

## **Low satisfaction and failed relational coordination among relevant stakeholders in Spanish Mediterranean marine protected areas**

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### **Abstract**

Marine protected areas (MPAs) are a conservation tool that are increasingly commonplace around the world. MPAs have the potential to benefit both ecosystems and human communities if well-designed and implemented. Achieving effective creation and governance of MPAs, however, is complicated because they target systems that occupy a space overlapping both the non-human environment and human economies and societies. As a result, MPA success is thought to primarily be dependent on socioeconomic factors, particularly the behavior of stakeholder groups involved in the MPAs. Using the theory of relational coordination, we designed surveys that we delivered to members of four stakeholder groups implicated in five MPAs in the Spanish Mediterranean to investigate their habits of inter- and intra-group communication and relations. Relational coordination posits that high-quality communication and relations results in positive stakeholder behaviors and an effective system, which makes it a useful tool to investigate the effectiveness of the MPAs involved in this study. Our results demonstrate that the presence of a high degree of relational coordination leads to higher satisfaction on the part of the participants in the system. The exploratory model constructed here also supports the notion that each stakeholder group adopts particular beliefs and behaves in particular ways in terms of relational coordination and satisfaction. We found patterns that indicated poor communication and relations amongst the four stakeholder groups, which in turn has grave implications for management outcomes of these MPAs, which cumulatively could precipitate their

failure. To remedy these concerns, we recommend establishing channels of communication between the four stakeholder groups, and investigating means to cultivate good relations amongst these groups. Doing so will help assure management success.

**Keywords:** relational coordination; canonical discriminant analysis; canonical correlation analysis; marine protected areas; fisheries; conservation

## 1. Introduction

Marine protected areas (MPAs) are considered a cornerstone of holistic management of the marine environment. They are increasingly being applied worldwide — there are now more than 15,000 MPAs around the world, which cumulatively cover 7.26% of ocean waters (UNEP-WCMC, 2018). When designed and managed properly, they benefit ecosystems as a whole, individual species (Sala and Giakoumi, 2018), fisheries (Selig et al., 2017) and socio-economic systems (Ban et al., 2017). The caveat here, is that MPAs must be properly managed, with all drivers involved in a well-functioning MPA adequately implemented—the creation an MPA alone does not automatically lead to success (Rife et al. 2013).

Because MPAs are at the interface of complex interacting socio-ecological relationships (Pollnac et al. 2010), their governance is complicated. Many argue that the success of an MPA is primarily dependent on socioeconomic factors rather than physical or biological factors (McClanahan 1999; Clarke et al. 2016; Christie 2004). Despite the essential role of an MPAs structural attributes (e.g., size, zoning), the success and failure of an MPAs performance is more often related to “contextual factors,” specifically with regard to stakeholder engagement (Giakoumi et al., 2018). An MPAs success is therefore determined by key factors that affect a socioeconomic systems’ interactions with the ecological system, such as effective enforcement, the presence of a management plan, stakeholder engagement during MPA design and management, stakeholder representation in MPA boards, and the promotion of sustainable fishing practices (Di Franco et al., 2016), all of these factors being affected by site-specific contexts (Christie, 2004).

Many MPAs fail due to shortfalls in meeting thresholds for effective and equitable management, often due to widespread shortages in staff and financial resources dedicated to MPA management combined with a deficient level of stakeholder

engagement (Rife et al. 2013), which encompasses the factors listed above, such as rule enforcement or execution of the MPA management plan (Gill et al., 2017).

Various studies have identified stakeholder satisfaction as a critical factor for the performance of any process (Cummings, 1970; Margalina et al., 2014), so it is important to investigate how MPAs can achieve high levels of stakeholder satisfaction. Despite the importance of satisfaction, however, the scientific literature on MPAs has yet to address it. The relationship between satisfaction and performance has been studied mostly in the industrial sector, in which numerous studies have demonstrated that satisfaction is one of the principal factors in performance (Kornhanuser & Sharp, 1976; Mirvis & Lawer, 1977). Therefore, it would be important to look into the levels of stakeholder satisfaction in the context of MPAs to help identify methods to cultivate management success.

Communication in particular has been identified as an important element of many characteristics necessary for the success of marine protected areas (MPAs), such as stakeholder compliance, stakeholder support, inclusion of stakeholders in the management and planning process, adaptive management, institutional legitimacy, and conflict prevention (Jentoft 2000, Board 2001, Jameson 2002, McClanahan et al. 2005, Salm and Siirila 2000, Pomeroy et al. 2007, Ramirez 2016, Pahl-Wostl 2009, Engle and Lemos 2010, Olsson et al. 2004, Chang et al. 2012, Muawanah et al. 2012, Pomeroy et al. 2016, Stamieszkin et al. 2009). All of these factors are related with stakeholder engagement and problems that arise as a result of the lack of these factors are derived from a lack of common aims among stakeholders. This quandary is the subject of relational coordination theory (Gittell, 2003) which proposes that high quality communication, supported by shared goals, shared knowledge and mutual respect results in positive stakeholder behaviors and learning and adaptation in the pursuit of achieving desired outcomes. Therefore, using the relational coordination framework, which emphasizes the importance of communication for the effectiveness of a system, to analyze the effectiveness of MPAs may elucidate the state and causes of this lack of communication.

Relational coordination construes coordination within a work setting to be a relational process, constituted by shared knowledge of the work and the context and in which it is done (Crowston and Kammerer, 1998; Faraj and Xiao, 2006; Gittell et al. 2008) It asserts that the effectiveness of coordination in a system is determined by the quality of communication amongst participants in the system (Gittell 2006; Gittell et al.

2008). Here, quality communication refers to its frequency, timeliness, accuracy, and a focus on problem solving rather than blaming. The quality of communication depends on the quality of the interactants relationships, which here is defined by the degree to which they share goals, share knowledge, and have mutual respect for one another (Gittell 2006; Gittell 2008). Relational coordination is expected to be particularly important for achieving desired objectives in systems that are characterized by high levels of task interdependence, uncertainty, and time constraints (Gittell et al. 2008). These are all characteristics that describe MPAs:

- 1) *Task interdependence*—many tasks depend on each other for success, for example enforcement is necessary for compliance, which is in turn necessary for the marine reserve to achieve its ecological objectives, and participation and inclusion of stakeholders is necessary for stakeholder support, stakeholder compliance, and adaptive management.
- 2) *Uncertainty*—Ecosystems are complex entities about which we know little. Take the philosophy behind adaptive management. It is a management system grounded in the admission that humans do not know enough about ecosystems to manage them (Lee 2001). In these circumstances, expert knowledge of local stakeholders can be the key to understand how the ecosystem works. Given the uncertainty surrounding marine ecosystems, many studies have recommended adaptive management as the ideal management system for MPAs (Rees et al. 2013, Agardy et al. 2003, Kelleher and Phillips 1999, Rossiter and Levine 2014, Day et al. 2002, Mascia 2003).
- 3) *Time constraints*—Many international agreements have set deadlines for conservation goals, including for marine conservation, therefore there is the obligation to conserve a given portion of all marine resources before a given date.

For these reasons, this research uses the relational coordination model to explain the level of stakeholder satisfaction in MPA context. Using the relational coordination framework, we designed a survey to be delivered to four distinct stakeholder groups to gauge stakeholder satisfaction, the relationships and communication amongst stakeholders across groups and within groups. Questions included in the survey measure factors listed above. The secondary goal of this study was to characterize the perceived satisfaction and the quality of communication and the quality of relationships. The results present an image of the condition of inter- and within-group relations, which in turn provides implications for the status of the socioeconomic system in its orientation to the MPA, and whether any social threats may be present. This study is the first

attempt to analyze the performance of the MPAs in terms of stakeholder satisfaction, and in relation to stakeholder communication and relationships among stakeholders in the framework science of MPAs.

## **2. Material and methods**

### ***2.1. Locations and study design***

The study involved surveys delivered to stakeholder groups associated with 5 of the 19 MPAs in the Spanish Mediterranean: Serra Gelada, San Antonio, Tabarca, Cabo de Palos, and Cabo Tiñoso (**Figure 1**). Four primary stakeholder groups are associated with the marine protected areas: fishermen, divers, scientists, and managers. Fishermen and divers are user groups that practice extractive or recreational activities in or around the MPAs and therefore stand to benefit economically from them. The activity of fishermen and divers is regulated by the managers, while the scientists carry out the monitoring the ecology of the MPA (e.g. species richness, population dynamics, abiotic conditions of the water).

Data was gathered through surveys delivered in person to fishermen, and via email to dive center operators, scientists, and managers associated with or knowledgeable of the MPAs selected for this study. The survey comprised 35 questions that used a 5-point Likert scale, in which the higher scores indicate more agreement with the statement given.

The survey was designed to measure the satisfaction of the relevant stakeholder groups with regards to the MPAs, as well as the relational coordination amongst these groups. The relational coordination was measured using a questionnaire embedded in the survey that covered seven dimensions developed by Gittel (2006). This instrument measures two interactional factors: supportive relationships and quality communication. Shared knowledge, shared goals, and mutual respect characterize supportive relationships, while timely, accurate, frequent, and problem-solving communication distinguish quality communication. Participants were asked to answer questions regarding the behaviour and perceived beliefs of all others stakeholder groups. For example, scientific participants were asked, “How much do the fishermen respect the role you play in the management of the marine reserve?”.

The satisfaction of the stakeholder groups was measured using seven questions – three regarding the satisfaction with the MPA (specifically with regards to its objectives,

its current socioecological state, and its management), and four regarding the satisfaction with the other three stakeholder groups, and the stakeholder group the interviewee was a part of. Surveys were delivered to 60 fishermen, 12 diving center operators, 38 scientists, and 6 managers – these numbers represent 68.9% of the fishermen, 90% of the diving center operators, 85% of the scientists, and 100% of the managers involved in the MPAs analysed in this study. The number of stakeholders interviewed for each group was proportional to the total number of stakeholders in each MPA.

## **2.2. Statistical analysis**

Preliminary testing of data was carried out to determine outliers to be discarded before further analysis. Next, multivariate analysis was used to answer the two questions of this study. (1) Are the satisfaction and relational coordination that each stakeholder group imbricated in the MPA perceives similar to those of other groups or does each group adopt beliefs and behave in a way unique to that group? (2) What relationships exist between the variables that comprise our measurement of satisfaction and relational coordination?

### **2.2.1. Satisfaction and relational coordination of stakeholders: canonical discriminant analysis and clustering**

The answer to the first question was resolved by two multivariate techniques. The first is the canonical discriminant analysis (CDA) (Everitt & Dunn, 1991; Tabachnick & Fidell, 1996), which gave us information about the similarities of the stakeholder groups step by step (communication, relationship, and satisfaction) and globally. The first step in the CDA was to determine the *a priori* basis for grouping the stakeholders. The analysis was developed separately for each of the blocks (communication, relationship, and satisfaction) and for the whole group of variables.

The efficiency of the discriminative power of a given model was determined by the test of significance of the Wilks' lambda value. The capacity of prediction for each model was tested using the absolute assignment of individuals to the pre-assigned group. The distances among groups were determined using the Mahalanobis distances among groups and their statistical significance. Stepwise discriminant analysis was used to determine the discrimination ability of the variables, either forward or backward (Caballero-Villalobos et al., 2018).

The CDA resulted in a graphic representation of the location of the observations in the space formed by the first two grouping variables. It gave a visual confirmation of the existence of groups among the variables. Thus, we generated similar graphic representations for the whole group of variables and its blocks.

The second involves clustering based on the Euclidian distances among groups calculated with individual Mahalanobis distances (Everitt & Dunn, 1991; Tabachnick & Fidell, 1996). This analysis gave us information regarding the concrete relationships that exist among the discriminated groups. The cluster analysis was appropriate because it provides not only a simple representation of the groups but also a quantification of the relationships among these groups (Tabachnick & Fidell, 1996) and complements the discriminant analysis because the latter explores only associations between data without explaining why they exist. In this research we have used the joining tree clustering method, which is based on a plot that shows linkage distances along the horizontal axis. Every node in the representation points out where a cluster is defined. When the data have a structure, with groups of similar elements, this grouping (structure) is established in the hierarchical tree in the form of different branches. Euclidian distances were used for the analysis.

Clustering analysis was carried out among the groups formed with individuals belonging to each stakeholder group. These analyses were developed using the individual Mahalanobis distances performed in the canonical discriminant analysis and were carried out for the whole group of variables and for each of its blocks (communication, relationship, and satisfaction). The results are provided as individual plots representing the determined clusters and their linkage points.

### ***2.2.2. Relationships among groups of variables: canonical correlations***

The second question was answered by a canonical correlation analysis (CCA) among groups of variables integrated within each of the blocks (communication, relationship, and satisfaction). This is a multivariate statistical model to study the interrelationships among groups of multiple dependent variables and multiple independent variables (Rivas et al., 2019). The main CCA principle is the building of successive pairs of canonical variables, that are lineal combinations from original ones, in such a way that each pair can be orthogonal to the previous one and represent the best explanation for  $Y$  group, composed by  $q$  dependent variables respect to the group  $X$ ,

composed by  $p$  independent variables, that have not prior been obtained by previous pairs (Liu et al., 2009). We use this technique to determine the magnitude of the relationships that may exist between the groups of variables, and to measure the relative contribution of each variable to the canonical functions.

We analyzed the canonical correlations by paired groups of variables: communication-relationship, communication-satisfaction, relationship-satisfaction, and relational coordination-satisfaction. Thus, we obtained the values of the canonical correlations and their significance by means of chi-square tests with successive roots removed. Canonical coefficients of the determinations are also shown. As an indicator of the robustness of the canonical correlations, the calculated variance and the total redundancy are also shown for each set of variables. The interrelationships within the collection of stakeholder groups were analyzed. All statistical analyses were performed using XLSTAT.

### **3. Results**

#### ***3.1. Satisfaction and relational coordination perceived by each stakeholder group***

**Table 2** shows the satisfaction and relational coordination perceived by each group of stakeholders.

The managers are the most satisfied stakeholder group. They also have the most positive perceptions of the relational coordination amongst the various groups. This group believes that the communication of other groups with managers is sufficiently frequent, timely, and accurate. However, they also believe that this communication does not adequately address what must be done to resolve issues related to the MPA. The measures of relational coordination generally yielded positive results with regards to this group. Healthy relationships with scientists and other managers, relative to the other groups, stand out. The managers are satisfied with the management and objectives of the MPAs, as well as the state they were in at the time they took the survey. They are also satisfied with scientists and other managers. The level of satisfaction is middling with regards to fishermen and divers.

The scientists believe that the communication from other groups with them is not sufficiently frequent, timely, or accurate. They are satisfied with within-group communication. However, they also consider the communication with them to adequately address the potential solutions to problems affecting MPAs. Scientists, in



general, have a mixed opinion with regards to aspects of relational coordination. They carry the most positive opinions on within-group relations and on relations with managers. They carry the most negative opinions of their relations with the fishermen. The scientists believe that the information fishermen and divers share with them is insufficient. They believe that they share objectives with managers and other scientists, though they only feel respected by other scientists. The scientists are only satisfied with their own group. The level of satisfaction is medium with regards to the other groups, with the objectives of the MPAs, the state of the MPAs, and their management.

The fishermen are the most unsatisfied stakeholder group. They also have the least favorable perceptions with regards to relational coordination. This group believes that the other collectives communicate and connect with them insufficiently—they gave negative responses to every aspect evaluated. Concerning within-group communication and relations, their perceptions are more positive regarding the following components of relational coordination: mutual respect, shared objectives, and timely and accurate communication. Fishermen are only satisfied with their own group. They are somewhat satisfied with the objectives of the MPA, the state of the MPA, and its management, and with the rest of the stakeholder groups.

The divers believe that the communication with managers and fishermen is infrequent and rarely timely or accurate. However, they also believe that the communication adequately addresses the resolution of problems with inter-group conflict with regards to every group. Divers have negative perceptions of all aspects of relational coordination with fishermen, and positive perceptions with other divers. They believe they share objectives and mutual respect exists with managers and scientists; however, they also believe that the information they receive is insufficient. The level of satisfaction is high with regards to the objectives of the MPA and their own group, medium with regards to the state of the MPA and with managers and scientists, and low with fishermen and with the management of the MPA.

### ***3.2. Differentiation of stakeholder groups***

The CDA gave results relating the possibility of differentiating amongst the various stakeholder groups implicated in the MPAs based on the perceived relational coordination and the satisfaction reached. **Table 1** shows the results obtained by the analysis with all measured variables present, as well as the variables relative to each

group (i.e. communication, relations, and satisfaction). In every case, the discrimination between the stakeholder groups was evident because the F statistics of the Wilks Lambda were always significant for the first discriminant variable.

The model based in the three groups of variables revealed that the four stakeholder groups can be easily differentiated. This result is supported by the Mahalanobis distances between the groups (**Table 1, complementary material**) and the matrix of classification of each subject in its preassigned group (**Table 2, complementary material**), which shows that the distances between the groups were significant, and that 98.28% of the subjects were correctly assigned.

This is more evident in the graph representing the results in two dimensions (**Figure 2**). The relational coordination and satisfaction clearly differentiated the four stakeholder groups. The cluster analysis supported these results, since the Euclidian distances obtained demonstrate clear divisions amongst the groups (**Figure 3**).

The F-statistics indicate a larger capacity of discrimination on the part of the two models based in the relational coordination variables (i.e. communication and relations). Both discriminant models correctly classified all the subjects in their preassigned groups. The graphs in **Figure 2** shows some overlap between managers and scientists with respect to communication and relations. The groupings obtained demonstrate that communication and relations clearly differentiate fishermen and divers, while there exists some similarity between managers and scientists.

The model based in variables measuring satisfaction demonstrated relatively lower capacity for discrimination. The model correctly classified 77.59% of the subjects in their preassigned groups. The graph in **Figure 2** and the grouping obtained show that only the fishermen are clearly differentiated from the other groups.

The variables with the most discriminative capacity are highlighted in **Table 3**. The variables involved in satisfaction with goals, management, and the condition of the MPAs did not lead to important differences amongst the stakeholder groups. The highest discriminative capacity corresponds to variables that measure frequency of communication, shared knowledge, shared goals, and satisfaction with divers, scientists and managers. Through stepwise discriminant analysis, the variables that discriminate amongst pairs of stakeholder groups were identified (**Table 4**). Frequent communication with divers (FD(D)) differentiated all the pairs of stakeholder groups. The variables with lower discriminant frequency were timely communication with scientists (TC(S)),

frequent communication with fishermen (FC(F)), mutual respect for fishermen (MR(F)), shared objectives with fishermen (SG(F)), and satisfaction with fishermen (S(F)).

### ***3.3. Relationships among groups of variables***

Through models of CCA, we sought to answer the question of whether relational coordination explains the satisfaction of the stakeholder groups implicated in the MPAs. We constructed four CCA models (relational coordination; satisfaction, communication; satisfaction, relationship; satisfaction and communication; relationship) whose general characteristics are listed in Table 5. We found high, statistically significant canonical correlations within the general frame of relational coordination, and between the characteristics of communication, the relational characteristics, and the characteristics of satisfaction (Table 6). When we analyzed satisfaction with relational coordination, there was sufficient evidence to confirm that the traits of satisfaction were strongly correlated with the traits of relational coordination. The relationship between the traits of communication and the relational traits was very strong, and the relationship was also strong between the traits of satisfaction, the traits of communication, and the relational traits.

Figure 4 depicts the structure of correlation amongst the traits analyzed here, and the two first pairs of significant canonical components in each model (in Tables 3 through 6 and in X the complete structure of correlation is available). The model created with the whole set of variables explained 56.8% of the variation in relational coordination and 100% of the variance in satisfaction. The first four pairs of canonical variables were significant and accounted for 78% of the variability in the data (**Tables 5 and 6**). The first pair of canonical variables principally contains information related to managers and scientists, with a correlation between canonical variables of 0.898 (**Figure 4**). This grouping positively relates the relational components and frequency and accuracy of communication with managers and scientists with the satisfaction with these same groups. The second pair of canonical variables has a correlation of 0.784, and indicates that the satisfaction with the fishermen depends primarily on the mutual respect that each groups perceives the fishermen has for them. The third pair of canonical variables has a correlation of 0.734 and indicates that the satisfaction with the objectives of the MPA primarily depends on the communication with fishermen. The fourth pair has a correlation of 0.675 and shows a slight relationship between the

satisfaction with the objectives and the state of the MPA, and the goals of divers and fishers.

Four pairs of significant canonical components relate the traits of communication with the relational traits. The first pair shows that relationships with the divers, the scientists, and the managers strongly depends on communication with these groups. The second pair relates the communication and the exchange of knowledge with scientists. The third pair primarily contains information about the communication and the relationships with divers. The fourth pair indicates that the communication with fisherman improves the perception of common objectives with them.

We have identified four pairs of significant canonical components amongst the traits of communication and the traits of satisfaction. The first shows the positive relation between communication amongst divers, scientists, and managers, and the satisfaction with said stakeholder groups and with the state and management of the MPA. The second pair indicates that frequent communication with fisherman improves satisfaction with them. The third pair positively relates the communication and satisfaction with fisherman and divers, and with the objectives of the MPA.

We have identified four pairs of significant canonical components between the relational traits and the traits of satisfaction. The first pair shows that the relationships with divers, scientists, and managers positively affects the satisfaction with these stakeholder groups and with the state and management of the MPA. The second pair contains information on the satisfaction with the managers, which is related primarily with the respect that fisherman express. The third pair involves the satisfaction with the fisherman, which is related primarily with the existence of common objectives with them. The fourth pair demonstrates that sharing objectives with fisherman also positively affects the satisfaction with the objectives of the MPA.

#### **4. Discussion**

The managers have demonstrated the highest levels of satisfaction with the functioning of the MPAs. They also have a more positive perception of their relations with the other stakeholder groups. In the extreme opposite end are the fishermen, who are only satisfied with other fishermen. The four stakeholder groups studied here show specific patterns of communication, relations, and satisfaction, evidencing that they share very few opinions on the functioning and state of the MPAs. In terms of communication

and relations, the managers and the scientists have similar levels of perceptions, while fishermen and divers have very different levels. The fishermen are the most dissatisfied with the functioning of the MPAs, principally because of the lack of frequent communication about the functioning of the MPAs, and the lack of shared objectives.

The perceptions and beliefs amongst the various stakeholder groups, and their behaviors in and around the MPA are clearly different between groups and very similar within groups. This finding is a result of the difference in each groups respective interests, a finding also seen in other sectors of the economy (Khosla et al. 2016; Gjerding and Kringelum 2018). The fisherman depend on their [incomes from harvesting](#), which, in the years immediately after the establishment of an MPA, reduced by the MPA (Hilborn et al., 2004; Fletcher et al.,2015) [which doesn't occur to other consumptive stakeholders such as divers](#).

The failure to adapt their fishing practices to -medium- to long-term plan, and the lack of a collective awareness to rationally manage their fisheries generates in the fisherman the perception that the creation of an MPA is a threat. This would explain the fishermen's initial stance against the MPA. On the other hand, the lack of satisfaction with the management of the MPA and with the other stakeholder groups results from a lack of relational coordination, which originates in the processes of design, implementation, and management of the MPAs. The process of MPA implementation tends to begin with the state-level agencies or NGOs, with the primary goal of protecting and conserving ecologies of interest, which almost always coincide with fishing grounds important for local fishermen. Although the fishermen are given an audience to the MPA design and implementation process, ecological conservation concerns always supersede fishing interests, [feeling very alienated over the process of MPA designation](#). This displacement of fishing interests generates short-term limitations for the development of fishing economies. The lack of adequate communication on the part of the state results in a lack of understanding of these issues amongst fishermen, and the perception that the MPAs are not well-justified. The fishermen are also the stakeholder group that can offer the most information about the MPAs to scientists and managers, and they believe that they could therefore contribute more in decision-making processes regarding MPA design and management.

We found that the divers had perceptions similar to those of the fisherman with respect to the managers and scientists, most likely because their business also depends on access to the MPA. Yet their business also depends on the MPAs state—for this rea-

son, the establishment of MPAs (which tend to protect particularly interesting and scenic marine habitat). Therefore, the creation of an MPA, which tends to take place over marine habitats of interest for recreational divers, may be seen as an opportunity for the divers that could improve their short-term benefits, and which could be improved in the medium- to long-term if the MPA persists. This would explain the high satisfaction the divers report with the objectives of the MPA despite the fact that they also report a lack of adequate communication, as well as a lack of good relationships with managers and scientists. [These patterns between fishers and divers have been reported similarly in other studies \(Suman et al., 1999\).](#)

The scientists report the most similarity with the managers, although they note deficiencies in communication with them and in relation to the information that other stakeholder groups share with them. They share objectives with the managers, but they relate poorly with the fishermen. This result may derive from the conservationist ideology that prevails in this stakeholder group, which is shared with the managers and divers. As the MPAs studied have an important fishing function, the managers and the scientists should consider economic criteria of sustainable use when managing MPAs to better attend to the objectives of the fishermen. On the other hand, the lack of frequent communication and high-quality communication with—primarily—managers and scientists also influences the poor relationships amongst these three stakeholder groups. This would explain the bad opinion scientists express about the fishermen, evidenced in this study. While the satisfaction of the scientists with the state of the MPA is not thoroughly coinciding with the managers, owing to the fact that the creation of the MPA manifested in possibilist terms to appease everyone involved and create the MPA without applying all of the scientific directives dictated by the studies that justify the creation of the MPA. This, together with the lack of investment in the MPA to carry out studies and monitoring, forms the base of differences in perception that scientists and managers report with regard to the objectives, state, and management of the MPA.

Communication between stakeholders and experts is essential for user support of MPAs, whether communication involves information flow from experts to stakeholders regarding results from monitoring, or from stakeholders to managers and scientists regarding their own traditional knowledge garnered over generations of fishing experience (McClanahan et al. 2005, Salm and Siirila 2000, Olsson et al. 2004). MPA managers should be mindful of this need throughout the management process (including aspects like monitoring and decision-making), clearly explaining, in coordination with the scien-

tists, what the state of the MPA is, and how this could contribute to reaching the médium- and long-term objectives of each stakeholder group. Lack of communication between various stakeholder groups and MPA managers can result in lack of trust, anger, suspicion, and feelings of marginalization amongst affected stakeholder groups, which can potentially result in the collapse of the MPA (Rodriguez-Martinez 2008, Mascia 2003, Kritzer 2004, Salm et al. 2000, Kelleher and Phillips 1999, Pomeroy et al. 2007, Tawake et al. 2001, Ramirez 2016, Chang et al. 2012, Christie 2004, Stamieszkin et al. 2009, Pollnac et al. 2001, Lundquist and Granek 2005). From our results in this study, it is evident that the self-satisfaction demonstrated by managers with the development of the MPA, combined with a lack of communication has resulted in feelings of dissatisfaction on the parts of divers and fishermen.

Communication is also an essential component of stakeholder inclusion, and feelings of inclusion amongst stakeholders, which in turn is another factor important for successful management of an MPA (Rodriguez-Martinez 2008, Mascia 2003, Kritzer 2004, Salm et al. 2000, Kelleher and Phillips 1999, Pomeroy et al. 2007, Tawake et al. 2001, Ramirez 2016, Chang et al. 2012, Christie 2004, Stamieszkin et al. 2009, Pollnac et al. 2001, Lundquist and Granek 2005). If active, engaged communication is taking place then it is likely that stakeholder groups are actively participating and influencing decision-making processes rather than being included in name only while in actuality being left out of, or isolated from, any deliberations (Pomeroy 2007; Ramirez 2016). In other words, communication must take place for participation to actually happen rather than becoming ‘paper participation’—similar to the ‘paper parks’ that exist in name only. Again, our results from this study have negative implications about the inclusion of stakeholders and their perceptions of whether or not they feel included. Moreover, fishermen (who were delivered surveys in person), often commented on their belief that they do not have a voice, or that the government tells them what to do and they do not have any say. Ultimately, these conditions may result in low stakeholder support of the MPA.

Institutional legitimacy may be built up by creating structures that allow for communication and deliberation on management and implementation of MPAs (Jentoft 2000). Relational coordination therefore has the potential to increase institutional legitimacy given the importance of constructive communication in this theory. It is possible that if the fishermen have been properly involved in deliberation and decision-making processes then the legitimacy of the cofradias may be transferred over to

the MPAs themselves (Jentoft 2000). Again, this is evidently not the case. We cannot make conclusive claims about stakeholder attitudes regarding the perceived legitimacy of the MPAs amongst user groups like fishermen and divers, but our results have negative implications for these perceptions.

Conflict can destabilize an MPA and potentially cause its collapse. Stakeholder participation and engagement is thought to help alleviate conflict that may result from implementation of MPAs (Chang et al. 2012, Muawanah et al. 2012, Pomeroy et al. 2016, Ramirez 2016, Pomeroy et al. 2007, Stamieszkin et al. 2009). Such engagement by necessity involves meaningful communication between local stakeholders and higher-up officials and managers to facilitate a more decentralized decision-making process (Pomeroy et al. 2016). Relational coordination may thus support conditions that are conducive to conflict alleviation and prevention. In the context of the MPAs we have included in our study, it is clear that the threat of conflict is elevated due to poor relations and lack of communication between the various stakeholder groups, particularly between scientists and managers, who have more power and authority, and fishermen and divers (the two user groups “on the ground”). In fact, our results demonstrate that communication aimed at the resolution of problems is not associated with relational variables nor with variables describing satisfaction. The structures of management in place should pay more attention to the potential that communication has the potential to resolve conflicts.

Winning stakeholder support ultimately can increase the likelihood that stakeholders will change their behaviors and comply with MPA rules (Kritzer 2004, Salm et al. 2000, Tawake et al. 2001). Further, participatory decision-making may also lead to social learning, building trust, and enhancing the legitimacy of MPA rules and regulations (Mascia 2003, Jentoft 2000). Therefore, relational coordination may increase compliance by increasing stakeholder support and encouraging participation of stakeholders in decision-making processes. The key stakeholder groups with regards to winning support and compliance with MPA rules are the divers and fishermen. We found that in the MPAs studied fishermen believe that the other stakeholder groups communication with them is insufficient in every regard, as do fishermen. These conditions suggest the possibility that fishermen and divers are more likely to disobey MPA rules, which in turn can destabilize the MPA.



## 5. Implications -and Conclusions

In this study we have applied the model derived from relational coordination to the context of MPAs. We have demonstrated empirically that a high degree of the standard measures of relational coordination amongst stakeholder groups results in better performance of the MPA system in terms of stakeholder satisfaction. The level of stakeholder satisfaction with the objectives, state, and management of the MPA is influenced by the following dimensions of communication and relationships composing the relational coordination model: frequent, timely, and accurate communication; mutual respect; and the existence of shared objectives. However, we have not demonstrated that communication oriented towards problem solving has a positive impact on stakeholder satisfaction. We have also demonstrated that communication has a positive impact on the relational dimensions of relational coordination. Therefore, MPA management may better satisfy stakeholders via communicative mechanisms and through high quality relationships amongst stakeholders.

The exploratory model constructed here also demonstrates that, under the relational coordination model, each stakeholder group adopts particular beliefs and behaves in a particular manner in the context of an MPA socio-ecological system. Frequent communication, knowledge exchange, shared goals, and satisfaction with divers, scientists, and managers are the principal factors that differentiate the four stakeholder groups. Given these findings, those in charge of MPA management should consider how to cultivate more similarities between relevant stakeholder groups [to increase the sharing of common objectives and](#) to better the performance of the reserves in terms of satisfaction.

Apparent from the results of this study is the lack of good relations and communication amongst the various stakeholder groups. Considering the breadth of factors important for effective MPA management that relational coordination underlies, these results are concerning. An amalgam of issues that are all interconnected—user support of MPAs, compliance with MPA rules, participation in management and design, feelings of inclusion in the management process on the part of the user groups, conflict mitigation, perceived institutional legitimacy—are at least in part cultivated by relational coordination. A lack of these components can ultimately result in MPA failure. Our results suggest significant fragmentation amongst the various stakeholder groups, especially between on the ground user groups like the fishermen and divers and the

groups with more authority, like the managers and scientists. Channels of communication are evidently non-existent, which suggests a lack of suitable formal structures which would facilitate interaction between these stakeholder groups, such as educational workshops or public meetings. Our results also evidence that the formal management structures do not achieve their principal objective, which is to generate the general acceptance of the MPA. Managers, scientists, and policy-makers must take these issues into account when creating MPAs and designing their management plans—channels of communication must be established, and good relations cultivated amongst stakeholder groups, in such a way that each stakeholder group understands what other stakeholder groups do and what benefits they may receive from them. An improved application of economic criteria of sustainable use would also be create conditions conducive for fisherman to adopt more proactive roles in line with the interests of the rest of the stakeholder groups. The ultimate end of MPAs ought to be to obtain the maximum utility of the ecosystem in terms of conservation and sustainable use, aside from preserving the cultural, immaterial, and ecological heritage that tends to exist in marine ecosystems protected by MPAs. Attending to these issues will assure that MPAs are a success.

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