

PREY SPECIES DENSITY OF BENGAL TIGER IN THE SUNDARBANS

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Abstract

A study was conducted on the abundance of the principal prey species of the Bengal tiger (*Panthera tigris tigris*) in the Sundarbans between January 1999 and March 2000. Three species were identified as the principal prey of the Bengal tiger viz., spotted deer (*Cervus axis*), wild boar (*Sus scrofa*) and rhesus macaque (*Macaca mulatta*). The absolute density (individuals/km²) of spotted deer, wild boar and rhesus macaque was 70.4, 7.9 and 15.8 respectively. The overall occurrence of principal prey species in different habitats varied significantly. These animals were found highest in the meadows (43%) and the lowest along riverbank (4%).

Key words: Prey species, the Bengal tiger, *Panthera tigris tigris*, the Sundarbans.

Introduction

The Sundarbans mangrove forest is the only habitat in the world where the Bengal tiger, *Panthera tigris tigris* occupies the pinnacle of both aquatic and terrestrial food webs (De 1999). This largest mangrove forest supports a unique biodiversity. Although large mammals (body weight more than 5 kg) constitute a small part of the total ecosystem and exist at relatively low density (Kumar 2000), but in case of the Bangladesh Sundarbans, they comprise a significant biomass with a large impact on nutrient cycling and habitat modification. The mammal community consists of mainly of spotted deer (*Cervus axis*), wild boar (*Sus scrofa*) and rhesus macaque (*Macaca mulatta*). They play an important role in the forest ecosystem, influencing reproduction, survival and structure of plants (Norton-Griffiths 1979). They need extensive and intact habitats for their survival. These large mammals have traditionally been exploited as resources by native people as well as people from outside, which often led to extinction (Madhusudan and Karanth 2000, Prakash 1990). They also form bulk of the prey for all the large carnivores like tiger in Indian subcontinent (Johnsingh 1983). Their survival is often a critical factor

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in arresting the decline of their predators (Karanth and Stith 1999). The abundance and distribution of different sized large mammals, thus, influence predator populations to a large extent (Sunquist *et al.* 1999). So, the present study on large mammal communities assumes to be important in this context. The principal aim of this study was to find out present status and distribution (habitat wise) of these mammal species in the Katka-Kochikhali area of the Sundarbans east wildlife sanctuary.

The Study Area

The whole Sundarbans, an area of about one million hectares, is the largest mangrove forest in the world. About 62% of this forest lies in the southern districts of Bangladesh and the rest 38% lies in the south-east of West Bengal in India (Choudhury 1968, Islam *et al.* 1999). The total area of the Bangladesh Sundarbans is about 5,770 km² of which 4,016 km² is land and the remaining 1,756 km² are under water in the form of rivers, canals and creeks (Hussain and Karim 1994). The Bangladesh Sundarbans represents 44% of the total forested area of the country, which comprises 45% of the country's total forest reserves.

At present, there are 3 wildlife sanctuaries inside the Bangladesh Sundarbans to protect the fragile ecosystem. The total area of these 3 sanctuaries is 323 km². Additionally, in order to draw global attention, this fragile ecosystem has recently been declared as a World Heritage Site. The total area of the World Heritage Site is about 1400 km².

The present study site, Katka-Kochikhali, is situated at the southeastern tip of the Sundarbans. The area lies between 21°51' and 21°55' N latitudes and 89°41' and 89°51' E longitudes in the district of Bagerhat. The whole area formed an island of 20 km², as it is surrounded by the Bay of Bengal in the south, Kochikhali and Jamtala *khal* (canal) in the north, the Supoti River in the east and the Katka River in the west. The coastline of this island is irregular, as a result, number of tidal creeks are formed and criss-crosses the island. The Katka-Kochikhali is an ideal island that covers diverse habitat types. The forest covers about 50% of the total area of the island of which meadows cover 30% and rest 20% are forest edge, sea beach, riverbank and human settlements (e.g., forest offices). There is a 10 km long meadow, an ideal place for the spotted deer and wild boar.

Materials and Methods

The study was conducted between January 1999 and March 2000. A total of 10 trips was made to carry out the fieldwork in the Sundarbans. A total of 744 hours in 81 days was spent in the field. Fieldwork was done between 0600 hrs and 1800 hrs because

most of the animals were active during this time period. One person served as field assistant during the study.

The population dynamics (e.g., group size, group density, individual density, biomass, metabolic biomass, etc.) of the large mammals was studied based on line transect method (Johnsingh 1983). The animals were recorded by direct counts. In the case of large mammals (e.g. spotted deer, wild boar, rhesus macaques, etc.) in the Sundarbans direct sightings are numerous enough to draw a population structure of them (Hendrichs 1975). In the study area, three 10 km long permanent transects were laid covering all habitat types proportionately. One transect was laid through the forest, one was through the meadow and the other one through the sea beach from Katka to Kochikhali, which were the major habitat types of the area.

The fieldwork was scheduled in two time blocks, between 0600 and 1000 hrs, and 1500 and 1800 hrs. The survey was conducted mainly on foot at a uniform pace of about 1.5 km/hour. Walking in the permanent transects in a zigzag route, the entire terrain, especially, areas favoured for walking on foot (Nair *et al.* 1977) such as deep forest, forest edge, meadow, sea beach, etc. were traversed. Sometimes it was difficult to walk inside the forest because of the presence of pneumatophores and submerged land due to high tide or heavy rain. A soundless country-made wooden boat was also used to explore the unfavoured portion of the transect for walking. The narrow creeks of the study area were also explored by the water vehicle at a speed of 5-7 km/hour. Whenever animals were sighted, the vehicle was stopped and animal group size, age, sex, etc. were recorded with the aid of binoculars (8 × 50). An SLR camera (Minolta XG-1) with 70-300 mm (Vivitar) zoom lens was used to photograph the animals as well as their activities. Classification and analysis of group size, age grouping, sex, etc. were largely based on the method used by Johnsingh (1983) and McCullough (1993).

For calculating spotted deer density average effective strip width was 100 metres, because major portion of the study was conducted in open meadow (Table 1) where the visibility was reasonably high. In case of wild boar density, the average effective strip width was assumed as 40 metres, whereas in case of rhesus macaque, the distance was assumed 30 metres due to their body size and extra sensitive movement. The biomass including metabolic of the animals in the study area was calculated following Karanth and Sunquist (1992).

Table 1: Proportion of various habitat types and distance covered in the study area during January 1999-March 2000

Habitat		Distance covered	
Types	% of the total area (approx.)	Kilometres	% of the total distance
Forest	50	201	20
Meadow	30	379	41
Sea beach	9	197	22
Forest edge	6	81	9
Riverbank	5	72	8
Total	100	930	100

Results and Discussion

Prey species: Three species of mammals viz., spotted deer (*Cervus axis*), wild boar (*Sus scrofa*) and rhesus macaque (*Macaca mulatta*) were identified as principal prey species of the Bengal tiger in the Bangladesh Sundarbans. These three animals mainly constitute the large mammal community of the Sundarbans mangrove forest.

Spotted deer was the common prey species in Katka-Kochikhali (Table 2). The absolute density of the animal was 70.4 individuals/km². Group size varied from 2 to 137 (mean =7; sd = ±31.03; n = 889) and group density was 9 groups/km². The biomass of this animal was 3870 kg/km². Absolute density of the rhesus macaque was 15.8 individuals/km² (Table 2). A total of 37 groups of rhesus macaque was recorded (13 groups/km²), the largest group consisted of 41 individuals whereas the smallest one was 3. The mean group size of rhesus macaque was 11.9 individuals/group (range = 3 - 41; sd = ±7.9; n = 37). The biomass of the animals was 126.8 kg/km². A total of 133 wild boar groups was recorded (Table 2). Group size varied from 1 to 15 (mean =2; sd = ±2.6; n =133). The group density was 3 groups/km² (Table 3). Absolute density of this species was 7.9 individuals/km² and the biomass was 300 kg/km².

Table 2: The overall prey species density in Katka-Kochikhali areas of the Sundarbans during the study period.

Species	Area surveyed	No. of groups	No. of individuals	Density (individuals/km ²)	Biomass (kg/km ²)	Metabolic biomass
Spotted deer	93	889	6545	70.4	3870	2903.2
Wild boar	37	133	294	7.9	300.2	225.2
Rhesus macaque	27.9	37	442	15.8	126.8	95.1

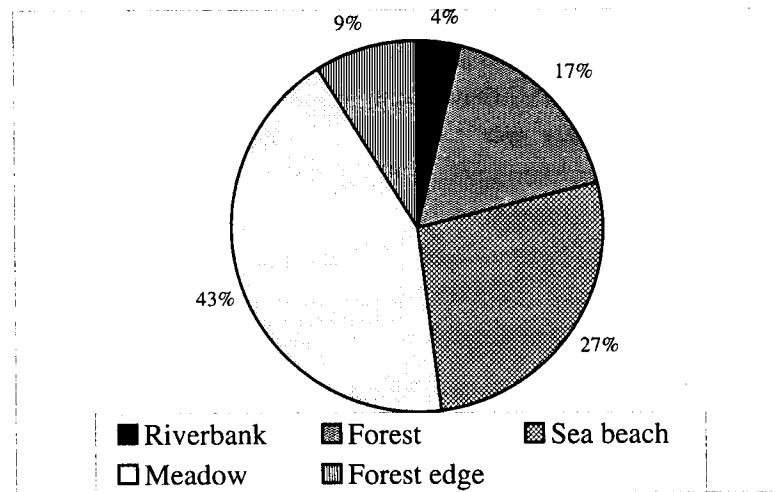


Figure 1: Percentage of occurrence of the prey species in different habitats of the study area.

Habitat preference: All these principal prey species were found in five different habitats of the Sundarbans viz., forest, meadow, sea beach, forest edge and riverbank. Their overall occurrence, however, varied significantly ($\chi^2 = 114.3$, $df = 4$) in different habitats. The animals were found highest in the meadows (43%) and the lowest in the riverbank (4%) (Fig. 1). The rhesus macaques are found mostly in the forest edge, forest and riverbank while wild boars are mainly found in the forest edge (Table 3).

Table 3: Prey species density in different habitats of Katka-Kochikhali area of the Sundarbans.

Habitat type	Area surveyed (km ²)	Spotted deer	Wild boar	Rhesus macaque
Forest	20.1	48.8	2.2	9.7
Meadow	37.9	79.9	2.3	0.8
Sea beach	19.7	100.4	0.6	0.2
Forest edge	8.1	41.0	15.8	21.1
River bank	7.2	31.5	3.3	6.1

The spotted deer was the most common and conspicuous mammal in Katka-Kochikhali, whereas the wild boar was comparatively rare. Rhesus macaque was mostly recorded in the morning and afternoon from the study area, especially from the forest edges and riverbanks. Hendrichs (1975) estimated the density of spotted deer in the Sundarbans as 20 individuals/km² and Khan (1986) as 13.15 individuals/km². All these

studies were conducted throughout the whole mangrove forest. Since the present study was exclusively conducted in the Katka-Kochikhali, an island situated in the Sundarbans East Wildlife Sanctuary and the habitat quality is better than any other parts of the forest, hence, spotted deer density was recorded reasonably high. Rashid *et al.* (1994) commented about the population status of the spotted deer of the area as 'the population of spotted deer may have increased beyond the carrying capacity of the area and the food supply for the animal may be insufficient'. Moreover, due to its location in the southern extreme of the Sundarbans reserved forest and inside the sanctuary area, Katka-Kochikhali is away from human disturbances.

Hendrichs (1975), Gittins (1981) and Khan and Ahsan (1986) estimated the density of rhesus macaque in the Sundarbans as 10/km², 52/km² and 17.05/km² respectively. During the present study, the estimated density of this primate species was 15.8/km². The density appears to be closer to the results of Khan and Ahsan's estimation. The group size of the rhesus macaque was calculated as 11.9 individuals/group, which is smaller than any other forest in Bangladesh (Feeroz *et al.* 1995). The wild boar density was estimated as 8 individuals/km² whereas Hendrichs (1975) estimated the density as 5/km².

The spotted deer are gregarious grazers and seem to attain their peak abundance in forested areas where grassy clearings are present (Karanth and Sunquist 1992). The density estimation of large mammals (especially the spotted deer) in Katka-Kochikhali was reasonable to the upper limit due to the presence of grassy clearings and forested area. In the present study area the wild boars are also gregarious but seem to attain the peak abundance in the forest edge where grassy and forested bushes were present in a same patch. The rhesus macaque was mostly recorded from the forest edge, searching for food. Sometimes they were also recorded from the forest and in the riverbanks during the low tide, they were feeding on the roots of dhanshi, *Myriostachya* sp.

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References

- Choudhury, A.M. 1968. *Working plan of the Sundarbans Forest Division for the period 1960-61 to 1979-80*. East Pakistan Government Press Dacca. pp. 82.
- De, R. 1999. *The Sundarbans*. Oxford University Press. India. pp. 1-75.
- Feeroz, M.M., M.A. Islam and M.M. Kabir. 1995. Status, distribution and conservation of non-human primates of Bangladesh. *Kyoto University Overseas Research Report of Studies on Asian Non-human Primates*. 9: 73-82.
- Gittins, S.P. 1981. A survey of the primates of Bangladesh. *Report to Fauna Preservation Society of London and Condor Conservation Trust, England*. pp. 64.
- Hendrichs, H. 1975. The status of the tiger, *Panthera tigris* (Linne, 1758) in the Sundarbans mangrove forest (Bay of Bengal). *Sonderdruck aus Saugeterkundliche Mitteilungen*, 23. Jgh., Heft 3, Seite 161-199.
- Hussain, Z. and Karim, A. 1994. Introduction. In: *Mangroves of the Sundarbans. Vol.2: Bangladesh*. (Eds. Z. Hussain and G. Acharya). IUCN Bangkok, Thailand. pp. 1-18.
- Islam, M.A., M.M.H. Khan, M.M. Kabir, T. Solhoy, N.B. Jordar and M.M. Feeroz. 1999. Winter birds of the Sundarbans, Bangladesh. *Ecoprint* 6(1): 41-49.
- Johnsingh, A.J.T. 1983. Large mammalian prey-predators in Bandipur. *J. Bombay nat. Hist. Soc.* 80(1): 1-57.
- Karanth, K.U. and B.M. Stith. 1999. Prey depletion as a critical determinant of tiger population viability. In: *Riding the tiger: Tiger conservation in human-dominated landscapes*. (Eds. J. Seidensticker, S. Christie and P. Jackson). Cambridge University Press. UK. pp. 118-119.
- Karanth, K.U. and M.E. Sunquist. 1992. Population structure, density and biomass of large herbivores in the tropical forests of Nagarhole, India. *J. Trop. Ecol.* 8: 21-35.
- Khan, M.A.R. 1986. Wildlife in Bangladesh mangrove ecosystem. *J. Bombay nat. Hist Soc.* 83:32-40.
- Khan, M.A.R. and Ahsan, M.F. 1986. The status of primates in Bangladesh and a description of their forest habitats. *Primate Conserv.* 7: 102-109.
- Kumar, S. 2000. Ungulate density and biomass in the tropical semi-arid forest of Ranthambore, India. *M.S. thesis*. Pondicherry University, Pondicherry, India.
- Madhusudan, M.D. and Karanth, K.U. 2000. Hunting for an answer: Is local hunting compatible with large mammal conservation in India? In: *Hunting for sustainability in tropical forests*. (Eds. J.G. Robinson and E.L. Bennett). Columbia University Press. pp. 339-354.
- McCullough, D. 1993. Variation in black-tailed deer herd composition counts. *J. Wildl. Manage.* 57(4): 890-897.
- Nair, S.S.C.; P.V. Nair, H.C. Sharatchandra and M. Gadgil 1977. An ecological reconnaissance of the proposed Jawahar National Park. *J. Bombay nat. Hist. Soc.* 74(3): 401-435.
- Norton-Griffiths, M. 1979. The influence of grazing, browsing, and fire on the vegetation dynamics of Serengeti. In: *Serengeti: Dynamics of an ecosystem*. (Eds. A.R.E. Sinclair and M. Norton-Griffiths). University of Chicago Press, Chicago. pp. 310-352.
- Prakash, I. 1990. Dilemma of ungulate conservation in the Rajasthan desert. In: *Conservation in developing countries: Problems and prospects*. Proc. Centenary Seminar, Bombay nat. Hist. Soc. (Eds. J.C. Daniel and J.S. Srao). Oxford University Press, Bombay.
- Rashid, S.M.A., A. Khan and A.W. Akonda 1994. Fauna. In: *Mangroves of the Sundarbans. Vol.2: Bangladesh*. (Eds. Z. Hussain and G. Acharya). IUCN Bangkok, Thailand. pp. 115-132.
- Sunquist, M.; Karanth, K.U. and Sunquist, F. 1999. Ecology, behaviour and resilience of the tiger and its conservation needs. In: *Riding the tiger: Tiger conservation in human-dominated landscapes*. (Eds. J. Seidensticker, S. Christie and P. Jackson). Cambridge University Press. UK. pp. 5-18.