An exploration of global trends in marine protected area effectiveness

The results presented below were derived from responses to a survey questionnaire on marine protected area (MPA) management effectiveness, which was sent to a random sample of MPAs around the world during July 2013. The work formed part of the MSc thesis of Lisa Boonzaier, which was supervised by Daniel Pauly at the *Sea Around Us*, University of British Columbia. The aim of this research was to improve understanding of the management effectiveness of MPAs globally.

For information on the methods used to generate the following results and more detailed information on the research aims, design and outcomes, please see the entire thesis available at: http://hdl.handle.net/2429/46707

Results and discussion

During July 2013, a survey questionnaire was sent to 360 MPAs randomly sampled from around the world. In response, 144 viable responses were received for 126 MPAs in 36 countries, corresponding to a response rate of 37%. These 126 MPAs represented a diversity of sizes, locations and human development contexts that were broadly representative of the global complement of MPAs, except with regards to development status. MPAs in less developed countries were not adequately represented.

There are likely to be differences between, first, the global complement of MPAs and the sampling frame from which they were drawn (i.e., coverage error), and second, the sampling frame and the respondent MPAs (i.e., non-response error) due to:

- The constant state of update of the MPA database maintained by the *Sea Around Us*[1] and used to construct the sampling frame;
- Inconsistencies among data sources used to update the database (this could have, for example, resulted in a bias toward 'high-profile' MPAs and MPAs with more financial, material and human resources available for management);
- The exclusion of certain sites from the sampling frame due to a lack of data;
- Lack of contact information for some MPAs, which therefore could not be included in the survey; and
- The low response rate (37%).

These differences and the potential resultant bias should be taken into consideration when interpreting the results drawn from this dataset. It is speculated that the respondent MPAs could be biased towards sites with more effective management.

[1] This database is currently (June 2014) not available on the *Sea Around Us* website (www.seaaroundus.org), but it should be later in 2014 or in early 2015.

The survey responses revealed a wide range of management effectiveness amongst the respondent MPAs, despite the potential bias towards better-managed sites. MPAs ranged from those with good levels of all three major types of management inputs (funding, staff, and facilities and equipment) to those without any of the basic management elements. Most MPAs fell somewhere in between. While the majority of respondent MPAs (71%) had some level of these three basic inputs, far fewer (9%) had them present at levels that were considered good for management needs (Figure 1).

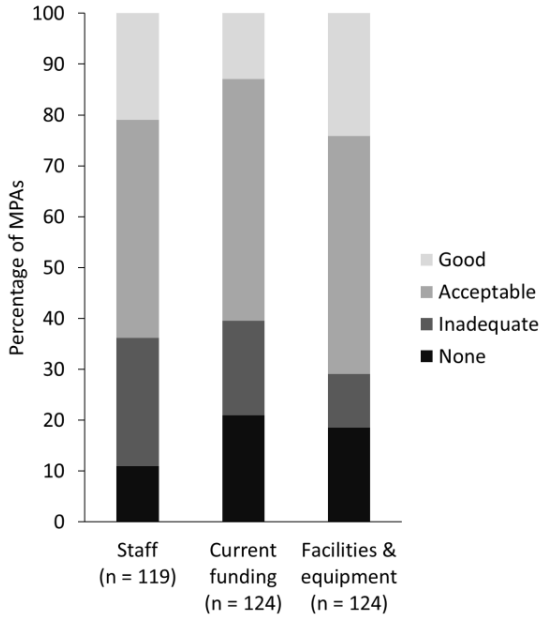

Figure 1. Adequacy of management inputs relative to management needs for respondent MPAs.

Of the MPAs represented, one-fifth were reported to have no funding, while only 13% had funding that was considered good for management needs. This highlights a major obstacle to effective management. The amount of funding received during the most recent financial year by the respondent MPAs that reported receiving funding ranged from about $1 per km^2 to more than $1 million per km^2 (in year-2012 US dollars adjusted for purchasing power parity) with a median of $2,186 per km^2. Due to the low response rate for this question, the results should be interpreted with caution.

Responses concerning the adequacy of enforcement capacity (i.e., equipment, personnel, funding, fuel, surveillance technology) were comparable to scores for other management input elements (funding, staff, and facilities and equipment). "Acceptable but could be improved" described the enforcement capacity of the largest proportion of MPAs (43%; n = 52/121). A similar proportion of MPAs (41%; n = 50/121) were described as having inadequate enforcement capacity or none at all. On the other hand, only 15% of MPAs (n = 18/121) had good enforcement capacity for management needs.

Despite apparent shortfalls in enforcement capacity, overall compliance was reported to be good with 63% of respondent MPAs (n = 74/118) reporting that more than 66% of users complied with MPA regulations. Of the respondent MPAs, 11% (n = 14/124) indicated that there were no rules and regulations for controlling resource use and activities in the MPA. This brings into question whether these sites can be considered protected areas according to the widely applied IUCN definition (Dudley 2008).

The general lack of tools to guide management, such as defined management objectives (which were missing at 16% of respondent MPAs) and a management plan (absent at 36% of respondent MPAs), indicated two additional, commonly reported gaps. It is not the intention of this research to diminish the crucial role of management and managers in the effective implementation of MPAs, but rather to highlight accomplishments as well as the challenges that threaten MPA success. The management

elements investigated here are considered to be among the minimum standards for effective protected area management (Carabias *et al.* 2004), and even after taking into account the potential for bias in these results, the shortcomings remain clear. Yet almost half (42%) of the respondent MPAs were reported to be achieving their objectives, possibly indicating that additional resources were not necessary for achieving MPA objectives or that the participants' assessments of input adequacy or achievement of objectives were not accurate. Furthermore, most of the participants reported that the condition of marine species and habitats within the MPA had either improved compared to when the MPA was first established or had remained the same, but was good to begin with.

Overall, scores for different indicators of MPA management effectiveness were positively correlated in all pairwise comparisons except three (out of 561). Indicators for the condition of natural features generally had weaker and less significant correlations with the other indicators of management effectiveness than observed for the remainder of the pairwise comparisons.

To investigate the possible influence of different participants' opinions on their survey responses, management effectiveness measures were compared between participants from different backgrounds. Comparing the overall MPA management effectiveness measures from participants involved in MPA management to those with other connections to the MPA (as a user, local community member, consultant, for example) revealed a significant difference: participants involved in management generally reported higher levels of management effectiveness than other participants. There are at least three possible explanations for this: (1) MPAs with managers have more effective management, (2) the opinions of managers are comparatively optimistic, or (3) the opinions of individuals not involved in management are comparatively pessimistic. The tendency of managers to over-estimate protected area effectiveness has been suggested elsewhere (e.g., Vanclay 2001; Dudley *et al.* 2007), but to my knowledge, has not been previously demonstrated.

Additional information

For further details about the methods and results of the survey, and associated research exploring the potential for developing a predictive model to estimate MPA management effectiveness, please refer to Lisa Boonzaier's complete MSc thesis available at: http://hdl.handle.net/2429/46707

References

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