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A clash of values and approaches: A case study of marine protected area planning in Mozambique

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ABSTRACT

Many developing countries are expanding their network of Marine Protected Areas (MPAs) to meet ambitious marine conservation targets set globally and to develop tourism nationally. This study explores the human dimensions of MPA planning in Mozambique by engaging local resource users in a series of structured discussions about marine resource use, pressures on marine resources, ways to address such pressures, and the potential positive and negative impacts of MPAs on the management of marine resources and livelihoods, from a community perspective. Findings show that the groups and communities interviewed are at best ambivalent towards MPAs while at the same time supporting increased government regulation, including conventional fisheries management measures. The study suggests that without significant community involvement in the choice of marine conservation tools, the drive to establish MPAs to achieve biodiversity conservation and tourism development goals may be counter-productive, at least in terms of poverty alleviation and sustainable resource use. It argues that a wider range of marine conservation approaches and tools needs to be considered in addition to MPAs, taking into consideration local views and institutional capacities.

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1. Introduction

Marine Protected Areas (MPAs) have become important tools for marine conservation and fisheries management (Lubchenco et al., 2003; Kelleher, 1999; Kelleher and Kenchington, 1992). However, the success of this approach in developing countries is disputed. Many MPAs are far from meeting their conservation goals, a problem which is often attributed to weak support from local resource users, especially non-compliance of fishers with conservation measures (Christie and White, 2007; Jameson et al., 2002). Nevertheless, the literature also reports an increasing number of successes, including MPAs that have resulted in higher fish abundance and diversity and improved habitat condition, spill-over catches to adjacent non-protected areas, and growing profits from tourism (Selig and Bruno, 2010; Alcalá et al., 2005; McClanahan and Mangui, 2000). But even these successes may have negative

impacts, for example if conservation has come at the expense of the exclusion of fishers in favour of other users, including dive operators and tourists (Christie, 2004).

Typically, the designation of MPAs has been driven by conservation goals and ecological criteria. The lack of attention given to social factors and dynamics in this process is one of the main reasons cited for the sometimes disappointing outcomes of MPAs. Today, scientists and managers generally agree that social considerations need to be integrated in MPA planning, implementation and evaluation (Pollnac et al.; Charles and Wilson, 2008; Pomeroy et al., 2006; Mascia, 2003). Stakeholder participation in decision-making is normally the means through which this integration is achieved and has become a central principle in MPA planning and management (Pomeroy et al., 2005; Bunce et al., 2000). Participation is believed to improve the ecological and social outcomes of MPAs in various direct and indirect ways, for example by helping to develop a sense of ownership and support for MPAs, improving compliance with conservation measures, and addressing potential conflicts between users.

Most MPAs now have provisions for stakeholder participation, which many believe signifies an important paradigm shift from

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earlier prescriptive, science-based approaches. At the same time, many countries are making efforts to implement marine conservation targets agreed globally as part of the Convention on Biological Diversity, namely the protection of 10% of the world's marine ecoregions by 2012 (<http://www.cbd.int/decisions/default.shtml?m=COP-08&id=11029&lg=0>). East Africa is one region where considerable progress in achieving these targets has been reported - particularly in Kenya, Tanzania and Mozambique - as demonstrated by a significant rise in the establishment of MPAs (Wells et al., 2007). These are also poor countries, where balancing conservation goals with the need of local populations to use marine resources for livelihoods presents significant challenges (Tobey and Torell, 2006; McClanahan, 1999). East Africa is one region of the world where a paradigm shift in the way MPAs are designated and implemented is most needed. However, is stakeholder participation in MPAs sufficient to guarantee sustainable resource use and poverty alleviation in East Africa? Or is the approach to marine conservation based on MPAs fundamentally at odds with local social dynamics in many developing countries?

This paper is based on research exploring community values and views in areas of northern and southern Mozambique identified in international and national plans as potential areas for the creation of MPAs. This research aimed to produce findings to assist MPA planning, specifically by contributing to better integrating socio-economic and ecological considerations. It formed part of a much larger EU-funded research project to generate scientific knowledge to inform the spatial design of a transboundary MPA network in coastal Eastern Africa (TRANSMAP). The aim of the project was not to produce a final plan for MPAs, but a base plan that could be refined with the involvement of stakeholders and the inclusion of additional scientific knowledge as it became available. The specific research that have origin to this paper started out with the aim of generating data to assist in the formulation of MPA plans, but its findings raise important questions regarding the suitability of the prevailing MPA planning approach in Mozambique to integrate conservation and resource use.

After reviewing plans and approaches to marine conservation in Mozambique, this paper explores the human dimensions of MPA planning by engaging local communities and marine resource users in a series of structured discussions about resource use, pressure on marine resources and the potential positive and negative impacts of MPAs on the management of marine resources and livelihoods, from a community perspective. It discusses the use of marine resources in the study areas, the pressures on them, and the measures proposed by communities to address such pressures, and then goes on to address (1) perceptions and attitudes to MPAs and (2) how without significant involvement of local marine resource users and communities in the choice of marine conservation tools, MPAs may actually fail to alleviate poverty and promote sustainable resource use.

2. Methods

Research methods included a review of plans for marine conservation in Mozambique and the Eastern Africa Marine Ecoregion (EAME) more broadly, and field-based research in two areas of Mozambique featured in these plans as sites for potential MPAs, namely Cabo Delgado and Maputo provinces, in northern and southern Mozambique respectively. Several coastal communities participated in the study at each of these two sites. In the north, these included Quirinde, Palma, Mocimboa da Praia and Ulo, and Santa Maria and Ndelane in the south. These communities were selected on the basis of having important populations of fishers, and thus likely to be significantly affected by the creation of MPAs. Figs. 1 and 2 show their location, marked in the map in the order

mentioned above. Also shown are existing and proposed MPAs for these two areas. The dotted delimitations show the proposed MPAs at the time of research (May 2007). In the north, marine conservation plans included an MPA called Rovuma National Reserve, which has not yet been created. In the south, there were plans for an MPA at Ponta do Ouro, which was created in October 2009, after fieldwork for this paper was undertaken.

The field research employed a combination of techniques to explore the use of marine resources, pressures on those resources, and the potential impacts of MPAs from the perspective of local communities. This research was undertaken in two stages. In the first stage, a questionnaire was applied to a number of households in each community to assess the use of marine resources by the members of the household, and perceptions of the respondent about (1) the contribution of marine resources in terms of providing household food and income, and (2) changes in the resources (i.e. more, less or same catches compared to 5 years ago) and numbers of users (i.e. more, less or same number of fishers compared to 5 years ago). Interviews with key informants (local leaders) and focus group discussions (occupational groups involved in marine resource use) (i.e. fishers using different gears) were also used to gain additional insights and triangulate the data collected.

The second stage of research consisted of workshops featuring three main activities over the course of a full day. Firstly, the facilitators presented an overview of the main findings of the first phase of field research. This included the results of a two-stage scoring exercise included in the questionnaire. In this exercise, respondents were asked to list all the activities undertaken by household members that contributed to household food and income, and then to allocate a number of beans out of 20 amongst the different activities listed in order to reflect their importance in terms of providing for both household food and income. This approach provided a quantitative indication of the relative dependence of the household on different activities. The scores were transformed into percentages and averaged across the sample for each site. A number of different activities were mentioned, but for the purposes of simplification similar types of activities were combined to give a reduced number of categories. These data were represented in large pie charts. Fig. 3 is an example of the pie charts used in the workshops.

The facilitators explained that the size of the pie chart slice reflected the importance of that specific activity – the larger the slice, the more important the activity. In the discussion that followed the presentation, the facilitators asked workshop participants whether those results reflected their own understandings of the main livelihood activities in their communities and the importance of those activities. Facilitators also asked participants if the main livelihood activities and their importance had changed over time in their communities, and the reasons for any changes. After discussing livelihood issues, the facilitators presented the results derived from the part of the questionnaire exploring perceptions of change in resources. This included a question asking fishers if their catches had increased, decreased or remained the same over the last 5 years. Participants were encouraged to think about these results and what they meant in terms of marine resource management.

The second workshop activity involved a series structured discussions around (1) main pressures on marine resources; and (2) measures to maintain and improve resources. Participants were asked to discuss these themes in small breakout groups with the help of a facilitator from the research team and select a 'rapporteur' who then presented the outcomes of the discussions in his/her group in plenary. In some communities, participants were reluctant to split into small groups and instead the questions were discussed in plenary, moderated by the facilitators.

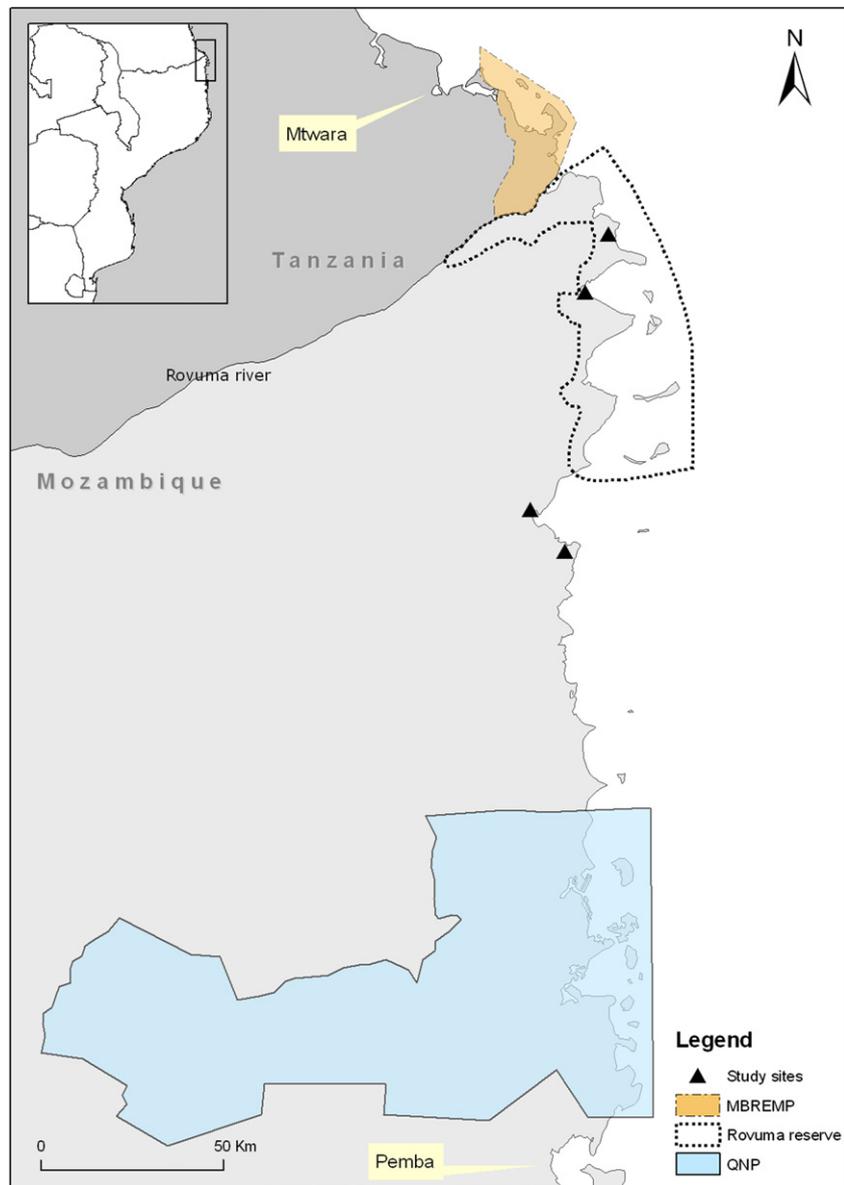


Fig. 1. Map of the northern Mozambique study area showing the study sites and existing and proposed MPAs.

The third workshop activity explored the views of participants about the potential positive and negative impacts of MPAs, if these were to be established in their areas. Before initiating discussions, the facilitators explained what an MPA is and what it involves. The IUCN definition of MPAs was used but adapted to be easily understandable by local communities (Kelleher, 1999). MPAs were put forward as 'areas in the sea where the use of natural resources obeys certain rules in order to protect that area and its resources'. It was also explained that MPAs often involve a zoning plan, which defines how different areas within the MPA can be used (Day, 2002; Kelleher, 1999). A simple model of two zones was given as an example of an MPA zoning plan. This included zones where resource use is allowed under certain conditions (i.e. allowed for certain social groups, gear types or in specific seasons), and no-take areas or 'sanctuaries' where no resource use is permitted, which would enable fish to reproduce and potentially replenish fished areas. These zones were presented as hypothetical without being linked to any specific locations. The facilitators then asked

participants about their views on MPAs in light of earlier discussions about the use of marine resources in their communities and the main pressures on resources identified.

3. Marine conservation in Mozambique

Mozambique has subscribed to various global policy frameworks and commitments on MPAs, the most important being the resolutions taken as part of the Convention on Biological Diversity (CBD) to achieve the establishment and maintenance by 2012 of comprehensive, effectively managed, and ecologically representative national and regional systems of marine protected areas (COP 7 Decision VII/28) (<http://www.cbd.int/decisions/default.aspx?dec=VII/28>); and at least 10% of each of the world's marine and coastal ecological regions effectively conserved by 2010 (COP8 Decision VIII/15) (<http://www.cbd.int/decisions/default.shtml?m=COP-08&id=11029&lg=0>). At the regional level, Mozambique forms part of the Eastern Africa Marine Ecoregion (EAME), which

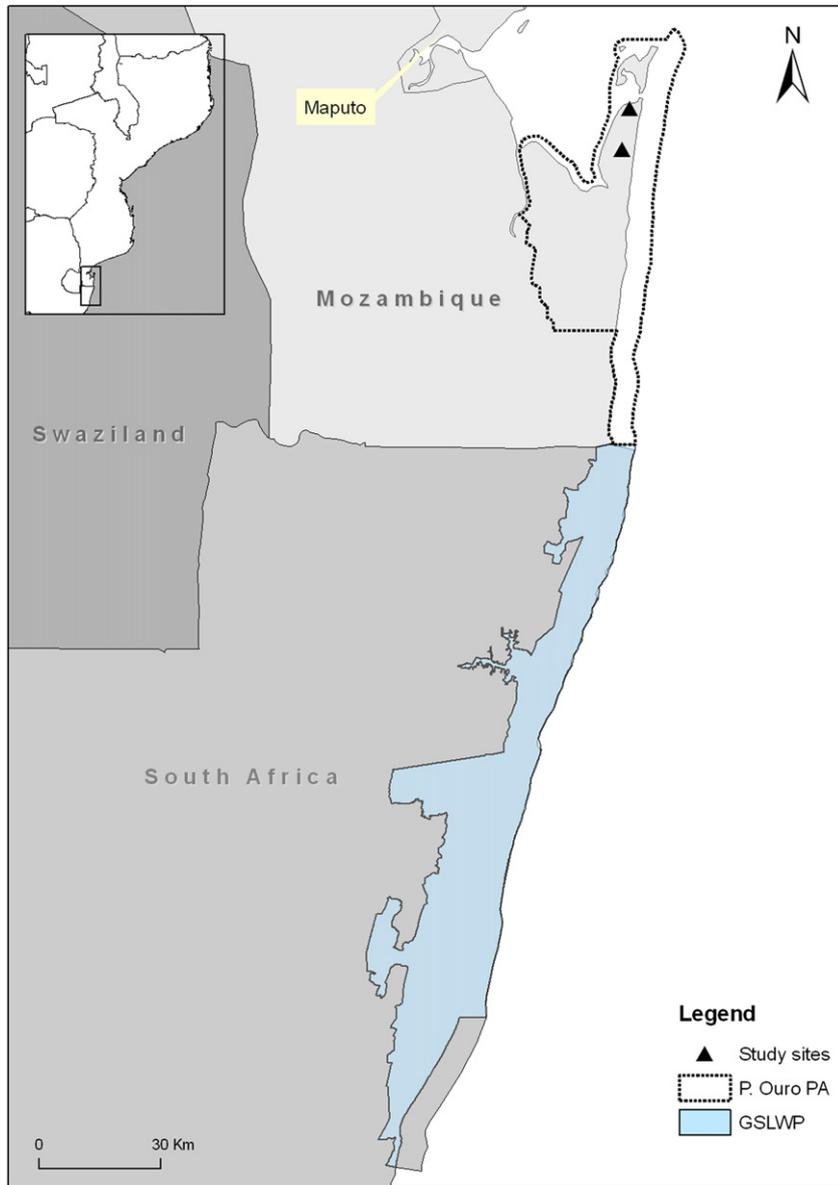


Fig. 2. Map of the southern Mozambique study area showing the study sites and existing and proposed MPAs.

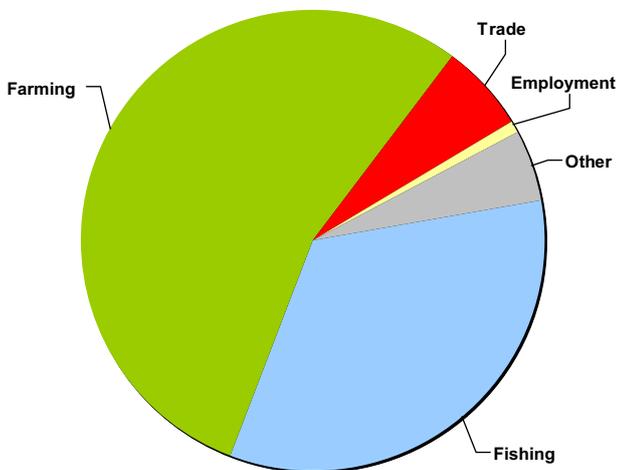


Fig. 3. Example of pie chart showing the perceived contribution of different activities for household food and income (Quirinde).

was defined by the World Wide Fund for Nature (WWF), a major international conservation non-governmental organisation (NGO), as being of globally outstanding importance for marine biodiversity (WWF Eastern African Marine Ecoregion, 2004a). The EAME identifies 9 priority sites for conservation in Mozambique: the Mtwara–Quirimbas Complex (a cross-border site between Tanzanian and Mozambique); Nacala-Mossuril; Ilhas Primeiras and Segundas; the Zambezi Delta System; Sofala Bay; Bazaruto Archipelago; Inhame Bay; Inharrime Complex; and Maputo Bay–Machangulo Complex – Greater Saint Lucia Wetlands (another cross-border site between Mozambique and South Africa).

The creation of MPAs in Mozambique is strongly supported by international organisations, in particular WWF and the World Bank through the Global Environment Facility. WWF's support is part of the wider EAME initiative for the establishment of MPAs in Kenya, Tanzania and Mozambique (WWF Eastern African Marine Ecoregion, 2004b). In Mozambique, WWF has supported technically and financially the creation and implementation of two national parks, the Bazaruto Archipelago National Park and

Quirimbas National Park (QNP), and has also lobbied for the creation of an MPA in the Primeiras and Segundas Islands (http://wwf.panda.org/who_we_are/wwf_offices/mozambique/wwf_mozambique_our_solutions/projects/). The World Bank funded the Coastal and Marine Biodiversity Management Project (CMBMP) between 2000 and 2007, the objective of which was to protect coastal and marine biodiversity in a network of protected areas in northern Mozambique (World Bank). This project supported studies for an MPA in northern Mozambique, the Rovuma National Reserve, which still awaits government approval.

Marine conservation has also been promoted as part of international initiatives aimed specifically at promoting transboundary conservation with neighbouring countries (Sandwith et al., 2001). This includes a protocol signed with South Africa in 2000 establishing the Lubombo Ponta do Ouro – Kosi Bay Marine and Coastal Transfrontier Conservation and Resource Area, which is a sub-component of the wider Transfrontier Conservation and Resource Area Protocol signed with South Africa and Swaziland (Guerreiro et al., 2010). This initiative resulted in the creation of the Ponta do Ouro Partial Marine Reserve in 2009, which links with the iSimangaliso Wetland Park on the South African side of the border (formerly the Greater Saint Lucia Wetland Park – GSLWP) (<http://isimangalisonews.wordpress.com/2009/10/29/mozambique-and-sa-link-hands-across-sea-creating-africa%e2%80%99s-largest-marine-protected-area/>). Refer to Fig. 2 for the location of these conservation areas. World Bank funded projects such as the CMBMP and a project for the development of the Mnazi Bay – Ruvuma Estuary Marine Park (MBREMP) also assisted in the development of plans for a transboundary marine conservation area between Tanzania and Mozambique, which would link MBREMP with the proposed Rovuma Reserve and the QNP, shown in Fig. 1. These two frontier areas were also the focus of a large collaborative research project funded by the European Union between 2005 and 2008 seeking to develop a scientific approach to the creation of transboundary networks of MPAs along the coasts of Tanzania, Mozambique and South Africa (TRANSMAP).

At the national level, the government of Mozambique is creating MPAs to meet its international commitments to conserve biodiversity, but also to promote tourism (Motta, 2008; MITUR, 2004). In recent years, investing in the tourism sector has become high on the government's plans as a means to alleviate poverty and promote economic development through income generation and job creation (MITUR, 2004; República de Moçambique, 2004). The marriage between biodiversity conservation and tourism in Mozambique is also evident in the fact that the institutional responsibility for creating and managing protected areas belongs to the Ministry for Tourism, through an agency created for that specific purpose, the National Directorate for Conservation Areas. In general, the policy documents dealing with tourism and poverty alleviation in Mozambique are largely positive with regards to the impacts of conservation on local communities. The Strategic Plan for the Development of Tourism (2004), for example, states that 'conservation is a valuable and compatible form of land-use that, when correctly administered, provides sustainable socio-economic goods and services for the well-being of communities, contributing for poverty alleviation' (MITUR, 2004, p. 34). The latest Poverty Alleviation Strategy Paper makes reference to the vital role of natural resource management and conservation in poverty alleviation in Mozambique, a country where the large majority of the population depends on natural resources for subsistence and income (República de Moçambique, 2004, p. 65).

The key challenge in Mozambique is to design MPAs that can balance conservation and community development. There are two main approaches in the scientific community to selecting candidate areas for MPAs, namely structure and process-oriented approaches

(Jones, 2002). The former involves selecting MPA designs that best conserve a representative set of habitats within a given biogeographic region, while the latter chooses the areas to be protected based on their ability to preserve critical areas for ecosystem function (i.e. spawning and nursery grounds). In Mozambique, limited data about ecologically critical areas, biodiversity patterns and variability, and habitat connectivity along the coastal range limit the application of process-oriented approaches. The approach normally adopted in Mozambique has been to derive MPA plans based on the best available scientific data (often contained in international and regional conservation plans), evaluate the social conditions in the target areas, and consult stakeholders about the proposed location of MPAs.

Recently, an important research initiative aimed to improve marine conservation planning in East Africa, focusing on border regions between Tanzania, Mozambique and South Africa (<http://www.transmap.fc.ul.pt/>). The TRANSMAP project mapped marine habitats in the borders of these countries using Landsat 5TM satellite imagery; and sought to assess the biodiversity in key habitats; identify biodiversity hotspots and critical habitats, including nursery grounds and spawning aggregations; and assess the relative contribution of each habitat to ecological functioning at the regional scale (TRANSMAP). These data were analysed with MARXAN software (used in systematic marine conservation planning) (Ball and Possingham, 2000) to generate MPA design scenarios for the Tanzania-Mozambique and Mozambique-South Africa borders. TRANSMAP also integrated socio-economic factors in the selection of areas for protection. This involved including fisheries data (distance from main fishing centres and location of key fishing areas mapped with fishers) in the MARXAN simulations in order to minimise negative effects on fishers. The MPA design options generated by TRANSMAP provided a starting point for marine conservation planning integrating ecological and socio-economic considerations. However, TRANSMAP fell short of involving local communities and other stakeholders in discussing the MPA scenarios generated by MARXAN, combining ecological and socio-economic data. This may still happen in the future, but it will depend on research results being used by decision-makers dealing with the creation and management of MPAs.

The analysis of policy documents at the international, regional and national levels, and selected marine conservation planning initiatives, suggests that plans for MPAs in Mozambique are being largely defined in response to marine conservation targets and priority areas for conservation and geared towards supporting the development of tourism. The approach to MPAs in Mozambique, as in many other parts of the world, is largely driven by science and political-economic motives. The scope for stakeholder participation in MPA planning is significantly reduced a priori, even before the idea is put forward to local communities and other stakeholders. When local stakeholders are consulted, it is about details such as MPA boundary setting, not whether an MPA is the most appropriate management tool to deal with the specific problems of that area. The next sections of this paper aim to illustrate the consistencies and inconsistencies between the dominant MPA approach to marine conservation and management and the perspectives of local communities on resource use, pressures on resources and management options.

4. Results

4.1. Marine resource use in areas targeted for MPAs

Fishing is an important livelihood activity in many coastal communities along the coast of East Africa. Mozambique is no different. The results of the questionnaire sections where

respondents were asked to score the different livelihood activities according to their contribution to household food and income indicate that these communities are generally highly dependent on natural resource-based activities, especially farming and fishing. Table 1 shows these results for all the communities. Trade is important in some communities, and this includes fish trade. Formal employment only makes a relevant contribution to livelihoods in southern Mozambique where the proximity to South Africa provides opportunities for migrant work and jobs in the tourism sector have recently become available. Activities under 'other' include different kinds of artisan trades such as carpentry, boat making, weaving mats and making lime, which are also natural resource based.

In most sites, no significant changes in the main livelihood activities were reported, except the rising importance of tourism-related employment in southern Mozambique. However, changes have apparently occurred in the relative importance of farming versus fishing. According to workshop participants, fishing has become more important and farming less important. They explained this shift as being the result of prolonged droughts and also pests, which are reducing crop yields and leading to an even greater dependence of households on fishing activities. For example, in the Santa Maria workshop (southern Mozambique), participants said that women are increasingly resorting to gleaning in the intertidal flats for clams, crabs and other resources for food. It is difficult to ascertain whether these perceptions indeed reflect long-term trends. However, most scientific projections of the impacts of climate change on crop productivity in Africa suggest a reduction in yields (Parry et al., 2004; Jones and Thornton, 2002). These perceptions may well be a reflection of increasing climate variability associated with more systemic climate change.

In the southern Mozambique workshops, participants talked about the rising importance of employment in tourism-related activities such as building of lodges, cleaning and gardening. However, they also raised concerns over the impacts of tourism development on their continued access to natural resources. At the Santa Maria workshop, local communities supported a large-scale tourism project on 10,000 ha of their lands, in return for employment, schools and other community infrastructure provided by an international investor. However, workshop participants were worried about the long-term impacts of losing control over such a large part of their land. They recognised that tourism is beneficial, but noted that it will not provide employment for everyone, and many people will continue to rely on shifting agriculture, fishing, hunting and harvesting wild plants and fruits. All these activities require access to natural resources, but the areas available for them have been significantly reduced with the establishment of this tourism development.

4.2. Resource user and community perceptions of resource trends and pressures

Local opposition to MPAs often results from resource users and managers not having the same understanding about the need to

Table 1
Perceived contribution of main livelihood activities to household food and income (expressed as percent average contribution).

	Quirinde	Palma	Mocimboa	Ulo	Santa Maria
Fishing	34	38	51	43	29
Farming	55	47	26	40	43
Trade	6	10	20	10	4
Employment	1	0	3	0	17
Other	5	5	1	8	7
	100	100	100	100	100

conserve resources. The workshops explored community perspectives regarding resource condition and trends to identify areas of agreement and disagreement with the conservation goals of MPAs. Following the discussion on livelihoods, facilitators presented the survey results of perceptions of change in fish catches. In all communities, most fishers mentioned a decrease in catches compared to 5 years ago. In general, workshop participants also agreed that fishing resources had declined. Although there is no scientific baseline data against which to cross-check the objectivity of these perceptions, the fact that fishers perceive a decline in resources may potentially increase the likelihood of them accepting conservation measures in the form of MPAs (Bunce et al., 2008).

Table 2 provides a summary of the workshop discussions regarding pressures on resources, and measures proposed to maintain and improve resources. Out of all the pressures identified, workshop participants were asked to identify the three most important. In northern Mozambique, the top three were the same for all communities. These included the growing number of migrant fishers, the use of harmful fishing gear and the lack of law enforcement. In southern Mozambique, the three main pressures were non-compliance with fishing regulations/lack of law enforcement, fishing trawlers and lack of rain. These were the same for the two communities. Below, we elaborate on the key pressures identified by participants.

4.2.1. Migrant fishers

The growing number of migrant fishers was seen as an important source of pressure on fishing resources in northern Mozambique. In this region it is common for fishers to leave their home areas to fish along the coast and islands during the dry season (May–November) for periods of time that vary from a few days to a few weeks. However, this region is also being increasingly visited by migrant fishers travelling much larger distances, coming from Nampula province, located some 400 km south, and from Tanzania. Workshop participants said that migrants generally have better gear (i.e. bigger nets and in good condition of repair) than local fishers which enables them to obtain higher catches. Reportedly, migrants also use larger boats, some equipped with engines, and tend to fish more intensively. In the workshops, local fishers said that 'the outsiders fish non-stop night and day'.

4.2.2. Use of destructive fishing gear

The fishing practices that local communities identified as being harmful include fishing with nets with very small-sized meshes, explosives, poisons and scuba equipment. Workshop participants said that destructive fishing gear and methods were employed mainly by outsiders. For example, they said that explosives are used by Tanzanian fishers. Reports indicate that explosives were commonly used across the border in Tanzania, but their use there has been successfully eradicated, especially with the creation of the Mnazi Bay-Rovuma Estuary Marine Park (MBREMP) in 2000 (Malleret, 2004). Other destructive gear such as beach seines have also been banned from the MBREMP and efforts are being promoted to encourage fishers to shift to more sustainable fishing practices. Malleret (2004) suggests that MBREMP may have displaced fishers and destructive fishing practices across the border to Mozambique where there is less control over fishing activities, which appears to corroborate with the reports of workshop participants.

4.2.3. Lack of law enforcement

The pressure on fishing resources by migrant fishers and the use of destructive fishing gear identified by workshop participants were linked to lack of law enforcement. Particularly in northern Mozambique, participants felt that there was virtually no

Table 2
Summary of workshop discussions.

Issues	Southern Mozambique				
	Quirinde	Palma	Mocimboa	Ulo	Santa Maria
Sources of pressure on marine resources	<ul style="list-style-type: none"> ■ Growing number of migrant fishers ■ Harmful fishing gear ■ Lack of law enforcement ■ Destruction of coral ■ Cutting of mangroves ■ Increasing demand for marine resources 	<ul style="list-style-type: none"> ■ Growing number of fishers ■ Harmful fishing gear 	<ul style="list-style-type: none"> ■ Growing number of migrant fishers ■ Harmful fishing gear ■ Lack of law enforcement ■ Extraction of live coral 	<ul style="list-style-type: none"> ■ Growing number of migrant fishers ■ Destructive gear ■ No regulation of fishing activities 	<ul style="list-style-type: none"> ■ Lack of law enforcement ■ Trawlers ■ Lack of rain ■ Increase in fishers/fishing boats ■ Pollution (industries)
Measures to address pressures	<ul style="list-style-type: none"> ■ Exclude migrant fishers ■ Prohibit harmful gear ■ Protect corals and mangroves ■ Temporary closures 	<ul style="list-style-type: none"> ■ Exclude migrant fishers ■ Prohibit harmful gear 	<ul style="list-style-type: none"> ■ Regulate the activities of migrants ■ Improve control and law enforcement 	<ul style="list-style-type: none"> ■ More regulation and control by the government 	<ul style="list-style-type: none"> ■ More law enforcement/control ■ Areas permanently closed to fishing ■ Temporary closures ■ Control mesh sizes
Views on MPAs and no-take areas	<ul style="list-style-type: none"> ■ Support no-take areas, depending on their location ■ Do not accept no-take areas due to high dependence on fishing 	<ul style="list-style-type: none"> ■ Do not accept creation of no-take areas on important fishing grounds ■ Concerned that restrictions would be unequally enforced 	<ul style="list-style-type: none"> ■ Support no-take areas, depending on location ■ Concerned with effectiveness of enforcement ■ Accept restrictions if others also accept them 	<ul style="list-style-type: none"> ■ Support MPA as a whole to bring in some form of management ■ Support no-take areas to enable fish to reproduce 	<ul style="list-style-type: none"> ■ Do not support no-take areas because of negative experience with existing protected areas

management of resources in place because anyone could fish where, how, when and how much they wanted. They noted that officials from the government agencies responsible for enforcing fishing regulations were rarely seen in the fishing areas, partly due to lack of means (boats and other forms of transport). This was especially the case in the islands where much of the fishing activities of migrant fishers are concentrated. They also felt 'invaded' and robbed of their resources because there were no measures to prevent or control the fishing activities of migrants. One workshop participant in Mocimboa da Praia said that 'they [migrant fishers] take our resources, sell them in their areas and we gain nothing', which captures the general view expressed in the northern Mozambique workshops.

4.2.4. Industrial and semi-industrial fishing

Trawlers were seen as an important cause of fisheries resource decline in southern Mozambique. The negative effects of trawlers which target shrimp were related to high volume of by-catch and the use of nets with small-size mesh. Trawlers were also seen as fishing very intensively. One participant in Ndelane said that 'when the season for shrimp fishing opens in April, trawlers are at sea fishing all the time; one vessel is used to transport the catches to port, while the others are fishing non-stop night and day'. Participants also said that fishing trawlers evade the minimum mesh size regulations imposed by the government. Nets are controlled at the port, but once at sea they said that cod ends are sometimes fitted with finer mesh nets.

4.2.5. Climate-related changes

Workshop participants in southern Mozambique rated drought and rising temperatures as major contributors for declining fisheries resources. Many people believed that rain is essential for the reproduction and life cycle of fish and other marine organisms and link lack of rain to the increasing scarcity of these resources. Fishers also mentioned that fishing areas in Maputo Bay are getting progressively shallower due to the reduced flow of the Maputo River, and that this shrinks fish habitats. Women fishers who collect bivalves, crabs and other organisms in the intertidal areas were particularly convinced that drought is affecting these resources negatively. This means that climate change may have important gendered impacts, if it is proven that shallow habitats, normally exploited by women, are especially at risk.

4.2.6. Other causes

In northern Mozambique, other causes of fisheries decline identified included the extraction of live coral for house building and making lime and the cutting of mangroves for construction. The growing demand for marine resources was also seen as an underlying cause of resource decline. One participant said that 'nowadays everything in the sea has value and can be sold'. Fish trade is an important economic activity in both northern and southern Mozambique. In the north, catches are mostly dried and sold to intermediaries supplying larger coastal urban centres as well as inland areas. In addition to finfish, there is also a large market for valuable products such as sea cucumbers, shells and shark fins, which find their way to international markets, mostly via Tanzania-based intermediaries. In the south, there is high demand for fresh fish and shellfish from nearby Maputo city with its large population. It is likely that markets for marine products were severely affected by the civil war, but have since bounced back and expanded. Population growth and improvements in income may also be contributing to increasing demand for fish. Pollution was linked to fisheries decline in southern Mozambique. This included oil discharges from ships and waste from industrial areas in the outskirts of Maputo city.

4.3. Management measures from a community perspective

Workshop participants suggested a number of measures to maintain and improve marine resources, which are summarised in Table 2. These can be grouped into three broad categories, including more effective regulation of resource use; the exclusion of migrant fishers or regulation of their activities; and closing some areas for fishing or imposing protection periods. Below we elaborate on each of these measures, based on workshop discussions.

4.3.1. Resource use regulation/law enforcement

Better enforcement of resource use laws and regulations was widely proposed as being vital to improve resources. In some workshops, participants focused attention on particular habitats such as prohibiting the destruction of coral reefs and regulating mangrove use. There was a strong opinion that government agencies responsible for enforcing fisheries and environmental regulations needed to be more active and present in areas where illegal activities are being practiced. Despite the recent formation of fisheries co-management organisations called Community Fisheries Councils (known by their abbreviated form in Portuguese as CCPs) and the presence of CCP members at some of the workshops, these were not mentioned as a potential means to improve resource management. Local communities emphasised government enforcement of existing fisheries and environmental laws.

4.3.2. Exclusion and regulation of migrant fishers

Measures aimed specifically at dealing with the perceived threat posed by migrant fishers to fisheries were proposed by nearly all communities in northern Mozambique. However, there were differences between communities with regards to the nature of these measures. In Quirinde and Palma, workshop participants suggested that migrant fishers should be excluded. In Mocimboa da Praia participants considered the exclusion option but rejected it as being unfeasible and unfair with regards to Mozambican fishers coming from other regions such as Nacala. They recognised that as Mozambican nationals, these fishers have the same rights as locals to fish and cannot be banned. Instead of a ban, participants agreed that the fishing activities of migrants needed to be better regulated.

From the workshop discussions and local observations it became evident that views regarding migrant fishers vary between and within communities. In Ulo, participants noted that the settlement of migrants is often facilitated by particular individuals in local communities while in Mocimboa one participant said that 'we the population are also to blame [for the problem of migrant fishers] because we sometimes welcome and support them'. In Palma, participants said that Tanzanian fishers, who legally cannot fish in Mozambique, form a partnership with a Mozambican national who then obtains the fishing license required by law. The role of village authorities in facilitating or preventing migrants from setting fishing camps is also important. Although many local fishers oppose migrants and blame them for overexploiting fishing resources, village authorities have sometimes authorised migrants to set camps in exchange for a fee. Other factors that complicate the exclusion of migrant fishers include their marrying into local communities, which is occurring in most areas, and their contribution to local economies through trade in fish and other products.

4.3.3. Temporary and permanent closures

Closure of certain areas to fishing for predetermined periods of time in order to allow fish to 'rest' and stocks to recover were proposed in Quirinde (northern Mozambique) and Santa Maria (southern Mozambique). In Quirinde, participants said that the local community is already experimenting with temporary closures of certain areas as part of efforts by the government to promote

fisheries co-management. However, they added that these closures are not being respected by everyone. In Santa Maria, southern Mozambique, people are familiar with the seasonal closure to shrimp fishing and proposed that certain areas could be closed off to all types of fishing for periods of time. Participants in Santa Maria also suggested closing off some areas permanently to fishing to enable fish to reproduce. They identified rocky outcrops in the eastern side of the coast known locally as 'pontas' as suitable areas for these closures. Curiously, these areas are accessible only to recreational fishers, since locals fish mostly in the more sheltered waters of Maputo Bay. Thus, they may only support the permanent closure of areas that will have little impact on them.

4.4. Community views on MPAs

MPAs attracted mixed views from workshop participants. In northern Mozambique, local communities were concerned with the potential closure of fishing grounds. There was some support for the establishment of MPAs depending on their location and as long as they continued to have access to their most important fishing grounds. In Santa Maria, southern Mozambique, there were similar concerns about the impacts of MPAs on access to resources and potential exclusion from decisions regarding the location and delimitation of no-take areas. People feared that such decisions would be made by the government without their involvement. Other issues were raised at the workshops, including the effectiveness of no-take areas at addressing key pressure on resources and the capacity of government authorities to enforce them. In Santa Maria, participants recognised that no-take areas could contribute to improving resources, but their effectiveness was likely to be limited because the main pressure on resources came from trawlers operating further away from the shore while no-take areas were likely to be established near the shore. In Mocimboa da Praia, some participants doubted the capacity of the government to enforce no-take areas given current weaknesses in the enforcement of fishing regulations.

In Palma, workshop participants were firmly against the establishment of no-take areas. They understood the need for resource conservation and the benefits that these areas might bring. However, they argued that people in their community were unlikely to respect them because many depend on fishing and have no other livelihood options. MPAs were also deemed unlikely to be effective at addressing the problem of migrant fishers, which are viewed as a major pressure on marine resources. The migrants would easily escape MPA regulations because they tend to operate from remote fishing camps where authorities rarely reach due to lack of means, including boats, car, fuel and staff. Migrant fishing camps are located mainly in the islands, but increasingly also in the continent with the establishment of tourism ventures in these islands and the exclusion of all fishers, both migrants and locals.

In Palma, participants also argued that limited capacity of government authorities to control fishing activities at sea would mean that monitoring and rule enforcement would happen mostly at landing sites on the mainland, thus affecting local fishers disproportionately. In Ndelane, southern Mozambique, local communities were critical of MPAs because of negative experiences with existing nearby protected areas, which are a source of long-standing conflicts over restrictions on resource use. These included the Inhaca Island Marine Reserves and the Maputo Elephant Reserve (Muacanhia and Albano, 2002; Soto et al., 2001).

5. Discussion

Local communities living in areas of northern and southern Mozambique featured in international and national marine

conservation plans in the form of MPAs and transboundary marine conservation recognise that marine resources are declining, and agree that something needs to be done to protect them. But unlike such plans, local communities do not necessarily see MPAs as the most appropriate measure to address pressure on resources, and emphasise better enforcement of existing fisheries regulations by the government and control of migrant fishing activities.

From the perspective of local communities, the main causes of resource degradation are external and include migrant fishing, industrial and semi-industrial fishing, and poor law enforcement by government authorities. Thus, some of the measures they propose for reversing resource degradation are targeted at specific activities such as destructive fishing gear, specific groups such as migrant fishers, or specific habitats such as coral reefs and mangroves. In contrast, MPAs often apply blanket measures in the form of no-take zones that make no such distinction and ban all forms of resource use and users, except tourism and scientific research. For local fishers it may seem unfair to be subject to prohibitions aimed at solving problems that they do not feel responsible for causing. Even though local communities recognise the need for some form of resource conservation, the application of sweeping restrictions on resource use may easily make MPAs look like a threat rather than a solution.

Marine conservation plans and the drive to establish MPAs for biodiversity conservation and tourism do not seem to take into account existing and future vulnerabilities in local communities. Coastal communities in Mozambique are already living with a host of vulnerabilities such as poverty, high reliance on marine resources and lack of other livelihood options (Bunce et al., 2010; Brown et al., 2008). New sources of vulnerability are emerging, including falling farming yields due to adverse climatic conditions, and reduced access to areas for shifting agriculture, hunting, collection of non-timber forest products and fishing as a result of tourism development and, potentially, the exploitation of oil and gas reserves (Gervásio, 2006). This is occurring amidst a decline in fishing resources, attributed to an influx of migrant fishers, use of destructive fishing gear and poor enforcement of fisheries laws. These factors combine to increase livelihood vulnerability to restrictions on resource use imposed as part of MPAs (McClanahan et al., 2009, 2008).

One way to reduce the negative impacts of conservation measures on local communities often suggested in the literature and tried in many developing country protected areas is to develop alternative income-generating activities to alleviate dependence on natural resources (Charles and Wilson, 2008). The promise of alternative sources of income is often used to persuade communities to agree with the establishment of MPAs. However, in many cases these alternatives have not lived up to expectations, either because they have not been rolled-out fast enough or on a sufficient scale to benefit all those affected by resource use restrictions, thus fuelling community criticisms of broken promises and negative attitudes towards MPAs (Gawler and Muhando, 2004). In others, the alternatives developed were not sustainable in the long-term (Leisher et al.). Even tourism, a much boasted provider of alternative livelihoods for local communities affected by MPAs, does not necessarily bring about sustainable benefits, not least because tourism is a fickle industry, one that is especially vulnerable to changes in the global economy and the impacts of distant political events (Levine, 2007).

Currently, marine conservation strategies in Mozambique and more widely do not adequately reflect the potential implications of climate change for local coastal communities impacted by such strategies (McClanahan et al., 2008). However, local communities potentially affected by MPAs are already experiencing impacts that may well be related to climate change. The resource user groups

involved in this study reported an increasing reliance on fisheries because drought is compromising farming yields. Climate change predictions suggest that crop yields in Africa are likely to fall by 10–20% by 2050 as a result of warming and drying (Jones and Thornton, 2002; Thornton et al., 2009) and effects reported in the workshops may be a reflection of these changes. In some communities, drought and increasing temperatures were also linked to a perceived decline in fishing resources, although for marine ecosystems it is more difficult to isolate the effects of climate change on fish populations because of time lags (Graham et al., 2007) and the interactions with other stressors such as overfishing and pollution (Munday et al., 2008; Hughes et al., 2005).

In sum, the communities interviewed may be materially harmed by the creation of MPAs that restrict fishing. There may also be few alternatives to the use of marine resources if climate change impacts on farming. Experiences from Asia and the Pacific shows mixed results in terms of community benefits from MPAs (Christie, 2004; Leisher et al.). Indeed, if established for conservation and tourism, this often comes at the exclusion of local resource users who are seen as the problem and not as part of the solution. This is exemplified by the example of southern Mozambique where local communities have mixed feelings about tourism, on the one hand recognising its potential economic benefits from employment, while on the other fearing exclusion from natural resources and thin and unequally distributed economic benefits. Much of the benefits that local communities are expected to derive from MPAs involve the provision of alternatives to fishing and the creation of jobs in tourism. However, suggesting that there is potential to effectively implement these activities when in fact this may be beyond the ability of local communities and the Mozambique government is at best naïve and at worse may lead to further poverty and food shortages.

What then is the way forward for marine conservation in Mozambique? First of all, a wider range of management tools and approaches need to be considered in addition to MPAs, selected with the significant involvement of resource users and local communities. In the study areas, local communities emphasised conventional fisheries management tools, including better monitoring and control of fishing activities drawing on existing fisheries and environmental laws. Fisheries laws in Mozambique feature measures aimed at regulating fishing activities, and protecting and ensuring the sustainable use of fishing resources. These include obligatory licensing, forbidden gears, minimum mesh and catch sizes, and closed seasons for certain species (Republic of Mozambique, 2003). There are also laws aimed at the protection of coastal and marine ecosystems which prohibit activities damaging corals and other fragile marine habitats (Republic of Mozambique, 2006). The effective application of these laws requires strengthening the capacity of government agencies responsible for their monitoring and enforcement.

Building and strengthening community-based institutions for resource management is another option that could be given a more central role in marine conservation efforts. Currently, local communities still look largely upon the government for action regarding the protection and management of resources. This is not surprising considering the top-down and centralised manner in which resources have traditionally been managed in Mozambique, under colonialism and socialism. Only recently has the Mozambican government begin to decentralise resource management. In fisheries, this is being promoted through the formation of local-level Community Fisheries Councils or CCPs, which are made responsible for controlling fishing activities in a specific stretch of coast (Republic of Mozambique, 2003). The approach to fisheries co-management through CCPs is incremental. Currently, CCPs have

limited powers, mainly to assist the government in enforcing fisheries laws and regulations. As the capacity and maturity of these organisations develops, they may be given additional powers, including defining their own resource use norms or by-laws, which would allow communities, for example, to close some areas seasonally or permanently to fishing and control the entry of migrant fishers. But while local communities may welcome greater involvement in resource management, their emphasis on the role of the government as enforcer can signify that there is a limit to the responsibilities that they will be willing to accept and can feasibly implement.

Marine conservation goals in Mozambique also need to be clarified and better prioritised. Given high poverty levels and dependence on marine resources, what should be prioritised: biodiversity conservation for tourism, or sustainable resource use to sustain and improve livelihoods? Both deal with conservation, but have very different implications for local communities and the creation of MPAs. An MPA for biodiversity conservation and tourism will require different management tools to achieve its goals than one established for sustaining livelihoods. No-take areas may be essential for the former, but not be suitable for the latter, which will probably involve better regulation of fishing activities, rotational or seasonal closures, and not necessarily a complete ban on fishing in certain areas. These two goals may not be mutually exclusive, but presenting MPAs featuring no-take zones as win–win solutions for conservation and livelihoods may only serve to produce frustration and antagonism amongst local communities for being misled (Jones, 2007).

Even from an exclusive biodiversity conservation perspective, conventional MPAs may not always be the best option. A study from Asia and the Pacific comparing the conservation effectiveness of three different management regimes (national parks, co-managed reserves and traditionally managed areas) suggest that 'in cases where resources for enforcement are lacking, management regimes that are designed to meet community goals can achieve greater compliance and subsequent conservation success than regimes designed primarily for biodiversity conservation' (McClanahan et al., 2006, p.1408, see also (Kareiva, 2006)). This seems to be the case in Mozambique, where authorities lack resources for the effective enforcement of fisheries and environmental laws. These alternative management regimes could include community-based approaches to fisheries management and conservation, including community-managed MPAs, which have shown some success in countries, especially the Philippines (Christie et al., 2009; Hind et al., 2010; Maliao et al., 2009; Cinner et al., 2005). The fisheries co-management regulations supporting the establishment of CCPs recently introduced in Mozambique could help to develop similar community-managed closed areas, either on a permanently, seasonally or rotational basis. Promising yet incipient community-managed closed areas called 'Tengefu' are also emerging in Kenya and, if successful, could serve as a reference for other countries along the coast of East Africa (pers. obs.).

6. Conclusions

With this critique we are not suggesting that MPAs are an unsuitable approach to marine conservation in Mozambique. We have tried to show that the global drive to establish MPAs can lead to unfeasible and poorly designed management interventions that fail to consider local dynamics and institutional constraints. In Mozambique, like in many other developing countries, establishing centrally planned MPAs based primarily on international conservation targets and the desire to promote tourism by the government is likely to fail to alleviate poverty, while potentially also having limited success at conserving marine biodiversity. We argue that the choice of marine conservation tools and approaches should

be made with resource users and local communities, and not be pre-defined and imposed on them as it is currently the case. Without this, MPAs may actually be counterproductive, at least in terms of poverty alleviation and sustainable resource use.

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