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Research Article

DISTRIBUTION RECORDS AND CONSERVATION STATUS OF TURTLES IN CHITWAN, NEPAL

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ABSTRACT

Turtle is one of the oldest reptile groups of which 18 species are reported in Nepal. Eight sites were surveyed for turtles in Chitwan. Data were collected by both direct and indirect methods. Nine turtle species and a total of 36 specimens were recorded in Chitwan. *Indotestudo elongata* and *Nilssonia hurum* were the most frequently recorded species. Morphometric measurements of seven turtles were also recorded. Madi (41.7%) was found to contain the highest species richness in the study area. This study also provides information on anthropogenic threats and potential remedies that will help to prevent the extinction of Nepal's turtles.

Keywords: Chitwan, distribution, habitat, threats, turtle

INTRODUCTION

Turtles have existed from more than 220 million years ago, making this one of the oldest reptile groups (Joyce, 2017). Of the 360 living species, more than half are threatened with extinction (Rhodin *et al.*, 2021). Turtles are represented in Nepal by 3 families, 11 genera and 18 species (Rhodin *et al.*, 2021). The Family Geomydidae comprises 13species (*Cyclemys oldhamii, Geoclemys hamiltonii, Hardella thurjii, Batagur dhongoka, Batagur kachuga, Melanochelys tricarinata, Melanochelys trijuga indopeninsularis, Morenia petersi, Pangshura tentoria flaviventer, Pangshura smithii smithii, Pangshura smithiii pallidipes, Pangshura tecta* and *Pangshura tentoria circumdata*), Testudinidae comprises one species (*Indotestudo elongata*) and Trionychidae comprises four species (*Nilssonia gangetica, Nilssonia hurum, Chitra indica* and *Lissemys punctata andersoni*).Ten turtle species are reported from Chitwan (Kästle *et al.*, 2013) of which nine are considered threatened by the IUCN Red List and either CITES Appendix I or II (Rhodin *et al.*, 2021). Turtles are adapted to a life with delayed sexual maturity, high juvenile mortality, and long adult lifespan featuring low natural mortality (Stanford *et al.*, 2020). The exploitation occurs on an unsustainable level, causing the decline of turtle population (Shrestha, 1997). The objectives of the study were to determine status, distribution, habitat preference and threats to turtles in Chitwan.

MATERIALS AND METHODS

Study area

Chitwan is in Bagmati Province and is composed of 2,238.39 km² (27.5833°N, 84.5833°E), elevation of 141m-1947m and temperature 8°C-37°C. Chitwan National Park (area 952.63 km²) at 27.5666°N, 85.2333°E ; Buffer Zone (area 729.37 km²) at 27.4666°N, 85.28333°E (DNPWC, 2019). Furthermore, there were covered four forest spots such as Jaldevi community forest (N27.7106670 E84.4389469), Nagar Baan (N27.694299 E84.410924), Gyaneshwor Community Forest (N27.692137 E84.358193) and Seti Devi Community Forest (N27.695146 E84.331826) (DFO, 2019).

Data collection and analysis

The study was carried out from mid-July 2019 to mid-November 2020. A total of eight survey sites (Forest-Anptari, Nagar Baan, Gyaneshwor, Seti Devi and Park-Beeshazari Lake, Kasara, Madi and Meghauli) were selected for carried out the work of turtle (Fig. 1). The sites were designed in water reservoirs (rivers, lakes, pond) and land, those covered habitat types (Forest, Wetland, Jungle). The team spent 6 hours per day (7:00 am – 9:00 am, 12:00 pm-2:00 pm and 3:00-5:00 pm) on the survey. Surveyed of turtles using binocular (Nikon 10 x 50, Bushnell 20 x 50), Canon EOS 600D, Canon Powershot SX 540 HS, Etrex 10 GPS, Digital Vernier Calliper, and Digital weight machine. The collected data based on direct visual encounters and direct observation from banks in and around the basking sites. Boat surveys of turtles in Beeshazari Lake (2 days) and Rapti river from Kasara to Meghauli (19.68 km, 2 days) in rainy season. Forest surveys used visual inspection of the forest floor, and shrubberies to search for terrestrial species in eight spots. As soon as the species were sighted, locations noted by GPS device and habitat types (river, pond, lake, agriculture land and water channel) were recorded. Also, there was used indirect method to collect data using questionnaires from local and carcasses of dead specimens. The turtle encountered and/or photographed in the field was identified using various standard literature and identification keys given by Iverson (1992), Shah and Tiwari (2004), Kästle *et al.* (2013), and Rhodin *et al.* (2021).

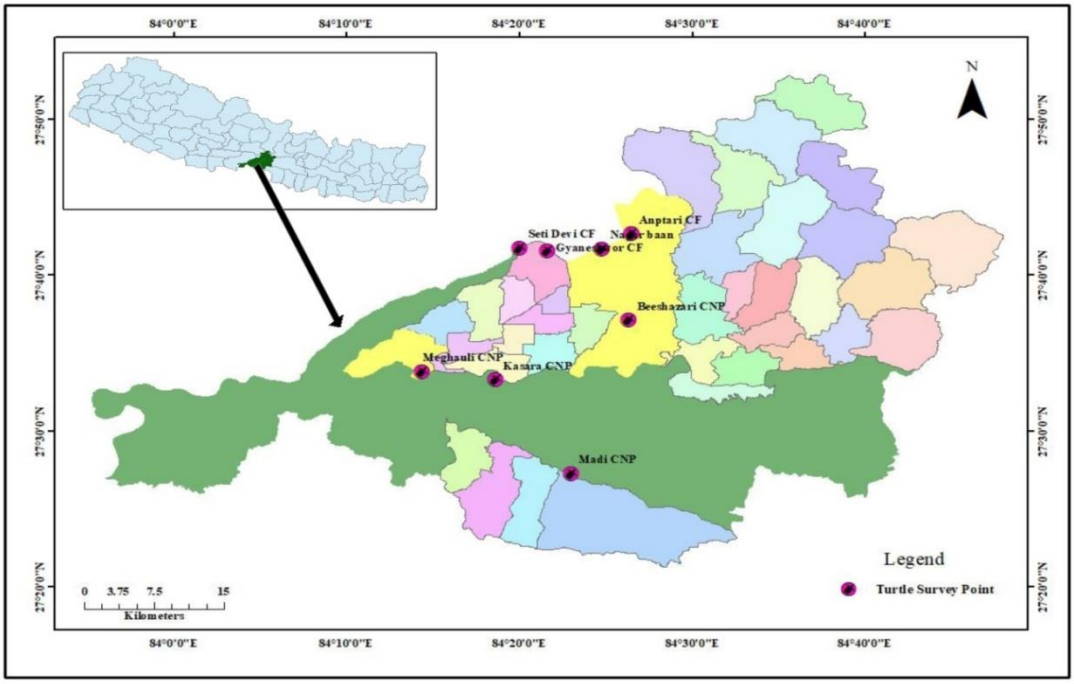


Figure 1. Survey sites of turtles in Chitwan (CF- Community Forest; CNP- Chitwan National Park).

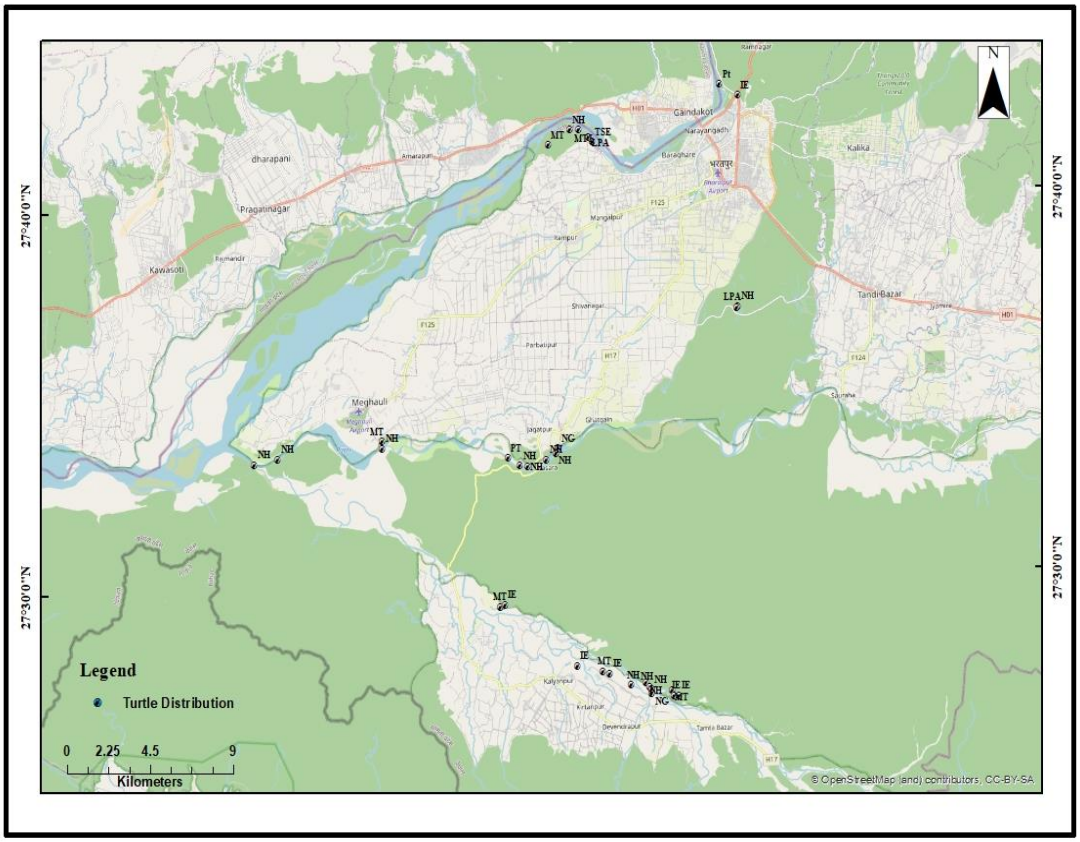


Figure 2. Distribution of recorded turtles in Chitwan. MT = *Melanochelys tricarinata*, MTI = *Melanochelys trijuga indopeninsularis*, Pt = *Pangshura tecta*, PT = *Pangshura tentoria*, IE = *Indotestudo elongata*, NG = *Nilssonia gangetica*, NH = *Nilssonia hurum*, LPA = *Lissemys punctata andersoni*, TSE = *Trachemys scripta elegans*.

RESULTS

A total of 36 specimens were recorded during the study. There were 9 different turtle species were recorded: *Melanochelys tricarinata, Melanochelys trijuga indopeninsularis, Pangshura tecta, Pangshura tentoria, Indotestudo elongata, Nilssonia gangetica, Nilssonia hurum, Lissemys punctata andersoni* and *Trachemys scripta elegans* (Table 2 and Fig. 2-6). Most of the recorded species are listed by IUCN Red List of Threatened Species and either in Appendix I or II of CITES (Table 1). The most often observed species was *Nilssonia hurum* (41.7%) and the least were *Pangshura tecta, Pangshura tentoria* and *Trachemys scripta elegans* (2.8%) Table 2. The high number of turtle distribution in Madi (41.7%), which is present in southern part of Chitwan and connected border of India; the other locations were also good for turtles such as Anptari CF (8.3%), Gyaneshwor CF (16.7%), Setidevi CF (5.6%), Kasara CNP (16.7%) and Meghauli CNP (11.1%) but Nagar Baan and Setidevi CF no turtles were seen (Table 2). There was recorded morphometric data of seven turtle in Table 3. Turtle habitats were recorded, where highest number of species was recorded in forest (40%), followed by river (30%), pond (6.7%), lake (6.7%) and water channel (16.7%). A total of six types of threats were identified and threats percentages were habitat loss (17.1%), hunting (24.4%), Pollution (22%), fishing (19.5%), forest fire (4.9%) and predator (12.2%).

Table 1. Conservation status of recorded turtles of Chitwan.

Scientific Name	Common Name	IUCN	CITES
Family: Geomydidae			
Melanochelys tricarinata	Tricarinate Hill Turtle	EN	I
Melanochelys trijuga indopeninsularis	Eastern Black Turtle	LC	II
Pangshura tecta	Indian roofed Turtle	VU	I
Pangshura tentoria	Indian tent Turtle	LC	II
Indotestudo elongata	Elongated Tortoise	CR	II
Family: Trionychidae			
Nilssonia gangetica	Indian softshell Turtle	EN	I
Nilssonia hurum	Indian Peacock softshell Turtle	EN	I
Lissemys punctata andersoni	North Indian Flapshell Turtle	VU	II
Family: Emydidae			
Trachemys scripta elegans	Red eared slider Terrapin	LC	-

LC= Least Concern, NT= Near Threatened, VU= Vulnerable, CR= Critically Endangered; S= Susceptible, V= Vulnerable (Source**:** Rhodin *et al.*, 2021)

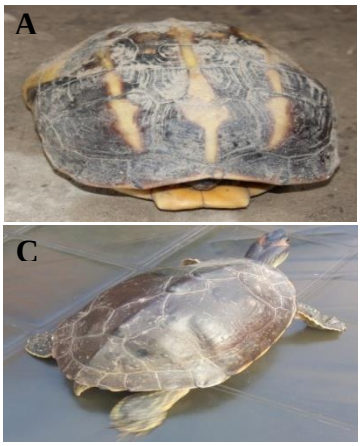
Table 2. Population Distribution and survey area of observed turtles in Chitwan.

Location	Geographic Coordinates, Elevation (m)	Observed Turtles									Total	%
		MT	MTI	Pt	PT	IE	NG	NH	LPA	TSE		
Anptari CF (Jaldevi)	N27.7106670 E84.4389469, 168.9	0	0	1	0	2	0	0	0	0	3	8.3
Nagar Baan	N27.694299 E84.410924, 171.9	0	0	0	0	0	0	0	0	0	0	0
Gyaneshwor CF	N27.692137 E84.358193, 165.6	1	2	0	0	0	0	1	1	1	6	16.7
Setidevi CF	N27.695146 E84.331826, 151.0	0	0	0	0	0	0	0	0	0	0	0
Beeshazari Lake CNP	N27.618171 E84.436299, 177.2	0	0	0	0	0	0	1	1	0	2	5.6
Kasara CNP	N27.554787 E84.307921, 144.0	0	0	0	1	0	1	4	0	0	6	16.7
Madi CNP	N27.454581 E84.380867, 172.7	3	0	0	0	5	1	6	0	0	15	41.7
Meghauli CNP	N27.563303 E84.237514, 152.9	1	0	0	0	0	0	3	0	0	4	11.1
Total		5	2	1	1	7	2	15	2	1	36	
%		13.9	5.6	2.8	2.8	19.4	5.6	41.7	5.6	2.8		100

MT= *Melanochelys tricarinata*, MTI= *Melanochelys trijuga indopeninsularis*, Pt= *Pangshura tecta*, PT= *Pangshura tentoria*, IE= *Indotestudo elongata*, NG= *Nilssonia gangetica*, NH= *Nilssonia hurum*, LPA= *Lissemys punctata andersoni*, TSE= *Trachemys scripta elegans*; CF=community Forest, CNP= Chitwan Nation Park, %=Percentage.

Table 3. Turtle Morphometry record during survey in Chitwan.

Turtle species	Stage	Measurement (cm)				Weight (gm)
		SCL/CuCL	SCW/CuCL	SPL/CuPL	SPW/CuPL	
Melanochelys tricarinata	Sub adult	14/16.2	19/14.2	12/12	7.4/7.4	375
Melanochelys trijuga indopeninsularis	Adult	24/27	17/25.5	21.5/	13	1980
Indotestudo elongata	Adult shell	-/27.5	-/25.5	24/-	16.5/-	-
Nilssonia gangetica	Juvenile	7/-	6.5/-	6.5/-	5.5/-	35
Nilssonia hurum	Sub adult	-/36	-/30	-/27	-/28	5900
Lissemys punctata andersoni	Juvenile	12.5/13.5	10/13	14	10	295
Trachemys scripta elegans	Sub adult	20/21	15/19.5	17.5	10	1220
L= Length, W= Width, C= Carapace, P= Plastron. S= Straight, Cu= Curve						



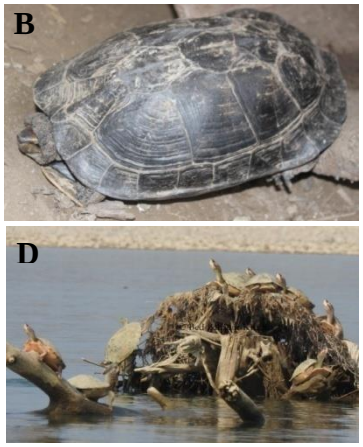


Figure 3. Family Geomydidae:
A- ***Melanochelys tricarinata***
B- ***Melanochelys trijuga indopeninsularis***
C- ***Pangshura tecta*** **(photo by Kamal G.C.)**
D- ***Pangshura tentoria***

(photo by Bed Bahadur Khadka)

Figure 4. Family Testudinidae: ***Indotestudo elongata***

Figure 5. Family Emydidae: ***Trachemys scripta elegans***

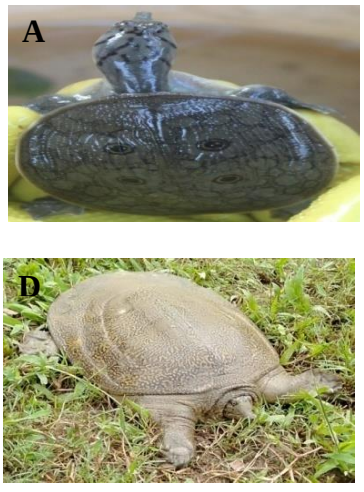


Figure 6. Family Trionychidae: A- ***Nilssonia gangetica*** **Juvenile, B-** ***Nilssonia hurum*** **Juvenile (photo by Gobinda Mahato), C-** ***Nilssonia gangetica,*** **D-** ***Nilssonia hurum*** **(photo by Padamlal Bhusal), E-** ***Lissemys punctata andersoni***

DISCUSSION

Ten turtle species were reported from Chitwan in the past (Shrestha 2001; Shah & Tiwari, 2004; Aryal *et al.,* 2010; Bhattarai *et al.,* 2017; Khadka & Lamichhane, 2020). In this study we recorded nine species, and eight species are *Melanochelys tricarinata, Melanochelys trijuga indopeninsularis, Pangshura tecta, Pangshura tentoria, Indotestudo elongata, Nilssonia gangetica, Nilssonia hurum* and *Lissemys punctata andersoni*; and *Trachemys scripta elegans* one of the species is exotic. *Nilssonia hurum* was the most observed turtle species and *Melanochelys tricarinata, Melanochelys trijuga indopeninsularis, Pangshura* and *Trachemys scripta elegans* were least recorded in the study. Morphometrics of recorded species are similar to previously published records (Shrestha, 2001; Shah & Tiwari, 2004; Kästle, 2013). Forests and rivers were more suitable habitat for turtles than agriculture land. Turtle population disturbs due to habitat loss (Shrestha, 1997), hunting (Shrestha, 2001), predators (Campbell *et al.,* 2013; Kanwal & Khan, 2018) and forest fire (Choudhury, 2001). Through this study, there were also recorded six threats to turtles such as habitat loss, hunting, pollution, fishing, forest fire and predators.

CONCLUSIONS

The present study concluded the total of nine turtle species among 36 specimens were recorded in eight spots in Chitwan. The highest species recorded in forest. Measurements of seven recorded species are similar to data of past work by other. Hunting is the most threats to the turtle in this study.

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AUTHOR CONTRIBUTIONS

SKP: designed, collected data, analyzed, and wrote manuscript, CBS: designed and edited manuscript, BBK: edited manuscript.

CONFLICT OF INTEREST

The authors declare no competing interests.

DATA AVAILABILITY STATEMENT

The data used in this study are available from the corresponding author, upon reasonable request.

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