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## Lack of evidence that governance structures provide real ecological benefits in marine protected areas



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### ABSTRACT

The Convention on Biological Diversity (CBD) has set targets for the total area of marine protected areas (MPAs), as well as targets to encourage a participatory approach to governance with equitable sharing of benefits of these areas to multiple stakeholders. These targets have contributed to a considerable volume of research in MPA governance, and in the ecological effectiveness of MPAs. However, examining the literature demonstrates there is very little joined up research to show that any particular governance approach results in improved ecological indices of fish stocks or biodiversity. Indeed, some of the well-cited examples of participatory governance implying improved ecological metrics are either incorrect (as data do not relate to MPAs under participatory governance systems), or do not provide any ecological data other than opinions of fishers to back up the claims. Evidence suggests that participatory governance approaches with equitable sharing of benefits can help the establishment and management of MPAs, and as such, there should be urgent further work assessing the ecological benefits that arise as a result of the establishment of MPAs with participatory and equitable governance approaches.

### 1. Introduction

The need for multidisciplinary research is now considered essential in conservation, yet here we demonstrate that joined up multidisciplinary research relating to marine protected areas (MPAs) is greatly lacking. Currently there is little evidence that equitable and participatory governance systems for MPAs generate any biological benefit. Effective multidisciplinary research is needed to address this evidence gap.

The concept of ‘conservation for people’ has displaced the former paradigm of ‘conservation despite people’ in recent years (Mace, 2014). Equitable governance of conservation for the benefit of multiple stakeholders is now a major concern of organisations from the UN through to local government and NGOs (van den Hove, 2003; Marks and Hooghe, 2004), and is participatory governance from a wide range of stakeholders is embedded as a principle in the Convention on Biological Diversity’s Programme of Work on Protected Areas (Borrini-Feyerabend et al., 2013). Alongside these proposed governance structures are a suite of international agreements for nature conservation, such as the Aichi targets, amongst which is the target to conserve 10% of marine habitats by 2020 (Bertzky et al., 2012; Edgar et al., 2014).

Traditionally the establishment of MPAs caused tensions and opposition within local communities, especially with members of the fishing industry (reviewed by West et al., 2006; Mora and Sale, 2011).

However, including local communities and fishers as participants within the governance structures has frequently been shown to lead to greater acceptance of MPAs, along with other benefits such as self-policing of the areas by the stakeholders (Defeo and Pérez-Castañeda, 2003; McClanahan et al., 2009; Taylor et al., 2013; Islam et al., 2017). Jones (2014) provides a detailed overview of how multiple stakeholders can create strong governance systems and facilitate establishment of MPAs.

There is also an expanding literature on the ecological benefits of MPAs (Gell and Roberts, 2003; Halpern, 2003; Sciberras et al., 2013; Costello and Ballantine, 2015; Gill et al., 2017), where evidence exists to demonstrate they can protect and enhance fish stocks, protect biodiversity and even provide economic benefit to fishers through the ‘spillover effect’ of increased fish outside the protected areas (Russ and Alcala, 2011). However, MPAs differ greatly in size (from < 1 ha to 1000s km<sup>2</sup> – see data in West et al., 2006; Wood et al., 2008) and protection they offer (from ‘no take’ Marine Reserves through to so called ‘Paper Parks’, where almost any activity and unlimited harvesting of fish are allowed or guidelines are unenforced) (Wood et al., 2008; Edgar et al., 2014; Pieraccini et al., 2017). Small-scale ‘paper parks’ can show no ecological benefit (e.g. Stafford et al., 2016) and comprehensive reviews demonstrate that larger MPAs show the most benefit (Sciberras et al., 2013; Edgar et al., 2014). While there are benefits from partially protected areas in terms of fish stocks in these

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areas (Sciberras et al., 2013; Gill et al., 2017), fully protected marine reserves have been proposed to be necessary to adequately protect biodiversity (Costello and Ballantine, 2015).

Given the working paradigm of ‘conservation for people’, and the Convention on Biological Diversity’s goals of equitable and participatory governance involving multiple stakeholders (Bertzky et al., 2012); this study investigates the relationship between research on governance structures of MPAs, involvement of multiple stakeholders, and the evidence of ecological benefits and protection the MPAs provide, through an examination of existing literature.

## 2. Examination of existing paradigms on the link between equitable governance and ecological success of MPAs

The CBD has been instrumental in research into participatory governance of MPAs (Borrini-Feyerabend et al., 2013; Jones, 2014; see data below). The paradigm which appears to have been adopted is that MPAs are good for marine conservation (although see discussion in Jones, 2014, which suggests that much of the basis of this paradigm is based around ‘no take’ MPAs), and establishing MPAs is easier (and more equitable, and contributes more to sustainable development goals) with participatory governance and equitable sharing of resources. In a CBD commissioned report, Kothari (2008) states: “Increasing evidence from around the world suggests that protected areas are not only established as a key strategy for conservation of nature and wildlife, but are also becoming important for addressing poverty and livelihood security. One of the common features of many recent innovations is the notion of participatory or community based governance. Simply put, the focus is on greater involvement of local communities, with net benefits for both conservation and people.” Such statements clearly support this paradigm, but do not stand up to scrutiny.

The evidence for this statement comes from an analysis of two MPAs: Bunaken in Indonesia, and the Apo Island in the Philippines. However, following the references given in the report to the original source (Leisher et al., 2007), several inconsistencies arise.

Firstly, the evidence in Leisher et al. (2007) is primarily from a different reserve, Navakavu in Fiji, and is based on hearsay from the local community, rather than scientific surveys: “People in Navakavu fish just outside the marine protected area, and 80% of the people there say fish catches are better than before the marine protected area was established.” Secondly, Leisher et al. (2007) do mention the reserves in Kothari’s (2008) report, but with no reference or data to support the claims “The spillover effect is also strong in Apo Island but slightly less so in Bunaken.” Subsequent investigation of published literature indicates there are documented studies of spillover in Apo Island (e.g. Russ et al., 2003), but little hard evidence to support improved fish stocks in Bunaken (Christie, 2004). Thirdly, while Apo Island did have community based governance until the mid-1990s, it subsequently has a more ‘top down’ government controlled governance approach (Hind et al., 2010).

Clearly the statement in Kothari (2008) is poorly justified, and there is therefore a need for evidence of ecologically effective MPAs to be linked to equitable governance. A recent and high profile study has investigated the linkages between MPA management (of which a component of the management ‘score’ assigned for each MPA was on non-state or mixed management systems) and fish stock enhancement (Gill et al., 2017). The study demonstrated that the major limitation to success of MPAs is a lack of funding for clear management and enforcement of the areas (Gill et al., 2017), indicating on average, adequate budgets for policing and enforcing regulations of MPAs resulted in almost three times the benefit of a typical MPA. No clear links with governance were found, but this may be due to the limited data on this, and as such the limited way these data were handled in the analysis. However, given that a possible benefit of participatory governance and equitable sharing of resources of MPAs is the role of self-policing (Defeo

and Pérez-Castañeda, 2003), this could provide support to the theory that participatory governance plays a role in MPAs ecological success.

In the Gill et al. (2017) study, out of the 589 MPAs studied worldwide, only 62 had both ecological (fish biomass) and management data associated with them. Of note is that for some MPAs such as Machalilla in Ecuador, there were relatively good measures of budget and management (equal to the median for all MPAs studied), but no ecological data to match to the analysis. Recent data demonstrate that there is no statistical difference in fish community structure between this long standing MPA, recently designated MPAs and non-designated neighbouring areas (Stafford et al., 2016). Although only a single example, it is possible that published datasets on fish biomass from inside MPAs may arise from a research or publication bias into the best performing areas (Caveen et al., 2015). Of further concern is the limited number of MPAs (~10%) which have both management information and easily available ecological data, making assessment of effective management of MPAs difficult to achieve.

## 3. Examining studies with a joint ecological and governance focus

To provide an overview of the typical research focus into governance of MPAs, an ISI Web of Knowledge search was conducted in April 2017. Using the search terms ‘governance’ and ‘marine protected area\*’ to allow for plurals of the latter term, in the titles, topics and key words found a total of 448 papers. When this search was further refined to include ‘biodiversity’ the number of studies fell to 130, including ‘biomass’ resulted in just 11, ‘fish stock’ in 19 papers and when refined to include ‘stock size’ rather than biodiversity, fell to just 2 studies. This compares to 1631 ‘marine protected area\*’ and ‘biodiversity’, 733 ‘marine protected area\*’ and ‘biomass’, 621 ‘marine protected area\*’ and ‘fish stock\*’ 239 for ‘marine protected area\*’ and ‘stock size’. Although a snapshot, and not a comprehensive list of every possible search term, these results indicate the huge mismatch between work including governance of MPAs alongside ecological metrics.

To obtain a better idea of what is typically included in studies examining the governance of marine protected areas, the same search terms (‘governance’ and ‘marine protected area\*’), were searched for in article titles, yielding a total of 30 results. On inspection of these, one was off topic and discarded and one result duplicated, two were editorials for special issues of journals and one a book review, giving a total of 25 papers (full details in Table 1).

Twenty of the papers detailed governance structures, 21 were case studies of particular MPAs or country level reviews and four were reviews of governance in general. However, the results demonstrated little in the way of evidence of different success measures of governance or ecological metrics. Seven studies indicated evidence of high levels of stakeholder engagement, and two detailed social benefits provided by the MPAs. Nine papers raised problems and concerns over governance and management measures.

While it is important to assess the success of MPAs against their ecological objectives (for example, protecting biodiversity is a different objective to enhancing fish stocks), only four papers showed any more than a cursory overview of ecological benefits (e.g. more than citations to previous studies of MPA benefits in general in the introduction). Of these one was a review, and therefore did not link ecological benefits to socio-economic factors at any particular site (Bennett and Dearden, 2014a), one was a review of UK MPAs and demonstrated that a voluntary reserve was not working and had subsequently been taken into top-down governance (Jones, 2012), and one was more an overview of seabird ecology than examining different governance structures explicitly (Yorio, 2009). One paper did provide direct reference to studies showing changes in ecological indices, although these were negative changes rather than positive (Day and Dobbs, 2013). As such, none of the 25 papers demonstrated any biological benefit, yet alone benefit measured against the ecological objectives, of the MPAs as a result of any governance, and especially of participatory governance. Most did

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