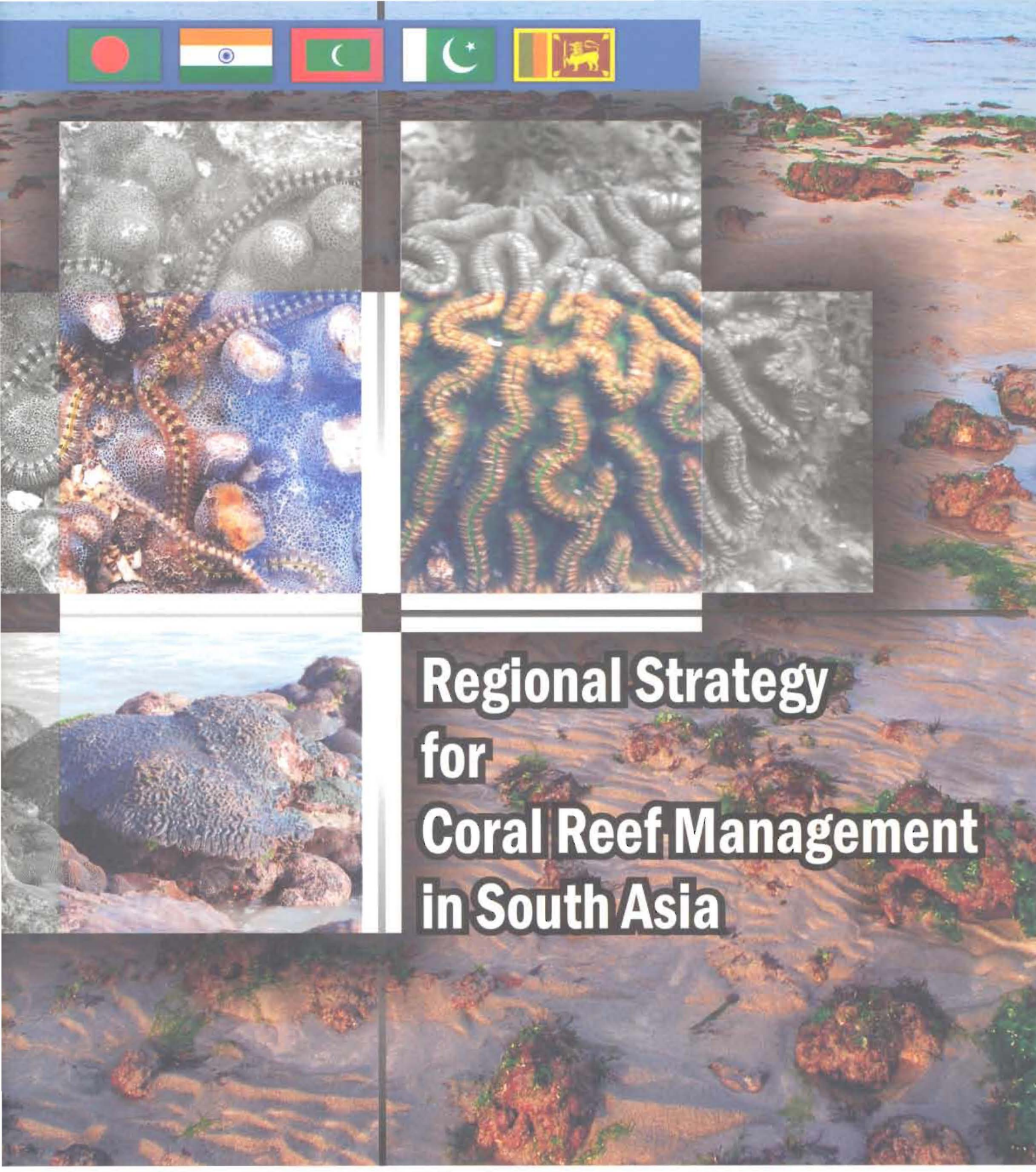
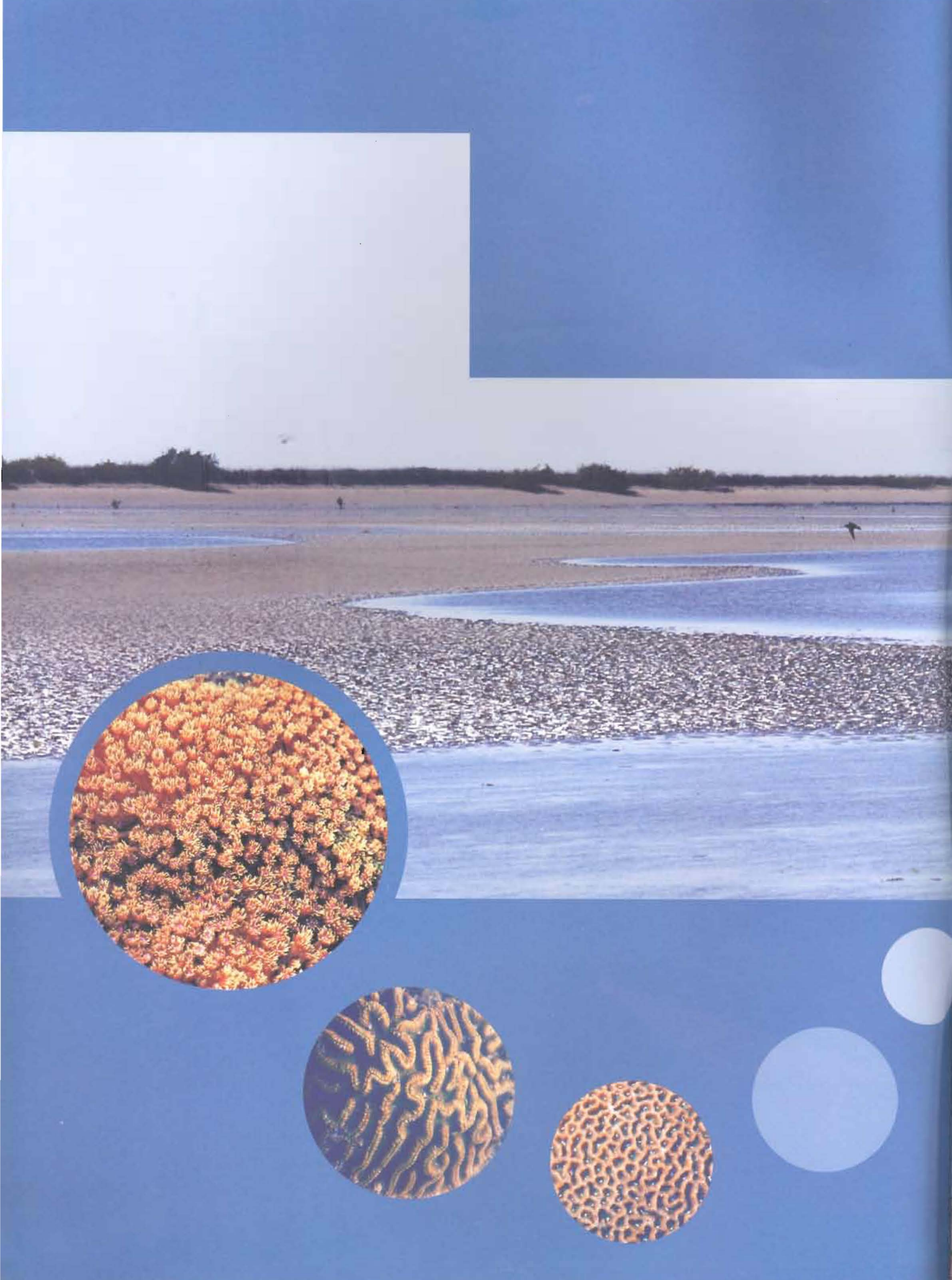


Regional Strategy for Coral Reef Management in South Asia

With funding from the European Union

SACEP

GEER Foundation



Regional Strategy for Coral Reef Management in South Asia

Prepared by

GEER FOUNDATION
INDRODA NATURE PARK, GANDHINAGAR - 382007, INDIA

With funding from the European Union

SACEP

December - 2008

Preface

Coral reefs form a uniquely placed ecosystem which supports a wide range of biodiversity which is comparable to that of tropical rain forests. Reefs are structures in sea waters, usually near the shoreline, built of the calcareous formations by small organisms. Coral reefs hold an entire array of species including a variety of marine vegetation, corals, fish, crabs, octopus, sea anemones, sea horse, sea slug, etc. Apart from being of great socio-economic value to the local reef dependent communities, reefs are the most colourful ecosystem on earth. However, due to enhanced human activities on the land and in the sea, such a fascinating ecosystem is facing serious threats across the globe.

Most of the coral reefs lie near the shore line in the tropical world. South Asia holds a very significant proportion of the world's coral reefs requiring collective and coordinated efforts for their conservation.

South Asian Cooperative Environment Programme (SACEP) is an inter-government organization of South Asian countries for furthering the cause of environmental conservation and protection in South Asian region. South Asia Coral Reef Task Force (SACRTF), a programme of SACEP, brought the conservation of coral reefs into focus and took an important decision in its first meeting to develop a Regional Strategy for Coral Reef Management with a view to enhancing the capacity of various institutions actively involved in management and conservation of coral reefs in South Asian Seas Member Countries which includes Bangladesh, India, Maldives, Pakistan and Sri Lanka.

Gujarat Ecological Education and Research (GEER) Foundation, India is actively involved in ecological education and research and has a long experience of research and survey in marine eco-systems involving mangrove and coral reef ecosystems. The task of developing the aforesaid regional strategy for coral reef management in South Asia was assigned to GEER Foundation by SACEP. It gives me immense pleasure to present this strategy document which gives a plan for capacity building of different institutions and stakeholders such as policy makers, managers, research institutions, NGOs and reef dependent communities. An attempt has been made to present a plan for identifying the capacity gaps and filling these gaps in a time frame of five years.

The strategy has been developed through a consultative process with SACEP representatives of different member nations during SACRTF meetings and the feedback received from various individuals, funding organizations, etc. A presentation about the draft report of the strategy was made during the third meeting of SACRTF held at Chennai, India on 16 December 2008. The feedback received from members have been incorporated in this final draft of the strategy.

We may mention that developing this strategy was a process of immense learning for GEER Foundation. We are thankful to SACEP and SACRTF members for assigning this task to GEER Foundation and for their valuable contributions to the development of this strategy document. We are hopeful that this will go a long way in conserving the unique, valuable and yet fragile coral reef ecosystems in South Asia.

29 December 2008

(C N Pandey)
Director
GEER Foundation
Gandhinagar

Acknowledgement

The development of this strategy document has been made possible by the initiatives and support of SACEP and SACRTF.

Thanks are due to Dr. B. P. Nilaratna, Chairman, SACRTF and other members of SACRTF and SACEP for inspiring this work.

Dr. Arvind Boaz, Director General, SACEP provided the framework for this task.

Dr. Venkatesan and Mr. Hiran Tillekaratne of SACEP made very valuable contributions to the content and form of the strategy.

A number of persons sent their comments and suggestions on the draft strategy report which have enriched the document. Thanks are particularly due to Dr. Kristian Teleki, Director and Ms. Nicola Barnard of ICRAN for their valuable feedback and support.

Thanks are due to Mr. Dhiraj Bhalani, Mr. B R Raval, Ms. Richa Pandey, Mr. Jignesh Suthar, Mr. Mehul Joshi and Mr. Shreejit Menon of GEER Foundation for their hard work and valuable contribution in developing this strategy document.

C. N. Pandey
Director, GEER Foundation, India

The Team

C. N. Pandey,

Dhiraj L. Bhalani,

B. R. Raval,

Richa Pandey,

Jignesh Suthar, Mehul Joshi and Shreejit Menon.

All Photographs by Vinod Gajjar

Executive Summary

The coasts of South Asian countries encompass biologically diverse coastal and marine ecosystems. The region is endowed with numerous estuaries, lagoons, mangroves, coral reefs, sea-grasses and wetlands that provide essential habitats for many rare and valuable species, which in turn contribute vital goods and services to millions of people. The South Asian countries of Bangladesh, India, Maldives, Pakistan and Sri Lanka have coral reefs. At present, these coral reefs are facing threats due to natural and anthropogenic factors. Many reef dependent communities are facing severe hardship as coastal resources are no longer able to sustain their livelihoods. The stakes are high and the issues are many and, in such a critical situation, the management and conservation of coral reefs face great challenges.

South Asia Cooperative Environment Programme (SACEP) initiated specific programmes to deal with the management and conservation issues by establishing the South Asia Coral Reef Task Force (SACRTF). In the first meeting of SACRTF, it was decided to develop a regional strategy for coral reef management in South Asia and the task was assigned to GEER Foundation, India.

The strategy document essentially emphasizes strengthening of institutions viz. policy making institutions, management level government agencies, research and academic institutions, NGOs and village level organizations involved as stakeholders in coral reef management. The proposed strategy suggests that after a thorough scrutiny of their expected roles, existing capabilities and available infrastructure facilities, various institutions and organizations should be covered by organization specific capacity building programmes addressing the identified gaps. These capacity building programmes would involve steps like strengthening the information base, knowledge base, manpower planning, training, skill up-gradation, orientation and awareness generation among stakeholders and strengthening of infrastructure including provision of necessary implements. Three thrust areas have been identified for actions which include 1. understanding the coral reef ecosystems and the threats faced by them, 2. measures for reducing threats and 3. raising awareness. The strategy also deals with monitoring and evaluation and prescribes a time frame of 5 years for completing the various tasks included in the strategy.

It is expected that this strategy will improve the status of conservation and management of coral reefs in South Asia and encourage systematic and collective approach in dealing with the management and conservation issues pertaining to coral reefs.

Contents

Regional Strategy for Coral Reef Management in South Asia

1. Background

Marine ecosystems are important and valuable biological, economical and recreational resources in tropical areas around the world. The ecological as well as socio-economic well being of people depend upon the health of such fascinating yet fragile ecosystems. Corals are tiny anemone like colonial animals that secrete an exoskeleton of calcium carbonate. Under the right conditions, these exoskeletons aggregate to form vast formations called 'Coral Reefs' which are acclaimed as the largest structures made by any living being. The coral reefs also have the distinction of being one of the most biologically diverse ecosystems on earth, rivaled only by tropical rain forests. Coral reefs can take a variety of forms, such as fringing reef, barrier reef, patch reef, apron reef, bank reef, ribbon reef, atoll reef and table reef.

1.1 Coral Reefs of the World

Coral reefs are found throughout the tropical and subtropical oceans in the Indo-Pacific and Atlantic regions, normally between the Tropic of Capricorn and the Tropic of Cancer (30^0 S and 30^0 N latitude). The coral reef region of the Indo-Pacific Ocean extends from the Red Sea and the Persian Gulf through the Indian and the Pacific oceans to the western coast of Panama. Coral reefs occur in over 100 countries. Most of these are developing countries. The coral reef area of the world has been estimated at 2,84,803 sq km (World Atlas of Coral Reefs-2001).

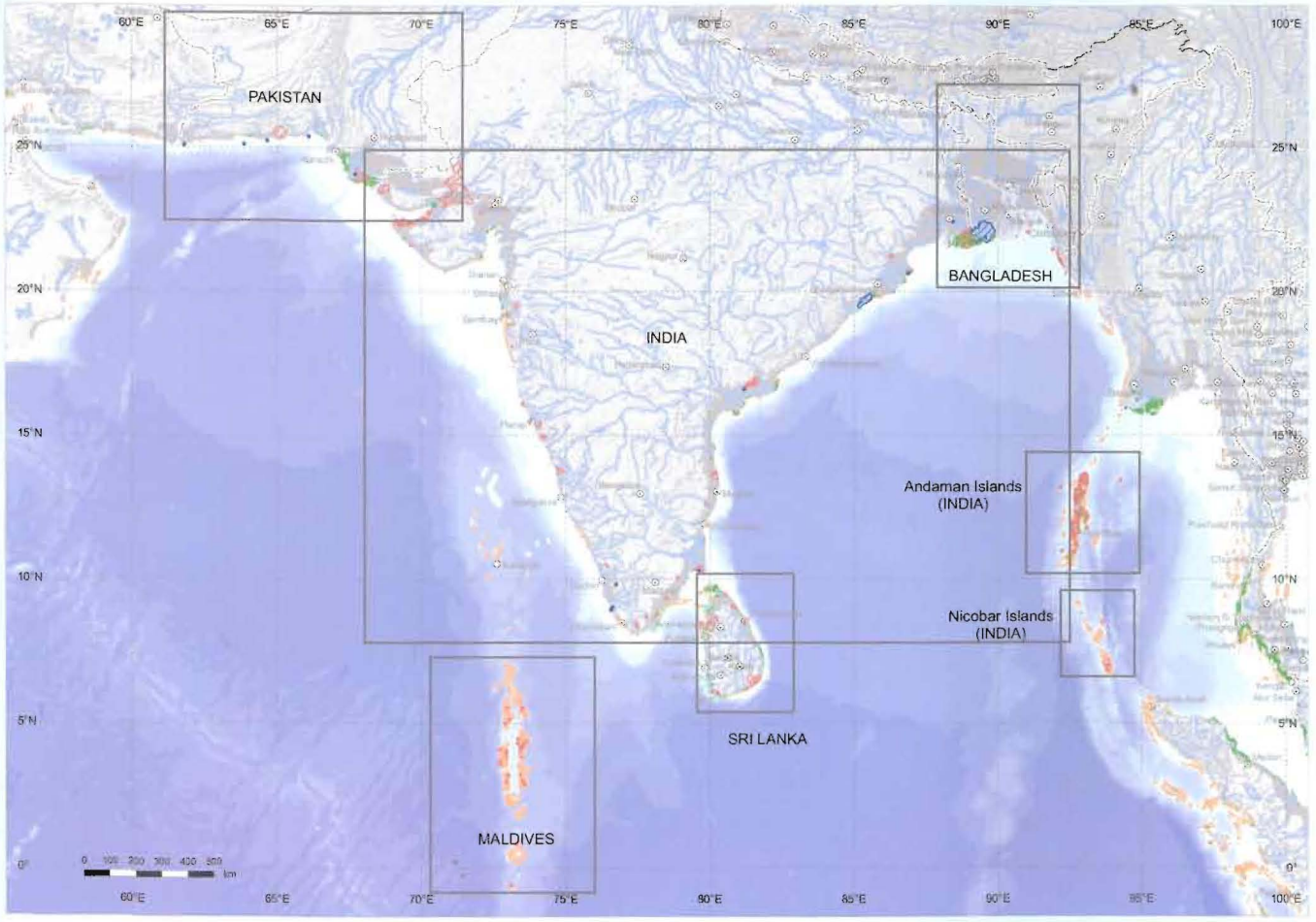
1.2 Coral Reefs in South Asia

The five maritime countries of the South Asia region, Bangladesh, India, Maldives, Pakistan and Sri Lanka are characterized by extensive river deltas and diverse marine and coastal habitats, supporting some of the richest concentrations of biodiversity in the world and encompassing globally significant mangrove, sea grass, and coral reef habitats.

South Asia has 19,210 km^2 (Status of Coral Reefs of World-2008) of coral reefs (i.e., about 6% of the world's reef area). India has 5,790 km^2, (i.e., 2.04% of the global reef area), Maldives has 8,929 km^2, (i.e., 3.14 % of the global reef area), and Sri Lanka has (680 km^2, i.e., 0.24% of the global reef area) (Spalding et al., 2001). Millions of people depend on these coastal resources for food and livelihoods. In addition, reef based tourism activities encourage essential foreign investment and generate local employment opportunities. They comprise the mainstay of both the Sri Lankan and Maldives economies. Coral reefs have been estimated to provide the world with US$375 billion in terms of goods and services. If we take into account, the value per unit area, they are among the most valuable ecosystems globally. As such, the maintenance of healthy coastal and coral reef habitats is very critical for sustaining the social and economic development of the South Asia region and protecting these significant resources on behalf of the global community.

The value of Marine and Coastal Protected Areas (MCPAs) for the protection of coastal resources has been recognized by governments and various nations have initiated the establishment of MCPAs. The details of MCPAs declared by various South Asian countries are given in Annexure-I. Coral reefs deserve protection for their intrinsic natural value. In addition, the economic, fishing and recreational resources of tropical areas around the world depend upon healthy coral reef ecosystems. For example, barrier coral reefs protect shorelines from erosion and storm damage.

Map of Coral reefs in South Asia



Legend

Marine and Coastal Protected Areas

Internationally recognised (by convention)

- World Heritage Convention
- UNESCO-MAB Biosphere Reserve
- Wetlands of International Importance (Ramsar)
- ASEAN Heritage

National

- Nationally Designated

Ecosystems

- Mangrove
- Coral
- Seagrass

General

- Coastline
- International boundary
- Cities
- River
- Water bodies
- Railways
- Roads

Coastal Definition

- < 50m elevation or 100km from coast (whichever comes first)

Bathymetry: Depth (m)

- 0-100
- 100-500
- 500-1000
- 1000-1500
- 1500-2000
- 2000-2500
- 2500-3000
- 3000-4000
- 4000-5000
- 5000-6000
- 6000-7000
- > 7000

Source: Managing Marine and Coastal Protected Areas- a toolkit for South Asia 2008 published by IUCN, CORDIO & ICRAN.

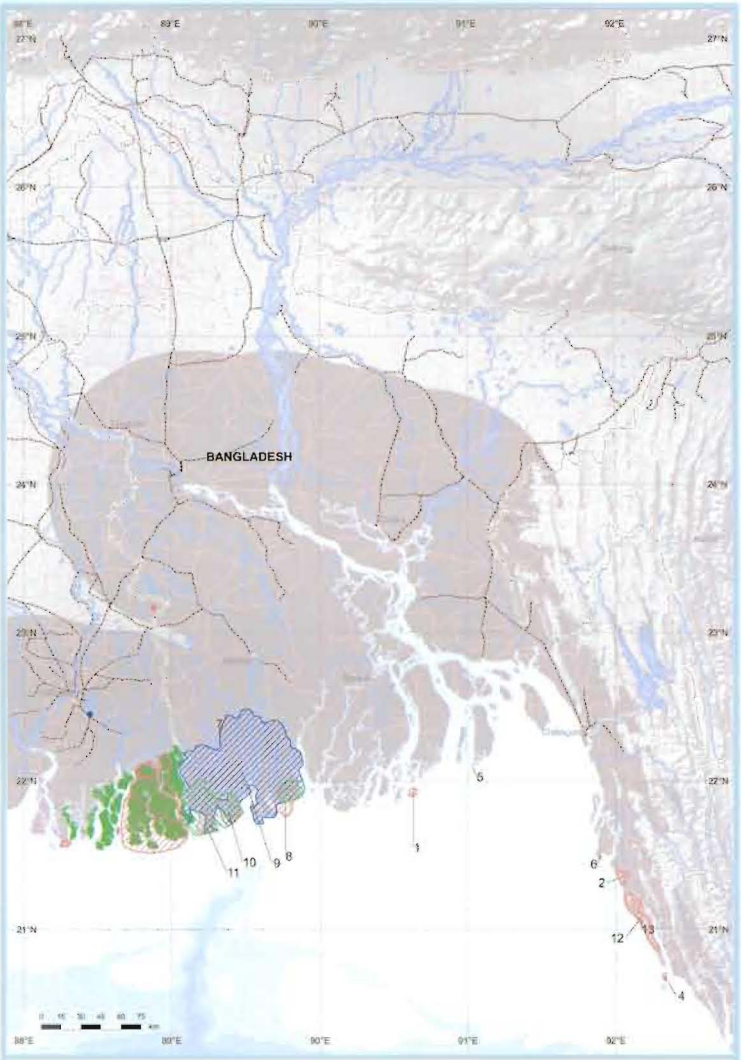
UNEP WCMC IUCN

1.3 Situation Analysis

A brief analysis of the extent and status of Marine and Coastal Protected Areas (MCPAs), threats to coral reefs and efforts made by different stakeholders for conservation at national and international levels is given below.

Bangladesh

Bangladesh is a low lying country with a total area of 1,43,999 km^2. The Bay of Bengal lies to the south of the country. St. Martin's Island in the Bay of Bengal is the only coral reef island of Bangladesh. A fringe of rocky substrate and coral communities extends to about 200 m from the island. The total reef area is about 50 sq km.



Source: Managing Marine and Coastal Protected Areas- a toolkit for South Asia 2008 published by IUCN, CORDIO & ICRAN.

UNEP WCMC IUCN

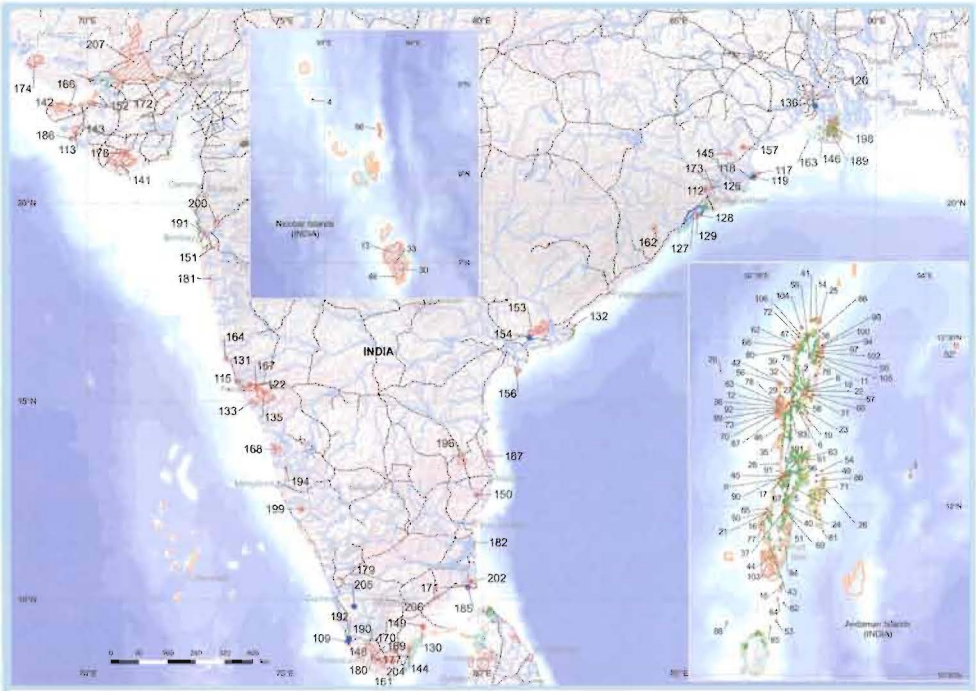
A shallow reef area about 15 km west of St. Martin's Island, locally known as Marphati Bandth, is not currently under any form of management. However, these reefs have remained protected which may be attributed to their remoteness and inaccessibility. The area is influenced by freshwater influx, monsoon and frequent disturbances, such as cyclones and storm surges resulting into high sedimentation as well as mechanical damage. An underwater survey was carried out under the Coastal and Wetland Biodiversity Management Project between 2005 and 2008 in areas around St. Martins Island which is a sedimentary continental Island. The underwater survey conducted under Coastal and Wetland Biodiversity Management Project (CWBMP) during 2007-'08 indicated the presence of about 65 species of corals, 37 species of reef associated fish, 46 species of algae and many other vertebrates and invertebrates. In this region, large rocks provide suitable substrate for coral settlement and, as a result, moderate recruitment of juvenile corals has been observed. Live coral cover is low around the island, generally around 5%, although somewhat higher (10-15%) in the north-west rocky shoal, *Boro Shiler Bandh. Porites* dominates the hard coral community, followed by *Favites, Goniopora, Cyphastrea* and *Goniastrea.* Another report (Wilkinson,C.2008), indicates that there are 66 species of Scleractinian corals belonging to 22 genera and 15 families in this area. Limited coral bleaching has been reported since 1998.

The area was declared an Ecologically Critical Area (ECAs) in 1999 under the Bangladesh Environment Conservation Act. To ensure the conservation of biodiversity found in the ECAs, the government is implementing the CWBMP. The project is supported by United Nations Development Programme (UNDP) and Global Environment Facility(GEF).

India

The total coral reef area in India is 5,790 km^2, distributed among 4 nationally recognized major coral reefs: Andaman and Nicobar Islands; Lakshadweep; Gulf of Kachchh; and Gulf of Mannar. The country has so far recorded 203 species belonging to 55 genera spread over its four major coral reef areas. Sporadic corals have also been reported from some other areas along the eastern and western coasts of mainland India, e.g., the Malvan coral reefs in Maharashtra State.

In the Andaman and Nicobar group of islands, the total reef area is about 11,939 km^2 consisting of reef lagoons, coral banks, reef slopes and reef flats. The Andaman and Nicobar Islands consist of 530 islands with extensive fringing reefs which are mostly in good condition. The total number of species recorded till to date is 197, belonging to 58 genera.



Source: Managing Marine and Coastal Protected Areas- a toolkit for South Asia 2008 published by IUCN, CORDIO & ICRAN.

UNEP WCMC IUCN

Reef structure and species diversity are different at different places due to variations in local conditions. Lakshadweep is an archipelago of 12 atolls surrounded by deep water on the northern end of the Lacadive-Chagos ridge. In Lakshadweep Islands, the total number of coral species recorded is 95.

In Gulf of Kachchh, there are shallow patchy reefs growing on sandstone platforms that surround 42 islands. In Gulf of Kachchh, the total number of coral species is 51 (41 hard corals + 10 soft corals). The reefs experience high salinity, frequent exposure, high tide, temperature fluctuation and heavy sedimentation.

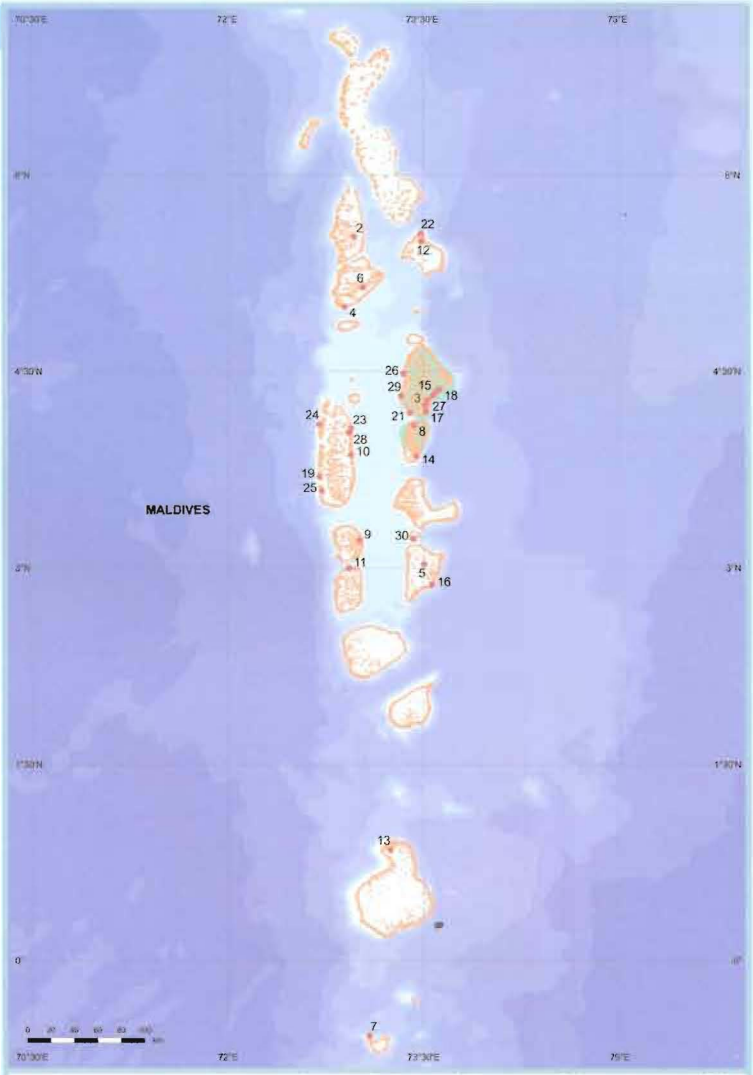
In the Gulf of Mannar, coral reefs are found mainly around 21 islands between Rameshwaram and Tuticorin. The total number of coral species reported from Gulf of Mannar are 117.

The coral cover is increasing in Lakshadweep group of islands at most reef sites. Recovery is faster on the sites facing west than the sites facing east, largely due to differences in settlement patterns and substrate stability. There has been a reduction in algal turf and macro-algal cover compared to earlier studies, possibly explained by healthy populations of algae eating fish, particularly Scarids and Acanthurids, which are reported to facilitate coral recovery. The species of *Acropora* genus, such as *A. abrotanoides*, which were dominant earlier, are returning to dominance. Increased coral bleaching was observed in April 2007; the extent of mortality is not known but it appears to be limited. (Wilkinson,C. 2008).

In 2002, India added a new legislation to protect corals and included corals in Schedule-I of the Wildlife (Protection) Act, 1972 according highest protection to corals under the law. India has promulgated various policies and a strong legal framework for environment conservation. The policy comprises National Forest Policy 1988 and National Environment Policy 2006, while the legal framework comprises Wildlife (Protection) Act, 1972, Forest Conservation Act, 1980, Environment Protection Act, 1986 and Biological Diversity Act, 2002 .

Maldives

The Maldives are in the centre of the Lacadive-Chagos ridge, and consist of 23 atolls, including 1,190 coral islands within an area of 8,920 km^2. A total number of 187 species of corals belonging to 33 genera have been recorded from Maldives. The archipelago is surrounded by deep oceanic water and reefs are generally less threatened by anthropogenic activities than in other parts of South Asia as the human population is low and there are large distances between atolls. Coral reefs form the resource base for the major economic sectors of tourism and fisheries. The tourism industry has become the largest income earner. The Government expanded the island hotel industry to all atoll groups in 2004 as a diversification strategy.



Source: Managing Marine and Coastal Protected Areas- a toolkit for South Asia 2008 published by IUCN, CORDIO & ICRAN.

UNEP WCMC IUCN

Coral cover is increasing at all sites across most atolls in the Maldives that were surveyed between 2006 and 2008; but reef recovery is highly variable. Live coral cover ranges from less than 10% to more than 80%, with much higher coral cover generally found on western atolls than those along the eastern chain. There is also some variation within atolls. The difference is probably due to site-specific factors such as sea water current, weather conditions and number of available larvae. The *Acropora* species which was extremely adversely affected during the 1998 bleaching, now dominates the coral community at most lagoon sites. This is the dominant genus and there have been large increases in coral cover in terms of *Acropora*. The coral size class distribution still reflects the fact that the reefs are recovering with the majority of colonies between 10 and 20 cm in diameter, followed by 20-40 cm diameter class. Coral diseases, such as white band and black band, are less frequent than previously observed at some coral reef sites, while the sponge *Terpios hoshinota* is common at some sites where it overgrows and kills several coral species.

A bleaching surveillance program called "Bleach-watch Maldives" was initiated by the Marine Research Centre and the Ministry of Tourism in mid March 2007 involving diving schools as members of the network of voluntary observers. Some evidence of temperature stress was observed between March and May 2007 but there was no significant or large scale bleaching (Wilkinson,C. 2008).

Monitoring and enforcement of environment laws are some of the limitations from government side, while NGOs play limited role in educating and organizing people on marine related issues. EIA regulation, land use regulation, fisheries law and Environment Protection Act are some of the initiatives from government side to strengthen the conservation efforts in Maldives.

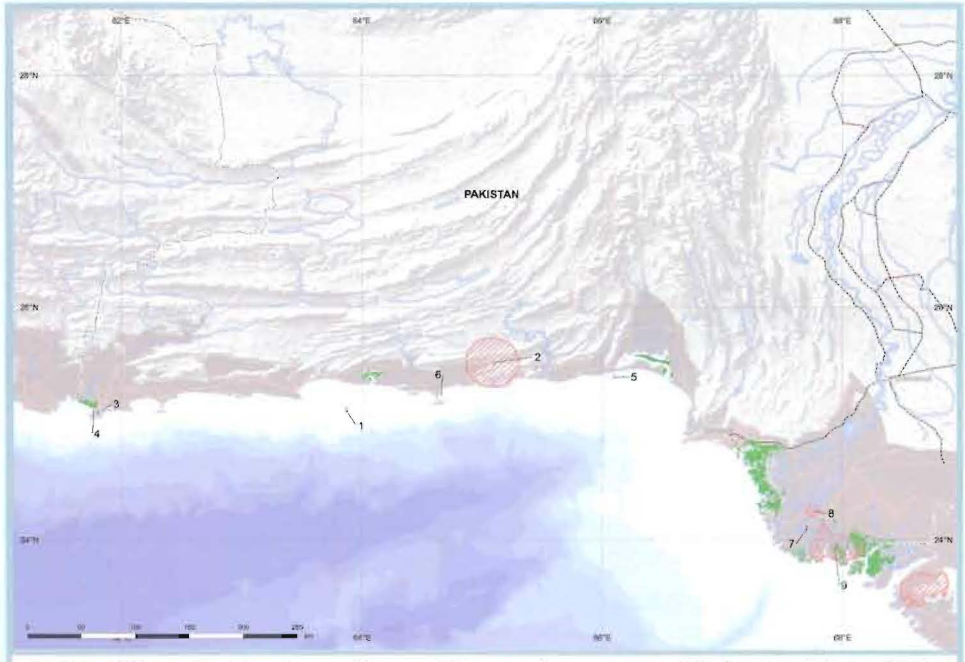
In recent years, "Maldives Environmental Management Project" is being supported by World Bank (since 2008),"Atoll Ecosystem Conservation Project" supported by GEFand "Mangroves for Future" (MFF) programme supported by International Union for Conservation of Nature (IUCN) are some of the international initiatives for strengthening the conservation efforts for marine and coastal protected areas in Maldives (www.mv.undp.org).

Pakistan

Corals have been recently found and reported from Pakistan. Therefore, not much is known about the coral communities of Pakistan. There are isolated coral patches on hard substrate along the Balochistan coast, but coral reef development is limited due to high sedimentation and turbidity. The total reef area is estimated to be less than 50 km^2.

The coral communities along the Balochistan coast have been poorly studied, although surveys around Jiwani and the area near Astola Island identified 25 coral species and 77 reef fish species (Wilkinson,C.2008).

Pakistan Environment Protection Act, 1997, Coastal Developmental Authority Acts (Sindh-1994 and Balochistan-1998), State Wildlife Protection Ordinances of 1972 (for Sindh and Balochistan), West Pakistan Mines and Mineral Development Act,1958, Ports Act, 1908 and Ordinance of 1984, the Land Acquisition Act, 1894, and Territorial Water and Maritime Zones Act, 1979 are some of the policy and legal initiatives by the government to support the conservation efforts at Marine and Coastal Protected Areas (MCPAs).



Source: Managing Marine and Coastal Protected Areas- a toolkit for South Asia 2008 published by IUCN, CORDIO & ICRAN.

UNEP WCMC IUCN

Sri Lanka

There are fringing, patch and platform reefs around Sri Lanka, including sandstone/limestone and rocky reef habitats covering 680 km^2. The most extensive coral reefs are offshore in the Gulf of Mannar region. The southwestern coast of Sri Lanka has many rocky headlands and most fringing coral reefs have developed on the leeward side of these headlands due to strong waves generated by the southwest monsoon as there are no barriers to the south of Sri Lanka to reduce the impact of oceanic waves on the coast. There is better fringing coral reef development along the eastern coast, both on the leeward side of headlands and on offshore rocks and islands. A total of 183 coral species belonging to 68 genera have been reported from Sri Lanka.

Source: Managing Marine and Coastal Protected Areas- a toolkit for South Asia 2008 published by IUCN, CORDIO & ICRAN.

UNEP WCMC IUCN

The major threats faced by the coastal areas are anthropogenic in nature. Moreover, the release of untreated sewage, industrial pollution and oil spills are causing indirect damage to coral reef areas. The physical environmental threats include sedimentation, storms and tsunami, changing currents patterns, over growth of seaweeds etc.

The highest rate of recovery from the mass bleaching event in 1998 has been recorded at Bar Reef Marine Sanctuary where coral cover increased from 40% in 2004 to about 70% in early 2007, largely due to rapid growth of *Acropora cytherea* and *Pocillopora damicornis*. There was high level of recruitment and growth of *P. damicornis* on most reefs including those in the south. Coral cover at Hikkaduwa Marine Sanctuary has increased from 12% in 2005 to 26% in 2007(Wilkinson,C. 2008). However, there has been slower reef recovery in other parts of the south-west; and some areas show a decrease in coral cover and health, largely due to human induced stress compounded by the tsunami. An increase in the growth of the calcareous algae *Halimeda* and high levels of sedimentation has damaged some fringing reefs, especially in the south, with algal cover increasing from 10% in 2005 to 60% in 2006 at Kapparatota. Many reefs in Sri Lanka are adversely affected due to pressures in the form of live coral mining and fishing using unsustainable gear and dynamite (Wilkinson,C. 2008).

Declaration of 5 sanctuaries since 1973 and 3 national parks since 1969 for conservation of corals and turtles are some of the initiatives undertaken by the Government of Sri Lanka. However, there is a need to strengthen marine fauna and flora conservation initiatives by providing appropriate legal and policy support, effective enforcement and scientific management of the marine bio- resources with active participation of local community and other key stakeholders.

There has been a positive trend in reef status across South Asia since 2004 if coral cover is used as the sole indicator. However, the region is still struggling from the massive impact of coral bleaching of 1998 and impact of the tsunami of 2004. By and large, the reef recovery is moderate or slow mostly due to direct human pressures. Many reefs in the region have changed considerably from their original state in terms of species compositions and ecological functionality. There is also no significant regional change in the number and magnitude of threat to coral reefs, mangroves and sea-grass beds in South Asia (Wilkinson,C. 2008).

To effectively conserve coral reefs, the South Asia region must continue efforts to control direct human pressures on reefs and improve the management of protected areas and ensure effective enforcement of MCPA regulations.

1.4 Marine and Coastal Protected Areas (MCPAs) in South Asia

The value of Marine and Coastal Protected Areas (MCPAs) as a fundamental mechanism for the protection of coastal resources has been recognised by governments and scientists world over. and, therefore, all countries have established MCPAs. However, the national legislation is often inadequately translated into suitable strategies and physical actions on the ground, which would lead to tangible outputs and effective contributions towards the successful and sustainable management of MPAs. While an effectively managed isolated MPA site will produce local rewards, a network approach to marine resource conservation is considered more effective for the protection of biological diversity. With the conservation of marine resources increasingly occupying centre stage in the global agenda, the concept of marine protected areas (MPAs) is being widely propagated.

Protected Areas (PAs) need to be seen not just as sites rich in biodiversity, but also as areas providing livelihood to many communities historically, socially and culturally living close to these resources. In practice, MCPAs have increasingly become tools that limit, forbid and control use patterns and human activity through a structure of rights and rules.

Bangladesh

The Bangladesh Wildlife Preservation (Amendment) Act, 1974, recognises three categories of protected areas namely national park, wildlife sanctuary and game reserve. Middle grounds and the south patches of the Bay of Bengal, comprising 698 sq km area have been declared as marine park in the year 2000 under the Marine Fisheries Act, 1985. Though Bangladesh has not set up time bound and measurable national-level protected areas targets and indicators under the CBD decision VII/28, limited activities are going on and the Government has stated its commitments in the Forest Policy, 1994 which has set up an aim to increase the protected areas by 10% of the reserve forest land by the year 2015. Some specific targets, as indicated below, for establishing protected area have been decided, however, no specific indicators are developed yet:

- Madhupur National Park Development
- The Nishorgo Support Programme has addressed co-management of the five PAs
- Conservation of important hotspots of biodiversity of Chittagong Hill Tracts
- Conservation of Rampahar and Sitapahar of Chittagong Region
- Conservation of denuded hill areas of Ramgarh Shitakunda

Establishment of three additional Wildlife Sanctuaries is under consideration: Hazarikhil, Rampahar-Sitapahar and Hail Haor, and similarly establishment of a National Park in Shatchari is also under consideration. Apart from policy and on-going activities, the Government has set up a clear-cut strategy regarding PAs management.

India

India has a network of 611 PAs including 96 national parks, 510 wildlife sanctuaries, three conservation reserves and two community reserves covering a total of 155,978.05 sq km or approximately 4.75 per cent of the geographical area of the country, including both terrestrial and marine ecosystems. Besides these, the Government of India has also declared 14 biosphere reserves under the Man and Biosphere (MAB) programme of the United Nations Educational, Scientific and Cultural Organization (UNESCO). India has 31 MPAs, of which 18 are totally under the marine environment, while the other 13 are partly also on land. Besides these, there are another 100 PAs that have terrestrial or freshwater ecosystems that border with seawater or partly contain coastal and marine environments. These PAs have been notified either as national parks or wildlife sanctuaries. There are three biosphere reserves. The 31 MPAs cover an area of 18.5 per cent of the islands and 6.16 per cent of the coastal biotic zones. It is proposed to increase these areas to 36.14 per cent and 7.12 per cent, respectively. India's first MPA was designated in 1967 for the protection of wetlands and the migratory birds congregating there, even before a central legal framework was put in to place. Most of the MPAs were designated during the 1980s and in early 1990s. The major MCPAs along the coastline of India (excluding the islands) that are important from a fishing-community and marine resource-conservation perspectives are: the Gulf of Mannar National Park (GoMNP), the Sunderbans National Park, the Gulf of Kachchh National Park, the Gulf of Kachchh Wildlife Sanctuary, the Malvan (Marine) Wildlife Sanctuary, and the Gahirmatha (Marine) Wildlife Sanctuary.

India has no specific legislation for MPAs, whereas PAs are declared mainly under the provisions of the Wildlife Protection Act (WLPA) 1972 (as amended in 2002 and 2006) in both terrestrial and marine ecosystems. The Act is implemented by the Centre's Ministry of Environment and Forests (MoEF), through the various State Departments of Forests and Environment. Significantly, in India, MPAs are designated for conservation and preservation of the ecosystem, and not for fisheries management.

In the case of fisheries management, there is a relevant central legislation relating to maritime jurisdiction, demarcation of the exclusive economic zone, regulation of fishing by foreign vessels, and management of fisheries. There are also policy notes and guidelines brought out by the Government of India.

Maldives

In the Maldives, the protected areas system revolves around the atoll ecosystems, which are the centres of biodiversity. The greatest diversity of life forms in Maldives occurs in the coral reefs surrounding the atolls. At least 1090 species of fish and 187 species of corals have been recorded from the Maldives. The reef literally provides the basis for the country's very existence as well as life-supporting services such as shoreline protection and goods upon which the economy is entirely dependent such as fisheries and tourism. Besides atoll ecosystems, the other ecosystems that are valuable in Maldives are reef ecosystem, wetland and mangrove ecosystems. Policies and action plans regarding the management and integration of protected areas find mention in all key policy documents of the Government, such as National Biodiversity Strategy and Action Plan (NBSAP), National Environment Action Plan (NEAP) and National Development Plans (NDPs). Most of the existing measures and policies on protected areas that are being implemented are from NBSAP and streamlined into NDP. Maldives does not have a law on protected areas as of yet but the Environment Protection and Preservation Act (Law No 4/93) can be amended to incorporate protected areas and develop a regulation on Protected Areas under the existing law.

Currently, Maldives has less than two percent of its territory and marine areas included in protected areas. The country has 25 marine protected areas (diving sites), in which only diving and bait fishing are allowed. In addition, three unique islands and two mangrove areas have also been declared as protected. However much remains to be done under the program of work on protected areas. As of today, out of a total of thirty protected

areas, only two areas have management plans (two mangrove sites). As there is a lack of technical expertise and many conservation regulations are formulated by different government departments, there is a very little co-ordination between these sectors, leading to poor management of these protected areas. The Government of Maldives plans to expand the number of protected areas in order to match with the classification of IUCN. Specifically, the plan is to focus on marine and coastal areas. 15 important marine diving sites were established as marine protected areas in 1996, registered in the Ministry of Planning Human Resources and Environment and managed by the Ministry of Tourism. In 1999 additional 10 diving sites were declared as protected areas established in the Ministry of Home Affairs Housing and Environment. Anchoring and fishing except for traditional bait-fishing and other destructive activities are strictly prohibited in these sites. Apart from the designated marine protected areas, the following islands are conserved and protected from exploitation. Hurasdhoo in North Ari Atoll, Hithaadhoo in Gaaf Alif Atoll and Rasfari in Kaafu Atoll. Within these protected marine areas, the following activities are prohibited.

- Anchoring (except in an emergency)
- Coral and sand mining
- Rubbish dumping
- Removal of any natural object or living creatures
- Fishing of any kind (e.g. for sharks reef fish or aquarium fish) with an exception of traditional live bait fishing
- Any other activity which may cause damage to the area or its associated marine life

Marine protected areas offer a wide range of benefits for fisheries, local economy and the marine environment. They are:

- A safe haven for fish stocks to recover
- Alternative sources of income for local people
- Conservation of habitat
- Conservation of marine biodiversity

Marine protected areas in the Maldives act as an insurance policy for the future, both for marine life and the people who benefit from it.

Pakistan

At least nine spots along the Sindh-Balochistan coast have been identified as potential sites that need to be declared as marine protected areas (MPAs). Three main sites recommended for immediate designation as MPAs are the Indus delta, Astola Island and Miani Hor (Sonmiani Bay). Pakistan makes a strong case for these areas to be declared as marine protected areas.

Sri Lanka

In Sri Lanka, 13 MCPAs sites have been declared, out of which four sites are having coral reefs, viz., Bar Reef (30,670 ha), Hikkaduwa (45 ha), Paravi Doopath- Pigeon Island (5 ha) and Rumassala (1,707 ha) (Managing Marine and Coastal Protected Areas- a toolkit for South Asia-2008 published by IUCN, CORDIO and ICRAN.

1.5 Major Threats to Coral Reefs

Coral reefs are facing threats which are natural and anthropogenic in nature. Natural threats include coral predation (e.g. crown of thorn fish and parrot fish), storm damage, and coral disease. Some diseases like Black Band disease and Pink Line diseases have been recorded in the region. However, human activities pose the

greatest threats to coral reefs. They include climate change, coral mining, pollution, ocean acidification, over fishing and infrastructure developments.

Climate Change

Climate change is a major emerging threat for the health of coral reefs. Countries like Bangladesh, India and Maldives are concerned about sea level rise due to increase in temperature as a result of climate change. The climate change may also lead to coral bleaching and coral diseases. The carbon dioxide dissolved in the ocean reacts with water to form carbonic acid resulting into ocean acidification. In such a situation, coral reduces calcification or enhances dissolution, when exposed to elevated carbon dioxide extent.

Coral Mining

Corals are a rich source of calcium carbonate which is used as raw material by cement and other chemical industries. Mining of coral is performed mostly by manual scooping and also by dynamite blasting which is extremely destructive method damaging not only the target area but a large extent of reef habitat

Pollution

Pollution introduces organic and non-organic/chemicals continuously into the water column. Organic pollution can result from soil run off which brings nutrients into sea water promoting the rapid growth of algae and phytoplanktons in coastal areas. Algae can out compete live corals leading to a reduction in coral cover and reef function. Untreated sewage and chemicals like fossil oil, radioactive waste, chemical fertilizers etc. are also responsible for algal booms.

Over-fishing

The coral reef ecosystem is stressed by over-fishing and coastal degradation and is now even less likely to support livelihoods. The high density of population and infrastructure in close proximity of shore line has also led to damage of coral reef ecosystem. Destructive methods like use of cyanide or dynamite for fishing, disturbing biological control such as fishing of bullet fish and balistidae promote the population growth of sea urchins, in turn destroying reefs when their population attain large proportion. Besides, dynamite fishing is also equally destructive method employed while fishing.

Coastal development

The digging of canals and access ways into islands and bays are other serious threats to these ecosystems. Some threats such as climate change, pollution, over-fishing etc. are trans-boundary problems in South Asia and there is a need for greater collaborative efforts to achieve the objectives of coral reefs conservation. Also uncontrolled tourism development activities in coastal areas are a major concern in South Asia Seas (SAS) region and also there is a conflict of interests between tourism industry and conservation groups. Also infrastructure developments for marine industry, tourism etc., can lead to reduction of mangrove ecosystem.

Impact of tsunami on coral reef ecosystem

The earthquake struck near Sumatra on 26 December 2004 followed by tsunami. Some reefs in Sumatra and the Andaman Islands were affected and much of the damage was caused by debris from the land or dead coral rubbles mashing or smothering other corals. Most of the corals has since recovered but over-fishing and pollution from poor land use and inadequate treatment of wastes remain the major threats (Wilkinson,C. et.al 2006). The post-tsunami observations conducted by Government of India in Gulf of Mannar revealed that there was no appreciable change in the bio-physical status of corals in the Gulf of Mannar. Coral species of the family Acroporidae which are vulnerable to the natural disturbances, did not show any damage in their

structures after the tsunami waves hit the Gulf of Mannar. Also the massive corals and associated fishes, algae and sea grass beds were not affected by the tsunami waves. There was, however, slight displacement of the coral rubble walls situated near the edges on the seaward side of some of the islands of the Gulf of Mannar. (Govt of India June 2005). However due to land upliftment by massive earth quake experienced prior to tsunami waves (Ramanamurthy et al) in Northern Andaman, coral reefs were exposed as sea had receded back. In other parts of SAS region like Bangladesh, Maldives, Sri Lanka, Lakshadweep Islands in India, no specific reports of damages to coral ecosystem were found from post tsunami studies.

1.6 Initiatives by South Asia Coral Reef Task Force (SACRTF)

The South Asia Coral Reef Task Force (SACRTF) was established under an EU funded regional initiative to facilitate and coordinate the management of coral reefs and associated ecosystems at a national level, and to promote collaborative action at the regional level, encourage trans-boundary responses to share environmental challenges and raise the political and public profile of coral reef related issues in the South Asia region.

The establishment of the SACRTF was endorsed by the country Governments of the 5 maritime nations of South Asia, at the SACEP 10th Governing Council (GC) Meeting in 2007 and further ratified by the 11th GC and 4th Inter Ministerial Meeting (IMM) of South Asian Seas Programme in 2008 in Jaipur India. The officially nominated representatives have met 3 times to advance regional discussions on coral reef related issues.

Significant achievements of the SACRTF

The major achievements of SACRTF to date include;

- The South Asia MCPA Project

With the support of the European Union, 5 small grant projects were implemented with local partners for environment education and awareness programmes among the public, local coral reef dependent communities and MCPA managers. These were found to be highly effective mechanisms to enhance the awareness about the importance and need for coral reef conservation. The dialogues between managers and local communities have brought about the perception of resource management and areas of common agreements. In one incidence in Andaman, India the managers could understand the difficulties faced by the local communities/tourist operators and NGOs, who agreed to support the local conservation programme. This in turn, highlights the importance of having two way communication in involving stakeholders in the decision making process. The outcome of the experiences of the MCPAs managers on these projects at the national level were shared during the task force meetings for mutual learning. (See www.icran.org for more information.)

- Training Workshop

At the regional level, a four day training workshop for Managers of MCPAs was organized by the GEER Foundation, Gandhinagar,India. The training provided an opportunity to the managers across the region, to share their experiences and identify the common areas to work together on the management of coral reef ecosystem. During the interactions of the managers, it clearly came out that the issues of natural disasters like global climate change, tsunami, cyclone, storms and livelihood aspects of coral reef dependent communities for sustainable development are some of the common issues faced in the region. It is realized that there is an urgent need to evolve-

- Regional strategy for coral reef management in South Asia for capacity building and developing institutional mechanism and
- Regional communication strategy for coral reef management in South Asia for generating massive awareness in South Asia.

2. Need for the Strategy

Globally coral reefs are in crisis due to several causes: over-exploitation of resources by commercial fishing; destructive fishing practices that degrade and destroy that habitat; increasing coastal population; poor land use practices and run off of pollutants, sediments and nutrients, out break of diseases which may be associated with poor water quality and pollutants, coral bleaching caused by increasing sea water temperatures and global climate change, and degradation of coastal mangrove forests. In this context, it is necessary to enhance the institutional capabilities to deal with the issues which are ecological, economical and social in nature for coral reef management and conservation and increase the cooperation between the South Asian seas member countries.

The collaborative efforts of South Asian Seas member countries will help in strengthening Marine and Coastal Protected Areas management by exchange of data and information, sharing of experiences including research output, using uniformly accepted tools and techniques of sampling and monitoring, documenting the major events, exchanging the communication material, strengthening the village institutions and generating mass awareness etc.

A comprehensive approach in the form of strategy will help in visualizing and identifying the areas which need strengthening, the approach and availability of resources. The task of implementing the strategy for conservation of coral reefs in South Asia would require significant involvement of various types of organizations ranging from government organizations to community-level organizations. The infrastructural and human resource capacities of these organizations need to be considerably enhanced and restructured to help them meet the challenges of coral reef conservation.

Long-term i.e. sustained biological success can be achieved only if proper mechanisms of governance are in place that include;

- **Comprehensive framework**: There is a need for comprehensive approaches for costal and marine resource management including and integrated coastal area management supported by legislation. MCPAs should be seen as one of the tools within this larger framework.
- **Community conservation initiatives**: Initiatives by local communities to conserve and manage resources, traditional or otherwise, should be supported, including through use of provisions in existing legislation.
- **Participation of communities**: Effective participation of communities in management and conservation activities should be ensured, especially in view of the understanding and knowledge that communities have about their ecosystems.
- **Alternative livelihood**: Long-term functional and sustainable alternative livelihood options need to be developed in consultation with communities.
- **Institutional co-ordination**: There should be greater institutional co-ordination between the various departments involved in the management of marine and coastal ecosystems, also to ensure coherence between various regulations in place, reducing their complexity and enhancing possibilities of compliance.
- **Institutional framework**: The role of the various State-level Departments in managing MCPAs needs to be recognized, secured and enhanced
- **Capacity building**: Capacity building of PA managers, from both the Forest and Fisheries Departments, is needed, especially in adopting a participatory approach to management.

3. Objectives

The objectives of the Regional Strategy for South Asia are:

1. Capacity building of various government and non-government organizations and institutions involved in the conservation and management of coral reef areas in South Asian Seas member countries of SACEP. The optimization of management strategies, generation of human and technical capacity and implementation and enforcement of measures in existing MCPA sites is therefore the first priority of the region.

2. Creating mass awareness and sensitizing people about the conservation values of coral reefs for enlisting massive participation of people, including support from policy makers and funding agencies, for conservation of coral reefs in South Asian Seas member countries of SACEP.

3. Developing institutional capabilities of various agencies, including local communities, for strengthening livelihood support systems for reef dependent communities in South Asian Seas member countries of SACEP.

4. Components of the Strategy

The capacity building strategy is perceived as a holistic approach to building capacities of concerned organizations to ensure sustained conservation of coral reefs and associated bio-resources. The strategy, therefore, needs to address the capacity building needs and the process and mechanism for meeting these needs. The first step, therefore, would be identification of various organizations or agencies or individuals whose capacities need to be enhanced. While doing so, it would be useful to prioritize various institutions and also prioritize the capacity building needs of various identified institutions, through an appropriate process so that actual action plans for capacity building may be based upon these priorities, particularly in view of available resources which are never unlimited. The following process would be adopted.

4.1 Capacity Building Process

In South Asian seas member countries, presently scattered efforts are made for coral reefs protection and conservation by Marine and Coastal Protected Areas (MCPAs), however, there is a need for systematic approach to deal with the issues of coral reefs, generating baseline data and enhancing the capacities of the existing institutions, both Government and Non-government, in a planned manner. The capacity building process will enlist such institutions, outline their goals and deliverables, assess their existing capabilities and identify the areas of capacity building and mechanism. Thus, the process would focus on

- Outlining the institutions' goals and deliverables
- Assessing the existing institutional capabilities
- Finalizing a suitable mechanism to suit the local conditions for capacity building which will include the capacity building needs in terms of information, awareness, skill building and physical and human resources.

4.2 Institutional Mechanism

As mentioned in capacity building process, institutional mechanism will be different for different types of institutions which are discussed below.

4.3 Major Institutional Types

The present administrative arrangements for coral reef management in different countries in South Asia region are different. However, they may be categorised into following five categories based on their expected roles in the reef management. The strategy would involve first identifying individual organizations within each category, clearly stating their expected role, assessing their present capability in terms of effective and efficient performance of their roles and responsibilities and identifying their capacity gaps and actual mechanism for capacity building.

I. Policy level government institutions
II. Management level Government Agencies
III. Community level organizations
IV. Research and academic institutions
V. Non-government organizations

I. Policy-level Government Organizations

Expected roles

Policy level government organizations are the national ministries of the five member countries who coordinate with management level government organizations. They are expected to play following major roles for formulation of new policies and providing directions.

- Policy formulation
- Overall direction
- Monitoring and control

The policy level organizations have to evolve programmes for research and academic institutions.

Needs

There are two kinds of information required for formulating policy which includes information and data about the management and monitoring.

Information Systems

The information systems are discussed at length in the communication strategy document titled "Regional Communication Strategy for Coral Reef Management in South Asia-2008". This strategy document deals with the requirement of various types of information needs, including the needs for management information system and monitoring information system.

Knowledge Base

The policy level government organizations require the following inputs for formulation of the new regulations and revising the existing regulations in tune with the changing global, regional, national and local scenario for the conservation and management of coral reefs.

- Global and regional strategies
- Base line information
- Requirements and aspirations of different stakeholders
- Expert information for sustainable resource use and conservation
- Expert information about carrying capacities
- New findings
- Research outputs

- Success and failure stories
- Impact of anthropogenic pressures on conservation
- Understanding of socio-economic dependence

Various capacity building measures suggested for policy level institutions

A suggestive list of capacity building measures suitable for policy level institutions or organizations is mentioned below. Each country may have different capacity building needs. Therefore, the suggestive list indicates broad types of measures which may be taken up as per the perceived country level needs and available resources.

- Facilitating exchange of information and sharing of knowledge base
- Orientation and awareness programmes
- Exposure tours to other parts of the region
- Institutional arrangements for workshops, seminars and other modes of information sharing
- Communication and awareness through mass media

II. Management-level Government Organizations

The management level organizations are state/ province level ministries who will follow the policy level organizations for the effective implementation of Policy formulated for the purpose of conservation and management of coral reefs. Policy has to be translated into actual implementation by the government departments who are expected to play the following roles

Expected Roles

- Translation of policy into action
- Enforcement of laws, rules and regulations
- Protection, management and conservation of MCPAs
- Generating information and database at the PA level
- Facilitating stakeholder participation
- Conflict and crisis management
- Applied research to fulfill management needs
- Communication and awareness generation
- Monitoring and evaluation

Assessment of Existing Capabilities

In order to plan the institutional capacity building, it is essential to assess the existing capabilities and identify various gaps which are required to be filled up by the internal or external agencies.

- Assessment of existing human resource in terms of
    - Organizational structure and functions vis-à-vis roles and responsibilities
    - Manpower
    - Skills
- Assessment of existing infrastructure, equipments and capabilities in terms of
    - Existing networking capabilities
    - Strengths of the agency
    - Experience and expertise present
    - Special areas of achievements and effectiveness
    - Conflict and crisis management capability

Identification of Areas Needing Capacity Building

An internal exercise could be planned for identifying strength, weaknesses, opportunities and threats (SWOT exercise) in the presence of external resource persons or institutions

- Subject areas and personnel needing training
- Infrastructure and equipment needs

Strategy for Enhancing Capabilities

Having gone through the SWOT exercise, the institution could identify areas requiring further strengthening and evolve a strategy for enhancing institutional capabilities.

a. Identifying capable institutions for imparting training.
b. Institutional mechanism for capacity enhancement, which will consist of the following:

- Manpower planning and provision of the required manpower
- Training and skill up-gradation programme
- Skilled human resource and trainers for training programme
- Provision of infrastructure, instruments, etc.
- Institutional arrangements for workshops, seminars and other modes of information sharing
- Facilitating exchange of information and sharing of knowledge base
- Orientation and awareness programme
- Exposure tours to other parts of the region
- Communication and awareness through mass media

III. Community Level Organizations

Certain communities are living close to marine and coastal areas since generations. These communities are largely dependent on the marine resources for their livelihood and income. They have rich traditional knowledge which could be used in the coral reef management. The sustainable management of marine resources is in the interest of both, the local communities and larger society. They could play a key role in ensuring conservation of coral reefs by their active involvement in the form of community level organizations. Thus, community organizations could play following roles.

Expected Roles

- Strengthening management
- Providing local and traditional wisdom
- Ensuring continuity, to management practices by leveraging their permanent presence
- Facilitating sustainable use of marine and coastal resources
- Providing support in crises detection and management
- Providing support in surveillance and vigilance
- Facilitating benefit sharing among stakeholders as per policy and law
- Conflict resolution

Understanding the community

Assessment of the existing capabilities of the community organizations will be essential for planning and for identifying future areas of capacity building. This could be done by participatory rural appraisals and by focused group discussions with the community and their leaders.

- Assessment of existing human resource in terms of
    - Organizational structure and functions vis-a-vis the roles and responsibilities
    - Manpower
    - Skills
- Assessment of existing infrastructure, equipments and capabilities in terms of
    - Existing networking capabilities
    - Strengths of the agency
    - Experience and expertise present
    - Special areas of achievements and effectiveness
    - Conflict management capability
    - Quality and strengths of consultative processes

Identification of Areas Needing Capability Enhancement

Participatory Rural Appraisals (PRA) and focused group discussions with the local community will help in identifying training and capacity building areas and resources required for enhancing their present skills and capabilities

- Areas and personnel needing training
- Need for infrastructure, equipment, etc.

Strategy for Enhancing Capabilities

At the end of the above mentioned exercises, a strategy for enhancing capabilities of community institutions can be developed covering following major areas.

a. Identifying suitable institutions for imparting training

b. Institutional mechanism for capacity enhancement, consisting of the following:

- Manpower planning and provision of required manpower
- Training and skill up-gradation programmes
- Trainers for training programme
- Provision of infrastructure, instruments etc.
- Skilled human resource for imparting training
- Institutional arrangements for regular workshops, seminars and other modes of information sharing
- Facilitating exchange of information and sharing of database
- Orientation and awareness programmes
- Exposure tours to areas with success stories
- Communication and awareness through mass media

The MCPAs can play a lead role for the active involvement of coastal communities, stakeholders and NGOs.

IV. Research and Academic Institutions

From the literature review in order to understand climate change, natural hazards etc. and to understand the coral recruitments and their spread it is imperative that systematic time-series data is collected. Academic and research institutions working in the marine resource areas can play an coordinative role between managers, communities, policy makers and other stakeholders by undertaking field based issues of management and development.

Expected Roles

- Generating the information base
- Carrying out research and providing research output
- Identifying research needs in consultation with managers and other stakeholders
- Institutional arrangement for information dissemination for policy makers, managers, communities and the society at large.
- Bio-physical monitoring
- Networking with other institutes for information sharing and avoiding duplication of research
- Providing research based inputs for developing communication strategy on key issues
- Facilitating training and Capacity building of managers based on research
- Facilitating the development and implementation of management action plans

Utilization of available resources

In the South Asian regions a number of research institutions, are working. There is a need to coordinate and collate the data collected and make the data available for the public domain. Assessment of existing capabilities of research institutions could be analyzed by their human resources, infrastructure and equipments and more importantly by the research publications and transferring their findings in the field.

- Assessment of existing human resource in terms of
  - Organizational structure and functions vis-à-vis roles and responsibilities
  - Manpower
  - Skills
- Assessment of existing infrastructure, equipments and capabilities in terms of
  - Existing networking capabilities
  - Strengths of the agency
  - Experience and expertise present
  - Special areas of achievements and effectiveness

Identification of Areas Needing Capability Enhancement

- Areas and personnel needing training
- Need for infrastructure, equipment, etc.

Strategy for Enhancing Capabilities

Following steps can be useful for enhancing the capabilities of the research and academic institutions.

- Identifying suitable institutions for imparting training
- Institutional mechanism for capacity enhancement, consisting of :
  - Manpower planning and provision of required manpower
  - Training and skill up-gradation programmes
  - Provision of infrastructure, instruments, etc.
  - Institutional arrangements for regular workshops, seminars and other modes of information sharing
  - Facilitating exchange of information and sharing of database
  - Improving the existing networking capabilities

V. Non-Government Organizations

There are many Non- Government Organizations (NGOs) working in South Asian region for coral reef conservation and providing alternative livelihood and employment to the local reef dependent communities. They are expected to play intermediary role between government and people. NGOs have necessary strength of mobilizing people and strengthening community based organizations by generating awareness and support.

Expected Roles

- Work as an interface between management and community.
- Mobilize community to participate in management and conservation efforts.
- Facilitate awareness generation.
- Facilitate local level planning and action involving local communities.
- Facilitate capacity building of stakeholders.
- Facilitate monitoring and evaluation.
- Documentation, networking.

Strategy for Involving NGOs

- Identification of capable NGOs having required manpower and skills to perform the jobs allotted to them.
- Development of institutional mechanism for long term involvement of the identified NGOs in the capacity building programmes.
- Institutional arrangements for regular consultative process with NGOs.
- Orientation and awareness programmes.
- Exposure tours to areas having success stories.
- Involvement of NGOs in developing communication and awareness programmes for different target groups.

5. Action Plan

The expected roles, identification of existing capabilities and strategy for enhancing the capacity of institutions have been discussed in details. Based on the above discussions, the actions to be taken up to fulfill the immediate needs on priority have been short-listed in three themes. However, the member country may decide on the basis of locale specific priorities. They are:

Theme 1: Understanding threats of coral reefs

Theme 2: Reducing threats

Theme 3: Raising awareness

5.1 Theme 1: Understanding threats to coral reefs

Each South Asian Seas member country is studying the present situation of the coral reefs in terms of extent and quality. This includes preparing an inventory of reef areas using remote sensing technologies by procuring satellite images from the respective agencies. This work has already been done in case of a number of coral reefs in South Asia. However, if this has not been done for any particular reef, it should be taken up on high priority.

Action 1: Monitoring and assessment of coral reef health

The first step of research is to consolidate base line data for each of the MCPAs and coral reefs outside the protected area network on the basis of percentage of live and dead corals, identification of coral species and their abundance, habitat evaluation, monitoring for key coral species etc. Later, the factors influencing corals like sedimentation, spread of algae etc. will be studied under the ecological research component.

The health of coral reef is being assessed by regular/seasonal monitoring of bio-physical parameters like salinity, temperature, pH, oxygen level etc. and by underwater photography and videography, satellite observation etc. The percentage of new recruitments, diseases and impact of bleaching of the corals are being considered while assessing the health of the coral reefs. However, methodology and frequency of these exercises are to be carried out on the yearly basis. A team of experts would be involved in this exercise. This can also be facilitated by holding annual workshops involving managers and subject experts.

Action 2: Targeted research including social and economic factors

In South Asian countries, many communities are living close to coral reef areas and are dependent on marine bio-resources for their livelihood. The socio-economic research is to be carried out to understand and assess their economic dependence on such bio-resources of local communities, especially fisherman communities on coral reef areas. There are various projects undertaken by national governments, international agencies, NGOs and private organizations. These activities were more prominent during post tsunami relief measures. Research is also required to assess and quantify the present level of economic activities carried out in the coral reef areas which include fishing, coral mining and extraction of other raw materials by industries etc. However, the work conducted so far has been scattered and not coordinated in a progressive manner to support the coastal communities. It is expected from the strategy that such efforts will be uniformly coordinated to achieve the goal of coral management.

5.2 Theme 2: Reducing threats of Coral Reef Management

The threats of coral reefs could be managed by enhancing capabilities of MCPAs managers, strengthening the law enforcement and collaborative actions for mitigation of climate change etc.

Action 1: Enhance and strengthen capabilities of MCPAs

For effective conservation and management of coral reefs, the existing capabilities of the MCPAs in terms of their human and physical resources need to be further augmented. This can be achieved by developing skills of the managers in the areas of understanding marine biodiversity, habitat management, monitoring and evaluation, legal enforcement and by providing infrastructure facilities to the MCPAs.

Action 2: Reduce adverse impacts of extractive uses

The member countries have their policies and laws and their international commitments well in place. However, there is a need for effective implementation and enforcement of the laws. In addition, the awareness building programmes specifically developed for different stakeholder groups will be useful in generating awareness and seeking their support in controlling fishing and other extractive uses of coral reefs.

Action 3: Reduce impacts of coastal development

A well defined policy should be evolved with a view to conserving coral reef eco-systems to restrict the development activities like human settlements, industries and other developmental activities. The enforcement on one hand and awareness programmes on the other, developed to address specific target groups will help in resolving such issues.

Action 4: Mitigate impacts of climate change

Climate change is a global issue which has to be addressed at the local level. The coral reef eco-system is known to be sensitive to climate change- particularly sea water temperature rise. Each nation may adhere to a time bound programme for reducing the level of green house gas emissions and enhancing carbon sequestration as per the programme agreed upon by the country either internally or internationally. Besides, a programme of coral rehabilitation / replanting of corals in coral potential areas may be take up in view of the role that corals play as carbon sinks.

5.3 Theme 3: Raising awareness

Awareness among the local people and other stakeholder groups are important for management of coral reefs. A success story on how small grants help to bring about awareness among the people in Bangladesh, India, Maldives, Pakistan and Sri Lanka are described in brief.

To raise awareness regarding the importance and value of coral reefs and associated ecosystems, people should be made aware of the long term, sustainable benefits of the MCPAs. Based on past experience of SACEP on five small projects granted to five member countries, raising such awareness is found to be very effective and useful in protection of MCPAs and was appreciated by all members of the SACRTF. The country reports were presented in the 3rd SACRTF meeting held at Chennai India during December 2008.With the support of the South Asia Coral Reef Task Force (SACRTF), five small action grants were facilitated for environmental education and outreach activities at the following participating MCPA sites.

1. St.Martins Island -Bangladesh
2. Mahatma Ghandi National Park, Andaman island- India
3. Baa Atoll- Maldives
4. Jiwani (Gwater)- Pakistan
5. Bar Reef- Sri Lanka

Concentrated efforts were made to generate awareness in the surrounding villages of the MCPAs by the concerned MCPA managers by using various media like print, audio-visual and traditional communication methods like drama, folk dances, story telling, field exposures etc. The target groups included students, teachers, general public, nature clubs, members of fisherman communities etc. The overall experiences of generating awareness have remained very positive and the efforts were appreciated by the SACRTF members.

However, the present efforts are not adequate for bringing about large scale awareness. In view of this, a separate communication strategy has been developed by SACEP for addressing the diverse communication needs of the different stakeholders.

6. Institutional Mechanism for Implementing the Regional Strategy

The strategy document was prepared and presented at 3rd SACRTF Meeting at Chennai and the inputs of the member countries were incorporated. For effective and efficient execution of the regional strategy following steps are recommended.

1. SACEP/ SACRTF will act as the central coordinating agency for implementation of the strategy in South Asian region.

2. The National Government may play a role of coordination at country level or may form a group namely National Coral Reef Task Force (NCRTF) under appropriate Ministry to coordinate with the

SACEP/ SACRTF and also with NCRTFs of other member countries and various institutions in their respective countries including MCPAs.

3. All NCRTFs will prepare their country level 'Resources and Action Plans' through a consultative process with various institutions, MCPAs, their National Government and SACRTF/ SACEP.

4. The action plans prepared in consultation with NCRTF will be executed by MCPAs. The members of the NCRTF and SACRTF will facilitate implementation of institutional capacity building strategy.

5. SACEP will approach various national and international agencies for effective implementation of institutional capacity building strategy and communication strategy.

7. Monitoring and Evaluation

1. Nodal agencies of the respective countries will monitor and evaluate the programme annually in consultation with SACEP.
2. The results of the monitoring exercise along with suggestions for future improvements will be presented by the nodal agencies in an annual workshop specially organized for this purpose by SACEP.

8. Time frame

The time frames for individual actions have already been prescribed.

Each nation would develop its country level strategy for capacity building based on the present strategy. The country level strategy would outline MCPA level strategy and non-MCPA reef level strategy specifying time frame for different activities. However, all the proposed activities would be concluded within a period of 5 years.

The strategy will be operationalized within 6 months of the acceptance and funding arrangements and the capacity building, as outlined in the country level strategies, would be fully achieved within a period of 5 years.

Annexure- I

Marine and Coastal Protected Areas of South Asia

The maps shown on the page no. 2, 3, 4, 5, 6 and 7 of this document and tables given below depict the location and diversity of protection measures for marine and coastal environments across the South Asia region. Officially designated protected areas falling within the coastal zone (<50m elevation or 100km from the coast) are listed for each maritime country alongside information (where known), on establishment date, total area, designation or convention, and IUCN category (Sheet A1 provides an explanation of IUCN Categories). A blank space indicates that the information is not available. Geo-referenced data points are used to display the specific location, and spatial boundary information of the listed protected areas on national and regional scale maps. Proposed protected areas, which have not yet been officially designated, are not included for any country. In some instances, wholly terrestrial sites have been removed from the tables following guidance from stakeholders.

This information was compiled based on the holdings of the World Database on Protected Areas (WDPA), hosted by UNEP World Conservation Monitoring Centre, with additional input from regional stakeholders, and the Mangroves for the Future MCPA gap analysis. A full list of thematic data sources is provided. Every effort has been made to ensure the accuracy of the information. Notice of any errors, amendments or the creation of new MCPAs should be provided to UNEP-WCMC to facilitate the continued updating of the WDPA data holdings (protectedareas@unep-wcmc.org).

For further information on MCPAs in South Asia please visit:
The World Database on Protected Areas: http://www.unep-wcmc.org/wdpa/
MPA Global Database: http://www.mpaglobal.org
IUCN Directory of Protected Areas in South Asia

LEGEND
(Logos: UNEP-WCMC, MFF, IUCN)
Maps compiled by UNEP-WCMC using ESRI ArcGIS software.
Coordinate System: Geographic
Date Printed: 01 September 2008

The contents of all maps do not necessarily reflect the views or policies of UNEP-WCMC or contributory organizations. The designations employed and the presentations do not imply the expressions of any opinion whatsoever on the part of UNEP-WCMC or contributory organisations concerning the legal status of any country, territory, city or area or its authority, or concerning the delimitation of its frontiers or boundaries.

The Millennium Assessment defines the coastal zone as a narrow band of terrestrial area, dominated by ocean influences of tides and marine aerosols. In physical terms this is accepted as a maximum of 100km in land or 50m elevation whichever is closer to the sea (MA Marine and Coastal Synthesis, 2006).

Sources of thematic datasets:

Data Set	Source
Protected Areas	World Database on Protected Areas (WDPA) in November 2007, supplied by UNEP World Conservation Monitoring Centre (UNEP-WCMC) (WDPA custodian). This dataset was reviewed by in-country experts through MFF and South Asia MCPA Project activities and feedback incorporated.
Mangroves	Mangroves data mainly from Mangrove forest distributions and dynamics (1975 - 2005) of the tsunami-affected region of Asia, by C. Giri , Z. Zhu, L.L.Tieszen, A. Singh, S. Gillette, J.A.Kelmelis, Journal of Biogeography (J.Biogeogr.) (2007) with additional data from: 1) extraction from version 3.0 of the global polygon dataset compiled by UNEP World Conservation Monitoring Centre (UNEP-WCMC) in collaboration with the International Society for Mangrove Ecosystems (ISME), 1997. This dataset was reviewed by in-country experts through MFF activities and where possible any feedback incorporated
Coral	Andréfouët, S., F. E. Muller-Karger, J. A. Robinson, C. J. Kranenburg, D. Torres-Pulliza, S. A. Spraggins, and B. Murch. 2005. Global assessment of modern coral reef extent and diversity for regional science and management applications: a view from space. in Y. Suzuki, T. Nakamori, M. Hidaka, H. Kayanne, B. E. Casareto, K. Nadaoka, H. Yamano, M. Tsuchiya, and K. Yamazato, editors. 10th International Coral Reef Symposium. Japanese Coral Reef Society, Okinawa, Japan. CDROM. Pages 1732-1745. Version 7.0 of the global 1km raster dataset compiled by the UNEP World Conservation Monitoring Centre (UNEP-WCMC), (2003) in Shapefile format.Data for Sri Lanka, Maldives, India (Andaman and Nicobar islands only) obtained from the Millennium Coral Reef Mapping Project, Institute for Marine Remote Sensing, University of South Florida (IMaRS/USF) and Institut de Recherche pour le Développement (IRD/UR 128, Centre de Nouméa).
Seagrass	Seagrasses extracted from version 2.0 of the global polygon and point dataset compiled by UNEP World Conservation Monitoring Centre (UNEP-WCMC), (2005). Review by in-country experts was undertaken and feedback incorporated.
Bathymetry	Reproduced from the GEBCO Digital Atlas published by the British Oceanographic Data Centre on behalf of the Intternational Oceanographic Commission (of UNESCO) and the International Hydrographic Organisation, 2003

"Important areas of conservation in five South Asian Countries"

This list of "Important Areas of Conservation in Five South Asian Countries" included in this document is from a publication by IUCN, in the years 2008 titled "Managing Marine and Coastal Areas"- a toolkit for South Asia. The list comprises Marine and Coastal Protected Areas of South Asia, having conservation significance. As it is evident from the list all the areas listed are not Marine Protected Areas. There are certain areas which may not be categorized as Marine Protected Areas. Further, this may be treated as a useful list of "Important areas of conservation in five South Asian Countries". The entire list has been included in this document for the purpose of making cross reference with the maps pertaining to different regions of South Asia, included in this report.

BANGLADESH

Map Number	Site Name	National Designation	International Designation (e.g.RAMSAR)	Establishment Date	Area Total (Hectares)	IUCN Category	Comments
1	Char Kukri-Mukri	Wildlife Sanctuary		1981	40	IV	Coastal Mangrove habitat
2	Himchari	National Park		1980	1,729	V	
3	Marine Reserve	Marine Reserve		2000	69800		*
4	Narikel Jinjira Dwip (St Martins Island) & Coral Reef	Ecologically Critical Area (ECA)		1999	590 + Coral Reef		Coral Reef habitat
5	Nijhum Dweep	National Park		2001	16,352	unset	
6	Sonadia Island	Ecologically Critical Area (ECA)		1999	4,916		Barrier Island, Sand dunes and Mangrove habitat
7	Sundarbans (10km Periphery)	Ecologically Critical Area (ECA)		1999			Mangrove habitat *
8	Sundarbans East	Wildlife Sanctuary		1977	31,226	IV	Mangrove habitat
9	Sundarbans Reserved Forests	Wetlands of International Importance / World Heritage Convention		1992	601,700		
10	Sundarbans South	Wildlife Sanctuary		1977	36,970	IV	Mangrove habitat
11	Sundarbans West	Wildlife Sanctuary		1977	71,502	IV	Mangrove habitat
12	Teknaf	Game Reserve		1983	11,615	unset	Hill Forest
13	Teknaf Peninsula (Cox's Bazar - Teknaf Sea Beach)	Ecologically Critical Area (ECA)		1999	10,465		World's Longest Sea Beach

* *Location unknown therefore not present on map*

INDIA

There are 9 National Parks and 95 notified national parks/sanctuaries in the Andaman and Nicobar (A& N) Islands, of India. These have been listed separately from mainland protected areas below:

ANDAMAN & NICOBAR ISLANDS

Map Number	Site Name	State/Province	National Designation	International Convention/Agreement (e.g. RAMSAR)	Establishment Date	Area Total (Hectares)	IUCN Category	Comments
1	Arial Island	A&N	Sanctuary		1977	5	IV	
2	Bamboo Island	A&N	Sanctuary		1977	5	IV	
3	Barren Island	A&N	Sanctuary		1977	810	IV	
4	Battimalv Island	A&N	Sanctuary		1977	223	IV	
5	Belle Island	A&N	Sanctuary		1977	8	IV	Part of the Mahatma Ghandi Marine National Park
6	Bennett Island	A&N	Sanctuary		1977	346	IV	
7	Bingham Island	A&N	Sanctuary		1977	8	IV	
8	Blister Island	A&N	Sanctuary		1977	26	IV	
9	Bluff Island	A&N	Sanctuary		1977	114	IV	
10	Bondoville Island	A&N	Sanctuary		1977	255	IV	
11	Brush Island	A&N	Sanctuary		1977	23	IV	
12	Buchanan Island	A&N	Sanctuary		1977	933	IV	
13	Campbell	A&N	National Park		1992	42,900	II	Part of the Great Nicobar Biosphere reserve
14	Chanel Island	A&N	Sanctuary		1977	13	IV	
15	Cinque islands	A&N	Sanctuary		1977	951	IV	
16	Clyde Island	A&N	Sanctuary		1977	54	IV	
17	Cone Island	A&N	Sanctuary		1977	65	IV	
18	Curlew (B.P) Island	A&N	Sanctuary		1977	16	IV	
19	Curlew Island	A&N	Sanctuary		1977	3	IV	
20	Cuthbert Bay	A&N	Sanctuary		1977	582	IV	*
21	Defence Island	A&N	Sanctuary		1977	1,049	IV	
22	Dot Island	A&N	Sanctuary		1977	13	IV	
23	Dottrell island	A&N	Sanctuary		1977	13	IV	
24	Duncan Island	A&N	Sanctuary		1977	73	IV	
25	East Island	A&N	Sanctuary		1977	611	IV	
26	East of Inglis Island	A&N	Sanctuary		1977	355	IV	

Map Number	Site Name	State/Province	National Designation	International Convention/Agreement (e.g. RAMSAR)	Establishment Date	Area Total (Hectares)	IUCN Category	Comments
27	Egg Island	A&N	Sanctuary		1977	5	IV	
28	Elat (flat) Island	A&N	Sanctuary		1977	936	IV	
29	Entrance Island	A&N	Sanctuary		1977	96	IV	
30	Galathea	A&N	National Park		1992	11,000	II	Part of the Great Nicobar Biosphere Reserve
31	Gander Island	A&N	Sanctuary		1977	5	IV	
32	Goose Island	A&N	Sanctuary		1977	1	IV	
33	Great Nicobar	A&N	Biosphere Reserve		1986	88,500	VI	
34	Gurjan	A&N	Sanctuary					*
35	Hump Island	A&N	Sanctuary		1977	47	IV	
36	Interview Island	A&N	Sanctuary		1977	13,387	IV	
37	James Island	A&N	Sanctuary		1977	210	IV	
38	Jungle Island	A&N	Sanctuary		1977	52	IV	
39	Kwangtung Island	A&N	Sanctuary		1977	57	IV	
40	Kyd Island	A&N	Sanctuary		1977	800	IV	
41	Landfall island	A&N	Sanctuary		1977	2,948	IV	
42	Latouche Island	A&N	Sanctuary		1977	96	IV	
43	Lohabarrack	A&N	Sanctuary		1977	2,221	IV	
44	Mahatma Gandhi Marine	A&N	National Park		1983	28,150	II	
45	Mangrove Island	A&N	Sanctuary		1977	39	IV	
46	Mask Island	A&N	Sanctuary		1977	78	IV	
47	Mayo Island	A&N	Sanctuary		1977	10	IV	
48	Megapode Island	A&N	Sanctuary		1977	12	IV	**
49	Middle Button Island	A&N	National Park		1987	64	II	Part of Rani Jansi Marine National Park
50	Montgomery Island	A&N	Sanctuary		1977	21	IV	
51	Mount Harriett	A&N	National Park		1987	4,662	II	
52	Narcondam	A&N	Sanctuary		1977	681	IV	
53	North Brother Island	A&N	Sanctuary		1977	75	IV	
54	North Button Island	A&N	National Park		1987	44	II	Part of the Rani Jhansi Marine Nat Park

55	North Island	A&N	Sanctuary		1977	49	IV	
56	North Reef Island	A&N	Sanctuary		1977		IV	
57	Oliver Island	A&N	Sanctuary		1977	16	IV	
58	Orchid Island	A&N	Sanctuary		1977	10	IV	
59	Ox Island	A&N	Sanctuary		1977	13	IV	
60	Oyster Island 1	A&N	Sanctuary		1977	8	IV	
61	Oyster Island 2	A&N	Sanctuary		1977	21	IV	
62	Paget Island	A&N	Sanctuary		1977		IV	
63	Parkinson Island	A&N	Sanctuary		1977	34	IV	
64	Passage Island	A&N			1977	62		
65	Patric Island	A&N	Sanctuary		1977	13	IV	
66	Peacock island	A&N	Sanctuary		1977	62	IV	
67	Pitman Island	A&N	Sanctuary		1977	137	IV	
68	Point Island	A&N	Sanctuary		1977	307	IV	
69	Potanma Islands	A&N	Sanctuary		1977	16	IV	
70	Ranger Island	A&N	Sanctuary		1977	426	IV	
71	Rani Jhansi Marine	A&N	National Park		1996	25,614	II	
72	Reef Island	A&N	Sanctuary		1977	174	IV	
73	Roper Island	A&N	Sanctuary		1977	146	IV	
74	Ross Island	A&N	Sanctuary					*
75	Rowe Island	A&N	Sanctuary		1977	1	IV	
76	Saddle Peak	A&N	National Park		1987	3,254	II	
77	Sandy Island	A&N	Sanctuary		1977	158	IV	
78	Sea Serpent Island	A&N	Sanctuary		1977	78	IV	
79	Shark Island	A&N	Sanctuary		1977	60	IV	
80	Shearme Island	A&N	Sanctuary		1977	785	IV	
81	Sir Hugh Rose Island	A&N	Sanctuary		1977	106	IV	
82	Sisters Island	A&N	Sanctuary		1977	36	IV	
83	Snake Island 1	A&N	Sanctuary		1977	73	IV	
84	Snake Island 2	A&N	Sanctuary		1977	3	IV	
85	South Brother Island	A&N	Sanctuary		1977	124	IV	
86	South Button Island	A&N	National Park		1987	3	II	Part of the Rani Jhansi Marine Nat Park
87	South Reef Island	A&N	Sanctuary		1977	117	IV	

Map Number	Site Name	State/Province	National Designation	International Convention/Agreement (e.g. RAMSAR)	Establishment Date	Area Total (Hectares)	IUCN Category	Comments
88	South Sentinel Island	A&N	Sanctuary		1977	161	IV	
89	Spike Island 1	A&N	Sanctuary		1977	42	IV	
90	Spike Island 2	A&N	Sanctuary		1977	1,170	IV	
91	Stoat Island	A&N	Sanctuary		1977	44	IV	
92	Surat Island	A&N	Sanctuary		1977	31	IV	
93	Swamp Island	A&N	Sanctuary		1977	409	IV	
94	Table (Delgarno) Island	A&N	Sanctuary		1977	229	IV	
95	Table (Exeelsior) Island	A&N	Sanctuary					*
96	Talabaicha Island	A&N	Sanctuary		1997	321	IV	
97	Temple Island	A&N	Sanctuary		1977	104	IV	
98	Tillangchong Island	A&N	Sanctuary		1977	1,683	IV	
99	Tree Island	A&N	Sanctuary		1977	3	IV	
100	Trilby Island	A&N	Sanctuary		1977	96	IV	
101	Tuft Island	A&N	Sanctuary		1977	29	IV	
102	Turtle Islands	A&N	Sanctuary		1977	39	IV	
103	Wandur	A&N	Marine National Park		1983	28,150	II	
104	West Island	A&N	Sanctuary		1977	640	IV	
105	Wharf Island	A&N	Sanctuary		1977	11	IV	
106	White Cliff Island	A&N	Sanctuary		1977	47	IV	

* Location unknown therefore not present on map

** The 2004 Indian Ocean Tsunami caused major morphological changes to the land area of the A&N Islands w hich may result in some inaccuracies to this map while the changes are explored and recorded.

MAINLAND INDIA

Map Number	Site Name	National Designation	International Convention/Agreement (e.g. RAMSAR)	Establishment Date	Area Total (Hectares)	IUCN Category	Comments
107	Achra	Sanctuary					*
108	Aliabet Island	Sanctuary					*

109	Ashtamudi Wetland		Wetlands of International Importance (Ramsar)	2002	61,400		
110	Attiveri	Sanctuary		1994	223	IV	*
111	Balai	Sanctuary					*
112	Balukhand Konark	Sanctuary		1984	7,172	IV	*
113	Barda	Sanctuary		1979	19,231	IV	
114	Barda (extension)	Sanctuary					*
115	Bhagwan Mahavir	Sanctuary		1967	14,852	IV	
116	Bherjan-Borajan-Podumoni	Sanctuary		1999	722		*
117	Bhitarkanika	National Park		1998	14,500	II	
118	Bhitarkanika	Sanctuary		1975	67,200	IV	
119	Bhitarkanika Mangroves		Wetlands of International Importance (Ramsar)	2002	65,000		
120	Bibhutibhusan	Sanctuary		1980	64	IV	
121	Black Buck	Sanctuary					*
122	Bondla	Sanctuary		1969	800	IV	
123	Bordoibam-Bilmukh	Sanctuary		1996	1,125	IV	*
124	Burachapori	Sanctuary		1995	4,406	IV	*
125	Cambay	Sanctuary					*
126	Chandaka	Sanctuary		1982	17,579	IV	
127	Chilika Lake		Wetlands of International Importance (Ramsar)	1981	116,500		
128	Chilka (Nalaban)	Sanctuary		1987	1,553		
129	Chilka-Nanda Island	National Park					
130	Chitrangudi	Sanctuary		1989	48	IV	
131	Chorao Island	Sanctuary		1988	178	IV	
132	Coringa	Sanctuary		1978	23,570	IV	
133	Cotigao	Sanctuary		1968	8,565	IV	
134	Dadra and Nagar Haveli	Sanctuary		2000	9,216	IV	*
135	Dandeli	Sanctuary		1987	47,502	IV	
136	East Calcutta Wetlands		Wetlands of International Importance (Ramsar)	2002	12,500		
137	Gaga	Sanctuary		1988	333	IV	*
138	Gaga Great Indian Bustar	Sanctuary		1988	33	IV	*
139	Gahirmatha (marine)	Sanctuary		1997	143,500	IV	*

Map Number	Site Name	National Designation	International Convention/Agreement (e.g. RAMSAR)	Establishment Date	Area Total (Hectares)	IUCN Category	Comments
140	Gahirmatha North	Sanctuary					*
141	Gir	Sanctuary		1965	115,342	IV	
142	Gujarat	National Park		1995	16,289	II	
143	Gulf of Kutch	Marine National Park		1980	16,289	II	
144	Gulf of Mannar	Bird Reserve/ Marine National Park/ National park	UNESCO Biosphere Reserve	1989	1,050,000	VI	
145	Hadgarh	Sanctuary		1978	19,106	IV	
146	Haliday Island	Sanctuary		1978	595	IV	
147	Honvavar	Sanctuary					*
148	Kalakad	Wildlife Sanctuary		1978	22,358	IV	
149	Kanjirankulam	Sanctuary/Bird Reserve		1989	104	IV	
150	Karikili	Sanctuary/Bird Reserve		1998	61	IV	
151	Karnala	Sanctuary		1968	448	IV	
152	Khijadia	Sanctuary		1981	605	IV	
153	Kolleru	Sanctuary		1953	67,300	IV	
154	Kolleru Lake		Wetlands of International Importance (Ramsar)	2002	90,100		
155	Kori Creek	Sanctuary					*
156	Krishna	Sanctuary		1989	1,989	IV	
157	Kuldiha	Sanctuary		1984	27,275	IV	
158	Kuldiha extention	Sanctuary					*
159	Kumarkon	Sanctuary					*
160	Kundapur	Sanctuary					*
161	Kuthankulam	Sanctuary		1994	129	IV	
162	Lakhari Valley	Sanctuary		1985	18,587	IV	
163	Lothian Island	Sanctuary		1978	3,800	IV	
164	Malvan	Sanctuary		1987	2,912	IV	
165	Mandvi	Sanctuary					*
166	Marine	Sanctuary		1980	29,503	IV	
167	Mollem	Sanctuary		1967	13,300	IV	
168	Mookambika	Sanctuary		1974	24,700	IV	
169	Mundanthurai	Wildlife Reserve		1977	56,738	IV	

170	Mundanthuria-Kalakad	National Park		1996	40,000	Unset	
171	Muthupet Mangrove Forest Reserve	Sanctuary		1967	1,726	IV	
172	Nal Sarovar	Sanctuary		1969	12,082	IV	
173	Nandankanan	Sanctuary		1979	1,416	IV	
174	Narayan Sarovar	Sanctuary		1995	44,423	IV	
175	National Chambal	Sanctuary		1979	28,000	IV	*
176	Navpada	Sanctuary					*
177	Neyyar	Sanctuary		1958	12,800	IV	
178	Paniya	Sanctuary		1989	3,963	IV	
179	Peechi Vazhani	Sanctuary		1958	12,500	IV	
180	Peppara	Sanctuary		1983	5,300	IV	
181	Phansad	Sanctuary		1986	6,979	IV	
182	Pichavaram	Sanctuary/Forest Reserve		1935	1,100	IV	
183	Pilarkhan	Sanctuary					*
184	Pitti (bird Island)	Sanctuary		2000	1	IV	*
185	Point Calimere Wildlife and Bird Sanctuary	National Park	Wetlands of International Importance (Ramsar)	2002	38,500		
186	Porbandar Lake	Sanctuary		1988	9	IV	
187	Pulicat Lake	Sanctuary		1980	15,367	IV	
188	Rocky Beach	Sanctuary					*
189	Sajnakhali	Sanctuary		1976	209,112	IV	
190	Sanctuary	Sanctuary		1984	10,032	IV	
191	Sanjay Gandhi	National Park		1983	8,696	II	
192	Sasthamkotta lake		Wetlands of International Importance (Ramsar)	2002	373		
193	Sohara	Sanctuary					*
194	Someshwara	Sanctuary		1974	8,840	IV	
195	Someshwara (extension)	Sanctuary					*
196	Sri Venkateswara	Sanctuary		1985	15,332	IV	
197	Sriharikota Island	Sanctuary					*
198	Sundarbans	National Park	UNESCO Biosphere Reserve	1984	133,010	Ia	
199	Talacauvery	Sanctuary		1987	10,559	IV	
200	Tansa	Sanctuary		1970	30,481	IV	
201	Turtle	Sanctuary		1989	700	IV	*

202	Udayamarthandapuram Lake	Sanctuary/Bird Reserve		1991	45	IV	
203	Vaduvoor	Sanctuary/Bird Reserve		1991	123	IV	*
204	Vellanadu	Sanctuary		1987	1,641	IV	
205	Vembanad-Kol Wetland		Wetlands of International Importance (Ramsar)	2002	151,250		
206	Vettangudi	Sanctuary		1977	38	IV	
207	Wild Ass	Sanctuary		1973	495,371	IV	

* Location unknown therefore not present on map

MALDIVES

Map Number	Site Name	National Designation	International Designation (e.g.RAMSAR)	Establishment Date	Area Total (Hectares)	IUCN Category	Comments
1	AA. Hurasdhoo	island		2006		unset	*
2	Anemone City	Dive Site		1995		Unset	
3	Banana Reef	Dive Site		1995		Unset	*
4	B.Olhugiri	island		2006		unset	
5	Devana Kandu	Dive Site		1995		Unset	
6	Dhigali haa	Dive Site		1999		Unset	
7	Eedhigali Kilhi - Koattey sarahadhu	Coastal area		2004		unset	*
8	Embudu Channel	Dive Site		1995		Unset	
9	Filitheyo Kandu	Dive Site		1999		Unset	
10	Fish Head	Dive Site		1995		Unset	
11	Fushi Kandu	Dive Site		1999		Unset	
12	Fushivaru Thila	Dive Site		1999		Unset	

13	GA. Hithaadhoo	island		2006		unset	
14	Guraidhoo Channel	Dive Site		1995		Unset	
15	H.P Reef	Dive Site		1995		Unset	
16	Hakura Thila	Dive Site		1999		Unset	
17	Hans Place	Dive Site		1995		Unset	
18	Huraa Kulhi	Mangrove Reserve		2006		unset	
19	Kadu Rah Thila	Dive Site		1995		Unset	
20	Kari Beyru Thila	Dive Site		1999		Unset	
21	Kuda Haa	Dive Site		1995		Unset	
22	Kuredhu Express	Dive Site		1995		Unset	
23	Lions Head	Dive Site		1995		Unset	
24	Maaya Thila	Dive Site		1995		Unset	
25	Madivaru	Dive Site		1999		Unset	
26	Makundhoo kandu	Dive Site		1995		Unset	
27	Nasimo Thila	Dive Site		1999		Unset	
28	Orimas Thila	Dive Site		1995		Unset	
29	Rasfari	Dive Site		1995		Unset	
30	Vattaru Kandu	Dive Site		1999		Unset	

?` Location unknown therefore not present on map

PAKISTAN

Map Number	Site Name	State/Province	National Designation	International Designation (e.g.RAMSAR)	Establishment Date	Area Total (Hectares)	IUCN Category	Comments
1	Astola Island (Haft Talar)	Balochistan	Proposed for MPA	Wetlands of International Importance (Ramsar)		600		
2	Hingol	Balochistan	National Park		1997	619,043	II	
3	Jiwani Coastal Wetland	Balochistan		Wetlands of International Importance (Ramsar) part of North Arabian eco-region	2001	4,600		19km coastline. Important nesting habitat for Green Turtles and marine mammals
4	Jiwani turtle beaches	Balochistan		Wetlands of International Importance (Ramsar) part of North Arabian eco-region	2001			8km coastline. Important nesting habitat for Green Turtles
5	Miani Hor	Balochistan		Wetlands of International Importance (Ramsar)	2001	55000		Estuary/lagoon, mangrove habitat
6	Ormara turtle beaches	Balochistan		Wetlands of International Importance (Ramsar)	2001	2400		Turtle nesting habitat
7	Indus Delta	Sind		Wetlands of International Importance (Ramsar)	2002	472800		
8	Keti Bunder North	Sind	Wildlife Sanctuary		1977	8,948	IV	Mangrove habitat and Important roosting and feeding ground for seabirds

9	Keti Bunder South	Sind	Wildlife Sanctuary		1977	23,046	IV	Mangrove habitat and Important roosting and feeding ground for seabirds

SRI LANKA

Map Number	Site Name	National Designation	International Convention/Agreement (e.g. RAMSAR)	Establishment Date	Area Total (Hectares)	IUCN Category	Comments
1	Andankulam	Forest Reserve			15,177	Unset	Borders a coastal lagoon
2	Bar Reef	Marine Sanctuary		1992	30,670	IV	Coral reef and sea grass habitats
3	Bundala	National Park	UNESCO MAB/Wetlands of International Importance (Ramsar)	1969	6,216	IV	Large forest area bordering the sea. Beach and intertidal area.
4	Chundikullam	Sanctuary		1938	11,150	IV	
5	Hikkaduwa	National Park		1998	45	IV	Entirely marine - incorporates coral reef habitat
6	Kalametiya Lagoon	Sanctuary		1984	712	IV	Estuary and adjacent wetland/riverine environment
7	Kokilai	Sanctuary		1951	2,995	IV	Wetlands and lagoon habitat
8	Kumana	Bird Sanctuary		1970	18,148	II	Forest with wetland area bordering the sea. Incorporates coast and intertidal area
9	Paravi Doopath (or Pigeon Island)	National Park		1974	5	IV	Includes large and small Pigeon Islands and surrounding coral reefs
10	Ruhuna (Yala)	National Park		1938	97,878	II	Forest area bordering the coast in the south east
11	Rumassala	Marine Sanctuary			1,707		Coral reef habitat
12	Sober Island	Sanctuary		1963	65	IV	
13	Wilpattu	National Park		1938	131,693	II	Large forest area bordering the sea. Incorporates beach and intertidal areas

References

Managing Marine and Coastal Protected Areas- a toolkit for South Asia 2008 published by IUCN, CORDIO & ICRAN.

M. Spalding et al., World Atlas of Coral Reefs (Berkeley, California: University of California Press and UNEP World Conservation Monitoring Center, 2001).

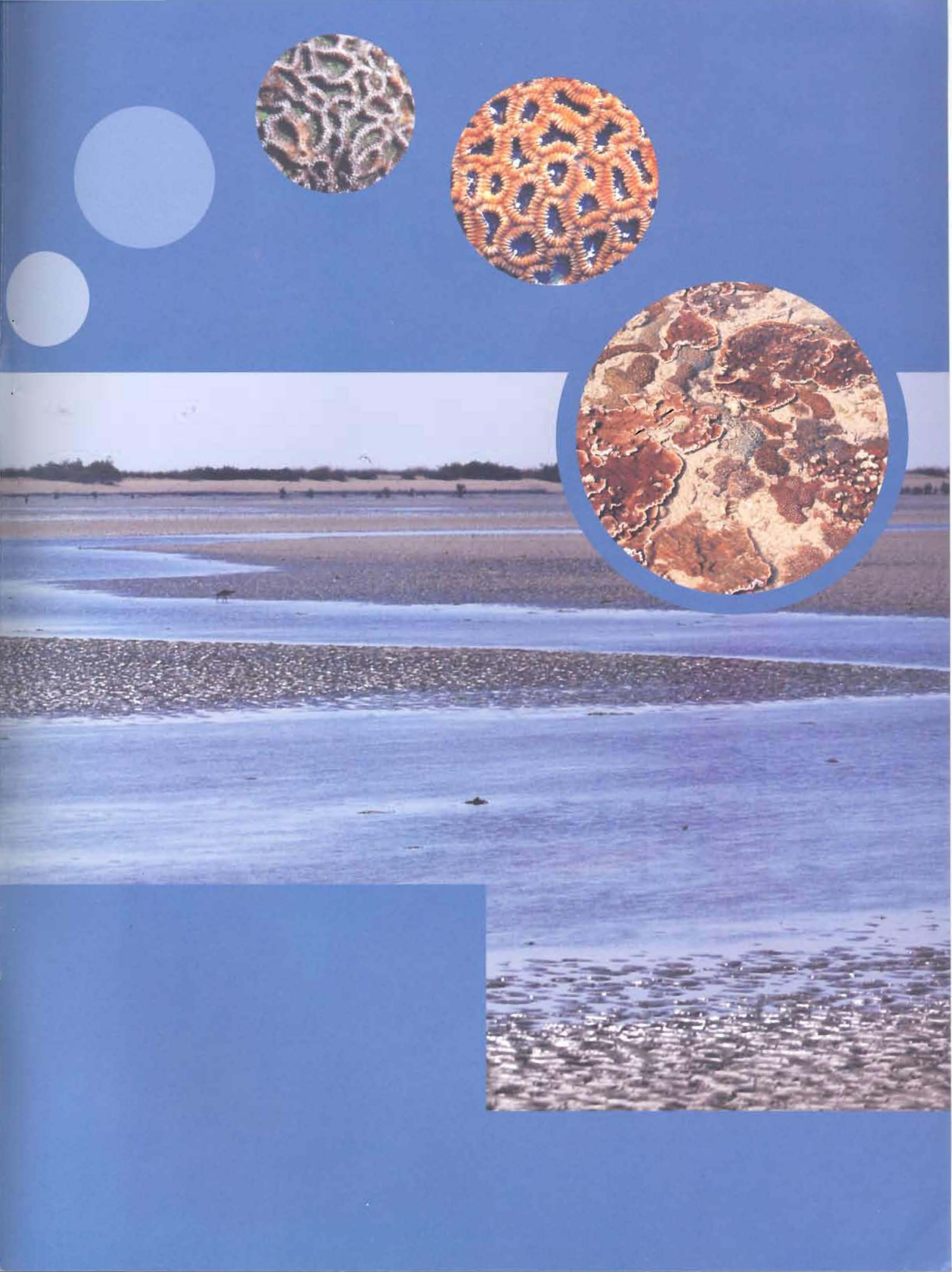
Ramanamurthy M.V, S. Sundaramoorthy, Y. Pari, V. Ranga Rao, P. Mishra, M. Bhat, Tune Usha, R. Venkatesan, and B. R. Subramanian, Inundation of Seawater in Andaman and Nicobar Islands and parts of Tamilnadu coast, India, during 2004 Indian Ocean Tsunami
Http://ioc.unesco.org/iosurveys/India/nicobar/nicobar.htm

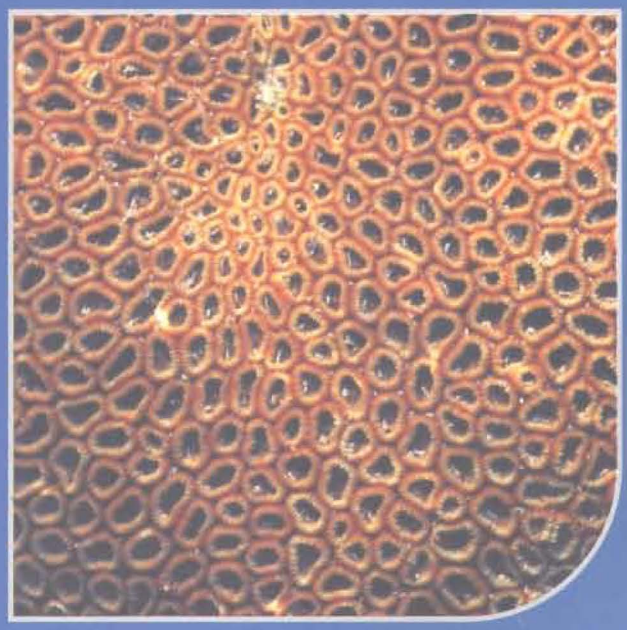
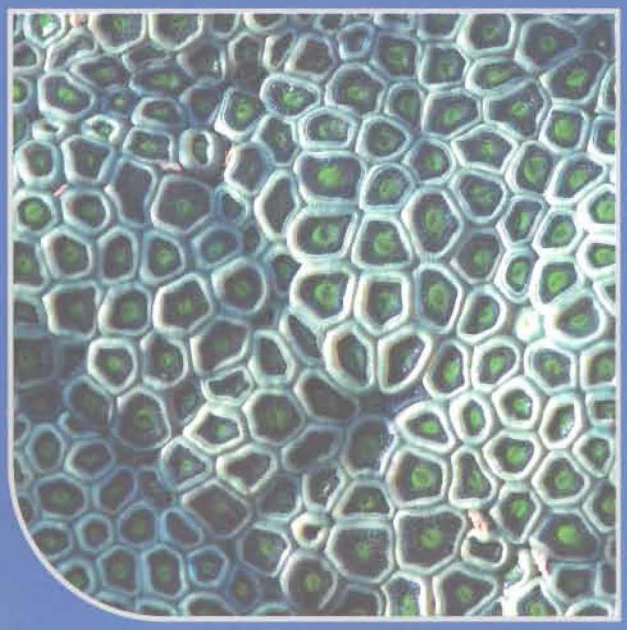
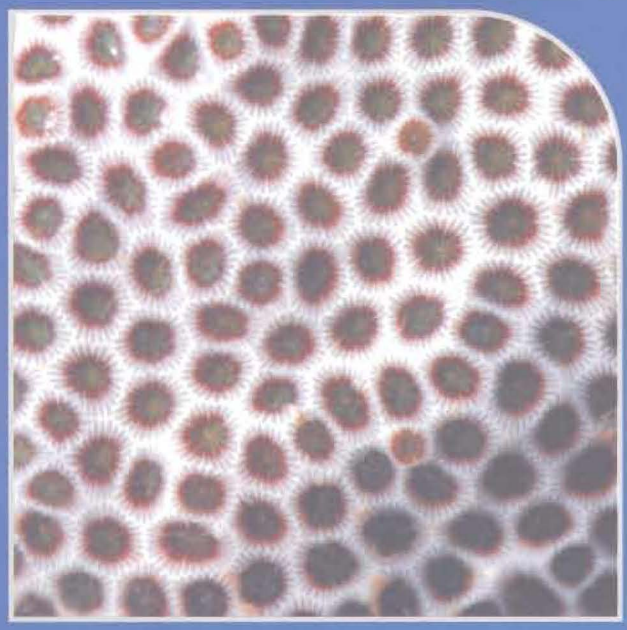
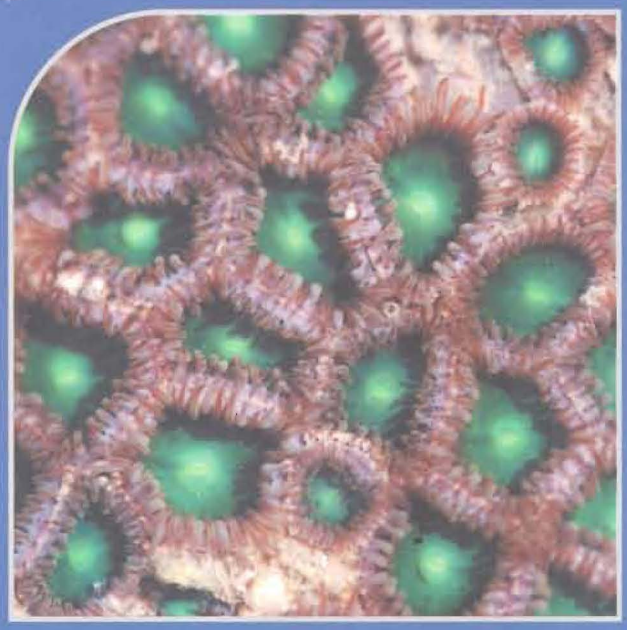
Wilkinson C, Souter D, Goldberg J (2006). Status of Coral Reefs in Tsunami Affected Countries: 2005. Australian Institute of Marine Science and Global Coral Reef Monitoring Network, Townsville, Australia.

Wilkinson, C. (2008). Status of Coral Reefs of the World: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia.

Glossary

CBM	Capacity Building Module
CM	Conservation Module
CORDIO	Coastal Ocean Research and Development in the Indian Ocean
CSGA	Communication System for General Awareness
CSPO	Communication System for Partner Organizations
CWBMP	Coastal and Wetland Biodiversity Management Project
ECAs	Ecologically Critical Areas
EU	European Union
GC	Governing Council
GCRMN	Global Coral Reef Monitoring Network
GEER	Gujarat Ecological Education and Research Foundation
GEF	Global Environment Facility
GoMNP	Gulf of Mannar National Park
ICRAN	International Coral Reef Action Network
IMM	Inter Ministerial Meeting
IUCN	International Union for Conservation of Nature
MCPAs	Marine and Coastal Protected Areas
MFF	Mangroves for the Future
MPAs	Marine Protected Areas
NBSAP	National Biodiversity Strategy and Action Plan
NCRTF	National Coral Reef Task Force
NDP	National Development Plans
NEAP	National Environment Action Plan
NGOs	Non Governmental Organizations
PAs	Protected Areas
RCA	Regional Coordinating Agency
SACEP	South Asia Co-operative Environment Programme
SACRTF	South Asian Coral Reef Task Force
SAS	South Asia Seas
SASP	South Asia Seas Programme
UNDP	United Nations Development Programmes
UNEP	United Nations Environment Programme
UNESCO	United Nations' Educational, Scientific and Cultural Organization
WCMC	World Conservation Monitoring Centre



Gujarat Ecological Education and Research (GEER) Foundation

Indroda Nature Park, P. O. Sector-7, Gandhinagar-382 007, Gujarat, INDIA

Phone : (O) +91-79-23221385, 23226829, Fax : +91-79-23241128

E-mail : dir-geer@gujarat.gov.in; Website: www.geerfoundation.gujarat.gov.in