

Allies, not aliens: increasing the role of local communities in marine protected area implementation

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THEMATIC SECTION
Community-based natural resource management (CBNRM): designing the next generation (Part 1)

SUMMARY

Various management approaches have been proposed to address the alarming depletion of marine coastal resources. Prominent among them are community-based management and the establishment of marine protected areas (MPAs). The overall poor performance of MPAs can be traced to a failure to effectively include local communities in the design and implementation of relevant measures. Recent efforts have incorporated aspects of community-based management into a hybrid form of management, which ideally builds upon existing local management practices. A key challenge lies in the development of appropriate frameworks that allow for the successful participation of local communities in management. A review of studies on MPA design and community-based marine resource management and fieldwork observations provides suggestions on how to address current socioeconomic shortcomings in MPA design and implementation, successfully involving local communities in order to provide a better local basis for effective larger MPA networks. A combination of MPA tools as the formal frame and community-based natural resource management as the adaptive core that recognizes local communities as allies, not aliens, is needed to develop successful conservation approaches.

Keywords: adaptive management, community-based management, customary management, emergent rules, flexible zoning, learning platforms, livelihoods, local knowledge, marine protected areas, temporal closure

INTRODUCTION

The conservation of marine natural resources has received significant attention over the last decade. This is partly because those regions with the highest marine biodiversity are also most threatened by anthropogenic stressors (Burke *et al.* 2002; Wilkinson 2008), but also because current methods and

instruments have shown only limited effectiveness. Compared with terrestrial systems, the management of marine natural resources faces some major challenges, such as less well-known resource tenure systems and high variability over space and time. In countries like Indonesia, fishers roam over vast areas in search of marine resources such as sea cucumbers or live reef fish. Moreover, fishing activity is usually dependent on the seasons, with fishing gear and fishing grounds changing according to climate patterns, spawning or feeding migrations of the target species and shifts in the availability of alternative income sources for fisherfolk.

The exploitation of many marine resources is strongly driven by market fluctuations. Trade in corals, ornamental fish and sea cucumbers is driven by demand from outside the supplier countries. Therefore, unforeseen stock market changes in Europe, China or the USA strongly influence exploitation patterns. Newly-targeted resources may not have been used before, having no local use regulations (Berkes 2004) and/or weak governance institutions (Johannes & Riepen 1995; Berkes *et al.* 2006; Scales *et al.* 2006).

In 2002, during the World Summit on Sustainable Development in Johannesburg, the world community committed to establishing a world network of marine protected areas (MPAs) by 2012. Recent studies show the limited effectiveness of many existing MPAs (for example Pollnac *et al.* 2001a; Mora *et al.* 2006). Significant attention has been paid to the development of new solutions; a general consensus is that the improved involvement of local communities is an indispensable condition for the success of marine management and conservation (Francis *et al.* 2002; White *et al.* 2002; Christie *et al.* 2003; Mascia 2003; White & Green 2003; ISRS [International Society for Reef Studies] 2004). While there have been some promising initial results (see White *et al.* 1994; Alcala & Russ 2006), in many cases current practices are being criticized for failing to deliver expected results in social and ecological terms (McClanahan 1999; Blaikie 2006; Maliao *et al.* 2009). This constitutes a serious problem for the conservation of marine resources and for the fulfilment of the 2012 benchmark. Last, but not least, it endangers often already marginalized coastal livelihoods across the globe (Laffoley 2008). Research into community-based natural resource management (CBNRM) can provide important lessons for the MPA discourse, yet few attempts have been made to consciously link these two concepts (for a noteworthy

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exception, see Cinner & Aswani 2007). In order to complement current discourses on MPA management and to define future directions for CBNRM research, a closer look at previous attempts of integrating communities in MPA management and at relevant findings regarding CBNRM is instructive (see chapters 6 and 8 in ICEM [International Centre for Environmental Management] 2003). If adequately framed, community-based natural resource management may provide a solid basis for the successful design and implementation of MPAs. Similarly, flexible MPA designs may help to overcome shortcomings of community-based tenure. A review of the relevant literature and practice is thus needed to link both the CBNRM and MPA communities and to guide future research.

In this paper, we review MPA and CBMRM (community-based marine resource management) approaches, with a focus on those regions and countries where contributing authors have field-based research experience. We examine different perspectives on the role of local communities in MPA management, and highlight some issues in need of further research concerning the involvement of local communities as primary resource users in the management of marine natural resources.

MPAS AS AN INSTRUMENT TO PROTECT MARINE RESOURCES

MPAs take many different forms, including marine reserves, marine sanctuaries and marine parks. A protected area is 'a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values' (Dudley 2008, p. 8). MPAs may include regulations allowing limited fishing with size- and species-selective fishing gear such as hand spears and fish traps, or completely ban the collection of any organisms (no-take-zones) (Maliao *et al.* 2009). Today, approximately 5000 MPAs exist worldwide (Laffoley 2008).

Effective MPAs can be expected often to lead to increased biomass of target species, increased biodiversity and export of biomass to adjacent areas (for example see Polunin 2002; Halpern 2003; Willis *et al.* 2003; Russ *et al.* 2004). Recent advances in research on the connectivity of marine animal populations allow for a refinement of MPA network design and development of a sound natural science basis for MPAs (see Almany *et al.* 2009), although the required ecological knowledge is still far from complete (Willis *et al.* 2003; Sale *et al.* 2005). However, socioeconomic factors, such as the successful consideration of the interests of local people, ultimately determine the success or failure of MPAs (Kelleher & Recchia 1998; Christie *et al.* 2003; Christie 2004; Majors 2008) and are crucial in successful marine conservation (Cinner 2007). It is here that more research is needed (Christie *et al.* 2003; Mascia 2003). The role of communities in MPA design has long been acknowledged (Kelleher 1999; Laffoley 2008), yet lesser importance is still frequently attributed to them (Wilshusen *et al.* 2002; Chapin 2004). Although

some cases show effective co-management of MPAs by local communities, as in the Philippines (see Alcalá & Russ 2006 and references therein), studies in several countries demonstrate that local users perceive themselves as the disenfranchised recipients of rules that are opposed to their interests, and consequently ignore and undermine them (see studies by Elliott *et al.* 2001 on Indonesia; Oracion *et al.* 2005 on the Philippines; Fraga & Jesus 2008 on Mexico; Mwaipopo 2008 on Tanzania; Rajagopalan 2008 on India; and Sunde & Isaacs 2008 on South Africa). Not surprisingly, a majority of MPAs are described as failures (for example see Kelleher *et al.* 1995; Burke *et al.* 2002; Mora *et al.* 2006).

LOCAL COMMUNITIES AND MARINE RESOURCE MANAGEMENT

Resource managers, conservationists, anthropologists and marine biologists have advocated making use of customary management systems such as customary marine tenure (CMT) to raise local acceptance and make conservation more effective (see review by Cinner & Aswani 2007). Cinner and Aswani (2007, p. 202) define customary management as local practices that are designed to regulate the use of, access to and transfer of resources. This covers a large variety of measures such as temporal or permanent area closures, gear prohibitions, species-specific bans and closed seasons (Cinner & Aswani 2007). Recently, there has been increased recognition of indigenous and community conserved areas (ICCAs) by international organizations and conventions (Berkes 2009), and some successful bottom-up initiatives of CBMRM are developing (Govan *et al.* 2006). An example is the locally-managed marine area (LMMA) network in the Indo-Pacific (LMMA Network 2009). However, the use of customary management also faces major limitations. Once widespread in the Asia-Pacific region (Johannes 1978; Ruddle 1994) and still practised in large parts of Oceania (Johannes 2002), in South-east Asia, the majority of these systems have weakened or completely disappeared in the course of institutional restructuring, technological innovation and social-ecological change (Pomeroy 1995). Such absence or inadequacy of local customary management poses a key challenge to the development of locally acceptable regulations.

Customary management is also challenged by coastal population growth (Foale & Manele 2004) and shifts in targeted species. Recent migrants may be ignorant of the local ecological conditions, institutions and traditions. Additionally, external market forces causing rapid shifts in target species do not allow for the establishment of sufficient local ecological knowledge, resulting in 'ecological illiteracy' among primary resource users (Krause & Glaser 2003). Even in cases where local ecological knowledge exists, it may be insufficient for successful conservation (Zerner 1994; Foale 2002).

Existing traditional and other local ecological knowledge is an important tool for devising management strategies (Berkes *et al.* 2000; Gadgil *et al.* 2000, Drew 2005). Appropriately integrated, it may constitute an essential plus for management,

however, the notion that management of natural resources by communities alone ensures conservation ignores the complex interactions of interests, policies and local institutions (Zerner 1994; Wilshusen *et al.* 2002). In Maluku (Indonesia), for example, members of the local elite traded the traditional exclusive fishing right to a fishing company using destructive methods in return for political support from the company and their allies, namely local military and bureaucrats (Adhuri 2004). While some cases of traditional management may have developed from an acute understanding of the ecology of targeted organisms and an inherent conservation ethic (Johannes 1981, 2002), customary tenure has also arisen from increased competition over scarce resources (Polunin 1984; Ruttan 1998). Such rules may thus not be based on ecological criteria relevant to successful resource conservation. As customary tenure constitutes a form of resource control that reflects the prevailing norms and is appropriate in a specific cultural context, resource use under customary management that incidentally achieves conservation may switch to an unsustainable pattern if the norms and socioeconomic context change (Johannes 1978; Foale 1998; Foale & Manele 2004).

Additionally, the time needed for conservation measures to bear fruit may exceed the time local communities are willing or able to wait for visible results (see Russ & Alcalá 2004), and there may be a mismatch in scale between the area covered by CMT regimes and the ecological size prerequisites for successful MPA functioning (Foale & Manele 2004). This requires mechanisms for an exchange of information and mutual learning between local communities, scientists and policy makers to enable successful networking and collaboration beyond the local scale. Thus, there is a clear and important role for interactions between science-based ecological information and community-based management (Polunin 2002).

CURRENT SHORTCOMINGS IN THE INTEGRATION OF LOCAL COMMUNITIES INTO MPA IMPLEMENTATION

A central point in most of the recent guidelines and MPA projects by large national and international agencies is the successful integration of local communities into planning and implementation of MPAs. In many cases, this has still not been achieved. Even where MPA projects are clearly designed for local participation and co-management, effective participation of local resource users typically fails during implementation (for example Bennet *et al.* 2006; Majors 2008; Baitoningsih 2009). One of the most widespread shortcomings appears to be centralized planning and a top-down approach to implementation. Where the integration of local communities into management planning is missing, the outcomes can easily be counterproductive to the envisaged conservation goals and may impact negatively on communities and ecosystems (Simonian & Glaser 2002; Diegues 2008; Reichel *et al.* 2009).

Community-based management needs to build on existing local rules and institutions (Berkes 2007). Scholars of

customary marine tenure have tended to focus on traditional systems that have developed over decades or centuries (Johannes 1978; Polunin 1984), however, among current-day coastal resource users conservation-oriented ethics and traditional institutions for the management of marine resources appear to be quite scarce. Where such institutions are missing, a locally accepted basis on which an MPA framework could be developed is much more difficult to establish (Henley 2008). In South Sulawesi (Indonesia), where traditional management regimes are absent for large regions of the target reefs, there is a lack of awareness and acceptance of MPAs (Baitoningsih 2009). This is partly because strict no-take zones were established first and multiple-use zones, although envisaged, had not yet been introduced. The concept of closed marine areas was foreign to the local communities. Furthermore, a lack of legal frameworks, institutional linkages and flexible multi-level governance systems may hamper both the adaptive management of community-based marine resource management (Armitage 2005; Cinner 2005), and the successful integration of community-based management into wider MPA design (Clifton 2003; Cinner & Aswani 2007).

Successful participatory MPA design and implementation is also hampered by the widespread misconception in community-based management practice that communities can be treated as homogeneous in terms of perceptions, interests and actions (Agrawal & Gibson 1999; Leach *et al.* 1999; Sandersen & Koester 2000; Singleton 2009). While some literature does include such differentiations (for example Agrawal & Gibson 1999; Few 2000; Tam 2007), protected area management practice frequently adopts a simplifying and generalizing view of local people's views and actions (West *et al.* 2006). This ignores that people are embedded in dependencies and hierarchies, holding different positions and views, and therefore also respond differently to policies and incentives. The simplifying approach to management has been strongly criticized (Cleaver 1999). It is equivalent to the external imposition of preconceived assumptions about the distribution of power in local communities. However, a community consists of various members with different means of voicing and negotiating their interests (Few 2000; Tam 2007). For instance, Indonesian fish traders endowed with stronger social networks or better financial resources than fishers are able to express and defend their interest much better than many fishers (Visser 2004). A failure to examine power structures, factions and hierarchies may lead to elite capture and undermine local acceptance (Blaikie 2006).

Frequently, the differential access to resources inside local communities is mirrored in community-based management approaches (Ribot & Peluso 2003; Baitoningsih 2009). People who use fewer resources might not depend less on them, but simply lack the entitlement for access (Leach *et al.* 1999). A broadening of the involvement of local communities via established leadership structures will not necessarily lead to the integration of everybody's interests. Situations may occur where only particular members of a community attend meetings, while others avoid them as they perceive they have

nothing to gain from participation (Mitchell 1999). As a result, a majority of community members may be uninformed and even unaware of MPA planning and implementation processes (Elliott *et al.* 2001; Bennett *et al.* 2006). Differing and potentially conflicting views and priorities regarding natural resources may be overlooked or ignored without meaningful participation. For example, for an MPA in Berau Province (East Kalimantan, Indonesia), a zonation plan was developed under the guidance of large transnational conservation organizations (B. Gunawan, personal communication 2009). Core and buffer zones were demarcated based on Western scientific knowledge with the aim of ecological conservation. While representatives of several coastal communities had informed the steering committee of the MPA that they must be included and allowed to give input into zoning (WWF-TNC [World Wildlife Fund-The Nature Conservancy] 2006), the no-take zones established now coincide with areas identified by local fishers as important fishing grounds (Venstra 2007). Without the collaboration and negotiation of all groups concerned, zoning maps will only capture segmented and partial information that might exclude the priorities of central ecosystem user groups. That this instigates resistance, conflict and implementation failure comes as no surprise.

Potentially existing ecological knowledge of local communities is seldom acknowledged when designing MPAs. This is either owing to unresolved issues surrounding ecological illiteracy, an assumed supremacy of Western-style conservation concepts, the enthusiasm of legislators for declaring MPAs without going through laborious planning procedures, or a lack of mechanisms for local communities to contribute and participate in designing and monitoring MPAs (Johannes 1998; Sale 2008). Furthermore, while the presence of ecological mechanisms underlying habitat degradation and species depletion might be intuitive for academic advisors and policy makers, local resource users might explain the abundance or scarcity of target organisms by cultural or religious beliefs (Zerner 1994; Foale 2002). Hence, local use and management of resources may not agree with prevailing scientific or management paradigms calling for conservation and constraint (Majors 2008). Too often, the introduction of rules devised by external decision-makers and based on scientific criteria thus results in the alienation and exclusion of local people (Christie 2004; Oracion *et al.* 2005).

Coastal small-scale fisheries are often subject to high spatial and temporal variability, owing to environmental and target-species seasonality and the prevailing open access nature of marine resources (see for example Amar *et al.* 1996). Customary marine tenure frequently accounts for such variability by employing spatially and temporally flexible use regulations (Cinner *et al.* 2006). Area and time-specific regulations have recently been advocated in fisheries management (Hall 2009), but this approach is not yet fully acknowledged in MPA design. Even though the different MPA categories listed by the IUCN (Dudley 2008) allow for a variety of uses, the majority of formally gazetted MPAs are rigid, without allowances for temporal or spatial flexibility in

regulations. Customary regulations of resource use, frequently the most appropriate form of management in a given context, do not fit into the rigid rules that govern most MPAs. In their current form, MPAs still constitute a rather unsophisticated and inflexible concept that does not cover the entire spectrum of possible management measures (Polunin 2002). This poses a potential barrier for the successful integration of local communities' marine resource use patterns.

THE WAY FORWARD: COMPLEMENTING MPAS AND CBMRM

In the evaluation of MPAs, socioeconomic considerations have to be adequately addressed (Christie 2004). Tools are available for the assessment of factors important for community participation in management and local perceptions of MPAs (Pollnac 1998; Bunce *et al.* 2000; Pomeroy *et al.* 2004; Halim & Mous 2006; Himes 2007). They can guide the way to identify problems, formulate solutions and develop targeted research. There are some successful examples: with over 1100 established MPAs of which about 20% are reaching their management goals (Lowry *et al.* 2009), the Philippines today is probably the leading nation in terms of numbers of MPAs. Quite a few have successfully grown 'from the bottom-up' with local institutional dynamics largely decoupled from central government objectives. The LMMA network in the Indo-Pacific has managed to capitalize on widespread traditions of CMT in the region to successfully establish community-based adaptive management in a number of countries (Govan *et al.* 2008). Furthermore, the Brazilian concept of marine extractive reserves (MERs) most consistently uses the protected area concept to incorporate local livelihood interests (Diegues 2008). Several general lessons can be drawn from these experiences. The combination of rights and responsibilities of local communities and participating authorities has to be transparent and unambiguous. There need to be appropriate incentives for local ecosystem users to cooperate. Ideally, the area to be protected should also be important for maintaining the livelihoods of the local communities (Glaser & da Silva Oliveira 2004; Diegues 2008).

Herewith we offer an overview of strategic principles that facilitate the development of a common understanding of resources management. These help to co-design management plans using the knowledge of local communities, authorities and researchers.

Increased flexibility

MPAs and their corresponding regulations need to be more flexible. Conservation approaches that are copied from terrestrial systems may lack the flexibility needed for community-based management of marine resources (Cinner *et al.* 2009a). Instead of fixed zoning, seasonal or other temporary closures can be used to protect vulnerable areas such as spawning grounds. While permanent closures are usually described as the most effective means for conservation

(Agardy *et al.* 2003), regimes allowing for temporary uses may be more effective (McClanahan *et al.* 2006). MPA designs which incorporate already effective rules-in-use of this kind are more likely to succeed in the local context (Johannes 1982). Measures such as rotational closures need to be coupled to effective controls of fishing effort or gear because the biomass of targeted species may be rapidly depleted by indiscriminate harvesting and take a long time to recover (ISRS 2004; Russ & Alcala 2004; Bartlett *et al.* 2010). Adaptive restrictions for fishing gear, supported by iterative planning processes, can also contribute to an increased flexibility of MPAs (*sensu* McClanahan & Cinner 2008).

Account for local views and priorities

Finding forms of locally meaningful participation, including different factions and knowledge of local communities, remains a key challenge (Majors 2008). In order to ensure a broad involvement of stakeholders in designing and implementing MPAs, a starting point can be the participatory mapping of interests and resource use of potentially affected groups (see Bunce *et al.* 2000; Aswani & Lauer 2006). This helps to identify areas of conflict and cooperation. The combination of such data with spatial information technology (such as geographic positioning systems [GPS]) and geographic information systems (GIS) provides a useful tool to integrate local and scientific knowledge (Calamia 1999; Momberg *et al.* 1999; De Freitas & Tagliani 2009) as well as the basis for the development of negotiation and cooperation between relevant stakeholders.

To deal with intracommunity heterogeneity, Agrawal & Gibson (1999) recommend a focus on the multiple actors with various and often divergent interests, on the processes through which they interrelate, and on the governing institutions. By targeting these with policies, incentives and capacity building, co-management can be supported (Agrawal & Gibson 1999; Leach *et al.* 1999; Berkes 2004; Singleton 2009). The distributive effects caused by feed-backs between conservation measures and local community asymmetries must be a central part of conservation planning if inequalities, exclusion, and local resistance to MPAs are to be avoided (Singleton 2009). A toolbox for effective participation of local actors can build upon experiences from existing successful examples of CBMRM and tools developed for participatory rural appraisal (Chambers 1992; World Bank 1996; Rambaldi & Callosa 2000, 2002; White *et al.* 2006; Govan *et al.* 2008). Legal and institutional frameworks are often still inadequate for the involvement of local communities in MPA design and co-management, negatively impacting the ecosystem concerned (Gelcich *et al.* 2006). State power structures do not always favor the establishment of active participation of resource users in natural resource management (Syarif 2009). Examples from Melanesia, where several governments have striven to strengthen community-based management by reforming national legislation (Caillaud *et al.* 2004), may help in devising appropriate policy frameworks. It is important to

remember, though, that no single universally valid solution can exist since the appropriate approach always depends on the local context.

Support platforms for knowledge exchange

Traditional, scientific and management knowledge should be combined to solve conflicts. MPAs should be designed as 'platforms for social learning' able to include traditional and other knowledge collaboratively and to react to change in an adaptive manner. The inter-community exchange with local people from successful community-managed MPA projects elsewhere and the establishment of fora where scientists, policy makers and community members interact help to combine relevant complementary knowledge and to recognize differences in stakeholder priorities. Thus, experiences with the organization and implementation of management measures can be exchanged, and effective working relations developed (Crawford *et al.* 1998; Alcala & Russ 2006; Singleton 2009). While subject to the same dangers of internal dependencies and power asymmetries among members of local communities, the creation of stakeholder fora, endowed with established rights and responsibilities, including the basic operational support for these institutions, is essential for the continuous participation of the local users of the ecosystems to be protected (Olsson *et al.* 2004). Such MPA fora need to relate to the locally prevalent social networks and forms and procedures of communication. Regular meetings can be used to discuss and decide on certain regulations, and to keep all parties informed about upcoming issues which may influence the MPA. Additionally, the development of MPA networks in areas with strong CMT traditions benefits from intercommunity exchange and networking (Foale & Manele 2004; Bartlett & Manua 2009). Pietri *et al.* (2009) showed that MPA compliance and success increase when MPA networks are endowed with infrastructure for the exchange and diffusion of information. Exchange platforms are an important factor in adaptive learning and resource management, increasing social-ecological resilience (Berkes & Turner 2006). The exchange of information and knowledge is crucial for involving local communities in conservation, but also to improve outsiders' understanding of local perspectives. Such two-way capacitation serves to better tailor MPA approaches to local needs and to anticipate difficulties (McClanahan *et al.* 2005; Oracion *et al.* 2005). More studies of communication patterns in cases of successful and unsuccessful participatory management (for example Tam 2007) are needed to improve MPA design towards more effective forms of participation.

Generate meaningful incentives

For the management of an open-access resource to develop, the expected benefits of investing and participating in management must be higher than the perceived costs (Ostrom 1990). In combination with the establishment of local rights

and obligations, the development of alternative livelihoods is important to provide incentives for community participation (Cinner *et al.* 2009b). Alternative livelihoods do not guarantee that beneficiaries will discontinue activities that contribute to resource degradation (Pollnac *et al.* 2001b). Additional income might even be invested in unsustainable practices (Sievanen *et al.* 2005). Thus, destructive fishing might continue when decreasing returns might otherwise have necessitated a shift to different activities. In order to avoid the reinforcement of existing unsustainable use patterns, rewards for sustainable livelihoods should be accompanied by an effective system of gradual sanctions for destructive activities (UNEP [United Nations Environment Programme] 2004). The creation of alternative income sources that support conservation rather than undermine it needs further research (White & Green 2003). Where community livelihoods are largely dependent on the ecosystem in question, the alternative livelihood option must be based on ecosystem protection to achieve a shift away from destructive behaviour. The benefits from a new livelihood option to those engaged in destructive resource use also need to be larger than the returns from the destructive livelihood. While the combination of such conditions is rare (for instance, in the development of community-based ecotourism accompanied by positive effects on reef fish and coral cover in Hol Chan, Belize; Garaway & Esteban 2002), cases of long-term success do exist and provide important lessons. More studies of successful marine conservation practice are needed to establish which conditions are most likely to meet with success.

Building on local norms and rules

A significant challenge lies in the development of 'local' management where traditional rules are missing or are blatantly inappropriate to present-day conditions. The absence or erosion of 'traditional' marine management does not mean that there are no local norms or rules concerning resource use. However, they may be more difficult to detect for the outsider and may not be agreed upon, or even known, by all members of a local community. In these cases, a challenge lies in formulating and making explicit commonly agreed rules in order to incorporate them into codified regulations. One possibility for policy design where rules are insufficient is the use of multi-level games. These enable the assessment of multi-level policy-making and behavioural responses, and thus support the cooperation of policy makers and resource users in assessing, inventing and selecting integrated marine management strategies. The underlying principle is to project the analysis onto the actual life cycle of various categories of actors, addressing decisions from the simplest daily domestic action, to the most strategic corporate management choice. This allows for an evaluation of the design of a particular MPA. Our suggestion for MPA design draws on approaches from experimental economics, in which field experiments are used to assess theoretical assumptions. This can be usefully complemented with

participatory modelling techniques (Vennix 1996; Daniell & Ferrand 2006) and companion modelling (Barreteau *et al.* 2003), where stakeholders jointly build a model of their situation and actions, and then apply it in simulations or role playing experiments in order to better design new strategies and assess their impacts (for example Ferrand 2007; Daniell 2008; Máñez Costa *et al.* 2009).

Additionally, even in those areas where the sea is formally an open access area, fishers usually implement some de facto rules-in-use pertaining to the use of the area or fishing practices to reduce conflict. While these emergent rules may not be adequately captured by ethnographic studies of traditional regulations that have developed over a long time, they can be made explicit through the mapping of fishing activities and gear use (see, for example, Zerner 1990). An alternative methodological approach is the use of game-based modelling exercises to reveal the rationales behind local agents' ecosystem-relevant behaviour (Castella *et al.* 2005; Ferrand 2007). Such arrangements can be used as the basis for the development of local participation in MPA design. Participatory GIS tools can help in the establishment of use zones and in the formulation of appropriate legal frameworks (Rubec *et al.* 2009). An important lesson from previous projects is that a perception of crisis in terms of natural resources is often a decisive factor for the involvement of local communities in management and the emergence of local rules on resource use (Siar *et al.* 1992; Pollnac *et al.* 2001a; Pomeroy *et al.* 2001).

CONCLUSIONS

An implementation practice which achieves stated MPA goals is still rare. Reasons for this may be legal, institutional and financial constraints, but also the desire to produce fast results with minimal effort. As ill-conceived interventions result in the alienation of local communities, leading to loss of interest, non-compliance and resistance, it is important to remain realistic about goals and potential limitations and shortcomings in MPA design. More independent studies, such as those by the ICSF (2009), are needed to better understand shortcomings from a community perspective. More comprehensive tools and well-timed interventions are required that follow local needs and capacities rather than project and political cycles.

Participatory processes need to be improved towards effective rights, meaningful regulations and reliable procedures and protocols for local resource users. This relates to at least five areas:

- (1) The establishment of MPAs both territorially and institutionally.
- (2) The development of monitoring criteria and the evaluation of monitoring outcomes.
- (3) The adaptive management of MPAs especially when faced with uncertainty, surprise, sudden shocks and unforeseen conflicts.

- (4) The inclusion of emergent rules and their associated rationales, especially in areas where there is little or no tradition in marine management.
- (5) A distribution of costs and benefits of MPAs which is locally perceived as just and equitable.

Community-based management systems have the advantage of usually being flexible and adaptive, and thus help in increasing the resilience of coastal social-ecological systems (Olsson *et al.* 2004; Folke *et al.* 2005). However, their use for conservation of marine resources is often constrained by a lack of adequate policy frameworks, a lack or insufficiency of customary management in the face of economic or social-ecological changes, an incompatibility with MPA design, the risk of elite capture, or a lack of coordination and integration beyond the local level. In the face of highly complex and dynamic threats to coastal ecosystems, the concept of CBMRM should not be easily discarded. We argue that, in order to achieve the effective inclusion of local potentials, even in cases where community management traditions are lacking, the community focus of MPA design and implementation must be maintained. A future challenge is to assess the scope and limitations of this. The current paucity of legal frameworks, institutional linkages and flexible multi-level governance systems which hampers the adaptive management of CBMRM (Clifton 2003; Armitage 2005; Cinner 2005; Cinner & Aswani 2007) needs to be addressed by the integration of community-based management into MPA design. Where management traditions are lacking, a focus on emergent rules that acknowledges the relevance of day-to-day user knowledge may be the way forward. While the involvement of communities in management has made some important advances in the past three decades, from top-down centralized management of marine resources to community-based management, and finally to co-management when it became clear that community-based management could not succeed in isolation (Christie & White 1997; Pomeroy & Viswanathan 2003), there is still some way to go towards sustainable management. Successful management must continue to involve, but not be exclusively based upon, local communities, first of all because 'communities' as a homogeneous structure are an illusion, but also because communities sometimes lack the capacities to undertake sanctions against severe infringements of management rules. It is here that the state is called upon. Solid rules, jointly agreed upon using well-designed forms of local participation which give the majority of local ecosystem users a voice, and the strict enforcement of such rules with state support are important. Frequently, the perception that regulations work against them, rather than to protect them, or do not work at all, frustrates local communities and undermines co-management (Baitoningsih 2009; Christie *et al.* 2009). Providing a platform that enables communities to participate in enforcement can significantly improve marine management (Crawford *et al.* 2004). MPAs can provide a frame to complement the strengths of community-based management while at the same time

placing it into an institutional framework that includes government bodies (Maliao *et al.* 2009). In the future, a revised co-management version of CBMRM, community-based MPAs in which enforcement and control is not necessarily based in the community, but on communities' needs and priorities, may prove most successful for marine conservation.

Community-based MPAs are not an end in themselves, but they can be the first step towards a wider integrated network of managed areas to meet the ecological imperatives of conservation (Christie *et al.* 2007; IUCN-WCPA [World Conservation Union-World Commission on Protected Areas] 2008). The feasibility of establishing such large-scale networks depends directly on the effective inclusion of communities at the local level (Christie *et al.* 2009). At the same time, it should be clear that there can never be a universal template for the successful implementation of MPAs. Approaches have to be context-specific, flexible and adapted to the local social, political and ecological setting. In addition, they should be combined with wider measures such as improved education and the development of alternative livelihoods (Polunin 2002; ISRS 2004). Coastal marine conservation will only succeed if local communities are allies, rather than alienated from it. A deeper understanding of what drives positive conservation behaviour, and what hampers it, is needed, and the participation of communities continues to be essential.

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