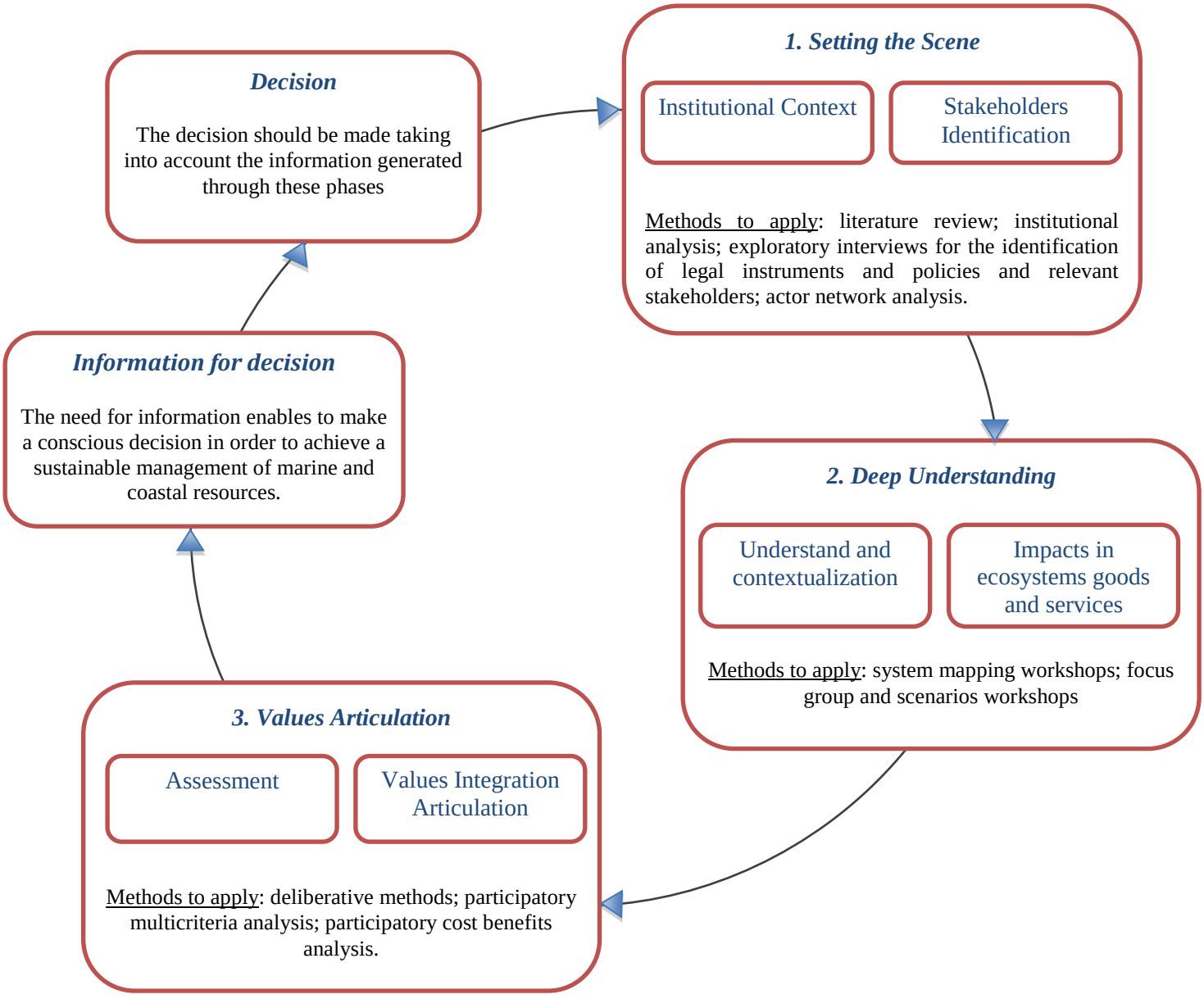

Figure 2 – Conceptual Framework for marine and coastal ecosystem services valuation.

Setting the Scene

The process starts with a conceptualization of the institutional context underling the decision. The identification of the legal instruments and the policies that are in place will help to understand what are the key factors that influence the decision. At this stage it is also desirable the identification of implicated stakeholders. There is a need to consider the different groups of agents such as those considered in the EU Integrated Maritime Policy (*e.g.* businesses, public sector and civil society organizations). According to Maguire et *al.* (2012), the level of stakeholder involvement is largely dictated by the political and/or legal requirements for participation but not all stakeholders need to be permanently involved and with the same intensity or type of involvement. We argue that stakeholder selection should be a participatory process itself, in order to identify stakeholders who are affected by both policies and impacts on ecosystem goods and services.

The methods suggested to apply at this stage include literature review, institutional analysis and exploratory interviews with key actors in order to collect information regarding the institutional structure and the stakeholders that should be involved in the process. Videira et *al.* (2012) applied this approach to Integrated Sustainability Assessment of Maritime Policies, where the exploratory interviews allowed to become familiar with the main issues and players involved in maritime affairs and to develop a preliminary list of stakeholder groups for the conduction of the assessment process. We also propose an actor network analysis, which is a suitable analytical tool for environmental questions (Burgess et *al.*, 2000).

Deep Understanding

The aim of this stage is to develop a shared understanding of the trade-offs and how the decision in question could affect the services provided by marine and coastal ecosystems. It is important to promote deliberation among stakeholders while identifying where the decision is potentially relevant and how it is understood by each stakeholder group. Vatn (2009) highlighted the observed differences in preferences people hold in individual and social settings. For this reason is important to understand the context in which the interested parties operate. This is followed by an identification of all ecosystem goods and services that can suffer impacts arising from

a given maritime decision. At this stage we also propose the elicitation of values that each stakeholder assigns to the goods and services under review and how they may be influenced by their professional and personal backgrounds.

The methods to apply throughout this stage include for example mapping workshops, focus groups and scenario workshops. Qualitative participatory models have been strongly supported and applied (Vennix, 1996; Videira et *al.*, 2009; Videira et *al.*, 2010). The mapping exercise could help supporting the conceptualization of the decision context as well as the different stakeholder perceptions regarding the value of ecosystems services and how it could be affected by the decision. As defended by Boumans et *al.* (2002) ecosystem processes and components may also be used in dynamic modelling to explore interdependencies and explicitly formalize the implications for their valuation.

Value Articulation

This phase aims to articulate the different values assigned to ecosystems services and the effect on the decision-making process. According to de Groot et *al.* (2002) the value of ecosystems goods and services should be a combination of economic, ecologic and social-culture values. Some authors (Farber et *al.*, 2002; Howarth and Farber, 2002, Vatn, 2009) have discussed the problem of value aggregation as well as its weighting in decision-making processes.

TEEB (2009) grouped the approaches for the estimation of nature's values into Preference-based approaches (market theory and Political science) and Biophysical approaches (Resilience theory and thermodynamics). Vatn (2009) developed a framework to help in the choice between various methods, including Cost Benefit Analysis, multi-criteria analysis and deliberative methods, differentiating the application of each one according to the context and the goal.

In this phase we support the application of participatory methods. Deliberative methods could play an important role in maritime decisions, since these systems are very complex and most of the time inaccessible and "invisible" to stakeholders. Promoting the discussion around the values of ecosystems services supports learning, awareness and exchange of perceptions leading to a deeper understanding of the issues at stage. According to Vatn (2009) deliberative methods help in the

communication of groups over different arguments in order to achieve a common solution, which could be by consensus or commitment. This fact is crucial when dealing with incommensurable values, which is often the case.

Through the development of these three stages direct inclusion of value measurements of ecosystem services is promoted, throughout the integrated and adaptive management cycle (Figure 2). The implementation and further development of the proposed framework is expected to support a decision-making process that affects marine and coastal ecosystems by identifying, informing, discussing, and assessing the values these services provide to human wellbeing. The participatory design underpinning the framework builds on the rationale that the translation and evaluation of ecosystem services cannot be restricted to economics terms, and that participation may foster the articulation of differences in perceptions of values. With this approach we intend to achieve a high level of participation (Videira et *al.*, 2006) by creating incentives for active stakeholder engagement.

The choice and design of specific methods and tools to apply will be strongly dependent on the type of decision. The framework is a work in progress and it is a participatory product in itself, since the development and the final version of this framework will be the result of the inputs from the interviews planned with a group of maritime stakeholders in Portugal.

4. Final Remarks

In this paper, we presented and illustrated a participatory framework for valuation of marine and coastal ecosystem services. This framework is expected to provide an improved methodology to support decision-making processes in marine and coastal ecosystems. Due to the recent policy initiatives and increasing attention given to the economic exploration of marine and coastal resources, these ecosystems are becoming highly exposed to anthropogenic pressures. The specificities of marine and coastal ecosystems, their complexity and most of the times the inaccessibility of their goods and services becomes an obstacle to creating awareness and recognition of the suite of benefits they provide. With this respect, the proposed framework adds communicative and informative features to maritime decision-making processes.

The proposed approach is a work in progress and it is intended to be in itself a participatory product. In order to understand the applicability of the framework a set of interviews will be conducted with experts and maritime stakeholders. An ex-post analysis of case studies will follow to understand how the values associated with ecosystems services have been considered in recent policy and decision-making processes. These tasks are expected to bridge the identified knowledge gaps and validate the framework prior to its implementation in an ex-ante case study.

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