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Cover: Life and death in one night - wolf hunting the hare. Mixed media—gouache, acrylics, pen & colour pencils. © Dupati Poojitha.



Conservation of sea turtles on the beach areas from Sonadia Island to Saint Martin's Island in the Bay of Bengal in Bangladesh

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Abstract: Five species of sea turtle are known to nest on the coastal beaches of Bangladesh: Loggerhead Sea Turtle *Caretta caretta*, Green Sea Turtle *Chelonia mydas*, Hawksbill Sea Turtle *Eretmochelys imbricata*, Olive Ridley Turtle *Lepidochelys olivacea*, and Leatherback Sea Turtle *Dermochelys coriacea*. Olive Ridleys are more common than Green Turtles, and the others are very rare. Sea turtle hatcheries were visited on the Bay of Bengal beaches running from Sonadia Island to the Saint Martin's Island Beaches of Cox's Bazar in Bangladesh, from January to March 2022. During this period 22 hatcheries were found operating in the field, of which 11 were maintained by Marine Life Alliance, eight by NACOM (Nature Conservation Management) and two by CODEC (Community Development Centre); one was anonymous. Only Olive Ridley Turtles nesting was recorded during 2021–22. CODEC recorded 26 nests and collected 2,943 eggs for hatcheries, which released 1,612 healthy hatchlings into the Bay of Bengal. The clutch size was 21–165 (average 103, $n = 26$), and the incubation period was 45–75 days (average 53 days, $n = 1,612$). The higher air temperature from March to May hastened the hatching process. NGOs are working on conservation aspects of the sea turtles, mostly by collecting eggs and releasing hatchlings into the Bay of Bengal. They have also prepared booklets and posters, hoisted banners, published papers, and organised seminars, rallies and workshops for education and awareness of the local people. These initiatives are encouraging, but it may be better if the efforts of NGOs to support sea turtle conservation were more integrated.

Keywords: Awareness, coastal beaches, distribution, education workshop, hatcheries, marine turtles, Olive Ridley Turtle, releasing hatchlings, status.

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INTRODUCTION

Sea turtles are an important part of the planetary food web, and they have played a vital role in maintaining the health of the world's oceans for more than 100 million years (Wilson et al. 2010). Bangladesh's coastal waters and beaches support turtles and provide suitable habitats for egg laying and hatchlings. Five of the world's seven species of sea turtles lay their eggs on the coastal beaches of the Bay of Bengal in Bangladesh, extending from the Sundarbans to Saint Martin's Island, and including some old and newly-emerged coastal islands.

Literature review suggests that works on sea turtles in Bangladesh are inadequate, but records on egg laying, maintaining hatcheries and releasing hatchlings are quite extensive and go back more than four decades. The listing of five species known to occur in Bangladesh territory of the Bay of Bengal was reported by Khan (1982a,b, 1987, 2010, 2015), Khan (2008, 2018), Shafi & Quddus (1976, 1982), and Sarker & Sarker (1988).

Ahmed et al. (1986) first reported the egg-laying activities of Olive Ridley Sea Turtle from Saint Martin's Island. Later, the Ministry of Environment and Forests (now called Ministry of Environment, Forest and Climate Change) made hatcheries on Saint Martin's Island and reported nesting records of sea turtles from 1996–2002, and hatchery success from 2000–01 to 2001–02 (CWBMP 2008). The Centre for Advanced Research in Natural Resources & Management (CARINAM) NGO started working on sea turtles in 1996 and then in 2000–2005, maintained hatcheries and released hatchlings in the Bay of Bengal. The Center for Natural Resource Studies (CNRS) did the same work as CARINAM possibly for a few years from 1997.

The CWBMP (Coastal and Wetland Biodiversity Management Project) under the DoE (Department of Environment) of the Ministry of Environment and Forests started monitoring, conservation programmes and networking in the three Cox's Bazar ECAs (Ecologically Critical Area), viz., the Saint Martin's Island (now it is a Marine Protected Area), the Sonadia Island ECA and Cox's Bazar-Teknaf Peninsula ECA during November 2005 to January 2008; it maintained sea turtle hatcheries (in Sonadia East, Sonadia West, Pechardwip, Khurerukh, Bodormokam, and the St. Martin's Island beaches) and released hatchlings in the Bay of Bengal (CWBMP 2008). It also created public awareness, information, education, and training of stakeholders for conserving sea turtles.

NACOM has been managing sea turtle hatcheries since 2007, and Isabela Foundation did it during 2017–18 (Isabela Foundation 2018). Recently (2021–2022) CODEC

(Community Development Centre) is working on the hatcheries as a pilot project on an experimental basis. Unlike other NGOs, the Marine Life Alliance has been mostly working on sea turtles, maintaining hatcheries, and releasing hatchlings in the Bay of Bengal since 1997. It also did a radio-tracking experiment on the Olive Ridley Turtles. The prime goal of all NGOs is the same to maintain hatcheries, hatch the eggs of sea turtles and release the hatchlings in the Bay of Bengal, and create conservation awareness.

According to local elders, about 30 years ago turtle nesting was quite common on most of the beach areas of the Saint Martin's Island. Nests remained unexploited in-situ due to high nesting frequency, and sightings of hatchling emergence were common (Islam 2002).

Status and distribution of Sea Turtles in Bangladesh

Globally, the IUCN lists Hawksbill Turtle as Critically Endangered, and Loggerhead, Green, Leatherback and Olive Ridley Turtles as Endangered (IUCN Bangladesh 2000). The Red list categories were assessed for these five species by IUCN Bangladesh (2015) as Critically Endangered (Green, Leatherback and Hawksbill Turtles), Vulnerable (Olive Ridley Turtle) and Data Deficient (Loggerhead Turtle).

1. Loggerhead Turtle (*Caretta caretta*): There are two records of the occurrence of this species in Bangladesh. One female laid eggs at Saint Martin's Island (Bhuiyan et al. 1985) and another was a stranded dead specimen found at Kassopia Island under Hatiya Upazila of Noakhali District in January 1995 (Khan 1996). The nearest egg-laying site of this species is the islands of Myanmar (Thorbjarnarson et al. 2000) east of the Saint Martin's Island. It should be noted that Olive Ridelys and Loggerheads are commonly misidentified (Frazier 1985).

2. Green Turtle (*Chelonia mydas*): Green Turtles are less widespread than Olive Ridelys and their nesting records are reported from Inani to Teknaf mainland beaches, Shahporir Dip, Saint Martin's, Sonadia, Kutubdia, Hatiya, and Swandip Islands between 1984 and 1994 are either rare or absent in the Sundarbans coastal beaches (cf. Rashid & Islam 2006). On several occasions, young individuals were seen from the research vessel of the Marine Fisheries Research Institute in the shallow continental shelf in south-central Bangladesh (F. Alam pers. comm. 1995 in Rashid & Islam 2006). Adult sea turtles are also trapped in fishing nets mostly during winter (December–January) which is the peak nesting period.

3. Leatherback Turtle (*Dermochelys coriacea*): Literature search indicates that there is no evidence of Leatherback nesting in Bangladesh (Mittra 1914). However,

one adult stranded dead individual was washed up after a storm on the Saint Martin's Island's beach on 11 April 1997 (Rashid & Islam 1999). Live individuals were caught in fishing gears in and around Sonadia Island and the emergence of one turtle on Saint Martin's Island was recorded in April 2001 (Islam 2002). One Leatherback Turtle (carapace length 152.4 cm, height 91.44 cm and weight 95 kg) was caught in the fishing net of local fishers in the Bakkhali River (Moheshkhali channel) on 14 July 2005 (Haroon & Rahman 2006).

4. Hawksbill Turtle (*Eretmochelys imbricata*): This is a rare visitor on the beaches of Bangladesh and was a regular visitor on the beaches of Saint Martin's Island (A. Kasem pers. comm. in Rashid & Islam 2006). One female nested and laid 56 eggs in January 1992 (Rashid 1997; Rashid & Islam 2006). An immature turtle was trapped in a fishing net in the northwestern waters of the Saint Martin's Island on 13 November 1996 (Rashid & Islam 2006). Three turtles nested on the beach of the Saint Martin's Island during 1998–99 (Islam 2002). In December 1997, January 2000 and January–March 2001, stuffed subadult specimens of Hawksbill Turtle were on sale at curio shops in Cox's Bazar and at least six specimens of sea turtles were sold in 2001 (Islam 2001).

5. Olive Ridley Turtle (*Lepidochelys olivacea*): Olive Ridley Turtles are the common nesters on the sandy beaches along the mainland coasts of Bangladesh from the Sundarbans to the Saint Martin's Island and also to the newly emerged coastal islands' beaches where human interference is low or absent. Besides those, other nesting beaches are Mandarbaria, Dubla, Egg, and Putney Islands in the Sundarbans; Swandip, Hatiya, Nijhumdip, Kutubdia, and Moheshkhali Islands, and Bhola Islands. Of all the nesting grounds of Olive Ridley Turtles in Bangladesh, the Sonadia and Saint Martin's Islands are the best known to all.

The major objectives of this work were to:

- (1) identify the available turtle species that come to lay eggs on the beach areas from the Sonadia Island to the Saint Martin's Island;
- (2) figure out the total number of turtle hatcheries (Government, INGO, NGO, Private Research Organization) are found in the beach areas from the Sonadia Island to the Saint Martin's Island;
- (3) quantify the total species-wise hatchlings found in the last 5 years;
- (4) identify the existing problems/obstacles for the turtle nesting/hatching and conservation in the beach area; and
- (5) provide possible suggestions for ex-situ and in-situ conservation.

METHODS

We (MFA, consultant; SKN, project director, Nature and Life Project; and the research assistant, Mr. Omar Shahdat) visited the beach areas from Inani to the Saint Martin's Island via the Sonadia Island to find out any signs and symptoms of laying eggs by the sea turtles during January to March 2022. We mostly worked during the day and we did not see any recent turtle crawling signs for egg-laying. We visited all turtle hatcheries in the study area and took their photographs. The result of one hatchery that was maintained by CODEC from January to May 2021 has also been incorporated into this study.

We tried to make personal contact with different NGOs to have recent (last decade) data on the sea turtle hatcheries, but it was not available to us. Problems and obstacles faced in running turtle hatcheries were pin pointed. All available published and unpublished reports on the sea turtles in Bangladesh found online were consulted and relevant information incorporated in this report. Based on field visits and my (MFA) long experience (42 years) working on wildlife in this country, threats to sea turtles on the nesting beaches and coastal waters were identified and suggested possible recommendations for in-situ and ex-situ conservation measures.

Incubation days have been compiled on monthly basis to show the relationship with monthly weather data and then correlation analysis has been done and regression lines have been prepared.

RESULTS

During our pilot survey period (January–March 2022), we found 22 hatcheries on the Saint Martin's Island to Inani Beach via the Sonadia Island, of which eight hatcheries belonged to NACOM (including one in-situ nest), 11 owned by Marine Life Alliance, two managed by CODEC (of which one was also maintained during January–May 2021) and owner of one was unknown (Image 1, Table 1, Figure 1).

Bamboo lattice fences have been used to build hatcheries in seven cases, nylon thread (medium or thin) nets used in five, four each hatcheries have aluminum and plastic wire nets, and in two cases both plastic wire nets and nylon thread net have been used. All these hatcheries used bamboo poles for supporting the fences. In one case, it is an in-situ nest nearly circular in shape (1.5 m radius with 1 m height), where a thin nylon net is used as a fence supported by poles of tree branches. The size of the hatchery ranges (length x width x height) from 4 x

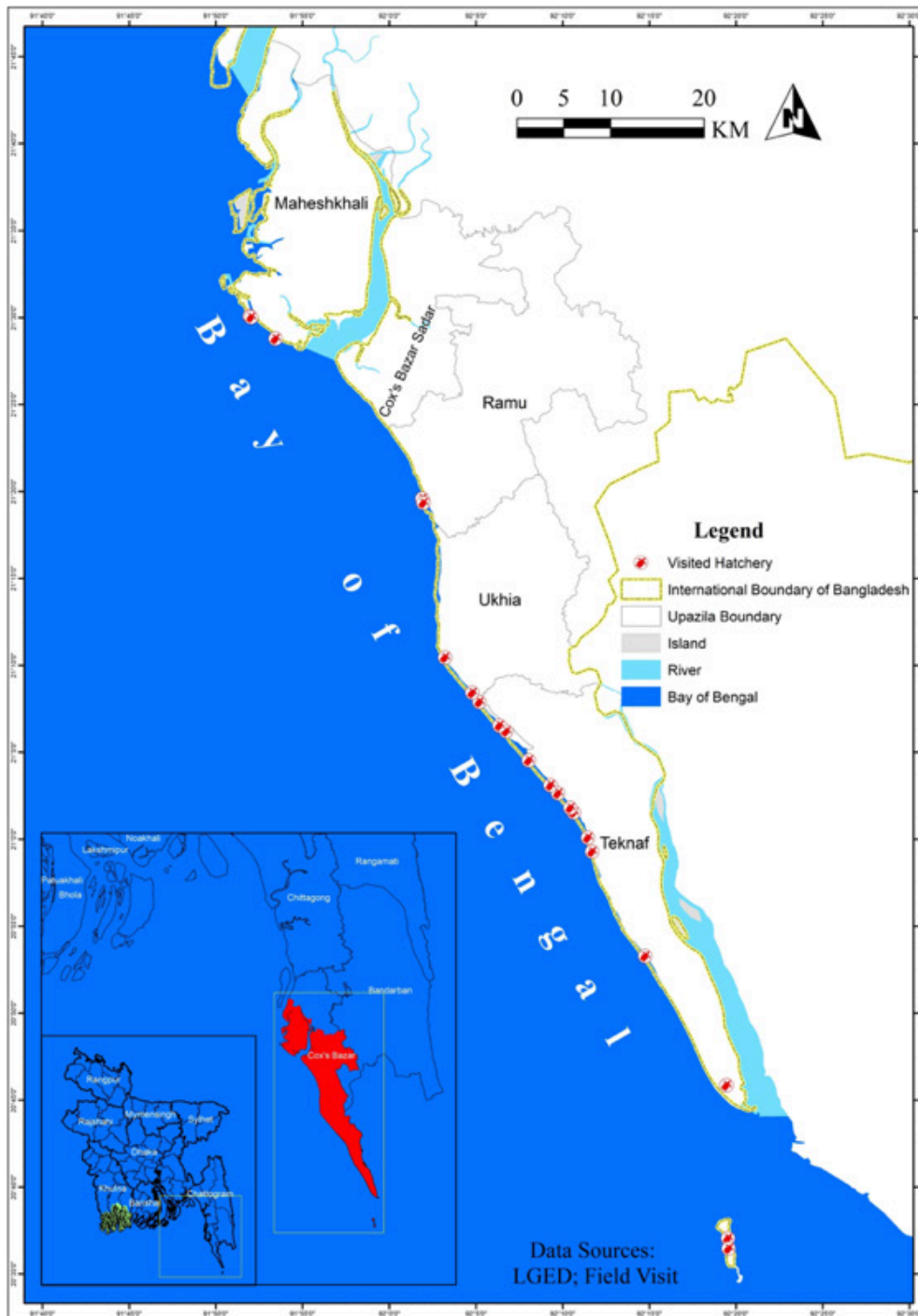


Image 1. Study area located on the Bangladesh map.

3 x 1 to 28 x 21 x 1.5 m³ (average 7.4 x 5.4 x 1.5 m³). The hatcheries are placed at 10–300 m far from the high tide water mark depending on the beach condition, except for the Shahporir Dip hatchery. This is because in Shahporir Dip, the sandy beach area is restricted by Border Guard Bangladesh. The suitable habitat is not found near the sea beach. Hence, they have selected a safe place for turtle

hatchery about 900 m far from the beach.

During the study period, eggs from 26 nests of Olive Ridley Turtles were transferred into the CODEC hatcheries and the collected eggs of each nest were put into egg pits made artificially, similar to natural nests (Table 2). The clutch size of eggs laid by each female Olive Ridley Turtle was 21–165 (average 103, n = 26). The incubation period

Table 1. List of hatcheries found from Saint Martin's to Inani during March–May 2022.

Hatchery operating Org.	Address of the Hatcheries and Hatcheries belong to	GPS (N, E)	Total
Marine Life Alliance	4. Hafiz Chara, 1 no. Ward, Teknaf UP, Teknaf*	20.887, 92.245	11
	5. Matha Bhanga Beach, Baharchara, Teknaf	20.988, 92.194	
	7. Halbunia, Shilkhali, Baharchara, Teknaf	21.025, 92.177	
	9. Choukidar Para, Shilkhali, Baharchara, Teknaf	21.043, 92.162	
	11. Shamlapur Beach, Shilkhali, Teknaf	21.075, 92.134	
	12. Supportkhali, Ukhiya	21.103, 92.112	
	14. Soyankhali, Ukhiya	21.131, 92.086	
	15. Imamer Dail, Ukhiya	21.140, 92.079	
	16. Patuatek, Inani, Ukhiya	21.174, 92.053	
	18. Pencherdip, Himchari, Cox's Bazar	21.324, 92.032	
	22. Sonadia Poshchimpara, Moheshkhali	21.501, 91.865	
Nature Conservation Management (NACOM)	1. Marine Park, Golachipa, Saint Martin's, Teknaf	20.617, 92.325	8
	2. Shilboniar Ghula Beach, Uttarpara, Saint Martin's, Teknaf	20.607, 92.326	
	3. Majerpara Primary School, Sha-porir Dip, Teknaf	20.764, 92.324	
	8. Bainnapara, Shilkhali, Baharchara, Teknaf	21.030, 92.173	
	17. Pencherdip, Himchari, Cox's Bazar (In-situ)	21.326, 92.031	
	19. Pencherd-p, Himchari, Cox's Bazar	21.322, 92.032	
	20. Sonadia Purbopara, Moheshkhali	21.479, 91.890	
	21. Sonadia Poshchimpara, Moheshkhali	21.500, 91.867	
CODEC	6. Hazom Para, Shilkhali, Baharchara, Teknaf	21.001, 92.190	2
	10. Uttar Skhilkhali, Baharchara, Teknaf	21.051, 92.154	
Unknown	13. Motherbunia, Baharchara, Teknaf	21.108, 92.105	1

* Serial number of hatcheries was made from Saint Martin's Island to Inani.

was 45–75 days (average 53 days, n = 1,612 eggs). The eggs hatched in January took a higher incubation period and subsequently the period went down and it was the lowest in May. This is because of air temperature that means in higher temperatures the incubation period was less than the lower temperature (Table 3, Figures 2–7). The correlation and regression of incubation period (in days) data with the weather data (monthly mean air temperature, relative humidity and total rainfall) have been calculated. The results show high significance between monthly incubation days and monthly total rainfall in 2022 ($r = 0.999$, $df = 1$, $P < 0.001$) and the others have moderate degrees of significance ($r = 0.560$ to 0.957 , $df = 1$, $P > 0.05$) because of meagre data (three months). It should be mentioned here that at least five sets of data are required for showing good correlation and regression statistics.

In total 2,943 eggs of 26 gravid females Olive Ridley Sea Turtles were conserved in the hatcheries of CODEC, of which 1,346 eggs were from 12 females at Hazom Para Hatchery and 1,597 eggs from 14 females at Shilkhali

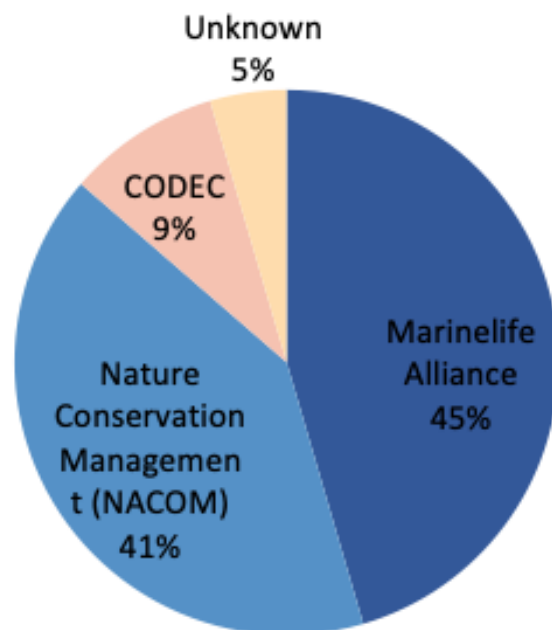


Figure 1. Hatcheries operating in Cox's Bazar, Sonadia ECA and Teknaf Peninsula.

Hatchery (Table 2). Overall, 1,612 (i.e., 54.77%) healthy hatchlings were released into the Bay of Bengal, of which 839 (i.e., 52.05%) were from Hazom Para Hatchery and 773 (i.e., 47.95%) from the Shilkhali Hatchery (Table 2).

Threats to Nesting Beaches

The following inland threats to marine turtles in Bangladesh were identified through interviewing local people, hatchery caretakers, and from our own experiences:

(1) disorientation caused by flashing lights on the beachside and man-made obstructions on the nesting beaches, particularly on the Saint Martin's Island and also other beaches along the Marine Drive Road, and some beach areas where hotels, motels, and rest houses have been established, and have crowded visitors;

(2) nest and hatchling predation by feral dogs and natural predators such as jackals, mongooses, monitor lizards, and predatory birds;

(3) physical alteration of beach infrastructure, e.g., Marine Drive Road has engulfed some areas of the long beach and created connectivity roads, making access to people that creates crowd and disturbed the ideal situation of the beach;

(4) an unusual increase in number of vehicles on Marine Drive Road, flashing lights and blowing of horns that disturb nesting facilities of the sea turtles in the beach areas;

(5) turtles getting entangled in fishing net; fishermen kill turtles when entangled in their nets, and use of beaches for drying fish and mending fishing nets;

(6) encloser nets ('gher-jal') prevent gravid females from reaching the beach, and/or they get entangled in the net;

(7) increased mechanized boats disturbing gravid females from reaching the beaches;

(8) boats anchored on the inter-tidal zone as well as in the water use flashlights which create barriers for nesting of the sea turtles as well as prevent gravid females to come onto the beach;

(9) beach seine fishing either kills or obstructs the movement of turtles;

(10) disturbances during shrimp-fry collection;

(11) alteration of the nesting beaches by the Jhao (*Casuarina equisetifolia*) plantation and new plantations have destroyed some nesting ground of the turtles. Bangladesh Forest Department plants Jhao trees there because newly emerged beach areas will be occupied by the people for their own purpose;

(12) egg poaching, earlier 90–95% of nests were exploited by humans- but now it is at a minimum;

(13) flooding nests by the high tide; tidal waves and cyclones flood the egg laying areas and consequently eggs are damaged;

(14) nest losses due to beach erosion is not so significant;

(15) flashing light on the beach and human (tourists) presence, especially on the Saint Martin's Island and other areas; and

(16) often poaching of eggs by the miscreants.

Conservation measures taken

The following initiatives have been taken by the Government of Bangladesh, and NGOs and international organisations for the conservation and management of sea turtles (Table 6).

So far, data could be collected from different sources on the conservation of eggs of turtles and hatching them into the hatcheries and releasing the hatchlings into the Bay of Bengal have jotted in Table 7.

DISCUSSION

The reasons for the lower rate of healthy hatchlings were due to: (i) 138 eggs were rescued from the miscreants and conserved at Hazom Para Hatchery did not hatch; (ii) the egg-laying date of these 138 eggs was unknown and was not preserved properly, that is why, not a single egg hatched; (iii) on the other hand, miscreants destroyed many eggs of seven clutches at Shilkhali Hatchery; and (iv) consequently and in addition, some dead and deformed hatchlings emerged in both hatcheries.

During 1996–98, 29 sea turtles (both sexes and subadults) were found dead on the beach of Saint Martin's Island, of which 19 individuals died due to fishing as suspected (Islam 2002). In 2000–01, more than 51 dead Olive Ridley Turtles were washed ashore (Islam 2002). The south and south-west offshore zones from the Saint Martin's Island are in deep sea, and these are mainly foraging zone of sea turtles and are also used by large mechanized fishing boats. So, dead turtles float for some days and are finally washed ashore on the beaches of the Saint Martin's and other coasts of Bangladesh (Islam et al. 1999).

According to local elders, nesting was common on most of the beaches 10–15 years ago. Rashid (1986) recorded 35 Green Turtles in one-night nesting on one beach. A maximum of seven Olive Ridley females were observed nesting in a single night in this study.

Although there are no records of Loggerheads nesting on the Saint Martin's Island, it is possible that they nested

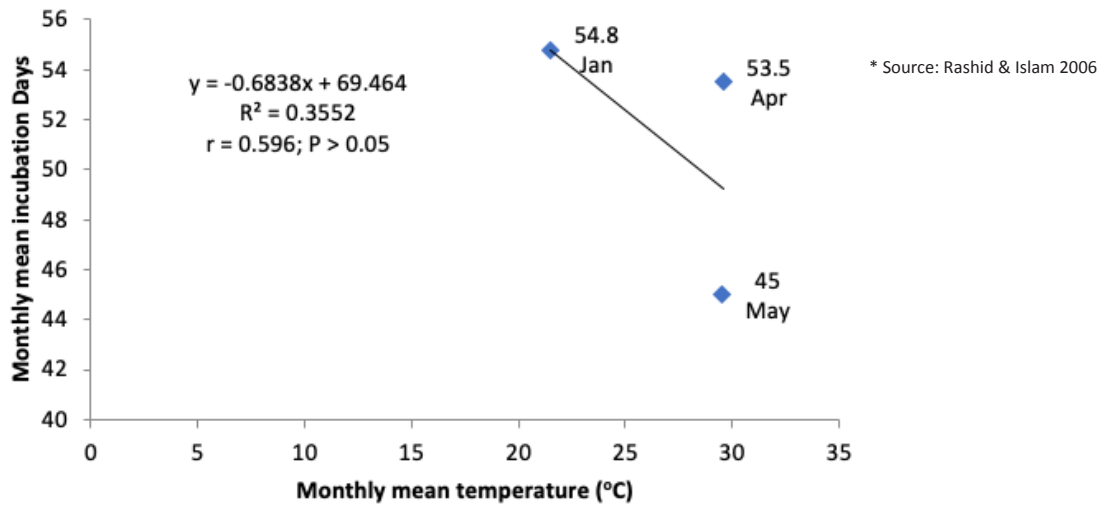


Figure 2. Relationship between monthly mean incubation days of eggs of Olive Ridley Turtle and monthly mean temperature during 2022.

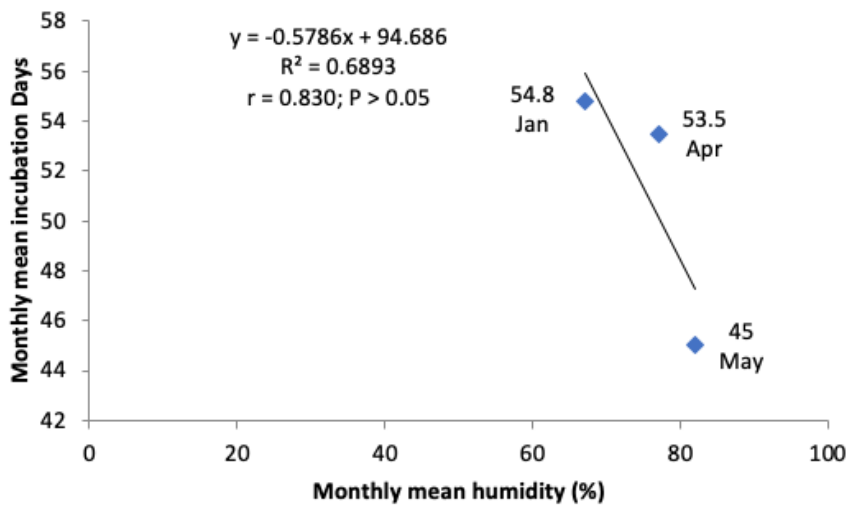


Figure 3. Relationship between monthly mean incubation days of eggs of Olive Ridley Turtle and monthly mean relative humidity during 2022.

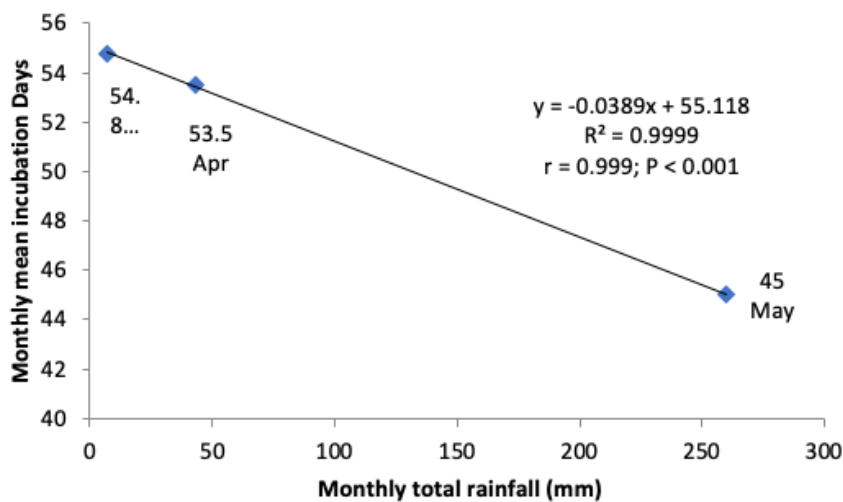


Figure 4. Relationship between monthly mean incubation days of eggs of Olive Ridley Turtle and monthly total rainfall during 2022.

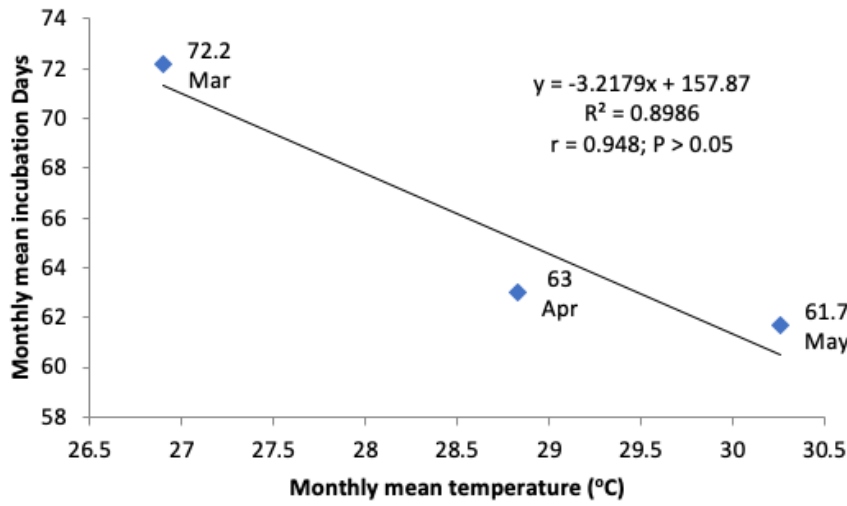


Figure 5. Relationship between monthly mean incubation days of eggs of Olive Ridley Turtle and monthly mean temperature during 2021.

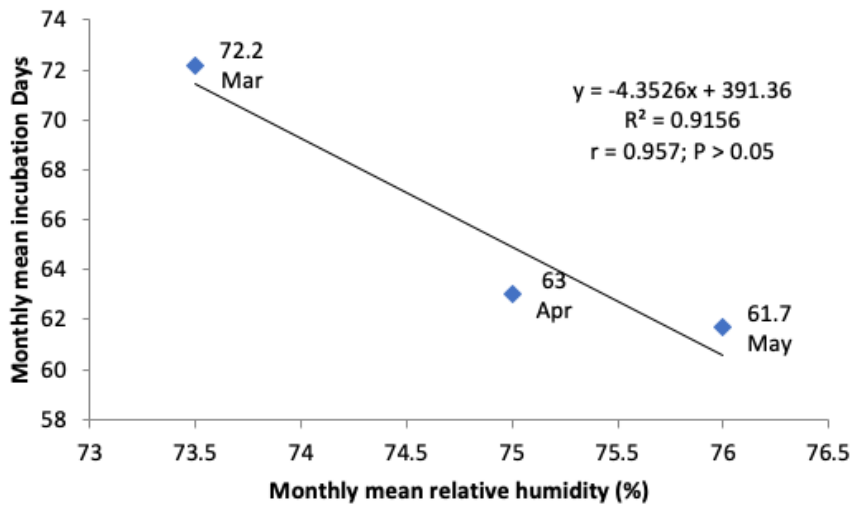


Figure 6. Relationship between monthly mean incubation days of eggs of Olive Ridley Turtle and monthly mean relative humidity during 2021.

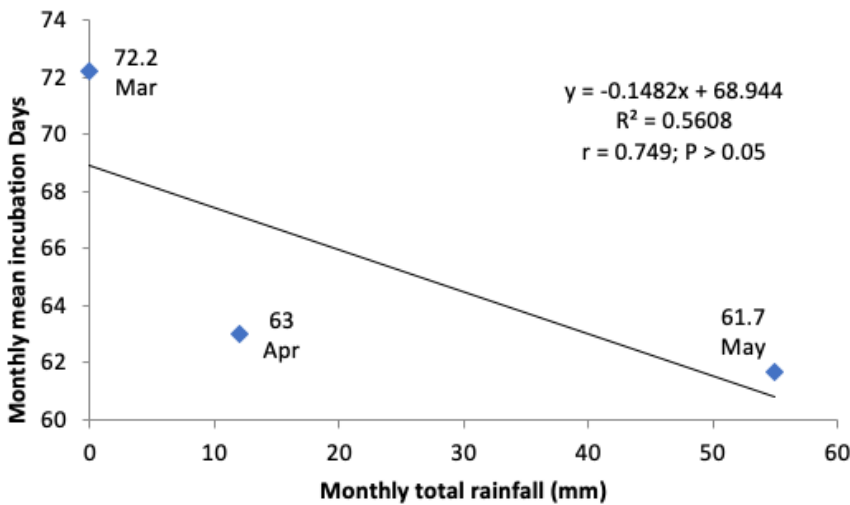


Figure 7. Relationship between monthly mean incubation days of eggs of Olive Ridley Turtle and the monthly total rainfall during 2021.

Table 2. Hatchery of CODEC pilot project in Cox's Bazar of Bangladesh during 2021–2022.

A. Hazom Para, Baharchara, Teknaf

Egg collection date	Egg collection time	No. of eggs	No. of nests	No. of egg pits in the hatchery	Hatching date	Incubation days (no. of hatchlings)	No. of healthy hatchlings	No. of dead/deformed hatchlings	Healthy hatchling rate (%)	Remarks
13.01.21	2.20 am	142	1	7	23.03.21–29.03.21	69 (09), 70 (10), 71 (05), 73 (14), 74 (08), 75 (11)	57	85	40.14	Cold temperature
28.01.21	8.00 pm	21	1	1	01.04.21	63 (03)	03	18	14.29	-do-
11.03.21	3.30 am	105	1	6	12.05.21	62 (77)	77	28	73.33	
11.03.21	9.00 pm	90	1	4	12.05.21	62 (68)	68	22	75.56	
13.03.21	3.40 am	149	1	6	12.05.21–15.05.21	60 (86), 63 (28)	114	35	76.51	
13.03.21	9.00 pm	32	1	1	16.05.21	64 (25)	25	07	78	
Sub-total		539	6	25			344	195	43.31	
14.11.21	11.20 pm	132	1	5	05.01.22–08.01.22	52 (01), 52 (02), 55 (34)	37	95	28.03	Cold temperature
20.02.22	02.00 am	149	1	6	13.04.22–22.04.22	54 (05), 54 (09), 55 (78), 58 (01), 63 (26)	119	30	79.86	
25.02.22	02.00 am	138	1	5	-	00	00	138	00	Escaped eggs from the miscreants. How many days ago the eggs were collected was not known.
03.03.22	04.00 pm	143	1	6	22.04.22–24.04.22	49 (11), 50 (80), 51 (28)	119	24	83.21	
04.03.22	3.40 am	111	1	4	24.04.22–27.04.22	50 (62), 51 (16), 53 (20)	98	13	88.28	
09.03.22	02.30 am	134	1	6	27.04.22	48 (122)	122	12	91.04	
Sub-total		807	6	32	-	-	495	312	-	
Total		1346	12	57	-	-	839	507	62.33	
Average						56.55 ± 6.99				

B. Uttar Shilkhali, Baharchara, Teknaf

Egg collection date	Egg collection time	No. of eggs	No. of nests	No. of egg pits in the hatchery	Hatching date	Incubation days (no. of hatchlings)	Total no. of healthy hatchlings	No. of dead/deformed hatchlings	Healthy hatchling rate (%)	Remarks
29.01.22	08:00 pm	124	1	5	07.04.22–13.04.22	68 (24), 71 (14), 73 (07), 74 (28)	73	51	58.87	Miscreants destroyed eggs in the hatchery.
18.02.22	02.30 am	121	1	5	13.04.22	56 (50)	50	71	41.32	-do-
21.02.22	01.00 am	107	1	4	15.04.22	54 (39),	39	68	36.44	-do-
21.02.22	08:00 pm	102	1	4	15.04.22–20.04.22	54 (22), 59 (11)	33	69	32.35	-do-
04.03.22	11.00 pm	141	1	6	21.04.22–23.04.22	47 (18), 48 (14), 49 (17)	49	92	34.75	-do-
05.03.22	9:30 pm	105	1	4	24.04.22–25.04.22	49 (31), 50 (16),	47	58	44.76	-do-
05.03.22	11:40 pm	131	1	5	26.04.22–27.04.22	51 (20), 52 (25)	45	86	34.35	-do-
26.03.22	03.00 am	107	1	4	11.05.22	45 (60)	60	47	56.07	
26.03.22	03.20 am	85	1	3	11.05.22	45 (48)	48	37	56.47	
26.03.22	04.00 am	92	1	4	11.05.22	45 (52)	52	40	56.52	
26.03.22	05.15 am	81	1	4	11.05.22	45 (46)	46	35	56.79	
26.03.22	06:00 am	165	1	6	11.05.22	45 (94)	94	71	56.96	
27.03.22	04:30 am	108	1	4	11.05.22	45 (50)	50	58	46.29	
27.03.22	04:30 am	128	1	5	12.05.22	45 (87)	87	41	67.96	
Total		1597	14	64			773	824	48.40	
Grand Total		2943	26	96			1612	1331	54.77	

Table 3. Weather Data from Teknaf Weather Station, Cox' Bazar and incubation days of eggs (- = No data)

Incubation data plus weather data of 2022.

Month	Mini Temp	Maxi Temp	Average Temp	Mini RH	Maxi RH	Average RH	Total Rainfall	Incubation Days
Jan '22	14.77	28.22	21.50	43	91	67.0	07	54.8
Feb	16.14	29.89	23.02	56	87	71.5	12	-
Mar	21.26	33.27	27.27	44	85	64.5	00	-
Apr	25.60	33.53	29.57	61	93	77.0	43	53.5
May	25.70	33.30	29.50	69	95	82.0	260	45.0

Incubation data plus weather data of 2021

Month	Mini Temp	Maxi Temp	Average Temp	Mini RH	Maxi RH	Average RH	Total Rainfall	Incubation Days
Mar	21.47	32.33	26.90	58	89	73.5	00	72.2
Apr	24.00	33.65	28.83	61	89	75.0	12	63.0
May	26.34	34.18	30.26	62	90	76	55	61.7

Table 4. Number of sea turtles that laid eggs during 1996–2003 and 2005–2010 on Bangladesh beaches*.

Year	Olive Ridley Turtle	Green Turtle	Hawksbill Turtle	Leatherback Turtle
1984–94 ¹	287**	31	1	0
1996–97	83	4	0	0
1997–98	124	5	0	0
1998–99 ¹	47	9	3	0
1999–2000	86	6	0	0
2000–01	137	4	0	1 (?)
2001–02	73	22	0	0
2002–03	85	3	0	0
Subtotal	635	53	3	1 (?)
2005–06	155	0	-	-
2006–07	142	1	-	-
2007–08	162	3	-	-
2008–09	151	3	-	-
2009–10	158	2	-	-
Subtotal	768	10	-	-
Total	1,403	63	3	1 (?)

* Sources: Islam 2002, MoEF No date, CWBMP 2008, Islam et al. 2011, NACOM 2010. ¹ Rashid & Islam 2006, ** including 204 from Saint Martin's Island in 1996–97, excluded from the total.

on the island in years past (Rashid & Islam 2006).

A total of 27 adult and sub-adult 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

Table 5. Number of marine turtles affected by various human activities at the Saint Martin's Island from October 1996 to February 2003*.

Nature of Threats/Disturbances	Number of turtles
1. Predation by dogs	20
2. Nests destroyed by dogs	7
3. Unsuccessful nesting due to rocks	18
4. Females with flippers cut	9
5. Unsuccessful due to tourist disturbances	13
6. Females with injury on the carapace	8
7. Females with tumours on flippers	2
Total	77

washed ashore during the 2000–01 season. In 1996 the Marine Fisheries Research Institute (MFRI) conducted fishing-related sea turtle mortality and reported that turtle deaths were not significant (Rashid 1997). However, that report probably underestimated the potential impact of fishing, as turtles continue to be found dead along the shoreline.

Since 1996, success has been gained through several awareness programmes, which have helped some of the traditional fishermen view sea turtles as friendly animals instead of being harmful to their fishing activity. Nevertheless, more work is needed, as most entangled turtles are still found dead. In addition, in Bangladesh TEDs (Turtle excluder devices) are not used on shrimping boats and the government is taking no initiative to impose any regulations regarding TED use. Another important factor is the submersion time and the depth at which other types of nets are set, which can affect turtle mortality.

Observations of 10 persons including one local from

Table 6. Initiatives taken for the conservation and management of sea turtles*.

Organization	Major activities
Government of Bangladesh	1. Declaration of Ecologically Critical Areas
	2. Sustainable resource management
	3. Establishment of ecotourism in that area
Non-Government Organizations (NGOs) and International Organization	1. School education programme
	2. Community awareness programme
	3. Hatchery management
	4. Establishment of education and research center
	5. Establishment of hatcheries
	6. Supporting ecotourism activity
	7. Ex-situ conservation through hatcheries
	8. Encouraging fishermen to use TEDs in gear

* Source: Hossain et al. 2013.

1984 to 2003 on sea turtle nesting places were reported by Rashid & Islam (2006) from 14 different spots of Bangladesh, of which Olive Ridelys nested in 13 spots, Green Turtles in seven spots and Hawksbills in one spot (the Saint Martin's Island). They recorded 287 Olive Ridley Turtle nests (including 204 at the St. Martin's Island in 1996–97), 31 Green Turtles and one Hawksbill Turtle were reported by locals from the St. Martin's Island plus eggshells were seen in Egg Island and Mandarbaria of the Sundarbans (Table 4).

From October 1996 to February 2003 (Rashid & Islam 2006), 77 turtles were affected by various human activities on the Saint Martin's Island, of which dogs (as first brought by the human on the Island) were the highest disturbing animals (predated eggs and destroyed nests), the second highest was unsuccessful nesting due to rocks and the third highest was unsuccessful nesting due to tourist disturbances (Table 5).

Furthermore, with the increase of local and international tourists in recent years especially on the Saint Martin's Island, the Bangladesh Parjaton Corporation (National Tourism Authority) started building hotels, motels, and other recreation centres in many areas along the coast, Inani and Cox's Bazar in particular. Some private enterprises including locals have constructed motels in the areas, which are identified as sea turtles' nesting beaches (Inani and the Saint Martin's Island), which is a clear violation of the country's law.

Increased fishing boats have increased oil spills, pollution and disposal of solid domestic and machinery wastes. The beaches are being used for drying fish and mending fishing nets during sea turtles' nesting period.

Table 7. Eggs conserved, and hatchlings released between 2000–2022.

Year	Egg conserved	Hatchling released	Sources
2000–01	3,850	2,700	MoEF (No date)
2001–02	7,600	5,680	MoEF (No date)
Total	11,450	8,380	
2007–2010	28,642	26,408	NACOM et al. (2010)
2021–22	2,943	1,612	CODEC (This study)
Grand Total	43,035	36,400	

Increased human activities and beach lighting (especially on the Saint Martin's Island) have also increased that disturb nesting females and disorienting hatchlings. The Bangladesh Forest Department under the Ministry of Environment, Forest and Climate Change is the sole authority for the protection, conservation, and management of all wildlife in the country.

Different NGOs are working on conservation aspects of the sea turtles and mostly collecting eggs and hatching them into their hatcheries and releasing them into the Bay of Bengal. They have also printed booklets and posters; hoisted festoons and banners; published a few papers; organised seminars, rallies and workshops for education and awareness of local people. These actions are encouraging, but it would be better if all these works on sea turtles in the country were integrated.

Very recently (in 2024), one threat has come for the mother turtles of our beaches, which was injuries caused by the propellor of the cruise ship ferrying tourists from Inani to Saint Martin Island during the winter season.

CONCLUSION

Marine turtles face population decline in many places of the world and its population is severely depleted in Bangladesh due to various anthropogenic threats. Reports of all organizations working on sea turtles are submitting reports to the respective donors are not accessible and open access. Community-based conservation would be the best idea for conserving these unique creatures of the oceanic planet. It would be better if all works on the sea turtles were integrated.

RECOMMENDATIONS

The following recommendations have been suggested for the conservation of sea turtles in Bangladesh:

1. Take meaningful steps to save sea turtle nesting beaches from human interference.
2. Awareness building, education, research on population biology, conservation of nests and nest-building beach areas.
3. Ecological Critical Area Rules 2016 and Protected Area Management Rules 2017, and regulations should properly be implemented.
4. Community-based conservation would be the best way to save these unique creatures of the oceanic planet.
5. As fishermen are responsible for the death of sea turtles, so using TED in fishing boats can be an effective tool for reducing the mortality of turtles.
6. The number of hatcheries should be established like 1-Hatchery/2 km of the sandy beach.
7. Hatchery management should be improved scientifically; and if all works on sea turtles were integrated this could bring better outcomes.

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