SUNDARBAN

REDISCOVERING SUNDARBAN

THE MANGROVE BEAUTY OF BANGLADESH

Edited by

Reza Khan

Research & Compilation

Shimanto Dipu

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Rediscovering Sundarban
The Mangrove Beauty of Bangladesh

Published by
Karunangshu Barua
Nymphea Publication
Shajan Tower (1st Floor)
4 Segun Bagicha
Dhaka 1000, Bangladesh
Phone: +88 02 9581527, +88 02 9581528
E-mail: info@nympheapublication.com
Web: www.nympheapublication.com

First Published
December 2013

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Citation of the book: Dipu, S. and Ahmed, F. 2013. Sundarban: Rediscovering Sundarban, The Mangrove Beauty of Bangladesh. Reza Khan (ed.). Nymphea Publication, Dhaka – 1000, Bangladesh.

Example of Article Citation: Sharma, D. 2013. The Message of the Sundarban. In: Reza Khan (editor): *Sundarban: Rediscovering Sundarban, The Mangrove Beauty of Bangladesh.* Dhaka: Nymphea Publication. 16-19 Pp.

ISBN: 978-984-90160-0-7
Price: ৳ 600 | $ 8 | € 6

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Wildlife of the Sundarban

Bangladesh is possibly the most blessed country in South Asia to have one of the biodiversity hotspots, the Sundarban Mangrove Forest, the largest such entity in the world as mentioned by world bodies like the WWF (World Wildlife Fund) and UNESCO (United Nations Educational, Scientific and Cultural Organization). In an overpopulated country like Bangladesh where there is an acute shortage of land even for human settlements it is noteworthy for it to have a single stretch of 6,000 square kilometres (sq. km.), out of a total of c. 10,000 sq. km., of natural forest shared by Bangladesh and the West Bengal State of India. The beauty of Bangladesh part of the Sundarban is that there exist no human habitations or permanent settlements whereas nearly half of Indian side of it is supposedly

By **Reza Khan**

under such settlements. It deserves some recognition in the world arena of environment and wildlife conservation. As such Bangladesh has already declared three areas covering some 400 sq. km. of the Sundarban as two wildlife sanctuaries and one as UNESCO's Ramsar Site cum wildlife sanctuary.

The Sundarban occupies the head of one of the largest deltas of the world formed at the confluence of three mighty South Asian rivers- the Padma, Jamuna and Meghna flowing down from the Himalayas to the Bay of Bengal. These rivers not only push freshwater to the Bay but also carry the nutrient rich top soil from hills and foot hills of the Himalayas. In the process of the downhill journey of this river water the alluvial soil and sand washed from the upstream hill country get deposited at the delta mouth forming the basis for the mangrove, tidal, coastal or estuarine vegetation as the Sundarban Mangrove Forest. Ultimately over the millennia the delta mouth has given rise to a unique array of plants forming the present Sundarban. This in turn has made the Sundarban a congenial place for the survival of hundreds of species of nano, micro, macro and mega- sized animals from microscopic zooplankton to huge buffalo or Bengal Tiger.

In the Bangladesh context the Sundarban is possibly the last hope for the survival of any unique and great population of wildlife in the wild because all the other types of forests such as the Sal in the central and northern parts, and Mixed or Semi-evergreen forests in the hill country have virtually become barren or devoid of wildlife. The reasons for such depletion are excessive deforestation or forested lands being brought under monoculture of indigenous and exotic plants or plantation forests comprising commercially viable species and shifting cultivations followed by land grabbing which has changed the composition of local vegetation which in turn has wiped out major forest-dwelling wildlife species from the country (Anon. 2006; Khan 1982, 1985, 1987, 1996, 2003, 2008 and 2010; Khan,2007; Kibria *et al*, 2010; Kibria *et al*, 2011; Mukul *et al*, 2008).

Considering the declining and disappearing status of most wildlife in the country we need to ponder managing or preserving the vast wildlife wealth we still have in the Sundarban Mangrove Forest in a sustainable manner.

By gross definition, all life forms in wild state are considered

wildlife of a country or region. Most animals and plants which are not nurtured and nourished by human beings come under this category. There is a fundamental difference between the currently used popular biodiversity and wildlife as both are sometimes used interchangeably to mean wild animals and plants. However, biodiversity has much broader connotation than wildlife because the former not only includes all wildlife but also all life forms and genetic materials derived from them that exist in the world be that in the wild, laboratory, as chryo-preserved specimens such as fertilized or unfertilized sperms, ova, seeds or domesticated animals and plants.

In this literature animals and plants are to be addressed by different authors at various levels. I am just trying to put an overview of the wildlife of the Sundarban and general comments on their preservation. This will also include a historical background of the wildlife, their disappearance and present constraints posed by some natural phenomena and man-made ones for the sustainable growth and management of the existing wildlife of the Sundarban.

Wildlife Background

Existence of the Sundarban was known to historians and olden day travellers from the time of Chinese Hiuen-Tsang, Moroccan Ibn Battuta and others. Hiuen-Tsang visited India between 629-645 AD. His memoir gives extensive information on the distribution of forests at that time. He recorded deep forests in Sravasti, Kapilabastu, and nearby regions including Ramgram. From Ramgram 'he went north-east through a great forest road which was a narrow dangerous path with wild oxen and wild elephants, and robbers and hunters always in wait to kill travellers. Emerging from forests he reached the country of Krishnagara. The great traveller crossed PUN-NA-FA-TAN or Pundrabardhana (Pabna according to Cunningham, and Rangpur according to Ferguson). He mentioned that Pundrabardhana was a low country with moist, prosperous, fertile soil and jackfruit trees. Then Hiuen-Tsang came to Samatata i.e. present day Jessore, Dhaka and Faridpur districts, where the climate was moist and the land was low, and full of trees and wild animals (Anon, 2006, Sundarban).

Abul Fazal mentions the presence of forests in Jannatabad, Khalifabad and Bazuha. In Khalifabad he mentions an abundance

of wild elephants; while in Bazuha thick long timbers suitable for masts. Jannatabad was grassy and full of wild buffaloes. The present Sundarban, according to the description, extended further north up to northern Nadia and northern Jessore, and or as full of crocodiles and tigers (Anon, *ibid*).

Possibly the first ruler-cum-naturalist of the old Indian Empire Emperor Babur was the first to specifically mention any particular animal of the Sundarban. His notes mention that the "Lesser Rhinoceros or Javan Rhinoceros was found in the Bengal Sundarban, and a very few individuals were stated to occur in the forest tract along the Mahanuddy river, and extending northwards towards Midnapore"[1].

During the Mughal period (1203-1538), the local kings leased the forests of the Sundarban out. In the British colonial time, the area was mapped by the Surveyer General as early as 1764 and the proprietary rights were obtained from the Mughal Emperor, Alamgir II, by the East India Company in 1757. Systematic management of the forest started in 1869 after the establishment of a Forest Management Division in the Province of Bengal, in British India.

The Sundarban was declared a reserved forest in 1875-76, under the Forest Act, 1865. A Forest Division was created in 1879 with headquarters in Khulna. The first management plan was written for the period 1893-98. In 1911, it then stretched for about 266 km from the mouth of the Hugli (in West Bengal) to the mouth of the Meghna (in present Bangladesh), and was bordered inland by three districts: Twenty-four Parganas (of West Bengal), Khulna and Bakergunj (Greater Barisal, of present Bangladesh). The total area including water was estimated to be 16,902 sq. km.

However, this figure is now considered to be about 10,000 sq km, of which Bangladesh has 6000 and the Indian West Bengal has 4000 sq km.

Wildlife Richness in the Sundarban

There is no doubt that the Sundarban is possibly the most biodiversity rich area of the country. If we consider the wildlife species covering the major vertebrates, that is from the Amphibia to

1 http://www.indianetzone.com/39/indian natural_history_mughal_ period.htm

Mammalia and Fishes, both bony and cartilaginous, then we have 42 species of amphibians, 157 reptiles, 718 birds and 124 (125) mammals vide Khan (2010), and 442 species of marine fishes divided as 56 cartilaginous, 386 bony fish species when there are 266 of inland or freshwater and brackish water fish species vide Banglapedia, 2006[2]. Of these wildlife species, nearly 50 % are present in the Sundarban, barring the amphibians.

Back in 1986 I had for the first time prepared a comprehensive report on the wildlife of our mangrove ecosystem and reported 8 species of amphibians, 50 species of reptiles, 261 species – 180 species of non-passerine and 81 species, of passerine birds and 49 species of mammals. However, this report almost entirely consisted of the species records from the Sundarban, with the exception of some man-made and man-destroyed mangroves all along the coastal areas from the Sundarban in the west down to the St. Martin's Island in the east. One exception was the Parailla Bandar or Crab-eating or Long-tailed Macaque (*Macaca fascicularis*) that was only found in the mangroves along the bank of the River Naaf under Teknaf Upazila reported by me (Khan 1985, 1986b) and many later researchers. Prater (1971) considered Assamese Macaque (*Macaca assamensis*) to be present in the Sundarban. But I have refuted it in my papers and books (Khan 1979, 1981a, 1982, 1982c, 1985b and 1987b).

When I personally visited the Zoological Survey of India at Calcutta during the mid 1970s, from June 1974 to 1979, and talked to zoologists there they told me that one specimen of an Assamese Macaque was collected from Kolkata market which was wrongly labelled to have been procured from the 'Sunderbans' in the early 20th century and the mistake was carried in all literature prior to 1980s. I have never met any Bangladeshi zoologist who has worked in the Sundarban and has ever come across this macaque there. Assamese Macaque is one of the mammals that did not cross the River Jamuna and Padma in Bangladesh in the historical past thereby making Bangladesh as its westernmost limit in its range of world distribution.

Against my 1986 figures, now defunct Sundarban Biodiversity Conservation Project has reported some 40 species of mammals, 270 birds, 45 reptiles and 11 species of amphibians. It has reported 120

2 http://www.banglapedia.org/httpdocs/ HT/F_ 0088.HTM

species of fishes from the Sundarban.

The Sundarban hosts about 50 species of mammals, about 320 species of inland and migratory birds, about 50 species of reptiles, 8 species of amphibians, and about 400 species of fish (Anon, 2006) in Sundarban[3].

Shariar (2011), quoting various sources, noted 334 species of plants, 49 mammals, 320 birds, 53 reptiles, 11 amphibians, 400 fishes and 873 invertebrates, and 1 species of Hemichordate from the Sundarban.

A comparison of wildlife species in Bangladesh Sundarban, shown below, compared to that of the West Bengal in India and the world based on Anon (2006), Anon (2008), Khan (1986) and Shariar (2011).

Taxonomic group	World	Species described	West Bengal vide Mandal (2003)	Anon (2008)	Bangladesh Sundarban	
		subcontinent	Sundarban		1986/2006*	
Protozoa	31,250	2,577	106	175	Invertebrates 873 (Shariar, 2011**)	
Porifera	4,562	500	Invertebrate Species 1104	29		
Cnidaria	9,916	842		102		
Ctenophora	100	12		10		
Rotifera	2,500	330		76		
Gastrotricha	3,000	100		4		
Platyhelminthes	17,500	1,622		126		
Nematoda	30,000	2,850		176		
Mollusca	66,535	5,072		479		
Echinodermata	6,000	765		46+		
Arthopoda	987,949	68,389		5000+	24 *** shrimps	7 *** crabs
Fish	21,723	2,546	481	653	177 400 (**)	
Amphibians	5,150	248		34	8/8* (11**)	
Reptiles	5,817	460	55	154	50/50(53)*	
Birds	9,026	1,232	248	650	261/320*	
Mammals	4,629	397	58	121	49/50*	

* Figures are from 1986 (Khan 1986)/ 2006 (Banglapedia, 2006)

** Shariar (2011)

*** From IUCN, 1994

Islam (2008), based on Rashid *et al* (1994) and Siddiqi (2001) produced a table, below, showing the percentage of Bangladesh's major wildlife species living in the Sundarban compared to national total.

3 http://www.banglapedia.org/ httpdocs/HT/S_0602.HTM

Animal group	No of species in Bangladesh	Species in the Sundarban, Khan (1986)	% in Sundarban	No of species Extinct	No of species Endangered
Amphibians	22	8	36%	-	2
Reptiles	109	50	46%	1	16
Birds	624	261	42%	2	11
Mammals	110	49	45%	4	10
Total	865	368	42%	7	39

It has now been sufficiently established that the Sundarban is our wildlife hotspot. Sundarban is also home for species discovery or type locality of several vertebrates. The same could be true for some invertebrates that I did not try digging.

Wildlife Concentrations in the Sundarban

Anyone visiting the Sundarban would notice that not a single inch of it is free from wildlife. This could be represented by tiny crabs to mudskippers, barnacles to sea-squirts or toads to tigers. Among invertebrates the most dominant are the crabs and gastropods and bivalves on mud banks and intertidal zones, when some gastropods could be found on mangrove plants such the Baen, Genwa, Golpata, Bola, and Sundari trees. Butterflies, moths, dragonflies, honeybees, wasps, beetles, bumblebee, ants, bugs, spiders, flies, midges, mosquitoes, damsel flies, spiders, cicadas, scorpions and centipedes dominate the terrestrial habitats. There is no dearth of shrimps, prawns and crabs in the water.

Invertebrates

Zooplankton provides a lifeline for the fishes and other animals living in aquatic environment. This generally comprises the larvae of shrimps, crabs and other crustaceans, mollusks and echinoderms as well as fish fries.

Among invertebrates the most important commercial species are the shrimps and prawns and lobsters. Mud Crab *Scylla serrata* that are being harvested from nature and/or their larvae and juveniles are collected en masse from nature and then nurtured to an exploitable size in commercial mini and mega ponds and shrimp farms.

Major prawn and shrimp species used in commerce are *Macrobrachium rosenbergii*, *M. malcolmsonii*, *M. rude*; *Penaeus monodon*, *P. semisulcatus*, *P. indicus*, *P. japonicas*, *P. merguiensis*, *P. penicillatus*, *P.*

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orientalis and *Metapenaeus monoceros*. The commercially trawled lobsters include *Panulirus polyphagus*. *P. versicolor*, *P. homarus*, *P. ornatus*, and *Thenus orientalis* (Anon, 2006, Prawns and Lobsters).

Among insects the most important commercial ones are the honeybees – Giant Honeybee *Apis dorsata* and European Honeybee *Apis mellifera*. Basically honey is extracted from the large honeycombs during the peak of the season in mid-April and continues for two months or so. In addition wax from the hive is also collected by Mouals – the honey collectors. Woodcutters and most other people who enter into Sundarban for livelihood are generally called Bawals or Bawalis.

Non-commercial crabs that decorate the mudflats, mud banks, sandflats, overland, tree trunks and in the water of the Sundarban includes Red fiddler crab *Gelasimus annulipus*, Fiddler Crabs of *Uca* and *Gelasimus* species, *Metopograpsus* species, *Portunus pelagicus*, Three Spot Swimming Crab *Portunus sanguinolentus*, *Scopimera* species, Ghost Crab *Ocypode* species, Moon Crab *Matuta victor*, Smooth-shelled Swimming Crab *Charybdis affinis*, hermit crabs, soldier crab, etc.

Sand Bubbler Crab *Scopimera globosa* and its related genus *Dotilla* species are possibly the most numerous crabs on any sandy beach. They keep forming tiny balls of sand at ebb which are arranged in thousands of patterns but all radiate from a central hole. They are also the smallest of the crabs we encounter regularly in the Sundarban's southern face.

The Sundarban is heaven for butterflies. Most spectacular, colourful, immense varieties in colours define the hordes of species that we encounter regularly in the Sundarban, irrespective of seasons.

We have an endemic subspecies of Crow Butterfly called Sundarban Crow *Euploea crameri nicevillei* (Moore, 1890). The other crow that is commonly found in Sundarban and the rest of the country is Common Crow *Euploea core*.

Common Tiger *Danaus genutia*, White Tiger *Danaus melanippus* Blue Glassy Tiger *Ideopsis vulgaris*, Dark Brand Bushbrown *Mycalesis mineus*, Sergeant Butterflies of the genus *Athyma*; Common Rose *Atrophaneura (Pachliopta) aristolochiae*; many species of Swallow-tails, Mormons, under the genus *Papilio*, Lime Butterfly *Papilio demoleus*,

Commodore, Wanderer, Sailor, Leopard, etc. Smaller species include Skipper Butterflies, Cabbage White, Lineblue, Grassblue, etc.

Among moths we commonly see Hawk Moth, Death's-head Hawk Moth, Moon Moth, Tiger Moth *Asota* species, Atlas Moth, Day-flying Moth such as Marbled White and *Dysphania, Milionia* species, Paper Moth *Acropteris* species, Leaf Mimicking Moth *Oreta* species, Wasp Moth *Amata* species, etc.

Over a dozen species of dragonflies and Damselflies can be encountered during a day's trip through the Sundarban. Wasps, beetles, bugs, hornets, cicadas, crickets, midges, flies, grasshoppers, leafhoppers, aphids, ants and spiders are countless.

The most important mollusk item in commerce is the gastropod species *Telescopium telescopium* collected in a wholesale manner and exploited for the production of commercial lime or Calcium Carbonate used in buildings as a white water soluble paint and to a lesser extent as lime for use as an ingredient of betel leaf chewing as well as soil fertilizer and in poultry feed.

The bivalves identified as commercially important and found in the Sundarban to the St. Martin's Island are as follows: edible oysters *Crassostrea madrasonsis, Crassostrea belcher*i, *Crassostrea gruphoides*' and *Saccostrea cucullata*; Windowpane oysters *Placuna placenta*; Clams include *Anadara granosa*, *Anadara rhombea, Meretrix* sp., and Mussels *Mytilus edulis*[4].

Diversity of aquatic and semi-aquatic invertebrate species of Bangladesh is shown in the following table. The table below is based on Ahmed (1990) and Bangladesh Fisheries Research Forum (BFRF)[5]. Many of these species are found within the environs of the Sundarban.

Invertebrate Groups	Habitat	Species Number
Shrimps	Freshwater and marine	56
Crabs	Marine	11
	Freshwater	4
Lobsters	Marine	3
Mollusks	Freshwater	26
	Marine	301

4 http://www.fao.org/docrep/ field/003/AB710E/AB710E09.htm
5 http://www.bfrf.org/value-chain-mollusc.pdf

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Vertebrates

Fishes

The most important commercially important resource of the Sundarban is its fish biodiversity that is heavily exploited year round. Species that are commercially exploited include Bhetki, Asian Seabass *Lates calcarifer*, Ilish, Hilsa Shad *Tenualosa ilisha*, Bata, Gold-spot Mullet *Liza parsia*, Tade Mullet *Liza tade* or *Chelon planiceps*, Loitta, Bombay-duck *Harpodon nehereus*, Anchil Macch Greater Lizardfish *Saurida tumbil*, Kai Magur, Grey Eel-tail Catfish *Plotosus canius*, Rup Chanda, Silver Pomfret *Pampus argenteus*, Pangash, Fatty Catfish *Pangasius pangasius*, Lakkha, Indian salmon *Eleutheronema tetradactylum*, Indian Tassel Fish *Polynemus indicus*, Topshe Macch, Paradise *Threadfin Polynemus paradesius* and Poa Macch, Coraker's Pama *Pama pama*. Other fish groups include catfishes, mudskippers, herrings, bass, perches, flounders and sole fishes. In addition to these, there are at least half a dozen species of cartilaginous fishes such as sharks, sawfish, hammerheads, guitar fish, bat fish, skates and rays. Most endangered among the cartilaginous fish in the country is the Ganges river shark *Glyphis gangeticus* that IUCN considers as Critically Endangered (CR), which is found in the Sundarban.

Other than fishes the vertebrate fauna is dominated by an abundance of amphibians, reptiles, birds and mammals.

Amphibians

Notable among the amphibians are the Common Toad *Duttaphrynus melanostictus*, Marbled Toad *Bufo stomaticus*, Indus-valley Bullfrog *Hoplobatrachus tigerinus*; Jerdon's Bullfrog, *Hoplobatrachus crassus*, Kankra-bhunk Bang, Crab-eating or Mangrove Frog *Fejervarya cancrivora* Shabuj Bang, Cricket Frog, *Fejervarya limnocharis*, Green Pond Frog *Euphlyctis hexadactylus*, Skipper Frog *Euphlyctis cyanophlyctis*, Ornate Narrow-mouthed Frog *Microhyla ornata*, Common Tree Frog *Polypedates maculatus*, and a few species of *Fejervarya* yet to be identified.

Reptilians

Reptiles are dominated by turtles and tortoises, both freshwater and marine, monitor lizards, geckos, skinks, snakes and crocodile.

At least three species of marine turtles – Green, Olive Ridley and Hawksbill – inhabit the sea-facing parts of the Sundarban bordering many islands. Loggerhead has also been recorded but the Leatherback has never been noted. All four are endangered species both nationally and internationally. Some eggs and live specimens are used in local commerce.

Among the fresh and brackish water species the most endangered is the Northern River Terrapin *Batagur baska* that IUCN has categorised as Critically Endangered. It occurs nowhere else in Bangladesh but in the Sundarban although an NGO, CARINAM, with collaboration of the forest department has started a small captive breeding population in Bhawal national Park, Gazipur. Other freshwater terrapins and turtles live overland where there are freshwater pools nearby. None of these can be found inside the Sundarban where there is no permanent freshwater accumulation.

Visibly the reptile fauna is dominated by the two species of Varanus or monitor lizards. Bengal Monitor *Varanus bengalensis* and Ringed Monitor *Varanus salvator* can be seen crossing small canals or swimming past the rivers, sometimes basking ashore or on tree trunks and branches. The largest population of the Ringed Lizard lives in the Sundarban. Its distribution is partial to the coastal areas where the Bengal could live from the Sundarban to the St. Martin's Island or near the Sangu-Matamuhuri river banks in the hills. The third monitor, Yellow Monitor – *Varanus flavescens,* usually prefers freshwater belts bordering the Sundarban.

Two species of house gecko *Hemidactylus* species and Tokay Gecko *Gekko gecko*, Oriental Garden Lizard *Calotes versicolo*r and Many-keeled Grass Skink *Eutropis carinata*, dominate the lizard and skink fauna.

Sundarban is also the home not only for the largest diversity of snake species but also supports the highest density of most snakes. Notable among these are the King Cobra, 2 other species of Cobra Naja species, 2 species of Green Pit Vipers, 2 species of Vine Snakes *Dryophis/Ahaetulla* species, 2 species of Tree Snakes *Dendrelaphis* species, Copperhead Rat Snake *Elaphe radiata*, Dog-faced Water Snake, Checkered and Striped Keelbacks, Rat Snake, Kukri, Wolf, Golden Flying Snake, Bronzeback, water snakes, Indian Python

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and Common Sand Boa. Blind snakes are restricted to the villages bordering the Sundarban since they avoid the saltwater. Among kraits, Banded Krait and Common Krait seemed to be common. Russell's Viper lives only along the villages bordering the Sundarban. Of the 10 species of venomous sea snakes at least 7 are found in and around the Sundarban and its sea face. One species among these *Disteira nigrocincta* (Daudin, 1803) alternatively *Hydrophis nigrocincta* had its type locality marked as Sundarban.

Bangladesh's only population of the Estuarine/Salt Water Crocodile *Crocodylus porosus* is restricted to the Sundarban. Wild population of the crocodile may not be more than 200 specimens. However, the government forest department has been successful in captive breeding in a nursery in Karamjal area, near Mongla within the Sundarban's Chandpai Range. Also there are two private commercial farms trying to breed this crocodile specimens. No captive bred specimen has yet been released into the Sundarban. But, these are no doubt good attempts towards species conservation as in case of necessity such captive-bred crocodiles could be reintroduced into nature, I mean in its former place of existence, somewhere in the Sundarban itself. Also, commercial farm crocodiles cannot be released anywhere in the country.

Avifauna

Sundarban is a paradise for birds. Even if you do not see an amphibian, reptile or mammal you are not going to miss a bird or fail to listen to the call/song of one inside or along the periphery of the Sundarban.

The most notable among birds are the Masked Finfoot (Neumann-Denzau *et al*, 2008), Mangrove Whistler and Mangrove Pitta that occur nowhere else in the country outside the Sundarban. The same is true for the Ruddy Kingfisher and Brown-winged Kingfisher that do not occur anywhere beyond the Sundarban. Also the Great Thick-knee *Eascus recurvirostris* possibly do not occur anywhere beyond certain sandy islands in and around Sundarban.

The Sundarban is possibly the only place in the world where 9 species of kingfishers live almost allopatrically in the whole of the forest. These are Common Kingfisher *Alcedo atthis* and Blue-eared

Kingfisher *Alcedo meninting*. The latter has been reported in Kolkata birds by Sumit Sen[6] for the Indian part of the Sundarban. So, logically it is likely to be present in our Sundarban too. None of us has so far seen or reported it from Bangladesh Sundarban. The others are Brown-winged Kingfisher *Halcyon amauroptera*, Stork-billed Kingfisher *Halcyon capensis*, Ruddy Kingfisher *Halcyon coromandra*, White-throated Kingfisher *Halcyon smyrnensis*, Black-capped Kingfisher *Halcyon pileata* and Collared Kingfisher *Todiramphus chloris*; and Pied Kingfisher *Ceryle rudis*.

The Sundarban supports the largest concentrations of Red Junglefowl, half a dozen species of woodpeckers, barbets, Spotted Owl, Buffy and Brown Fish Owls, Collared Dove, Lesser Adjutant Stork, Little Green Heron, Pond Heron, Little Egret, Greater Egret, Night Heron, Green-billed Malkoha, Greater Coucal, Large and Black-headed Cuckoo-shrike, Chestnut-headed Bee-eater, White-bellied Sea Eagle, Grey-headed Fish Eagle, Crested Serpent Eagle, Shikra, Oriental Honey-Buzzard, Brahminy Kite, Rufous Treepie, Ashy Wood Swallow, Golden-fronted Leafbird, Black-hooded Oriole, Bronze Drongo, Greater Racket-tailed Drongo, Common Wood Shrike, Small Minivet, Scarlet Minivet, Bar-winged Flycatcher Shrike, Black-naped Monarch, Chestnut-tailed Starling, Asian Pied Starling, Jungle Myna, Velvet-fronted Nuthatch, Red-whiskered Bulbul, Yellow-bellied Prinia, Oriental White-eye, Thick-billed Flowerpecker, Orange-bellied Flowerpecker, Purple-rumped Sunbird, Purple Sunbird, and Crimson Sunbird.

None of us has so far seen or recorded the Alexandrine Parakeet *Psittacula eupatria* either from Bangladesh or the Indian part of the Sundarban (Khan, 1986; Khan, 2004, and Sumit Sen quoted above).

However, there is an interesting account of the breeding of this parakeet in the Bangladesh part of the Sundarban in the book *The nests and eggs of Indian birds* by Allan Octavian Hume. Hume guess Mr. H. James Rainey who writes: "Of the nidification and breeding habits of this exceedingly pretty species of Paroquet, the local name of which is Chandana, I made some notes several years ago, when residing in the Eastern Sundarbun, and those notes form the basis of

6 http://www.kolkatabirds.com/ sunderchecklist.htm

this paper.

" From the last half of the month of March up to the first half of the month of May, these birds are to be seen flocking to the interior of the forests of the Eastern Sundarbun, especially that portion of it situated between the Haringhata and Bhola rivers on the extreme eastern side of the Jessore district. They at once select suitable trees with convenient hollows in them, some 25 to 30 cubits above the surface of the ground, rather far apart from one another, and away from the banks of rivers and khals. The tree most preferred is, evidently, the Keura (*Sonneratia apetala*, Buchanan), a large tree, the wood of which is light, and the next in demand is, apparently, the Sundri (*Heritiera minor*, Roxburgh).

"They build their nests in the hollows, first scooping them down perpendicularly some two to two and a half feet, so that it requires a long arm to be able to remove the nestlings in them; and many go out on this quest annually at the proper season, as a pair of these birds readily fetch about a rupee or two shillings in the neighbouring hats or fairs, being in great demand by the natives on account of their beauty, and the facility with which they can be taught to imitate the human voice.

"The eggs are, usually, two or three, and sometimes four in number, slightly smaller in size than pigeon's eggs, and in colour like those of the domesticated fowl, only slightly more whitish. They are deposited in the end of the hollows, the scrapings of the wood being gathered below to form a soft bed for them and the young, when hatched. Both the parent birds perform, alternately, the duty of incubation. The eggs take, I have been told, about four weeks to hatch, but on this point I have no exact knowledge personally. During the month of June men go out bird-nesting into the interior of the forests of the Sundarbun, generally three or four of them together, and then the young birds are not quite fledged, and therefore unable to quit their nests. Great numbers of them are hauled out of their nests by the several parties who go out for them, and they find, as before stated, a ready sale for the nestlings.

"The young are able to leave their nests and fly away in the following month, July, and they then go to the cultivated tracts, roosting on the reed-jungle, known in the vernacular as Nal (*Arundo*

karka, Linnaeus), along the banks of streams ; and as vast flocks of them congregate in the same place every night, where they remain for about a month, if undisturbed, before dispersing themselves all over the surrounding country, they are easily caught in large numbers with bird-lime in the following manner. Slender sticks of split bamboo with their upper ends well smeared with bird-lime are placed in those parts of the Nal jungle where the birds are likely to settle for the night, and the next morning the flocks fly away, leaving those of their companions that have been caught, with the bird-lime, to captivity for life. Many are secured in this way, which is evidently profitable, for one patch of such jungle as they frequent (another may be miles away) is leased for this purpose for 20 rupees and upwards."[8] A version of the account with modernized spelling is available online.[9] Rainey originally published his paper in the ***Stray Feathers Journal*** published by the BNHS – Bombay Natural History Society that was edited by A. O. Hume).

Mammalians

Green (1990) states that "The Sundarban is the only remaining habitat in the lower Bengal Basin for a great variety of faunal species. The presence (or former presence) of at least 40 mammal species has been documented (Sarker, 1986). Of these, no less than five spectacular species, namely Javan rhinoceros *Rhinoceros sondaicus* (E [IUCN Endangered]),), water buffalo *Bubalus bubalis* (E), swamp deer *Cervus devauceli* (E), gaur *Bos gaurus* (V) and probably hog deer *Axis porcinus* have become locally extirpated since the beginning of this century (Salter, 1984). The only primate is rhesus macaque *Macaca mulatta*, considered by Blower (1985) to number in the region of 40,000 to 68,200, based on the surveys by Hendricks (1975) and Khan (1986, [here 1986b]), respectively, as compared to the much higher estimate of 126,220 derived by Gittins (1981)."

He also mentioned that "The Sundarban of Bangladesh and India support one of the largest populations of tiger *Panthera tigris* (with an estimated 350 in that of the former Hendrichs (1975). Again, Gittins' (1981) estimate of 430-450 tigers may be over-optimistic (see Blower, 1985). Spotted deer *Cervus axis*, estimates of which vary between 52,000 Khan (1986, [here 1986b]) and 80,000 (Hendrichs, 1975)

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and wild boar *Sus scrofa*, estimated at 20,000 (Hendrichs, 1975), are the principal prey of the tiger, which also has notorious reputation for man-eating. Of the three species of otter, smooth Indian otter *Lutra perspicillata*, estimated to number 20,000 (Hendrichs), is domesticated by fishermen and used to drive fish into their nets (Seidensticker and Hai, 1983). Other mammals include three species of wild cat, *Prionailurus bengalensis*, *F. chaus* and *Prionailurus viverrinus*, and Gangetic dolphin *Platanista gangetica*, which occur in some of the larger waterways."

The Sundarban is the only place in the whole country where we still have the Spotted Deer. It has disappeared from the rest of the country. Along with it we have the largest concentration of Rhesus Macaque and the Wild Boar in this forest. Same could be true for the Fishing Cat, Leopard Cat and Smooth Otter.

Sad Saga of Bengal Tiger

The most spectacular living mammal species not only in the Sundarban but also in the whole world is our National Animal, Banglar Bagh, the Bengal Tiger *Panthera tigris tigris* Linnaeus, 1758, whose number in both parts of the Sundarban is supposed to range from 400 to 500 or 600 to 800 heads only!

During the 18th century travellers passing through the Sundarban and the British Civil Servants have all declared the tiger a renegade and considered it a menace for civilization. As a result there was wholesale persecution of tiger not only in and around the Sundarban but the whole range from Myanmar to India and Nepal.

"Tigers are endangered because of the action of humans. In the past, tigers were hunted for sport. Thousands were killed and displayed as hunting trophies. Humans also killed tigers because they were considered pests. Beginning 1875, for the next 50 years, more than 57,000 tigers were killed in India. Tiger hunters received bounties for their kills. Today, humans continue to kill tigers for their fur and their body parts. Today, humans continue to destroy their homes and take their land away from them."[7]

Khan (2004) submitted and got his Ph.D. degree based on a thesis on Bengal Tiger in our Sundarban. He mentions "Based on the most

7 http://www.landofthetigers.co.uk/#!endangered

recent pugmark census, simultaneously done in both parts of the Sundarban, the rough estimates are 500 tigers for the Bangladesh Sundarban (Bangladesh Forest Department 2004) and 250-300 for the Indian Sundarban (Forest Department of West Bengal 2004).[8]

Barlow (2009), in his Ph. D. thesis based on a study of Bengal Tiger in Bangladesh Sundarban, has recorded the following: "A total of 3,615 human deaths were recorded, with data available from 84 years over a period of 126 years (1881-2006). Using only years where data were available for both the Indian and Bangladesh Sundarban gave an average of 51 human deaths/year (range 0-168). Taking into account missing data and a 33% error in recording efficiency, the estimated total number of people killed was 9,540, or 76 human deaths/year. A total of 1,259 tiger deaths were recorded for 81 years from 1881 to 2006, but some years had data for only the India or Bangladesh side. The mean number of tiger deaths was 6/year for Bangladesh and 1/year for India. The numbers of humans and tigers killed each year have dropped in recent decades, but current levels of conflict severely impacts local communities and may be a serious impediment to tiger conservation."

The population size for the Bangladesh Sundarban was estimated at 100-150 adult females or 335-500 tigers overall (Barlow, 2009). His highest population figure of 500 is similar to what Khan (2004) mentioned quoting Bangladesh Forest Department. Both these estimates ensure that Bangladesh Sundarban has the highest number of Bengal Tiger population in a single block of about 6000 sq. km. of the Sundarban. This must also be the largest single population of tiger anywhere in the world barring a population of 400-500 Sumatran Tiger in Sumatra, Indonesia[9]. When we add the tigers in the Indian part of the Sundarban (vide Khan, 2004, ibid) of 250-300 tigers the Sundarban is the only landmass in the world that supports the largest tiger population of maximum 800 with a density of one tiger per 12.50 sq. km.

For all practical purposes we need to consider that whatever may be the tiger population in our Sundarban or combined with Indian Sundarban we should not be complacent about the high density

8 http://www.carnivoreconservation.org/files /thesis/khan_2004_phd.pdf
9 http://en.wikipedia.org/ wiki/Tiger

or large tiger numbers. Our tigers have both natural enemies and human adversaries, since man himself is responsible for large number of deaths every year as mentioned by Barlow, above.

Biologically the Sundarban mangrove forest is the only tiger habitats of its kind in the whole world. Nowhere else does the tiger permanently live in a mangrove forest intersected and encircled by saline water, and where always there is a dearth of freshwater that tigers need to drink every now and then. Also, tigers of the Sundarban have become detached and isolated from all the other existing tiger populations in the Indian subcontinent. Moreover, the tiger has disappeared from the whole of Bangladesh, barring the Sundarban. So, Sundarban tiger cannot exchange its genetic material with any other tiger populations of the world.

As per the map below there is no living tiger population anywhere in Bangladesh or areas of India bordering Bangladesh where there is a viable population of Bengal Tiger within a 100 km radius of the Sundarban. The nearest one just over 100 km as a crow flies is in Simlipal in the Jharkhand State of India, beyond the border of West Bengal. Towards the north of Bangladesh, in the Jalpaiguri District of India, there are tigers in Jaldapara Wildlife Sanctuary and in Buxa Tiger Reserve. But the crow fly distance will be over 200 km from Sundarban. In all directions from Sundarban, barring the Bay of Bengal in the south, there are only human habitations and no contiguous forests through which tigers could migrate.

If a Sundarban tiger tries to get out of its jungle perimeter either members of the public will kill it or forest personnel will tranquilize and return it to the jungle provided they reach the tiger before the public do so.

In addition to killing by people, withdrawal of tiger cubs and poaching, and destruction of forest by people and calamities like the cyclone or tidal surge such as Aila and Sidr could have devastating effect on the prey species and tigers themselves.

Here we need to note that both nature and we ourselves were not kind to the wildlife of our country and the neighbouring countries during the past two centuries. This resulted not only in the loss of habitats but also large number of wildlife.

Of all the countries of the subcontinent Bangladesh is the greatest

loser. We have lost all the three species of Rhinoceroses, Buffalo, Barasingha, Hog Deer and Leopard from the Sundarban and rest of the country. Of these, only the Sumatran Rhino did not occur in the Sundarban. Also disappeared are the Marsh Crocodile, Gaur, Banteng, Pygmy Hog, Hispid Hare or Assam Rabbit, Wild Dog or Dhole, Striped Hyaena and Wolf from rest of the country as these did not occur in the Sundarban.

Aquatic Mammals

The Sundarban and its southern face up to the Swatch of No Ground in the Bay of Bengal is Bangladesh's dolphin-whale gold mine. Ganges River Dolphin or Susu (*Platanista gangetica*), Indo-Pacific hump-backed dolphin (*Sousa chinensis*), Irrawaddy dolphin (*Orcaella brevirostris*) and finless porpoise (*Neophocaena phocaenoides*) have made our Sundarban as their home. Bottle-nose Dolphin, Pantropical Spotted Dolphin, and Spinner Dolphin lives at the sea face of the Sundarban. Country's lone confirmed species of whale- the Bryde's Whale is also found in the Swatch of No Ground, some 60 km west of the Sundarban.

Bangladesh Cetacean Diversity Project and its Bangladeshi zoologists and field biologists have done commendable works on the cetacean species in the Sundarban. They have discovered the largest world population of Irrawaddy Dolphin, some 6000 in number in the Sundarban. On the basis of their recommendations the Government has already decided to declare a large chunk of the Sundarban as dolphin-porpoise sanctuary in the late 2011.

Possibly the largest population of Gangetic Dolphin or Shishu lives in the Sundarban when its population in the rest of the country is dwindling. Also in no other place in the subcontinent we have so much concentration of dolphins, porpoise and river dolphins.

Records of major Sundarban animals in the historical Past

There are records of type localities for at least five species of bony fishes from the Sundarban although a few have later turned out to be synonymous with other valid names as shown below:

1. *Aplocheilus panchax* (Hamilton 1822) Synonym – *Aplocheilus*

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chrysostigmus McClelland 1839; Type Locality Sundarban and ponds about Calcutta, India[10].

2. *Danio rerio* (Hamilton 1822) Synonym-Danio striatus McClelland 1839; Type Locality Bengal, particularly Sundarban[11]; *Danio rerio* (Hamilton 1822), Synonym- *Perilampus striatus* McClelland 1839, Type Locality- Bengal, particularly Sundarban, India.

3. *Cynoglossus cynoglossus* (Hamilton 1822), Synonym – *Cynoglossus deltae* Jenkins 1910; type locality- Off Morelganj, Khulna dist., Sundarban, Bangladesh, 10 fms[12].

4. *Cynoglossus lingua* Hamilton 1822 Synonym – *Cynoglossus acinaces* Jenkins 1910 Sundarban, Khulna dist., Bangladesh, 10 fms[13].

5. *Puntius gelius* (Hamilton 1822), Synonym *Cyprinus gelius* Hamilton 1822 that M'Clelland (1838) said this fish to be common in and around Sundarban.

There appears no type locality for the amphibians from the Sundarban but *Kankra-bhunk Bang*, Crab-eating or Mangrove Frog *Fejervarya cancrivora* (Gravenhorst, 1829) is basically restricted to the Sundarban and its neighborhood in Bangladesh (Khan, 2009). Another species, the Green Pond Frog (*Euphlyctis hexadactylus*) is also found within the freshwater to slightly brackish water zones bordering the Sundarban (Khan, 1982, 1986, 2010).

Of the reptiles so far two species seemed to have been named based on type specimens collected from the Sundarban. A third one has been mentioned in the old text by Cantor a shown below:

6. World's largest and longest venomous snake is the *Raj Gokhra*, *Shankhachoor*, King Cobra *Ophiphagus Hannah* (*Ohiophagus hannah*), was first named in 1836 by Cantor based on specimen collected from the Sundarban vide "*Ophiophagus hannah* (Cantor, 1836) Synonym – *Hamadryas hannah* Cantor, 1836: 87; Type locality: "Sundarban" (Sundarban, West Bengal, E India, at that time there was no East Pakistan or Bangladesh and the Sundarban was a single unit under

10 http://www.fishwise.co.za/Default.aspx?TabID=110&GenusSpecies=Aplocheilus _chrysostigmus&SpecieConfigId=208068 Accessed on 17 July 2012

11 http://www.fishwise.co.za/Default.aspx? TabID=110&GenusSpecies=Danio_striatus&SpecieConfigId=258743

12 http://www.fishwise.co.za/Default.aspx?TabID=110&SpecieConfigId=211829&GenusSpecies=Cynoglossus_deltae

13 http://www.fishwise.co.za/Default. aspx?TabID=110&SpecieConfigId=194101&GenusSpecies=Cynoglossus_acinaces

the British Raj) and "jungle not far from Calcutta"[14].

Other than king cobra Daudin's Sea Snake has also been founded based on specimen collected from the Sundarban.

7. Daudin's Sea Snakes *Disteira nigrocincta* (Daudin, 1803) , Synonym – *Hydrophis nigrocincta* (Daudin, 1803) or *Hydrophis nigrocinctus* Daudin 1803: 380, Type locality: "salted waters of a river near Calcutta, Sundarban", Bengal[15].

8. Red-Tailed Bamboo Pit viper *Trimeresurus erythrurus* (Cantor, 1839), Synonym *Trigonocephalus erythrurus*, Cantor (young). Cantor (1886) says, "In Bengal I never observed but a single young one (T. erythrurus), captured in the Sundarban."

As per the literature no bird species has been named based on specimens collected from the Sundarban. But there are quite a few interesting notes in some of the 19th century literature.

9. *Podiceps cristatus*, Linnaeus , many killed in Sundarban and brought to Calcutta', noted by Jerdon (1864). This bird is our current *Jhuti/Shikhar-jukta Duburi*, Crested Grebe. He also mentions 'Gigantic Stork (or Adjutant Stork), to be breeding in the Sundarban. This stork is called Hargila, Greater Adjutant or simply Adjutant, *Leptoptilos dubius*. However, it has now virtually disappeared from the Sundarban although several pairs found breeding in the haor basins of the Greater Sylhet District. Its status in the country is a winter breeding migrant and an endangered species too.

10. Jerdon (1864) also mentioned that The Bengal Green Pigeon *Crocopus Phcenicopterus* Latham; (*Columba phoenicoptera* [as [Columba] Latham, 1790, Index Ornithologicus, 2, p.597,no.13; Synonym – Purple-shouldered Pigeon Latham,1787 (current name Botkol/ Haludpa Horial, Yellow-footed Green pigeon *Treron phoenicopterus* (Latham, 1790)), used to breed in Sundarban.

11. He also noted that our popular but fast disappearing *Kea/Jolar Titir* "The Kyah Partridge, *Ortygornis gularis,* (or current name Swamp Francolin, *Francolinus gularis* was common from Bengal, Sundarban to and extending eastwards into Assam, Sylhet, Cachar and Tipperah" (Jerdon, 1864).

12. E.C.S. Baker (1908) in his famous article "The Indian ducks

14 http://reptile-database.reptarium.cz/species?genus =Ophiophagus&species=hannah
15 http://reptile-database.reptarium.cz/species?genus=Hydrophis&species= nigrocincta

and their allies" published in the journal of Bombay Natural History Society gave a vivid account of our Buncha Hansh or Nukta. He mentions that "in Cachar it is by no means very rare. I have seen it in Sylhet and again have had notice of its occurrence sent me from the North Looshai Hills. As regards the Sundarban, Jessore was the district in which I first made the acquaintance of this species, a distant acquaintance only, it is true, but in the next district (Khoolna), we came into closer contact with one another. Here a pair of Nukhtas formed part of a bag of 140 couple of duck and teal got by my father, Mr. T. Wilcox, and myself in the Moolna (Khoolna, Khulna) bhil, a vast extent of swamp and water, covering fully 20 square miles of the country. This was in the cold weather, the end of January, I think, of 1882. In Cachar, Sylhet, and Looshai the-birds remain all the year round and breed, as they do in most of the other parts of their habitat, but in the Sundarban, I should think, they are, very probably, migrants, though I have no evidence on this point."

13. About the Greater Whistling-Teal (now called Large Whistling Teal, *Dendrocygna bicolor*), Baker (1908) mentions that he took a few nests of the teal in Rungpur, where, however, the bird was not common, one in Nadia, and a few in the Sundarban. This bird is now entirely a migratory species in the Sundarban and other parts of the country although a few may breed within the foothill country of Indian State of Meghalaya in Sylhet-Sunamganj Districts, bordering haors.

The most interesting information on the mammals of Sundarban appears in literature of the 19th and a few in late 18th centuries. Of these, important ones are the Frith's Tailless Bat *Coelops frithii* Blyth, 1848, and the Javan Rhinoceros *Rhinoceros sondaicus* Desmarest, 1822.

14. East Asian Tailless Leaf-nosed Bat *Coelops frithii* Blyth, 1848. Type Locality: Bangladesh, Sundarban. This is the only higher vertebrate species that has definitely been collected from Bangladesh Sundarban and the species was established in 1848 by Blyth on this basis.

"Colour dusky or blackish; the fur tipped with ashy brown above, paler and somewhat ashy beneath; membranes fuscous. This bat is

rare. The above description, given by Jerdon, is based on one specimen sent to Mr. Blyth by Mr. Frith, who obtained it in the Sundarban" (Sterndale, 1884).

15. Rookmaaker (1997) Notes that the "Javan Rhinoceros existed in the forests near the bay of Bengal, called the Sundarban, in southern Bangladesh and the state of West Bengal, India. It was first shot by F.V. Lamarepiquot in 1828, whose two specimens were described as a new species, *Rhinoceros inermis*, by Lesson in 1838. In total 11 specimens are now in different museums. The rhinos lived in small numbers in well-defined localities throughout the entire Sundarban. It must have become extinct before 1925."

Later on *Rhinoceros inermis* turned out to be a relict subspecies of Javan Rhinoceros. *Rhinoceros sondaicus inermis* Lesson, 138, known as the Indian Javan rhinoceros, once ranged from Bengal to Burma, but is presumed to have gone extinct before 1925. The term *inermis* means "unarmed", as the most distinctive characteristic of this subspecies is the small horns in males, and evident lack of horns in females. The original specimen of this species was a hornless female[16].

Jerdon (1867) mentioned that 'the Lesser Indian Rhinoceros, *Rhinoceros sondaicus*, Desmarest, 1822 (the Indo-Bangladesh subspecies 'inermis') "is found at present in the Bengal Sundarban, and a very few individuals are stated to occur in the forest tract along the Mahanuddy river, and extending northwards towards Midnapore; and also on the northern edge of the Rajmahal hills near the Ranges. It occurs also more abundantly in Burmah, and thence through the Malayan peninsula to Java and Borneo. Several have been killed quite recently within a few miles of Calcutta." One of these species formerly existed on the banks of the Indus, where it was hunted by the Emperor Baber."

According to Rookmaaker (1997) there "are three earlier reports of rhinos in the Sundarban. Around 1630; Sebastien Manrique passed the island Xavaspur (point 7 in his figure appended here), in the estuary of the Meghna River, and 'came across many Rhinos, whose horns, offensive in life, are after their death used in a defensive drug' (Manrique, 1927). On 16 January 1664, the Dutchman Wouter

16 http://en.wikipedia.org/wiki/ Javan_rhinoceros

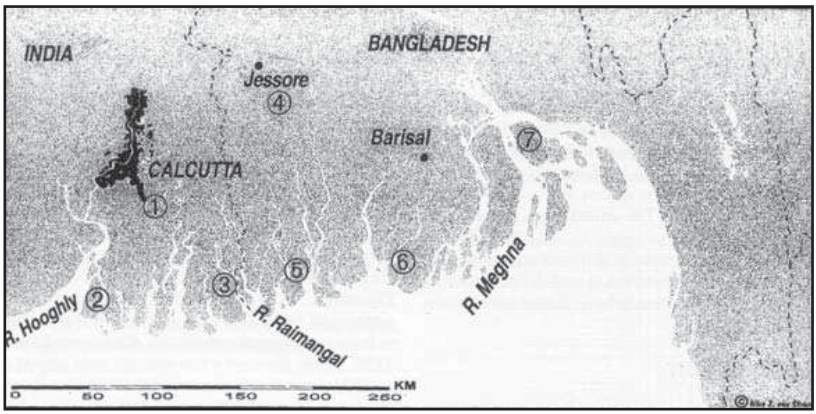

Figure 1. Map of Sundarban of India and Bangladesh. The numbers show locations where rhinos were sighted vide Roommaker, 1997

Schoutens (1676) passed the River Jillisar [?], where the shores of the Ganges are covered with bushes, inhabited by rhinos and other animals. Another traveler, Thomas Bowrey (1905) visited the 'creeks and rivolets at or about the entrance into the Ganges' around 1670 and mentioned the presence of 'rhinocerots' besides tigers and bears."

Figure 1 shows a map of the Sundarban of Bangladesh and India showing the locations of rhino sightings vide Rookmaaker (1997)

Of the 7 sightings of Javan Rhinoceros reported by Rookmaaker, 4 are in our part of the Sundarban and the nearby districts of Barisal and Jessore where the Sundarban existed about two centuries back. However, this rhino not only disappeared from the Sundarban but also from the whole of the Indian subcontinent.

Mallick (2011) mentions that the last rhino was killed around 1888 in the Sundarban. He further noted that its presence during the early 20th century is doubtful. Remains of this animal were collected from an excavated pond in upper layers (in the Sundarban) in 1870 and displayed in the Indian Museum, Kolkata. This museum has a few specimens of this rhino stuffed in its display and store. During a visit in 2003 I took pictures of a specimen collected from the Sundarban.

The board on the museum specimen of rhino in Kolkata clearly mentions the specimen was collected from the Sundarban.

16. *Felis bengalensis* (present *Chita Biral*, Leopard Cat *Prionailurus*

bengalensis) is found at the level of the sea in the Bengal Sundarban (Jerdon, 1867).

17. Jerdon, above, also considered that Buffalo to be very common in the Sundarban.

18. *Rhinoceros unicornis* Linnaeus, 1758 Great Indian one-horned Rhinoceros. Changing landscape and loss of freshwater mangroves led to extinction of this species (Mallick, 2011). Blyth (1862) mentions that "the Rhinoceros are still common" in the eastern Sundarban, and also of the Rajmahal hills in Bengal (where fast verging on extirpation), being identical with that of Java and Borneo, in the great oriental archipelago.

19. According to Mallick (2011) Asiatic wild water buffalo *Bubalus bubalis* Linnaeus, 1758 was found till 1885; by the end of 19th century it died out. A specimen of hip bone found from a pond (in the Sundarban) excavation during 1980 was identified by Zoological Survey of India to belong to this species.

20. *Rucervus duvaucelii* Cuvier, 1823 Swamp deer or *Barasingha* existed till the earlier part of the 20th Century in the West Bengal part of the Sundarban (Mallick, 2011). A team from the Wildlife Trust of Bangladesh collected an antler from the Sundarban during the 2000s confirming it was present there in the historical past (Samiul Mohsanin, WTB, pers comm.).

21. *Axis porcinus* Zimmermann, 1780 Hog deer Extinct at the end of 19th century (Mallick, 2011).

Achievements

In the past three decades or so Bangladeshi scientists and environmentalists and their supporting national and international NGOs have done commendable works on various aspects of the Sundarban, its wildlife and the parties involved, the stakeholders and international interest groups, each for saving each ones interests or motifs in the Sundarban.

The outcome has been varied – a couple of doctorate and postgraduate theses that gave their producers university degrees and later on promotions in their jobs; 100s of published newspaper reports and scientific articles at home and abroad; emergence of many experts on Sundarban; dozens of Sundarban stakeholders killed by tigers when stakeholders killed almost a reciprocal number of tigers

through revenge killing, in addition to gathering of some baseline data missing before.

At the end Sundarban has attracted more stakeholders, made some international bodies like the money lenders such as ADB and World Bank, UN bodies, donor agencies or countries over interested in the Sundarban vis-à-vis tiger conservation or its decimation (!) through massive investments in which grassroots stakeholders have very little to do or achieve, loss of more forests from the Sundarban and land grabbing and encroachment of certain areas progressed smoothly.

All these have compromised the basic need of conserving the Sundarban in its entirety, not piece meal, as is being done today, simply because our government machinery is divided in our national goals of saving the Sundarban from our national and international perspectives and not on donors and agencies or bankers' whims and wishes.

One net outcome of the works of the past three decades proved beyond doubt that we need to undertake a thorough in-depth study of the Sundarban by our own people with a view to inventorying of every resource living in every square kilometre of land towards a very long term planning for sustainable management for getting maximum benefits for the Sundarban itself and for those who depend on it for their livelihoods.

However, so far the Sundarban wildlife is concerned, we need to know that we have not done justice to the study of invertebrate fauna of the Sundarban as there are too many gaps in our knowledge about the species listings and relative abundance of major groups like the intertidal and benthic fauna, especially arthropods and mollusks, platyhelminthes, nemathelminthes, annelid and echinoderms.

It is noteworthy that scientists in the Indian part of the Sundarban have already done commendable studies on these animal groups (Mukherjee, 1975; Mandal and Nandi, 1989; Naskar and Mandal, 1999; Gopal and Junk, 2000; Chaudhuri and Choudhury, 1994; Nandi *et al*, 1993). This shows that we are lagging behind in these aspects.

Potentials in all the invertebrate are resources for conservation and enhancing the national wealth through sustainable resource utilization and management, and injecting more life to the existing

conditions need to be searched out.

Deductions

The last retired World Bank president has made tiger country heads, environment and wildlife ministers and ministries and some scientists to believe that if WB pours money and stakeholder countries plan the world population of tigers would be doubled in nature, possibly in two decades! This is far from the truth. The tiger or large cat population could only be doubled or tripled and appreciably increased in any zoo or captive breeding condition but not in nature simply because nature has its own intrinsic force or value that stops it from overpopulating an area with super abundance of a particular species or species groups, especially the carnivore and among them the larger carnivores like the lion, tiger, leopard and cheetah.

During 1975 Hendrichs (1975) conjectured that there are 350 tigers in Bangladesh Sundarban, Bangladesh Forest department and Dhaka University Zoology department in 1982 considered the population to be 450; Seidensticker (1987) put the figure as 150 adults in our Sundarban and 100 in West Bengal Sundarban. Forest department claimed the figure to be 359 in 1992 and Tamang (1993) considered the population to be 362 when Reza (2000) put the figure as 720 tigers in the Sundarban. All these information are from Khan (2004).

Sunquist (1981) mentioned that on an average a tigress needs about 5 to 6 kg of food per day and tiger needs 6 to 7 kg per day. He also found that a tigress without having young would go hunting every 8 to 8.5 days averaging 42 to 45 kills per year. A tigress with cubs of 6 to 10 months old killed prey every 5 to 6 days that means 61 to 73 kills per year.

Karanth (2001) reported that to sustain a tiger, where Spotted Deer is the main food, a situation similar to our Sundarban, 500 deer are needed. Khan (2004) has quoted this figure in his thesis too.

Khan (2004) estimated, rather conjectured, to have nearly 21 spotted deer per square kilometre of the Sundarban. Consider that we have 6000 sq. km. of Sundarban that has 4000 sq. km. of land and 2000 sq. km. of water. Deer lives on land. That means we have 84, 000 deer in Sundarban that should support at least 168 Tigers.

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However, Karanth's (2001) study mostly concerns tigers in evergreen and deciduous forests of Himalayan foothills, central and southern India where habitat types are completely different than the Sundarban.

Khan (2004) himself believes and considered in his thesis that there could be 200 tigers in Bangladesh Sundarban. So, the number of tigers in the Sundarban may sensibly range between 200 and 500 and superfluously up to 720 vide Reza (2000). Considering the density of Spotted Deer I will be satisfied with a figure ranging from 150 to 300 tigers in our Sundarban. If this level can be maintained for the coming century it will still represent the largest single population of the Bengal Tiger anywhere in the world.

However, it appears that we do not have a definite figure for our Sundarban tigers. This does not matter.

Why tiger numbers cannot be doubled in the Sundarban in the next two decades may be considered in the light of the utter failure of the tiger project in India after spending billions of Indian rupees over the past 40 years as the first tiger project was launched in 1973.

The Project Tiger people in India claimed that it was "able to bring the population of tigers from 1,200 in 1970s to 3500 in 1990s." However, when the Government of India did a survey in 2008 the tiger population was estimated to be only 1,411[17].

Details of this latest 2008 survey reveals the following: "The methodology used during the tiger census of 2008 extrapolates site-specific densities of tigers, their co-predators and prey derived from camera trap and sign surveys using GIS. Based on the result of these surveys, the total tiger population has been estimated at 1,411 individuals ranging from 1,165 to 1,657 adult and sub-adult tigers of more than 1.5 years of age."[18]

This Indian instance sufficiently proved that the tiger number cannot be doubled whether we spend billions of rupees or dollars because largely nature and to some extent the erratic actions of humans control the environment and healthy growth of any animal population in a major forest or ecosystem.

We have no need to go beyond our country to get an example of

17 http://tech02.hubpages.com/hub/ different-ways-to-save-the-tiger-population-in-india-tiger-conservation

18 http://projecttiger.nic.in/whtsnew/status_of_tigers_in_india_2008.pdf.

such human atrocities towards forests and wildlife therein. An example is the total destruction of naturally growing Sal forest from the Dhaka, Gazipur, Mymensingh, Tangail, Jamalpur and Sherpur districts, and wholesale destruction and conversion of mixed-evergreen forests of the Chittagong and Sylhet revenue divisions into man-made forests or plantations as well as slash and burn cultivation and settlements of indigenous and plain-dwelling people that ultimately wiped out major wildlife species such as Tiger, Gaur, Leopard, all three species of Rhinoceros, Pygmy Hog, Hispid Hare, Spotted Deer, Indian and Green Peafowl, White-winged Duck, etc., (Khan, 1987, 2003, 2010) and Khan (2008).

When we want to discuss any issue regarding the Sundarban of Bangladesh we try to revolve it round the tiger or become tiger-centric! We shall have to come out of this exclusivity and consider the Sundarban in its entirety.

For a Scientific Management of the Sundarban we need to highlight on:

A detailed survey of all wildlife species occurring in the Sundarban.

1.1. This is to be done by dividing the Sundarban into at least 500 one square kilometre block/plot or 2 such plots in each of the existing Forest Management Blocks, based on GPS, each marked on a map, over an initial 5-year plan extendable to another two such terms.

1.2. All biodiversity of each 1 sq. km. block to be physically surveyed, identified and ones that cannot be identified in the field or microscopic ones are to be preserved and transported to laboratory facilities for species level identification.

1.3. Make inventory of the wildlife vis-à-vis the biodiversity.

Determine a priority list of pioneering species that are to be studied in detail from the point of biology and sustainable utilization. These could be:

2.1 Bengal Tiger, its prey species and competitors
2.2 Smooth-Clawed Otter
2.3 Irrawaddy Dolphin
2.4 Finless Porpoise
2.5 Ganges River Dolphin
2.6 White-bellied Sea-eagle
2.7 Mangrove Whistler and Mangrove Pitta
2.8 Larger Kingfishers- 3-4 species

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2.9 Larger owls
2.11 Saltwater Crocodile
2.12 Northern Batagur
2.13 Ring and Bengal Lizard
2.14 King Cobra
2.15 Green Pond frog
2.16 Crab-eating Frog
2.17 Mudskippers
2.18 River Shark and other Cartilaginous fishes
2.19 Non-commercial fishes
2.20 Non-commercial crabs
2.21 Non-commercial Mollusks
2.22 Butterflies
2.23 Bugs, Beetles, Wasps
2.24 Grasshoppers
2.25 Moths
2.26 Spiders
2.27 Annelids
2.28 Microbenthos
2.29 Macrobenthos
3 Assessment of the total exploitable resource that can be extracted on yearly basis
4 Surveying the total number of Obligate and Facultative Bawalis.
5 Determine the needs of the Obligate Bawalis
6 Find out alternative livelihood for the Bawalis
7 Develop means of diversification of resource-base
8 Long term monitoring programme for biodiversity
9 Long term monitoring programme for the weather pattern
10 Long term monitoring programme for Salinity study
11 Long term monitoring programme for Water Quality and Pollution
12 Long term monitoring programme for the role of Bawalis and stakeholders in the Sundarban

The Sundarban is still the best forest in Bangladesh because the forest department used some common sense in not removing all plants of block or neighbouring blocks of the Sundarban when they extracted timber on commercial basis as they did in the Sal and Mixed-evergreen Forests. So, past process of selected logging kept both flora and fauna more or less intact but it did not allow century old trees to remain in place. Even then there is the chance of natural regeneration as no monoculture or exotic tree has been introduced into the system.

During the last Cyclone Sidr I made a public appeal to the government through newspaper that parts of the Sundarban destroyed by Sidr must not be disturbed, or uprooted trees or broken branches

be removed. Rather if left untouched the forest would regenerate on its own. Additionally, if government wanted to expedite the process of regeneration it can transplant saplings of local plants to those areas where regeneration process is slow.

Government did respond to my call and it is for the first time that our forest department did not jump into action of removing cyclone hit areas of a reserved forest. The Sidr was in November. When I visited the Sidr-hit area in January the regeneration process had already begun and if one visits those spot they may not find the 'burnt-out' trees. Of course the logs that had been trampled to the ground are still there and decaying slowly and in the process adding manure to the soil.

Why Sundarban needs to be conserved in its entirety?

1. It is the only naturally formed mangrove forest of the country.
2. The Sundarban is the largest piece of natural forest that is still intact.
3. It has the highest largest biomass per kilometre of land anywhere in the country in terms of both flora and fauna.
4. The Sundarban of ours and that of Indians together formed the largest single block of mangrove forest in the world.
5. The Sundarban of Bangladesh has no human settlements-a rare phenomenon in a country which has the highest human population per square kilometre of land in the world.
6. This forest supports the largest single population of Bengal Tiger in the whole world.
7. No other mangrove forest in the world has so much of plant and animal diversities as we have in our Sundarban.
8. It is the only place where we still have our national animal-The Bengal Tiger, the Chital or Spotted Deer and Saltwater or Estuarine Crocodile.
9. Possibly the largest world population of Irrawaddy Dolphin lives in the Sundarban.
10. The Sundarban is the single largest source of natural honey production, crabs, prawns and some fishes.
11. Highest snake, monitor lizard, crab-eating frog, wild cats, otter, macaques, wild boar and bird biodiversity of the country live in the Sundarban.
12. Nowhere else in the country 350,000 to 400,000 people enter

into a forest for their livelihood almost on daily basis.

13. This is the only place where wild animals kill at least 100 people on a yearly basis.
14. The Sundarban works as the natural supplier of mangrove seeds and propagules to the whole of the coastal areas of the country.
15. It is the largest nursery for fin fish and shell fish in the country.
16. It is the hottest biodiversity spot in the country.

The Sundarban is our national pride and we must save and protect it for our future generations and for the biodiversity to flourish unhindered in the centuries to come.

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