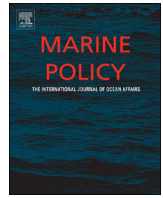




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Imprecise and weakly assessed: Evaluating voluntary measures for management of marine protected areas



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ABSTRACT

Voluntary measures may be an alternative or addition to legislation for marine protected areas (MPAs), yet the effectiveness of these measures is rarely analyzed. The application and effectiveness of voluntary measures was reviewed for MPA management in developed nations where complex jurisdictions and legislative processes make voluntary measures appealing to management. Four types of voluntary measures were identified: sacrifice of access, sector- or activity-specific restrictions, voluntary stewardship, and education or outreach, with sector- or activity-specific measures being the most common. Very few papers (only 20 of 144) provided thorough assessments of outcomes or effectiveness of voluntary measures; of these, less than a quarter pointed to successful outcomes in connection with voluntary measures for MPAs or marine conservation more broadly, while half indicated mixed or uncertain results. The main factor to which failure of voluntary measures was attributed was the lack of leverage to discourage non-compliance. Key factors for the success of voluntary measures included community support, cohesive user organizations, and good governance (i.e., leadership, financing, a perception of fairness). To improve efficacy of voluntary measures for MPAs, empirical research is needed to establish effective circumstances where, when, and how voluntary measures can be applied to address management objectives.

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1. Introduction

Exploitation, mismanagement, and climate change threaten the health and function of the world's oceans [1,2]. Marine conservation efforts using marine protected areas (MPAs) – clearly defined areas managed to achieve the long-term conservation of nature with associated ecosystem services and cultural values – are increasingly being implemented to protect biodiversity and ecosystem function while supporting sustainable fisheries [3–7]. MPAs can provide environmental, social, and economic benefits, yet the establishment of well-regulated MPAs can be challenging and time-consuming, as these tools demand effective institutions and governance [8–10].

The complexity of legal systems in the marine environment and processes associated with regulation and enforcement make regulatory management often slow to enact, unresponsive and

difficult to modify [11,12]. Development of regulations and legislation can be held up by complex governance processes, be suspended due to lack of funding or effective legal standing, and take years of involvement by those at the highest levels of governance, often disconnected from local stakeholders [12,13]. When statutory MPAs are established, government agencies may lack sufficient resources for monitoring and enforcement programs [14], or lack statutory powers to enforce the range of regulations required to support conservation objectives. In contrast, voluntary measures are non-enforceable approaches adopted by an individual, organization, agency or community in order to constrain or modify behaviors in support of specific objectives, and can therefore require fewer resources or management [12,13]. Voluntary conservation approaches have been applied in terrestrial land management and forest conservation with some success, although mostly on private land and with monetary compensation to those private landholders [15,16]. Non-monetary voluntary participation has been far less explored or described in the literature [16].

There is growing interest in understanding and applying voluntary measures that complement regulations for both spatial and non-spatial conservation management in marine

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environments [11]. Such measures include voluntary restrictions on access or use of an area, restrictions on specific activities or sectors, stewardship or monitoring activities, and education to raise awareness of conservation or management goals. The hypothesis is that voluntary measures, when endorsed by users, can avoid many of the issues associated with a regulatory approach to MPA management (e.g. timeliness, funding constraints, legal authority, lack of ownership of the measure by users). However, research on voluntary measures for marine protected areas is limited [17–19], and as far as we could determine, no comprehensive review of the types of voluntary measures applied to MPAs or their effectiveness exists.

The purpose of this review is to document voluntary measures used in the management of MPAs in developed countries and to identify factors contributing to success or failure of voluntary measures in MPA management. We focus on developed countries, where centralized governance structures mean that the establishment and management of MPAs can be complex, take a long time and be especially costly [20], hence where voluntary measures are of particular interest. We focused on two key questions: What voluntary measures are used for MPA management, and what factors contribute to the success or failure of those measures?

2. Methods

A literature search was conducted using Google Scholar and Web of Knowledge on a combination of search terms: (voluntary OR “code of conduct” OR “self-regulation” OR “community-driven”) AND (“marine protected area” OR “marine reserve” OR “no-take”) AND (ocean OR marine OR coastal). The search was limited to articles that were published in English since 1990 (including articles up to February 7, 2015). We reviewed the abstract and

keywords of the initial search results (265 articles) for two selection criteria: first, that the study focused on MPAs or marine conservation in developed countries, and second, that the study mentioned or focused on voluntary measures for conservation management or codes of conduct. This step was used to identify and describe the different types of voluntary measures applied in marine conservation. The 144 articles that were relevant to the objectives of the review were analyzed, and found that only a subset of 39 articles had sufficient focus on voluntary measures to be useful for the specific question. This subset included some papers addressing aspects of marine conservation not directly focused on MPAs, but which were informative about voluntary measures, as well as papers about MPAs where voluntary measures were more often a peripheral theme than a central focus. Of the 39 articles, only 20 documented or evaluated the outcomes or effectiveness of voluntary measures for MPA or conservation management; these key papers formed the basis for the interpretation of factors contributing to the success or failure of voluntary measures.

3. Results

3.1. Types of voluntary measures: from limits to access, to education

Voluntary measures used in MPA management were classified into four categories (Table 1): sacrifice of access, sector- or activity-specific restrictions, voluntary stewardship, and education or outreach. While there is some overlap among these categories for some voluntary measures, papers were placed into the most relevant category (Table 2). Sector- or activity-specific voluntary restrictions had the most examples in the literature (Table 2, Fig. 2), and were mostly applied to the commercial recreation sector (tourism, etc.; Fig. 1). Education or outreach activities

Table 1

Types of voluntary measures, divided into two main categories of regulation and positive action.

Management Measure	Included measures, examples	Initiation
<i>Self-regulation:</i>		
Sacrifice of access	Voluntary restrictions on area/location or timing of activities, including: <ul style="list-style-type: none"> • Self-imposed no-take area or zone • Long-term, area-based fisheries closures • Areas to be avoided or Particularly sensitive areas 	The initiative to close an area to a certain use may be taken by a user group, community, or user-agency collaboration.
Sector or activity-specific voluntary restrictions	Voluntary restrictions on conduct of activities, including restrictions on equipment and practices such as: <ul style="list-style-type: none"> • Voluntary bycatch reduction devices • Catch and release angling • Keeping distance from cetaceans, etc. The voluntary restrictions may be applied through: <ul style="list-style-type: none"> • Codes of conduct • Codes of practice • Standards, etc. (Codes of conduct are sometimes used as well in applying sacrifice of access restrictions and they are also used in the case of statutory regulation.)	The restrictions may be initiated (and codified) by a range of bodies, from quasi-governmental, international organizations, to recreational groups.
<i>Promotion of positive activities:</i>		
Voluntary stewardship	Voluntary conservation activities, such as monitoring of species and habitat, and Voluntary surveillance and enforcement (or monitoring of human use), such as: <ul style="list-style-type: none"> • Incident reporting • “Eyes and Ears” programmes 	Stewardship activities are usually undertaken in cooperation with MPA management agencies.
Education or outreach	Encouraging behaviors consistent with management objectives and increasing the potential for adherence to other voluntary measures through measures such as: <ul style="list-style-type: none"> • Educational programs • Awareness-raising, outreach, etc. The intended audience may be the general public, local communities or user groups.	These are usually initiated by MPA management agencies, but may originate in other organizations.

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