Chapter 07

Tortoises and Freshwater Turtles of Kaziranga National Park, Assam – Diversity, Distribution, Conservation Status.

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Introduction

The northeastern region is a 'Hotspot' of tortoises and freshwater turtles within India with 21 species found in the region out of 29 species known to occur in the country (Ahmed *et al.*, 2009). Very little is known about the chelonians of the region. This is evident that even new species of turtles were described from the region recently (Fritz *et al.*, 2008) and also species added to Indian chelonians not known earlier (Pawar and Choudhury, 2000). Very few efforts have been made to scientifically study the chelonians of the region. Some of the notable works that addressed the region are Fritz *et al.* (2008), Pawar and Choudhury (2000), Das (1990), Prachag and Gemel (2002), Sengupta *et al.* (2000), and Choudhury (1995). Sadly, the tortoises and freshwater turtles of the region are facing extinction due to excessive hunting for meat and rapid loss of habitat. Even they are extirpated in most part of the region from outside well protected conservation areas. Being one of the best protected areas, Kaziranga National Park and its surrounding Reserve Forests presumably represent the best Turtle habitat left in the region. Although very little is known about this bewildering chelonian diversity of Kaziranga National Park.

Methodology

The study was carried out during January through December 2004 (followed by random visits till March 2009), with an aim to determine the diversity and natural history information of turtles and tortoises in and around the Kaziranga National Park (**Table-1**). The study area included the notified National Park area, nearby reserved forests plantations and the fringe areas including tea gardens, paddy and human habitations.

Field surveys were carried out during day time. During the extensive survey, we carried out visual inspection of forest floor, shrubberies, grasses and wetlands. All possible ecotones were searched thoroughly including such microhabitat as puddles and springs and along the streambeds, wetlands, aquatic vegetations, basking areas, under loose barks and logs, bases of buttressed trees, under rocks, accumulated debris and such areas which often attract turtles and tortoises for food, shelter or breeding.

We looked for turtles and tortoise from 0800 h to 1200 h and in the afternoon 1400 h till dusk. While looking for basking or active reptiles we visually mapped the habitat to be surveyed in the afternoon.

Occasionally turtles at distant locations were observed through binoculars (20x50) and spotting scope (40X). Whenever possible individuals were caught, photographed and measured for future reference before releasing back. Turtle shells were collected from different localities and camps inside the park and also from the villages.

Data sheet was filled in to record - date, time, specific locality, latitude, longitude and altitude (recorded using a Garmin 12 channel GPS), habitat type, habitat description, morphological measurements, weather such as temperature and humidity, detailed live coloration and natural history as well as other important field notes were taken for most of the animals we observed. Photographs were taken in natural condition for additional information. Forest staffs based in the camps inside the park and communities living in the fringe villages were interviewed to get more information about turtles.

Taxonomy and nomenclature follows Das (2002, 1995), Prachag and Gemel (2000), Praschag *et al.* (2007a and b, 2009), Fritz *et al.* (2008), Fritz and Havas (2007).

Table-1: List of localities along with geographical coordinates where turtles were observed in and around Kaziranga NP, Assam.

Locality	Range HQ/Area	Coordinates
Ahotguri	Agoratoli	26° 43′ 10.59″ N, 93° 28′ 43.54″ E
Bhengrai Nullah	Agoratoli	26° 42′ 37.21″ N, 93° 29′ 50.23″ E
Debeshwari	Agoratoli	26° 44′ 34.97″ N, 93° 27′ 19.05″ E
Rongamatia Beel	Agoratoli	26° 41′ 52.22″ N, 93° 31′ 05.65″ E
Donga Beel	Bagori	26° 35′ 18.67″ N, 93° 16′ 26.84″ E
Gandermari	Bagori	26° 36′ 15.68″ N, 93° 16′ 24.52″ E
Roumari	Bagori	26° 35′ 58.24″ N, 93° 17′ 52.92″ E
Sapekhati Beel	Bagori	26° 36′ 45.43″ N, 93° 17′ 03.90″ E
Biswanath Ghat	Biswanath Chariali	26° 39′ 31.49″ N, 93° 10′ 18.92″ E
Bagsher RF	Buhrapahar	26° 33′ 14.71″ N, 93° 06′ 05.74″ E
Arimora	Kohora	26° 40′ 59.99″ N, 93° 20′ 26.43″ E
Bokpara camp	Kohora	26° 36′ 51.43″ N, 93° 21′ 19.22″ E
Borbeel Camp	Kohora	26° 36′ 08.09″ N, 93° 20′ 51.64″ E
Borbeel (Arimora)	Kohora	26° 40′ 55.18″ N, 93° 20′ 27.40″ E
Buruntika Beel	Kohora	26° 38′ 48.96″ N, 93° 21′ 59.57″ E
Daflang Beel	Kohora	26° 38′ 04.92″ N, 93° 21′ 29.27″ E
Hulalpath	Kohora	26° 36′ 15.68″ N, 93° 16′ 24.52″ E
Mihi Beel	Kohora	26° 36′ 50.20″ N, 93° 22′ 31.86″ E
Mihimukh Grassland	Kohora	26° 36′ 26.71″ N, 93° 23′ 12.02″ E
Panbari RF	Kohora	26° 36′ 49.51″ N, 93° 31′ 19.08″ E
Diffolu River	Kohora	26° 38′ 21.22″ N, 93° 20′ 36.57″ E

Abbreviation used

SCL= straight carapace length
SCW= straight carapace width
PL= plastron length
PW= plastron width
RF= reserve forest
KNP= Kaziranga National Park.

Study site

The Kaziranga National Park (26° 34¢ N to 26° 46¢ N and 93° 08¢ E to 93° 36¢ E) covers civil jurisdictions of Nagaon and Golaghat districts in Assam (Plate 7.1 A). The Brahmaputra River flows by the northern boundary and Karbi Anglong hills stands to the south. Thickly populated villages bound the east and west boundaries of the park. The total area of the park is 860 km^2. The park and neighbouring Laokhowa and Buhrachapori Wildlife Sanctuary together notified as the Kaziranga Tiger Reserve that covers an area of 1033 km^2.

The alluvial deposits of the Brahmaputra River formed most of the park area (Vasu, 2003). The River also continuously forms and removes river islands, a very dynamic process. The newly formed islands are initially colonized by *Saccharum* and other grass species that are slowly succeeded by tree species as they stabilize. Numerous channels (old and new) of the Brahmaputra and Diffolu River crisscross the entire park and had formed wetlands of various sizes and depth. Altogether, there are 191 wetlands or beels in the park. The Diffolu River originating from Karbi Anglong Hills flows east to west and divides the park in two sections before merging to the Brahmaputra. Altogether there are 58 rivers, rivulets and streams in the drainage systems of the park.

Kaziranga NP has the largest population (2048 individuals, Data Source: Park Authority, 2009) of Indian one-horned rhinoceros (*Rhinoceros unicornis*). The park is also a safe heaven for Asian elephant (*Elephas maximus*),

swamp deer (*Cervus duvaucelli ranjitsinghi*), Asiatic water buffalo (*Bubalus arnee*), and tiger (*Panthera tigris*) that are significant from conservation point of view. This park is also home to some 490 species of birds (Barua and Sharma, 1999; Choudhury, 2004). Previous surveys recorded thirteen species of tortoises and freshwater turtles from the park (Das, 1990; Choudhury, 2004). However, this was the first ever extensive scientific study carried out to evaluate species richness, status and conservation of the chelonians in the Kaziranga NP.

Climate

The climate of the park is tropical monsoon with four distinct seasons: dry winter (December-February), Pre–monsoon (Mach-May), Monsoon (June-August) and Post–monsoon (September-November). Annual rainfall varies from 2000-2900 mm, more than 70% of the rainfall occurs during the monsoon alone.
Temperature ranges from minimum 7°C in winter (with low humidity) to maximum 35°C in summer (with high humidity). A comparatively dry season is observed in the park during January through April. The wettest months observed are June through August and during this period the park is inundated more than once.

Vegetation

The vegetation of the park can be classified into grassland (66%), woodland (28%) and aquatic vegetation (6%) (Marry *et al.*, 1998). The wet alluvial grasslands in Kaziranga NP also known as 'elephant grass' generally grows up to a height of five meter during monsoon season and are dominated by grass species like *Erianthus ravannae, Imperata cylindrica, Saccharum elephantanum, Saccharum spontaneum.*

Low lying and marshy areas are covered by *Arundo donax, Phragmites karka, Alpinia allughas, Cynodon dactylon, Egrostis* spp., *Crysopogon* spp. Woodlands of the park are characterized by some evergreen patches on the high grounds often with cane brakes and scattered trees among grasslands and are dominated by species like *Albizzia procera, A. odoratissima, A. lucida, Bombax ceiba, Aesculus pandana, Premna latifolia, P. bengalensis, Lagerstroemia parviflora, L. flos reginae, L. speciosa, Tetrameles nudiflora, Ficus religiosa, F. glomerata, F. bengalensis, Dillenia indica, Cedrela toona, Sterculia villosa, Terminalia belerica, Artocarpus chaplasa, Oroxylum indicum, Salix tetrasperma,* and *Schima wallichi. Bombax ceiba* and *Ziziphus jujuba* are found scattered all around the grasslands.

The vegetation along the wetlands of the park are dominated by *Eichhornia crassipes, Andropogon* spp., *Ipomoea reptans, Enhydra fluctuans, Pistia stratiotes, Nymphaea lotus, Enhydra fluctuans, Pistia stratiotes* and *Nelumbium speciosum.*

Located on the flood plain of the Brahmaputra River, annual flooding is a natural phenomenon in the park. The park area is inundated usually more than once by surging water of the rivers annually.

As a management practice, the grasslands are burned annually to benefit the herbivores, as they are attracted to feed on resprouting grasses followed by burning. The burning is believed to arrest the succession process from grassland to woodland (Vasu, 2003; Kushwaha and Unni, 1986).

Results

Out of 21 species of chelonians known to occur in northeast India (Ahmed *et al.*, 2009) as many as 17 species **(Table-2)** are recorded from in and around the park. As many as 14 species of the turtles found in and around the park are globally threatened, including 1 Critically Endangered (CR), 6 Endangered (EN) and 7 Vulnerable (VU). This study recorded two species of turtles for the first time from the park. Importantly, all the four species of large Softshell turtles known to occur in the region, *Nilssonia gangetica, N. hurum, N. nigricans* and *Chitra indica* are found in the park and adjoining the Brahmaputra River. Population of the chelonians outside the park is very thin or non existent as habitat is altered or disturbed and very often large individuals are killed for meat.

Table-2: Tortoises and freshwater turtles recorded from in and around the Kaziranga National Park, Assam (Plates 7.2 and 7.3).

S.No	Scientific Name	Common Name	IUCN Status	Schedule of Wildlife Protection Act, 1972	Remarks
FAMILY: TESTUDINIDAE					
1	*Manouria emys*	Asian Brown Tortoise	EN	Schedule IV	Recorded based on Choudhury (2004).
FAMILY: TRIONYCHIDAE					--
2	*Chitra indica*	Narrow-headed Softshell Turtle	EN	Schedule IV	--
3	*Lissemys punctata andersonii*	Indian Flapshell Turtle	NA*	Schedule I	--
4	*Nilssonia gangetica*	Indian Softshell Turtle	VU	Schedule I	--
5	*Nilssonia hurum*	Peacock Softshell Turtle	VU	Schedule I	--
6	*Nilssonia nigricans*	Black Softshell Turtle	CR	Not listed	First record from KNP
FAMILY: BATAGURIDAE					--
7	*Cuora amboinensis*	Malayan Box Turtle	VU	--	--
8	*Cuora mouhotii*	Keeled Box Turtle	EN	Not listed	First record from Kaziranga area.
9	*Cyclemys gemeli*	Indian Leaf Turtle	NA*	Not listed	--
10	*Geoclemys hamiltonii*	Spotted Pond Turtle	VU	Schedule I	--
11	*Hardella thurjii*	Crowned River Turtle	VU	Not listed	--
12	*Pangshura smithii*	Brown Roofed Turtle	NT	Not listed	--
13	*Pangshura sylhetensis*	Assam Roofed Turtle	EN	Schedule I	--
14	*Pangshura tecta*	Indian Roofed Turtle	NA*	Schedule I	--
15	*Pangshura tentoria*	Indian Tent Turtle	NA*	Not listed	--
16	*Melanochelys tricarinata*	Tricarinate Turtle	VU	Schedule I	--
17	*Morenia petersi*	Indian Eyed Turtle	VU	Not listed	Not observed during the study

Species Account:
The following section describes the distribution of the species in Assam and its status in the park as well as in the state.

1. ***Manouria emys*, Asian Brown Tortoise: EN**. Not encountered during the survey. Choudhury (1996, 2004) reported it from nearby Karbi Anglong Hills. The subspecies *Manouria emys phayeri* is reported from Nongkhellym Wildlife Sanctuary of Meghalaya (Das, 1991), Maibong, Langting-Mupa RF of North Cachar

Hills, Loomajooting of Nagaland (Anderson, 1871, 1872) Barail Wildlife Sanctuary (Das, 2009), and Nengpui Wildlife Sanctuary, Aizwal of Mizoram (Pawar and Choudhury, 2000; pers. obs.) and Motbung of Manipur (pers. obs.), state in the region. All these localities are on the south of the River Brahmaputra. *M. emys is* known to inhibit evergreen and bamboo forest. Pawar and Choudhury (2000) obtained specimen from thick leaflitter of moist *nullah* during February. Das (1995) also mentioned that the species inhibit tropical moist, evergreen forests close to water. A large growing tortoise extensively hunted for is meat. Though information on population is not available, this species is facing extinction due to overexploitation and severe habitat fragmentation throughout its distributional range.

2. ***Chitra indica*, Narrow-headed Softshell Turtle: EN**. Two basking individuals spotted on the sandy Brahmaputra river bank off Debeshwari and Arimora in Agoratoli and Kaziranga ranges respectively during our survey. This species is reported from Kaziranga National Park and Nameri National Park of Assam by Bhupathy *et al.* (1999). Choudhury (1995) reported it from Dibru-Saikhowa National Park. However, the species is often seen in the temple tanks of Assam. Two individuals in the possession of Assam State Zoo are reported to be from the River Brahmaputra. Another individual was rescued from Puthimari River at Puthimari Village in Kamrup District of Assam. This indicates that C. *indica* has a wider distribution in the Brahmaputra River System. Being exclusively aquatic, this species is rarely seen. Information on population is lacking. Also used to be seen commonly in local markets.

3. ***Lissemys punctata andersoni*, Indian Flapshell Turtle:** Not assessed. A single individual was observed on a log basking among the aggregation of *Pangshura sylhetensis* in Diffolu river in the park. Formerly reported by Das (1990). We also observed one shell inside the park. A highly adaptable species and can be seen in salt marshes, river, ponds, ox-bow lakes, streams, rice fields, and even in canals (Das, 1995). Used to be commonly seen in the swamps of Assam. However, of late it has become very rare in the low lying areas of the state. Extensively exploited for local trade in the state and population is pushed close to extinction.

4. ***Nilssonia gangetica*, Indian Softshell Turtle: VU**. Observed in the Debeshwari area of Brahmaputra River inside park. Juveniles in the possession of local fishermen were observed in the Bishwanath Ghat area on the north bank of the River Brahmaputra. Like other Softshell turtles, this species is also heavily exploited for meat. Even this species was earlier known to be brought from Bihar, West Bengal and Bangladesh for sale in the markets in Assam (M. F. Ahmed, unpublished data). Being exclusively aquatic, not much is known about this species. Extensive collection is the principal cause of population decline in the region.

5. ***Nilssonia hurum*, Peacock Softshell Turtle: VU**. Our observation of the species in KNP is based on juvenine individuals observed from Bishwanath Ghat area (north bank of the River Brahmaputra) and also from Kohora area. One adult individual (SCL 620 mm) rescued from local market near KNP which was reported to be caught from Diffolu river just outside park boundary. Further, in Assam State Zoo one individual was reportedly obtained from Deepor Beel Wildlife Sanctuary and two more obtained from Brahmaputra river. Das (1995) reported the species from Dilkhush, Sibsagar, Sonapur, Guijan, Nazirah, Bokakhat, Mupa-Langteng RF of Assam. Choudhury (1995) reported it from Lakhimpur and Datta (1997) reported it from Dhubri district. However, as observed by Prachag and Gemel (2002), the earlier records of this species need further verifications as some of them might represent the closely related *Nilssonia nigricans*. Known to inhabit the Brahmaputra River, its tributaries, wetlands and some of the temple ponds in Assam. Becoming rare due to population crash as extensively exploited for meat throughout the region.

6. ***Nilssonia nigricans*, Black Softshell Turtle: CR**. In the Kaziranga NP, first individual was found on April 14, 2004, at 1400 h. Observed on the bank of the Rangamatia Beel of Agoratoli Range. On 03 December 2009, one female individual (SCL 450 mm, SCW 470 mm, PL 430 mm; total CL 550 mm) was found dead near Diffolumukh camp in the Diffolu River. Another live individual (SCL 430 mm, SCW 420 mm, PL 600 mm) was observed on the bank of Sapekhati beel near Gandermari camp on 06 December 2009. The largest of the individuals in the park was observed on 18 February 2010 on the dry bed of Bhengrai Nala (1.5 km from Rongamotia Camp. This large (SCL 580 mm, SCW 480 mm, PL 570 mm, PW 540 mm; total CL 740 mm) male

was first observed on a small pool in the *nallah* on 13 February 2010 that was on the move in search of deeper water downstream.

Once thought to be restricted to the Bostami tank of Bangladesh, Prachag and Gemel (2002) reported the wild population from Bishwanath Ghat, Dibrugarh, Tinsukia and Nameri National Park of Assam and also found that *N. nigricans* is the most common turtle species found in some temple ponds of Assam which were previously misidentified as *N. hurum*. Significantly, this study recorded this species for the first time from the park. It inhabits the Brahmaputra River, its tributaries, wetlands and some temple ponds in Assam plains. No information is available on population trend. This Critically Endangered species is extensively collected for meat.

7. ***Cuora amboinensis*, Malayan Box Turtle: VU**. We found one individual (SCL 230 mm) while it was crossing forest trail at Holalpath woodland during November 2008. This individual had scratch marks on its carapace that might have resulted from a carnivore attack. Basking individuals were observed from Diffolu River and Ahotguri camp area in the park as well as a shell from Rajamari Camp indicating its widespread distribution in the park. Earlier the species was reported by Das (1995) from the park. It inhabits the low lying areas including small rivers, swamps, ponds and paddy fields of Assam. Liat and Das (1999) regarded this species as highly adaptable, and may be found in ponds, freshwater marshes, canal streams, mangrove swamps, plantations, rice fields and also around human habitation. Though least exploited for its meat, this species is becoming increasingly rare outside protected areas and almost extirpated from most of its range in Assam.

8. ***Cuora mouhotii*, Keeled Box Turtle: EN**. We observed two shells of the species from Borjuri village. Both the individuals were reportedly collected from adjacent Panbari reserved forest of Kaziranga National Park. The species was recorded from Dhansiri reserved forest of Karbi-Anglong district (Choudhury, 1993) and Madhupur Village of Lakhimpur district (Choudhury, 1996). Inhabits forest floor of the evergreen, semi evergreen and subtropical broadleaf forests of the region from 100-2500 m altitude. The species is however, recorded from Cachar Hills (Anderson, 1871), Mupa-Langteng Reserved forest, near Maibong and Kapali reservoir of North Cachar Hills (Das, 1995), Barail Wildlife Sanctuary (Das *et al.*, 2009), Garo and Khasi Hills of Meghalaya (Das, 1995), Namdhapa National Park (Deban) (Das, 1990), Mehao Wildlife Sanctuary (Bhupathy and Choudhury, 1992). The lone live individual (SCL 175 mm, PL 158 mm) encountered in the Namdhapha National Park was found on thick leaf litter of evergreen forest (M F Ahmed, pers. obs.). Das (1995) mentioned that the species presumably live in the leaflitter on the forest floor. Exploitation is uncommon because the species is extremely rare. The volume of collection by local communities is not quantified.

9. ***Cyclemys gemeli*, Indian Leaf Turtle.** Not assessed. Choudhury (2004) reported *C. oldhamii* from Baghser Reserve Forest close to the park. Not encountered during this study. However, recently the *C. oldhamii* population found to occur in the northeast India has been recognized as a distinct species, named *C. gemeli* (Fritz *et al.*, 2008). Further, based on extended description and locality information of *C. gemeli* by Prachag *et al.* (2009) we consider that the record of *C. oldhamii* from Kaziranga can be referred to *C. gemeli*. *C. gemeli* is also recorded from Barail Wildlife Sanctuary (Das *et al.*, 2009), Nameri NP, Damra village near Goalpara; Barnihat, Meghalaya; Dimapur and Tuli village, Nagaland (Praschag, 2009).

Habitat of the species is reported as large rivers as Jia Bhoroli River and its oxbow lakes, fast flowing creeks, and also leaf litter of evergreen forest (Praschag, 2009; Das *et al.*, 2009). Loss of habitat is the major threat. Fishing with poison might be one big concern around its type locality that would need further investigation. Not much is known about the population in the region.

10. ***Geoclemys hamiltonii*, Spotted Pond Turtle: VU**. One of the frequently encountered species inside the park. The species was mainly observed in beels and swamps and also while crossing forest trails near such places. Basking individuals were observed along beels and on fallen logs of slow flowing Diffolu River.

When disturbed, individuals rapidly try to burry themselves under the mud. Previously reported by Das (1995). Das (1990) reported consumption of large individuals of this species inside the park which was also observed during this study in a few camps. Most consumed measured around SCL 250-400 mm. Though relatively common inside the park, this species is however, almost extirpated outside protected areas of Assam.

11. ***Hardella thurjii*, Crowned River Turtle. VU.** The individuals of the species were recorded from Donga, Borbeel Nulla and Mihi beel of the Park. Large shells (SCL 400-500 mm) were observed in Arimora camp was reportedly collected from large wetlands nearby. One shell at the Kohora Range Office labeled as *Kachuga kachuga* was reidentified as *Hardella thurjii* during our study. All the individuals were recorded basking on the aquatic edges of stagnant water bodies. Das (1995) also recorded this species from the park. Elsewhere, this species was recorded from Deepar Beel Wildlife Sanctuary; Mayeng Hill reserved Forest, Pabitora Wildlife Sanctuary by Sengupta *et al.* (1998, 2001).

12. ***Pangshura smithii*, Brown Roofed Turtle. NT.** Two Individuals (SCL 115 and 128 mm) in the possession of local fishermen were observed at Bishwanath Ghat on north bank of the River Brahmaputra. Both individuals were reportedly caught from river by fishermen. Das (1995) reported it from the KNP. Choudhury *et al.* (1999) reported its occurrence in both lentic and lotic environments of Kamrup district of Assam. Inhabits small and large rivers preferably in areas with abundant macrophytic growth (Frazier, 1992; Das, 1995). Though not a very common species, we observed it being released at temple ponds (*e.g.* at Nagshankar and Hajo) in Assam by religious groups.

13. ***Pangshura sylhetensis*, Assam Roofed Turtle. EN.** Most commonly seen in the slow flowing Diffolu River of the park as they bask in congregation, on fallen logs. We also observed it in the River Brahmaputra (Arimora) and at Biswanath Ghat on north bank of the Brahmaputra. Not common in the main channel of the River Brahmaputra. Lahkar (2000) reported it from a Beel in the park. Recently, this species was also recorded from Buhridihing River, Jeypore Forest in eastern Assam (M. F. Ahmed, pers. obs.). Inhabits slow flowing rivers and streams in rocky or forested lower hills. Not much is known and surveys are targetting the species.

14. ***Pangshura tecta*, Indian Roofed Turtle.** Not assessed. We observed the species in the Brahmaputra River (within Kaziranga NP) basking on logs, aquatic vegetation or on the banks of wetlands or rivers. Previously reported by Das (1995). We observed individuals basking on *Eicchornia* sp. of the wetland near Baruntika Beel. One individual was observed and photographed while basking on a log at Diffolu River and another shell was observed on the bank of Borbeel, Arimora. Inhabits rivers as well as beels in Assam. Choudhury (1999) reported most individuals of the species from beels with reed beds. Though common in the park, this species (including *P. tentoria*) is equally rare outside the protected area as they avoid human disturbances and interferences in their habitat. Exploitation for meat or pet trade is uncommon in Assam.

15. ***Pangshura tentoria*, Indian Tent Turtle.** Not assessed. Seems uncommon but likely wide-spread over the park. We observed only few occasions at Boruntika locality, Brahmaputra River and Ahatguri (Agoratoli) area in the park. Previously reported from the park by Das (1995). Basking individuals on logs were observed in the Brahmaputra river near Agoratoli range. Choudhury (1999) reported this species as fairly common in Kamrup district of Assam. Exploitation for meat or pet trade is uncommon in Assam.

16. ***Melanochelys tricarinata*, Tricarinate Turtle. VU.** Das (1995) reported this species from the park. Live male individual (SCL 182 mm, SCW 120 mm, PL 156 mm) of the species was found while it was crossing a forest trail near Mihimukh grassland at around 1600 h. Few burnt shells were obtained from Debeshwari, Mihimukh area of the park suggesting its vulnerability from grassland burning. One shell was observed on bank of the River Brahmaputra near Mou Chapori, Buhrapahar Range. The species is also reported from Pabitora Wildlife Sanctuary (Sengupta *et al.*, 1998), Orang National Park, Kaziranga National Park, Mupa-

Lanteng Reserved Forest (Bhupathy *et al.*, 1992), Manas Tiger Reserve (Das, 1990), Sonapur and Bishwanath plain (Das, 1995). Inhabit grassland and forest areas in terai as well as in alluvial floodplains. Collected for consumption but not recorded in local trade. Nearly extirpated outside protected areas in Assam.

17. ***Morenia petersi*, Indian Eyed Turtle. VU.** Choudhury (2004) reported this species from the park without any specific locality. We did not encounter any live animal or shell in and around the park but most likely to be found in the wetlands of the park. Elsewhere, we observed live individuals from Deepor Beel Wildlife Sanctuary in Kamrup district of Assam and Sengupta *et al.* (1998) reported it from Pabitora Wildlife Sanctuary. Das (1995) reported from North of Brahmaputra (Assam) without giving any specific locality record. Inhabit both standing and slow moving water. Status not known.

Discussion

The diversity and abundance of freshwater turtle species in the KNP perhaps suggests that this protected area is the most important turtle habitat left in the entire Northeast India. Out of 20 recorded species from Assam state, as many as 17 species have been recorded from in and around the park. This study confirms the presence of 14 species *viz. Lissemys punctata, Nilssonia nigricans, Nilssonia gangetica, Nilssonia hurum, Chitra Indica, Hardella thurjii, Pangshura sylhetensis, Pangshura tecta, Pangshura tentoria, Pangshura smithii, Cuora amboinensis, Cuora mouhotii, Melanochelys tricarinata and Geoclemys hamiltonii* from in and around Kaziranga National Park. Occurrence of *Morenia petersi, Manouria emys* and *Cyclemys gemeli* in the park is based on literature records. *Pangshura sylhetensis* appears to be the most frequently encountered turtle species having patchy distribution in the Park, followed by *Geoclemys hamiltonii*, with rather widespread distribution in the park.

Out of these 17 species of chelonians recorded from park, 14 species are globally threatened. This includes one Critically Endangered (CR), six Endangered (EN) and seven Vulnerable (VU) species. Significantly, all the four species of large Softshell turtles (*Nilssonia gangetica, N. hurum, N. nigricans* and *Chitra indica*) known from eastern India are found in the park and adjoining Brahmaputra River.

The record of poorly known *Cuora mouhotii* from adjacent Panbari RF is noteworthy. This rare turtle species is seldom recorded from evergreen and semi-evergreen habitats of Northeast India. Further surveys may thus yield information on its distribution from Kaziranga-Karbi Anglong landscape. Similarly, the relative abundance of *Hardella thrurjii* in the beels and stagnant waterpool of the park presumably indicate towards a significant population of this large hardshelled species in KNP.

The record of *Nilssonia nigricans* and *Cuora mouhotii* therefore constitutes the first from this area. Further, the population of the Critically Endangered, *Nilssonia nigricans* found in the park is the only known population inside a protected area. The study observed that the population of the chelonians outside the park is very thin or non existent as habitat is altered or disturbed and often individuals are killed for meat. High species richness of chelonians indicates that the Kaziranga NP offers tremendous opportunities for survival of these threatened as well as other species of tortoises and freshwater turtles.

Research, Management needs and Conservation

There is no information on community ecology of the freshwater turtles found in the park. Information on ecological requirements of the turtles are also lacking in the park that limit management options for freshwater turtles for the managers and policy makers. Further, preliminary observation suggest that grassland burning for habitat management has adverse effects on turtle species, particularly, those that remain out of water during winter. We observed that *Pangshura tecta* (n=2), *Melanochelys tricarinata* (n=6), *Cuora amboinensis* (n=3) and *Geoclemys hamiltonii* (n=1) were killed or burnt in Kaziranga or similar grassland habitats in the region. A detailed study on effect of burning on grassland and its biodiversity is of utmost need.

The turtles inside the park are well protected, however, because of fishing activity on the boundary of the park, particularly in the river sketch of Bishwanath Ghat, turtles often get entangled in the fishing nets. Also, many

juveniles and hatchlings were caught and kept for sale by the fisherman around Bishwanath Ghat, which is a serious cause of concern.

The Kaziranga National Park offers tremendous conservation opportunities for the chelonian community of the alluvial floodplains which are not found in any other similar habitats in the region. However, there is very little or no chance for chelonians of the park to get an opportunity to exchange genes with other remnant populations in the region except for a few species living in the Brahmaputra River. For long term conservation of chelonians in the region, they must be protected from excessive hunting for meat and more areas should be brought under protected area network. Also being a home to a remarkable chelonian diversity, the Kaziranga National Park represents one of the best sites for future chelonian community ecology study and wild gene pool conservation of chelonians in the region.

The level of awareness about the need of conservation of chelonians is extremely low in the region. The situation is the same around Kaziranag NP as well. Turtles are traditionally consumed in Assam and hence the turtle population outside protected areas is mostly extirpated. We have attempted to create awareness among common people and fishermen during the study including those forest staff through personal meeting and consultation. Large scale and well designed awareness activities are the need of the hour to enhance protection and conservation of chelonians in the region.

Concluding Remarks

1. The Kaziranga National Park in Assam is the only protected area that is known to house highest diversity of chelonian fauna in northeast India.

2. This study observed killing of Softshell turtles in local trade on the northern boundary of the park (Biswanath Ghat). Earlier, Prachag and Gemel (2002) also reported turtles being sold in the markets around Kaziranga NP.

3. Including the Brahmaputra River (the 6th Addition to the park) inside the park boundary and enhancing protection measure could provide safer sanctuary to the turtles living that stretch of the river as killing for trade would be minimized.

4. The park could be a hub for turtle research in the region due to its species richness and its role in the river ecosystem.

5. Thousands of visitors around the region visit the park annually, so, a well designed education programme could spread message for turtle conservation to the mass.

6. A tortoise and freshwater turtle research and conservation facility near the park would fulfill both the purpose of research and education. We highly recommend such a move.

7. Though open sale of turtles in Assam were drastically reduced due to awareness among civil society members, NGOs and forest and law enforcement agencies, a new trend of 'home delivery' and 'supply against advance order' of turtle meat is serious concern.

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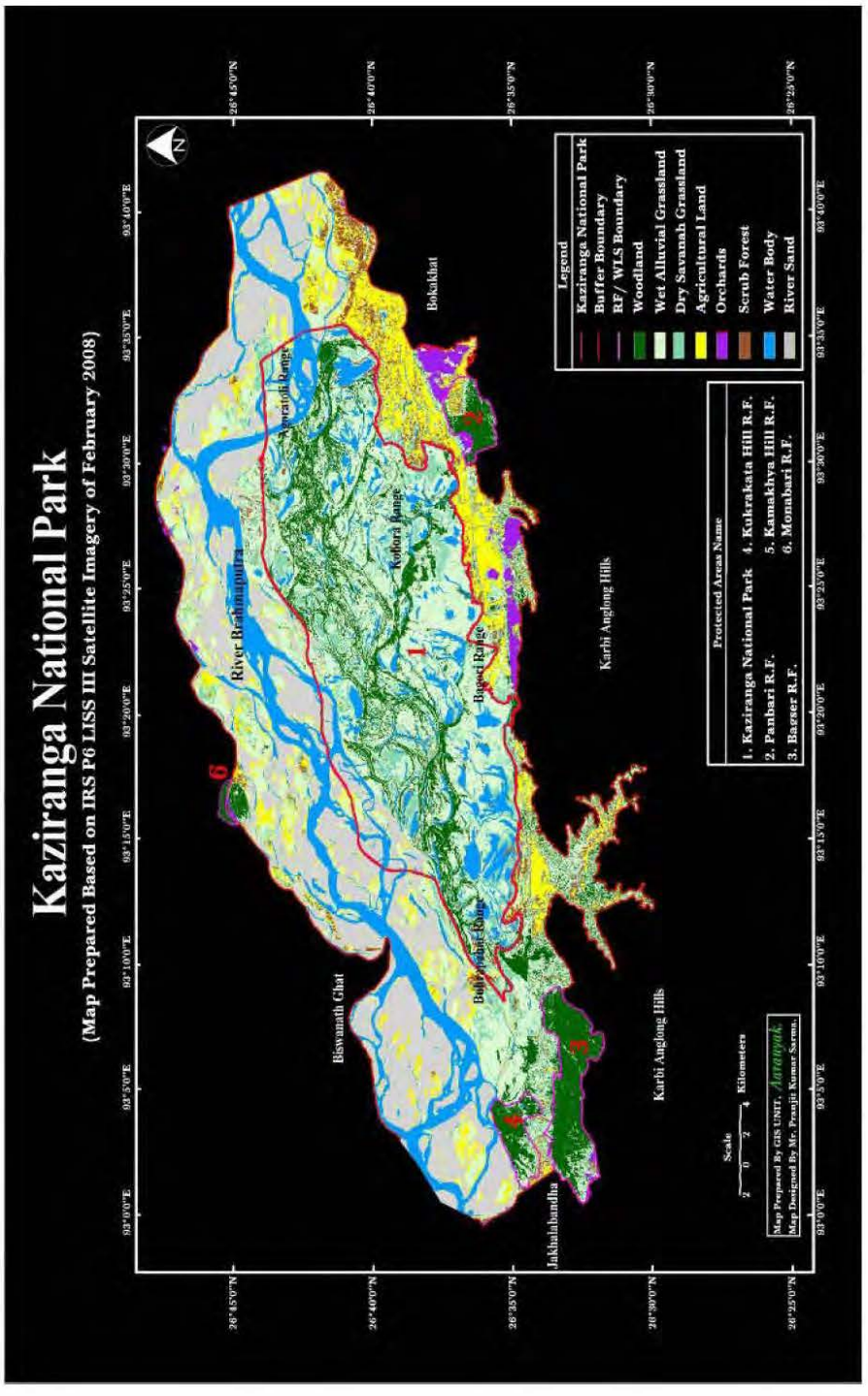
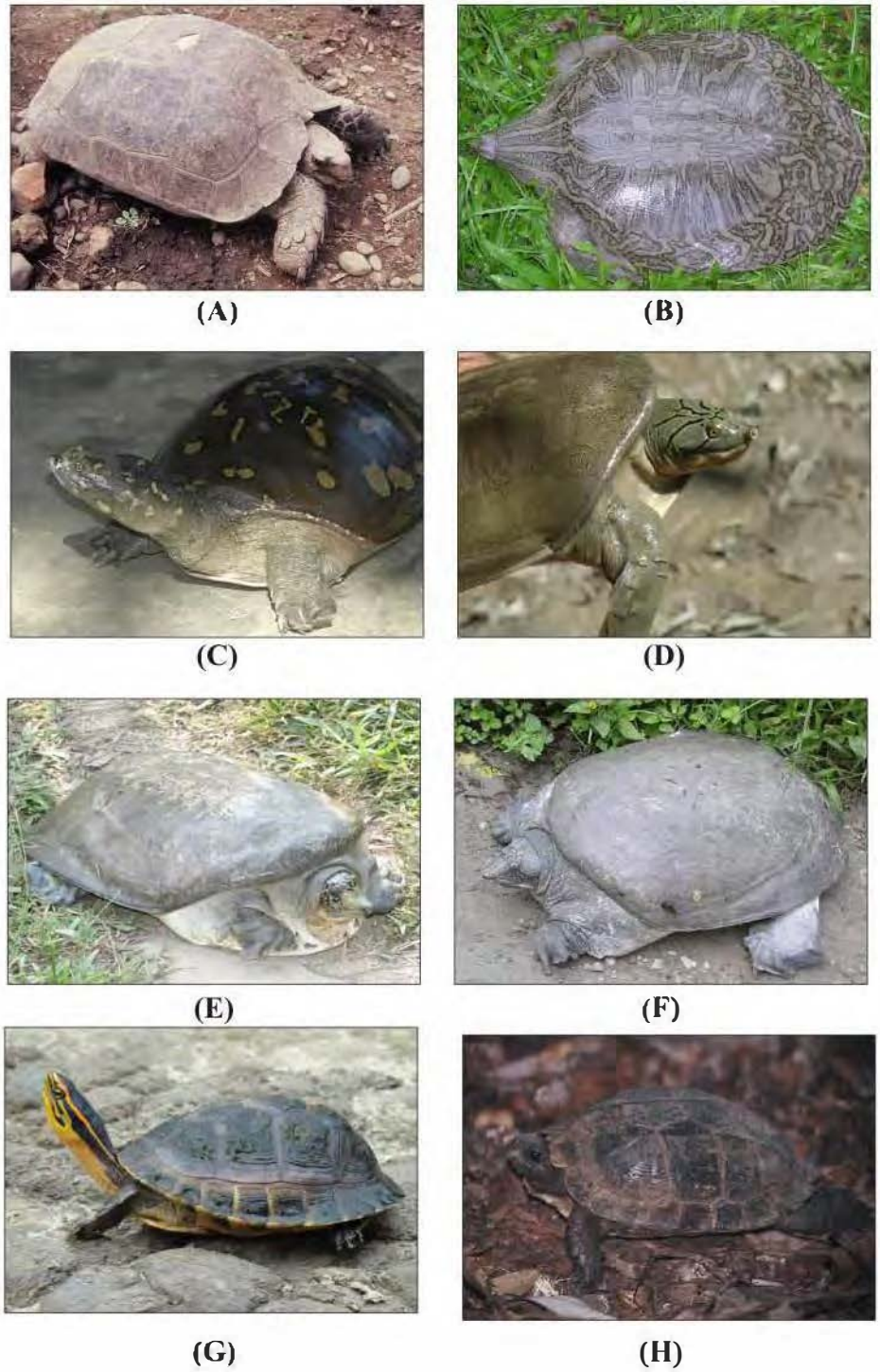
Plate 7.1



Map of Kaziranga National Park, Assam

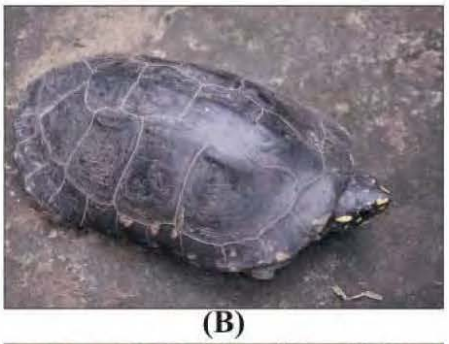
Plate 7.2



(A): *Manouria emys*; (B): *Chitra indica*; (C): *Lissemys punctata andersonii*; (D): *Nilssonia gangetica*; (E): *Nilssonia hurum*; (F): *Nilssonia nigricans*; (G): *Cuora amboinensis* and (H): *Cuora mouhotii*. Photos A, B, C, D, F & H by M. Firoz Ahmed; E by Abhijit Das and G by Nabha

Plate 7.3

(A)

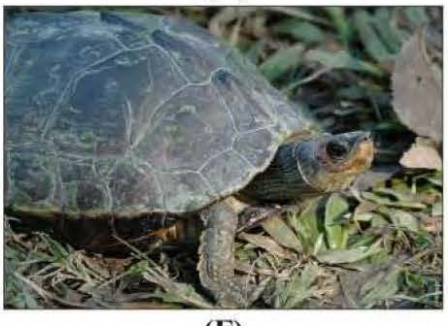


(B)

(C)

(D)

(E)



(F)

(G)

(H)

(I)

(A):*Cyclemys gemeli*; (B): *Geoclemys hamiltonii*; (C): *Hardella thurjii*; (D): *Pangshura smithii*; (E): *Pangshura sylhetensis*; (F): *Pangshura tecta*; (G): *Pangshura tentoria*; (H): *Melanochelys tricarinata* and (I): *Morenia petersi*. Photos A & G by Abhijit Das; B by Bibhuti P. Lahkar; C, D, E, F, H & I by M. Firoz Ahmed.

Turtle and Tortoise Diversity Database of Northeast India

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The Centre for Wildlife Research and Conservation Action (CWRCA) and Bioinformatics Centre (DBT-BIF), Gauhati University have developed software for exploring the Turtle and Tortoise diversity of Northeast India. A Scientific communication was made in the recent issue of *Turtle and Tortoise Newsletter* anouncing this (Baruah and Sharma 2009). This software is designed to further the understanding of status, distribution and molecular phylogenetics. It will be of value in determining taxonomic relationships among turtle species and fulfill the need for identification and enforcement of protection. The database is designed with information on the turtles of Northeast India, which comprises of information based on first hand investigation, from various researchers in the region and exsiting literature.

The major aims of the database are:

(i) to generate a rich source of information from behavior to molecule for the turtles of Northeast India by creating a Data Bank,

(ii) to provide necessary information for the conservation of different turtle species of Northeast India and

(iii) to educate the local people and budding conservationists regarding the Chelonian resources of the Northeast region.

The database is freely available for academic users. Although at present it is available in the form of CD-ROM the online version is being developed. The "Turtles and tortoises diversity information system of Northeast India" is designed to address all the conservation needs.

Database query search page with options for facilitating easy searching.
[Photo: Chittaranjan Baruah]

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