



## An inventory of mammals, birds and reptiles along a section of the river and banks of upper Ganges, India

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**Abstract:** A study was conducted to assess faunal diversity along a 165-km stretch of the upper Ganges River between Bijnor and Narora cities, Uttar Pradesh, from January to June 2007. Both river and bank species diversity of reptiles, birds and mammals using a combination of boat surveys, linear walks and random searches were inventoried. Presence of 18 species of mammals, 55 species of birds and 13 species of reptiles were recorded from the river stretch including 16 species of global conservation significance. Maximum encounter rate was observed for little cormorant ( $3.160 \pm 0.290$ ), macaque ( $2.385 \pm 0.442$ ) and brown roofed turtle ( $1.009 \pm 0.107$ ). Our study is an attempt towards generating baseline information on the faunal diversity of the upper Ganges and we recommend exhaustive surveys and regular monitoring of this river stretch through indicator species approach.

**Keywords:** Conservation, encounter rate, faunal diversity, Ganges, monitoring.

Aquatic ecosystems are critical components of our environment. In addition to being essential contributors to biodiversity and ecological productivity, they also provide a variety of services to human populations (Poff et al. 2002). Rivers, lakes, wetlands and estuaries constituting the freshwater ecosystem alone support about 6% of the described world species (Hawksworth & Kalin-Arroyo 1995) and provide habitats consisting of benthic, aquatic, and terrestrial components (FISRWG 2001). Freshwater biodiversity constitutes a valuable natural resource, in economic, cultural, aesthetic, scientific and educational terms (Dudgeon et al. 2006). However, there is an increasing concern worldwide on the loss of aquatic ecosystems and their associated biodiversity (Georges & Cottingham 2002; Saunders et al. 2002; Cullen 2003), particularly for riverine landscapes (Dunn 2004). Rivers and associated freshwater habitats are among the most threatened ecosystems of the world (Revenge et al. 2005; WWF 2006) due to a wide range of intensive human use and developmental activities. In addition, declines in biodiversity are far greater in fresh waters than in the most affected terrestrial ecosystems (Sala et al. 2000), because in spite of facing varied threats and large scale exploitations, the freshwater hotspots generally receive less management attention than their terrestrial counterparts (Myers et al. 2000). Moreover, knowledge of the diversity of fresh waters is woefully incomplete and the data are insufficient to accurately estimate rates of freshwater biodiversity loss in many regions (Dudgeon et al. 2006).

River Ganges regarded as one of the largest rivers coursing through 2,510km from northern to eastern India and acting as a lifeline to the vast Indian plains is well recognised for its enormous cultural and economic significance (Adel 2001). It supports about 8% of the world's population living in its catchments

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(Newby 1998) and is also a centre of social and religious tradition. Above all, the river is home to a wide variety of life forms ranging from primitive phytoplanktons to highly evolved species such as dolphins, thus signifying its biological and ecological importance. Information on species diversity, abundance and habitat characteristics are key baseline parameters for conservation planning; unfortunately such information is lacking for many river segments of the Ganges.

A stretch of upper Ganges between Rishikesh and Kanpur functions as an ecologically important section because of its hydrological characteristics (Behera 1995). But, due to high regulation of dams, barrages and associated irrigation canals, infrastructure development, water abstraction and pollution, present-day flow of the upper Ganga Basin has decreased by about 2–8 % and such a reduced flow regime also impacts downstream water availability, water quality and riverine ecosystems (Salemme 2007; Behera et al. 2008; Bharati et al. 2011). Within this, a stretch of 165 km from Bijnor to Narora has been reported to be rich in biodiversity and the only promising habitat for the elusive species such as, Ganges River Dolphin *Platanista gangetica gangetica*, Smooth-coated Otter *Lutrogale perspicillata* and Mugger Crocodile *Crocodylus palustris* in the upper Ganges (Behera 1995; Behera & Rao 1999; Behera 2002; Bashir et al. 2010a). There is a knowledge gap regarding the faunal assemblage of this stretch and whatever information is available, is in the form of casual records and sightings reported in least accessible formats. With this background, we conducted brief surveys in the stretch in an attempt towards assessing relative abundance and habitat occurrence of species (mammals, birds and reptiles) in the study stretch and along its banks.

### Material and Methods

The study was conducted in a 165-km stretch of upper Ganges, between Bijnor (29°22'12.6"N & 78°02'07.8"E) and Narora (28°11'28.4"N & 78°23'48.1"E) barrages in western Uttar Pradesh, India (Fig. 1), between January and June, 2007. The entire study area had an average width of 200 m and was generally shallow with only intermittent small stretches of deep water pools. The banks are either sandy or muddy characterized by forest, shrub and grasses.

Surveys were conducted on a motor boat powered by a 15-hp engine at a constant speed of 6 km/h. Surveys were done between 0600 to 1800 h which also included frequent halts at the banks generally after every 5 km on both sides of the river depending on their accessibility. Banks were surveyed up to 1 km away from the river course through linear walks (1 to 1.5 km) along the river, and random searches for wildlife sightings, signs and evidences by a team of five observers (one researcher and four trained field assistants). Further information regarding the presence of various mammal and reptile species was gathered through informal conversations with farmers, fishermen and other people living along the banks. In addition, during boat surveys opportunistic animal sightings on adjacent banks were also recorded. Field recordings were done with naked eye and using 50×10 binoculars (generally for birds) followed by comparison with field guides (Prater 1971; Ali & Ripley 1987; Grimmett et al. 2001; Das 2002; Menon 2003; Whitaker & Captain 2004). Photographs were also taken wherever possible as supporting evidence and later compared with field guides and discussed with species experts for proper identification. We separately calculated encounter rates (number/km) of species recorded during boat surveys and during bank searches and also generated information on their habitat occurrence (river course, islands [small temporary landmasses created in the stretch due to variation in water flow speeds along the banks], riverbeds, bank cliffs, marshlands, agricultural fields and dense forests along banks) based on records and local information. Each survey of the entire stretch along with the bank surveys took about 12–15 days. A total of four boat surveys (two upstream & two downstream) with an effort of 660 and 116 km of bank searches were done.

### Methodological considerations

Biodiversity surveys in general are limited by a number of factors. Wetlands being dynamic systems species occurrence and detection are constrained by season and time of the day due to variation in activity levels and behaviour among species (Shields 1977; Rollfinke & Yahner 1990). Consequently, a combination of boat surveys and ground based bank searches were conducted for estimating relative abundances in terms of encounter rates (separate for each method) as these could act as a useful monitoring

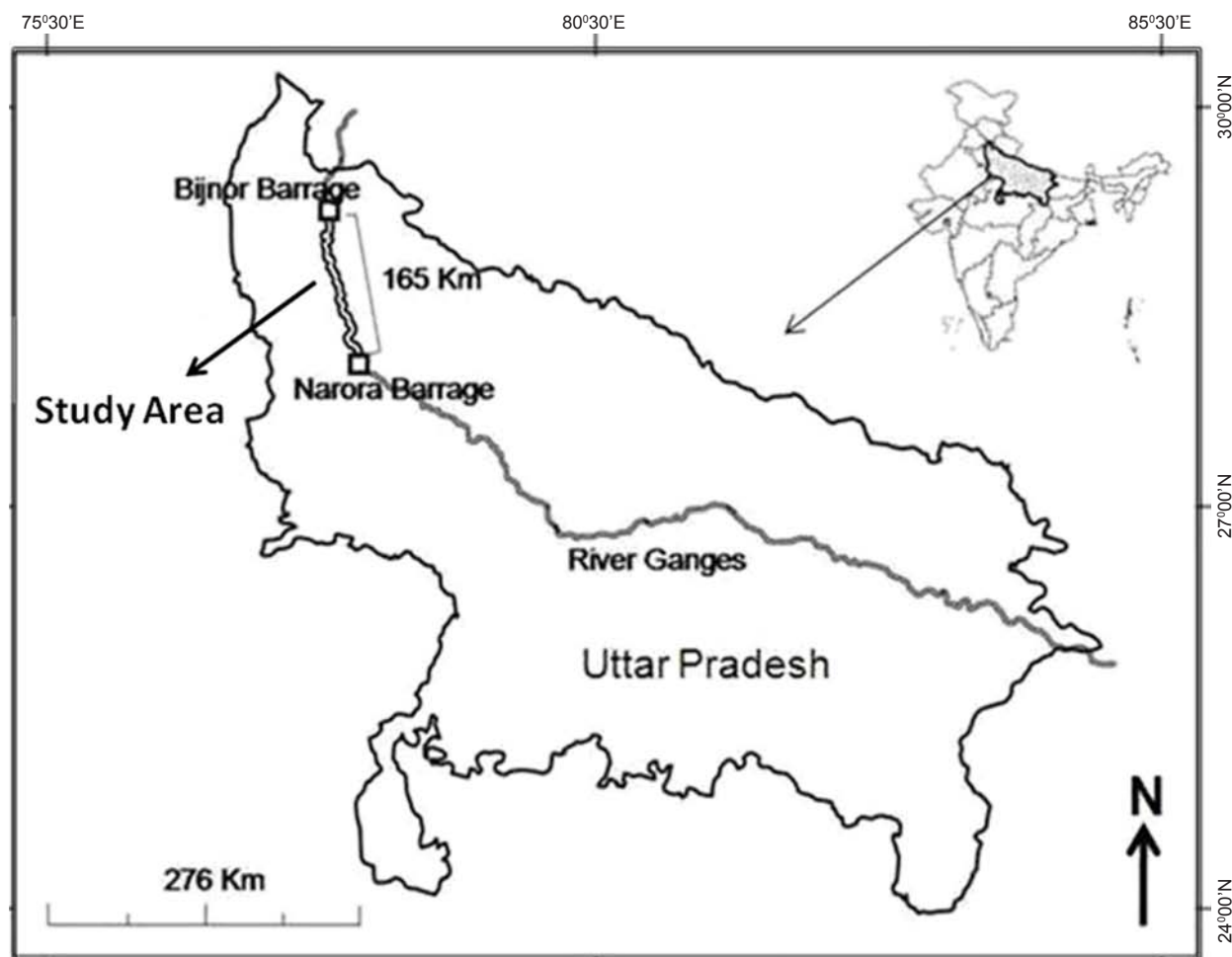


Figure 1. The location of the study area in Uttar Pradesh, India. Source: WWF-India

tool for rapid assessment for a range of species (Anonymous 1998; Kiszka et al. 2004).

We conducted linear surveys along a river stretch, covering 15–20 km and sampling 3–4 segments on each day. Two upstream and two downstream surveys (each survey 165 km) were done in this way. Consequently, segments were exposed to sampling over a mixture of daily time periods. Thereafter, we pooled sightings and signs during each complete survey and reported encounter rates of species for the entire river stretch. Similar technique was used to calculate encounter rates of species recorded during bank searches for a total search/walking effort of 116 km. Our survey method is the most feasible monitoring technique used for wildlife inventories along river stretches and wetlands (Anonymous 1998; Carletti et al. 2004). We invoke that care should be administered in comparing these results with future studies and comparisons should be made only with studies involving similar

survey protocols.

## Results

### Faunal diversity

We recorded the presence of 18 species of mammals (Table 1), 55 species of birds (Table 2) and 13 species of reptiles (Table 3) from the study stretch (aquatic & terrestrial) including one Critically Endangered, four Endangered, six Vulnerable and five Near Threatened species (IUCN 2010) (Images 1–3). While surveying the banks we also encountered antlers of Swamp Deer *Rucervus duvaucelii* (Image 1b) and scats of a wild felid species probably that of Fishing Cat *Prionailurus viverrinus* (Image 1e). Among mammals the maximum encounter rate (individuals/km  $\pm$  Standard Error) was observed for macaque (2.385 $\pm$ 0.442) followed by Jackal (0.478 $\pm$ 0.153) and Ganges River Dolphin (0.24 $\pm$ 0.061), while minimum was for the Fishing Cat (0.025 $\pm$ 0.012 [signs/km]). In case of birds maximum

**Table 1. List of mammalian species recorded along upper Ganges and its banks.**

Common name	Scientific name	Encounter rate (#/km)±S.E.		Evidence	Habitat(s)
		During boat surveys	During bank searches		
Ganges River Dolphin	<i>Platanista gangetica</i>	0.24±0.061	-	S	RC
Smooth-coated Otter	<i>Lutrogale perspicillata</i>	-	0.060±0.015	SG	RC, I, RB
Hog Deer*	<i>Hyelaphus porcinus</i>	-	0.046±0.006	SG	M, A
Swamp Deer*	<i>Rucervus duvaucelii</i>	-	0.086±0.012	SG	M, A
Blackbuck*	<i>Antelope cervicapra</i>	-	-	LI	M, A
Nilgai	<i>Boselaphus tragocamelus</i>	-	0.144±0.032	S	A, F
Fishing Cat*	<i>Prionailurus viverrinus</i>	-	0.025±0.012	SG	I, M
Indian Wolf*	<i>Canis lupus pallipes</i>	-	-	LI	-
Jackal	<i>Canis aureus</i>	0.019±0.007	0.478±0.153	S	M, A, F
Wild Boar	<i>Sus scrofa</i>	-	0.178±0.037	S	M, A
Rhesus Macaque	<i>Macaca mulatta</i>	0.353±0.103	2.385±0.442	S	BC, F
Indian Porcupine	<i>Hystrix indica</i>	-	0.028±0.007	SG	M, A
Five-striped Palm Squirrel	<i>Funambulus pennanti</i>	-	0.121±0.023	S	RB, A, F
Small Indian Civet*	<i>Viverricula indica</i>	-	-	LI	M, A, F
Small Indian Mongoose	<i>Herpestes auropunctatus</i>	-	0.092±0.017	S	A, F
Indian Hare	<i>Lepus nigricollis</i>	-	-	LI	M, A, F
Indian Hedgehog	<i>Paraechinus micropus</i>	-	-	LI	-
Indian Pangolin	<i>Manis crassicaudata</i>	-	-	LI	-
Soft-furred Field Rat	<i>Millardia meltada</i>	-	0.063±0.012	S	A, F
Fulvous Fruit Bat	<i>Rousettus leschenaultii</i>	-	0.042±0.017	S	F

\* Species reported by Behera (1995) but not recorded in the present surveys; + New additions to the list

S = Sighting, SG = Signs, LI = Local information; RC = river course, I = islands, RB = riverbeds, BC = bank cliffs, M = marshlands, A = agricultural fields, F = dense forests along banks.

**Table 2. List of avian species recorded along upper Ganges and its banks.**

Common name	Scientific name	Encounter rate (#/km) ± S.E.		Habitat(s)
		During boat surveys	During bank searches	
Cattle Egret	<i>Bubulcus ibiss</i>	1.016±0.085	1.20±0.268	I, RB, M, A
Indian Pond Heron	<i>Ardeola grayii</i>	0.089±0.032	0.257±0.128	I, RB, M
Grey Heron	<i>Ardea cinerea</i>	0.050±0.018	-	I, RB, M
Little Egret	<i>Egretta garzetta</i>	0.292±0.100	-	I, RB, M, A
Intermediate Egret	<i>Egretta intermedia</i>	0.106±0.072	-	I, RB, M
Large Egret	<i>Egretta alba</i>	0.095±0.056	-	I, M, A
Great Cormorant*	<i>Phalacrocorax carbo</i>	-	-	-
Little Cormorant	<i>Phalacrocorax niger</i>	3.160±0.290	-	I, RB
Darter/Snakebird	<i>Anhinga rufa</i>	0.065±0.015	-	I, RB, M
Indian Shag*	<i>Phalacrocorax fuscicollis</i>	-	-	-
Common Teal	<i>Anas crecca</i>	0.245±0.047	-	RC, I, M
Common Pochard	<i>Aythya ferina</i>	0.156±0.082	-	RC, I, M
Red Crested Pochard	<i>Netta rufina</i>	0.097±0.044	-	RC, I
Pintail	<i>Anas acuta</i>	0.080±0.051	-	RC, I, M
Indian Peafowl	<i>Pavo cristatus</i>	-	0.103±0.025	A, F
Sarus Crane	<i>Grus antigone</i>	0.285±0.065	0.192±0.076	I, RB, M, A

Common name	Scientific name	Encounter rate (#/km) ± S.E.		Habitat(s)
		During boat surveys	During bank searches	
White-breasted Waterhen	<i>Amauornis phoenicurus</i>	0.045±0.020	0.309±0.134	RC, I, RB, M, A
Moorhen	<i>Gallinula chloropus</i>	0.033±0.006	0.280±0.114	RC, I, M
Eurasian Coot	<i>Fulica atra</i>	0.057±0.031	-	RC, I, M
Painted Stork	<i>Mycteria leucocephala</i>	0.063±0.011	0.041±0.014	RC, I, RB, M
Black Necked Stork	<i>Ephippiorhynchus asiaticus</i>	0.015±0.006	-	RC, I, M
Asian Openbill	<i>Anastomus oscitans</i>	0.024±0.010	-	RC, I
Eurasian Spoon Bill	<i>Platalea leucorodia</i>	0.116±0.020	-	RC, I
Greater Flamingo	<i>Phoenicopterus ruber</i>	0.015±0.007	-	RC, I
Bar Headed Goose*	<i>Anser indicus</i>	-	-	-
Ruddy Shelduck	<i>Tadorna ferruginea</i>	0.054±0.017	-	RC, I
Northern Shoveller	<i>Anas clypeata</i>	0.057±0.016	-	RC, I, M
Spotbill Duck	<i>Anas poecilorhyncha</i>	0.168±0.045	-	RC, I, M
Comb Duck*	<i>Sarkidiornis melanotos</i>	-	-	-
Red-wattled Lapwing	<i>Vanellus indicus</i>	0.698±0.057	0.941±0.238	I, RB, BC, M, A
Black Winged Stilt	<i>Himantopus himantopus</i>	0.047±0.025	0.102±0.035	I, RB, M
Common Sandpiper	<i>Tringa hypoleucos</i>	0.056±0.017	-	I, RB, M
White-throated Kingfisher	<i>Halcyon smyrnensis</i>	0.077±0.029	0.106±0.046	I, RB, BC, M, A
Pied Kingfisher	<i>Ceryle rudis</i>	0.027±0.017	0.030±0.021	I, RB, M
Hoopoe	<i>Upupa epops</i>	0.036±0.006	0.202±0.097	RB, A, F
Eurasian Stone-curlew*	<i>Burhinus oedicnemus</i>	-	-	-
Pied Avocet	<i>Recurvirostra avosetta</i>	0.150±0.038	-	RC, I
Great Stone-curlew*	<i>Esacus recurvirostris</i>	-	-	-
Little Ringed Plover*	<i>Charadrius dubius</i>	-	-	-
Kentish Plover*	<i>Charadrius alexandrinus</i>	-	-	-
Spur Winged Plover*	<i>Vanellus spinosus</i>	-	-	-
Common Redshank*	<i>Tringa totanus</i>	-	-	-
Blue Tailed Bee-eater	<i>Merops philippinus</i>	-	0.038±0.016	M, A, F
Green Bee-eater*	<i>Merops orientalis</i>	-	-	-
Indian Roller	<i>Coracias benghalensis</i>	-	0.010±0.005	M, A
Indian Bushlark*	<i>Mirafra erythroptera</i>	-	-	-
Rufous-tailed Lark*	<i>Ammomanes phoenicurus</i>	-	-	-
Little Tern*	<i>Sterna albifrons</i>	-	-	-
Brown-headed Gull*	<i>Larus brunnicephalus</i>	-	-	-
Black-headed Gull*	<i>Larus ridibundus</i>	-	-	-
River Tern	<i>Sterna aurantia</i>	0.272±0.059	-	I, M
Black-bellied Tern*	<i>Sterna acuticauda</i>	-	-	-
Indian Skimmer	<i>Rynchops albicollis</i>	-	0.090±0.055	I, M
Crow-pheasant	<i>Centropus sinensis</i>	-	0.021±0.009	M, F
White-rumped Vulture	<i>Gyps bengalensis</i>	-	0.005±0.003	F
Egyptian Vulture	<i>Neophron percnopterus</i>	-	0.130±0.061	BC, M
Shikra*	<i>Accipiter badius</i>	-	-	-
Pallas's Fish-eagle*	<i>Haliaeetus leucoryphus</i>	-	-	-
Blue Rock Pigeon	<i>Columba livia</i>	0.130±0.033	0.374±0.071	RB, BC, A, F
Eurasian Collared Dove	<i>Streptopelia decaocto</i>	-	0.141±0.063	RB, A, F



Common name	Scientific name	Encounter rate (#/km) ± S.E.		Habitat(s)
		During boat surveys	During bank searches	
Red Turtle Dove*	<i>Streptopelia tranquebarica</i>	-	-	-
Rose-ringed Parakeet	<i>Psittacula krameri</i>	-	0.071±0.027	M, F
Brown Fish-owl*	<i>Bubo zeylonensis</i>	-	-	-
Little Swift*	<i>Apus affinis</i>	-	-	-
Red Vented Bulbul	<i>Pycnonotus cafer</i>	0.07±0.017	0.135±0.051	BC, M, A, F
Indian Myna	<i>Acridotheres tristis</i>	0.172±0.052	0.492±0.108	RB, BC, A, F
Pied Myna	<i>Stumus contra</i>	0.040±0.016	0.231±0.075	RB, A, F
Bank Myna*	<i>Acridotheres ginginianus</i>	-	-	-
Black Headed Myna*	<i>Stumus pagodarum</i>	-	-	-
House Sparrow	<i>Passer domesticus</i>	0.089±0.017	0.989±0.218	RB, BC, A, F
Rufous Treepie	<i>Dendrocitta vagabunda</i>	-	0.045±0.015	A, F
Oriental Magpie Robin	<i>Copsychus saularis</i>	-	0.028±0.012	M, A, F
Indian Robin	<i>Saxicoloides fulicata</i>	-	0.013±0.007	A, F
Brahminy Kite*	<i>Haliastur indus</i>	-	-	-
Black-Winged Kite*	<i>Elanus caeruleus</i>	-	-	-
Black Kite*	<i>Milvus migrans</i>	-	-	-
Long-tailed Shrike	<i>Lanius schach</i>	-	0.062±0.015	M, A
Grey Wagtail*	<i>Motacilla cinerea</i>	-	-	-
Large Pied Wagtail*	<i>Motacilla maderaspatensis</i>	-	-	-
Common Babbler	<i>Turdoides caudatus</i>	-	0.032±0.010	RB, M, A, F
Large Grey Babbler	<i>Turdoides malcolmi</i>	-	0.097±0.024	RB, BC, M, A, F
Bran Swallow*	<i>Hirundo rustica</i>	-	-	-
Red-rumped Swallow*	<i>Hirundo daurica</i>	-	-	-
House Crow	<i>Corvus splendens</i>	0.178±0.026	0.448±0.153	I, RB, M, A, F
Jungle Crow	<i>Corvus macrorhynchos</i>	-	0.218±0.083	RB, M, A, F
Common Drongo	<i>Dicrurus adsimilis</i>	0.034±0.011	0.181±0.033	M, A

\*Species reported by Behera (1995) but not recorded in the present surveys

RC = river course, I = islands, RB = riverbeds, BC = bank cliffs, M = marshlands, A = agricultural fields, F = dense forests along banks.

encounter rate was for Little Cormorant (3.160±0.290) and minimum for Indian White-rumped Vulture *Gyps bengalensis* (0.005±0.003). While among reptiles maximum encounter rate was observed for Brown Roofed Turtle (1.009±0.107) and minimum for Indian Cobra (0.011±0.011), respectively. The information on the habitat occurrence of mammal species depicted that more than 50% of species occurred in agricultural fields, dense forests along banks as well as in marshlands while just 12% occurred in river course, islands and river beds. In case of birds more than 60% species were encountered in marshlands and islands, and more than 30% in agricultural fields, river beds, in dense forests along banks as well as in river courses, while only 14% were encountered in bank

cliffs. In addition, more than 50% of the reptile species were encountered in river beds, agricultural fields, marshlands and dense forests along banks, while more than 30% in islands and river courses and only 15% in bank cliffs. Interestingly, more than 80% of the snake species were encountered in agricultural fields.

Besides this, we encountered carcasses of Indian Monitor Lizard *Varanus benghalensis* with fatal wounds (Image 1a) and Swamp Deer with cut antlers (Image 1c). We also found entangled Peacock Soft Shell Turtle *Nilssonina hurum* (Image 3b) in one of the permanently laid fishing nets, recovered antlers of Swamp Deer and Hog Deer *Heylaphus porcinus* (Image 1d) and rescued a live specimen of Indian Roofed Turtle from local farmers, who superstitiously

**Table 3 List of reptilian species recorded along upper Ganges and its banks.**

Common name	Scientific name	Encounter rate (#/km) ± S.E.		Habitat(s)
		During boat surveys	During bank searches	
Indian Rock Python*	<i>Python molurus</i>	-	0.104±0.031	M, A, F
Russell's Viper*	<i>Daboia russelii</i>	-	0.040±0.011	RC, A, F
Checkered Keelback*	<i>Xenochrophis piscator</i>	0.015±0.006	0.230±0.055	RC, RB, M, A
Indian Rat Snake*	<i>Ptyas mucosas</i>	-	0.044±0.011	RB, A, F
Red Sand Boa*	<i>Eryx johnii</i>	-	0.040±0.008	RB, A
Indian Cobra*	<i>Naja naja</i>	-	0.011±0.011	A, F
Mugger Crocodile	<i>Crocodylus palustris</i>	0.058±0.010	-	RC, I, RB, M
Gharial	<i>Gavialis gangeticus</i>	-	-	-
Black Pond Turtle*	<i>Geoclemys hamiltonii</i>	-	-	-
Crowned River Turtle*	<i>Hardella thurjii</i>	-	-	-
Red-crowned Roofed Turtle*	<i>Batagur kachuga</i>	-	-	-
Three-striped Roofed Turtle*	<i>Batagur dhongoka</i>	-	-	-
Brown Roofed Turtle	<i>Pangshura smithii</i>	1.009±0.107	-	I, RB
Indian Roofed Turtle*	<i>Kachuga tecta</i>	-	-	-
Indian Tent Turtle*	<i>Pangshura tentoria</i>	-	-	-
Indian Black Turtle*	<i>Melanochelys trijuga</i>	-	-	-
Indian Flapshell Turtle*	<i>Lissemys punctata</i>	-	-	-
Indian Softshell Turtle	<i>Aspideretes gangeticus</i>	0.052±0.032	-	RC, I, RB
Peacock Softshell Turtle	<i>Nilssonina hurum</i>	-	-	I, RB, M
Narrow-headed Softshell Turtle*	<i>Chitra indica</i>	-	-	-
Monitor Lizard*	<i>Varanus bengalensis</i>	-	0.134±0.064	M, A, F
Common Calotes*	<i>Calotes versicolor</i>	-	0.276±0.048	I, RB, BC, M, A, F
Indian Bull Frog*	<i>Hoplobatrachus tigerinus</i>	-	0.961±0.021	I, RB, BC, M, A, F

\*Species reported by Behera (1995) but not recorded in the present surveys; \* New additions to the list  
RC = river course, I = islands, RB = riverbeds, BC = bank cliffs, M = marshlands, A = agricultural fields, F = dense forests along banks.

believed the turtle carapace as a sign of protection to their cattle. During our visits to the local fish market (mandi) we also got evidences of illegal fishing (catches <250g).

## Discussion

The high species richness of the river stretch including species of global significance validates the ecological importance of the area and also merits a need for its conservation and management. Comparisons with earlier reports indicate that our surveys yielded fewer species of birds in contrast to 86 species (Table 2) reported by Behera (1995), but more mammals compared to Behera (1995, 2002) including Hog Deer, Swamp Deer, Fishing Cat and Small Indian Civet as new additions (Table 1). We recorded similar number of reptile species in our surveys in comparison

with earlier reports of 14 species (12 turtles and two crocodiles) by Behera (2002), but with nine species as new additions (Table 3). The probable reasons for fewer bird species encountered may be attributed to seasonal migration in some species which requires a year round sampling effort or cryptic nature of certain species which needs intensive and repetitive surveys for detection, which could not be addressed in this study. The encounter rate for Ganges River Dolphin in the entire stretch was similar to the estimate (0.23) in the Lohit River, eastern Assam (Wakid 2005) but lower than our estimate (0.52±0.068) for a small stretch of 28km between Narora and Anupshahar (Bashir et al. 2010b), 0.44 in the Brahmaputra River, Assam (Mohan et al. 1997) and 1.8 in Vikramshila Gangetic Dolphin Sanctuary (Choudhary et al. 2006). Our results also confirm Brown Roofed Turtle as most abundant turtle





Image 1. (a) Monitor Lizard carcass with deadly wounds; (b) Swamp Deer antler; (c) Swamp Deer carcass with cut antlers; (d) Swamp and Hog deer antlers recovered; (e) Fishing Cat scat



Image 2. (a) Sarus Cranes; (b) Greater Flamingo and Eurasian Spoon Bill; (c) Indian Skimmer





**Image 3. (a) Common Calotes; (b) Peacock Softshell Turtle entangled in fishing net; (c) Russell's Viper**

species in the stretch as reported earlier (Behera 1995; 2002), signifying it as a potential habitat in the upper Ganges for dolphin and turtle conservation (Behera 1995; Behera & Rao 1999; Behera 2002). Occurrence of a major proportion of water birds is also an indicator of good habitat quality. Majority of mammal, bird and reptile species occurrences in agricultural fields, forest patches along banks and in marshlands symbolises that not only the river stretch but its banks are equally rich in biodiversity representing a rich riverine ecosystem, but with few concerns; since agricultural activities are continuing to increase along the banks (Bashir et al. 2010a) and additionally some threats to riverine biodiversity were identified at local level in this study. Increasing agricultural activities and percentage of cultivated land of riparian wetlands have been suggested to affect bird communities by decreasing species diversity (Mensing et al. 1998). Despite survey constraints, there is a regular need to assess the level of biodiversity and health of this river

stretch. An indicator species approach can be a useful assessment tool in this regard (Anonymous 2008). In a multi-organisimal study of a dynamic ecosystem (wetlands), water birds have been suggested as excellent environmental indicators as their populations are not only extremely dynamic and sensitive to change but more often reflect land use conditions than other groups (Galatowitsch et al. 1999; Anonymous 2008). Hence, future studies should be conducted with this approach along with awareness programs at local levels.

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