



Law, Social Justice & Global Development
(An Electronic Law Journal)

Tourism and Conservation of Biodiversity: A Case Study of St. Martins
Island, Bangladesh

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This is a **commentary** published on: 08 April 2009

Citation: Hasan, M. M. 'Tourism and Conservation of Biodiversity: A Case Study of St. Martins Island, Bangladesh', 2009 (1) Law, Social Justice & Global Development Journal (LGD).
<http://www.go.warwick.ac.uk/elj/lgd/2009_1/hasan>

Abstract

Global biodiversity is the burning issue nowadays. It is seen in every country that their biodiversity is at stake and for the protection of the biodiversity they are taking various initiatives. In the recent years international organisations and countries have taken policies to conserve the global biodiversity and special measures have taken for small islands states. St. Martin's Island is the only coral island of Bangladesh which is totally separated from the mainland and its biodiversity is very rich in respect of the flora and fauna. Huge number of species like multicolor fishes, coral associated fishes, crab, mammals, birds, corals and sea turtles etc. are found around the island and they are threatened due to tourism, fishing and other man made factors. Tourism has been increased deliberately in the island over the last few years and for this reason tourism related activities have also been increased which is posing threat to this special type of island and its biodiversity. The ecosystem on the island is not well equipped to manage itself. Tourists have been found in illegal activities such as stealing live corals and other lives for souvenirs, fishing within the marine protected areas. Moreover, natural and other anthropogenic activities also put the island at stake in respect of biodiversity. Concerned bodies must observe the impact of tourism on the island's biodiversity and have to take necessary steps for the conservation of biodiversity. It will not be wise to stop the tourism in the very beautiful island since it is growing concern for the tourists and tour operators home and abroad. Initiatives should be taken immediately to integrate tourism management into biodiversity conservation in the island. This article focuses on brief description of St. Martin's Island of Bangladesh, present status of flora and fauna in the island, impact of tourism on the island, assimilation of the tourism into biodiversity, the stands of our government, laws and policies to be adopted by the government in respect of biodiversity conservation and position of Bangladesh government in the Convention of Biological Diversity (CBD).

Keywords

Biodiversity, Conservation, Tourism, Assimilation, Impact, Coral Reef, Sea Turtles, St. Martin's Island, Bangladesh.

1. Introduction

Small St. Martin's Island is the only coral island of Bangladesh which has seen a massive increase in tourism over the last few years and the weak ecosystem on the island is not well equipped to handle it. Bangladesh embarked into the global Convention of Biological Diversity (CBD) with the declaration of her Ecologically Critical Areas (ECA) in 1999. St. Martin's Island which referred as only one coral bearing reef of Bangladesh is declared ECA with other two coastal and one inland wetland areas. Now, around 3,000 tourists arrive every day and they are staying there overnight. The tourists are to and fro on this island with their own will and they are caught during illegal activities in respect of the island's biodiversity. It is noted that local officials see a certain risk in St. Martin's success with tourists, with some people hunting turtles and breaking off corals to sell to visitors which makes the island's biodiversity on stake. Coral, algae, different species of shells, star fish are collected by the tourists regularly. Corals and sea turtles are the main biodiversity of St. Martin's Island and these are threatened due to tourism, fishing and other anthropogenic activities. Local people also collect stone and rock daily for selling to the visitors and construction works, which is a threat for the existence of the island. Construction of buildings for hotels, restaurants, jetty for tourists are also making threats for this island's biodiversity. There are regular big ship services and engine boat, used for carrying of tourist, to the island and for this reason, a huge amount of rough oil, plastic and other non-biodegradable waste are discharged in the marine water adjacent to the island. Cyclones, storm surges, heavy fresh water runoff during monsoon and other anthropogenic activities, harmful boat anchoring practices and uses of destructive fishing gear has taken the island's flora and fauna in danger.

2. St. Martins Island

St. Martin's Island is a very small island in the Bay of Bengal is located at 20034' - 20038N and 92018' - 92022'E, the southernmost slant of Bangladesh separated from the mainland by a channel which is about 9 km wide and 10 km south of the southern tilt of Teknaf peninsula and 34 kilometres from Teknaf mainland in Cox's Bazar district of Bangladesh (Islam, 2002). The island is located on a shallow continental shelf with a maximum depth of 25m. The maximum depth of coast of island is only 10m. It is said that in 1926, the District Collector of the British government Mr. Martin brought this island under settlement record following which the island was named 'St. Martin's Island'. The small island is locally known as Narikel Jinjira (Coconut Island) (Haider, 2008). This tiny island with beaches fringed with coconut palms and laid-back locals. There is a naval base near the centre of the island. The island was devastated by a cyclone in 1991 but has fully recovered, and was untouched by the 2004 tsunami. The subtropical cloudburst climate that prevails over Bangladesh chiefly controls the weather of the island. During May-August it receives the southwest and northeast monsoon climate which is characteristically warm. Currently, the island has a total population of 7000 inhabitants, of whom about 90% are fishermen (Haider, 2008) and between October and April fishermen from neighbouring areas bring their catch to the island's temporary wholesale market. Rice and coconuts are the other crop crops, and algae is collected and dried from the sea rocks and sold for consumption to Myanmar.

This is the only island in Bangladesh which has coral colonies in the shallows. Enormous areas of sand ridge, some mangrove formations, Pandanus vegetation and scattered boulder/dead corals are the major characteristics of this island. The surface area of the island is about 8 kilometres depending on tidal level. The total beach length of island is about 14 kilometres and out of this, a very small lengthen about 2 kilometres (14%) is suitable and is visited by nesting turtles (Islam, 2002). The north portion of the island is called 'Cheradia Dwip', because during high tide, this portion of the island is separated from the other and also considered as the last southern landmark of Bangladesh (Haider, 2008).

It's possible to walk around the island in a day since it measures only 8 km, shrinking to about 5 km during high tide. Most things are concentrated around the far north of the island, with the centre and south being mostly farmland and makeshift huts. There is no electricity on the island, though the larger hotels run generators in the evenings for a few hours. November to February is the main tourist season with the best weather. Corals and clear blue water have helped Bangladesh's only coral island becomes a major tourist attraction - just don't expect a lively nightlife. Few years ago, fewer than 200 people dared to cross the unreliable sea every day to land on the island and they mostly returned before nightfall. Now, more than 3,000 tourists (Haider, 2008) arrive every day and they are staying there at night. St. Martin's Island in the Bay of Bengal attracts thousands of local and foreign visitors every day thanks to its charming beauty and clean and tidy marine life. Local authorities recently introduced scuba diving and speedboat sailing to attract more tourists, and there are plans to bring water skiing and other sporting facilities to the island.

3. Global biodiversity significance and St. Martin's Island

The word biodiversity is often used to describe all the species living in a particular area. Biodiversity can be defined as the variety of life on Earth at all its levels, from genes to ecosystems, and the ecological and evolutionary processes that sustain it. Article 2 of The Convention on Biological Diversity defines biodiversity as 'Biological Diversity' means the variability among living organisms from all sources, inter alia, terrestrial, marine and other ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.' The interactions between the individual organisms of a population or community, and their specialisations for their environment (including ways in which they might modify the environment itself) are important functional aspects of biodiversity. These functional aspects can determine the diversity of different communities and ecosystems. The processes of natural selection and species evolution, which may often be associated with the geological processes, also result in changes to local and global flora and fauna.

Biodiversity influences people's economic, social and cultural development and hence their quality of life. The knowledge, cultural traditions, innovations and management practices of indigenous communities, and the traditional practices of farmers and rural communities concerning biodiversity, are being threatened in Bangladesh by the destruction and pollution of natural habitats due to our failure to recognize the social, economic and cultural value of bio-diversity. St. Martin's Island is gifted with extraterrestrial oceanic and land resources having global biodiversity significance. The island is a good example of co-occurrence of corals, algae, sea weeds, grasses and mangroves. It has been known from a study by Canadian coral biologist Dr. T. Tomasik in 1997 that notably the rocky sub-tidal habitat from the seaward margin to about 1000m offshore supports a diverse coral community represented by approximately 66 Scleractinian coral species, of which 19 are fossil corals, 36 are living corals and the rest are under families of subclass Octocorallia (11 species of soft corals). Although as many as 240 fish species were recorded from the catch landed on Narikel Jinjira, (DoZ, 1997), only 86 of them are coral reef associated (Tomascik, 1997; Department of Zoology, 1997). The most abundant coral or reef associated fish are Damsel, Parrot, Surgeon, Groupers, Snappers, Emperors and Butterfly fish (Haider, 2008).

The main attraction for any coral island is their different, varieties of multi- colour ornamental fishes. It has been reported that nearly 25%-40% of the world marine fish resources came from coral reef area. Reef area is also a major nutrients supplier for primary production in marine food chain. The mollusc on the St. Martin's is the largest and most beautiful in Bangladesh. 186 species of mollusc & oyster, 7 species of crab, 9 species of echinoderms, 4 species of sea urchin, 1 species of sea cucumber & some brittle stars were reported. There are confirmed records of 5 species of marine mammals in the sea surrounding the St. Martin's Island as well as Bay of Bengal which are globally threatened according to the International Union for Conservation of Nature (IUCN) Red data book. The island has its fame as an important nesting ground for 3 marine turtles, including Olive Ridly, all of them are considered as globally endangered by IUCN. So far, 14 species of algae have been recorded from the St. Martin's Island. Coastal swamps Biodiversity Management Project and Marine Life Alliance have been breeding turtles in hatcheries by collecting turtle eggs from the beach for the last two years and also works on creation of a congenial environment for turtles 'egg-laying'. There is an estimated amount of 1500 MT red sea weeds available around island. 29 reptilian species have been recorded from the island, of them 11 are locally threatened. 120 species of birds have been reported from the island of which 67 species are resident and 53 migratory, many of them are in threatened list of IUCN. The economy of the local people of the island is based mainly on fishery. It is estimated that 1650 MT of fish are caught annually from the waters adjacent to this island (Haider, 2008).

4. Coral Reef and Sea Turtle status in St. Martin's Island

Corals are found around most of the island, except the northern part. The fossil corals are mainly scattered among the boulders on the beach and on the land interior into the island. Some isolated massive coral blocks (measuring 1.5m x 0.65m x 1.1m) are found on the beaches and on the inter-tidal rock pools. The rocky, subtidal seaward margin of intertidal to about 200-600m offshore support coral communities. Corals are also found in the rock pools of lower intertidal. A total of 66 scleractinian coral species, belonging to 22 genera and 10 families, has been recorded from Narikel Jinjira. All families represent reef forming corals. The genera Porites, Favites, Goniopora, Cyphastrea and Goniastrea are most abundant. In terms of coral coverage, Porites is by far most important genus (Mollah). The abundance of corals and their cover is low. The coral cover varies from 2-10% of the rocky substrate (DoZ, 1997). Based on the quadrant transect survey, the density at some selected areas is about 1.3 colony/m² (Tomascik, 1997). The soft coral community on Narikel Jinjira is a unique feature of subtidal zone. The deep water soft coral belongs to 6 families, namely, Plexauridae, Aanthogoridae, Subergorgoniidae (gorgonians sea fans) and Malithaddae, Anthothetidae (small sea fans), Ellisellidae (sea whips) (Mollah).

Sea turtles come to nest on the beaches of Bangladesh at different spots from Sundarban to St. Martin's Island. Several decades back, the nesting population was high in number, but day by day they have declined due to severe exploitation of eggs and illegal killing of adult female turtles by fishing and other activities. Now only a few individuals come to nest on the sandy beaches. Five species of marine turtle are reported to occur in the territorial waters of Bangladesh such as Olive Ridley (*Lepidochelys olivacea*), Green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochelys imbricata*), Loggerhead turtle (*Caretta caretta*) and Leatherback turtle (*Dermochelys coriacea*) (Rashid 1986, 1997; Rashid et al. 1999). Migrating species are still to be explored in the offshore and foraging habitats. Threats from human intervention are getting higher gradually. The highest nesting was recorded in the 2000-01 season. The nesting season runs from July until April, but regular nesting occurs largely from October through November, which corresponds to the dry season and tourism season also. Turtles generally emerge to nest in between 2000-0200 hours, 3-4 hrs before and at high tide (Islam, 2002).

4.1. Threats to Coral Reefs and Sea Turtles in St. Martin's Island

The major threats to the coral habitats are high levels of sedimentation, cyclones, storm surges, freshwater and agricultural runoff, pollution from human settlements and the removal of coastal vegetation (Rajasurya and others, 2000). The main threat to future viability of coral communities comes from direct extraction of corals colonies. Coral collection activities started in 50's but until recently extraction was at low level. Large-scale removal of coral boulders and dredging of channels has caused considerable damage to the reefs, and a barrier wall built on the sea front has caused beach erosion (Mollah). The removal of Pandanus trees for firewood has also caused much beach and dune erosion (Rajasurya and others, 2000). Pollution from both land based and vessel based Sewage, oil and grease, garbage and grey water are among the long-standing pollution problems that can have significant negative effects on coral reefs system. There is also over-harvesting of corals, sea cucumbers and molluscs by excessive numbers of subsistence fishers. The main destructive fishing practice is using stones to weigh down the nets, which smash corals. There are no reports of blast fishing or the use of poisons. The main fishery in Bangladesh is offshore, with a small inshore fishery for croakers and snappers. These are caught using bottom-weighted gill nets and hook and line. Some snappers and medium sized groupers (approximately 40-50cm long) are caught near St. Martins Island, indicating that a relatively healthy population remains. Other fisheries include sea cucumber and molluscs (Mollah). Unregulated harvesting of reef resources is contributing to a decline of reef biodiversity and abundance of resources.

Several causes have been identified for declining sea turtle populations which includes decline and reduction of nesting beaches, high mortality of adults by fishing activity, predation of nests and poaching of eggs. Nesting intensity may have declined greatly within 15-20 years. Rashid (1986) recorded 35 green turtles nesting in one night on the same beach in St Martin. According to local elders, 10-15 years ago, turtle nesting was very common on most of the beaches. Endless over-exploitation has brought the nesting turtles to near extinction. The traditional uses of marine turtle products by local communities are not significant. Major consumers of the turtle eggs are the ethnic communities of the country and the biggest business zone are the 3 hill tract districts of Khagrachari, Rangamati and Bandarban. Very recently *L. olivacea* eggs were recorded in a tribal market at the district main town at Bandarban. A stuffed Hawksbill was recorded on sale at the main tourist town at Cox's Bazar (Islam, 2001). Law enforcement and media coverage, awareness from the Government of Bangladesh regarding sea turtle conservation is still totally neglect this issue.

According to the fishermen many sea turtles are trapped in this sort of net. If any sea turtle gets entangled, fishermen intentionally kill or cut the flippers and head to save their nets. The situation has improved at least in St. Martin's Island thanks to sea turtle conservation awareness programmes in the last several years (Islam, 2002b). A total of 27 adult and sub-adults turtles of both sexes were found dead on the beaches during 1996-98, more than half of which were believed to be caused by fishing activities. More than 54 dead adult and sub-adult turtles washed ashore during the 2000-01 season (Islam, 2002a). Dead turtles float for some days and are finally washed ashore on St. Martin's Island and on other coasts of the country. Hundreds of dead turtles are found being washed ashore along the coastal lines from Cox's Bazar to St. Martin's Island with bruises all over their bodies. Over 400 female dead turtles have floated ashore over the last two weeks, local claims. The turtles get entangled in the fine fishing nets used indiscriminately by fishing trawlers. The fishermen, instead of releasing them back to the sea, beat them to death with sticks and dump their bodies into the sea, experts allege. Their bodies are then washed ashore by the tide (The Daily Star, 2009). To overcome these hazards, regulations should be imposed to prevent setting these types of nets in these places. Only those turtles washed ashore on island were counted, but huge numbers may float away from the island to other coasts of the country or the nearby Myanmar coasts.

4.2. Tourism & Threats to Coral Reefs and Sea Turtles in St. Martin's Island

It would certainly contribute to the increase of solid wastes with increase of visitors in St. Martin's Island which makes threat to the island's coral health. The physical action of waste throwing by tourists either on the beach or in

the water might not be an apparent threat. The marine park islands would have to cope with the waste problem from the general population of the islands as well as with the increased amount of wastes from lodges and resorts. At present, solid wastes disposal system remains disorganised and unavailable on most islands. Oil pollution caused by passenger boats and ferries is also an issue that contributes to the deterioration of water quality. The advent and rising demand of tourism on these islands had resulted in the increase number of boats and ferries. The cumulative effect of the oil residue could affect the health of the marine resources. Snorkelling and scuba diving are the most popular activities that tourists engaged in during their visit to the marine parks. This activity has been noted to pose significant threat to corals in shallow water as inexperienced snorkelers and scuba divers tend to either crush or stand on the reefs. Coral breakage could also be the result of diving activity as well as anchoring of boats done by irresponsible boat operators or illegal fishermen. Visitors have also been caught engaging in illegal activities such as stealing live corals and other marine lives for souvenirs. Tourists are also prohibited from fishing within the marine parks limit but there are reported cases of this illegal activity done by them.

Nevertheless, St. Martin's Island in the Bay of Bengal attracts thousands of local and foreign visitors every day thanks to its panoramic beauty and immaculate marine life. The island has seen a massive increase in tourism (mostly Bangladeshis) over the last few years, and the fragile ecosystem on the island is not well equipped to handle it. Tourists are requested to do what they can to encourage eco-friendly practices, and definitely don't litter the island. Tourists are also requested to keep a reasonable distance and don't disturb turtles if they or their eggs are seen. But the tourists are breaking the rules of the island. It is noted that local officials see a certain risk in St. Martin's success with tourists, with some people hunting turtles and breaking off corals to sell to visitors which makes the island's biodiversity on stake. At present, more than 3,000 tourists, rise to more than 5,000-7,000 during holidays including weekends (Rashid, 2008), arrive every day and tend to stay overnight in such a very small island. Tourists visited here and there of the island every moment and create a noisy atmosphere by shouting for enjoyment by their own way though they are requested not to out after 2000 hours since emerging time of turtles to nest in between 2000-0200 hours (Islam, 2002b). As a result, the nesting turtles feel disturb and their up-and-coming to this island decreasing day by day and the biodiversity of the island is on stake. It is also noted that generator of the hotels and motels run till midnight for tourists which is another reason for decreasing the number of nesting turtles in the St. Martin's Island.

5. Impact of Tourism on Biodiversity

Environmental degradation caused by tourism activities is commonplace. Due to their small size, many small islands face relatively large environmental dangers, even in the absence of tourism, mostly due to the pressures arising from the process of economic development. Building for tourist accommodation such as hotels, motels, restaurants has increased at a very rapid rate as a result of intensive development in certain areas. The fragility of their ecosystem arises as a result of a low level of resistance to outside influences. The increase in tourism has brought with it increased use of environmentally dangerous products, such as plastic containers and emissions of toxic gasses from cars, power stations, and barbecue grills. Many of these environmental dangers are of course exacerbated by tourism (Briguglio and Briguglio, 1996). The huge amount of waste produced by tourist related activity gives rise to huge waste dumps, which are often only a short distance away from the tourist centres. This creates health hazards and reduces the aesthetic qualities of the place. Another problem of small size island is related to density and carrying capacity. Many islands experience high tourism densities in relation to their population and land area.

There are nearly 7000 people on this small island of 12 square kilometres area. In tourist season (Nov.-Feb.) average 3000 people visit this island daily, which is beyond the holding capacity of this small marine island (Haider, 2008). There is regular big ferry services and engine boat, used for carrying of tourist, to the island. For this reason, a huge amount of crude oil and other non-biodegradable waste are released in the sea water adjacent to the island. In addition to this huge amounts of untreated market and domestic wastes, which include sewage matters (only 5% of the local people have sanitary latrine facilities) from the local people and tourists, are discharged into the adjacent coastal water. Thus the quality of coastal water is degrading gradually. Coral, algae, different species of shells, star fish are collected by the tourists regularly. Local people also collect stone and rock daily for lime making and construction works, which is a threat for the existence of the island. Construction of multi-storied concrete building, hotel, motel, jetty etc. for the last few years are also posing a threat for this special type of island and its sensitive biodiversity, though that type development activities and construction have been stopped now by the government. In addition to above factors, cyclones, storm surges, heavy fresh water runoff during monsoon as well as other anthropogenic activities like over exploitation of coastal fishery resources, harmful boat anchoring practices instead of mooring buoy and uses of destructive fishing gear, mainly the use of rock weighted gill nets over the inshore boulder reefs is a prime aggravation and one of the main causes of death of the endangered rare turtle species, who came to lay their eggs considering this island as ideal nesting ground after crossing many hundred miles. Nearly every day one/two big turtles are found dead by human activities in the coastal water of St. Martin's island. (Haider, 2008)

6. Assimilating Tourism Management into Biodiversity Conservation

St. Martin's Island has been identified for protection and management under the National Conservation Strategy of Bangladesh, but no analysis and identification of key sites has been carried out. There are no management plans and no trained staff to undertake conservation, therefore destructive human activities continues to degrade the reef resources. As there are no baseline data on St Martin's Island, surveys and taxonomic knowledge are needed, particularly concerning fish and invertebrate diversity. There is no clear conservation policy and consultations with the local community on resource management have been limited. A review of the National Conservation Strategy showed that legal and institutional issues have largely been ignored. To manage tourism in any marine park, it is useful not to lose sight of the primary objective of declaring the islands as marine protected areas. There are several points that are worth considering in order allowing tourism opportunities to work in perpetuity with the environmental conservation objective. These points are:

- **Establish ecotourism in marine protected area**

Maintaining the ecosystem integrity should be on the very top of priority list of goals. It is indeed a challenge for park managers to balance between providing quality recreation experiences for the visitors and protecting the marine ecosystem and resources. Ecotourism is environmentally friendly tourism that gives people the opportunity to experience the beauty of nature and learn how to be more environmentally responsible.

- **Recognizing tourism related matters that affect the island's resources**

Ecologically critical areas visitation is gaining popularity in tourism marketing and widespread interests among visitors. It is common knowledge that adverse impact to this fragile environment is likely to occur if tourism planning and management are done arbitrarily. Effects of tourism to the country's small island have long been discussed and the existing tourism related issues affecting island's ecosystem and resources are generally documented to land development for tourism facilities, pollution, damage and destruction of coral reef systems as well as illegal activities done by visitors.

- **Impact assessment and minimizing adverse impact**

Environmental and social impact assessments can be undertaken for this purpose. Such assessments should contain a description of the potential direct, indirect and provoked effects on the environment and on society at large, and a description of alternative sites which can be used for the same projects. The exercise should also propose suggestions as to how the adverse environmental and social effects can be mitigated. One of the problems with tourism inflows in St. Martin's Island is that such inflows tend to be concentrated in some areas and in some months. This suggests that if the impact could be spread, the carrying capacity of the islands would be less taxed, and the environment less threatened.

- **Visitor-impact problems and identify management strategies**

There are several visitor-planning frameworks to assess visitor impact problems and identify management strategies. The processes involved in all frameworks are useful steps that could contribute to balancing the conflicting goals of conservation and recreational opportunities. Some of the useful attributes of these various visitor-planning models are:

- i. Provide understanding of the biological and social conditions of the area collecting baseline information is an integral part of the processes involved in the visitor-planning framework.
- ii. The models would likely yield a win-win situation for both conservation and tourism. These processes would not restrict recreational opportunities unnecessarily.
- iii. Interaction with the community will lead to greater mutual learning of issues and concerns between managers and local community as well as building of understanding and support.
- iv. Monitoring is carried out to support management decisions as well as to evaluate the success of implemented actions.

- **Improving management strategies of the islands**

The development of a sustainable approach to tourism must be based on strategies that protect and strengthen both natural and cultural diversities. It needs to integrate the rights of local communities to use and manage natural resources. And it should ensure that any profits from tourism are used by the local populations as well as for the conservation of natural resources. Ecotourism has the potential to help preserve and enrich local indigenous cultures not only in the short term. When developing an ecotourism strategy, the vulnerability of the natural or cultural resource being promoted must be carefully assessed to ensure that any planned activities do not threaten or undermine it. Governments' planning and development approach of the islands is perhaps more on fostering tourism for socio-economic reason. Thus, much attention has been or is being given to physical development such

as the development of resorts and other tourism infrastructures. To successfully protect and conserve the marine resources, it is important to acknowledge the interlinked effect of land with the sea.

- **Setting standards and monitoring**

Many environmental problems arising from tourism are associated with the absence of standards and ineffective monitoring. Certain activities need to be controlled and monitored on an ongoing basis, either because they cause damage due to certain unforeseen circumstances. Monitoring implies setting quality and quantity standards and codes of good practice in the first place, which in the case of tourism could include levels of permitted tourist capacity in certain beaches, maximum levels of pollution etc.. Enforcement problems are now the main reason why environmental degradation still takes place at what too many is an unacceptable level. The legal and institutional set-up is sufficiently developed, as was shown above (Briguglio and Briguglio, 1996).

- **Social Impoverishment**

One problem is that the foreign culture, as portrayed by tourists, appears out of context. While on vacation, many people change their styles of sleeping, spending, gambling, and socialising. As a result the view that local people receive of the visitors' culture is not only alien, but also inaccurate. In general, the more exotic the location, the more in demand as a tourist destination. This is why tourists tend to favour places with a high degree of biodiversity. The contradiction is that tourism, which thrives in high- diversity environments, can accelerate the degradation of such environments.

- **Alternative forms of tourism**

Most tourists visit the islands mostly because of its Mediterranean climate, and its sea and sun. One is tempted to conclude therefore that alternative forms to mass tourism are attractive only if they supplement traditional tourism and if they enhance the potential of the island as a tourist resort. Tourism on economic grounds, preemptive and corrective measures to reduce its negative impacts may be more meaningful and operationally useful than policies to reduce the inflows (Briguglio and Briguglio, 1996).

- **Self-regulation**

Self-regulation can be advocated as a means of reducing the negative environmental impact of tourism. It is in the interests of the tourism industry itself to protect the environment and therefore there exists an incentive for the tourist industry itself to prevent destruction of the environment. There is now a general consensus that planning tourism activities are essential, primarily because there is a growing concern about its impact on the environment (Briguglio and Briguglio, 1996).

7. Government Policies, Laws and Legislations relating to Conservation of Biodiversity

To protect the environmental problems of the country, various environmental laws have been made from time to time in Bangladesh. There are more than 200 sectoral laws that are in force dealing with environmental issues. As a signatory to Agenda 21, Bangladesh is committed to implementing the international legal instrument as national programme and policy. Environmental policy of 1992 was an important development in this regard. The Ministry of Environment and Forest and the Department of Environment was created in 1989. The Environmental Conservation Act was enacted in 1995. The Act looked into the broader issues of environment and development (Chowdhury, 2000). The Department of Environment has power to close down the activities considered harmful human life or the environment and to declare an area affected by pollution as an Ecologically Critical Area (ECA). The said ecological critical areas of Bangladesh are the Cox's Bazar-Teknaf sea beach, Sonadia Island, St. Martin's Island, Hakaluki Haor, Tanguar Haor and Marjat Baor (Ali and Ahmed, 2000). In order to enforce this act, the Environment Conservation Rules were framed in 1997. The 'Bangladesh Wildlife Preservation Order, 1973' and the amended 'Bangladesh Wildlife Preservation Act 1974' provide government with the power to establish national parks, wildlife sanctuaries and game reserves. Provision for establishing marine reserves for flora and fauna was further strengthened by the enactment of the Marine Fisheries Ordinance, 1983. The East Bengal Protection and Fish Conservation Act, 1950 as amended by the Protection and Conservation of Fish (Amendment) Ordinance, 1982 and 1995 provides provisions for the protection and conservation of fish in inland waters of Bangladesh. The relevant government agencies and semi-government organisations that need to coordinate this action are: Department of Environment (DoE), Ministry of Environment and Forest; Directorate of Fisheries, Ministry of Fisheries and Livestock; Ministry of Aviation and Tourism; Forest Department, Department of Science and Technology, Ministry of Education; SPARSO; Bangladesh Wildlife Advisory Board; and Environmental Pollution Control Board (EPCB) (Chowdhury, 2000).

8. Position of Bangladesh in the Convention on Biological Diversity

Bangladesh possesses rich and diverse genetic resources of flora and fauna because of its climate and fertility of land. It has about 5000 species of flowering plants and 1500 species of fauna. But the number was remarkably more a century ago. Many species are now extinct in the country and many more species are listed as threatened or endangered. Regarding animal diversity, the only information available is about mammals, reptiles, amphibians and birds. But there is no complete agreement about the total number of their species. There are about 932 species of wildlife in Bangladesh, including 123 species of mammals, 154 reptiles, 23 amphibians and 632 birds. It has 260 freshwater species and 475 marine species. As far available information, other faunal species include 327 molluscs and 66 corals. Status of insect species is not available but it is reported to be highly diverse. The crops are rice, wheat, jute, pulses, oilseed plants, minor cereals, sugar crops, fruit plants, vegetables, root rubber crops, spices, forest trees, beverage crops, flowers, medicinal and aromatic plants and other wild plants. (Ali and Ahmed, 2000).

Bangladesh has signed, ratified, accepted and acceded to CITES, World Heritage Convention, Ramsar Convention, CBD, Climate Change Convention and Convention to Combat Desertification. Thus it remains and commit to the conservation of biodiversity and the environment (Haque, 2000). Bangladesh signed the Convention on Biological Diversity at Rio in 1992 and ratified it in 1994. Bangladesh has completed the Pre-Investment Feasibility study on Coastal and Wetland Bio-Diversity Management project under GEF (Global Environmental Facilities) and its follow-up project, titled 'Coastal and Wetland Bio-Diversity Management in Cox's Bazar and Hakaluki Haor in Greater Sylhet', has already been approved by the GEF, which is going to provide Bangladesh with USD 5.9 million. Bangladesh has already completed some baseline studies through the National Conservation Strategy (NCS) implementation Project Phase-1. These are surveys of flora and fauna, land cover, and land use survey preparation of base maps and ecological survey of some important ecosystems of the country. Other major bio-diversity conservation related projects of Government of Bangladesh include: Bio-Diversity Conservation in the Sundarbans Reserved Forest, Forest Departments; Fourth Fisheries Project, DoE; Bay of Bengal Programme, DoE; Coastal Fisheries Empowerment Project, DoE; etc. the preparation of National Bio-Diversity Strategies and Action Plan has already been started by the Ministry of the Environment and Forest under the supervision of the Convention of Biological Diversity (Ali and Ahmed, 2000).

Moreover, the Government of Bangladesh has taken up some projects concerning bio-diversity management such as: Madhupur National Park development project, establishment of botanical garden and eco-park at Sitakunda, Coastal Greenbelt Project, establishment of Madhutila eco-park and development Bhawal National Park, Baldha Garden and Botanical Garden. The Government has also planned to undertake other projects related to biodiversity conservation. They are: Final Survey of Bangladesh, establishment of Bay Park from Himchhari to Teknaf, establishment of eco-park at Gajoni Abokash Centre and conservation of bio-diversity, establishment of marine-park and eco-tourism in St. Martin's Island (Ali and Ahmed, 2000).

Since signing and ratification of the CBD the status of implementation of CBD in Bangladesh can be measured on the following activities as outlined against the concerned issues and Articles of the CBD below which are formulated by IUCN, Bangladesh Country Office:

- i. We are in the process to develop common approach for conservation of Sundarbans, particularly the World Heritage Sites of the Sundarbans of both part of Bangladesh and India and both countries will cooperate each other regarding conservation and sustainable use of biodiversity according to Article 5 of Convention on Biological diversity.
- ii. Article 6 says that contracting parties shall develop national strategies, plans or programmes for the conservation of biological diversity. Bangladesh has initiated the preparation of Biodiversity Strategies and Action Plan (BSAP) for conservation of biodiversity in Bangladesh under the sponsorship of the GEF. Hopefully, the BSAP of Bangladesh will be completed within 2001.
- iii. Article 7 is about the ordering and use of information on biological diversity and biological resources for the purposes of Articles 8 – 10. Bangladesh has high diversity of species and has also quite a diverse ecosystem. As for example the country has tiger, elephant, Ganges dolphin, Whitewinged Wood Duck, Palass's fishing Eagle, Python, River Terrapin which are globally threatened species. We have been working for conservation of these species along with their habitats since emergence of Bangladesh as an independent country. IUCN Bangladesh Country Office has prepared Red Data Book of animals and these are under process of printing. Recently, faunal survey has been completed in five ecologically critical areas – namely St. Martins Island, Himchhari Coastal Belt, Tanguar Haor, Baid Tract and Chalan Beel. National Herbarium has also conducted floral survey in these areas.

- iv. Article 8 (In situ conservation) provides the main set of convention obligations to conserve biological diversity through conservation of ecosystems, wild species and genetic diversity. As to conserve biodiversity in In Situ Conservation, Bangladesh has three acts in which there are provisions for conservation of biodiversity through creation of Wildlife Sanctuary, National Park, Game Reserve, Fish Sanctuary, and Ecologically Critical Area (ECA). So far, we have established 8 wildlife sanctuaries, 5 national parks and 1 game reserve under the provisions of the Bangladesh Wildlife (Preservation) Order, 1973; and seven ECAs under the Bangladesh Environment Act, 1995. Fish sanctuary is established under the Bangladesh Fish Act, 1950 for seasonal protection of fishes, and their habitats.
- v. Article 9 (Ex situ Conservation) provides for measures to be adopted by the CPs for conservation of biodiversity in ex situ condition. Bangladesh has ex situ gene bank facilities. An important gene bank has been established for conservation of rice genetic resources is located in the Bangladesh Rice Research Institute. This bank has so far collection of 4523 varieties of traditional rice and including exotic varieties. It has a total of 7439 collection of rice varieties.
- vi. Article 10 (Sustainable use of components of biological diversity) says that the CPs shall integrate consideration of the conservation and sustainable use of biological resources into national decisions making. Prior to the signing and ratification of CBD by Bangladesh, it completed two major conservation initiatives namely a) National Conservation Strategy (NCS) and b) National Environmental Management Action Plan (NEMAP). Department of Environment has completed implementation of the pre-feasibility part of a project for conservation of biodiversity in the wetlands of the country. Currently, DoE has undertaken a project for biodiversity conservation for preparation Bangladesh Environmental Management Plan (BEMP).
- vii. Article 11 (Incentive measures) provides for adoption of economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity. Bangladesh has not yet been initiated for adopting tools of biodiversity conservation.
- viii. Article 12 (Research and Training) provides that the contracting parties shall have to establish and maintain programmes for scientific and technical education and training for identification, conservation and sustainable use of biological diversity. Bangladesh has by now, established several training and research institutes in addition to the scientists and teachers working in the universities and non-governmental organisations. There is gap regarding biodiversity research and training is the lack of any institute for taxonomy of biodiversity. For this reason, the concerned field managers are not in a position to identify the biodiversity and biological resources for proper conservation and management as per requirement of the national and international purposes as well as implementation of CBD in the country.
- ix. Article 13 (Public education and awareness) has the mandate to promote and encourage understanding of the importance of biodiversity. In Bangladesh, all development projects contain components for public awareness and education with priority basis.
- x. Article 14 says about impact assessment and minimizing adverse impacts. The DoE has Environmental Impact Assessment (EIA) rules, which are applied for establishment of industrial and big infra-structural development project. Under the 1995 Environment Conservation Act (ECA), EIA is mandatory for all development projects. The rules and regulations framed in 1997 under the 1995 ECA, provides detailed procedures for EIA and project approval.
- xi. Article 15 (Access to genetic resources) provides to create conditions for facilitation of access to genetic resource for environmentally sound uses by the CPs and not to impose restrictions. Bangladesh has been working for generation of information for enabling the focal points of CBD and the concerned authorities to adopt legal documents in this regard for implementation of this Article of CBD in the country.

9. Conclusion and Recommendations

The management and conservation activities are not followed properly, where users of the island still haphazardly utilise the natural resources of coral reef. The destruction of habitat and over-exploitation of these resources have resulted in decaling the biodiversity as well as degradation of coastal and island ecosystems. There is lack of awareness among the resource users about the interaction of various coastal components and they do not have enough knowledge about the resource and its importance, utilization and conservation. Studies revealed that in

addition to the declaration of ECA by Ministry of Environment, Bangladesh, new scientific studies should be planned for the Saint Martin's Island, since the unique and dynamic nature of the inter-tidal and sub-tidal rocky habitats offers excellent research opportunities for the national and international scientists as a global interest of coral reef biodiversity. At present, there is not much data or information on the present status of corals and associated flora and fauna in St. Martin's. No one is using currently available state of the art technology and no 'Coastal Zone Management Unit' exists in this island. So, proper implementation of the rules and regulations for 'Ecologically Critical Areas (ECA's)', declaration and implementation of 'Marine Protected Area (MPA)' as suggested by Tomasik (1997) and other experts in 'Eco-tourism -- St. Martin's Island', control of pollution, sustainable and controlled tourism, alternative livelihood for the local people, and further research should be immediately undertaken for sustainable utilisation and to save rich biodiversity of this only coral island of Bangladesh. Still there may be time to save the biodiversity and fish resources of this island; otherwise it may be too late. So, all the stakeholders including government policy makers should come forward to save the marine biodiversity of this important island and the livelihood of the local people. For the conservation of biodiversity in the St. Martin's Island the following rules, regulations, policies and management strategies recommended to be done:

- Strengthen socioeconomic monitoring of reef resources to provide information appropriate for coral reef management;
- Improve evaluation of reef fisheries and identify and develop viable alternative livelihoods for those dependent on threatened reef resources;
- Accelerate the establishment of the national network of nature conservation and reserved, protected areas that include a full range, type and level of biodiversity and which will have a reasonable distribution and appropriate area coverage;
- Strengthen infrastructure and capacity for resource management, primarily targeting marine protected areas;
- Strengthen the capacity to develop and implement regulations relating to resource extraction;
- Conservation of special habitats and eco-systems such as hill forests, wetlands, mangrove ecosystems, coral reef ecosystems as well as the protection of migratory animals and birds;
- Each person visiting the island brings in additional issues to be taken care of like drinking water, sewage, solid waste, food, accommodation, etc.
- Restrict tourists to go out and walk around the island after 2000 hrs since 2000-0200 hrs is the nesting period of sea turtles;
- Create mechanisms to link monitoring information to management, through improved dialogue between government institutions and agencies;
- A conservation fund may be created by imposing surcharge on every tourist visiting the island. The fund may be managed by an independent committee.
- Establish a national information system for the conservation of biodiversity. A national biodiversity database may be established which will include nature reserve database, an ecologically critical area database on rare and endangered plants and species;
- Strengthen the research work to conserve the biodiversity of freshwater and marine aquatic life for ex-situ conservation of endangered species of sea life forms;
- The marine park islands would have to cope with the waste problem from the general population of the islands as well as with the increased amount of wastes from lodges and resorts;
- Undertake awareness raising activities to highlight the reef ecosystem and its interdependence with surrounding coastal ecosystems, threats to the reef and the options available for the future;
- Identify sustainable long-term funding mechanisms for protected area management and habitat conservation activities.
- Develop and implement environmental, biological, socioeconomic and user monitoring programmes;
- Cooperation with the various law enforcement and paramilitary agencies like the Bangladesh Police, Bangladesh Rifles, and Bangladesh Coast Guards should be further strengthened to protect the island's biodiversity and tourist management
- Implement the ecosystem approach and community based conservation programme of biodiversity;
- Develop a clear government policy statement on the future conservation, management and protection objectives of marine resources for St. Martin's Island, which will also address the coordinated management of coastal lands;
- Measures to mitigate the adverse effects caused by cyclones and anticipated global warming and sea level rise;
- Establish the educational and specialised institutions for conservation;
- Promote the publicity and education on the protection of biodiversity. The promotional activities may be carried out through the use of various media; and

- Support the proposed management plan for St. Martin's Island and its coral resources with planning that involves all levels of government (i.e. an intergovernmental approach).

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