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Data collection and mapping – Principles, processes and application in marine spatial planning

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ABSTRACT

Marine spatial planning (MSP) is increasingly being used as a mechanism to manage the marine environment. Human activities can impact biophysical ecosystem features, reducing resilience and potentially impacting ecosystem services, which can affect the environmental, socio-economic and cultural benefits derived by coastal communities. Central to MSP is the collection and collation of baseline data on biophysical ecosystem features and ecosystem services to inform decision making and target management measures. The data collection process should be a structured, transparent process to ensure adequate data and metadata collation to enable it to be effectively used in MSP. This data should be subject to stakeholder consultation, producing quality assured information and mapping. The resources required to undertake data collection should not be underestimated. Recognition should be given to the limits of knowledge of the marine environment and its complexity. Planners and developers should exercise caution when using and interpreting the results of mapping outputs.

1. Introduction

As increasing demands are placed on marine ecosystems the effectiveness of the current sectoral approach to management has been brought into question [1,2]. The place based nature of ecosystems together with the temporal and spatial nature of human activities point towards a need to manage marine areas from a spatial and temporal perspective [3,4]. Marine spatial planning (MSP) is increasingly being recognised as an important tool for the sustainable management of marine ecosystems [5]. Whilst several definitions exist for MSP UNESCO defines it as 'a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process' [6]. MSP has been developed across the globe at a variety of spatial scales and administrative areas, from country-wide plans e.g., Scotland [7], Belgium, [8], Portugal [9] to regional or local plans e.g., Shetland Islands – UK [10], Dorset – UK [11], British Columbia – Canada [12].

A key component of ecosystem based management, and hence MSP, is to map biophysical conditions, and human uses of the ocean [3,13]. These human uses that are derived from the marine environment's ability to provide ecosystem goods and services can include both tangible and intangible benefits for sustaining and fulfilling human life [14]. The Millennium Ecosystem Assessment (MA) framework distinguishes four categories of ecosystem services: supporting services; provisioning services; regulating services; and cultural services [15].

The process of mapping requires the identification, collection and collation of available data on ecosystem services, as well as known significant biophysical elements or 'features' of the ecosystems from which these services are derived. Mapping can help to visualise competing demands and assess the implications of new uses or new management measures on both the environment and on existing users. It can be used to identify and test future sea use scenarios, helping to anticipate potential future opportunities, conflicts or compatibilities for the area and can guide proactive decision making [6].

The range of data available and its accuracy has the potential to influence how it is mapped, interpreted and subsequently used to develop spatial strategies within MSP. Ensuring the data collection processes is undertaken systematically and transparently, and understanding data limitations is an important consideration prior to mapping. Mapping is an important component of MSP, helping to inform management scenarios, and guide policy development. Understanding the limitations and resources required for these processes is important for marine planers, to help sure that adequate financial and human resources are in place to ensure that MSP aspirations can be met.

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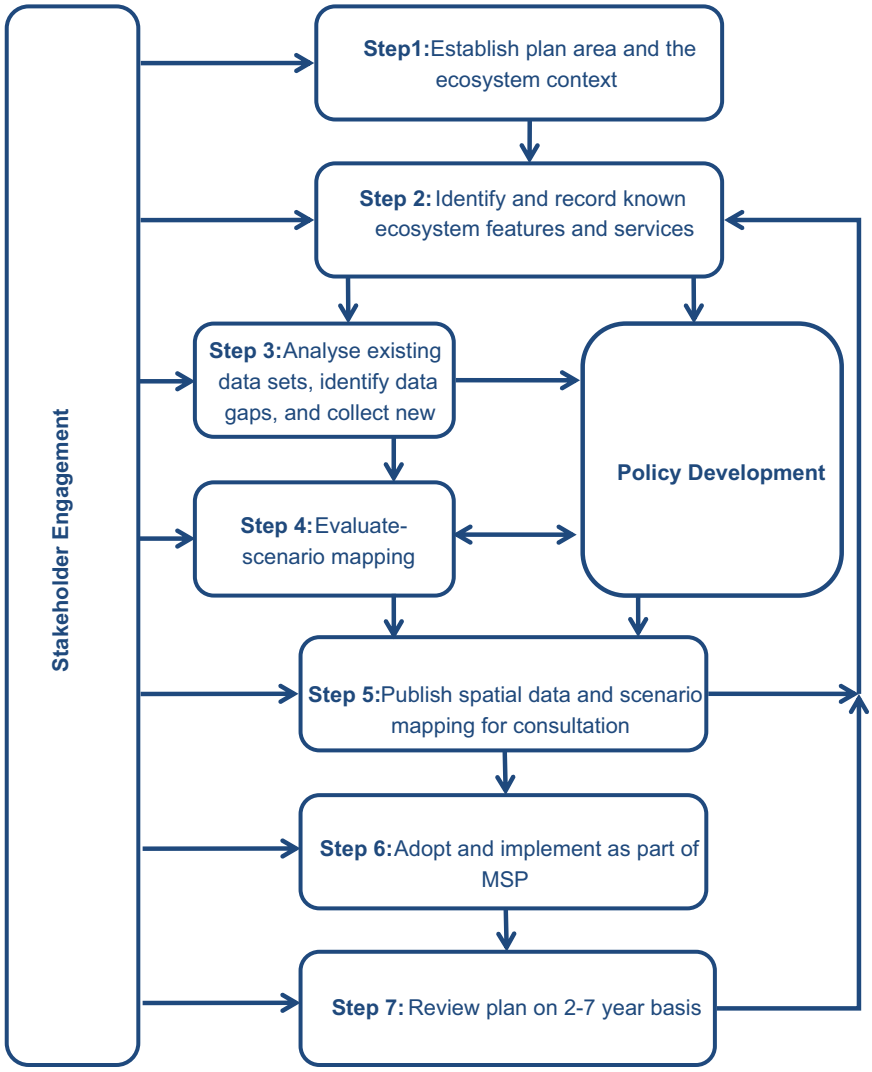

Fig. 1. Steps in data collection and evaluation.

2. Data collection principles and processes in MSP

Scenario mapping and the development of marine spatial plans is not possible without the collection and collation of spatial data, herein termed 'data collection'. Given its importance to MSP it is important that collected data uses reflect, as far as possible, the current state and use of the marine environment. UNESCO [6] proposed a systematic process for the development of marine spatial plans, which could be considered similar to those undertaken in risk management.

Data collection and mapping is undertaken in parallel to policy development as part of the MSP process. A systematic seven step cyclical process is proposed, Fig. 1, which complements the proposed UNESCO approach [6] to overarching MSP development. Stakeholder engagement is considered to be intrinsic to MSP [16] and should be initiated from the start of the process [17]. It is important that the views of all stakeholders are considered and that none are neglected or presumed [18], and can be considered important throughout all stages of the data gathering and mapping process.

2.1. Step 1 – establishing the ecosystem context

Establishing the area that will fall within the governance of a marine spatial plan is likely to be an early procedural step of a plan's development [6]. However, the administrative boundaries of many plans will be smaller than the ecosystem area [19]. Marine features and activities may also be impacted by activities upstream (e.g., agricultural runoff) and downstream (e.g., open ocean) from the marine management area [6]. In addition, some ecosystem services may be gained in different spatial location to the ecosystem feature. For example, coastal tourism and recreation such as walking routes and shore-based wildlife watching may be reliant upon the marine ecosystem although they take place on the land. Therefore in some instances the landward and seaward extent of relevant data collection may be greater than the plan area [6]. Establishing the ecosystem context of the plan is likely to require stakeholder engagement to ensure that the area is sufficiently large to include all relevant components but not too large that the process overlaps excessively with other jurisdictions or is overly burdensome.

2.2. Step 2 – identification of biophysical ecosystem features and services

The identification of biophysical ecosystem features and services allows the identification of the types of data and information that can support the MSP process. Stakeholder engagement can help to ensure that no biophysical features or services are excluded.