

Some observations of the Pallid Harrier *Circus macrourus* from Keoladeo National Park, Rajasthan, India

Ashok Verma & Deepali Sharma

Verma, A., & Sharma, D., 2013. Some observations of the Pallid Harrier *Circus macrourus* from Keoladeo National Park, Rajasthan, India. *Indian BIRDS* 8 (2): 33–36.

Ashok Verma, Wondo Genet College of Forestry & Natural Resources, Hawasa University, PO Box 28, Ethiopia. Email: vermaasok@rediffmail.com

Deepali Sharma, Society for Research in Ecology and Environment, Bharatpur, Rajasthan, 321001, India.

Manuscript received on 11 June 2012.

Abstract

The Pallid Harrier *Circus macrourus* is a rare, highly dispersed, and poorly studied raptor. Any information, especially from its wintering grounds, contributes greatly in targeting measures for its conservation. The present study collects information on its communal roost habitat, roosting behaviour, and winter diet in India. A communal roost comprising six individuals was located at Keoladeo National Park, Bharatpur (eastern Rajasthan) during February–April 2008. Direct observations on the roost were made, both in the evening and morning, using telescope (20x) and binoculars (8x35). Additionally, one of the individual roosts was marked with a Teflon ribbon to collect information on the use of individual roost-site and to investigate roost territoriality and pellet regurgitation strategy. Most harriers arrived at the roost from outside the park. They roosted in the park's Koladhar area in tall grasslands of *Desmostachya bipinnata* and *Vetiveria zizanioides*. Prior to roosting, they were observed pre-roosting on trees, stumps, and on the ground. Each harrier had an individual roost site and the continuous use of the site ranged from three to 34 days. The evidence against holding same site was also confirmed by their pellet deposition. Pellets however were not regurgitated daily and the frequency of regurgitation decreased as summer approached. Pellet analysis (N=101) showed small birds, rodents, and reptiles, especially the common garden lizard *Calotes versicolor*, comprising the winter diet of the species.

Introduction

Harriers as top predators are an essential component of the environment as they provide a link for ecosystem-level conservation, act as bio-indicators of their ecosystem's health, and appear to be sensitive to global change (Viverette *et al.* 1996; Bildstein 2001; Sergio *et al.* 2006; Bird *et al.* 2007). Monitoring migrating raptors can offer considerable potential for assessing human activities that influence local, regional, continental, and global ecosystem processes (Bildstein 2001). Of the 16 species of harriers in the world, the greatest diversity, six species, is reported from India (Simmons 2000). The Pallid Harrier *Circus macrourus* [34] is rare, highly dispersed, and poorly studied (BirdLife International 2003). It breeds from Eastern Europe to western-central Asia, and winters in Africa, India, and Sri Lanka. The largest wintering communal roost of harriers, over 3,000 birds, has been recorded from India of which 15–25% were Pallid Harriers (Clarke *et al.* 1998). However, in the recent past, it has been listed globally as Near-threatened

(IUCN 2011). Recent literature suggests that both, India, and Africa, once holding large wintering population of the species, now show a reverse trend (Ali & Ripley 1983; Ferguson-Lees & Christie 2001; BirdLife International 2003; Verma 2005). In India, degradation of roosting and hunting habitats as well as the use of pesticides, overgrazing, and decrease of food availability are potential problems for harriers (Verma 2007). The little information that exists about the species' ecology refers to their breeding grounds (BirdLife International 2003; Terraube *et al.* 2009). Recently, a detailed study on the species' sex- and age-related foraging habitat preferences was done in its African wintering grounds (Buij *et al.* 2011). Most published information from India, to date, mainly concerns numbers, distribution, and migratory movement (Ganesh & Kanniah 2000; Verma 2010a, b). The present study was an attempt to collect preliminary data on the roost site characteristics, roosting behaviour, and winter diet of the Pallid Harrier at Keoladeo National Park (KNP), Bharatpur, north-western India.

Study area

The study was conducted in the Koladhar grassland area of KNP, which is located on the extreme western edge of the Gangetic basin in the semi-arid biogeographical zone (27°7.6'–27°12.2'N, 77°29.5'–77°33.9'E). This 5 km² grassland is the last remnant patch of *Vetiveria zizanioides* and *Desmostachya bipinnata* spp., in the region. The KNP is both, a world heritage, and a Ramsar site known for its wintering palearctic waterbirds. The temperature ranges between 0.5°C in January and 50°C in May (Vijayan 1991). The average rainfall received in Bharatpur from 1980 to 1990 was approximately 655 mm (Vijayan & Vijayan 1990). The lowest annual relative humidity recorded at 0830 hrs was 84.9 (±12.9%), which occurred in 1999, and the highest, 90.6 (±4.9%) in 1997.



34. Pallid Harrier *Circus macrourus* quartering over grassland. Photo: A. Verma.

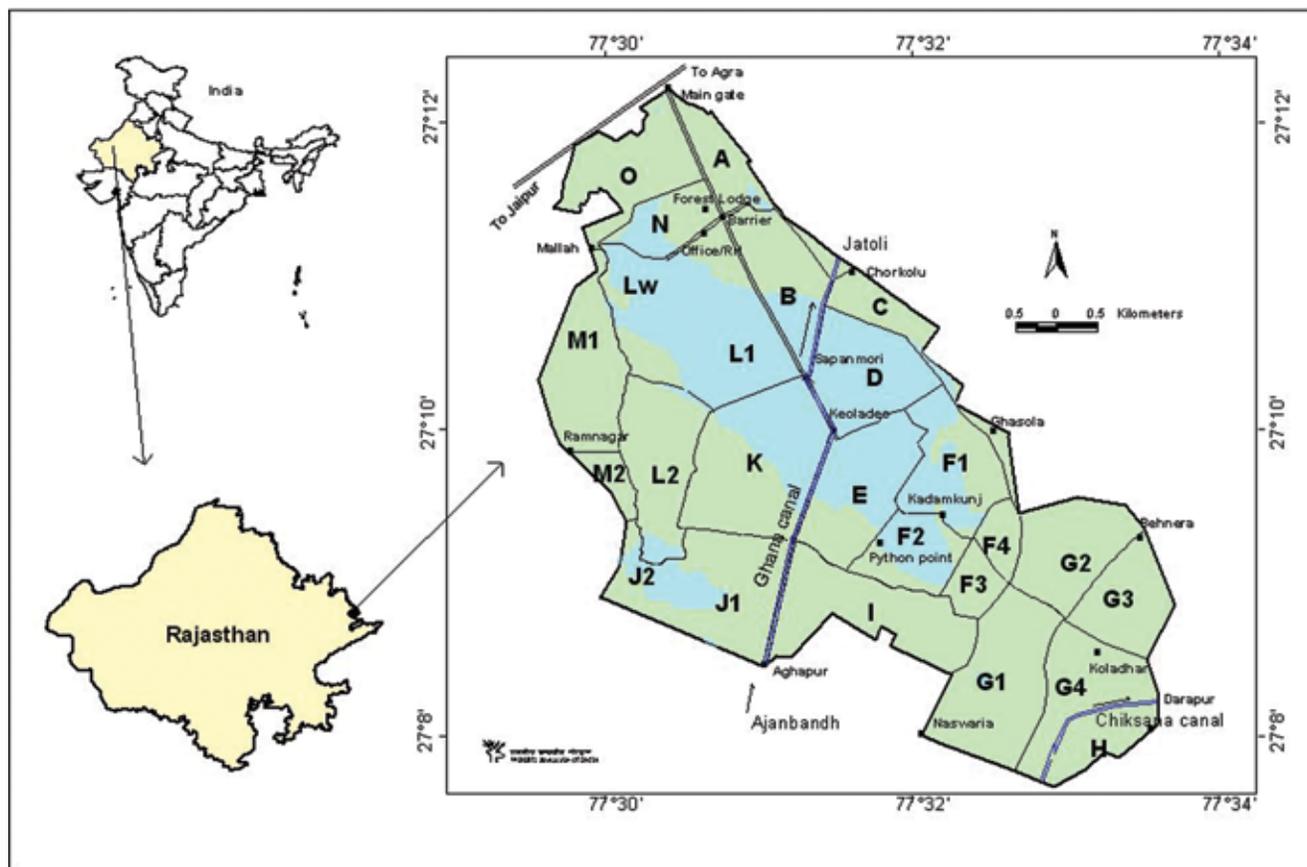


Fig. 1. Map of Keoladeo National Park. The communal roost of Pallid Harrier was located in grasslands of Koladhar (Block- G4).

Agriculture fields of 18 villages surround the Park. The two main crops are 'kharif' (Monsoon season) and 'rabi' (Winter/Spring). Kharif crops like rice *Oryza sativa*, bajra *Pennisetum* spp., and dencha *Sesbania bispinosa*, a fodder crop, are grown before the monsoon sets in, and are harvested by October. A temporary reservoir, Ajan Bund, is situated 500 m south of the park. When the reservoir is drained in August–September, the area is utilised for raising a rabi crop of wheat *Triticum aestivum*, mustard *Brassica campestris*, and pulses.

Methodology

During February–April 2008 observations on roost characteristics and roost behavior were made from two hours prior to roosting up to the time when all harriers had roosted in the evening, and from an hour before sunrise to the time that all birds had left the roost in the morning. We used binoculars (8x35) and telescope (20x) during roost counts and for observing behaviour. During 47 roost counts, we made 89 roost observations for two juveniles, 61 for three males, and 24 for one female.

One individual roost of a male Pallid Harrier was demarcated using a Teflon ribbon to obtain information on the use of individual roost site and pellet regurgitation strategy. The mark was helpful in deciding which individual roost belonged to which of the roosting harriers. Measurements on the roost habitat were carried out the following morning when all harriers had vacated the roost and dispersed for foraging. Pellets were collected fresh from the communal roost. Further, that all pellets collected belonged to Pallid Harriers was confirmed by monitoring roosts,

both, at evening, and the subsequent morning. The pellets were first sun dried and later dissected with forceps and needle, to study the remains of prey. Avian remains were identified by feathers, beak, and claws, rodents by hair and jaws, and reptiles by scales and claws. Reptilian prey could be identified to species level by comparing scales with live specimens caught in the field.

Results

Roost composition

A communal roost of six Pallid Harriers was recorded from the Koladhar grasslands on 24 February 2008. Most birds arrived from outside the park except one or two that foraged in the park and later joined others at the roost. All male, female, and juvenile harriers were present in February in the ratio of 3:1:2 respectively, which changed to 1:0:2 by late March; only juveniles remained in the park by mid-April. The females were found to be the first to leave the park (19 March 2008) followed by males (9 April), and Juveniles (24 April).

Roosting behaviour

Harriers started gathering at the roost 20.4 mins (± 11.9 , $n=15$) prior to sunset, arriving till 17.7 mins (± 5.2 , $n=31$) after sunset. However, by late March their arrival to the roost was observed after sunset. Early arrivals to the roost were found pre-roosting in trees (48%, $n=44$), stumps (27%), and on the ground (25%). They used *Acacia nilotica*, and *A. leucophloea* trees with average height of 8.9 m (± 1.6 , $n=21$) for pre-roosting. During pre-

roosting, they had aggressive interactions with harriers that had already arrived to the roost. They attacked and displaced them with a shrill call. Some pre-roosting harriers also vocalised at the new arrivals.

The Black-shouldered Kite *Elanus caeruleus*, Short-eared Owl *Asio flammeus*, and House Crow *Corvus splendens* occasionally had inter-specific interactions with the pre-roosting harriers. On two occasions, the harriers attempted to jointly mob and chase a jungle cat *Felis chaus* from the roost. About sunset, the harriers began leaving their pre-roost perches, and indulged in an inspection by soaring low and high over the roost for about half an hour or so. Till the time they finally roosted in the grass, there were a number of settlings and re-settlings, including displacing of those already roosted. In the morning, they started vacating the roost c. seven minutes (± 2.9 , $n=23$) before sunrise and by 8.8 mins (± 12 , $n=8$) after sunrise they were all gone. By mid-March, all were found leaving the roost before sunrise. Spotted deer *Axis axis* and nilgai *Boselaphus tragocamelus* were recorded as roost associates of harriers.

Roost site characteristics

The roost was confined to c. 0.4 x 0.3 km area of grassland in Koladhar. It was located about 122.2 m (SD ± 26.4 , $n=29$) from a road, 450 m (SD ± 61.2) from a wetland, 140 m (SD ± 10) from agricultural land, and one kilometre from a human settlement. *D. bipinnata* (c. 1.2 m tall) and *V. zizanioides* (c. 2.8 m tall) grasses formed the roost. *D. bipinnata* constituted 91.7% of the roost habitat. Harriers roosted alone, maintaining 50–200 m distances between each other. The individual roost site was about 1.4 (± 0.2) x 1.0 (± 0.3) m long and wide. Within the large roost, they shifted on several occasions. The continuous use of marked individual roost sites ranged between three and 34 days. Male Pallid Harrier used three individual roost sites, of which, one was used continuously for three days, another for five days and a third for 27 days. The only female Pallid Harrier roosted at two sites. One was used continuously for 12 days, and the other for four days, before it departed on 19 March 2008. One of the two juveniles that roosted in the park was observed at the same roost site for 34 days. Of 45 individual roost sites investigated, 40% contained fresh pellets, 44% had no pellets but only excreta, and 15% were devoid of both pellets and excreta. Both males and juveniles did not regurgitate pellets regularly and sometimes they even did not excrete (Table 1). From 13 March to 8 April, 2008, (27 days), the male Pallid Harrier that we marked roosted continuously at one site and we found that it regurgitated one pellet per day inconsistently with some days fresh excreta only.

Pellet analysis

We collected 101 pellets. Pellet sizes ranged between 2.5 cm (± 0.4) long and 1.5 cm (± 0.4) wide. In all, Pallid Harrier males regurgitated 46 pellets, juveniles 14, and 41 were mixed, including from females. 119 prey remains were separated out of all pellets: small birds comprising 60.5%, rodents 37%, and reptiles 2.5%. Six prey categories were identified in 101 pellets; 55 pellets comprised only small bird remains, 28 only rodents, one only reptile, 15 both small birds and rodents, one each of small bird and reptile, and small bird, mammal, and reptile. The pellet analysis showed that the winter diet of both adults and juveniles consisted largely of small birds followed by rodents

(Table 2). The common garden lizard was the only reptile identified in the pellet of a male Pallid Harrier.

Discussion

The principal wintering ground of the Pallid Harrier is open country throughout the Indian Subcontinent, the savanna belt in Africa south of the Sahara, and the East African steppes (BirdLife International 2003). Grasslands of the Blackbuck National Park, Velavadar (Gujarat, India) hosting up to 3,000 birds (Clarke *et al.* 1998), and Rollapadu Wildlife Sanctuary (Andhra Pradesh, southern India) up to 1,000 birds (Rahmani & Manakadan 1987; Clarke & Prakash 1997) are the largest recorded Pallid Harrier roosts in India. These are regular, traditional roosts, attracting mainly Montagu's Harriers *C. pygargus*, but at Velavadar up to 25% harriers are Pallid and at Rollapadu perhaps 10% (BirdLife International 2003). The KNP is a smaller Pallid Harrier roost. The KNP grassland is the last remnant patch of *Vetiveria* and *Desmostachya* grass spp., and is the largest and only protected grassland in the region. Historical literature suggests that the Pallid Harrier used to be more widespread and common than Montagu's Harrier in the Indian Subcontinent (Ali & Ripley 1983), however, recent experience shows that Montagu's Harriers outnumber the former by at least 3:1 (BirdLife International 2003; Verma 2005). Degradation of roosting and hunting habitats, use of pesticides, overgrazing, excess harvesting, conversion to croplands and development, and decrease of food availability are some of the factors adversely affecting Pallid Harriers in India (Ganesh & Kanniah 2000; BirdLife International 2003; Verma 2005). Grass cutting or burning can also be critical factors as, if excessive, can destroy available roosting and foraging habitats (Verma 2002). Degradation of traditional croplands is also a threat; the largest known winter roost in the world, at Velavadar, is located on an alluvial plain of salt flats and black cotton soil known as the 'Bhal', covering 3,000–4,000 km² along the western shore of the Gulf of Khambhat. This is traditionally a low-input, low-output arable farmland known for cotton and wheat. Irrigation canals from the major Sarovar Project have reached the Bhal, bringing the possibility of intensification of agriculture, increased use of pesticides, and unsustainable use of saline land.

Communal roost sites are an essential resource for the survival of wintering harriers. The radio-tracking of the Eurasian Marsh Harrier *C. aeruginosus* in KNP has shown that harriers travel long distances daily between foraging and roosting grounds, up to 3–12 km, with a maximum of 40 km occasionally (Verma & Prakash 2007). As harriers forage far from roosts, a landscape approach for their conservation should be employed (BirdLife International 2003).

This study finds evidence that Pallid Harriers maintain individual roost territories during winter and if such sites are undisturbed the use of the same site may continue into future seasons. The evidence of sexual differences in foraging preference related to land use in the sexually dimorphic Pallid Harrier, and evidence that juveniles used different habitats from adults have been found in wintering ground in Africa (Buij *et al.* 2011). It is however not known whether harriers have sexual differences for roosting preferences in their wintering grounds in India. Detailed systematic studies are required.

One reason for harriers shifting individual roosts that has emerged from the present study is the presence of villagers for grass cutting at roost till late evening. Earlier study in the same area has shown adverse effects of grass cutting on roosting

Table 1. Pellet regurgitation of Pallid Harrier *Circus macrourus* at individual roost sites in KNP, Bharatpur between 18 March and 24 April 2008

Harrier	% sites found with fresh pellets	% sites found with excreta only	% sites found devoid of pellets & excreta	Total sites investigated
Male	44.44	33.3	22.2	18
Juvenile	37.0	51.9	11.1	27
Total	18	20	7	45

Table 2. Percentage occurrence of prey items in Pallid Harrier *Circus macrourus* pellets (n=101) collected in KNP, Bharatpur from 29 February to 21 March 2008

Prey	Small bird	Rodent	Reptile	Prey remains/pellets
Male	54	38.6	5.3	57/46
Juvenile	50	50	0	14/14
All including female	69	31.3	0	48/41
Prey remains	72	44	3	119/101

harriers (Verma 2002). The late arrival of harriers at roost in March is indication that they spend more time foraging during the period. This was also evidenced from the individual roost sites found without pellets in the same month. The information on the winter diet of the species is limited (BirdLife International 2003). Land birds and rodents being a major component of its diet in Indian wintering grounds corresponds with its diet on the breeding grounds (Cramp & Simmons 1980). The foraging Pallid Harrier attempted attacks on wagtails and pipits (Motacillidae), and larks (Alaudidae) in the park (pers. obs.). Rodents such as Indian bush rat *Golunda ellioti*, lesser bandicoot rat *Bandicota bengalensis*, Indian gerbil *Tatera indica*, Baluchistan gerbil *Gerbillus nanus*, *Rattus* spp., and grey musk shrew *Suncus murinus*, which have been recorded in the diet of Eurasian Marsh Harrier from the same area (Verma 2010c), may constitute the rodent diet of Pallid Harriers too. Further studies are required to account for diet preferences of the species in its wintering grounds in India.

A countrywide roost survey, detail study on the winter ecology, and regular monitoring of communal roost sites are recommendations of this study for planning long term survival of Pallid Harrier in India. Countrywide roost survey for wintering Hen Harrier has been conducted in Britain (Clarke & Watson 1990). Monitoring across the country may provide valuable information about changing environmental conditions and thereby clues for their conservation. Monitoring numbers of raptors at Migration Watch sites, particularly when counts are conducted in conjunction with counts at other watch sites, and across large geographic scales, offers considerable potential for assessing which human activities influence local, regional, continental, and global ecosystem processes (Bildstein 2001).

Acknowledgements

The authors thank the Rajasthan Forest Department, and in particular R. N. Mehrotra, PCCF, and Sunayan Sharma, DFO, Keoladeo National Park for research permission and cooperation during the study and the Society for Research in Ecology and Environment (SREE), Bharatpur for financial support. Bhuri Singh assisted in the field with the pellet collection and roost observations.

References

Ali, S., & Ripley, S. D., 1983. *Handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka*. Compact ed. Delhi: Oxford University Press. Pp. i-xlii, 1 l., pp. 1-737, 56 ll.

Bildstein, K. L., 2001. Why migratory birds of prey make great biological indicators. In: *Hawkwatching in the Americas* (Bildstein & Klem, eds.). Pp. 169-179.

Bird, D. M., Bildstein, K. L., Barber, D. R., & Zimmerman, A., (eds). 2007. *Raptor research and management techniques*. The Raptor Research Foundation, Inc., & Hancock

House Publishers: USA. Pp. 461.

BirdLife International., 2003. International Action Plan for the Pallid Harrier (*Circus macrourus*). Proceedings of the 23rd meeting of the Standing Committee, December 1-4, 2003, Strasbourg, France.

Buij, R., Der Goes, D.V., De Iongh, H. H., Gagare, S., Haccou, P., Komdeur, J., and De Snoo, G., 2012. Interspecific and intraspecific differences in habitat use and their conservation implications for Palearctic harriers on Sahelian wintering grounds. *Ibis* 154 (1): 96-110.

Clarke, R., & Watson, D., 1990. The Hen Harrier *Circus cyaneus* winter roost survey in Britain and Ireland. *Bird Study* 37: 84-100.

Clarke, R., & Prakash, V., 1997. The wintering ecology of harriers at Rollapadu Wildlife Sanctuary. *Raptor* 1997/98: 43-46.

Clarke, R., Prakash, V., Clark, W. S., Ramesh, N., & Scott, D., 1998. World record count of roosting Harriers *Circus* in Blackbuck National Park, Velavadar, Gujarat, north-west India. *Forktail* 14 (August): 70-71.

Cramp, S., & Simmons, K. E. L., 1980. *Handbook of the birds of Europe, the Middle East and North Africa. The birds of western Palearctic*. Vol. 2. Oxford University Press: London.

Ferguson-Lees, J., & Christie, D. A., 2001. *Raptors of the world*. 1st ed. London: Christopher Helm. Pp. 1-992.

Ganesh, T., & Kanniah, P., 2000. Roost counts of Harriers *Circus* spanning seven winters in Andhra Pradesh, India. *Forktail* 16: 1-3.

I.U.C.N., 2011. IUCN red list of threatened species. Version 2011.2, International Union for Conservation of Nature and Natural Resources. URL: www.iucnredlist.org.

Rahmani, A. R., & Manakadan, R., 1987. A large roost of Harriers in Andhra Pradesh, India. *J. Bombay Nat. Hist. Soc.* 83 (Centenary Suppl.): 203-204.

Sergio, F., Newton, I., Marchesi, L., & Pedrini, P., 2006. Ecologically justified charisma: preservation of top predators delivers biodiversity conservation. *J. Applied Ecol.* 43: 1049-1055.

Simmons, R. E., 2000. *Harriers of the world. Their behaviour and ecology*. 1st ed. London: Oxford University Press. Pp. i-xiv, 1-384.

Terraube, J., Arroyo, B. E., Mougeot, F., Madders, M., Watson, J., & Bragin, E. A., 2009. Breeding biology of the pallid harrier *Circus macrourus* in north-central Kazakhstan: implications for the conservation of a Near-threatened species. *Oryx* 43 (1): 104-112.

Verma, A., 2002. *Winter ecology of Marsh Harrier*. Ph.D. Thesis, Mumbai University, Mumbai, India.

Verma, A., 2005. Evaluation of Pallid Harrier (*Circus macrourus*) status from various communal harrier-roosts occurring in India. Report Submitted to the Natural Research Limited, U.K. Pp. 1-30.

Verma, A., 2007. *Harriers in India: a field guide*. Wildlife Institute of India, Dehradun, India, Pp. 1-32.

Verma, A., 2010a. Status, ecology, behavior and conservation of harriers (Genus *Circus*) in the Thar Desert of Rajasthan, India. A report submitted to the Rufford Foundation, U.K. Pp. 33.

Verma, A., 2010b. Application of telemetry technique for raptor research in India with special reference to satellite telemetry. *ENVIS Bulletin* 13 (1): 135-139.

Verma, A., 2010c. The winter diet of Western Marsh Harrier (*Circus aeruginosus*) in the semiarid environment of Keoladeo National Park, Bharatpur, India. *Aquila* (116-117): 43-48.

Verma, A., & Prakash, V., 2007. Winter roost habitat use by Eurasian Marsh Harriers *Circus aeruginosus* in and around Keoladeo National Park, Bharatpur, Rajasthan, India. *Forktail* 23 (August): 17-21.

Vijayan, L., & Vijayan, V. S., 1990. Ecology of Siberian Crane with special reference to conservation. Proceedings of the Seminar on Wetland Ecology and Management, February 23-25, 1990, Bharatpur, India.

Vijayan, V. S., 1991. Final report 1980-1990. Keoladeo National Park, Bombay Natural History Society, Bombay.

Viverette, C. B., Struve, S., Goodrich, L. J., & Bildstein, K. L., 1996. Decreases in migrating Sharp-shinned Hawks (*Accipiter striatus*) at traditional raptor-migration watch sites in eastern North America. *Auk* 113: 32-40.

With the compliments of
G.B.K. CHARITABLE TRUST

Rajan House, 2nd Floor, A.M. Marg, Prabhadevi, Mumbai 400025