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Explicitly incorporating socioeconomic criteria and data into marine protected area zoning

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ABSTRACT

Addressing community needs or aspirations is critical for the success of marine protected areas (MPAs). However MPA design based on the results of systematic conservation planning tools alone does not fully represent important information on socioeconomic factors. This is because of the reliance of conservation planning tools on spatial data which is better suited to ecological rather than socioeconomic factors which are predominantly non-spatial. We present a case study from Raja Ampat in Indonesia, to demonstrate how we developed MPA zoning plans for six multiple use MPAs that encompass more than 1 million ha of the world's most diverse coral reef ecosystems. These were developed by combining analysis of ecological and spatial socioeconomic data using decision support tools (Marzone), and incorporation of non-spatial socioeconomic data from experts, stakeholders, and local communities. By explicitly including socioeconomic criteria and data into MPA zoning, the final zoning plans recognize community use and governance of resources, maximize equity and access to traditional fishing grounds, and better support long-term food security and livelihoods of local communities. These plans also met recommended guidelines for resilient MPA design and were supported by the community and MPA managers (i.e. Raja Ampat Regency and Indonesian National Government). This case study can act as a guide to other MPA managers and conservation practitioners to better incorporate socioeconomic considerations into MPA zoning plans and systematic marine conservation planning.

1. Introduction

Overexploitation of coastal resources is causing irrevocable changes to the structure and function of our coasts and oceans (Halpern et al., 2008; Burke et al., 2011). Integrated forms of governance and management that incorporate ecological, economic, social and governance factors are essential to effectively resolve issues of unsustainable use.

Ecosystem based management (EBM) is an approach that includes humans and society as part of the ecosystem and therefore considers social, cultural, economic and ecological factors in the development of management solutions (Arkema et al., 2006; Curtin and Prellezo, 2010). Marine Protected Areas (MPAs) and MPA networks are important outcomes of an EBM approach to marine spatial planning (MSP) (Katsanevakis et al., 2011) and are one of the most cited management tools to conserve marine biodiversity, habitats and ecosystem services (Lubchenco et al., 2003; McCook et al., 2010; Green et al., 2014). MPAs are one of the key strategies for conservation and sustainable fisheries in the Coral Triangle (CTI Sectretariat, 2009). The Government of Indonesia has demonstrated its commitment to establishing a regional network of MPAs through its leadership in the Coral Triangle Initiative (http://www.cti-secretariat.net/).

However, in most parts of the Coral Triangle, the effectiveness of MPAs and MPA networks is low (White et al., 2014) due to a lack of local community or government awareness, support or capacity to enforce zones and regulations. Increasingly, managers and scientists are recognizing the importance of socioeconomic factors to the successful implementation of an MPA. Uses and activities in an MPA are usually regulated through a spatial plan known as an MPA zoning plan that identifies the location and definition of multiple

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zones (Friedlander et al., 2003; Richardson et al., 2006; Cinner, 2007; Ban et al., 2013). In particular the perceptions and aspirations of the beneficiaries of conservation and development must be recognized and incorporated into the final zoning plan. Existing novel approaches to incorporate socioeconomic factors into spatial planning include: integrating economic factors or costs (Naidoo et al., 2006; Wilson et al., 2007; Arponen et al., 2010); mapping traditional use and social assets (Aswani and Lauer, 2006; del Campo and Wali, 2007); integrating data on social institutions and governance structures (Pressey and Bottrill, 2008; Mills et al., 2013); and measuring social well-being indicators (Stephenson and Mascia, 2014).

Existing tools used to support the development of MPA zoning plans are designed to analyze spatial data by setting quantitative targets for representation. While these tools were originally designed to analyse biological and ecological factors, they are now being used to incorporate socioeconomic factors (e.g. Grantham et al., 2013). However, socioeconomic data are not always easily represented spatially (St. Martin and Hall-Arber, 2008; Ban et al., 2013) and concepts such as equity do not lend themselves to simple quantitative targets especially in hierarchical societies. In many cases of MPA zoning, socioeconomic factors are described in vague terms (e.g. minimize impact on livelihoods) (e.g. Fernandez et al., 2005). Social interests are more often treated as threats (Pressey et al., 2007; Stephanson and Mascia, 2014), rather than as specific objectives for MSP (Fernandez et al., 2005).

We found little published information on how to combine spatial and non-spatial data related to socioeconomic factors in the development of an MPA zoning plan.

We present a case study from Raja Ampat in Indonesia, to demonstrate how we developed MPA zoning plans for six multiple use MPAs that encompass >1 million ha of the world's most diverse coral reef ecosystems using an EBM approach. We used ecological and spatial socioeconomic data in decision support tools for spatial planning (Marzone), and non-spatial socio-economic data from experts, stakeholders, and local communities to produce MPA zoning plans. These plans met recommended guidelines for resilient MPA design and were supported by the community and MPA managers (i.e. Raja Ampat Regency and Indonesian National Government). This case study can be used as a guide for other MPA managers and conservation practitioners to better incorporate socioeconomic considerations into MPA zoning plans and systematic marine conservation planning.

1.1. Site description

The Raja Ampat Regency off the northwestern tip of West Papua in eastern Indonesia encompassing 4.5 million ha of ocean, islands and coral reefs is a global priority for conservation (Mangubhai et al., 2012). Sitting in the heart of the Coral Triangle, Raja Ampat has the highest diversity of corals and reef fish on the planet (Veron et al., 2009). These ecosystems support more than 45,000[2] people who are highly dependent on the health and abundance of natural resources for food and livelihoods (Larsen et al., 2015). This area is now an internationally renowned dive destination with potential to bring income to local communities through a regency dive tag system and small scale businesses associated with the tourism industry (Mangubhai et al., 2012).

In West Papua, tenure over both land and marine areas is supported by the 2001 Special Autonomy Law. Traditional natural resource management known as 'sasi' that sets restrictions on harvesting certain species at particular times and locations is still practiced (McLeod et al., 2009a; Boli et al., 2014). Despite the diversity and abundance of resources and these customary forms of management, West Papuans are among the poorest communities in Indonesia. This is driving strong pressure for rapid, large-scale development to reduce poverty in West Papua. However, West Papuan communities rely on subsistence fisheries as a key source of protein (Larsen et al., 2015). Therefore increasing exploitation of natural resources, both legal and illegal, and irresponsible development practices threaten the health of coastal ecosystems and local fisheries (Mangubhai et al., 2012) and the food security of local communities.

In 2006, local communities initiated the establishment of a network of six multiple use MPAs covering 1,185,940 ha of coral reefs and small islands (Fig. 1) and zoning plans were developed with the support of The Nature Conservancy and Conservation International. In Indonesia, decentralized governance means that regencies may legally establish protected areas under parliamentary decrees, as long as they do not conflict with national laws.

2. Incorporating socio-economic factors into MPA zoning – a case study

The process of incorporating socio-economic factors in the development of multiple use MPA zoning plans for the Raja Ampat MPA network involved 1) setting objectives for the MPA network and developing biological and socioeconomic MPA design criteria, 2) collation and collection of spatial (Grantham et al., 2013) and non-spatial data, 3) the development of zoning scenarios using a decision support tool Marzone (Grantham et al., 2013), 4) modification of zoning scenarios to take account of non-spatial socio-economic data and 5) multiple reviews of draft zoning plans by stakeholders (Fig 2). Local government, local communities and other stakeholders provided input throughout this zoning process.

2.1. Setting objectives and MPA design criteria

The development of biological objectives and criteria is detailed in Grantham et al. (2013). Biological criteria took into account important biophysical characteristics of the region, as well as climate change-related resilience principles detailed in the scientific literature (McLeod et al., 2009b; Green et al., 2009).

Socioeconomic objectives for the MPA network were developed by government, communities and other stakeholders in Raja Ampat. The objectives are (i) support and promote sustainable livelihoods and the sustainable growth that results in a healthy marine ecosystems and food security and increased public welfare; and (ii) supply and preserve local knowledge, values and resource use systems (such as sasi) through the management of the MPA network.

We then developed 14 design criteria in consultation with local communities to meet these socio-economic objectives (Table 1). These criteria had the same status as biological MPA design criteria (detailed in Grantham et al., 2013). For each socioeconomic criterion, stakeholders assessed whether it was critical for zoning, local support and engagement in implementation of the MPA. Meaning, if a criterion was not met or addressed adequately, stakeholder buy-in or support would not be forthcoming. For example, improved fisheries and greater food security were considered critical, as these are the main motivation for communities to protect or manage land and coastal waters. This was an important process for setting targets used in decision support tools (see below). Equally zoning criteria were designed to reinforce or strengthen local communities' rights to utilize and manage their natural resources (Table 2).

[2] 2012 Census of residents, Raja Ampat Regency.