Ocean & Coastal Management 128 (2016) 18–28

Contents lists available at ScienceDirect

Ocean & Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

Perceptions of practitioners: Managing marine protected areas for climate change resilience

Charlotte Rachael Hopkins [a, *], David Mark Bailey [a], Tavis Potts [b]

[a] University of Glasgow, Glasgow, G12 8QQ, UK
[b] Department of Geography and Environment, University of Aberdeen, AB24 3UF, UK

ARTICLE INFO

Article history:
Received 8 July 2015
Received in revised form
5 April 2016
Accepted 25 April 2016
Available online 4 May 2016

Keywords:
Adaptive management
Climate change
Conservation
Marine protected areas
Resilience

ABSTRACT

Climate change is impacting upon global marine ecosystems and ocean wide changes in ecosystem properties are expected to continue. Marine Protected Areas (MPAs) have been implemented as a conservation tool throughout the world, primarily as a measure to reduce local impacts, but their usefulness and effectiveness is strongly related to climate change. MPAs may have a role in mitigation through effects on carbon sequestration, affect interactions between climatic effects and other drivers and be affected themselves as the distributions of protected species change over time. However, to date, few MPA programmes have directly considered climate change in the design, management or monitoring of an MPA network. This paper presents a series of international case studies from four locations: British Columbia, Canada; central California, USA; the Great Barrier Reef, Australia and the Hauraki Gulf, New Zealand; to review perceptions of how climate change has been considered in the design, implementation, management and monitoring of MPAs. The results indicate that some MPA processes have already incorporated design criteria or principles for adaptive management, which address some of the potential impacts of climate change on MPAs. Key lessons include: i) Strictly protected marine reserves are considered essential for climate change resilience and will be necessary as scientific reference sites to understand climate change effects ii) Adaptive management of MPA networks is important but hard to implement iii) Strictly protected reserves managed as ecosystems are the best option for an uncertain future. Although the case studies addressed aspects of considering climate change within MPA networks and provided key lessons for the practical inclusion of these considerations, there are some significant challenges remaining. This paper provides new insights into the policy and practical challenges MPA managers face under climate change scenarios.

1. Introduction

Climate change in the marine environment is having a substantial impact on marine ecosystems, and there is an extensive body of literature evaluating these impacts (see Harley et al., 2006; Hoegh-guldberg, 2010; Pörtner et al., 2014). Climate change as a stressor on the marine environment operates at a global scale and therefore cannot be removed locally (Micheli et al., 2012). Marine Protected Areas (MPAs) as spatially explicit conservation tools cannot directly influence all impacts of climate change affecting species and habitat traits, however, MPAs are still a useful tool in climate change adaptation and mitigation (Côté and Darling, 2010; McLeod et al., 2009).

The predicted climate change impacts on marine ecosystems: temperature increases, rising sea levels, ocean acidification, changing circulation patterns, changes in weather conditions and dissolved oxygen levels (Hoegh-guldberg, 2010; Pörtner et al., 2014), can directly and indirectly affect species distributions and abundances, community composition, habitat quality, and changes in population dynamics (Cheung et al., 2009; Harley et al., 2006; Lawler, 2009). The cumulative effects of climate change and anthropogenic drivers, (e.g. fishing) can lead to complex patterns of change and result in enhanced vulnerability of natural and human systems (Halpern et al., 2008; Pörtner et al., 2014). At an ecosystem level, interactions between climate change impacts and fishing can enhance diversity loss in benthic communities (Griffith et al., 2011) and promote a change in ecosystem structure (Kirby et al., 2009).

* Corresponding author.
E-mail addresses: c.hopkins.1@research.gla.ac.uk (C.R. Hopkins), David.Bailey@glasgow.ac.uk (D.M. Bailey), tavis.potts@abdn.ac.uk (T. Potts).

http://dx.doi.org/10.1016/j.ocecoaman.2016.04.014
0964-5691/

Additionally, the truncating effect of fishing on age and size structure of populations can lower population recruitment variability and reduce their ability to buffer environmental fluctuations (Perry et al., 2010).

Protection of marine biodiversity from local stressors, such as fishing, can enhance the resilience of species and habitats to climate change impacts (Micheli et al., 2012). Mitigation of global climate change may also be enhanced by protecting habitat areas that contribute to carbon sequestration, including mangroves, seagrasses, and salt marshes (Crooks et al., 2011). However, the low predictability and variability of ecosystems to climate change may undermine the effectiveness of conservation measures (Pörtner et al., 2014). As a result, there have been numerous calls to consider climate change in the establishment of MPAs to ensure marine biodiversity is protected effectively under future climatic scenarios (McLeod et al., 2009; Salm et al., 2006).

MPAs have historically been implemented on an individual basis to address local stressors, more recently, MPA networks have been planned to achieve larger scale conservation by protecting wider ecosystems and being strategically placed (IUCN-WCPA, 2008). An MPA network is intended to operate more effectively and comprehensively than individual MPA sites alone and over various spatial scales (IUCN-WCPA, 2008), however, there is little evidence of MPA sites within a network performing synergistically (Grorud-Colvert et al., 2014). An additional concern is that MPA networks have not been designed with climate change in mind (Gaines et al., 2010), and therefore, are not optimising potential benefits.

Conflict exists between local and national initiatives with differing priorities and differing capacities to implement MPAs or MPA networks. International and regional agreements require a network approach to MPA designation, yet these agreements rely on member states to implement the recommendations (e.g. The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR)). Even where legal sanctions are available, there is no clear definition of a “network”, against which MPAs could be tested.

Understanding the perceptions of those involved in resource management and conservation is important for understanding the policy process and the success of management action. Yet most research has focused on using the perceptions of end users to inform and improve resource management; a lack of research surrounding perceptions of environmental managers has been identified (Cvitanovic et al., 2014). Exploring the perceptions and opinions of those involved in MPA processes informs of operational and political realities that may not be published the academic literature. The aim of this study was to explore perceptions and experiences in four different case study locations of how climate change is considered in MPA processes and networks. Three key objectives of this study were: i) identify how climate change considerations have been successfully included in these MPA processes thus far ii) explore the perceived barriers to including considerations of climate change in these MPA processes iii) provide insights into best practice advice for climate change resilient MPAs.

2. Materials and methods

2.1. Case study selection

Four case study locations were selected for inclusion in this study: British Columbia, Canada; Central California, USA; Great Barrier Reef; Australia and Hauraki Gulf, New Zealand. All had liberal democratic governments with functioning law enforcement systems, free press, market capitalist economies and well-developed expertise in marine science and conservation. The ecosystems considered varied from coral reefs to cold temperate coasts and coastal to offshore systems (see Table 1).

In British Columbia, Canada, MPAs have so far been implemented on an ad-hoc, site by site basis with little overall coordination of protected sites and jurisdictional uncertainties (Ban et al., 2014). Yet there has been progress towards the design of MPA networks (Ban et al., 2014) with some discussion of climate change resilient MPA network design (Burt et al., 2014).

The Marine Life Protection Act (MLPA) (California State Law, enacted 1999) mandated a redesign of California's existing MPAs to create a state-wide MPA network (Fox et al., 2013) and the successful implementation of California's MPA network is often used as an exemplary case for stakeholder involvement in MPA design and planning. The MLPA requires each MPA to have goals and objectives, whilst collectively the MPA network should achieve the overall goals and guidelines of the Act (MLPA, 1999). A clear monitoring framework to evaluate MPA effectiveness was developed and the central California coast was the first region in the state wide network to report on the monitoring results after five years of the network being implemented (see California Ocean Science Trust and California Department of Fish and Wildlife, 2013).

The world's largest coral reef system, the Great Barrier Reef, Australia is managed by the Great Barrier Reef Marine Park Authority (GBRMPA) and is designed as a multiple use park regulating through a zoning plan. There is a clear recognition of climate change in monitoring and management of the Great Barrier Reef Marine Park as demonstrated by the development of a climate change adaptation strategy (see Great Barrier Reef Marine Park Authority, 2012) and the long term sustainability plan (Commonwealth of Australia, 2015). It is also important to note the highly sensitive political nature of the GBRMP, with recent debates over the UNESCO World Heritage status and the threats posed by continued activities on and around the reef.

New Zealand has a long history of implementing marine reserves, with the first marine reserve, Cape Rodney-Okakari Point, in the Hauraki Gulf, established in 1975 under the Marine Reserves Act, 1971. However, these marine reserves were primarily designated for local protection and were established individually and independently, not considering larger scale processes or wider biodiversity (Thomas and Shears, 2013).

2.2. Data collection

In-depth interviews were used to explore the range of opinions and experiences surrounding climate change and MPAs. The advantage of in depth interviews in untangling complex topics and exploring experiences and perceptions made this a particularly good method for this study (Qu and Dumay, 2011). Interviews were conducted with MPA managers, academics with experience of climate change and marine conservation interventions, NGO employees with a direct link to MPA processes in each case study region and governmental staff.

Interviewees were identified from a review of the academic literature and grey literature including government and NGO reports. Further participants were identified through snowball sampling. The interviews were conducted using a semi structured format which allowed for an open, flexible question order and discussion format (Bryman, 2008; Rubin and Rubin, 2012). The semi-structured format allowed the researcher to narrow the discussion topics, but the interviewees' responses determined the information produced about those topics and the relative importance of each of the topics (Green and Thorogood, 2014). After reviewing the literature regarding MPAs and climate change, five key topics were defined: i) MPA network design ii)