

Status, Exploitation, and Conservation of Freshwater Turtles and Tortoises in Chittagong Hill Tracts, Bangladesh

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ABSTRACT. – The Chittagong Hill Tracts (CHT) comprises an extensive expanse of hills located in the far southeast of Bangladesh, bordered by India and Myanmar. CHT covers more than 10% of the total land area of Bangladesh and lies within the Indo-Burma Biodiversity Hotspot. Because of political instability and the generally remote nature of this region, it remains as the least explored area in Bangladesh. Very little is known about the chelonian fauna of CHT. We investigated the occurrence, conservation status, and exploitation of chelonians in the southern part of CHT, in Sangu–Matamuhuri Reserve Forest and adjacent areas, from 2011 to 2015. During our survey, we obtained specimen-based records of 8 species: Arakan Forest Turtle (*Heosemys depressa*), Asian Brown Tortoise (*Manouria emys*), Keeled Box Turtle (*Cuora mouhotii*), Elongated Tortoise (*Indotestudo elongata*), Sylhet Roofed Turtle¹ (*Pangshura sylhetensis*), Asian Leaf Turtle (*Cyclemys* spp.), Malayan Softshell Turtle (*Amyda ornata*), and Indian Flapshell Turtle (*Lissemys punctata*). The critically endangered *H. depressa* and the endangered *C. mouhotii* are recorded from Bangladesh for the first time, and the endangered *P. sylhetensis* is recorded from CHT for the first time. We documented 2 isolated populations of *M. emys* in the Sangu-Matamuhuri Reserve Forest. We did not find any evidence of large-scale, commercial turtle harvesting in our survey area. Subsistence hunting is probably the most immediate threat to chelonians in this region. With no intervention, subsistence hunting will likely cause large-scale local extirpation of extant, low-density populations. Considering the species diversity and the opportunities for long-term conservation, CHT may be considered to be a priority site for conservation of these species in danger. To mitigate turtle hunting, we recommend a bottom-up, community-based conservation model, the foundation of which should be based on trust, traditional ecological knowledge, community participation, and ecological science.

KEY WORDS. – *Heosemys depressa*; *Cuora mouhotii*; subsistence hunting; hunting mitigation; Chittagong Hill Tracts; Bangladesh

To date, 23 freshwater turtle and tortoise species have been recorded from Bangladesh (Rashid and Swingland 1997; Rashid and Khan 2000; Khan 2008, 2010; Kabir et al. 2009). Most information on the non-marine chelonian fauna in Bangladesh is based on the market surveys of aquatic species (Fugler 1984; Barua and Islam 1986; Das 1990; Rashid and Swingland 1990; Rashid and Khan 2000; Rashid and Rahman 2014), mostly from areas around the Ganges–Brahmaputra–Meghna floodplains and the wetlands of northeastern Bangladesh. Areas such as the mixed-evergreen forest of the northeast region and the southeast region of Bangladesh have been poorly surveyed (Khan 2008, 2012), and in particular, little is known about the turtle fauna of the Chittagong Hill Tracts (CHT) of Bangladesh. The CHT comprises an extensive expanse of hills located in southeastern Bangladesh and falls within the Indo-Burma Biodiversity Hotspot (Myers et al. 2000), which harbors many globally threatened chelonian species. Because of political instability and the

remote nature of this region, it remains the least explored area in Bangladesh (Khan 2012). The CHT covers approximately 10% of the total land area of Bangladesh. Kabir et al. (2009) mention the occurrence of *Manouria emys*, *Indotestudo elongata*, *Cyclemys* spp., *Pangshura sylhetensis*, and *Cyclemys amboinensis* in the CHT region based on anecdotal reports.

Because of restrictions of movement, to our knowledge, no comprehensive surveys have been conducted to date in the CHT region. In particular, little is known about chelonian distribution, conservation status, and the extent of their exploitation. In an effort to shed light on these questions, we conducted field surveys of the chelonian fauna in CHT from 2011 to 2015, with a focus mainly on terrestrial and semiterrestrial species. Herein, we report the results of our surveys and assess the conservation status and exploitation level of the aforementioned testudines, report the occurrence of *Heosemys depressa* and *Cuora mouhotii* for the first time in Bangladesh, and make recommendations for the conservation of its chelonians.

¹ The type specimen is from Sylhet, Bangladesh, hence the name *sylhetensis*. We prefer the name Sylhet Roofed Turtle.

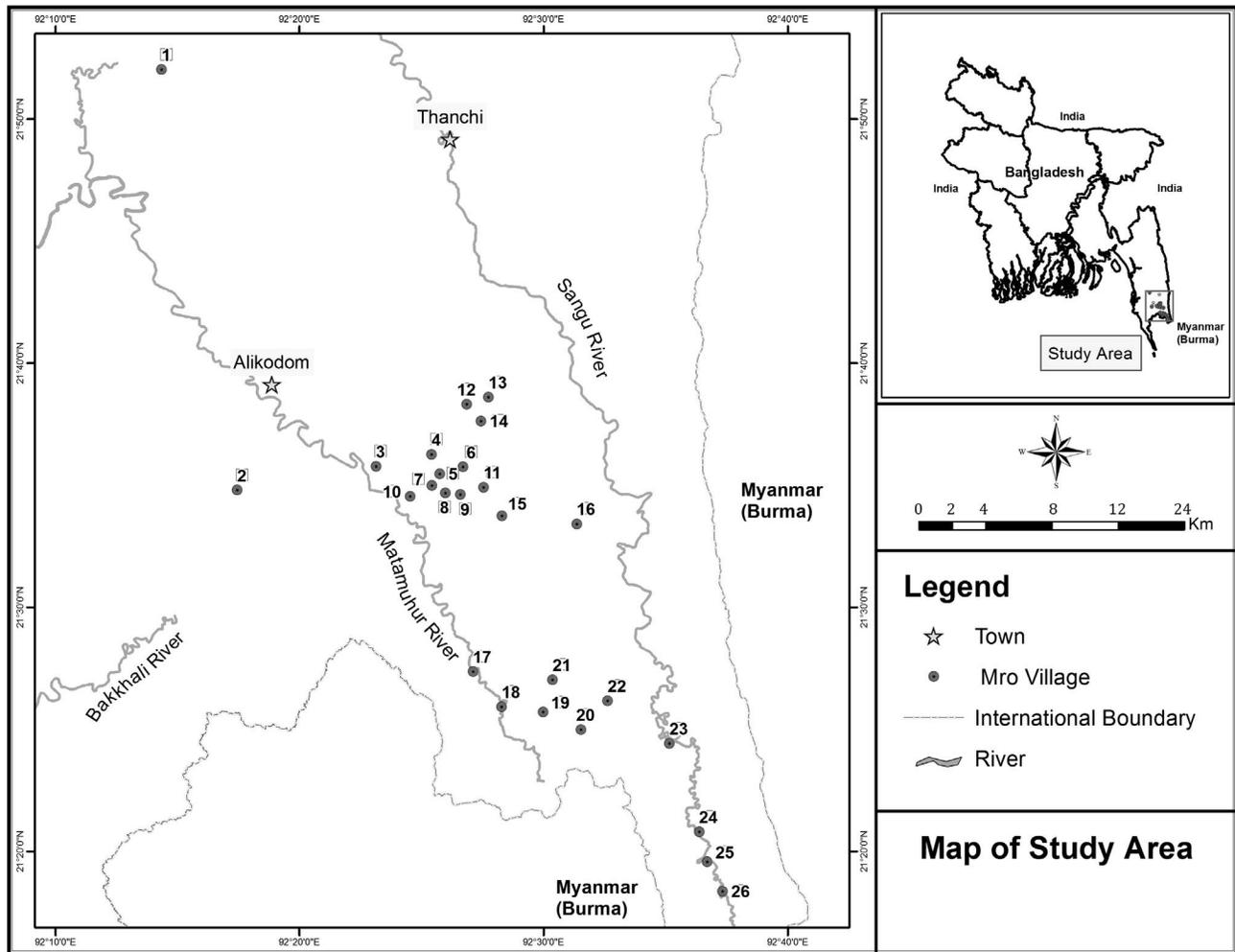


Figure 1. Map of extreme southeastern Bangladesh showing the Mro villages surveyed and other landmarks mentioned in this article.

METHODS

Survey Area. — The CHT is an extensive, hilly area that is part of the 1800-km mountain range that runs from the eastern Himalayas in China to western Myanmar. The CHT makes up the region of Bangladesh bordered by Myanmar to the southeast and by India to the north (Tripura) and east (Mizoram) (Fig. 1). The hill range is part of the Arakan-Yoma mountain range that is oriented north to south in parallel ridges incised by deep gorges and with topography and vegetation very similar to that of western Myanmar (Platt et al. 2003, 2010). With an area of 13,295 km², it comprises 10% of the total land area of Bangladesh (Gain 2000). CHT is divided into 3 administrative districts, namely Khagrachari, Rangamati, and Bandarban. We focused our survey effort in the southern part of CHT in Lama, Naikhongchari, Alikodom, and Thanchi subdistricts within the Bandarban District. The Sangu and the Matamuhuri are the 2 major rivers of Bandarban District that flow parallel from south to north. There are 3 major hill ranges in this area: 1) Mowdok

Hills, at the east of Sangu River on the Bangladesh–Myanmar border; 2) Chimbook Hills, between the Sangu and Matamuhuri rivers; and 3) Mirinja Hills, west of the Matamuhuri River. The area south of Alikodom and Thanchi—along the Sangu and Matamuhuri rivers—is the Sangu–Matamuhuri Reserve Forest of the Forest Department of Bangladesh. Tribal villages are located within this protected area. Because of the remote nature of the area, the Forest Department of Bangladesh exercises little to no jurisdiction here. Much of the CHT, until recently, consisted of old-growth, semievergreen, and bamboo forests. Most of these forests, by rotation, have been cleared, primarily by shifting agriculture practices and by logging (Rasul 2007; Mahony and Reza 2008; Khan 2012). Patches of old-growth forest remain in the extreme southeast of CHT, near the Bangladesh–Myanmar border. Within the agriculture landscape, patches of riparian forest have been left by the ethnic people to retain water and to supply timber products for their household use.

The climate of the region is tropical with monsoon and with a mean annual rainfall of 2540 mm. The region

is sparsely populated, with ethnic groups such as the Chakma, Marma, Tripura, and Mro of Tibeto-Burmese origin (Lewin 1869). The southern part of Bandarban district is inhabited predominantly by the Mro people. Each Mro village typically consists of 13 to 15 families; the largest village we observed in our survey area consisted of 25 families. Villages are some 0.8 km to 5 km apart. These people grow rice on hills under a shifting agriculture system known as *jhum*. Vegetation is cleared, burned, and cultivated for 1 yr before being left fallow for 2–10 yrs—depending on the land available—after which farming is moved to a new area, and then the same pattern is repeated.

Data Collection. — We visited our survey site 7 times from December 2011 to January 2015. Each visit was of 3 to 10 d. We conducted fieldwork on a total of 49 d during this period. We visited 26 Mro tribal villages (Table 1; Fig. 1) along our route and conducted semi-structured and open-ended interviews and focus group discussions to gather information on the occurrence, natural history, and exploitation of turtles and tortoises in the area. Because of a low detection rate, forest-dwelling turtles can often be difficult to find; therefore, this interview technique is widely used in southeast Asia to gather information on them (Stuart et al. 2011; Ly et al. 2013; Platt et al. 2013, 2014). To establish rapport with the villagers, each village was visited at least twice during the survey, and we stayed in each village for at least one night. With few exceptions, we conducted interviews at night when the villagers had returned from the field. Our interviews were more conversational in nature, rather than a rigid question–answer session, following the guidelines of Huntington (2000). Interviews were conducted by one of the authors (P.M.) in the Mro language and later translated into English. We asked the villagers to show us any live chelonians or shells they possessed. We collected external morphological data for each individual specimen obtained, which will be published in a separate article. During the day, we also asked the villagers to show us the areas where they had found the turtles. In this article, we report on the species found as live specimens or shells and in hunters' possession.

RESULTS AND DISCUSSION

During the survey we documented the occurrence of 8 species of chelonians: *H. depressa*, *C. mouhotii*, *M. emys*, *I. elongata*, *Cyclemys* spp., *Lissemys punctata*, *P. sylhetensis*, and *Amyda ornata*. We did not observe any shells or live specimens of *Cuora amboinensis* during our survey, although it is known to occur in Bandarban District and Rangamati District (M. Khan, *pers. comm.*, January 2015). *Melanochelys tricarnata* and *Melanochelys trijuga* are recorded from the adjacent Cox's Bazaar District (Khan 1982)—located approximately 30 km southwest of our survey area—and may occur in our survey area as well. *Nilssonina nigricans* and *Nilssonina*

Table 1. Geographic coordinates and elevation of the villages mentioned in the text.

Village no.	Latitude	Longitude	Elevation (m)
1	21°52'1.48"N	92°14'20.73"E	93
2	21°34'47.47"N	92°17'27.24"E	283
3	21°35'45.90"N	92°23'8.10"E	130
4	21°36'15.48"N	92°25'24.72"E	99
5	21°35'27.59"N	92°25'44.73"E	155
6	21°35'45.44"N	92°26'42.36"E	246
7	21°34'58.82"N	92°25'25.48"E	172
8	21°34'40.96"N	92°25'59.18"E	193
9	21°34'36.92"N	92°26'35.82"E	220
10	21°34'32.00"N	92°24'32.60"E	213
11	21°34'54.19"N	92°27'32.18"E	211
12	21°38'18.73"N	92°25'51.50"E	333
13	21°38'35.89"N	92°27'44.68"E	607
14	21°37'37.52"N	92°27'25.89"E	417
15	21°33'44.16"N	92°28'17.64"E	175
16	21°33'24.39"N	92°31'21.41"E	700
17	21°27'21.31"N	92°27'6.61"E	164
18	21°25'54.59"N	92°28'16.86"E	103
19	21°25'41.72"N	92°29'59.12"E	283
20	21°24'58.58"N	92°31'32.18"E	193
21	21°27'1.26"N	92°30'22.02"E	226
22	21°26'9.72"N	92°32'37.80"E	550
23	21°24'24.44"N	92°35'9.64"E	121
24	21°20'47.72"N	92°36'22.68"E	158
25	21°19'33.67"N	92°36'42.48"E	150
26	21°18'21.31"N	92°37'20.17"E	145

hurum are known to occur in the northern part of CHT (Liebing et al. 2012), and they also may occur in the Sangu and Matamuhuri rivers, within our survey area.

Heosemys depressa

In 2014, we found 1 live hatchling, 1 live juvenile, 2 live adults, and 10 shells of *H. depressa* in 7 villages (no. 2, 9, 12, 13, 14, 17, and 19; see Fig. 1). According to villagers, *H. depressa* also occurs in the forest upstream of Sangu River (villages no. 23, 24, 25, and 26; see Fig. 1). This indicates that it is highly unlikely that these individuals were smuggled in from Myanmar and surrounding regions but rather occurs locally in Bangladesh. The villagers reported that they find *H. depressa* in primary and secondary degraded forest. Villagers considered *H. depressa* as the second-most common terrestrial turtle in the area, after *I. elongata*. In one particular village, the inhabitants failed to distinguish between *I. elongata* and *H. depressa*. The local name for *H. depressa* is *Lip-loy*. *Heosemys depressa* is listed by IUCN as Critically Endangered; these are the first records of the species from Bangladesh. Previously it was thought to be endemic to Rakhine State of Myanmar (Platt et al. 2003, 2010). Platt et al. (2014) have recently discovered a population of *H. depressa* in Kyauk Pan Taung Wildlife Sanctuary, Myanmar, located approximately 35 km east of our survey area. Discovery of this species in Bangladesh has opened new possibilities for its long-term conservation from global perspective. Detailed

information on its habitat and morphometrics will be published elsewhere.

Cuora mouhotii

We found 2 shells of freshly killed *C. mouhotii* in villages no. 2 and 12 in 2011 and 2013 and 2 live specimens in village no. 19 in 2014 (see Fig. 1). All had been found in degraded primary forest. Inhabitants of villages no. 23, 24, 25, and 26 also reported its presence in their areas. This species is locally known as *Slo-lip* and is considered by residents to be the rarest turtle in the area. The majority of the villagers we interviewed had never seen *C. mouhotii*. It is listed by IUCN as Endangered, and this is the first record of it from Bangladesh. Also, we are aware of a *C. mouhotii* specimen found in Kassalong Reserve Forest, in the Khagrachori District of the northern Chittagong Hill Tracts bordering Tripura and Mizoram, India (R. Halder, *pers. comm.*, May 2014). It indicates that *C. mouhotii* probably occurs in distinct populations throughout the Chittagong Hill Tracts.

Manouria emys

Manouria emys is listed as Endangered (IUCN). Kabir et al. (2009) mentioned the occurrence of *M. emys* in CHT, however with no recent locality record. Locally known as *Lip-puk*, and according to the Mro villagers, *M. emys* was extirpated from most of its southern CHT range. During our study, we have found shells and live specimens of it in 5 villages: 4 (no. 23, 24, 25, and 26; see Fig. 1) located in the hill forest at the extreme southeastern part of the CHT and also in village no. 2 located on the western side of the Mirinjia Hills west of the Matamuhuri River. Four specimens of *M. emys* were collected from Mowdok, northeast of our study area, and are now kept at the Bhawal National Park for captive breeding (S.M.A.R., *pers. comm.*, May 2014). All the live specimens and shells of *Manouria* we examined appeared to be of *M. e. phayeri*; we did not find any evidence of *Manouria e. emys* in our survey area, and it is very unlikely that it occurs in Bangladesh. There are no recent records of *M. e. phayeri* from other villages within our survey area. The southern part of Mirinjia Hill Range, west of the Matamuhuri River, and the forest located upstream of the Sangu River are probably two of the largest remaining strongholds of *M. e. phayeri* in Bangladesh. Villagers from localities 23, 24, 25, and 26 (see Fig. 1) reported that they find 10–20 *M. e. phayeri* every year per village. It appears that the populations of *M. e. phayeri* have been extirpated from the northeastern region of Bangladesh and from most of the Chittagong Hill Tracts; although at present, it may still occur in the Kassalong Reserve Forest in Khagrachari District. Also, we are aware of a *M. e. phayeri* specimen found in 2012 near Remakri Khal, about 25 km south of Thanchi.

Indotestudo elongata

Indotestudo elongata is locally known as *Lip-man*, and it is probably the most common terrestrial species in the area. It was recorded in all 26 villages. The locals reported that it is found both in forested and highly degraded shrubby habitat. According to villagers, its numbers have substantially declined in the last 10 yrs attributable to subsistence hunting. Villagers reported that plastrons are opportunistically sold for \$1.29/kg to Burmese traders and apparently for traditional Chinese medicine. It is listed as Endangered by IUCN and occurs throughout the Chittagong Hill Tracts, and in the adjoining Chittagong and Cox's Bazaar districts. In the northeastern part of the country, it is found in forest-tea plantation mosaic landscape of Moulvibazaar, Habiganj, and Sylhet districts.

Cyclemys spp.

During the survey, we found 6 live specimens and 1 shell of *Cyclemys* sp. in villages no. 1, 9, 23, 24, 25, and 26 (see Fig. 1). It is likely that it is still found throughout the survey area but locals reported that their numbers have substantially declined in recent years in CHT. Locally known as *Ranghkhiyong* and *Shampoozaa*, villagers mentioned that this species is found in rivers and streams adjacent to both primary and degraded forest. In Bangladesh, it is known to occur throughout the Chittagong Hill Tracts, Cox's Bazaar, and Chittagong districts and in the northeastern region of the country. *Cyclemys dentata* and *Cyclemys oldhamii* are listed in the checklist for Bangladesh (Khan 2008, 2010; Kabir et al. 2009). However, recent molecular work shows that *Cyclemys* sp. west of the Naga Hills and Arakan-Yoma Mountain represents *Cyclemys gemeli* (Fritz et al. 2008). Based on the traditional ecological knowledge, more than one species of *Cyclemys* occurs in our study area. Detailed taxonomical study of *Cyclemys* is beyond the scope of this article.

Pangshura sylhetensis

We found 1 shell and have observed basking *P. sylhetensis* in the Sangu River (villages no. 23, 24, 25, and 26). Locally known as *Lip-chu*, according to local villagers, it is seen basking in the fall and winter months—October to February—upstream in the Sangu River. Locals also reported that it is the most difficult turtle to capture; it is occasionally caught in fish nets. Listed as Endangered by IUCN, it is considered to be a rare turtle species in this region. Kabir et al. (2009) mentioned its occurrence in the CHT but gave no locality information. This is the first published record of *P. sylhetensis* from CHT. Hasan et al. (2014) mentioned its occurrence in wetlands in the northeast of Bangladesh; however we do not know of any recent record or locality information from the northeast. Specimens of *P. sylhetensis* have recently been found in the

underground turtle trade, and it is highly unlikely that those specimens were originated from Bangladesh. It appears that the upstream of Sangu River is probably the last stronghold of *P. sylhetensis* in Bangladesh.

Amyda ornata

The Mro tribe refers to *A. ornata* as *Tui-lip*. We found live specimens in the upstream of Sangu River (villages no. 23, 24, 25, and 26; see Fig. 1) and a shell in village no. 1 near Matamuhuri River. It appears that *Amyda* occurs in both Sangu and Matamuhuri rivers, but according to the villagers, the population in Matamuhuri River has likely declined substantially primarily attributable to overharvesting. Villagers reported that it is common upstream in the Sangu River. We met one Mro villager (village no. 26) who specializes in hunting softshell turtle. He mentioned that he found 5–10 specimens of *A. ornata* on each trip. Khan (2012) mentioned the occurrence of *Amyda cartilagenia* in the Sangu River; however, recent molecular studies showed that the specimens in the CHT belong to subspecies of *A. ornata* (Fritz et al. 2014).

Lissemys punctata

We found 1 live specimen of *L. punctata* in a manmade pond in village no. 1. Villagers mentioned that this species, locally known as *Sabak-lip*, is not found in the hilly, forested areas but primarily associates with low lying areas with ponds and paddy fields in villages adjacent to towns. *Lissemys punctata* is probably the most common and widespread turtle species in Bangladesh (Rashid and Rahman 2014).

Exploitation

We found no evidence of commercial turtle harvesting in the survey area. We also could not conclude whether commercial harvesting of turtles existed here historically. Because of persistent subsistence hunting for many years, it is likely that the turtle populations in this area have declined to a level so low that finding sufficient numbers for commercial harvesting is now not feasible. With few exceptions, the Mro people did not appear to purposefully hunt turtles, but opportunistic harvesting of them for consumption is widespread. It is noteworthy that forest-dwelling turtles are typically harvested with the aid of local hunting dogs. It did not appear that dogs are trained specifically to hunt turtles. Rather, the dogs indiscriminately caught any animals they found. Typically during these hunts, one or two Mro hunters joined the dogs. The dogs roamed freely in the forest and barked if a hunt was successful. We have seen dogs in every Mro village; however, not all dogs are used for hunting. Of the 26 Mro villages we visited, we observed highly skilled hunting dogs only in 3 villages (villages no. 15, 18, 23), locally called *Kui-shuk*. The

villagers reported that dogs are not commonly used for hunting these days, primarily because of a substantial decline in game numbers. The dogs appear to have very high mortality rate from canine viral infestation. Occasionally, to catch terrestrial turtles, the locals use pitfall traps in forested areas during the monsoon. The pitfall traps are called *wam*. Pitfall traps would be dug up near fruiting trees, such as *Artocarpus chaplasha*, in undisturbed areas. The villagers mentioned that the fruits would attract *I. elongata*, and they would get up to 5 tortoises in a week. This technique is mostly practiced in forested areas in villages no. 23, 24, 25, and 26. Softshell turtles (e.g., *Amyda ornata*) are hunted using spear, locally known as *Longhachu*.

Another method to collect turtles occurs during *jhoom* (slash and burn) cultivation, when large patches of forest are cleared by villagers before it is set on fire. This activity drives the turtles out into the open, which renders them vulnerable to predators and to collection by villagers for consumption.

Recommendations

The majority of the primary forest areas in CHT have been clear-cut for shifting agriculture. Within the agricultural landscape, patches of forest are left in riparian areas by the ethnic people to retain water. Those patches often serve as important habitat for turtles and tortoises. In this forest-agriculture mosaic landscape, hunting for subsistence appears to be the most immediate threat to turtles, and with no intervention, it is likely to cause the extirpation of their already low-density populations (Klemens and Thorbjarnarson 1995). Because of the remote nature of the CHT, the Forest Department of Bangladesh exercises little to no jurisdiction or enforcement there. Therefore, top-down regulation for hunting will have little effect. Mitigation of turtle hunting in the CHT would require the formation of close relationships with local people such as the Mro and of alternative sources of sustenance and livelihood for them. We recommend establishing a community-owned conservation program to mitigate turtle hunting in Chittagong Hill Tracts. The right approach would be to incorporate community participation and integrate traditional ecological knowledge with ecological science. Similar approaches have been proven successful with Egyptian Tortoises in Egypt (Attum et al. 2008), lions in Kenya (Hazzah et al. 2014), and hornbill in northeast India (Datta and Rane 2011).

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