

1 'Organization Science': A new prospective to assess marine protected areas
2 effectiveness

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7

8 **Abstract**

9 Marine Protected Areas (MPAs) are widely considered as useful tools to achieve both conservation
10 and resource management goals. They have the potential to produce a wide array positive of socio-
11 ecological effects. Their effectiveness, however, varies dramatically. The sources of this variability
12 are numerous and, in some cases, quite well studied. Yet, a significant portion of the variability in
13 MPAs effectiveness still remains unexplained. MPAs, due to a number of intrinsic features, can be
14 considered “organizational systems”, a definition recognizing the fact 1) that their effectiveness can
15 be influenced by their own organizational dimensions and 2) that they could be analyzed employing
16 the typical tools provided by ‘Organization Science’ (OS). Here we analyze the available literature
17 on MPAs worldwide to explore whether and how the principles of OS have been used as a scientific
18 basis for the evaluation of MPAs effectiveness. We found that no study explicitly used a
19 comprehensive OS framework for evaluating effectiveness in the context of MPAs. Just 20 studies
20 considered some organizational dimensions in their analysis (e.g. professionalism of the
21 organization members, vision, goals, strategies and networking), but not in an comprehensive
22 manner. The outputs of our review stress the limited use so far of the OS methodologies and
23 principles in the context of MPAs. We posit that there is significant potential for new insights from
24 a more integrated implementation of an OS framework that seeks to interpret and improve MPA
25 and socio-ecological effectiveness.

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27

28 **Key words:** marine reserves; MPA performance; organizational dimensions; literature review.

29 **1. Introduction**

30 Marine Protected Areas (MPAs) are usually defined as “*any area of intertidal or subtidal terrain,*
31 *together with its overlying water and associated flora, fauna, historical and cultural features, which*
32 *has been reserved by law or other effective means to protect part or all of the enclosed*
33 *environment*” (Kelleher, 1999). They are a typology of the wider category of Protected Areas that
34 more recently have been defined as “*a clearly defined geographical space, recognized, dedicated*
35 *and managed, through legal or other effective means, to achieve the long-term conservation of*
36 *nature with associated ecosystem services and cultural values*” (Day *et al.*, 2012).

37 MPAs are increasingly regarded as valuable tools aimed at achieving both marine
38 conservation and resource management goals (Gaines *et al.*, 2011). They are basic instruments for
39 the ecosystem-based management approach used to mitigate the multitude of severe threats
40 affecting coastal and marine systems (Worm *et al.*, 2006). Marine ecosystems worldwide are, in
41 fact, subjected to both human (e.g. overexploitation of marine resources, pollution, habitat
42 degradation) and climate change impacts (Halpern *et al.*, 2008; Harley *et al.*, 2006; Jackson *et al.*,
43 2001) that can compromise natural biodiversity, ecosystem functioning and services relevant to
44 society (Worm *et al.*, 2006).

45 Available evidence and a number of case studies worldwide confirm that MPAs may play an
46 important role in recovering marine communities and ecosystems and in enhancing fishing stocks
47 and related revenues to fishermen (Claudet *at al.*, 2008; Guidetti & Claudet, 2010; Halpern &
48 Warner, 2002; Lester *et al.*, 2009; White *et al.*, 2008). Such successes have been associated with a
49 dramatic worldwide increase of the number of MPAs – a number that now exceeds 7,500 (WDPA,
50 2012). Although on average MPAs exhibit positive effects, the magnitude (and occasionally also
51 the direction) of responses to protection can vary dramatically (Lester *et al.*, 2009).

52 The sources of this variability in the MPAs’ performance are numerous and, in some cases,
53 quite well studied. Key issues that have been documented include the level of enforcement, social
54 compliance, MPA size, age, location, design and fishing regulations (Claudet *at al.*, 2008; Edgar *et*

55 *al.*, 2014; Guidetti *et al.*, 2014; Guidetti *et al.*, 2008; Lester & Halpern, 2008; Mora *et al.*, 2006;
56 Sala *et al.*, 2012). A significant portion of the variability of MPA effectiveness, however, still
57 remains unexplained, which suggests the need to explore more in depth other aspects possibly
58 affecting MPA performance linked, for example, to the organization of MPAs in terms of scope and
59 goals that each MPA has set and the activities undertaken in order to get results and their
60 consistency with the scope/goals.

61 Organization Science (hereafter OS) studies organizational structures, processes, and practices, and
62 supplies the tools to carry out organizations' performance analysis (Denison & Mishra, 1989;
63 Fitzgerald & Desjardins, 2004; Moorhead, 1981; Schmid, 2002; Wang *et al.*, 2008), trying to
64 identify the reasons of their success (e.g. Burns & Stalker, 1961; Hannan & Freeman, 1977;
65 Lawrence & Lorsch, 1967; Woodward, 1958)

66 Organizations are "*cooperative systems of consciously coordinated activities of two or more*
67 *persons, with a common purpose*" (Barnard, 1938). Within the framework of the OS, organizations
68 are evaluated based on their 'organizational dimensions'. These dimensions include variables that
69 measure the structural dimensions of organizations, such as centralization, formalization, size,
70 professionalism of staff members, and other characteristics, such as networking, vision and
71 compliance, goals and strategies (Daft, 2010). More specifically, 'centralization' identifies the
72 participation in decision making or the degree to which the authority having the power to make
73 certain decisions is located at the top of the management hierarchy (Hage & Aiken, 1967).
74 'Formalization' (or 'standardization') determines the degree to which an organization lays down
75 standard rules and procedures (Pugh, 1973) and "denotes the extent to which rules, procedures,
76 instructions, and communications are written" (Pugh *et al.*, 1968). The 'size' of an organization is
77 described in different terms e.g. the number of employees or the amount of resources that the
78 organization can rely on in order to reach its goals. 'Professionalism' delineates the level of formal
79 education and training of the employees at all hierarchical levels (Daft, 1978). 'Networking'
80 characterizes the number and kind of collaborative relationships that the organizations may activate

81 with their ‘environment’ (Powell, 1990; Uzzi, 1996). Where the ‘environment’ is everything outside
82 the boundaries of a given organization. The concept of network has been specifically defined in OS
83 as “two or more organizations involved in long-term relationships” (Thorelli, 1986). The
84 relationships of the organizations with their environment are, evidently, an essential aspect for their
85 life (Von Bertalanffy, 1968). ‘Vision’ has been defined as “a realistic, credible, attractive future for
86 your organization”. It is a destination toward which the organization should aim, a future that is
87 better, more successful, or more desirable for the organization (Nanus, 1992) or, more simply, the
88 picture of the future we seek to create (Senge, 2006). In OS there is no generally accepted definition
89 of the term “compliance” (Pupke, 2008). Many authors define compliance as the extent to which
90 there is adherence to laws, regulations (e.g. Schneiberg & Bartley, 2008; Zaelke *et al.*, 2005), and
91 unwritten, ethical norms (e.g. Welcomer, 2002)” (Foorhuis, 2012). ‘Goals’ are the results or the
92 end points toward which organizational efforts are directed and represent one of the cornerstones in
93 OS (Etzioni, 1964; Mintzberg, 1973). ‘Strategy’ is the plan for interacting with the environment to
94 achieve organizational goals. The “management plan” is part of the strategy of the organizations
95 and it describes how the organization is going to reach its goals.

96 Considering the above issues it appears clear the potential of OS in the field of MPA science,
97 having OS studies always historically tried to interpret the different level of performance reached by
98 organizations, focusing on their organizational dimensions (e.g. Child, 1972; Dalton *et al.*, 1980;
99 Gordon & DiTomaso, 1992).

100 It is well known that Protected Areas can be seen as social-economical systems (Ostrom, 2009;
101 Micheli & Niccolini, 2013), established and often managed by public and/or no-profit
102 organizations. MPAs, therefore, can be considered “organizational systems” whose effectiveness
103 can be influenced by their own organizational dimensions. As a result, the tools provided by OS
104 may provide important insights to analyze MPA performance.

105 Here, we explore the available literature on the use of OS principles as a scientific basis for the
106 evaluation of MPAs effectiveness worldwide. We also focused on the level of overlap of the two

107 science, OS and MPA science, identifying the variables in common.

108 This synthesis will also identify unexplored opportunities for the expansion of an OS framework in
109 order to assess MPAs' performance.

110

111 **2. Materials and methods**

112 We selected published peer-reviewed literature through *Web of Science* using the following key
113 words and Boolean operators: (Marine Protected Area OR Marine Reserve AND Organization*)
114 OR (Marine Protected Area OR Marine Reserve AND Management) OR (Marine Protected Area
115 OR Marine Reserve AND Governance) OR (Marine Protected Area OR Marine Reserve AND
116 Organization Structure). All the papers published until January 2014 have been included in the
117 selection. We did not use any filter for time and journals.

118 Because many evaluations of MPAs performance and design can be captured in unpublished
119 reports, we also consulted the available gray literature and personal archives.

120 We screened the collection by a two-steps analysis. During the first step, we analyzed all the papers
121 and reports in order to individuate if any of them applied a formalized OS approach to explore
122 MPAs effectiveness. Through the second step, we analyzed again the literature in order to detect
123 whether some organizational dimensions have been already adopted in MPA science outside the
124 comprehensive framework provided by OS.

125

126 **3. Results**

127 Our search with *Web of Science* highlighted 7604 potentially useful papers. After an initial
128 screening, we identified 89 potentially relevant papers. None of the studies used a formalized OS
129 approach to explore MPAs effectiveness, although a few papers pointed out that management
130 process models used in business could potentially provide useful frameworks (Alder *et al.*, 2002;
131 Armstrong, 1986; Pomeroy *et al.*, 2004, 2005).

132 Although no studies used a comprehensive OS approach, several publications did take into account

133 individual organizational dimensions commonly used in OS. Sixteen papers out of the 89 selected
134 with *Web of Science*, and 4 additional documents from the gray literature, formed the foundation of
135 our analysis. Thirteen out of the 20 studies carried out an evaluation of the effectiveness of MPAs
136 *sensu lato* (i.e. marine protected areas, marine reserves, national marine parks, marine managed
137 areas and protected areas). The remaining studies, conversely, supplied useful guidelines and lists of
138 indicators for assessing management of MPAs.

139 The year of publication of the 20 studies referring to organization variables in MPAs was highly
140 skewed. The oldest paper was published in 1986, while the remaining 19 studies have all been
141 published between 2002 and 2013.

142 The researches have been carried out worldwide. In detail, 7 researches have been carried out in the
143 Pacific Ocean, two in the Indian Ocean, one in both Pacific and Indian Ocean, another one took into
144 account MPAs in the Pacific and Indian Ocean and also in the Caribbean Sea. 3 studies deal with
145 MPAs in Mediterranean, one in the Atlantic Ocean and only Pomeroy in both his papers carried out
146 a worldwide study. The last three papers did not take into account any specific area or MPAs.

147 Cumulatively, the existing studies cover 9 different organizational variables (see Table 1 for
148 references and details): centralization, standardization, size, professionalism, networking, vision,
149 compliance, goals and strategies. The most investigated organizational dimensions are ‘goals’ and
150 ‘networking’ (both mentioned in 13 studies out of 20), followed by ‘size’ and ‘strategies’ (in 12
151 studies). ‘Professionalism’ has been taken into account in 7 studies, ‘compliance’ in 6, ‘vision’ in 5,
152 and finally ‘formalization’ and ‘centralization’ in 2.

153 For 3 variables. i.e. vision, compliance and goals, the same terminology is used in both OS and in
154 the examined papers referring mostly to MPA science. For the other 6 variables, instead, the
155 terminology is sometimes different in the two fields (i.e. ‘professionalism’ for ‘training’) or no
156 specific terms exist in MPA science even though the general concepts are perceived as important,
157 such as ‘networking’, ‘size’, ‘strategies’, ‘formalization’ and ‘centralization’.

158 Some of organizational dimensions individuated have been analyzed through different approaches

159 or using different or families of variables. Goals have been analyzed with two different approaches:
160 1) qualitative evaluations of the achievement of the goals inside MPAs and 2) the identification of
161 all the possible goals that can be set in MPAs along with the analysis of the contingent conflicts
162 arising from the different nature of such goals (see Table 1 for references). The networking has
163 been analyzed taking into account different variables, which include for instance the ‘level of
164 participation in the management’, the ‘level of conflict’ (referring to the nature and characteristics
165 of conflicts associated with planning, management and decision-making), the ‘level of local
166 community organization’ and the ‘level of stakeholders satisfaction’ (see Table 1 for references).
167 ‘Size’ has been considered in both its components: the number of employees (or staff) (9
168 publications) and the amount of resources that the organization can rely on in order to reach its
169 goals (11 publications) (see Table 1 for references). Different strategies have been taken into
170 account in order to evaluate or describe the actions undertaken by the MPAs, for example the
171 adoption and the degree of implementation of the management plan, the presence of plan for the
172 enforcement and programs of environmental education, monitoring and research. Centralization has
173 been analyzed through two different variables: “level of MPAs management”, meaning the
174 jurisdiction of the management authority (local Vs. national); and “the structure of those involved in
175 managing the MPA”.

176 The other variables, professionalism, compliance, vision and formalization have been analyzed in
177 an uniform way in the papers that focused on them.

178 **Table 1** - The organizational variables we found in the studies selected. Ce=Centralization; Fo=Formalization; Si=Size;
 179 Pr=Professionalism; Ne=Networking; Vi=Vision; Co=Compliance; Go=Goals; St=Strategies.

Studies	Organizational variables								
	Ce	Fo	Si	Pr	Ne	Vi	Co	Go	St
Abdulla A., Gomei M., Maison E. and Piante C. 2008. Status of Marine Protected Areas in the Mediterranean Sea. <i>IUCN, Malaga and WWF, France</i> . 152 pp.			x				x	x	x
Alder J., Zeller D., Pitcher T. and Sumaila R. 2002. A method for evaluating marine protected area management. <i>Coastal Management</i> . 30 : 121-31.					x				x
Batista M. I., Baeta F., Costa M. J. and Cabral H. N. 2011. MPA as management tools for small-scale fisheries: The case study of Arrabida Marine Protected Area (Portugal). <i>Ocean & Coastal Management</i> . 54 : 137-47.					x			x	x
Berliarang J. J. & Fang Q. 2013. Management effectiveness evaluation of Bunaken National Park of Indonesia using an updated framework In <i>Progress in Environmental Science and Engineering</i> . Pts 1-4, ed. QJ Xu, YH Ju, HH Ge, pp. 3180-85.		x	x	x		x		x	x
Day J. 2008. The need and practice of monitoring, evaluating and adapting marine planning and management - lessons from the Great Barrier Reef. <i>Marine Policy</i> . 32 : 823-31.								x	
Ehler C. N. 2003. Indicators to measure governance performance in integrated coastal management. <i>Ocean & Coastal Management</i> . 46 : 335-45.			x	x	x	x	x	x	x
Garces L. R., Pido M. D., Tupper M. H. and Silvestre G. T. 2013. Evaluating the management effectiveness of three marine protected areas in the Calamianes Islands, Palawan Province, Philippines: Process, selected results and their implications for planning and management. <i>Ocean & Coastal Management</i> . 81 : 49-57.					x		x		
Guajardo A. & Navarrete C. 2012. Adaptive management of marine protected areas in Chile: a method for his evaluation. <i>Latin American Journal of Aquatic Research</i> . 40 : 608-12.			x	x	x		x	x	x
Heylings P. & Bravo M. 2007. Evaluating governance: A process for understanding how co-management is functioning, and why, in the Galapagos Marine Reserve. <i>Ocean & Coastal Management</i> . 50 : 174-208.					x	x			
Muthiga N. A. 2009. Evaluating the effectiveness of management of the Malindi-Watamu marine protected area complex in Kenya. <i>Ocean & Coastal Management</i> . 52 : 417-23.			x		x				
Pomeroy R. S., Parks J. E. and Watson L. M. 2004. How is your MPA doing?: a guidebook of natural and social indicators for evaluating marine protected area management effectiveness. <i>IUCN. Gland, Switzerland and Cambridge, UK</i> . xvi + 216 pp.			x	x	x		x	x	x
Pomeroy R. S., Watson L. M., Parks J. E. and Cid G. A. 2005. How is your MPA doing? A methodology for evaluating the management effectiveness of marine protected areas. <i>Ocean & Coastal Management</i> . 48 : 485-502.			x	x	x		x	x	x
Rice J., Moksness E., Attwood C., Brown S. K., Dahle G., Gjerde K. M., Grefsrud E. S., Kenchington R., Kleiven A. R., McConney P., Ngoile M. A. K., Naesje T. F., Olsen E., Olsen E. M., Sanders J., Sharma C., Vestergaard O. and Westlund L. 2012. The role of MPAs in reconciling fisheries management with conservation of biological diversity. <i>Ocean & Coastal Management</i> . 69 : 217-30.								x	
Shafer C. L. 1999. National park and reserve planning to protect biological diversity: some basic elements. <i>Landscape and Urban Planning</i> . 44 : 123-53.								x	
Tempesta M. & Otero M. 2013. Guide for quick evaluation of management in Mediterranean MPAs. <i>WWF Italy, IUCN</i> . 68 pp.			x		x				x
Thompson M. H., Dumont C. P. and Gaymer C. F. 2008. ISO 14001: Towards international quality environmental management standards for marine protected areas. <i>Ocean & Coastal Management</i> . 51 : 727-39.	x		x	x	x		x	x	x
Togridou A., Hovardas T. and Pantis J. D. 2006. Factors shaping implementation of protected area management decisions: a case study of the Zakynthos National Marine Park. <i>Environmental Conservation</i> . 33 : 233-43.			x		x	x		x	
Warner T. E. & Pomeroy R. S. 2012. Paths of Influence: The Direct and Indirect Determinants of Marine Managed Area Success. <i>Coastal Management</i> . 40 : 250-67.			x		x				x
Wells S. & Mangubhai S. 2005. Assessing Management Effectiveness of Marine Protected Areas: A Workbook for the Western Indian Ocean. <i>IUCN Eastern Africa Regional Programme, Nairobi, Kenya</i> , i-viii and 60 pp.		x	x	x		x		x	x
White A.T. 1986. Marine reserves - how effective as management strategies for Philippine, Indonesian and Malaysian coral-reef environments. <i>Ocean Management</i> . 10 : 137-59.	x								

180 **4. Discussion**

181 Thanks to the review of existing studies, potential connections between OS and MPA science have
182 been identified, especially in the way networking, goals and vision are conceived. In both sciences a
183 crucial role has been assigned to these three key organizational dimensions. In MPA science,
184 networking chiefly concerns the relationships that MPAs may have with e.g. corporations,
185 associations or categories of stakeholders. As with any organization, MPA ‘environment’
186 (especially ‘stakeholders’) can affect its success (Agardy, 2000; Lundquist & Granek, 2004; Mascia
187 2003). In this context, the largest research efforts have explored the social environment where
188 MPAs are established and the relationships among the different actors (Fiske, 1992; Jentoft *et al.*,
189 2007). These findings would suggest that a more comprehensive OS analysis would be crucial to
190 interpret and assess MPA effectiveness formally and properly taking into account the nature and
191 impact of ties (their typology, number, relevance, frequency and effects) between MPAs and
192 stakeholders. Goals are one of the two organizational dimensions most often considered in
193 published studies (in 13 of the 20 papers). Their importance has been stressed (see e.g. Shafer,
194 1999) due to the difficulty in defining appropriate criteria and indicators to measure progress
195 without clearly articulated goals (Kay & Alder, 1999). In this perspective, the organizational vision
196 is a very peculiar goal that is regarded in OS as a key variable influencing organizational
197 performance (Baum *et al.*, 1998; Collins & Porras, 1994; Lipton, 1996; Nanus, 1992; O’Connell *et*
198 *al.*, 2011). This concept may provide the most insight on MPA performance, especially in a
199 networking perspective, as the broad and long-term perspective shared by all actors involved in co-
200 management of MPAs along with a common sense of what is needed to achieve (Heylings & Bravo,
201 2007). The well-defined ‘desire for the future’ (or vision) is also considered “very crucial to provide
202 a guide to management and decision making by site managers, meanwhile a lack of details could
203 lead to confusion and failure in execution” (Berliarang & Fang, 2013). Despite the crucial role
204 assigned to the vision, just five researches in overall have taken it into account, probably because
205 the concept of vision is not adequately widespread in MPAs context, yet. Six publications have

206 analyzed the compliance (to the rules and also to the vision of MPA), suggesting that these two
207 variables, vision and compliance, would need more attention.

208 Strategies is a variables taken into account 12 times. Since the strategies are the actions undertaken
209 in order to reach the goals, it seems logic that both strategies and goals are considered in several
210 papers. Nevertheless, not all the papers that consider goals consider also the strategies and vice
211 versa, suggesting that the connection between the two dimensions, useful to evaluate MPAs'
212 performance, is not always evident.

213 Size is an organizational dimension that assesses the resources of the organizations, both human and
214 financial. In other words, the size evaluates the resource that an organization can rely on in order to
215 undertake the strategies and reach the goals. Again, the number of papers that take into account the
216 size and the strategies is the same, and really close to that for the goals. But, none of the papers
217 selected carried out an integrated evaluation of all these variables, pointing out an interesting gap in
218 MPAs science.

219 The professionalism evaluates the qualification of the human resources. The only seven papers that
220 have taken into account such organizational dimension underline that the effects of the level of
221 training of the staff need to be analyzed more deeply.

222 Centralization and formalization have been dealt with in two papers each. In OS both variables are
223 defined as structural dimensions (Daft, 2010) as they are crucial features of any organization, while
224 in MPA science they are evidently marginally considered.

225 Our results show how in MPA science there is a general perception about how a MPA should be
226 evaluated from an organizational point of view. Nevertheless, the discrepancy, between the two
227 sciences, in the importance attributed to crucial organizational dimensions (e.g. vision and size) and
228 related interactions (e.g. among goals, strategies and size) underline as a more coherent interaction
229 between OS and MPAs science is needed in order to better assess MPAs performance and
230 ameliorate their management. So, although some differences remains, for example in terms of
231 context for the use of some relevant variables (as in the case of 'compliance' and 'vision', more

232 used at individual or organizational level in OS and at inter-organizational or environmental level in
233 MPA science), the potential of the integration of OS into MPA science is more than promising. This
234 conclusion stems from the following facts: 1) the size of the OS bibliography concerning different
235 organizations (e.g. public schools, federal government organizations and nonprofit human services
236 organizations) is relevant (Baldy *et al.*, 2014; Jung, 2012; Schmid, 2002); 2) OS allowed to
237 assess/improve the organizations' efficiency; 3) MPAs, considering their intrinsic nature, are
238 'organizations'. In this perspective, OS supplies scientifically valid, robust and consistent tools and
239 theoretical frameworks already tested for other types of organizations and totally applicable to
240 MPAs.

241 In conclusion, this study shows that, although some studies took into account some organizational
242 variables/dimensions of MPAs, no published studies applied comprehensively the OS approach to
243 MPAs conceived as 'organizations'. We believe that there are unexplored components of OS that
244 may be playing significant roles once integrated into MPA science. How many MPA management
245 bodies formally analyze the characteristics of the implicit conflicts whenever they plan, manage and
246 make decisions? How many MPAs are actually aware of the relationship between their internal
247 organization (organizational chart, professionalism, etc.) and their effectiveness in terms of socio-
248 economic and ecological results? How many MPA bodies perceive as crucial the sharing of a
249 'visions' (the local basis of compliance) and actually measure/assess it among internal and external
250 actors? How many MPAs, in the different regions of the world, formally defined their 'goals' and
251 then identified and measured, through pertinent and shared criteria, indicators to properly
252 assess/quantify their progress and success? These are just a few questions focused on some relevant
253 aspects, but there are many other organizational facets that have never been analyzed before using
254 the comprehensive OS framework. As OS is usually applied in economics to assess organization
255 (e.g. enterprises, public organizations and NGOs) performance, there is more than a potential for the
256 application of OS to analyze organizational dimensions of MPAs, in order to better interpret and
257 potentially improve their management effectiveness.

258

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