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Management effectiveness of a large marine protected area in Northeastern Brazil

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ABSTRACT

Brazil has one of the largest protected areas (PA) systems in the world but just a small fraction is devoted to the protection of marine habitats. The effectiveness and integrity of PA are being challenged and questioned worldwide and this situation is not different in Brazil. Poorly managed PA are more vulnerable to habitat loss, poaching and other threats. Alarmingly, studies have shown that just a fraction of the current PA can be considered effectively managed. Facing such scenario, studies on the effectiveness of the management of PA – and especially marine PA (MPA)- become essential to enhance the role these areas play in biodiversity conservation, as well as provide useful tools for managers and decision-makers. Using the Rapid Assessment and Priorization of Protected Area Management (RAPPAM) methodology, we evaluated the management effectiveness of the largest MPA in Brazil, the Environmental Protected Area Costa dos Corais (APACC, IUCN category V). In a rare opportunity in the context of Brazil's PA system, we were able to access the management effectiveness of APACC over a 15-year period, tracking progresses, identifying strengthens and weaknesses experienced. The overall management effectiveness of APACC has improved over the last 15 years. Although there were variations, five out of 14 indicators analyzed presented improvements while nine remained stable over the years. Finance was the module that contributed the most for the general improvement of APACC. Contrary to many other PA worldwide, which face budget restrictions, APACC's financial situation is currently stable and such stability may have had a positive effect on other management modules, like Infrastructure and Outputs. Research, Monitoring and Evaluation was among modules with slower progress, which is a contradiction considering APACC is amongst the Brazilian MPA with more research. The feedback from researchers is considered poor and most of the research conducted considered not useful for management purposes. Tourism has the highest increase in criticality, being not only the biggest pressure, but also the main threat. Considering that there were improvements in other areas, increasing APACC's limited staff should be a priority for the coming years. RAPPAM proved to be a quick and easy-to-apply methodology, making it effective for temporal analysis on the management of MPA. However, caution is necessary when analyzing some of RAPPAM results. Frequent changes in the management staff, poor records of the management process and the activities adopted, and incomplete transference of information between staff members inevitably compromises the answers and the overall accuracy. RAPPAM needs *in loco* validation of the answers and this could be a time consuming process for large PA. For better results, RAPPAM could and should be applied together with other evaluation methods.

1. Introduction

In a fast changing world, the conservation of marine and terrestrial environments has become a major challenge (Balmford et al., 2005; Pimm et al., 2014; Ceballos et al., 2015; Haddad et al., 2015). There are many strategies and approaches for the conservation of the world's biodiversity (CBD, 2014) and many international commitments were set (e.g Aichi Targets). However, despite all the problems and criticism, protected areas (PAs) are still considered one of the most efficient strategies for *in situ* biodiversity conservation (Palumbi, 2004; Chape et al., 2005; Sale et al. *2005*; Watson et al., 2014).

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Although there is a high number of protected areas on the planet (~162,000) covering a considerable area (~5.6% of planet's surface – Watson et al., 2014), they are spatially biased towards terrestrial ecosystems and the nearly 7.300 marine PAs (hereafter MPA) cover only about 3% of ocean's surface (Watson et al., 2014). Expanding the extension and coverage of MPA is an actual challenge (Halpern et al., 2008; Veitch et al., 2012). Such scenario is beginning to change since MPA are seen today not only as a tool for the conservation of marine biodiversity, but also for the management of fish stocks (Gell and Roberts, 2003; Sale et al., 2005; Lester et al., 2009), with many studies pointing out to an increase of fisheries in and around MPA (Halpern and Warner, 2002; Claudet and Guidetti, 2010; Edgar et al., 2014).

Brazil has one of the largest PA systems in the world (WDPA, 2015) but just a very small fraction is devoted to the protection of marine habitats. The establishment of MPAs in the country had a late start and the first Brazilian MPA (Atol das Rocas Biological Reserve) dates from 1979 (Prates, 2007). Today, Brazil has ~1.8% of its marine area covered by approximately 300 MPAs in both coastal and marine zones (Magris et al., 2013; Schiavetti et al., 2013), being 62 of them federal (Gerhardinger et al., 2011). Although a signatory of global agreements committed to the expansion of its MPA network by 2020 (Magris et al., 2013), in the last years the creation of marine and terrestrial PAs in the country has stagnated (Bernard et al., 2014).

The effectiveness and integrity of PA are being challenged and questioned worldwide (Dowie, 2009; Fuller et al., 2010; Mascia and Pailler, 2010; Rife et al., 2012) and this situation is not different in Brazil (Magris et al., 2013; Bernard et al., 2014; Ferreira et al., 2014; Araújo et al., 2015). Poorly managed PA are more vulnerable to habitat loss, poaching and other threats (Watson et al., 2014). Alarmingly, studies have shown that just a fraction of the current PA can be considered effectively managed (e.g. Craigie et al., 2010; Leverington et al., 2010; Clark et al., 2013). The few studies on the effectiveness of PA in Brazil highlight a critical scenario: An assessment conducted in 2005 and 2006 in 245 Brazilian federal PA showed that only 13% of them were highly effective (Onaga and Drumond, 2007). In fact, the latest CBD targets calls for PA to be effectively managed, but MPA present unique challenges for managers, like border delimitation and enforcement (Brock et al., 2012).

Against a scenario of increasing pressures, scarcity of financial resources and declining political support (Watson et al., 2014), studies on the effectiveness of the management of PA – and especially MPAs- become essential to enhance the role these areas play in biodiversity conservation, as well as provide useful tools for their managers and decision-makers (Day et al., 2012). The study presented here aimed to contribute on filling such a gap. Using the Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) methodology (Ervin, 2003), we evaluated the management effectiveness of the largest MPA in Brazil, the Environmental Protected Area Costa dos Corais (hereafter APACC), one of the most prolific sites for marine research in the country (e.g. Ferreira et al., 2001; Frédou and Ferreira, 2005; Ferreira and Maida, 2006). In a rare opportunity in the context of Brazilian's PAs, we were able to access the management effectiveness of APACC over a 15-year period, tracking progresses, identifying strengthens and weaknesses experienced, as well as forecasting important features for APACC over the next 5 years, as predicted by the methodology.

2. Materials & methods

2.1. Study area

The Environmental Protected Area Costa dos Corais is an IUCN category V MPA established in 1997 by federal decree (Brasil, 1997). APACC covers an area of ~413,000 ha, from the maximum high tide line up to 20 miles into the ocean (Fig. 1), bordering 12 cities between Maceió, in Alagoas State (9°32′51″ S, 35°36′59″ W) and Tamandaré, in Pernambuco State (8°42′16″ S, 35°04′40″ W) (ICMBio, 2012). With the exception of Maceió, all the cities covered by APACC rely on fishing and/or tourism as main income source. Those 12 cities have a total population of 1.064.718 people, with a *per capta* income of approximately U$ 1600.00 (IBGE, 2014).

APACC was created for the conservation of a large coral reef present in the area, as well as to protect local mangroves and one of the last populations of the marine manatee (*Trichechus manatus*) in the Brazilian coast (ICMBio, 2012). Until 2007, APACC was managed by Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA), when this responsibility changed to Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio). Currently, APACC has two offices (Tamandaré and Maceió) and a technical staff of one manager (in charge since 2012) and three environmental analysts (the oldest since 2009).

APACC's management council was set in 2011, with 27 seats representing different sectors that have a direct or indirect influence in the area (ICMBio, 2011a). In 2012, its management plan was concluded and a zoning system proposed with seven different classes: Sustainable Use Zone; Beach Zone; Conservation Zone; Fishing exclusive Zone; Marine Life Preservation Zone; and Transition Zone.

2.2. RAPPAM – methods and application

RAPPAM is a methodology designed to offer managers and decision makers a quick and direct identification of management weaknesses and strengths, as well as tendencies, pressures and threats to a given area or protected area's system (Ervin, 2003). This method has been applied in over 53 countries and 1600 PAs (Leverington et al., 2010). In Brazil, RAPPAM was used for the first time in 2004, for the evaluation of 32 state PA in São Paulo (Instituto Florestal, 2004), and later applied in 2005 and 2010 for the evaluation of federal PA (ICMBio, 2011).

We used the same RAPPAM questionnaire (See Supplementary Material Tables S1 and S2) applied in Brazil by ICMBio with 94 questions in 16 modules covering five elements developed by the World Commission on Protected Areas (WCPA, 2014): 1) Context, 2) Planning, 3) Input, 4) Process and 5) Outcomes (Hockings, 2003). Answers for the questionnaire were obtained during an interview with APAAC's manager in April 11th, 2014. A second interview to review all the answers occurred in July 8th, 2014.

RAPPAM Module 1 (Profile) consists of questions on the identification and characterization of the PA and is not included in the effective analysis of management effectiveness. Module 2 (Pressures and Threats) consists of 16 activities previously identified by ICMBio as the most striking to PAs in Brazil (ICMBio, 2011 – Supplementary Material Table S1) and aims to evaluate the criticality, i.e., the severity of the different pressures and/or threats on a given PA. *Pressures* are defined as activities that have been present in the area for the last five years, while *Threats* are activities that have the potential to affect the area over the next five years. Pressures and Threats are evaluated individually, and four aspects are analyzed for the first: Tendency, Coverage, Impact and Permanency. In Threats, the analyzed aspects are Probability, Coverage, Impact and Permanency. Tendency and Probability were scored from −2 to 2, while Coverage, Impact and Permanency were given scores from 1 to 4 (see Supplementary Material Table S3). Criticality equals Coverage × Impact × Permanency, with scores ranging from 1 to 64. Results for Criticality were transformed to percentage in order to rank different activities based on their severity.

Modules 3 to 16 contain questions regarding management