



Incorporating ecosystem services in marine planning: The role of valuation



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ABSTRACT

This paper scrutinises the use of ecosystem service valuation for marine planning. Lessons are drawn from the development and use of environmental valuation and cost-benefit analysis for policy-making in the US and the UK. Current approaches to marine planning in both countries are presented and the role that ecosystem service valuation could play in this context is outlined. This includes highlighting the steps in the marine planning process where valuation can inform marine planning and policy-making as well as a discussion of methodological challenges to ecosystem service valuation techniques in the context of marine planning. Recommendations to overcome existing barriers are offered based on the synergies and the thinking in the two countries regarding the application of ecosystem service valuation to marine planning.

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1. Introduction

The need to understand the benefits of marine ecosystems in economic terms has never been more pressing. Marine ecosystems provide benefits to people through the provision of seafood and other resources worth trillions of dollars annually as well as regulation of the earth's climate and the modulation of global biogeochemical cycles [1], maintenance of water quality [2] and support of cultural and aesthetic uses [3]. Such marine ecosystem services are subject to degradation from anthropogenic sources including ocean acidification, climate change, deoxygenation, pollution, over-fishing and habitat degradation [4–6]. These global pressures are coupled with the ever increasing and broadening human uses of the marine environment such as through shipping, renewable energy generation, fisheries, recreation, aquaculture, oil, gas and aggregate extraction. Indeed, the Committee on International Capacity-Building for the Protection and Sustainable Use of Oceans and Coasts states that

“it is vital to build capacity – the people, the institutions, and technology and tools – needed to manage ocean resources” [7].

To balance the competing demands on marine ecosystems and limit or reserve degradation, a variety of policies are being employed globally, including

- UK Marine and Coastal Access Act 2009 (MCAA).
- EU Marine Strategy Framework Directive 2008 (MSFD).
- US National Ocean Policy 2013.
- EU Integrated Maritime Policy 2012.
- IMO Convention on Ballast Water Management 2004.
- UN Convention on Biodiversity 1992.

Marine planning¹ has emerged in the US and UK as a pro-active approach for the sustainable management of the marine area. In the

¹ Originally referred to as marine spatial planning, this concept has of late increasingly been called marine planning (see, for example, [8]). We treat the terms as synonymous and use marine planning except where the literature specifically refers to marine spatial planning.

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UK, the Marine Management Organisation (MMO) aims to prepare a first suite of marine plans for 11 marine areas in England [9]. In the US, the federal government has proposed as many as seven voluntary, regional planning bodies to bring marine planning into federal waters (i.e. seas beyond three miles from shore [10]).

An “ecosystem approach”, which takes environmental, social and economic factors into consideration, is integral to marine planning in the US and UK. This approach requires direct consideration of ecosystem services, which have been defined as “the benefits that humans obtain from ecosystems” [11]. Ecosystem service valuation (ESV) is the process of assessing the values of these benefits and many publications and initiatives have created typologies and quantified the value of marine ecosystem services [3,12,13]. However, the implementation of these valuations in a marine policy context has been variable and often limited [14].

Applications of ESV to marine ecosystems arise from decades of research and development of valuation methods for market and non-market goods. Significant efforts have been made to estimate the values of coastal and marine ecosystem services (e.g. [3,12,15–21]).² Furthermore, a variety of technical tools and models are available to predict the way these integrated marine ecosystem service values may change due to policy intervention (e.g. Marine InVEST, MIMES, ARIES).

Ecosystem service valuation (ESV) in marine planning has potential to highlight hidden ecosystem benefits and costs that might be overlooked if only commercial revenues and costs were considered. It can also improve understanding of the economic trade-offs from different marine plans or scenarios, including trade-offs between different kinds of ecosystem services as well as between those services and commercial economic activities that do not depend on the condition of marine ecosystems, but may affect them. To date, however, the use of ESV in marine planning is still nascent. The time is right to think carefully about how and when ESV could be best used to inform marine planning.

This paper draws on lessons learned in the application of non-market environmental valuation for policy-making in the US and UK with the goal of providing guidance for the application of ESV for marine planning in these countries and elsewhere. While acknowledging that ESV clearly makes use of market and nonmarket approaches to valuation, we focus primarily on the nonmarket area given the methodological challenges and ensuing level of controversy that still accompanies the application of relevant approaches [23,24]. In both countries, the basic methods used for valuation have developed in unison and the theoretical and methodological foundations of valuation are the same. The US and UK are considered to be at the vanguard of research regarding the application of ESV in the marine environment [17]. However, there are clear differences in the geography, politics and demographics of ESV applications in the two countries. Therefore, there is significant benefit in comparing the policy drivers and applications of valuation to policy, which are historically different in each country. In addition both the US and UK are currently developing marine planning approaches, and would therefore benefit from this comparison of approaches to enable more effective and efficient marine planning.

2. Valuation of nonmarket environmental goods for policy in the US and UK: 1960 to present

Understanding the use of nonmarket environmental valuation in policy could help the future successful use of ESV in marine

planning [25]. Influential policies have triggered the development and application of valuation methods in environmental cost-benefit analyses (CBA) in the US and UK. Much of the relevant literature reviewed here does not specifically relate to the valuation of marine resources, but the development and application of methods are applicable across ecological domains. Many of these methods have not been applied to ecosystem services directly but to a more loosely defined set of environmental goods since the development of most valuation approaches predate the mainstreaming of the ecosystem services concept, but these valuation approaches are directly applicable to ESV.

Starting in the 1960s, new legislation in the United States, such as the Clean Air Act 1963 (CAA), Clean Water Act 1972 (CWA), National Marine Sanctuaries Act 1972 as well as the establishment of the Environmental Protection Agency (EPA) ushered in a need for environmental valuation to assess the costs and benefits of new environmental policies and programmes (cf. Table 1). While valuation methods had been applied previously (e.g. contingent valuation [26], the travel cost method [27,28]), the CAA and CWA focused the need to refine methods for demonstrating the value of environmental improvements (and damages).

In 1980s, two events led to rapid theoretical and practical development of nonmarket valuation methods in the US. Firstly, in 1981 Presidential Executive Order 12291 mandated the use of CBA for any federal project expending more than \$100 m, thus implicitly creating the need for empirical measures of values to support CBA of environmental change. The outcome of this need was the expansion of the theoretical underpinning necessary for policy applications of a subset of revealed-preference valuation methods known as travel cost models [29].

Secondly, the grounding of the Exxon Valdez tanker in 1989 led to a national valuation study [30,31] that used contingent valuation to assess the passive use environmental values lost due to the accident for which the responsible party would be held financially liable. Partly due to the ensuing controversy, in 1992 the National Oceanic and Atmospheric Administration (NOAA) commissioned a panel of expert economists to assess the validity of using this valuation technique to measure passive use values [32]. In conditionally endorsing contingent valuation as a valid method, the NOAA Panel set the framework for stated-preference methods to be used to estimate values to support litigation and policy analyses in the US. Subsequent to the seminal work by Bockstael and McConnell [29] and the NOAA Blue Ribbon Panel Report, much of the academic literature has focused on methodological refinement and standardisation of practices for application of non-market valuation methods (e.g. [33,34]).

The driving forces behind the relatively early incorporation of environmental valuation in CBA in the US have no contemporary parallels in the UK. Rather, the use of CBA and associated environmental valuation in UK public decision-making has developed in a more piecemeal fashion with a “chequered history” [35]. From experimental use in transport projects in the 1960s, developments in the use of CBA led to a recognition of its relevance to policy evaluation and as a means of incorporating environmental values into decision making, culminating in the (then) Department of the Environment's publication of Policy Appraisal and the Environment [36] (DoE 1991). Although Pearce [35] further cites an interdepartmental “White Paper” [37] as signalling an acceptance of CBA in environmental policy the paper itself is not explicit on this count, referring to (amongst other things) the need for economic research on the costs and benefits of environmental protection measures. Perhaps more significant in this respect was a report commissioned by the Department of the Environment published as *Blueprint for a Green Economy* [38], which highlighted the potential roles of environmental valuation methods in decision-making and the use of such values in CBA.

² There are further initiatives like the Nature Capital Committee in the UK and the UN System of Environmental Economic Accounting (SEEA) [22], which will not be considered in this paper because they do not value marginal changes in ecosystem service provision.

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