



A multidisciplinary approach in the design of marine protected areas: Integration of science and stakeholder based methods



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ABSTRACT

Different approaches exist for building a system of marine protected areas (MPAs), with stakeholder-based site selection at one end of the spectrum and science-based selection at the other. Although a combination of both approaches is typically adopted, the process tends to be dominated by one of them. However, for MPAs to be successful it is necessary that their design achieves a balance between both ecological conservation and socioeconomic needs. The present study aimed to assess, compare and integrate two different approaches to the planning process of MPAs in Wales (UK). A stakeholder-based approach and a science-based systematic approach were compared. Stakeholder priorities for the establishment of MPAs were identified during individual interviews with relevant stakeholders' representatives. Science-based solutions were developed using biological and socioeconomic spatial data in the decision support tool Marxan. A comparison of the outcomes generated by both approaches revealed that although the spatial configuration of the resulting MPAs differed, stakeholders performed well at including representative proportions of relevant marine habitats and species. The integration of the stakeholder driven approach with the science-based solution revealed that an integrated approach could be used as a tool to achieve conservation targets while simultaneously accounting for stakeholder's preferences, as the resulting integrated MPA solution met all conservation targets and was only slightly larger than the science-based solution alone. Results also revealed the potential utility of using stakeholders' knowledge as a proxy for identifying ecologically important areas when spatial data on conservation features are sparse.

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1. Introduction

Marine protected areas (MPAs) are important management tools to achieve global marine conservation targets (Agardy, 1994; IUCN, 2005; Sciberras et al., 2013; Stewart et al., 2009). Planning for and implementing MPAs is, however, challenging for several reasons. While the positive benefits derived from the implementation of MPAs for habitat restoration and biodiversity conservation within the boundaries of MPAs are well known (Blyth-Skyrme et al., 2006; Fenberg et al., 2012; Halpern, 2003; Halpern

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and Warner, 2002; Lester et al., 2009; Stewart et al., 2009), the role of MPAs in the recovery of fish stocks remains an issue of debate (Kaiser, 2005; Stefansson and Rosenberg, 2006; Vandeperre et al., 2011). The establishment of MPAs is often controversial as the closure of portions of the sea to human activities can have associated negative impacts on those sectors of society affected by the closures (e.g. fishing, mining, tourism) (Christie, 2004; Hattam et al., 2014; Oracion et al., 2005; Stump and Kriwoken, 2006). However, MPAs can achieve a balance between ecological conservation and socioeconomic needs (Klein et al., 2008a) by using biological principles as primary design criteria (Roberts et al., 2003) and including relevant socioeconomic aspects to ensure community support and compliance (Moore et al., 2004; Pita et al., 2013; Walmsley and White, 2003).

Different approaches exist for the site selection process of MPAs, with stakeholder-based site selection at one end of the spectrum

(e.g. Rodriguez-Martinez, 2008) and science-based systematic selection at the other (e.g. Leslie et al., 2003; Moilanen et al., 2009). Although in most cases a combination of both approaches is adopted, the designation process of MPAs tends to be dominated by one aspect or the other. MPA design processes based on stakeholder decisions often have been criticised for being *ad hoc* or driven by political interests and are frequently questioned in terms of their conservation effectiveness (Pressey, 1994; Stewart et al., 2003). On the other hand, MPA designations solely based on ecological criteria, although perhaps effective from a conservation perspective often fail to achieve the support of the people affected by the establishment of the protected area (Christie, 2004; Pollnac and Seara, 2011; Walmsley and White, 2003).

Conservationists, resource managers and social scientists frequently disagree on whether it is possible to achieve a balance between social and ecological benefits in environmental management (Christie, 2011; Grumbine, 1994), as some argue that in a multiple objective process it is impossible to maximize more than one variable at a time (Stanley, 1995). Recent studies, however, indicate that it is possible to balance social and ecological factors in natural resource management (Keough and Blahna, 2006; Klein et al., 2008a). In the marine environment, the use of optimization algorithms in systematic conservation planning as decision support tools for the designation of MPAs has facilitated the integration of spatially explicit biological and socioeconomic information (Richardson et al., 2006). The type of socioeconomic data used in the design process of MPAs typically include data that are readily available, such as fisheries revenues, fishing effort or the spatial distribution of other marine activities that could be affected by the establishment of an MPA (Alpine and Hobday, 2007; Ban and Klein, 2009; Klein et al., 2010; Weeks et al., 2010). When such data exist it is possible to identify areas that are valuable from a socioeconomic perspective, thus allowing the inclusion of some stakeholder's needs in the MPA design process (Ban et al., 2009a; Klein et al., 2008a, 2008b). However, while such information is important for the consideration of the interests of certain stakeholder groups, i.e. commercial fishers, it cannot account for all stakeholders' preferences regarding the location of MPAs, as these might not be adequately reflected in the information available for use in the optimization algorithms.

The present study attempts to compare the outcomes of a science-based approach using biological and socioeconomic variables and a stakeholder-based approach regarding the spatial planning of MPAs in Wales (UK). The Marine and Coastal Access Act (MCAA) commits the Welsh Government (UK) to “establishing an ecologically coherent, representative and well-managed network of marine protected areas” taking into account “environmental, social and economic criteria”. The Government will consider social and economic issues to ensure that MPA sites are, as far as possible, chosen to maximize ecological, social and economic benefits while minimizing any unnecessary conflicts with the different uses of the sea (DEFRA 2009). The aims of the study were to (i) assess the potential conservation performance of a stakeholder-based MPA, (ii) to compare the spatial distribution and extent of MPAs produced as result of a stakeholder-based and a scientific-based process and (iii) to attempt to integrate both approaches in order to achieve solutions that meet conservation objectives and consider stakeholder preferences simultaneously.

2. Methods

2.1. Planning region

The planning region of this study was defined by the Territorial Sea around the coastline of Wales. This area extends 12 nautical

miles (nm) offshore from the midline of the Dee Estuary in the northeast and the midline of the Severn Estuary in the south. The area lying to the east of Worm's Head was excluded from the planning exercise as not enough biological data were available for the region (Fig. 1). A 10×10 km grid covering the entire study area was created, this process delineated 182 square cells or “planning units”, each which could be selected as part of an MPA. Due to the irregular shape of the study area, a number of planning units were truncated at the coastline and near shore islands, creating some size variation across the planning region.

Recreational coastal activities such as fishing, diving, kayaking and wildlife watching are popular in Wales and represent an important source of income for the local economy (Ruiz-Frau et al., 2013). Commercial fishing has a long tradition in Wales, Welsh fisheries are mainly dominated by inshore (<10 m) vessels that target mostly shellfish (crab, lobster, mussels cockles, whelks and scallops).

2.2. Stakeholder-based approach

A mapping exercise was undertaken with various stakeholders' representatives that had an interest in the Welsh marine environment. The Wales Coastal and Maritime Partnership (WCMP) is formed of representatives of maritime and coastal interests in Wales encompassing twenty-six organizations drawn from the public, private and voluntary sector. For the purpose of the study, only those organizations with direct involvement in the marine environment were approached (24 organizations). Of these twenty-four organizations, four declined to participate in the study and no response was received from a further six organizations; despite several attempts to contact them. Thus a total of fourteen organizations took part in the study. Whenever possible, two members from each organization were interviewed separately

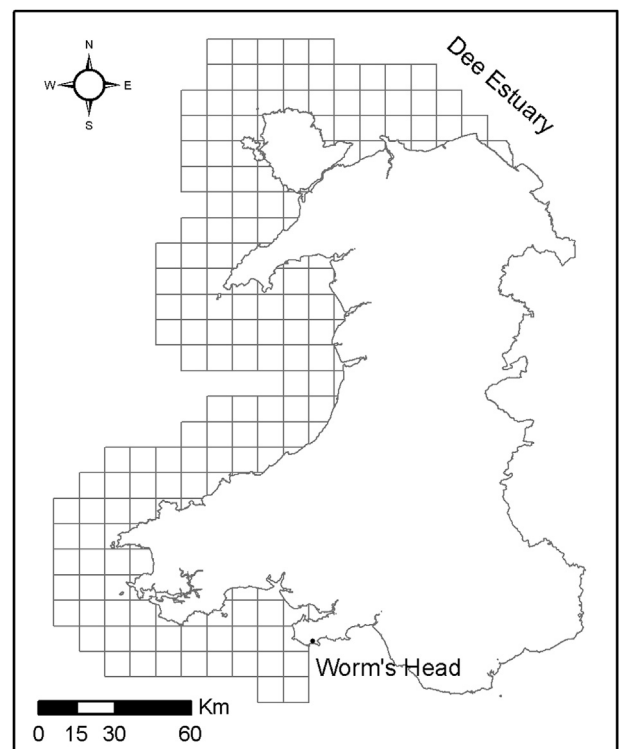


Fig. 1. Overview map of the planning region showing the distribution of the 10×10 km planning units.

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