

Research and Conservation of Marine Turtles in Bangladesh

S M A Rashid and M Zahirul Islam

Study Area

Bangladesh (20°34'–26°38' N and 88°01'–92°41' E), located on the northern side of the Bay of Bengal in mainland Asia, supports five species of marine turtles in its territorial waters, including the olive ridley turtle, green turtle, hawksbill turtle, loggerhead turtle and leatherback turtle (Smith 1931, Husain 1976, 1979, Shafi and Quddus 1977, Khan 1982, 1987, Sarker and Sarker 1988, Das 1991, Rashid 1997). The total coastline of Bangladesh measures 710 kilometres approximately (ICZM 2003). Not all the coastline is suitable for nesting, as sandy beaches are available in sections along the mainland coast. Apart from the mainland coast, there are numerous offshore islands whose sandy beaches ideal for marine turtle nesting (Figure 1).

Three species of marine turtles have been reported to nest in Bangladesh. Among them, olive ridleys (Ahmed et al 1986, Khan 1987, Rashid 1984, 1986, Rashid and Islam 1999, and *in press*, Islam 2002) and green turtles (Khan 1982, 1987, Rashid 1997, Rashid and Islam 1999) are common, while hawksbills are rare (Rashid 1997, Islam 2002). There was an unconfirmed nesting record of a loggerhead based on a specimen collected by the staff of the Marine Fisheries Research Institute (MFRI), in Cox's Bazaar (F Ahsan, pers. comm. 1995). Loggerhead nesting is doubtful especially due to widespread misidentification of ridleys from loggerheads (Frazier 1985). Leatherback turtles are seldom encountered (Rashid and Islam 1999) and with no known records of nesting, in Bangladesh. However, a recent crawl mark recorded in Ceeradia, St. Martin's Island is suspected to be from a leatherback turtle.

Marine turtles have never been prioritised in any agenda for research or conservation since Bangladesh gained independence in 1971. The only available information was in



Figure 1. Bangladesh coast.

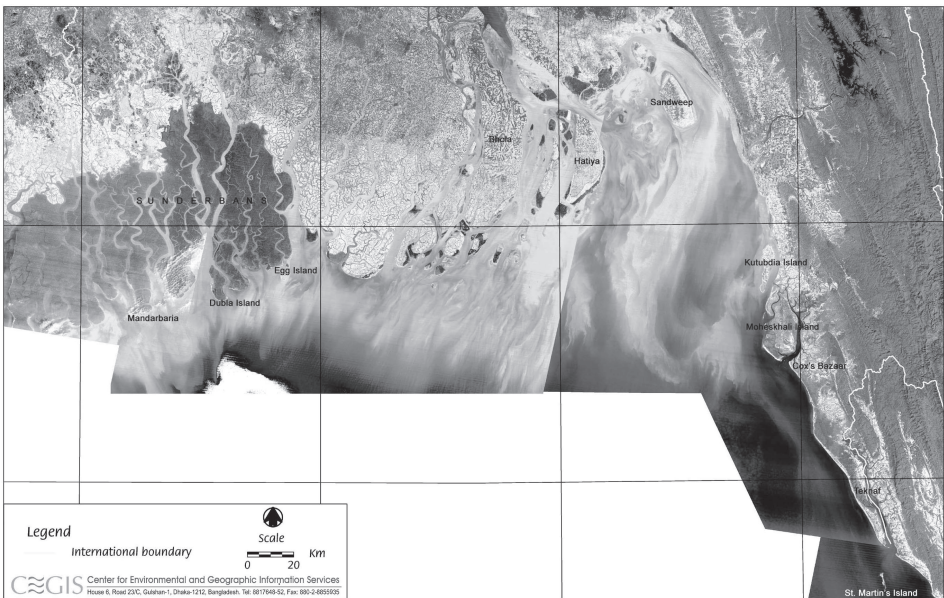


Figure 2. Satellite image of offshore islands with turtle nesting beaches.

a few anecdotal notes, district gazetteers, forest department reports, and newspaper reports in national dailies on the captures of marine turtles by fishermen. There were no scientific publications or systematic surveys on marine turtles till recently. Some information from sporadic surveys and observations first started to appear in the 1980s (Khan 1982, 1985, 1987, Rashid 1984, 1986) and provided the impetus to conduct surveys and update available information on the status of marine turtles in Bangladesh.

Rashid (1997) attempted to collate information from published literature. However, much of the information was gathered over a period of two decades from irregular surveys and interviews with elderly and young fisher folk, and communities living in remote coastal areas and offshore islands. In October 1996, the Centre for Advanced Research in Natural Resources and Management (CARINAM) initiated a study and conservation programme on marine turtles (including the establishment of a hatchery) on St. Martin's Island (Figure 3) in the Bay of Bengal.

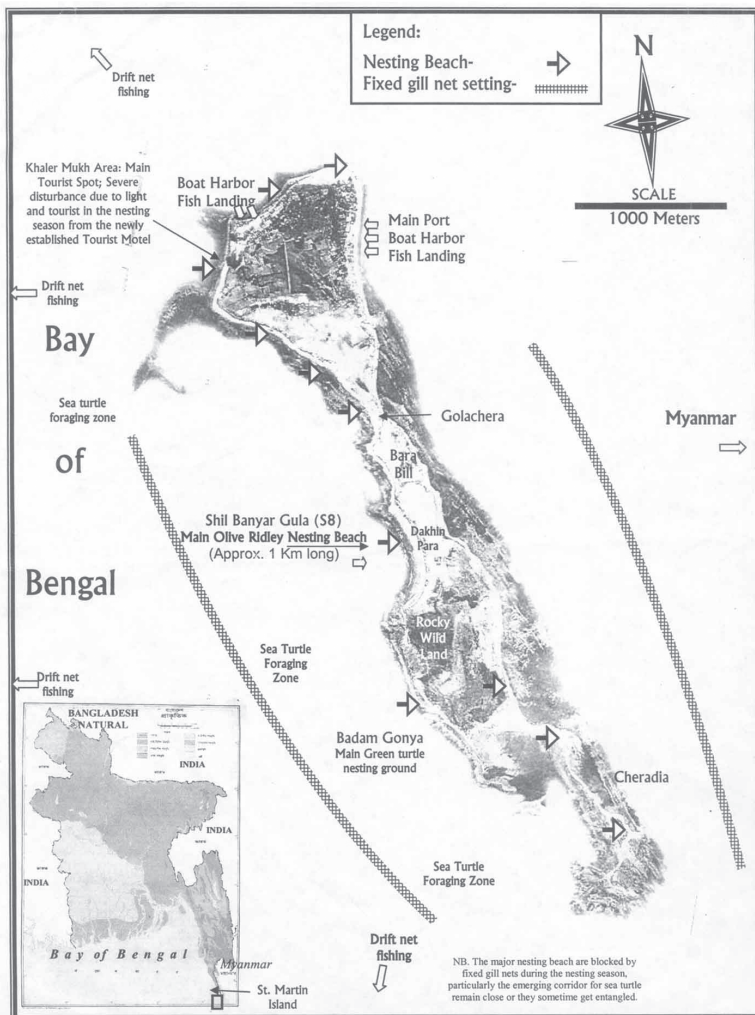


Figure 3. Map of St. Martin's Island.

During the 18-month study period, 17,852 eggs were collected from 132 olive ridley and four green turtle nests, and 15,120 hatchlings were released in the Bay of Bengal, with a hatching success of 84.7 per cent (Rashid and Islam 1999, Islam et al 1999). NGOs and local people were provided training on the establishment of hatcheries, collection of eggs, relocation of nests and rearing of hatchlings. This study has since prompted many others to initiate marine turtle conservation programmes on other island beaches.

Meanwhile, the National Conservation Strategy Implementation Project-1 (NCSIP-1) under the Ministry of Environment and Forests (MOEF) conducted a study on St. Martin's Island to develop a management plan for the island (Tomascik 1997). As a follow-up of the management plan, the Government of Bangladesh (GOB) financed a MOEF project titled Conservation of Biodiversity, Marine Park Establishment and Eco-tourism Development at St. Martin's Island (SMBMED) for the period 2000–05. One of the priorities of this project is to protect and manage important nesting beaches, initially identified by CARINAM. The project has so far released 2,700 and 5,680 ridley hatchlings during 2000–01 and 2001–02 respectively (MOEF 2002, see www.stmartinsbd.org for further details of the project).

Status and Distribution

OLIVE RIDLEY TURTLES

Olive ridleys have been found to nest on sandy beaches all along the mainland coast and islands stretching from the Sunderban mangrove forests in the southwest, to St. Martin's Island (locally known as *Narikel-Jinjiradweep*) in the southeast. Few turtle nesting beaches are known, which highlights the need for detailed surveys. Nesting beaches include Mandarbaria, Dubla Island, Egg Island and Putney Island in the Sundarbans; Sandweep, Hatiya, Nijhumdweep and Bhola islands on the southwest coast; adjoining islands on the south-central coast; Inoni, Kochopia, Bordal, Monkhali and southern Teknaf along the southeastern mainland coast of Teknaf peninsula; and Sonadia, Kutubdia, Moheshkhali and St. Martin's islands on the southeast coast. The south-central areas are located at the estuaries of large rivers, the Meghna and the Jamuna, and are disturbed due to frequent physical alteration of the islands due to soil erosion. However, turtles have been recorded nesting in the central islands and mainland beaches. Breeding of both olive ridleys and green turtles has been recorded off Sandweep Island located in the south-central region. Further, several male turtles were trapped in fishing nets along the coasts of Hatiya, Sandweep and Bhola islands (K Ahmed, pers. comm. 1989).

The estimated number of marine turtles nesting annually on these beaches may not exceed 100–200 individuals. The highest number of turtles recorded in one night was 35 individuals on St. Martin's Island. These turtles generally emerged to nest either solitary or in some cases two or three at a time. Subsequent comprehensive studies (CARINAM 1996–98) have shown that the estimated numbers of ridleys nesting annually at St. Martin's Island may be less than 100 individuals (Rashid and Islam *in press*). A total of 639 ridleys have been recorded to nest on St. Martin's Island from October 1996 to February 2003 (Figure 4), with the highest numbers recorded during



the 2000–01 season. However, the study during these years was not consistent and data on the frequency of nesting is sporadic and incomplete. Olive ridleys nest round the year, but the frequency of nesting peaks from end-August to December (Figure 5). The frequency of nesting on St. Martin's Island was highest in December (18.6 ± 3.6 , $n=7$) for which complete records are available from 1996–97 to 2002–03.

The frequency of nesting was observed to be higher during high tide and varied accordingly with the tide schedule (Rashid and Islam *in press*). Olive ridleys, unlike green turtles, have rarely been observed to crawl above the coral to nest. The nests are usually about 30 metres from the water line. The nest sites varied from moist sandy soil to dry sandy areas. While some nests were in the open, others were laid in vegetation like *Ipomoea pescaprae* and *Pandanus* spp. Clutch size averaged 141 eggs, ranging between 36 to 182 eggs (Table 1). However, the highest number of eggs was 196, collected from a single nest on St. Martin's Island in 1984.

Incidental mortality of ridleys is greater during winter, which corresponds with their peak breeding season. At other times of the year, there are fewer instances of turtles being trapped in fishing nets. Islam (2002) reported the death of 27 turtles during 1996–98 and another 54 individuals during 2000–01.

Table 1. External morphological measurement, clutch sizes and egg dimensions of olive ridleys recorded at St. Martin's Island from October 1996 to February 2003.

Variable	No	Mean	\pm SD	Range
Curved carapace length (cm)	76	70.4	3.4	61–77
Curved carapace width (cm)	76	69.3	8.6	46–77
Body weight (kg)	6	41.7	4.8	36–54
Clutch size	141	126.3	28.2	36–182
Egg dimension (mm)	420	38.2	1.2	36.9–39.5
Egg mass (g)	420	29	3.6	25.5–33.5
Nest depth (cm)	21	41	6.8	33–50

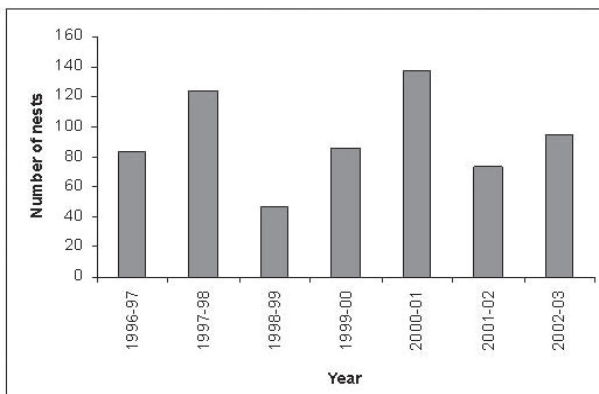


Figure 4. Annual variation in the frequency of nesting olive ridleys at St. Martin's Island from October 1996 to February 2003.

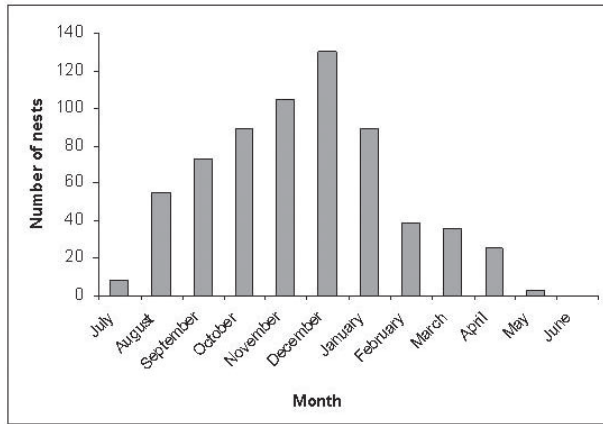


Figure 5. Nesting frequency of olive ridleys at St. Martin’s Island on a monthly basis from October 1996 to February 2003.

GREEN TURTLES

Green turtles are less widespread than olive ridleys, but they do nest both on the mainland coasts and on island beaches. They have been reported to nest on south-central island beaches, mainland beaches in the southeast (from Cox’s Bazar to Teknaf) and also on some coastal islands like St. Martin’s, Sonadia, Kutubdia, Hatiya and Sandweep islands. Nesting records for this species are either rare or absent for the coastal beaches of the Sunderbans. The shallow continental shelf in south-central Bangladesh supports immature and young green turtles. On several expeditions by the marine research vessel of the MFRI, small-sized young individuals, with straight carapace lengths ranging from 35–45 cm, were observed (F. Alam pers. comm. 1995). On several occasions, adult green turtles were also trapped in fishing nets. They were observed and captured mostly during winter (December–January), which coincides with the peak green turtle nesting period.

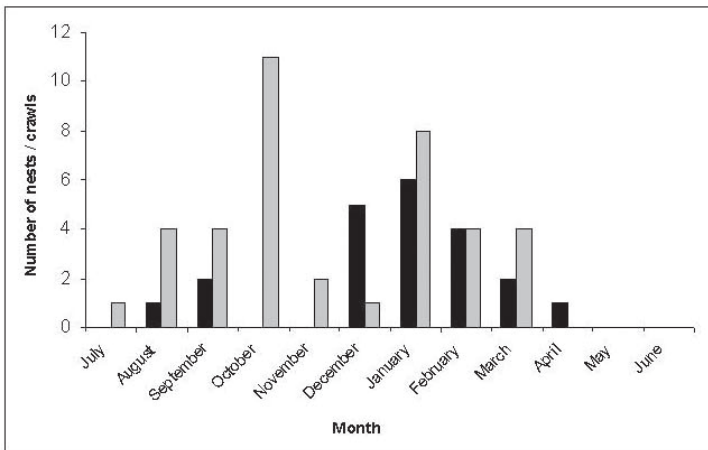


Figure 6. Nesting frequency of green turtles on St. Martin’s Island, recorded during the breeding season 2001–02.



Green turtles nest round the year but the frequency of nesting increases from October to February, with the peak during November to January (Figure 6). They nest on the same beaches as olive ridley turtles, though there may be differences in nest site selection. According to local people and fishermen, the number of nesting females has declined by almost 70–80 per cent in the last thirty years or so. Green turtles were once among the most common species of marine turtles to nest on mainland and island beaches (A Kasem, pers. comm. 1996, Khan 1982), but this does not seem to be the case any longer.

Table 2. External morphological measurement, clutch sizes and egg dimensions of green turtles recorded at St. Martin's Island from October 1996 to February 2003.

Variable	No	Mean	±SD	Range
Curved carapace length (cm)	12	100.1	7.7	91–112
Curved carapace width (cm)	12	89.3	5.5	82–96
Clutch size	15	98.9	25.5	60–141
Egg dimension (mm)	50	42.9	1.8	42.1–43.9
Egg mass (g)	50	43.2	1.3	42–44.5
Nest depth (cm)	4	100	10.6	85–104

HAWKSBILL TURTLES

This species is a rare visitor to the beaches of Bangladesh. There are a few unconfirmed reports of nesting on St. Martin's Island, the most recent being in 1992 (Rashid 1997). Reports from the local people of the island indicate that it used to nest here regularly in the 1950s (A Kasem pers. comm.). Later, the numbers appear to have declined drastically. In January 1992, one female was reported to have nested with a clutch size of 56 eggs, but no information on egg dimension is available (Rashid 1997). Recent studies on the island under NCSIP-1 indicate that the island ecosystem is capable of supporting hawksbill turtles. Underwater observations revealed the abundance of sponges (T Tomascik, NCSIP-1, pers. comm. 1996), which can form a large proportion of the diet of this species. On 13 November 1996, an immature hawksbill (SCL 27 cm) was trapped in a fishing net in the northwestern waters off St. Martin's Island. There is a need for further investigation to determine the population status of hawksbills around the island.

LOGGERHEAD TURTLES

Little information is available on this species in Bangladesh. The nearest sites where nesting of loggerheads has been reported are the islands off Myanmar (Thorbjarnarson et al 2000), which lie east of St. Martin's Island. It is not unlikely that a few nest in Bangladesh. There is an unconfirmed report of nesting (F Ahsan, pers. comm. 1995), but it must be noted that ridleys and loggerheads are commonly mistaken for each other (Frazier 1985).

LEATHERBACK TURTLES

No information is available on this species. Literature searches indicate no historic evidence of leatherback nesting in Bangladesh (Mitra 1914). However, on 11 April 1997 a dead adult leatherback turtle was washed ashore on St. Martin's Island (Rashid

and Islam 1999). During the 2000–01 breeding season, a crawl mark, suspected to be that of a leatherback's, was observed at the southern tip of the southern-most of the three Ceeradia islands.

Table 3. Nesting frequencies of marine turtle species recorded for St. Martin's Island from October 1996–February 2003.

Species	1996–97	1997–98	1998–99	1999–00	2000–01	2001–02	2002–03
Olive ridleys	83	124	47	86	137	73	85
Green turtles	4	5	9	6	4	22	3
Hawksbills	0	0	3	0	0	0	0
Leatherbacks	0	0	0	0	1 (?)	0	0

Table 4. List of important nesting beaches identified along the mainland coast and islands of Bangladesh. (Sp=Species, OR=olive ridley, GT=green turtle, HB=hawksbill, NST=Numbers recorded to nest) (AZK – Anisuzzaman Khan, FA – Fakhrul Alam, KA – Khabiruddin Ahmed, MS – Manmata Sarker, MSI – Md. Sazedul Islam, MZI – Md. Zahirul Islam, OG – Osman Gani, RA – Raguibuddin Ahmed, SMAR – SMA Rashid).

Location	Coordinates	Sp	NST	Month	Year	Observer
St. Martin's Island	20°34'–20°38' N, 92°18'–92°22' E	OR	35	Nov.–Jan.	1984	SMAR/RA
		OR	204	Nov.–Apr.	1996–97	SMAR/MZI
		GT	6	Sep.–Dec.	1984	SMAR/RA
		GT	3	Nov.	1997	MZI/MSI
		HB	1	Jan.	1992	Local
Teknaf	20°55' N, 92°18' E	OR	4	Dec.	1987	SMAR/RA
		GT	2	Dec.	1987	SMAR
Bordal	21°03' N, 92°15' E	OR	4	Dec.	1989	SMAR/RA
		GT	6	Nov.	1986	SMAR
Kochopia	21°04' N, 92°14' E	OR	6	Jan.	1985	SMAR/RA
		GT	6	Jan.	1985	SMAR
Monkhali	21°05' N, 92°10' E	OR	4	Jan.	1984	SMAR/RA
		GT	2	Jan.	1985	SMAR
Inoni	21°10' N, 92°02' E	OR	6	Dec.	1989	SMAR
Cox's Bazaar	21°25' N, 91°90' E	OR	7	Nov.	1988	MS
Sonadia Island	21°29' N, 91° 55' E	OR	5	Nov.	1989	SMAR/AZK
		GT	2	Dec.	1989	FA
Kutubdia Island	21°47' N, 91°35' E	OR	7	Dec.	1995	SMAR
Moheskhalia Island (SW)	21°32' N, 91°41' E	OR	5	Jan.	1987	SMAR/AZK
Sandweep Island	22°23' N, 91°30' E	GT	4	Dec.	1985	KA
Egg Island, Sunderban	21°50' N, 89°46' E	OR	4	Nov.	1991	SMAR
		OR	egg shells	Apr.	2003	AZK
Mandarbaria, Sunderban	21°41' N, 89°15' E	OR	egg shells	Jan.	2003	OG
Dubla Island, Sunderban	21°48' N, 89°33' E	OR	3	Jan.	1994	SMAR



Nesting records

Though detailed surveys to identify marine turtle nesting sites are lacking, annual waterfowl censuses along the coast have provided an opportunity to collect information on marine turtle nesting beaches. These provide a base line for in-depth surveys in the future. The major nesting sites identified for marine turtles in Bangladesh are listed in Table 4. Some of these sites fall under the existing protected area management system. For example, Mandarbaria, Egg Island and Dublar Char are within the Sunderban wildlife sanctuary, and protecting these beaches will be much easier than other public beaches.

St. Martin's and Sonadia islands have been declared as Ecological Critical Areas (ECA) *vide* GOB Gazette Notification No. MOEF/4/7/87/99/285 dated 19 April 1999. Plans are underway to conserve and manage St. Martin's Island for ecotourism *vide* GOB Gazette Notification No. MOEF/4-33/38/99/831 dated 29 June 1999. For example, SMBMED is working on the management of nesting beaches through local participation. The recently initiated GEF-funded Coastal and Wetland Biodiversity Management Project involving the UNDP and MOEF/DOE will focus on ECAs like Sonadia Island and Teknaf Peninsula, in addition to St. Martin's Island and another freshwater wetland, Hakaluki Haor.

Further, the Water Resources Planning Organisation (WARPO) in association with the Royal Netherlands Embassy and DFID of the British Government initiated a three-year Integrated Coastal Zone Management (ICZM) Project from February 2002. ICZM will primarily focus on the formulation of a coastal development strategy (CDS) and a coastal zone policy (CZP), among other activities (Anon. 2002). The results from these projects are expected to have some bearing on the conservation and management of marine turtles.

Tagging

Tagging of marine turtles at St. Martin's Island started in 2000 and tagging techniques followed Balazs (1999). All the tags are monel (#1005-49, National Band and Tag Co., Kentucky), numbered from N401 to N500. The return address inscribed on the tags is: Research Box 736, Durban, South Africa. The tags were attached to the hind margin of the front flipper (left or right) of both olive ridleys and green turtles; in some cases, the tags were attached to the rear right or left flipper. Sixty-five turtles (olive ridleys and green turtles) have been tagged since October 2000. Tagging provided primary data on multiple clutches, inter-nesting intervals between clutches and nest site fidelity.

Olive ridleys were recorded to nest twice during a nesting season with an interval of 14-16 days (average=14.8 days; n=18). There were only three re-nesting records for green turtles, with the nesting interval ranging between 14-17 days (Average=15.3 days; n=3); the females laid eggs two to three times during a season.

Among the tagged turtles, nine females were recovered with serious injuries on the carapace, two individuals with the hind-flippers cut, and two with fibro-papilloma tumours on the front flipper. The injuries on the carapace give some indication of the threats to the turtles while they are at sea.

Threats

EXPLOITATION

Traditional utilisation by local coastal communities is not significant. Only two or three fishing communities and tribes consume turtle meat. Turtles that get entangled in the fishing nets are slaughtered and the meat is then either sold or distributed free of cost among the community or tribe members. These communities are located in Patharghata, Chittagong, Khepupara, Patuakhali, and in some tribal villages along the mainland coastline between Cox's Bazaar and Teknaf.

The other form of exploitation is egg depredation from the turtle nests. This practice has gained momentum only during the last 20 years or so. Rashid and Islam (1999) discussed the magnitude of depredation, which is estimated to be in the range of 12,000 to 18,000 eggs annually from St. Martin's Island alone. Along the mainland coast, the eggs are sold for US\$ 5 for 100 eggs, and for more than twice that in the cities. From the islands, the eggs are either transported to mainland markets or bartered for rice and other food commodities. Recently, Islam (2001) reported the sale of turtle eggs further inland in Bandarban area, probably due to the increase in the demand of this resource. In addition to turtle eggs, stuffed specimens and processed and cleaned carapaces are also sold in curio shops in Dhaka, as well as in some coastal towns like Cox's Bazaar and Teknaf. The prices vary from US\$ 35–55 for stuffed specimens and US\$ 10–15 for carapaces.

Though marine turtles are not included in the protected list of the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974, the government has been discouraging their exploitation. Paramilitary forces like the Bangladesh Rifles (BDR), Bangladesh police posted in coastal areas and on islands, and coast guard personnel have been specially instructed to curb the exploitation of marine turtles. Despite this, egg depredation does continue. Some success in reducing this form of exploitation has, however, been gained in St. Martin's Island with the initiation of a marine turtle conservation programme. With support from the local people, the BDR and Bangladesh police, poaching of eggs is estimated to have reduced by almost 60 per cent.

No large-scale international or commercial trade has so far been reported for marine turtles or marine turtle products in Bangladesh. With the increase in the number of tourists in recent years, some curio shops have started to sell stuffed marine turtles and paintings on marine turtle shells (Islam 2001). If not stopped right now, the trade may expand and will then be difficult to control. So far, either due to religious taboos or lack of knowledge of the turtle trade, the local communities have not considered the exploitation of marine turtles.

THREATS ON NESTING BEACHES

Nesting females are occasionally killed by stray dogs and jackals on coastal islands and along mainland coasts (Table 5). In some cases, local people may kill nesting females out of curiosity. As mentioned earlier, a few communities slaughter the turtles for meat as food, but this form of exploitation is less significant than the natural predation of nesting females. Turtles slaughtered for meat are mostly the ones that get entangled or drown in fishing nets.



Table 5. Numbers of marine turtle affected by various human activities at St. Martin's Island from October 1996 to February 2003.

Nature of Threats/Disturbances	Number of Turtles
Predation by dogs	20
Nests destroyed by dogs	7
Unsuccessful nesting due to rocks	18
Females with flippers cut	9
Unsuccessful due to tourist disturbances	13
Females with injury on carapace	8
Females with tumours on flippers	2
Total	77

It is estimated that almost 90–95 per cent of the nests are exploited by humans; of the rest, 5–8 per cent are predated by natural predators like jackals, mongooses and monitor lizards. Only 2–5 per cent of the nests survive under natural conditions. Nest loss due to flooding by high tide may contribute to 1–2 per cent of nest loss, but that is limited to some seasons, like April–May or October–November. Nest loss due to beach erosion is also not significant on mainland beaches, but may contribute to some nest loss on island beaches.

FISHERY-RELATED THREATS

Incidental turtle mortality occurs in trawl nets, drift nets, gill nets, and mesh nets where the turtles get entangled and cannot escape. The turtles die either of suffocation or the fisher folk kill them to free their nets. Deaths from collision with fishing vessels are also common and sometimes intentional. Since the superstitious fishing community considers the sighting of a turtle, or it getting entangled in their fishing net, as a bad omen, they may intentionally hit the turtles and kill them. This information was obtained during interviews with deep-sea fishermen using country-made mechanised fishing trawlers. However, with the initiation of community education and awareness programmes by SMBMED and other NGOs in the coastal areas, the trend may change.

In a recent study conducted by the MFRI (F Alam, pers. comm. 1996) to investigate the frequency of turtle mortality due to either drowning or entanglement in fishing nets, the number of turtle deaths was reported to be low. The report was not made available to cite exact numbers. These results may have been biased because of the US ban on the import of shrimps from Bangladesh unless the fishing vessels used turtle excluder devices (TEDs). With the submission of this report, the USA allowed the import of shrimps from Bangladesh.

DEVELOPMENT-RELATED THREATS

These threats are more widespread and alarming for the survival of marine turtles. Along the coastline, physical alterations and development of infrastructure has increased tremendously in the last 10–15 years. Moreover, the construction of embankments along the coast (to protect the mainland or islands from erosion and marine water infiltration) and the development of shrimp farms in most of the areas along the coast has had a significant impact and altered the physical characteristics of the coastline.

On St. Martin's Island, stones and dead coral excavated from the shallow inter-tidal areas are used to erect stonewalls along the high tide mark to prevent infiltration of saline water. With the construction of embankments, remote coastal areas have become accessible and human movement has increased. With the arrival of humans, development activities, including shipbuilding, and coastal traffic have increased, and so has the presence of scavenging animals—all of which are hazardous to nesting turtles and hatchlings.

With the increase in local and international tourism in recent years, the Bangladesh Parjatan Corporation (National Tourism Authority) has started building hotels, motels and other recreation centres in many areas along the coast, particularly Cox's Bazaar. Some private enterprises have constructed motels on areas identified as turtle nesting beaches, as for example on St. Martin's Island. This is in clear violation of the law as St. Martin's is declared as an Ecologically Critical Area. A highway along the coast from Cox's Bazaar to Teknaf is almost complete despite objections from conservation groups; this area supports tropical evergreen forests and the beaches support major nesting sites for marine turtles. Some wealthy people have also recently started to acquire land in coastal areas, thus increasing human presence and exploitation along the coast.

In most of the islands, fishing villages have started to develop along the beaches. Humans, domestic and feral animals increase pressure on the nesting turtles and eggs. With increasing number of fishing villages, the numbers of mechanised fishing boats are increasing and with that there is an increase in oil spills, pollution and disposal of solid domestic and machinery waste. The beaches are also utilised for drying fish and mending fishing nets from October to March. This corresponds with the peak nesting period of the marine turtles. Due to the increase in human activity, beach lighting has also increased which is detrimental to turtles and hatchlings.

Legislation

The forest department, under the aegis of the Ministry of Environment and Forest, is the sole authority for the protection, conservation and management of all wildlife in the country. Even though marine turtles are under the mandate of their protection, marine turtles are not included in the list of protected species, Schedule III of the Bangladesh Wildlife (Preservation) (Amendment) Act 1974 (BWPA). In a revised government notification, all wildlife species will be protected, and the government can from time to time, through gazette notifications, indicate which species are liable for any form of exploitation or trade. Currently, the act is in the final stages of revision by the forest department and marine turtles are included in the list of protected animals.

On the other hand, the MFRI under the aegis of the Department of Fisheries (DOF), Ministry of Fisheries and Livestock (MFL) also claim that they are responsible for the protection and management of marine and freshwater turtles, and marine resources like cetaceans and crustaceans, which are presently controlled by the forest department. Considerable revenue is at stake and this might be the bone of contention between the two government agencies. This issue needs to be discussed at the highest level to strengthen inter-departmental co-operation and co-ordination to ensure the conservation



of turtles and other aquatic resources. Several good examples of co-operation and co-ordination between various government ministries have recently started to emerge, for example between the Ministry of Local Government, Rehabilitation and Development (LGRD), Ministry of Land and the MOEF, and between the Ministry of Fisheries and Livestock and the Ministry of Land.

The Government of Bangladesh has either, signed, ratified or accessed several international or regional agreements, conventions, treaties and protocols related to marine environment and biological resources (Islam 1996), which directly or indirectly affect marine turtles (Table 6). However, there are several limitations or gaps in the existing laws. The first and foremost limitation or gap is the non-inclusion of marine turtles in the Protected List of Animals (Schedule III) of the BWPA. Rashid (1986) suggested their inclusion in the protected list. They may now be incorporated in the list in the latest revision of the Act. There is little protection of nesting or foraging habitats, which are critical to marine turtle survival. Beaches are already under intense pressure for development by the tourism industry. Immediate steps have to be taken to identify and protect significant beaches and foraging areas. Only recently, some beaches on St. Martin's Island have been declared as protected areas for marine turtles.

There is little planning for coastal zone management and land use in the context of nesting beaches. There should be well-defined policies for coastal zone utilisation. The ongoing Integrated Coastal Zone Management (ICZM) project should consider these aspects in their proposed management strategy and policy. For example, there is no legislation or policy to regulate construction at specified distances from the spring tide mark (Kamaluddin, ICZM, pers. comm. 2003). The existing legislation does call for community involvement in wildlife management but there are very few good examples of implementation. However, the Flood Action Plan (FAP) did initiate a public participation process, though controversial to some, and included components related to biological resources management. The SMBMED, Sustainable Environment Management Programme (SEMP), and the Sunderban Biodiversity Conservation Project (SBCP) under the MOEF have initiated some programmes under this theme. Clear definitions of responsibilities or mandates should be assigned where different departments or agencies share the same subject/resources/interests, in order to avoid any misunderstanding or conflict.

Table 6. List of international agreements, conventions, treaties and protocols signed, accessed, or ratified by the Government of Bangladesh, which directly or indirectly affects marine turtles.

Conventions/Treaties/Protocols	Signed	Accessed	Ratified
Agreement on the Network of Aquaculture Centres in Asia and the Pacific, Bangkok, 1988.	–	–	15.05.1990
Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Basel, 1989.	–	01.04.1993	–

Table 6 (contd.)

Conventions/Treaties/Protocols	Signed	Accessed	Ratified
Convention on the Continental Shelf, Geneva, 1958.	–	–	–
Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar, 1971.	–	–	20.04.1992
Convention Concerning the Protection of World Cultural and Natural Heritage, Paris, 1972.	–	–	03.11.1983
Convention on the Prevention of Marine Pollution by Dumping Wastes and other Matters, London, 1972.	–	–	–
Convention on International Trade in Endangered Species of Flora and Fauna, Washington, 1973.	20.11.1981	–	18.02.1982
Convention on Biological Diversity, Rio de Janeiro, 1992.	05.06.1992	–	20.03.1994
Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979.	MOU 14.07.2000	–	–
International Convention for the Prevention of Pollution of the Sea by Oil, London, 1954.	–	–	28.12.1981
International Convention for the Prevention of Pollution from Ships, London, 1973.	–	–	–
International Convention on Oil Pollution Preparedness, Response and Cooperation, London, 1990.	30.11.1990	–	–
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, Brussels, 1969.	–	–	04.02.1982
United Nations Convention on the Law of the Marine, Montego Bay, 1982.	–	–	10.12.1982
United Nations Framework Convention on Climate Change, New York, 1992.	09.06.1992	–	16.02.1994



Management

The forest department is the sole authority to conserve and manage the wildlife of the country. The department, however, has neither adequate manpower nor any institutional arrangement with other organisations for the management of marine turtles. There are virtually no management strategies in place to address the threats listed above. The law is there, the law enforcement agencies are there, but there is little or no co-ordination to mobilise them and achieve the objectives. A great deal needs to be done, in terms of infrastructure, enhancing coordination between agencies and also capacity building, to address the issues related to the conservation and management of marine turtles. There is a particular need for training the staff on issues related to marine turtle and coastal zone management.

Collaboration with other agencies is essential where resources are considered as common property, as in the case of marine turtles, which is a bone of contention between the forest and fisheries departments. A coordination committee can be formed under the umbrella of the Wildlife Advisory Board (WAB) to implement and monitor activities. The WAB, with support from experts in different fields, can initiate and prioritise research activities and draw up a pragmatic schedule for the conservation and management of marine turtles, nesting beaches and other coastal zones.

The highest priority needs to be accorded to legislation, which needs immediate revision and inclusion of marine turtles in the protected species list (Schedule III of the BWPA). Specific policies need to be developed regarding the utilisation of beaches. Nesting beaches should be brought under a protected management system. Bangladesh has signed several international conventions, which are not clearly reflected in existing legislation. There is a need for incorporation of international agreements into the national laws and if necessary, the national laws should be updated to address current needs.

Some of the beaches mentioned below are currently protected; for example the sites mentioned for the Sunderbans (Dubla, Mandarbaria and Egg islands) (Table 5) legally fall under protected areas but there has been little enforcement of the laws regarding beach activities until recently. These two islands are under immense utilisation pressure by fisher folk during the fishing season in winter which coincides with the marine turtle nesting season. Nocturnal activities are restricted due to fear of tigers (*Panthera tigris*), which may be a blessing in disguise for marine turtles. Recently, the government has declared a section of St. Martin's Island as a protected beach for marine turtles and the ongoing project (SMBMED) has the responsibility to come up with appropriate measures for managing the nesting beaches.

Currently, there are a few ongoing projects for the conservation of marine turtles. After the initiation of CARINAM's Marine Turtle Conservation Programme (MTCP) in 1996, several non government organisations (NGOs) and the MOEF have started research and data collection on marine turtles. Public awareness is increasing with the programmes initiated by NGOs including publications in the local language to reach the masses. The government has also initiated some research and community involvement activities and chalked out several participatory conservation programmes for the near future.

The MOEF executed NCSIP-1, with financial support from the Norwegian Agency for Development (NORAD). Detailed cross-sectoral surveys were carried out in selected critical ecosystems including St. Martin's Island and tropical forest areas (and beaches) of the Teknaf peninsula for the preparation of management plans. IUCN monitored and evaluated the NCSIP-1 project activities and progress. The Asian Development Bank (ADB) is funding a biodiversity conservation project in the Sunderbans, with marine turtles as a component, which is currently pending further evaluation and reformulation. The Department of Environment (DOE)/MOEF and United Nations Development Programme (UNDP) will soon embark on the coastal biodiversity management project under a GEF grant and marine turtles will be included in the programme. These projects may play a significant role in the training, assessing and implementation of TEDs by fisher folk, capacity building of both the fisher folk and government staff, identifying loopholes in the enforcement of wildlife protection laws, and further detailed surveys to identify other important nesting beaches and threats to the biological resources, including marine turtles. Public awareness and education programmes supported by incentives deserves the highest priority.

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Literature Cited

- Ahmed, B, K M N Huda, and G S M Asmat. 1986. The breeding of the olive ridley, *Lepidochelys olivacea* (Eschscholtz), at St. Martin's Island, Bangladesh. *Bangladesh J. of Zoology* 14(1): 59–69.
- Anonymous. 2002. *Brief on the Project Development Office-Integrated Coastal Zone Management Project*. Dhaka: PDO-ICZM. 4 pp.
- Balazs, G H. 1999. Factors to consider in the tagging of sea turtles. In *Research and management techniques for the conservation of sea turtles*, eds. K L Eckert, K A Bjorndal, F A Abreu-Grobois and M Donnelly. Washington D C: IUCN/SSC Marine Turtle Specialist Group Publication No. 4. 101–109.
- Das, I. 1991. *Colour guide to the turtles and tortoises of the Indian subcontinent*. UK: R & A Publishing Ltd. 133 pp.
- Frazier, J. 1985. Misidentifications of sea turtles in the eastern Pacific: *Caretta caretta* and *Lepidochelys olivacea*. *J. of Herpetology* 19: 1–11.

- Husain, K Z. 1976. *Wildlife management in Bangladesh*. Department of Films and Publications, Government of the Peoples' Republic of Bangladesh. 50 pp.
- Husain, K Z. 1979. Bangladesher bonnyajontu swampad o tar sangrakshan (in Bangla). *Bangla Academy Bignan Patrika* 5(3): 29–31.
- ICZM. 2003. *Integrated Coastal Zone Management Project*. (<http://www.iczmpbangladesh.org>)
- Islam, A. 1996. *International conventions, treaties and protocols: Bangladesh perspective*. Dhaka: IUCN-Bangladesh. 100 pp.
- Islam, M Z. 2001. Notes on the trade in marine turtle products in Bangladesh. *Marine Turtle Newsl.* 94: 10–11.
- Islam, M Z. 2002. Marine turtle nesting at St. Martin's Island, Bangladesh. *Marine Turtle Newsl.* 96: 19–21.
- Islam, M Z, M S Islam, and S M A Rashid. 1999. Marine turtle conservation program in St. Martin's Island, Bangladesh by CARINAM: A brief review. *Tiger Paper* 26: 17–28.
- Khan, M A R. 1982. *Wildlife of Bangladesh: A checklist*. Dhaka: University of Dhaka. 174 pp.
- Khan, M A R. 1985. St. Martin's: A vanishing coral island of Bangladesh. *Tiger Paper* 12(4): 6–12.
- Khan, M A R. 1987. *Bangladesher banya prani Vol.1*. Dhaka: Bangla Academy. 168 pp.
- Mitra, S C. 1914. *Jessore-Khulnar Itihas Vol. I&II*. Reprinted 2001. Khulna: Rupantar. 620 pp.
- MOEF. 2002. *Wealth of Bangladesh: St. Martin's Island, Saving marine turtles*. Ministry of Environment & Forest, Government of the Peoples' Republic of Bangladesh. 20 pp.
- Rashid, S M A. 1984. Jolpai rong shamudrik kasim. Poribesh Porikroma. *Bull. of the Wildlife Society of Bangladesh* 1: 3–6.
- Rashid, S M A. 1986. Conservation plan for marine turtles in St. Martin's Island, Bangladesh. (Abstract). *Paper presented in the 6th National Zoological Conference*, Chittagong University, Bangladesh. 8 pp.
- Rashid, S M A. 1997. Country report on the marine turtles of Bangladesh. *Presented at the IUCN/SSC MTSG Northern Indian Ocean Workshop*, Bhubaneswar, India.
- Rashid, S M A, and M Z Islam. 1999. Establishing marine turtle hatchery in St. Martin's Island, Bangladesh. In *Proceedings of the 4th Asia-Pacific NGOs Environmental Conference*. Singapore: National University of Singapore. 150–162.
- Rashid, S M A, and M Z Islam. *In press*. Nesting olive ridley turtles, *Lepidochelys olivacea* at Narikel Jinjiradweep (St. Martin's Island), Bangladesh. *Chelonian Conservation & Biology*.
- Shafi, M, and M A Quddus. 1977. Bangladesher matshya swampada: Part 4. Kasim, kaitta o samudrik kasim. *Bangla Academy Bignan Patricia* 3(2):14–36.
- Smith, M A. 1931. *The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. 1. Loricata, Testudines*. London: Taylor & Francis. 185 pp.
- Sarker, S U, and N J Sarker. 1988. *A systematic list of wildlife of Bangladesh*. Private pub. 50 pp.
- Thorbjarnarson, J B, S G Platt, and S T Khaing. 2000. Sea turtles in Myanmar: Past and present. *Marine Turtle Newsl.* 88:10–11.
- Tomascik, T. 1997. *Management plan for coral resources of Narikel-Jinjiradweep (St. Martin's Island)*. Prepared for the National Conservation Strategy Implementation Project–1, Ministry of Environment & Forest, Government of the Peoples' Republic of Bangladesh. 124 pp.