Highlights

- Few studies demonstrate ecological benefits of MPA governance
- Some key studies participatory governance incorrectly assign ecological benefits
- There is a need to link governance to ecological indices in MPA studies

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

Author: Richard Stafford

Address: Department of Life and Environmental Sciences, Bournemouth University, Fern Barrow, Poole, BH12 5BB, UK.

Email: rstafford@bournemouth.ac.uk

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.

Key words: MPA, Biodiversity, Fish Stocks, Convention of Biological Diversity, Stakeholders

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 & 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 & 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 & Pérez-Castañeda 2003; McClanahan et al., 2009; Taylor et al. 2013; Islam 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 & Roberts 2003; Halpern 2003; Sciberras et al. 2013; Costello & 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 & Alcala 2011). However, MPAs differ greatly in size (from < 1 ha to 1000s km2 – 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 areas (Sciberras et al. 2013; Gill et al. 2017), fully protected marine reserves have been proposed to be necessary to adequately protect biodiversity (Costello & 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.

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

111 times the benefit of a typical MPA. No clear links with governance were found, but this may be due to
112 the limited data on this, and as such the limited way these data were handled in the analysis.
113 However, given that a possible benefit of participatory governance and equitable sharing of resources
114 of MPAs is the role of self-policing (Defeo & Pérez-Castañeda 2003), this could provide support to the
115 theory that participatory governance plays a role in MPAs ecological success.
116
117 In the Gill et al. (2017) study, out of the 589 MPAs studied worldwide, only 62 had both ecological
118 (fish biomass) and management data associated with them. Of note is that for some MPAs such as
119 Machalilla in Ecuador, there were relatively good measures of budget and management (equal to the
120 median for all MPAs studied), but no ecological data to match to the analysis. Recent data
121 demonstrate that there is no statistical difference in fish community structure between this long
122 standing MPA, recently designated MPAs and non-designated neighbouring areas (Stafford et al.
123 2016). Although only a single example, it is possible that published datasets on fish biomass from
124 inside MPAs may arise from a research or publication bias into the best performing areas (Caveen et
125 al. 2015). Of further concern is the limited number of MPAs (~ 10%) which have both management
126 information and easily available ecological data, making assessment of effective management of
127 MPAs difficult to achieve.
128
129 **Examining studies with a joint ecological and governance focus**
130 To provide an overview of the typical research focus into governance of MPAs, an ISI Web of
131 Knowledge search was conducted in April 2017. Using the search terms ‘governance’ and ‘marine
132 protected area*’ to allow for plurals of the latter term, in the titles, topics and key words found a total of
133 448 papers. When this search was further refined to include 'biodiversity' the number of studies fell to
134 130, including ‘biomass’ resulted in just 11, ‘fish stock’ in 19 papers and when refined to include 'stock
135 size' rather than biodiversity, fell to just 2 studies. This compares to 1,631 ‘marine protected area*’
136 and ‘biodiversity’, 733 ‘marine protected are*’ and ‘biomass’, 621 ‘marine protected area*’ and ‘fish
137 stock*’ 239 for ‘marine protected area*’ and ‘stock size’. Although a snapshot, and not a

138 comprehensive list of every possible search term, these results indicate the huge mismatch between
139 work including governance of MPAs alongside ecological metrics.
140
141 To obtain a better idea of what is typically included in studies examining the governance of marine
142 protected areas, the same search terms ('governance' and 'marine protected area*'), were searched
143 for in article titles, yielding a total of 30 results. On inspection of these, one was off topic and
144 discarded and one result duplicated, two were editorials for special issues of journals and one a book
145 review, giving a total of 25 papers (full details in Table 1).
146
147 Twenty of the papers detailed governance structures, 21 were case studies of particular MPAs or
148 country level reviews and four were reviews of governance in general. However, the results
149 demonstrated little in the way of evidence of different success measures of governance or ecological
150 metrics. Seven studies indicated evidence of high levels of stakeholder engagement, and two detailed
151 social benefits provided by the MPAs. Nine papers raised problems and concerns over governance
152 and management measures.
153
154 While it is important to assess the success of MPAs against their ecological objectives (for example,
155 protecting biodiversity is a different objective to enhancing fish stocks), only four papers showed any
156 more than a cursory overview of ecological benefits (e.g. more than citations to previous studies of
157 MPA benefits in general in the introduction). Of these one was a review, and therefore did not link
158 ecological benefits to socio-economic factors at any particular site (Bennett & Dearden 2014a), one
159 was a review of UK MPAs and demonstrated that a voluntary reserve was not working and had
160 subsequently been taken into top-down governance (Jones 2012), and one was more an overview of
161 seabird ecology than examining different governance structures explicitly (Yorio 2009). One paper did
162 provide direct reference to studies showing changes in ecological indices, although these were
163 negative changes rather than positive (Day & Dobbs 2013). As such, none of the 25 papers
164 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 mention the ecological benefits of MPAs in the introduction, but presented no evidence of increased biomass, stock sizes, biodiversity or any other ecological metric specific to the MPA(s) in the studies themselves. While this is not, nor is it intended, to be a full systematic review of the literature, it does clearly and unambiguously highlight the mismatch between research focus in the MPA literature.

The vast majority of the examined work on governance of MPAs has occurred since 2007, with only two studies in the analysis preceding this. Case studies on a local or country level, with a description of governance structures have been common over the last ten years (Table 1). However, investigation of participatory governance and identification of issues with governance appear to have been more prevalent in studies published since 2012. This presumably stems from the publication of protected planet report published in 2012, indicating a specific target for equitable governance of MPAs (Bertzky et al. 2012).

Jones et al. (2011) produced a comprehensive report of governance of MPAs with 20 case studies considered from around the world. From these case studies, eight provide no evidence or mention of ecological indicators (i.e. increases in stock sizes, biomass or biodiversity), a further two indicate it is too early to assess ecological effects, and a further four only supply anecdotal information (with no data or references to support the claims, in this case, of no improvement in ecological indicators). Only six of the 20 sites provide evidence of ecological indicators with data or references to published studies, with five of these six reporting benefits to at least one species or group of species in the reserve. However, it should be noted that success of governance was measured by changes in management or behaviour of the users of the MPA. Such changes are the immediate changes occurring from successful governance, with ecological changes occurring subsequently from management or behavioural change (discussed in detail in Jones 2014). It should also be noted that many of these case studies have been published, and where the search terms used in this study were included in article titles, the published research is also included in the analysis in Table 1.

192

193 These analyses are not intended to dispute the work on governance conducted in the reports and
194 papers examined, but is intended to display the lack of integration between examination of
195 governance and ecological benefits of MPAs. They highlight the extent of the mismatch, but do not
196 conclude that studies on governance never consider biological indices. Indeed, in later work on these
197 case studies included in Jones et al. (2011), there is detail of how three of these MPAs have shown
198 ecological resilience compared to non-protected sites from external factors such as climate change
199 (i.e. fewer coral bleaching events, fewer crown of thorn starfish outbreaks and reduced anoxia and
200 increased abalone egg production – reviewed in Jones 2014). Furthermore, studies in Jones et al.
201 (2011) do identify human behavioural change or changes in management as a result of governance
202 (e.g. changes in fishing practices). Such changes are likely to benefit ecological indices, but in many
203 cases, there is simply a lack of evidence that this has occurred. As such, it is not intended to suggest
204 from the data obtained that participatory governance is bad for marine protected areas, just that the
205 ecological benefits are poorly studied in relation to governance structures.
206

207 **Consequences of equitable governance and diversification of livelihoods**

208 It is generally accepted that many fisheries are overexploited (Pauly & Zeller 2016), although there
209 are examples of well managed and sustainable fisheries throughout the world (Hilborn and Hilborn,
210 2012). Participatory governance, involving multiple stakeholders in the establishment of MPAs, has a
211 possibility of perpetuating the status quo of communities relying on ultimately unsustainable fishing
212 practices. However, there is evidence that local communities may not be as dependent on fishing as
213 previously thought (Jones et al. 2014), especially if a maritime-based community is formed (e.g.
214 fishers can still rely on the sea for their livelihood). Diversification of livelihoods can result in improved
215 benefits for natural resources and wildlife (Ellis & Allison 2004). Examples of this include the
216 development of ecotourism, such as whale watching, SCUBA diving and snorkelling trips (e.g.
217 Stafford et al. 2016). However, such approaches need to be developed with care (Brockinton et al.
218 2008; Jones 2014). Predictions for the economic benefit provided to the local community from
219 livelihood diversification from fishing to tourism in mainland Ecuador indicated that to maximise

benefits to wildlife and the local economy would require education and investment at the local level. Failure to deliver this investment at the local level would either lead to exploitative ecotourism (poorly regulated diving and whale watching delivering smaller financial returns and damaging the marine environment), or the 'buy in' of national or international tourism companies, preventing offset of economic loss through fisheries (Stafford et al. 2016). Nevertheless, simple acceptance of the status quo within a fishing community is unlikely to address long-term or larger-scale marine conservation concerns, especially outside the confines of an MPA.

Conclusions

MPAs are an important component of contemporary marine conservation, and their use is embedded in international agreements. The evidence surrounding the ecological benefits of MPAs are clear and increasing, but are not unequivocal (Caveen et al. 2015). Indeed, the nature of bias against negative results in scientific publishing may even prejudice against studies showing little or no effect of MPAs (Caveen et al. 2015).

Alongside the CBD targets for the percentage cover of MPAs are targets for governance and management of the MPAs. In general, participatory governance structures, result in multiple use reserves which are preferred by the fishing community (Suman et al. 1999; Helvey 2004), and hence are more likely to be established where legislative frameworks for conservation are less developed. However, multiple use MPAs are considered worse (but certainly not entirely ineffective) in protecting ecological parameters than full 'no take' marine reserves (Sciberras et al. 2013; Costello & Ballantine 2015; Gill et al. 2017). As such, it is unreasonable to conclude that participatory governance of protected areas is unable to adequately protect marine wildlife and biodiversity in MPAs, however, there is scant evidence that this is the case, and some evidence that the level of protection is not as great as it may be thought. This study therefore is a clear call for properly conducted multidisciplinary research around MPAs, ensuring studies on the governance or management of MPAs also properly consider the ecological benefits occurring in the MPAs in question, that the measured benefits are

appropriate to the objectives of the MPA, and that studies indicating ecological benefits of MPAs also investigate and report on management and governance structures.

References:

Barr BW, Thornton SR. 1998. Marine protected areas, ecosystem management, and ocean governance: making pieces of different puzzles fit together (without a hammer). Pages 62-73 in Magoon OT, Converse H, Baird B, Miller-Henson M, editors California and the World Ocean'97: Ocean Resources: An Agenda for the Future. American Society of Civil Engineers, Reston, VA.

Bennett NJ, Dearden P. 2014a. From measuring outcomes to providing inputs: governance, management, and local development for more effective marine protected areas. Marine Policy **50:** 96-110.

Bennett NJ, Dearden P. 2014b. Why local people do not support conservation: community perceptions of marine protected area livelihood impacts, governance and management in Thailand. Marine Policy **44:** 107-116.

Bertzky B, Corrigan C, Kemsey J, Kenney S, Ravilious C, Besançon C, Burgess N. 2012. Protected Planet Report 2012: Tracking progress towards global targets for protected areas. IUCN, Gland, Switzerland and UNEP-WCMC, Cambridge, UK.

Borrini-Feyerabend G, Dudley N, Jaeger T, Lassen B, Broome NP, Phillips A. 2013. Governance of protected areas: from understanding to action. Best Practice Protected Area Guidelines Series No. 20. IUCN, Gland, Switzerland.

Bown NK, Gray TS, Stead SM. 2013 Co-management and adaptive co-management: Two modes of governance in a Honduran marine protected area. Marine Policy **39:** 128-134.

Brockington D, Duffy R, Igoe J. 2008. Nature unbound: conservation, capitalism and the future of protected areas. Earthscan, Abingdon, UK.

274 Cárcamo PF, Gaymer CF. 2013. Interactions between spatially explicit conservation and
275 management measures: Implications for the Governance of marine protected
276 areas. Environmental management, **52:** 1355-1368.

277 Caveen A, Polunin N, Gray T, Stead SM. 2015. The controversy over marine protected areas:
278 science meets policy. Springer-Velag. Berlin.

279 Chircop A, Francis J, van Der Elst R, Pacule H, Guerreiro J, Grilo C, Carneiro G. 2010.
280 Governance of marine protected areas in East Africa: a comparative study of Mozambique,
281 South Africa, and Tanzania. Ocean Development & International Law **41:** 1-33.

282 Christie P. 2004. MPAs as biological successes and social failures in Southeast Asia. Pages
283 155-164 in Shipley JB, editor. Aquatic protected areas as fisheries management tools: design
284 use and evaluation of these fully protected areas. American Fisheries Society, Maryland.

285 Christie P, White AT. 2007. Best practices for improved governance of coral reef marine
286 protected areas. Coral Reefs **26:** 1047-1056.

287 Costello MJ, Ballantine B. 2015. Biodiversity conservation should focus on no-take marine
288 reserves: 94% of marine protected areas allow fishing. Trends in Ecology and Evolution **30:**
289 507-509.
290
291 D'Anna G, Fernández TV, Pipitone C, Garofalo G, Badalamenti F. 2016. Governance analysis
292 in the Egadi Islands Marine Protected Area: A Mediterranean case study. Marine Policy **71:**
293 301-309.
294

295 Day JC, Dobbs K. 2013. Effective governance of a large and complex cross-jurisdictional
296 marine protected area: Australia's Great Barrier Reef. Marine Policy **41:** 14-24.

297 Defeo O, Pérez-Castañeda R. 2003. Misuse of Marine Protected Areas for fisheries
298 management. Fisheries Bethesda **28:** 35-36.

299 Duda AM. 2016. Strengthening global governance of large marine ecosystems by
300 incorporating coastal management and marine protected areas. Environmental
301 Development **17:** 249-263.

302 Edgar,GJ et al. 2014. Global conservation outcomes depend on marine protected areas with
303 five key features. Nature **506:** 216-220.

304 Ellis F, Allison E. 2004. Livelihood diversification and natural resource areas. Food and
305 Agriculture Organization of the United Nations, Rome.
306
307 Gell FR, Roberts CM. 2003. Benefits beyond boundaries: the fishery effects of marine
308 reserves. Trends in Ecology and Evolution **18:** 448-455.
309
310 Gill DA et al. 2017. Capacity shortfalls hinder the performance of marine protected areas
311 globally. Nature 543: 665-669.

312 Gruby RL, Basurto X. 2013. Multi-level governance for large marine commons: politics and
313 polycentricity in Palau's protected area network. Environmental Science and Policy **33:** 260-
314 272.

315 Halpern BS. 2003. The impact of marine reserves: do reserves work and does reserve size
316 matter? Ecological Applications **13:** 117-137.

317 Helvey M. 2004. Seeking consensus on designing marine protected areas: keeping the
318 fishing community engaged. Coastal management **32:** 173-190.

319 Hilborn R, Hilborn U. 2012. Overfishing: What Everyone Needs to Know. Oxford University
320 Press, Oxford.

321 Hind EJ, Hiponia MC, Gray TS. 2010. From community-based to centralised national
322 management: a wrong turning for the governance of the marine protected area in Apo Island,
323 Philippines?. Marine Policy 34: 54-62.

Ho TVT, Woodley S, Cottrell A, Valentine P. 2014. A multilevel analytical framework for more-effective governance in human-natural systems: A case study of marine protected areas in Vietnam. Ocean and Coastal Management **90:** 11-19.

Horigue V, Aliño PM, White AT, Pressey RL. 2012. Marine protected area networks in the Philippines: trends and challenges for establishment and governance. Ocean and Coastal Management 64: 15-26.

Horigue V, Fabinyi M, Pressey RL, Foale S, Aliño PM. 2016. Influence of Governance Context on the Management Performance of marine protected area networks. Coastal Management **44:** 71-91.

Islam GMN, Tai SY, Kusairi MN, Ahmad S, Aswani FMN, Senan MKAM, Ahmad A. 2017. Community perspectives of governance for effective management of marine protected areas in Malaysia. Ocean and Coastal Management **135:** 34-42.

Jentoft S, van Son TC, Bjørkan M. 2007. Marine protected areas: a governance system analysis. Human Ecology **35:** 611-622.

Jones EV, Caveen AJ, Gray TS. 2014. Are fisheries-dependent communities in Scotland really maritime-dependent communities? Ocean and Coastal Management **95:** 254-263.

Jones PJ. 2012. Marine protected areas in the UK: challenges in combining top-down and bottom-up approaches to governance. Environmental Conservation 39: 248-258.

Jones PJ. 2014. Governing marine protected areas: resilience through diversity. Routledge, Abingdon, UK.

Jones PJ, Qiu W, De Santo EM. 2011. Governing marine protected areas: getting the balance right. United Nations Environment Program, Nairobi.

Kothari A. 2008. Diversifying protected area governance: ecological, social, and economic benefits. Pages 57-66 in Janishevski L, Noonan-Mooney K, Gidda SB, Mulongoy KJ, editors.

348 Protected areas in today's world: their values and benefits for the welfare of the planet.
349 Technical Series no. 36. Secretariat of the Convention on Biological Diversity, Montreal.

350 Leisher C, van Beukering P, Scherl LM. 2007, Nature's investment bank: how marine
351 protected areas contribute to poverty reduction. Nature Conservancy. Arlington, VA

352 Mace GM. 2014. Whose conservation? Science 345: 1558-1560.

353 Macedo HS, Vivacqua M, Rodrigues HCL, Gerhardinger LC. 2013. Governing wide coastal-
354 marine protected territories: a governance analysis of the Baleia Franca environmental
355 protection area in south Brazil. Marine Policy **41:** 118-125.

356 Marks G, Hooghe L. 2004. Contrasting visions of multi-level governance. Pages 15-30 in
357 Bache I, Flinders M, Editors. Multi-level Governance. Oxford University Press, Oxford.
358

359 Mascia MB. 1999. Governance of marine protected areas in the wider Caribbean: preliminary
360 results of an international mail survey. Coastal Management 27: 391-402.
361

362 McClanahan TR, Castilla JC, White AT, Defeo O. 2009. Healing small-scale fisheries by
363 facilitating complex socio-ecological systems. Reviews in Fish Biology and Fisheries **19:** 33-
364 47.

365 Mora C, Sale PF. 2011. Ongoing global biodiversity loss and the need to move beyond
366 protected areas: a review of the technical and practical shortcomings of protected areas on
367 land and sea. Marine Ecology Progress Series **434:** 251-266.
368

369 Pauly D, Zeller D. 2016. Catch reconstructions reveal that global marine fisheries catches are
370 higher than reported and declining. Nature Communications 7: 10244.
371

372 Powell RB, Cuschnir A, Peiris P. 2009. Overcoming governance and institutional barriers to
373 integrated coastal zone, marine protected area, and tourism management in Sri
374 Lanka. Coastal Management **37:** 633-655.

375 Pieraccini M, Coppa S, De Lucia GA. 2017. Beyond marine paper parks? Regulation theory to
376 assess and address environmental non-compliance. Aquatic Conservation: Marine and
377 Freshwater Ecosystems **27:** 177-196.
378
379 Ramirez LF. 2016. Marine protected areas in Colombia: advances in conservation and
380 barriers for effective governance. Ocean and Coastal Management **125:** 49-62.
381

382 Russ GR, Alcala AC. 2011. Enhanced biodiversity beyond marine reserve boundaries: the
383 cup spillith over. Ecological Applications **21:** 241-250.

384 Russ GR, Alcala AC, Maypa AP. 2003. Spillover from marine reserves: the case of Naso
385 vlamingii at Apo Island, the Philippines. Marine Ecology Progress Series 264: 15-20.
386
387 Sciberras M, Jenkins SR, Kaiser MJ, Hawkins SJ, Pullin AS. 2013. Evaluating the biological
388 effectiveness of fully and partially protected marine areas. Environmental Evidence **2:** 1-31.
389
390 Stafford R et al. 2016. An integrated evaluation of potential management processes on
391 marine reserves in continental Ecuador based on a Bayesian belief network model. Ocean
392 and Coastal Management **121:** 60-69.

393 Suman D, Shivlani M, Milon JW. 1999. Perceptions and attitudes regarding marine reserves:
394 a comparison of stakeholder groups in the Florida Keys National Marine Sanctuary. Ocean
395 and Coastal Management **42:** 1019-1040.
396

397 Taylor E, Baine M, Killmer A, Howard M. 2013. Seaflower marine protected area: governance
398 for sustainable development. Marine Policy **41:** 57-64.

399 van den Hove S. 2003. Participatory approaches for environmental governance: theoretical
400 justifications and practical effects. Pages 18-25 in Stakeholder Involvement Tools: Criteria for
401 Choice and Evaluation. Proceedings of a Topical Session at the 4th meeting of the NEA
402 Forum on Stakeholder Confidence. Organisation for Economic Co-operation and
403 Development, Paris
404

405 Vasconcelos L, Pereira MJR, Caser U, Gonçalves G, Silva F, Sá R. 2013. MARGov–Setting
406 the ground for the governance of marine protected areas. Ocean and Coastal
407 Management **72:** 46-53.

408 West P, Igoe J, Brockington D. 2006. Parks and peoples: the social impact of protected
409 areas. Annual Review of Anthropology **35:** 251-277.

410 Wood LJ, Fish L, Laughren J, Pauly D. 2008. Assessing progress towards global marine
411 protection targets: shortfalls in information and action. Oryx **42:** 340-351.

412 Yorio P. 2009. Marine protected areas, spatial scales, and governance: implications for the
413 conservation of breeding seabirds. Conservation Letters **2:** 171-178.

414 Table 1. Key topics (indicated by +) covered by papers containing search terms ‘governance’

415 and ‘marine protected area*’ in the title from a Web of Science search in April 2017.

416

Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Details of Governance Structure	+	+	+	+		+	+	+		+	+	+	+	+	+	+	+	+	+			+	+		+
Site to country level study of Governance	+	+	+		+		+	+	+	+	+	+	+	+	+	+	+	+	+		+			+	+
Review of Governance				+		+																+	+		
Evidence of equitable governance (stake holder engagement)	+				+							+			+	+	+				+				
Social Benefits (+ improved, - worse)					+			a				+			+										
Identified issues with Governance Structure		+	+		+					+			+	+				+				+			
Discussion of ecological benefits						+					b			c		+				+					
Year of study	2017 - 2016					2014					2013					2012		2010		2009		2007		1999 - 1998	

417

418 a) Decline in social benefits reported

419 b) Reference given in paper to report indicating decline.

420 c) Methods indicate data on fish catch were taken, but no results of this

421 1. Islam et al. 2017. 2. D'Anna et al. 2016. 3. Ramirez 2016. 4. Duda 2016. 5. Horigue et al.

422 2016. 6. Bennett and Dearden 2014a. 7. Ho et al. 2014. 8. Gruby and Basurto 2014. 9. Bennett

423 and Dearden 2014b. 10. Carcamo and Gaymer 2013. 11. Day and Dobbs 2013. 12. Taylor et

424 al. 2013. 13. Macedo et al. 2013. 14. Bown et al. 2013a. 15. Vasconcelos et al. 2013. 16. Jones

425 2012. 17. Horigue et al. 2012. 18. Hind et al. 2010. 19. Chircop et al. 2010. 20. Yorio 2009. 21.

426 Powell et al. 2009. 22. Christie and White 2007. 23. Jentoft et al. 2007. 24. Mascia 1999. 25.

427 Barr and Thonton 1998.

428