In: Marine Research and Conservation in the Coral Triangle ISBN 978-1-61668-473-0
Editors: Richard K.F. Unsworth, Julian Clifton, pp.

Chapter 15

FUTURE DIRECTIONS FOR MARINE CONSERVATION IN THE CORAL TRIANGLE

Julian Clifton(1) and Richard K.F. Unsworth(2)

1. School of Earth and Environment, University of Western Australia, Crawley, WA 6009 Australia
2. Marine Ecology Group, Northern Fisheries Centre, Department of Employment, Economic Development and Innovation, Queensland Government, PO Box 5396, Cairns, QLD 4870, Australia

This book owes its existence to the diversity and depth of research conducted in the Wakatobi National Park over the past ten years by a range of academics from the natural and social sciences, all of whom have a shared interest in marine conservation. It was our intention to utilize this work, aspects of which have been published in numerous academic journals, to produce a single text which could demonstrate the theoretical and practical value of specialized research with regard to marine conservation and resource management. This was given additional impetus by the recent upsurge of interest in these issues in the wider Coral Triangle area and the investments being made by governments, non-governmental organizations and other groups towards conservation in this region. In so doing, we hoped to be able to highlight issues of common concern which may facilitate good governance of existing and future marine protected areas in the area.

One recurrent theme throughout this text has been the value of the Wakatobi National Park as a 'living laboratory', whose geographical characteristics and high biodiversity enables the advancement of scientific knowledge in a variety of areas. This point is underlined in relation to reef resilience by Hennige and colleagues in chapter 3, mangrove environments by Cragg and Hendy in chapter 5, bird populations by Kelly and Marples in chapter 9 and specialized studies of sponge assemblages (Bell and colleagues) and intertidal habitats (Bennett) in chapters 6 and 7 respectively. The implications of this research, which has been focused in a relatively small region of the WNP, are clearly evident in that further discoveries of practical relevance to resource conservation await both within the WNP and in the surrounding region. As in many situations, the restricting factors include funding, personnel and research facilities. The advances that have been made in the Wakatobi are, however,

indicative of how the quality of the natural environment can be used to attract academics, graduates and undergraduate students engaged in a structured research programme. The existence of many established organizations catering for this 'research tourism' or 'volunteer tourism' market is testament to its ability to withstand political, economic and other upheavals which are unfortunately more common in developing countries where such research is based. In light of the need for sound scientific data underpinning ecosystem-based management, this type of research offers considerable potential for development elsewhere in the Coral Triangle to support conservation measures. It should also serve as a means to form collaborations between local and overseas academics and thereby assist the longer term development of intellectual capacity and expertise through shared knowledge.

However, another theme emerging from these contributions relates to the ongoing degradation of the marine environment in the Wakatobi. Through an extensive review of data collected over five years, McMellor and Smith demonstrate the potential for short term widespread changes in coral cover and fish assemblages. Although the direct causes of these changes are difficult to accurately ascertain, unsustainable levels of fishing are quickly altering the trophic structure of these marine systems. Declining coral cover should be seen as a warning signal of future environmental degradation. These findings demonstrate the extent to which known centres of marine biodiversity such as the WNP may be subject to periods of environmental degradation, with clear implications for the stability of ecosystems at a larger scale. In chapter 11, Exton illustrates how the introduction of intensive fishing techniques can have dramatic impacts upon the productivity and long-term sustainability of nearshore fisheries. The adoption of these techniques is related to the need to sustain individual catch returns from a declining fishery, which itself is linked to a growing population and lack of alternative protein sources. Once again, these features are characteristic of a wide range of maritime communities in the Coral Triangle, although the lack of detailed catch data at the local level prevents the identification of similar problems elsewhere. A similar problem of unsustainable fishing is identified by Unsworth through long term studies of the seagrass meadows in the Wakatobi, wherein a range of fishing practices practiced by a growing population is seen to be having detrimental impacts on both invertebrates and fish stocks in these habitats. Whilst remaining an under-researched area, de León and colleagues show that the functional roles of seagrass meadows in the Wakatobi and the connectivity between seagrass and other habitats underline the negative implications of further environmental degradation to local fish stocks and the need for much greater ecosystem-based co-management. Seagrass meadows and mangroves play large roles in contributing to coral reef productivity, but this role is rarely recognised in marine park management in the Coral Triangle. Effective ecosystem based management needs to embrace these roles. Finally, the unmanaged exploitation of mangroves for firewood, housing and fish trap construction is shown by Cragg and Hendy as presenting a threat to both the resident fauna and the maintenance of other ecosystem services. Once more, these activities are enhanced in proximity to existing settlements and are thus likely to be exacerbated under conditions of continued population growth.

This widespread and ongoing degradation of various habitats within the Wakatobi National Park inevitably focuses attention upon the resident groups whose activities are thought responsible for these trends and the design of appropriate policies to address these issues. Cullen's detailed quantification of socio-economic characteristics of village communities in Kaledupa underlines both the general extent of dependence on marine

resources and its variability at the inter- and intra-village level. The need for policies tailored to the local context is emphasised through this research. This is reflected in Clifton's description of spiritual and cultural characteristics amongst the Bajau ethnic group who are widely held to be responsible for activities resulting in unsustainable resource usage. The fundamental differences in environmental perceptions between the Bajau and those trained in Western scientific thought presents an obvious example of the need for conservation policies to be reflective of the local cultural as well as socio-economic environment. Pilgrim's analysis of traditional environmental knowledge serves as a reminder that policies designed to address perceived 'poverty' and promote livelihood diversification as a means to address over-reliance on marine resources run the risk of eroding and eventually losing valuable and irreplaceable ecoliteracy. The roles played by international non-governmental organisations with regard to park policies are highlighted by Clifton, who demonstrates how these may be incongruent with local resource users' needs and the implications for the Coral Triangle under this model of protected area development.

If it is accepted that the data presented here can be used as an exemplar for the wider Coral Triangle region, the implications of these findings warrant further comment. The dependence of local communities upon maritime resources cannot be disputed and, other than widespread events such as coral bleaching or ocean acidification, will be the most significant factor contributing towards environmental degradation. However, it would be inappropriate to assume that stricter enforcement of national park regulations alone can successfully address these issues, as this would neglect the wider driving forces influencing behaviour and choice at the individual and community level. With regard to unsustainable levels of fishing, which is associated with population growth and increasingly intensive fishing techniques, clearly the former is outside the control of any national park management. The adoption of newer, more efficient, fishing technology can theoretically be regulated by prohibition, licensing or other means. However, this can only practically be enforced in relation to residents of the national park, meaning that fishers entering the park using these techniques would be 'free-riders' benefiting from the abstinence of local fishers. In the case of the Wakatobi, there are few nearby centres of population outside the park boundaries and hence the majority of fishing effort can be associated with park residents. In other parks, however, the presence of 'free-riders' may quickly erode any support for restrictive measures amongst local fishers, leading to a reduction in compliance, an increase in enforcement costs and a greater potential for conflict between fishers and management authorities.

The instigation of alternative income-generating activities is often perceived by park managers, non-governmental organizations and policy advisers as a means to reduce fishing pressure. In developing countries such as those in the Coral Triangle region, the most commonly cited strategies include promoting tourism, particularly nature-based tourism or ecotourism, mariculture practices such as seaweed farming or the promotion of agriculture as a substitute protein source to replace fish and other marine resources. With respect to the Wakatobi, the low rainfall and limestone geology restricting surface drainage leads to poor soil quality, hence the latter alternative is not realistic. In other marine protected areas, land itself may be scarce or subject to intensive use for cash crops or subsistence purposes, whilst the adoption of new techniques may be restricted by farmers' lack of knowledge or unwillingness to alter existing practices.

The cultivation of seaweed, principally *Eucheuma*, along lengths of submerged fishing line over the reef flat, has expanded rapidly both within the Wakatobi and the wider region,

with the Philippines and Indonesia leading current global production (Sievanen *et al*., 2007). This reflects the ongoing increase in demand for carrageenan which is extracted from dried seaweed for use in food processing and the cosmetics and pharmaceutical sectors. Projects in developing countries have frequently sought to diversify the economic base of fishing communities through such activities with the intention of reducing overall fishing effort. This view is reflected in the current WNP management plan which specifies that these provide sustainable alternative incomes to fishing activity. However, research has shown that seaweed farming, whilst offering a viable alternative income source to fishing communities, can actually result in increased pressure on fisheries as individuals invest capital earned in fishing equipment and technology (Sievanen *et al*., 2007). Moreover, the involvement of women and children in seaweed farming may mean that men continue to focus their efforts on fishing activities, resulting in little change in fishing effort. It is also important to recognise that the growth of marine algae within shallow-water environments has been recorded to have detrimental impacts upon seagrass productivity (Eklöf *et al*., 2006). It may be prudent to develop methods to extend this aquaculture into deeper waters rather than inpact the ecologiucal function of seagrass habitats.

The potential incomes derived from seaweed farming are, however, constrained in rural or remote areas by the facilities, skills and energy supplies required to extract carrageenan, hence the only processing activity possible involves air-drying of the product. Taking the Wakatobi as an example, this means that, whilst seaweed cultivation may contribute significantly towards total regional income (Cullen, this volume), this is more reflective of the total number of individuals involved. The annual household income associated with seaweed cultivation in Kaledupa is in the order of US$600, exceeded by all other categories including fishing (US$700), tourism (US$800), seaweed trading (US$1100) and civil servant occupations (US$1600) (Cullen, 2007).

Other maricultural practices promoted to reduce pressure on fisheries in the Coral Triangle region focus upon crustaceans (prawns, shrimp and crabs) and fish (milkfish,grouper and snapper) which are ‘cultivated’ in ponds, pens or cages. The adverse environmental impacts of these practices are well documented, principally involving the loss of mangrove forests and high levels of organic and inorganic pollution. Shrimp farming alone is considered to account for over a third of mangrove habitat loss (Valiela *et al*., 2001). Furthermore, the use of wild-caught juveniles rather than hatchery larvae generates a large bycatch from seine netting activities designed to target species such as milkfish. This bycatch can constitute up to 85% of the catch, causing considerable additional stresses to nearshore fisheries (Primavera, 2006). Pollution of nearshore coastal environments and the spread of diseases from cultured species present additional risks.

In light of these considerations, nature-based tourism or ecotourism would appear to offer many comparative advantages as an alternative income source, given its dependence upon undisturbed or pristine marine environments and the various potential socio-economic benefits available to local communities (Fennell, 2008). The Wakatobi NP is notable in that tourism in any form has been considerably constrained up until very recently due to the lack of commercial air transport to the region. The most recently available data indicate that international visitor numbers remained around 900 per year between 2001 and 2004, in contrast to the average of almost 8,000 international visitors to Bunaken National Park in north Sulawesi during this period (Kwakkel-Hol, 2006; Bunaken National Park, 2009). The impetus for increased levels of international visitation to the WNP has come about with the

opening of the formerly private airstrip on Tomia to commercial use and the completion of Matahora airport on Wangi-Wangi in 2009, the latter being capable of accommodating aircraft carrying 168 passengers. This impetus is also reflected in the head of the Wakatobi district government's recent announcement stating a target of 40,000 visitors annually. Given these developments, it would appear that tourism in the Wakatobi is not envisaged as being focused upon small-scale, environmentally sensitive forms of nature-based tourism, which has evident implications for conservation, environmental quality and the participation of local communities in tourism-related activities. The significance of this is reflected in the fact that there is a complete absence of sanitation systems across all of the Wakatobi islands, whilst disposal of solid waste is already a chronic problem with detrimental effects visible in many beaches and coastal locations. Furthermore, the targeting of a general tourism market rather than the niche segment represented by nature-based tourism or ecotourism would likely diminish the proportion of economic benefits accruing to local communities. Customers in the nature-based tourism segment often have a greater interest in consuming locally produced goods or services in comparison to those in the general tourism market, lessening the economic multipliers associated with the latter form of tourism. Furthermore, the need for established linkages between local tourism operators and travel agents, airlines and other sectors at the international level to meet the demands of the general tourism market greatly restricts opportunities for local involvement and participation in the industry.

The provision of alternative income sources itself does not guarantee a reduction in fishing pressure, as employment in mariculture or tourism often represents a supplementary rather than alternative activity. Occupational multiplicity is a characteristic feature of coastal communities, with residents optimizing the potential contribution from various income streams in order to minimize overall risk (Allison and Ellis, 2001). This also highlights the underlying assumption that poor communities engage in destructive or degrading fishing practices and that this can be addressed through diversifying the economic base and promoting economic development. Such an assumption is frequently not borne out in reality, with the driving forces behind poverty being unaffected by interventions designed to address narrowly defined indicators of both poverty and biodiversity (Agrawal and Redford, 2006).

The question therefore arises as to what, if any, form of action is appropriate in order to alter patterns of unsustainable resource usage such as those which have been documented in the Wakatobi. Increasingly strict enforcement of existing regulations is a short term option which may achieve certain goals but will inevitably increase costs of enforcement as user groups grow increasingly frustrated and non-compliant. Education and awareness-raising is frequently seen as a means to facilitate acceptance of the need for restrictions on natural resource usage. However, as highlighted in this text, such measures reflect a specific worldview grounded in empiricism which may be incongruent with resource users' epistemologies. The inclination to discount these forms of knowledge, effectively excluding them from contributing towards decision-making, enhances the levels of uncertainty in resource management and should therefore be avoided.

This highlights a potential path forward in marine conservation for the Coral Triangle region which may both facilitate participation and inclusion of local stakeholders whilst also strengthening scientific and non-scientific contributions towards resource management. Achieving an empathetic understanding of local resource users' beliefs with regard to the natural environment is inevitably slow and requires a highly specific array of skills and research techniques. However, this reflects the fact that these local resource users are

themselves a diverse group of individuals, each of whom has specific views, needs and desires in relation to the natural environment (Agrawal and Gibson, 1999). Understanding how these views have evolved and their relationship to non-local notions of protected areas, sustainability and conservation itself would enable an approach to management which can accommodate and reflect the diverse cultural background of all interested parties.

The generation of 'hybrid knowledge', whereby equal value is attributed to differing forms of knowledge, occupies a distinct place in development studies (Nygren, 1999) and has prior application in natural resource management (Thomas and Twyman, 2004; Cinner and Aswani, 2007). It is evident from the preceding chapters that scientific research in the Wakatobi and elsewhere in the Coral Triangle is only just beginning to discern the nature and extent of environmental interactions, which serves to highlight the potential benefits of this approach to understanding and managing the natural environment. Evidently, this would broaden the scope of conservation-related activities, drawing in active contributions from anthropologists and other social scientists who themselves have developed a distinct discourse and body of work in relation to protected areas. Recent reviews of this literature (West *et al*., 2006) underline the means through which a shared understanding of communities' views on their environment and their rights to access resources can be achieved.

A corollary of this, however, is that some current approaches to marine conservation emphasizing strengthened management 'solutions' to perceived 'threats' such as destructive fishing would need to be revised. There is undoubtedly a strong body of opinion demanding that conservation measures be reinforced in the light of evidence pointing towards ongoing loss of biodiversity, with the International Union for the Conservation of Nature (IUCN) stating that 'delaying MPA design and implementation rarely, if ever, benefits marine conservation' (IUCN, 2008). The adoption of a more holistic approach based upon integrating natural and social science perspectives would be readily perceived in some quarters as introducing unwanted delays and labeled counter productive in this regard. However, it can be equally stated that a precautionary approach to marine conservation necessitates the inclusion of all relevant data to guide decision-makers, as the consequences of inadequate or poorly-designed resource management policies are frequently unpredictable and/or irreversible. Furthermore, the adoption of adaptive management strategies as recommended by many workers (Olsson *et al*., 2004; Carlson and Berkes, 2005; Armitage *et al*., 2008) would recognize the evident failures in many marine parks worldwide and would seek to identify new means by which marine resource management and conservation can be improved.

With regard to the Wakatobi, such an approach involving joint knowledge sharing and research involving local communities and scientists would firstly, and most importantly, enable a greater understanding of the dynamics of the marine environment and the natural variability of fish stocks. This would directly help managers through enabling prioritization of key issues and the range of options which may be appropriate to address these. Similarly, this would assist the further refinement of scientific research through identifying areas of uncertainty or conflicts in opinion. The establishment of close working relationships with fishing communities would aid the identification of the underlying economic, cultural and political forces driving 'destructive' fishing activities. A detailed understanding of the nature of individual and group decision-making in relation to livelihood activities would also

facilitate the design of culturally-specific mechanisms to reduce dependence on marine resources and lessen the impacts of these destructive fishing activities over time.

This would also require a parallel shift in working practices and relationships at the managerial level. Park authorities would need to move away from a focus on enforcement towards one of co-operation, recognizing and building upon the needs of fishing communities rather than consistently prioritizing environmental or scientific interests through fishing regulations. In many situations, relations between park authorities and fishery-dependent communities are strained as a result of past enforcement activities, hence developing new working relationships may require the intervention of 'brokers' acting as mediators to initiate this process. In this regard, local NGOs have been seen as fundamental towards generating new and productive alliances in the Wakatobi (Steenburgen, 2008). Whilst the outcome of any situation will be uncertain, reflecting individual brokers' capacity as well as the local circumstances, this would seem to be a logical step to take.

Furthermore, a management approach emphasizing the importance of active and equal community participation in research and management would necessitate a modification of policies followed by a number of international NGOs and their donors. Whilst the severity of threats to coral reefs in the Coral Triangle is without doubt, the current model of marine protected area networks fails to adequately recognise various factors which are crucial to long term conservation success. These include the specific needs of local communities, the variable nature of threats to coral reefs and their driving forces and the actual resilience of individual marine habitats to these threats. The drive towards establishing an international network of marine protected areas as currently envisaged by key NGOs assumes that a uniform policy of protected area design and enforcement is both appropriate and effective. This is counter to evidence presented in this text which underlines the need to understand the nature of driving forces at the local level and identify appropriate techniques in light of these. We argue that such networks should allow for a greater degree of autonomy in terms of management within the component protected areas. Building equal partnerships between international and small-scale indigenous NGOs would be more effective in promoting conservation within local communities than existing approaches followed by international NGOs which place emphasis on alliances with various levels of government. This would enhance existing social and institutional capacity in protected area management rather than seeking to create and superimpose a new layer of protected areas designed to meet regional goals rather than locally specific needs.

To conclude, this approach would entail the design of conservation strategies which are tailored to the local environmental and cultural context, rather than the 'one size fits all' policy dominating the thinking of some governments and non-governmental organizations. Whilst necessarily more complicated, lengthier and potentially costly in the short term, such a policy would have distinct long term advantages with regard to achieving the shared goals of scientists, local resource users, State agencies and other interest groups, which remains the conservation of natural resources for the use and enjoyment of the current generation and those to come.

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