

## STATUS OF THE BIODIVERSITY OF ST. MARTIN'S ISLAND, BAY OF BENGAL, BANGLADESH

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**ABSTRACT:** A total of 234 species of fish have been recorded from the St Martin Island. Of which, 98 species are coral associated. The total number of recorded mollusc and crab species stands at 187 and 7 species respectively. A total of 66 coral species were recorded, of which 19 are fossil corals, 36 living corals and the rest are under 6 families of subclass Octocorallia (soft corals). A total of 14 species of algae have been recorded from the St. Martin's Island. There is an estimated amount of 1500 MT red sea weed biomass available around the St. Martin's Island. The island contains some of the most unique, benthic community associations in Bangladesh, not found anywhere else in the South Asian region. The unique marine communities have very high scientific value for research and monitoring and there are only a few examples worldwide, where coral-algal communities dominate rocky reefs. The economy of the island is based on fishing. It is estimated that, about 1650 MT of fish are caught annually.

Over-exploitation of renewable marine and coastal resources (e.g., rocky reef fisheries, coral and shell extraction; removal of coastal vegetation from inter-tidal and sub-tidal habitats) is a major threat to this ecosystem. Destructive fishing practices, mainly the use of rock-weighted gill nets over the inshore boulder reefs is of prime aggravates. Proper implementation of the rules and regulation for 'Ecologically Critical Areas' ('ECA's), alternative livelihood for the local people and further research should be immediately taken for sustainable utilization and to save the rich biodiversity of the only coral island in Bangladesh.

**KEY WORDS:** Corals, threats, over-exploitation, ecotourism, pollution.

### INTRODUCTION

St. Martin's Island locally called 'Narikel Jinjira' is located on the southern most tip of Bangladesh, roughly between 20°34' - 20°39' N and 92°18' - 92°21' E, separated from the mainland by a channel that is about 9 km wide. The island is located in the Northeastern part of Bay of Bengal and while being within the tropical belt; its weather is heavily influenced by the subtropical monsoon climate that prevails over Bangladesh. A recent Bangladesh-Dutch study under Nature Conservation Strategy-2 project has revealed that the island is not actually a coral island but it is the surface of a submarine hill, which is a part of the Teknaf range stretching from Cox's Bazar to Teknaf. Actually a considerable amount of coral deposits every year on the island has given it the apparent look of a coral island. The island is mainly formed of sand stones. The distance between the island and the head quarter of Teknaf is about 34 km and it is 10 km away from Badarmokam of Teknaf (SHED, 2002).

Its area is about 8 sq. km. and the population is about seven thousand. In addition to the 535 resident islander families (households), there are an additional 61 Rohingya

refugee families on the island as well. The sex ratio in the children population is roughly 1:1; married adults represent 30.7% of the total population as reported by SEANJ (A local NGO based on the island).

### MATERIALS AND METHODS:

For preparing this report, a review of relevant articles, reports, studies, documents etc. was made, many scientists, representatives from Government and Non-Government organizations and other interested parties provided material for writing this report.

### FINDINGS:

The environmental conditions that have a direct impact on the biotic and abiotic processes, ultimately determine the productivity of coastal and marine waters. The factors that dominate the ecology of St. Martin's island are surface seawater temperature, salinity, circulation, tides, cyclonic storms, earthquakes and relative sea level. Except few studies on mollusca (Ahmed, 1990), algae and sea grass (Islam, 1976; 1980), very little information is available on the biogeography of this area due to lack of detailed scientific study of this island. During November to March strong winds from the north-east set up a strong anti-cyclonic (clockwise) gyre (Verlaan, 1991). This system reverses during the southwest monsoon (April-October). Surface seawater temperatures remain tropical (20°C to 30°C). Surface nutrient concentrations (phosphate and nitrate) in the Bay of Bengal are generally low, varying from 0 to 1  $\mu\text{mol/l}$  (Verlaan, 1991). This is likely due to high surface productivity, which is reflected by massive *Trichodesmium* blooms observed around St. Martin's Island (Tomascik, 1997) as well as high productivity of benthic macrophytes.

The average environmental data recorded over the coral community habitats on St. Martin Island is given below (Table 1) and is compared to general optimum conditions that are required for normal coral reef development.

**Table 1. Environmental parameters of St. Martin Island.**

Environmental Factors		Optimal Conditions (Range)
Sea Surface Temperature (°C.)	26.0 $\pm$ 1.7 (N = 44)	20-30
Salinity (ppt)	27.5 $\pm$ 3.7 (N = 44)	32-37
Turbidity (Secchi disc in meters)	2.5 $\pm$ 1.2 (N = 31)	>7.0

(Source: Tomascik, 1997)

### Zonation of St. Martin's Island:

The shallow water marine habitats include rocky and sandy inter-tidal zone, offshore lagoons, rocky subtidal zone, coral aggregations, sea grass beds, soft coral habitats and offshore soft bottom habitats.

**East coast:** A generalized zonation of east coast benthic communities along an inshore-to-offshore gradient starting from the lower inter-tidal is as follows: 1) Inter-tidal

gastropod-algal community. 2) Coral-algal community. 3) Mixed sea grass-algal community. 4) Soft coral community and 5) Soft-bottom (mud) community.

**West coast:** The zonation on the west coast is as follows: 1) Gastropod-algal community; 2) Coral-algal community; 3) Algal community; 4) Soft-bottom community. Coralline algae are more abundant in the lower inter-tidal zone on the west coast than on the east coast. With respect to corals, they are usually more abundant in sheltered areas. Corals are found around most of the island, but their abundance is generally low.

**Table 2a. Fish and Fisheries resources of St. Martin's Island (Ahmed, 1990; Tomascik, 1997)**

Fish and Fishery	Molluscs	Crabs		Echinoderms
		The following 7 species of crabs were recorded from the island.		
		Name of species	Relative Abundance	
<p>A total of 234 species of fish in 85 families representing 14 orders and 2 classes have been identified, of which only 16 are freshwater species, (excavated ponds, number of open wells, a freshwater wetland and a sizeable floodplain area in the island) of the fishes, 98 species are coral associated. The most abundant coral or reef-associated fish are damselfish, parrotfish, surgeonfish, dogfishes, groupers, snappers, emperors, and butterfly fish. <b>Shrimp:</b> Data is not available.</p>	<p>Ahmed (1990) listed a total of 301 molluscs; along the Bangladesh part of the coastline of the Bay of Bengal. Of which, 154 species in 74 genera, 42 families and 11 orders under 3 classes were reported from the St. Martin's Island. Three deep water opisthobranchs under 2 families were not recorded by Ahmed (1990). However, Tomascik (1997) recorded all these and a fourth unidentified species from the island. The total number of recorded mollusc species from the St. Martin's Island stands at 187 species of 93 genera, 51 families, 11 orders and 3 classes. Nevertheless, it appears that both the lists are incomplete and many more molluscan taxa await discovery from the island.</p>	<p><i>Ocypoda ceratophthalma</i>  <i>Portunes sanguinolentus.</i>  <i>Thalamita crenata</i>  <i>Charybdis cruciata</i>  <i>Dotilla myctiroides</i></p> <p><i>Atergalis integerrimus.</i>  <i>Paramelthorax aculeatus</i></p>	<p>Very Common  Common  Common  Fairly common  Fairly common    Few  Few</p>	<p>A total of 9 species belonging to eight genera in four classes of phylum Echinodermata were recorded from the island.</p>

**Southeast coast:** Based on the limited quantitative quadrat data from the southeast part of the island named Siradia, where corals are more abundant than in other areas, the density estimate of corals is 1.3 colonies/m<sup>3</sup>. In this area, corals cover 7.6% of the rocky substrate.

#### Resources of the St. Martin's Island:

St. Martin's has a natural beauty including its natural resources, which can be utilized in a sustainable manner and it is also a unique place for the oceanographic research and ecotourism development. Table 2 (a, b) shows the natural resources of St. Martin's island.

#### Coral Fauna of St. Martin's Island:

A total of 66 scleraclinian coral species were recorded belonging to 22 genera. The subtidal rocky habitat also supports a low diversity coral reef-associated fauna and flora (Table 2 b).

**Table 2b. Coral Fauna of St. Martin's Island (Tomascik, 1997).**

Fossil Corals (Dead corals)	Living Corals	Soft Corals
A total of 19 species in 9 genera and 4 families of fossil (dead) corals were collected and identified from the island. The genera are: <i>Acropora</i> , <i>Cyphastrea</i> , <i>Favia</i> , <i>Favites</i> , <i>Galaxea</i> , <i>Goniastrea</i> , <i>Goniopora</i> , <i>Montipora</i> and <i>Porites</i> . However, many of them do not represent the real reef forming species.	A total of 36 species in 16 genera of 7 reef-building coral families (Order-Scleractinia) were collected and identified from the island. However, Tomascik (1997) found 65 species of 22 genera in 10 families from St. Martin's Island. According to Tomascik (1997) the genera <i>Porites</i> , <i>Favites</i> , <i>Goniopora</i> , <i>Cyphastrea</i> and <i>Gonastrea</i> were the most abundant.	Soft corals belong to the Sub-class Octocorallia. Taxonomy of soft corals is difficult and needs specialist attention. Presence of a community off the east coast of St. Martin's Island is a unique feature of the island. The dominant families of soft corals on the island are the following six families. A. Gorgonian sea fans: <i>Acanthogorgiidae</i> , <i>Malithaeidae</i> , <i>Plexauridae</i> and <i>Suberogorgiidae</i> B. Small sea fans: <i>Anthothelidae</i> C. Sea whips: <i>Ellisellidae</i> - <i>Stephanometra</i> is also present, but rare (Tomascik, 1997).

#### Seaweed and Algae:

Seaweeds are sedentary macrophytes growing mostly on rocks and other plants in the intertidal and subtidal environment. There are about 8,000 species of seaweeds along the world's coastline and they may extend as deep as 270 m. According to Santhanam *et al.*, (1990) "A total of 25 species of green seaweeds, 90 species of brown and 350 species of red seaweeds are found in the world sea are commercially important" because of their protein, amino acids and mineral contents. Sarker (1992) reported about 1,500 MT. 'Red seaweed' biomass available around the St. Martin's Island. According to published reports, there are 185 species including 80 genera occurring on Bangladesh coast belonging to benthic marine algae among which 56 species and 40 genera belonging to

red algae group (Rhodophyta). But there are many species of seaweeds yet to be reported. According to Rahman (1999), a total of 14 species (5 species of Chlorophyta, 5 species of Phaeophyta and 4 species of Rhodophyta) were recorded from the studied area of the St. Martin's Island, of which 9 species were identified at species level and the rest at genus level. Table 3 shows some of the reported species of algae in St. Martin's Island.

**Table 3. Reported species of algae in St. Martin's Island (Islam, 1976; Sarker, 1992; Rahman, 1999).**

Chlorophyta	Phaeophyta	Rhodophyta
<i>Halimeda discoidea</i> Decaisne	<i>Hydroclathrus clathratus</i> Bory	<i>Hypnea cornuta</i> (Lamouroux)
<i>Halimeda opuntia</i> (Linn.) Lamouroux	<i>Dictyota dichotoma</i> (Huds.) Lamouroux	J. Agardh <i>Hypnea sp.</i>
<i>Caulerpa recemosa</i> (Forsskal) J. Agardh	<i>Dictyota ciliolate</i> Kutzing <i>Padina sp.</i>	<i>Amphiroa fragilissima</i> (Linn.) Lamouroux
<i>Codium sp.</i> <i>Ulva sp.</i>	<i>Sargassum sp.</i>	<i>Jania adherens</i> Lamouroux

**Seagrass:** Seagrass are marine flowering plants but are not true grass (family Poaceae). There are about 50 recognized species placed in 12 genera reported globally and they grow completely submerged (hydrophytic adaptations). In Bangladesh, *Halodule uninervis* has been reported from littoral zone around St. Martin's Island (Islam, 1980). A preliminary survey by the FEJB (2000) on the land based faunal resources of the St. Martin's Island shows that 2 species of amphibians, 11 species of reptilian and 18 species of birds are threatened locally among the reported 4 amphibians, 24 reptilian, 19 mammals, 120 birds and 6 species of butterflies (Table 4).

#### **Bio-geographic and Scientific importance:**

The island contains some of the most unique, benthic community associations in Bangladesh, in fact not found anywhere else in the South Asian region. The unique marine communities have very high scientific value for research and monitoring. There are only a few examples world wide where coral-algal communities dominate rocky reefs. The island is famous for its corals, which are not found in other parts of Bangladesh. Since very little biological information is available from this region of the Bay of Bengal, even single species inventories from St. Martin's island will constitute a significant contribution to oceanographic research.

#### **Socio-Economic importance:**

St. Martins Island has a long history of fishing since its inhabitation by migrants from the mainland. The economy of the island is based on fishing. The main fishing season extends from September to April. It is estimated that about 1650 MT of fish are caught annually. The main fish groups caught are clupeids, catfishes, ribbonfish's, perches, jewfishes and croakers, which include a significant portion of dogfishes (*Scolidon sorrowkah*).

**Table 4. Land based faunal resources of St. Martin's Island (SEHD, 2002; FEJB, 2000).**

Amphibians			Reptiles	Mammals	Birds	Butterflies
Status: A moderate population of frogs and toads inhabits the island. Only four amphibians were recorded from the island. Of them two species (Bull Frog and Tree frog) appeared to be vulnerable.						
Scientific Name	English Name	Local Name	Status :A total of 29 reptilian species in 11 families of 3 orders has been recorded from the island; of them 11 species are locally threatened.	Status :A total of 19 species of mammals belonging to 7 families were recorded. The distinctive feature of the island is the absence of any carnivorous mammal and there are no reports regarding their existence in the past.	Status: A total of 120 species of birds were recorded from the island, of them 77 species are resident and 43 migratory. Of the birds, 18 species may be classified as locally threatened.	6 species of butterflies were identified from the island.
<i>Euphlyctic cyanophlyctis</i>	Toad	Kuno Bang				
<i>Euphlyctis cyanophlyctis</i> ( <i>Rana cyanophlyctis</i> )	Skipper frog	Sarsari Bang				
<i>Hoplobatrachus tigerinus</i> ( <i>Rana tigrina</i> )	Bull frog	Sona Bang				
<i>Polypedates maculates</i> ( <i>Rhacophorus maculates</i> )	Tree frog	Gecho Bang				

**Tourism potentiality:**

Bangladesh has no significant tourist industry. If well planned, it can be a useful development tool that can bring substantial benefits to remote areas such as St. Martin's Island. Thousands of tourists from all regions of Bangladesh that visit the island are an important, as yet untapped, resource for future conservation efforts. Development of small-scale community based ecotourism, to satisfy national demand for new travel destinations, is available option on St. Martin's Island that needs to be promoted. It is also clear that due to environmental limitations (e.g. limited supply of fresh water, cyclone prone area) large-scale tourism development is not advisable. The implementation of 'ecotourism' project, only possible with active participation of local people and effective protected area management plan. It may be mentioned that government of Bangladesh declared St. Martin's Island as an 'Ecologically Critical Area (ECA)' with other five ECA's and proposed a number of guidelines for sustainable management of those areas (ECR, 1997).

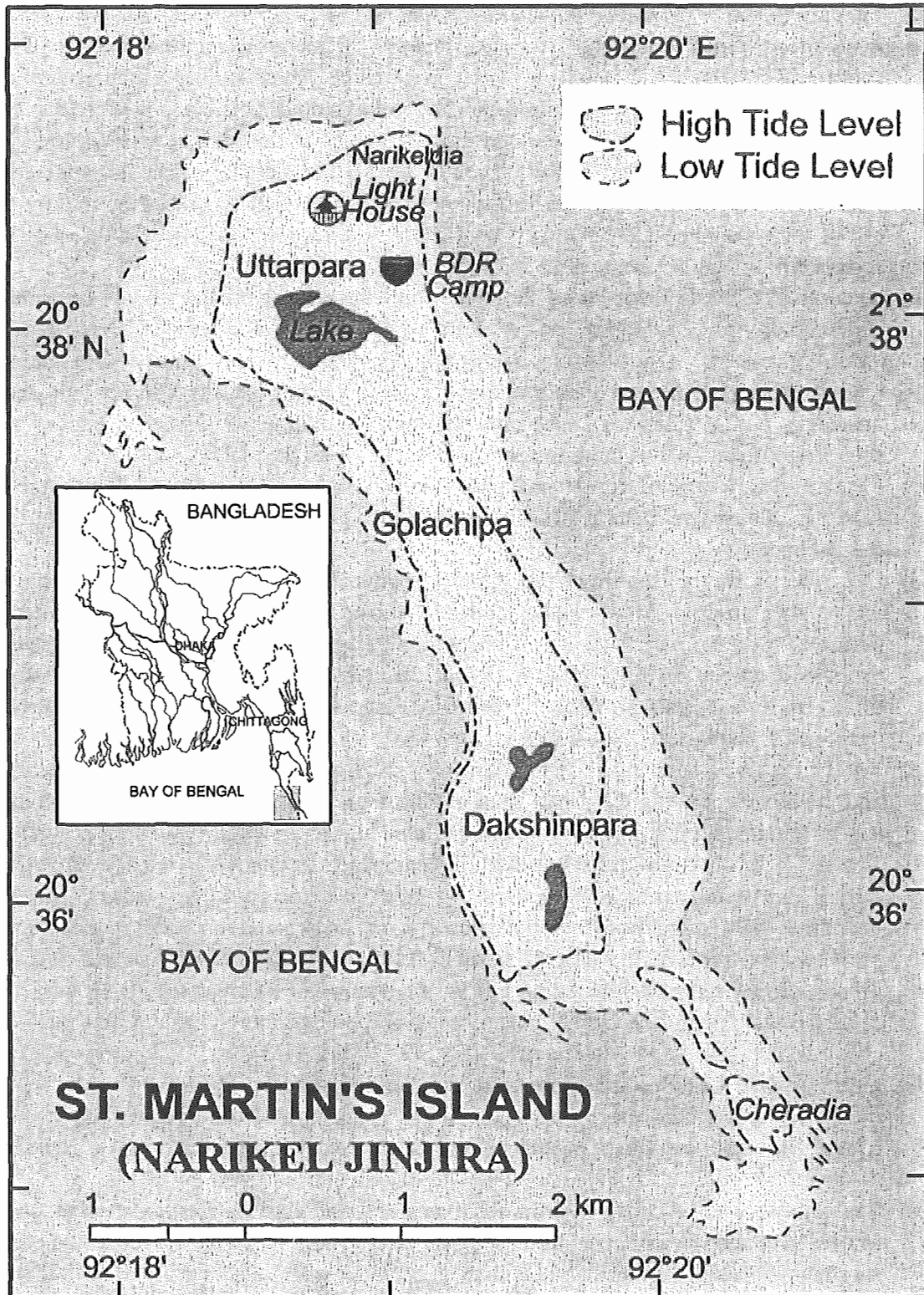


Fig. 1. Map shows the location of St. Martin's Island of the Bay of Bengal, Bangladesh.

**Threats to the St. Martin Island and its Resources:**

- (a) A couple of families collect live corals and feed the booming tourist market of the country. They use coral boulders to obtain calcium. About a dozen men collect the eggs of the Olive Ridley turtle and the Green turtle and sell them. Sea urchins and starfish are also collected in great bulk in the vicinity of the island. Over-exploitation of rocky reef fisheries, extraction of corals and shells; removal of coastal vegetation from inter-tidal and sub-tidal habitats and destructive fishing practices, mainly the use of rock-weighted gill nets over the inshore boulder reefs also pose a threat to the ecosystem.
- (b) Uncontrolled waste disposal on the island may have a significant impact on ground water quality and increased load of solid waste. Introduction of TBTO (tri-butyltin oxide), presence of antifouling agents (Resorts, Hotels and Marine Operations), release of pollutants, such as gas and oil from marine supply sources and from operating boats, release of nutrients and toxic compounds during dredging and subsequent maintenance has a long-term effect (Tomascik, 1997).
- (c) Physical destruction of corals and other marine organisms is reported due to anchor damage, destructive fishing practice, small boat grounding and unplanned tourism development.
- (d) Only 5% of the households have sanitary toilets. Lack of sanitary facilities on the island is alarming. Most young children suffer from skin disease and internal parasites (i.e., worms), largely due to poor hygiene. Lack of sanitation facilities on the island causes severe problems during the rainy season, when the ground water often becomes contaminated. Severe flooding during the rainy season is due primarily to the lack of proper drainage system.
- (e) Poorly managed agricultural lands introduce high quantities of sediments, nutrients and pesticides into coastal areas, thus adding high amounts of nutrients into coastal waters and contaminating the groundwater table and often resulting in eutrophication.
- (f) The fish catch per unit effort has declined compared to that 4-5 years ago. However, during the period the number of fishing boats has increased by about 30%. The decline in fish abundance does not appear to be local, rather it reflects the over all prevalent situation in the Bay of Bengal. The population of jellyfish has declined greatly during the past few years, but the reason is not so clear (FEJB, 2001). Fish offal's discarded on the beach, have created a local hygienic problem and mortality of birds feeding on the rotten offal (SHED, 2002). However, collection of living molluscs, like Cowries and some other smaller species has contributed to the loss of their abundance. Similarly there is a decline in the population size of Windowpane oyster, *Placuna placenta*, *Trochus sp.* and *Conus sp.* which are important commercial groups.
- (g) The following are the key environmental (natural and anthropogenic) concerns in St. Martin's Island which pose threats to environment and resources degradation. A summary of the potential threats is provided below with their relative contribution to environment and resource degradation as revealed by Tomascik (1997). Threat level from 1(low) to 5 (high).



Anthropogenic Threats	Relative Threat Level
Turbidity and sedimentation	5
Coral extraction	5
Shell extraction	5
Inter-tidal boulder removal	5
Tourism activities	5
Agriculture pollution	5
Over- fishing	5
Coastal erosion	4
Destructive fishing techniques	3
Domestic pollution	3
Oil pollution from boats	3
Fish processing	3
Boat building	2
Boat anchoring	2
Coral use for construction and lime	1
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Natural Threats	
Cyclones and storms	5
Sedimentation and resuspension	5
Freshwater flooding	5
Earthquakes	1

(Source: Tomascik, 1997)

By far the most serious threat to the future viability (ecological and economical) of coral resources of St.Martin's Island is over exploitation. This is serious issue throughout the tropical regions where local communities depend heavily on coral reef resources for their survival and economic well-being. However, the situation on St.Martin's Island is greatly different. The main natural resource exploitation activity that brings subsistence to the local population is an offshore (i.e., fishing more than 1 km from the island) fishery for pelagic fish. About 24 boats using a weighted gill net do fishing in the inshore waters over the boulder reefs. Since nets are frequently damaged and catches are very small compared to the offshore catches, fishing on the boulder reefs is relatively infrequent.

#### RECOMMENDATIONS:

Environmental Conservation Rules (ECA), 1997 should be properly implemented for sustainable management of St.Martin's Island- a declared 'Ecologically Critical Area' (ECA's) of Bangladesh. The experience from the conservation of Bali Coral Island, Indonesia with the participatory approach of the local people and its natural resources i.e by-products of coconut, a successful project on conservation of coral Island can be followed for the St. Martin Islands. **The key concern** that needs immediate attention is the over-exploitation of natural resources. It is therefore essential that, prior to any future development activities, environmental management and Environmental Impact Assessments (EIA) should be obligatory, including tourism development. Local people need alternate livelihood, such as, development of small cottage industry. In addition to fishing, poultry farming, and animal husbandry, there is possibility of alternative livelihood by establishing small cottage industry. Coconut may be a good raw materials in St. Martin's island for small cottage industry because of its abundance.

It is strongly recommended that new scientific studies should be undertaken by setting up a marine field laboratory at St.Martin's Island to facilitate research. Assistance for the establishment of field laboratory can be sought from international donor agencies (e.g., UNESCO, BOBLME, GEF, FAO). The **Institute of Marine Science, University of Chittagong**, can play a paramount role for this type of research.

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