



Revisiting “Success” and “Failure” of Marine Protected Areas: A Conservation Scientist Perspective

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OPEN ACCESS

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Specialty section:

This article was submitted to
Marine Conservation and
Sustainability,
a section of the journal
Frontiers in Marine Science

Received: 27 December 2017

Accepted: 11 June 2018

Published: 29 June 2018

Citation:

Giakoumi S, McGowan J, Mills M, Beger M, Bustamante RH, Charles A, Christie P, Fox M, Garcia-Borboroglu P, Gelcich S, Guidetti P, Mackelworth P, Maina JM, McCook L, Micheli F, Morgan LE, Mumby PJ, Reyes LM, White A, Grorud-Colvert K and Possingham HP (2018) Revisiting “Success” and “Failure” of Marine Protected Areas: A Conservation Scientist Perspective. *Front. Mar. Sci.* 5:223. doi: 10.3389/fmars.2018.00223

Marine protected areas (MPAs) form the cornerstone of marine conservation. Identifying which factors contribute to their success or failure is crucial considering the international conservation targets for 2020 and the limited funds generally available for marine conservation. We identified common factors of success and/or failure of MPA effectiveness using peer-reviewed publications and first-hand expert knowledge for 27 case studies around the world. We found that stakeholder engagement was considered to be the most important factor affecting MPA success, and equally, its absence, was the most important factor influencing failure. Conversely, while some factors were identified as critical for success, their absence was not considered a driver of failure, and vice versa. This mismatch provided the impetus for considering these factors more critically. Bearing in mind that most MPAs have multiple objectives, including non-biological, this highlights the need for the development and adoption of standardized effectiveness metrics, besides biological considerations, to measure factors contributing to the success or failure of MPAs to reach their objectives. Considering our conclusions, we suggest the development of specific protocols for the assessment of stakeholder engagement, the role of leadership, the capacity of enforcement and compliance with MPAs objectives. Moreover, factors defining the success and failure of MPAs should be assessed not

only by technical experts and the relevant authorities, but also by other stakeholder groups whose compliance is critical for the successful functioning of an MPA. These factors should be considered along with appropriate ecological, social, and economic data and then incorporated into adaptive management to improve MPA effectiveness.

Keywords: conservation scientists, effectiveness assessment, failure, marine protected areas, stakeholder engagement, success

INTRODUCTION

More than 15,000 marine protected areas (MPAs) cover roughly 7% of the world's marine environment (Lubchenco and Grorud-Colvert, 2015; UNEP-WCMC IUCN, 2017). Scientific evidence shows that MPAs can produce ecological, economic, and social benefits under appropriate design and management conditions (Ban et al., 2012; PISCO UNS, 2016). Comparative studies across marine regions have enabled us to explore common factors contributing to MPA success (e.g., Charles and Wilson, 2009; Edgar et al., 2014). However, assessments of the factors that result in the failure of MPAs to achieve their objectives using information from many regions are far less common (but see Gill et al., 2017). The emphasis on success and achievement may allow us to overlook the importance of failure for learning and development. MPAs are expensive ventures absorbing much of the scarce resources allocated to marine conservation. Thus, identifying practices that ensure MPA effectiveness is a major issue (Pendleton et al., 2018).

Herein, 21 conservation scientists and practitioners (the authors of this paper) used their first-hand knowledge of 27 MPA case studies from around the world (Figure 1, Appendix S1, Table S1.1). These case studies were used to critically consider how success and failure are defined and measured when assessing MPA effectiveness. In addition, key factors driving MPA success and failure were identified.

DEFINING MPA SUCCESS AND FAILURE

Given our case-studies span many countries, socio-ecological systems, and biogeographic regions, we needed to establish a common definition by which to benchmark the success or failure of an MPA. The general English language dictionaries define success as “the accomplishment of an aim or purpose.” Using that definition, an MPA was considered a success if it accomplished its objectives. Conversely, failure was defined as “not accomplishing an aim or purpose.” Thus, an MPA would be a failure if its implementation and/or management were insufficient, inappropriate or neglected. The last would be the case of the so called “paper parks” (Agardy et al., 2011; Scianna et al., 2015). An important challenge is how to assess success or failure when multiple objectives are involved. The aims of MPAs often include ecological, social, economic, cultural, and institutional objectives (Fox et al., 2012). In many cases, planning for multiple objectives concurrently demands trade-offs in achievement across social, economic, and ecological domains (Beger et al., 2015). Thus, in practice, most MPAs have aspects

of both success and failure (Christie, 2004). Here, we focus on success or failure in achieving ecological outcomes, because evidence is more abundant for assessing ecological rather than other objectives (Gill et al., 2017).

MEASURING MPA SUCCESS AND FAILURE

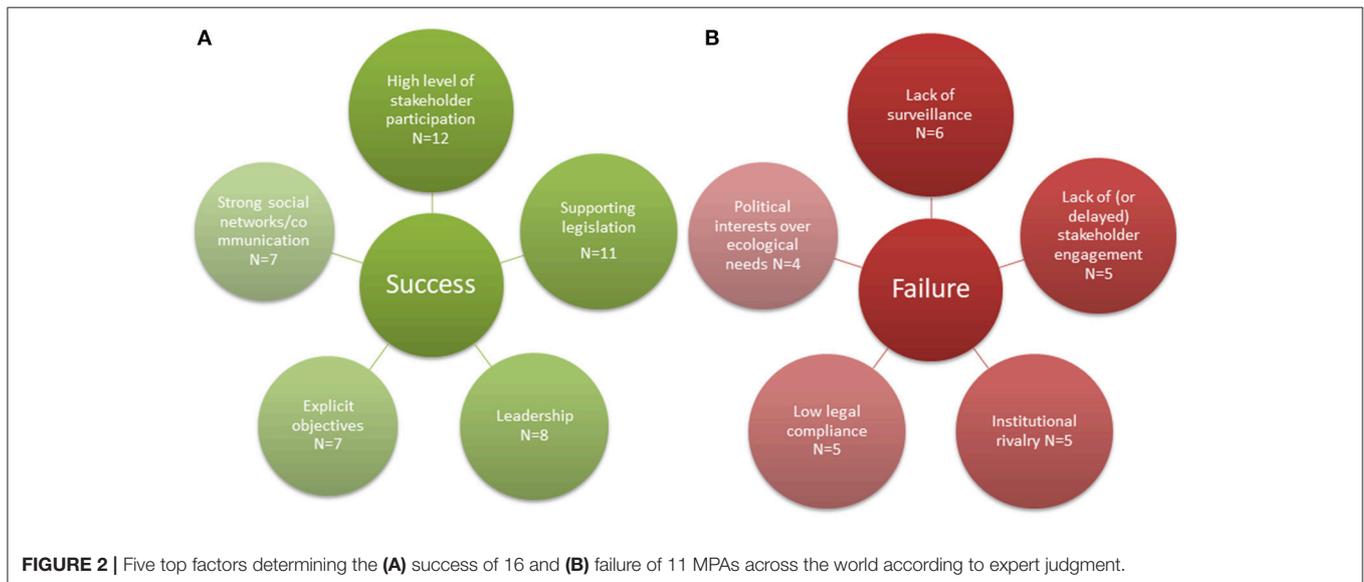
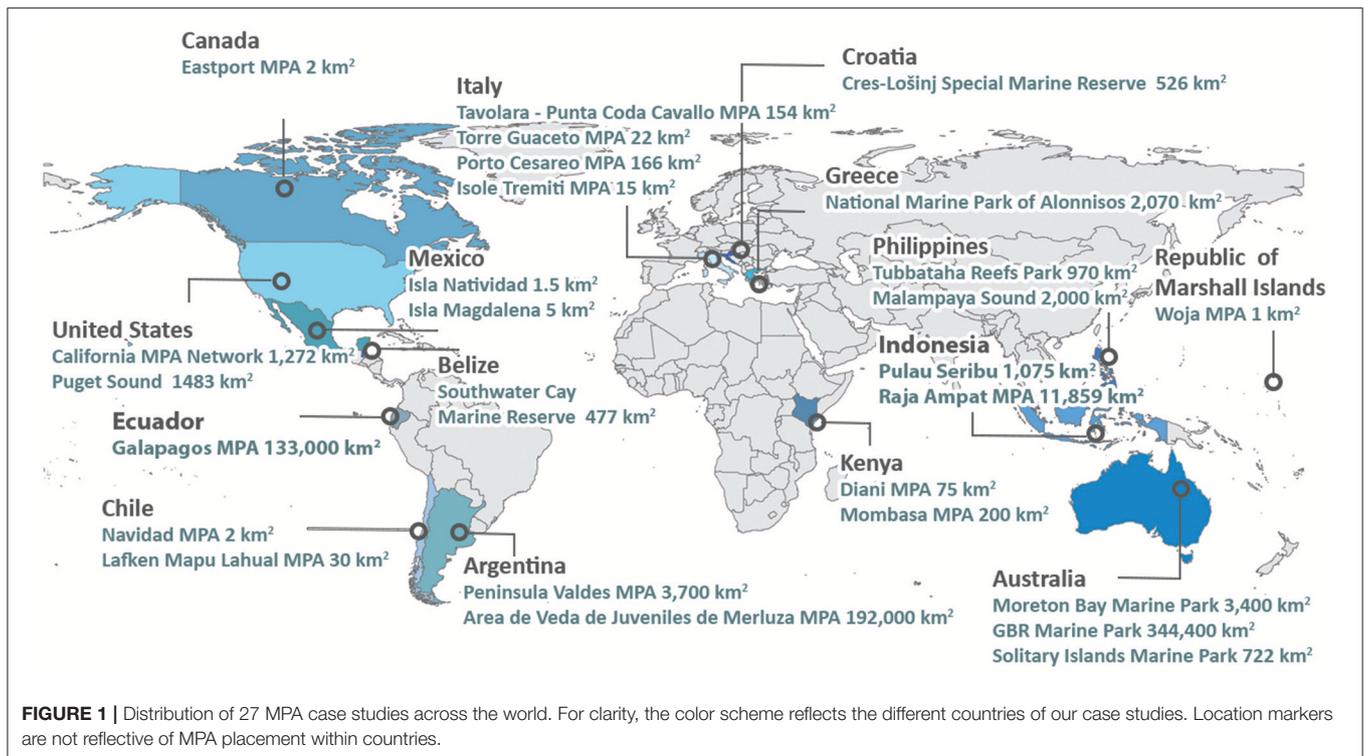
MPA effectiveness, in ecological terms, is commonly measured by comparing values of ecological or biological measures (e.g., sizes of organisms, density and biomass of fish assemblages, species richness, live cover of benthic organisms) in MPAs and adjacent unprotected areas and/or before and after an MPA is established. However, the appropriate rigor of the empirical design for such evaluations of the ecological effectiveness is often lacking (Ferraro and Hanauer, 2014). Thus, our assessments of ecological success, while considering available published evidence, reflect our perspectives based on first-hand experience and expert knowledge (Table S1.2). Acknowledging the fact that MPA effectiveness is not static, this assessment corresponds to a specific time period for which we had data and/or personal experience. This period does not necessarily correspond to the initial stage of the MPA establishment but also to later post-establishment stages which vary across our case studies depending on the age of each MPA.

For each case study, we considered 23 factors that were identified through group discussions and a literature review, as those commonly attributed to MPA “success” and “failure” (Table S1.1). For each case study, five factors were ranked based on their importance for the success or failure of the case study (for more information see Appendix S1).

ASSESSING MPA SUCCESS AND FAILURE

On aggregating the individual rankings, most factors indicating success were found to also point to failure; i.e., when the presence of a factor was considered to lead to success, its absence led to failure (Figure 2, Table S1.3). Overall, the factors viewed as principal drivers of success and failure of MPA effectiveness were related to contextual factors, such as governance and socio-economic characteristics, rather than the design attributes, such as the MPA size.

Stakeholder engagement was consistently selected as the most important factor affecting MPA success; its absence was most often linked to failure. Other factors that were reported as crucial for success, and their absence as drivers of failure, included: surveillance, leadership, political will, and the existence of sanctioning and conflict resolution mechanisms. Interestingly,



whereas some factors were identified as critical for success, their absence was not identified as a driver of failure (Table S1.3). Those factors include setting clear objectives, strong scientific engagement throughout the planning and implementation stages, and the existence of clearly delineated MPA boundaries. The existence of explicit objectives (i.e., well-defined overarching qualitative objectives such as protection of endangered species or habitats, fisheries enhancement, or food security) was selected as one of the most important factors defining success. Yet, its absence was never identified amongst the most important factors

contributing to MPA failure. This mismatch may originate from disparities between the scientific principles of MPA design, on the one hand, and practical realities of MPAs, on the other. Scientific literature often recommends that MPA goals and objectives should be clearly defined, compatible with one another, and account for inherent uncertainty (Rossiter and Levine, 2014). In practice, however, the absence of explicit objectives may not lead to failure, but may facilitate broader acceptance by a range of stakeholders, each of which may have a different set of objectives with respect to their interests.

socio-cultural, political, and legislative context in which the MPA is established (Gill et al., 2017).

AUTHOR CONTRIBUTIONS

SG coordinated this effort and wrote the first draft of the paper, JM and MM produced the figures, all authors provided questionnaire input, edited and contributed with text.

ACKNOWLEDGMENTS

We thank all participants of the workshop Marine protected areas: overcoming barriers to successful implementation held at the 2014 Pew Fellows Annual Meeting for discussions. We also

thank Polita Glynn for assisting in the workshop organization. SG, JM, and MM were supported by ARC CEED, University of Queensland funding. RB, PC, PG-B, SGe, LMCC, FM, PM, AW, and HP were supported by The Pew Fellows Program in Marine Conservation. AC was supported by funding from SSHRC and NSERC, Canada. LMCC was supported in part by a President's International Visiting Professor Fellowship (2016VEA025) from the Chinese Academy of Sciences.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmars.2018.00223/full#supplementary-material>

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