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Marine Protected Areas in Sri Lanka: A Review

Nishan Perera · Asha de Vos

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Abstract Despite the popularity of marine protected areas (MPAs) as a management tool, increasing evidence shows that many fail to achieve conservation objectives. Although several MPAs exist in Sri Lanka, most are not managed, and resource extraction and habitat degradation continue unabated. At present, the declaration and management of MPAs is carried out without adequate consideration of the ecology, socioeconomic realities, or long-term management sustainability. Managers have focused more toward the creation of new legislation and protected areas rather than ensuring the implementation of existing regulations and management of existing protected areas. Poor coordination and a lack of serious political will have also hindered successful resource management. As in other developing countries, MPA managers have to contend with coastal communities that are directly dependant on marine resources for their subsistence. This often makes it unfeasible to exclude resource users, and MPAs have failed to attract necessary government support because many politicians are partial toward the immediate needs of local communities for both economic and political reasons. A more integrated approach, and decisions based on the analysis of all relevant criteria combined with a concerted and genuine effort toward implementing strategies and achieving predetermined targets, is needed for effective management of MPAs and the sustainable use of marine resources in Sri Lanka.

N. Perera (✉) · A. de Vos
Sri Lanka Country Office, The World Conservation Union,
53 Horton Place, Colombo 7, Sri Lanka
e-mail: boraluwa@gmail.com

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Introduction

Fishing and other forms of resource extraction provide substantial economic benefits to local communities (McManus 1997). Therefore, management of marine resources is necessary to ensure the sustainability of such activities for the well-being of coastal communities and for maintaining the ecological integrity and biological diversity of marine ecosystems. Marine protected areas (MPAs) have become one of the most accepted and successful marine resource management initiatives (Bohnsack 1993; Roberts & Polunin 1993), and their benefits in protecting habitats and increasing fish stocks have been well documented (Gell & Roberts 2003). MPAs vary from large fishery reserves and multiple-use parks to small, strict conservation zones and sanctuaries depending on habitat, resources available for management, and conservation objectives. The definition of an MPA is broad and includes many coastal ecosystems, such as estuaries, lagoons, salt marshes, mangroves, and beaches as well as true marine ecosystems and oceanic waters. According to the World Conservation Union (IUCN), an MPA is defined as being ''any area of inter-tidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment'' (Kelleher & Kenchington 1992). As such, in addition to protecting biological resources, MPAs may also include cultural and archeological sites, such as historic coastal buildings and shipwrecks (Zann 1996).

Despite having a short history, MPAs are now probably among the most popular tools for marine resource management (Kelleher & Kenchington 1992; Jones 1994). They provide an opportunity to concentrate efforts and resources into protecting representative or critical habitats (Kelleher 1999),which is a major advantage during ground-level implementation of management strategies and enforcement of regulations. Overall, conservation has shifted from a single-purpose approach toward an ecosystem-based approach that attempts to manage human use across a range of habitats (Stevens 2002). This provides a more holistic approach toward management than single-purpose laws and regulations that lack practical applicability and fail to consider ecosystem-level patterns and processes (Davis 2003). However, although the last few decades have seen a rapid increase in the declaration of new MPAs (Kelleher and others 1995), they have had limited success, especially in developing nations, where most fail to progress from the proposal or declaration stage to an implementation stage during which some degree of management is achieved (McClanahan 1999). The high cost of research and management and a poor understanding and lack of support from communities and politicians have been major obstacles toward successful marine resource management (Zann 1996). Marine environments are also considered as open access areas by the majority, who often are not supportive of the designation and enforcement of boundaries and no-take reserves. This article provides a brief review on the history and current status of MPAs in Sri Lanka and examines factors affecting their management and success in achieving conservation objectives.

MPAs in Sri Lanka

History

Acceptance and use of MPAs as a conservation tool has been slow in Sri Lanka. Several marine and coastal habitats located along the boundaries of terrestrial protected areas (TPAs) have not been afforded formal protection (Table 1), whereas some subtidal and intertidal habitats, such as wetlands, mangroves, and estuaries, are currently protected as part of TPAs and therefore not officially recognized as MPAs (Table 1).

Pigeon Island (Fig. 1), currently an MPA, was first declared a sanctuary in 1974 but did not incorporate the surrounding coral reefs until 2003. The first true MPA in Sri Lanka was declared in 1961 at Hikkaduwa in the form of a fisheries protected area under the Fisheries Ordinance to halt indiscriminate fishing (HSAMMSCC 1996). Subsequently, the Hikkaduwa Marine Sanctuary (Fig. 1) was created in 1979 and covers an area of 44.5 ha (Rajasuriya 1995). In 1998, it was declared a nature reserve, and the protected area extended to 104 ha, after which it was upgraded to the status of a national park in 2002 (Rajasuriya and others 2002). This series of declarations were carried out to provide a stronger legal mandate for management. The declaration of Hikkaduwa was followed by the establishment of several other MPAs around the country. However, although several other sites were identified as needing protection by an Inter-Ministerial Committee on Marine Parks and Sanctuaries, many have not yet been designated as protected areas (De Silva 1985; Rajasuriya 1995).

Legislation

Currently, the major legislation used in declaring protected areas is the Fauna and Flora Protection Ordinance (FFPO) of 1993, which is administered by the Department of Wildlife Conservation (DWC). This was created primarily for the purpose of protecting terrestrial biodiversity and has provision for the declaration of protected areas. Currently, four MPAs have been declared under this act as marine sanctuaries and national parks (Table 2). National parks provide the highest level of protection and do not allow any form of resource extraction. They also require regulation of access for nonextractive uses, although this is currently not carried out within marine national parks. Sanctuaries allow open access for nonextractive uses, and limited subsistence-based resource extraction under permit. In addition to this, there is provision under the Fisheries and Aquatic Resources Act (FARA) of 1996, which is administered by the Department of Fisheries and Aquatic Resources (DFAR), to declare fishery managed areas (FMAs). FMAs are designed for the management of fisheries through the restriction of fishing effort by regulating access to a limited number of licensed operators. To date, two marine FMAs have been declared under this act (Table 2).

Current Status

Despite increasing recognition of the need for management, ground-level action has not been forthcoming, and currently, most MPAs exist only as ''paper parks.'' The best criteria for judging the status of an MPA is the extent to which it is achieving the conservation objectives for which it was originally established (Zann 1996). Accordingly, using the scorecard approach developed by Staub and Hatziolos (2004), the management status of Sri Lanka's MPAs can be regarded as poor (Table 3). Within these MPAs, habitats continue to degrade, and fish stocks

Table 1 Major TPAs with marine and coastal components

Name	Year	Area / ha.	Responsible agency	Government legislation	Marine and coastal habitats within protected area	Marine and coastal habitats adjacent to protected area
Wilpattu National Park	1938	131,667.10	DWC	FFPO	Beaches, cliff coast, coastal vegetation	Sea grass beds
Yala National Park	1938	97,880.7	DWC	FFPO	Beach, sand dunes, coastal vegetation, coastal wetlands	Subtidal rocky reefs
Yala East National Park	1970	18,148.5	DWC	FFPO	Beach, sand dunes,coastal vegetation, coastal wetlands	Subtidal rocky reefs
Bundala National Park	1993	6,216	DWC	FFPO	Beach, sand dunes, coastal vegetation, coastal wetlands	Subtidal rocky reefs
Paraitivu Island Sanctuary	1973	97.1	DWC	FFPO		Subtidal reefs
Chundikulam Sanctuary	1938	11,149.1	DWC	FFPO	Lagoon system	
Kokilai Lagoon Sanctuary	1951	1,995	DWC	FFPO	Lagoon system	
Great Sober Island Sanctuary	1963	64.7	DWC	FFPO		Coral reefs
Little Sober Island Sanctuary	1963	6.5	DWC	FFPO		Coral reefs
Kalametiva Sanctuary	1984	2,525	DWC	FFPO	Lagoon, mangroves	

have decreased (Rajasuriya and others 2002, 2005; Rajasuriya 2005), indicating that their declaration is not achieving the desired objectives. Furthermore, management is mostly limited to policy decisions and development of management plans; there is little practical application. Management only exists within the Hikkaduwa National Park, where a park office has been established along with a resident park warden and several rangers. This has been effective in preventing fishing and coral mining within the MPA, although other activities, such as reef walking, continue unabated (Table 4). The Bar Reef Marine Sanctuary, Rumassala Marine Sanctuary, and Pigeon Island National Park are presently not managed, and destructive fishing practices, such as the use of explosives and bottom-set nets, occur regularly (Table 4).

Design and Management of MPAs in Sri Lanka

The declaration of MPAs in Sri Lanka has mostly been carried out in an ad hoc manner and has tended to ignore the practical realities involved in managing new MPAs. Such declarations have resulted in MPAs that may be ecologically unsustainable or difficult to manage because of inadequate planning of management needs. The procedure of identifying areas for protection and evaluating management options involves the analysis of multiple criteria that affect their ecological and socioeconomic processes (Fernandes and others 1999). This requires the integration of a variety of scientific, socioeconomic, and political factors, such as critical habitats and nursery areas for endangered and commercially important species, existing forms of resource use, traditional rights and indigenous uses, and economics (Stevens 2002). Policies based on a single criterion of evaluation, such as environmental quality, social acceptability, or economics, are often unsuccessful because they are unable to overcome complex problems influenced by multiple factors (reviewed by Fernandes and others 1999). For example, declaration of a no-take reserve will be unsuccessful if the local community is fisheries dependent because their needs must be accommodated. In such a case, there would be considerable pressure to violate regulations, as is the case with the Bar Reef Marine Sanctuary, where an extensive area with fisheries-dependant communities was declared as a sanctuary where fishing was prohibited.

Incorporation of Scientific Data

An understanding of ecological processes is vital for increasing management efficiency because it improves the capacity of marine resource managers to make decisions that result in maximum ecological benefits (Stevens 2002). Selection of protected habitats and their legislation should be based on scientific data that provide clear evidence of past and current status and management needs. This provides transparency to the planning process and promotes a

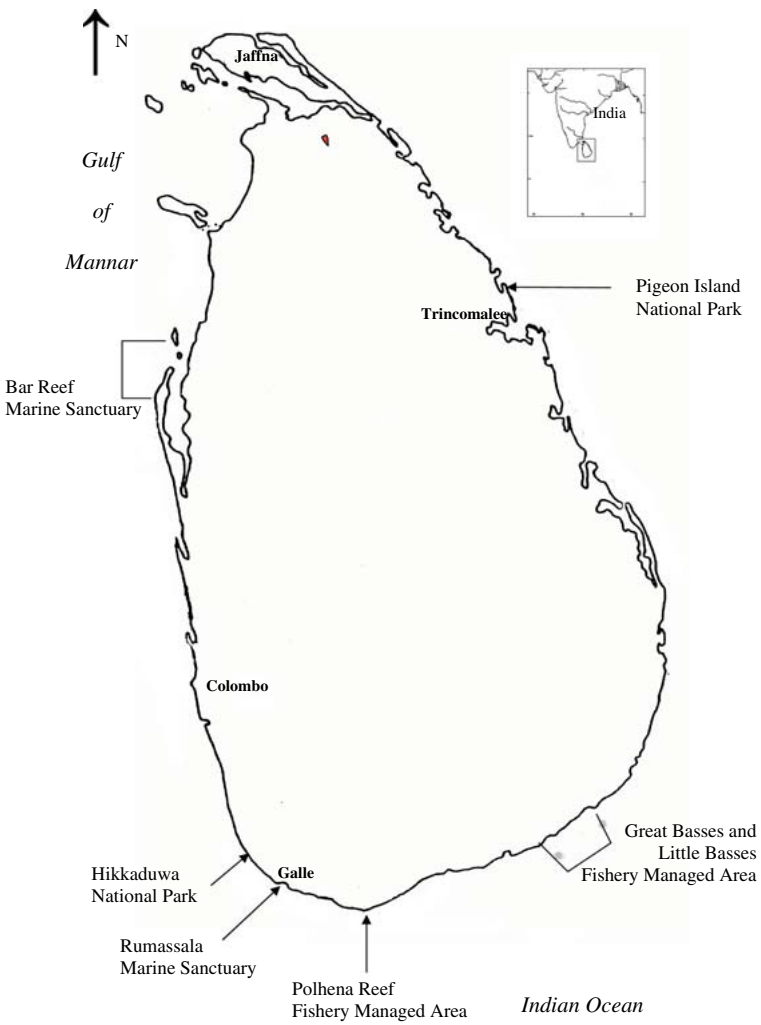

Fig. 1 Location of MPAs in Sri Lanka

greater degree of acceptance by resource users (Stevens 2002). However, many MPAs tend to be declared on limited data (Harriot and others 1999) as has been the case in Sri Lanka (Table 2).

Although research and monitoring has improved during the last decade, there are still major deficiencies in the available data. Currently, most research and monitoring are carried out by the National Aquatic Resources Research and Development Agency (NARA), which is the research institution under the Ministry of Fisheries and Aquatic Resources. However, the scope of this agency is restricted because resources are limited. Research by academic institutions and other organizations tend to be conducted in isolation without a cohesive approach and often fail to provide answers to specific management-related questions. At present, important information, such as patterns of larval recruitment as well as movement of commercially targeted fish species and their spawning behavior, are not known. To improve management, it is desirable to employ a more rigorous monitoring scheme to capture all such critical information. Additionally, communication between managers and researchers is poor, with responsible agencies often failing to identify and convey research priorities to researchers.

Community Involvement

Alienation of local communities has been a problem with many management plans around the world (Diop and others 1999; Himes 2003), leading to a lack of support for MPAs or other management interventions. MPA planners and managers must attempt to achieve both biological and social objectives by creating compatibility between them (Santora 2003). The incorporation of socioeconomic and sociological factors into management plans is fundamental for the success of MPAs (Bunce and others 1999). This is because different user groups tend to have antagonistic relationships with each other caused by competition for the same resource (Bunce and others 1999), and no single group is willing to make sacrifices because they believe it may provide an unfair advantage to others. The Coast Conser-

Table 2 PAs in Sri Lanka

Name	Year of declaration	Area / ha	Responsible agency	Governing legislation	Selection criteria	Permitted activities	Prohibited activities	Major habitats
Hikkaduwa National Park	1979*	104	DWC	FFPO	Biologically diverse and important marine habitat	Recreational activities	Fishing and extraction of other natural resources	Coral reef
Pigeon Island National Park	2003	471.4	DWC	FFPO	As above	As above	As above	Coral reef
Bar Reef Marine Sanctuary	1992	30,670	DWC	FFPO	As above	As above artisanal fisheries	Commercial fishing and other resource extraction	Coral reef, sandstone reef
Rumassala Marine Sanctuary	2003	1707	DWC	FFPO	As above	As above	As above	Coral reef
Great and Little Basses FMA	2001	Unclear†	DFAR	FARA	Management of commercially important fishery resources	Recreational activities, fishing with permit	Fishing without a licence from the DFAR	Rocky reefs
Polhena FMA	2001	Unclear†	DFAR	FARA	As above	As above	As above	Coral reef

* Upgraded to the status of national park in 2002

† Boundary of FMA has been demarcated, but area is not included in declaration

vation Department (CCD) of Sri Lanka has developed Special Area Management (SAM) plans to encourage local community participation in decision making and management (Ganewatte and others 1995). A SAM plan has been developed for Hikkaduwa National Park, while another is being developed for the Bar Reef Marine Sanctuary. As a result, these two sites are the only MPAs with some degree of planning and community input into management (Table 3). However, in many instances, community participation in management decision making has been limited, and managers have tended to ignore the suggestions and needs of local communities in the final planning process and implementation. Local communities also lack ownership of resources, thus decreasing their commitment toward conservation. As has been proven elsewhere (Crawford and others 2004), community-based management is most successful where communities are empowered to be directly responsible for management decision making and implementation. This includes enforcement of regulations through community-based institutions that are granted legal provisions to do so. Unfortunately, in the Sri Lankan context, local communities are still dependant on state institutions and mechanisms for implementation and enforcement. In many instances, such institutions are unable to enforce regulations, thereby leading to a breakdown of management mechanisms.

Education and Awareness

Support for conservation is enhanced by an educated and well-informed public (McClanahan 1999). Decisions must be clearly conveyed to resource users to ensure maximum cooperation and decrease suspicion of the management process. With the exception of Hikkaduwa National Park, the declaration of marine parks in Sri Lanka has not been publicized, and boundaries are not clearly demarcated. Fishermen and the public are often unaware of the boundaries or regulations of marine parks and are therefore likely to violate regulations. Another major problem has been a lack of awareness among the general public, which does not see marine habitats and species as charismatic or in need of conservation. An educated public with an appreciation of the marine environment can lead to a greater commitment to protect it. Public opposition to destructive practices has been effective in terrestrial conservation in Sri Lanka (Raheem & De Soysa 1995), but marine conservation fails to generate similar support.

Size and Structure

Curley and others (2002) state that understanding the relationships between habitats and the structure of faunal communities is essential because the former provides a

Table 3 Management success of MPAs in Sri Lanka*

Assessment criteria	Hikkaduwa National Park	Pigeon Island National Park	Bar Reef Marine Sanctuary	Rumassala Marine Sanctuary	Great and Little Basses FMA	Polhena FMA
Important threats and the policy environment	62	23	27	23	8	15
MPA design and planning	64	7	29	7	7	7
Availability of management resources	57	21	14	7	21	14
Management approach	44	4	24	4	0	0
Implementation of management programs and actions; delivery of products and services	23	0	10	0	0	0
Management outcomes and achievement of objectives	15	7	7	7	7	7
Total	40	10	18	8	6	7

* Based on the scorecard approach by Staub and Hatziolos (2004)

more tangible framework for designing and managing MPAs and sustainable fisheries. The size of an MPA can vary depending on habitat type and purpose of the area to be protected but wherever possible must be large enough to protect all life stages of an organism to maintain ecological integrity (Zann 1996). This is especially important to minimize human impacts because management is often poor or absent outside park boundaries (Zann 1996). Most MPAs in Sri Lanka are small and may not be ecologically viable in the long-term considering the reproductive strategies of many marine organisms.

Many coral and fish species are broadcast spawners, and larvae settling within a marine park are often likely to have originated elsewhere. Even species that produce larvae at a stage closer to planulation may require larger areas to provide adequate parent stock and suitable area for settlement to occur within park boundaries. This is highlighted by the fact that recruitment of many coral species is often lower in small isolated reef areas than larger reef systems (Harriot & Banks 1995; Soong and others 2003). As such, conventional marine parks may not be sufficient to protect small coral reefs (Epstein and others 1999). In Sri Lanka, this is evident in the small fringing reef within the Hikkaduwa National Park, which has shown poor recovery and coral recruitment since the 1998 mass coral bleaching event compared with larger areas such as the Bar Reef (Rajasuriya & Karunarathna 2002).

A number of fish species are also known to move across large areas and may require larger MPAs, or a system of multiple interconnected MPAs, to effectively protect them (Curley and others 2002; Griffiths & Wilke 2002). Some fishes also undergo age-related changes in diet (Gillanders 1995), leading to movements between habitats during their life cycle. In addition, although abundance and biomass of target fishery species is often higher within marine reserves, species richness and overall abundance may be greater in nonprotected areas (Garcia-Charton and others 2004). Considering such factors, the minimal viable size of an MPA is likely to be larger than that of most existing MPAs and may even require areas to be larger than that of most TPAs (Zann 1996). Designing a network of interconnected MPAs or implementing the biosphere reserve concept (Batisse 1990) is likely to provide greater ecological integrity than a multitude of patchy habitats that are geographically separate from each other.

Representative Areas

Ideally, MPAs should include a variety of habitats representing all habitat types and biodiversity of an area (Roberts & Hawkins 2000, cited in Harmen and others 2003). Representativeness and uniqueness are now regarded as major criteria in designing protected areas along with sensitivity and vulnerability (Zacharias & Gregr 2005). The conservation significance of a protected habitat depends to a large extent on its similarity to other habitats in the region, and an MPA will not adequately represent local biodiversity or fulfill its conservation objectives if significant habitats existing outside the park are poorly represented within its boundaries (Bucher and Hartley 2004). Although attempts are being made to incorporate habitats not represented within existing protected areas into new MPAs (Stevens 2002), many continue to be biased toward threatened or high-profile species and habitats (Day and others 2002). Subsequently, important habitats remain outside park boundaries although they may be unique or biologically diverse. Additionally, because many habitats are ecologically linked to one another, incorporating a variety of habitats

Table 4 Management of Sri Lankan MPAs

Name	Major Issues	Current Management Level	Recommendations
Hikkaduwa National Park	Uncontrolled tourism, pollution, sedimentation	Poor; signs declaring protected status are on display; DWC office established and park warden present on site; management plan has been developed and multiple use zoning carried out; however, patrolling is minimal and effectiveness of management is low	Effective patrolling, inclusion of MPA boundaries on signs and establishment of visitor centre for education and awareness
Pigeon Island National Park	Uncontrolled tourism, fishing, collection of ornamental species	None; there are no DWC personnel assigned to manage this site	Establish DWC office with a ranger on site who can educate visitors and enforce regulations; display signs declaring protected status and boundaries, and initiate collaborative management with tourist boat operators
Bar Reef Marine Sanctuary	Overfishing, use of destructive fishing gear	None; there are no DWC personnel assigned to manage this site	Establish DWC office and assign several rangers, due to extent of site, with patrol boat to enforce, regulations; clearly demarcate sanctuary borders, and initiate multiple use zoning and educate resource users on relevant zones*
Rumassala Marine Sanctuary	Overfishing, use of destructive fishing gear, collection of ornamental species	None; sanctuary is under the purview of the DWC official at Hikkaduwa, which is approximately 20 km away and thus not practical	Allocate a DWC ranger for management, and education of visitors; establish signs declaring Marine Sanctuary status and boundaries
Great and Little Basses FMA	Overfishing, use of destructive fishing gear	None; Unlicensed operators continue to fish, and there is a lack of capacity within the DFAR to enforce regulations	Streamline procedure for issuing fishing permits and restrict numbers of fishermen; monitor fishing effort with assistance of Navy
Polhena FMA	Uncontrolled tourism, collection of ornamental species	None; unlicensed operators continue to fish, and there is a lack of capacity within the DFAR to enforce regulations	Establish DFAR presence with regular patrolling by fisheries inspectors, initiate licensing of fishermen

* Management plan developed and activities currently being undertaken as part of the SAM project of the CCD

is essential for the survival of many organisms. This requires the protection of habitats such as mangroves and sea grasses, which are spawning and nursery habitats for many commercially important fish species.

At present, Sri Lanka's MPAs are biased toward the protection of coral reefs, although other significant habitats, such as sandstone reefs and sea grass areas, are inadequately covered within protected areas. Sandstone reefs constitute a unique, biologically diverse and extensive habitat type in Sri Lanka (Öhman & Rajasuriya 1998; Rajasuriya and others 1998) and are also important fishery areas as are sea grass habitats. Extending the boundaries and management objectives of coastal TPAs or near-shore MPAs to include conservation of adjacent near-shore marine environments may be a first step toward a more representative system of MPAs.

Multiple-Use Marine Parks

Zoning marine parks into a network of multiple use areas by designating different zones for different uses has been practiced to minimize conflict between user groups while promoting conservation. The Great Barrier Reef Marine Park is considered one of the best examples of multiple-use zoning incorporating a variety of uses such as fishing, tourism, indigenous rights, and research while maintaining the overlaying objective of conservation (Day and others 2002). In Sri Lanka, multiple-use zoning has been practiced within Hikkaduwa National Park (De Silva & Rajasuriya 1985) by demarcating three separate areas for glass bottom boats, snorkeling, and research (HSAMMSCC 1996), but this has not been successful, mainly because of nonenforcement of regulations. The small size of the park is also an impediment to effective zoning because users are more likely to trespass into other zones, and glass-bottom boats in particular are guilty of nonadherence to zoning plans. Larger MPAs, such as the Bar Reef Marine Sanctuary, are better suited as multiple use marine parks because they provide different habitats for different user groups as well as sufficient area within each zone to adequately cover the needs of each group. Large multiple-use parks also tend to provide more scope for sustainable management of human activities (Zann 1996) by allowing limited and regulated extractive uses such as fishing (Day 2002; Davis and others 2004). This makes an MPA more acceptable to user groups (Zann 1996), especially fishermen. The declaration of an area that allows extractive uses within a marine park often allows better regulation of such practices and opportunities to limit fishing effort while ensuring the continuance of important livelihood activities.

Interagency Collaboration

Management of marine resources in Sri Lanka is hindered by the sectoral approach of many government agencies (Rajasuriya 2003). There is often little interaction amongst organizations, resulting in delays, and management decisions are often based on departmental priorities rather than overall conservation objectives. Currently, national parks, sanctuaries, and nature reserves are declared and managed by the DWC, which is under the purview of the Ministry of Environment and Natural Resources. However, FMAs are declared and managed by the DFAR, which is under the Ministry of Fisheries and Ocean Resources. Additionally, SAM projects at selected coastal sites, including several MPAs, are implemented by the CCD. This leads to overlapping responsibilities (Rajasuriya 2003), and individual organizations are often unwilling to take responsibility for management, especially with regard to enforcement of regulations. Such overlap also occurs with legislation, leading to confusion among both resource users and enforcement authorities. For example, marine species protected under the FFPO and FARA are inconsistent, again because of the lack of interagency collaboration.

Creating an environment that enables successful cooperation among all organizations is essential to increase the efficiency of each organization and the overall management process (Shamsul Huda 2004). In addition, better partnerships between government agencies, the general public, businesses, nongovernmental organizations, the scientific community, and local communities are needed because governments alone are unable to effectively manage resources (Dight & Scherl 1997).

Management is further complicated because of impacts of numerous nondirect activities conducted outside MPA boundaries that come under the jurisdiction of organizations not involved in marine resource management. Land-based pollution and sedimentation are often the result of poor land use practices and are beyond the scope of marine resource mangers. A more integrated approach is required to overcome this problem and manage such issues at the point of origin rather than the point of impact. Currently, integrated coastal management remains a concept with little evidence of practice.

Implementation

Most Sri Lankan MPAs have been declared without adequate consideration of suitable management options or their practicality. McClanahan (1999) sees this as a common phenomenon, where the success of some MPAs leads to the creation of others in the hope that they will eventually succeed. In Sri Lanka, two new MPAs were declared

in 2003 by the DWC despite the evidently poor management of Hikkaduwa National Park and nonexistence of management within the Bar Reef Marine Sanctuary. At present, the two new MPAs are not managed, and destructive practices, including the use of illegal fishing methods, continue unabated. As such, it would be useful to first establish proper management in existing MPAs and control resource extraction outside their borders before declaring new MPAs (McClanahan 1999). Managers seem to believe that the declaration of a protected area alone would deter destructive practices, although many such practices are illegal regardless of whether they are carried out within or outside an MPA. Such is the case with the use of dynamite and bottom-set nets for fishing in Sri Lanka. Where management options have been identified, delays in implementation have lead to changes in the ecological and socioeconomic situations at the site, rendering such options ineffective. In Hikkaduwa, a major management plan was developed in 1996 (HSAMMSCC 1996) but is yet to be fully implemented. Continued degradation of the reef (Rajasuriya & Karunarathna 2002) and an unregulated increase in the number of glass-bottom boats operating within the park (Rajasuriya 2003) since then has meant that the original zoning and management plan are not practical.

Crawford and others (2004) suggested that despite problems, there is often some degree of compliance in protected areas compared with nonprotected areas. This is not the case in Sri Lanka, and many MPAs, in particular the Great and Little Basses FMA and the Bar Reef Marine Sanctuary, have experienced an increase in destructive practices and habitat degradation following their declaration (Rajasuriya 2003; Rajasuriya and others 2005). Surveillance and enforcement are essential to maintain the integrity of an MPA (Davis and others 2004) because the attraction of short-term economic gain provides sufficient incentive for illegal activities to continue. Although management should not be overly dependent on laws, ensuring that regulations are enforced is vital to maintain equity among resource users and promote best-use practices. It is inevitable that conflicts and grievances will arise through enforcement of regulations as MPAs attempt to restrict access to resources and areas that many have traditionally considered to be unrestricted. However, equality in the distribution of benefits and sacrifices made, and fairness in the procedures of the enforcement authority, can eventually increase the level of compliance by resource users (Sutinen & Kuperan 1999).

A lack of a concerted effort and political will to implement management actions is probably the single most contributory factor leading to the failure of management initiatives in Sri Lanka. Partiality in law enforcement and political interference in the legal process have been cited as major factors in the breakdown of marine resource management in Sri Lanka (Rajasuriya 2002). Unfortunately, many politicians tend to be sympathetic toward resource abusers while ignoring those whose livelihoods are negatively impacted by such activities.

Long-Term Sustainability

According to McClanahan (1999) developing nations sometimes tend to declare MPAs in the belief that they will attract donor funding to carry out management. Such funding is often not forthcoming (McClanahan 1999) because it constitutes a long-term commitment, and many complexities are involved in the implementation of management recommendations, resulting in numerous nonfunctional MPAs. Another major problem is that transaction costs, in the form of developing management plans, consultancies, studies, and meetings, account for a high proportion of the total cost of most management projects, and there is little funding for implementation, which eventually leads to the failure of such projects (Sumalde 2004). In Sri Lanka, although many projects have focused on developing management plans at great cost, there is no clearly defined funding source for implementing such plans and covering such costs on the long-term. Resources provided by projects, such as buoys, signs, and patrol boats, often are not maintained and as such become idle and unusable after a few years, as has been the case at Hikkaduwa National Park. Therefore, MPA managers must additionally identify sources for long-term financing to ensure management sustainability (McClanahan 1999). In general, the lack of resources is a major hindrance for management in Sri Lankan MPAs. Only Hikkaduwa National Park has any notable implementation of regulations, and all MPAs fare poorly in achieving overall management objectives (Table 3).

Conclusion

Major factors impeding successful MPA management, such as poor enforcement, lack of interagency collaboration, and inadequate research, exist throughout the developing world (McClanahan 1999). Increasing demands from marine conservationists have resulted in an often ad hoc declaration of MPAs throughout the developing world (Roberts & Polunin 1993), but in many instances, these MPAs have met with stiff resistance from local communities and have failed to achieve any conservation objectives. The protection of habitats has often been a result of limited access due to location or other reasons rather than effective management. In Sri Lanka, this was most evident in the Bar Reef Marine Sanctuary, where military restrictions because of a civil conflict resulted in restriction of fishing activities for several

years. However, successful MPAs in areas such as Indonesia (Crawford and others 2004), the Philippines (Tongson & Dygico 2004), the Cook Islands (Hoffmann 2002), and East Africa (McClanahan 1999) have shown that despite numerous difficulties, effective MPA management is possible in developing nations. In all developing countries, the direct dependence of local communities on natural resources makes conventional exclusion practices, such as no-take reserves, impractical. However, during the last few decades, the policy has shifted toward reserves where limited or benign extraction is allowed (McClanahan 1999). This provides an opportunity to eliminate destructive fishing practices, which are often the major cause of habitat degradation and overexploitation.

Habitat protection through well-designed and efficiently managed MPAs is essential to prevent the continuing degradation of Sri Lanka's marine environment and fishery resources. A new approach toward marine resource management combined with a greater political will is needed if this is to become a reality. Unfortunately, many current managers tend to ignore past initiatives, leading to repetition of past mistakes and subsequent failure of new management initiatives. Hikkaduwa National Park has been the focus of a number of management plans during the last decade (Nakatani and others 1994; De Silva 1997; Rajasuriya and others 2002), but this has not resulted in a decrease in destructive activities, such as reef walking. Frequent changes often lead to confusion among user groups as well as a lack of interest and poor compliance, and such modifications, combined with poor enforcement of regulations, are major reasons for the failure of marine parks (Gell & Roberts 2003).

Managers must reasses the criteria and processes under which protected areas are declared and base decisions on scientific information to develop more practical management plans with achievable goals. Applied research targeted at answering management-related questions, and improved administrative capacity with greater collaboration at all levels, are needed for a more holistic approach to management. Well-managed MPAs can lead to significant improvements in habitat structure and increased fish stocks both within and outside park boundaries (Ashworth & Ormond 2005; Gell & Roberts 2003). In the long term, such results can lead to increased acceptance of MPAs by local communities who see tangible benefits through improved and more consistent fisheries that serve as valuable trade-offs for proactive participation in management. McClanahan (1999) pointed out that management is most difficult during the initial stages and that MPAs are often successful if managers are able to overcome the first hurdles. However, poor management, as is the case in Sri Lanka, hinders the success of MPAs and the ability to demonstrate such long-term benefits to resource users, thereby decreasing community support for resource management in the future.

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