WHITE-RUMPED VULTURE

Nest features and nest tree characteristics of *Gyps bengalensis* (Aves: Accipitriformes: Accipitridae) in Moyar Valley of Tamil Nadu, India

Adult White-rumped Vulture brooding the nestling in Moyar Valley

IUCN Red List: Critically Endangered (BirdLife International, 2017)

Aves
[Class of Birds]

Accipitriformes
[Order of the diurnal birds of prey]

Accipitridae
[Family of birds of prey]

Gyps bengalensis
[White-rumped Vulture]

Species described by Gmelin in 1788

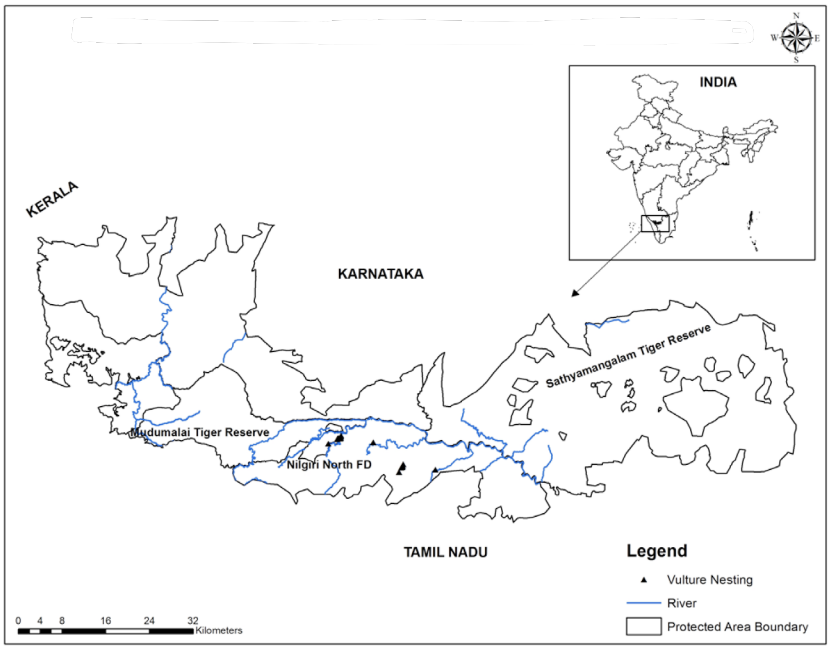
True tree nesting Gyps Vulture species under family Accipitridae in India are represented by two species-the White-rumped Vulture *Gyps bengalensis* and Slender-billed Vulture *Gyps tenuirostris*. Once White-rumped Vultures were commonest birds of prey species distributed throughout Indian subcontinent (Ali 1983). Nine species of vultures are recorded in India. The vulture numbers decreased markedly due to veterinary use of non-steroidal anti-inflammatory drug (NSAID) diclofenac in India (Green et al. 2004) and Pakistan (Oaks et al. 2004). Population of Gyps vultures endemic to South Asia decreased by more than 97% in early 1990's to 2012 (Cuthbert et al. 2015) leading to their categorization as Critically Endangered in the IUCN Red List of Threatened Species (BirdLife International 2017).

Few studies have been conducted on White-rumped Vulture to describe the structure of nests in favoured tree species in Himachal Pradesh (Thakur et al. 2012), Uttar Pradesh (Jha 2015). Ramakrishnn et al. (2014) described about nesting trees characteristics in the Segur Plateau of Nilgiri North Forest Division in Tamil Nadu. None of the studies have attempted to describe and compare actual nest trees with available trees. An attempt was made in the Nilgiri North Forest Division to determine the most important characteristics determining the choice of nesting trees. The aim of the study is to describe nest structure and to evaluate nest tree characteristics of White-rumped Vulture by comparing actual nest trees with randomly selected trees.

Global Distribution:
Native: Afghanistan, Bangladesh, Bhutan, Cambodia, India, Iran, Myanmar, Nepal, Pakistan.
(BirdLife International, 2017)

Study Area

The Moyar Valley is located between 11.70^{0}N, 76.59^{0}E and 11.47^{0}N, 77.14^{0}E bounded by the Nilgiri plateau to its southeast, Thalamalai plateau to the northeast, and Mudumalai Tiger Reserve to the west. The approximate length of the valley is 50km falling within the Tamil Nadu and Karnataka states. Mudumalai and Sathyamangalam Tiger Reserves of Tamil Nadu and Bandipur Tiger Reserve of Karnataka within the Moyar Valley have been declared as Protected Areas (PAs). The uniqueness of the landscape is its connection with the Western and Eastern Ghats. Elevations of the area ranges from 209–1950 m. Extremes of climate are experienced with temperature varying between 17^{0}C and 37.5^{0}C. During the northeast monsoon season, the eastern part of the Moyar Valley receives heavy rainfall and during the southwest monsoon the western part receives heavy rainfall. There is a 260m deep gorge called Moyar gorge located in the eastern end of Nilgiri District, which separates the Segur and Mysore plateaus. The study area sprawling over 600sq.km covers parts of Masinagudi Range in Mudumalai Tiger Reserve, Segur Range, Nilgiri mountain, Eastern slope of the Nilgiri North Forest Division and Bhavanisagar Range of Sathyamangalam Tiger Reserve. Different types of the vegetation, healthy wild prey and predator base of the Moyar Valley, supports the six species of vultures (Venkitachalam 2018).



Map showing study area with White-rumped Vulture nest distribution in Moyar Valley

Methods

As many occupied locations by White-rumped Vulture territories as possible were located in the study area during the 2012 to 2014. The historical description of traditional nesting sites and territorial behaviour of breeding pairs were noted from high vantage points as well as by extensive exploratory surveys on foot (Fuller & Mosher 1987). A total of 31 nests were located in the occupied territories. Data on nest tree characteristics were collected during July and August of 2012 and 2014 after fledging. We recorded the following information to describe each nest trees such as species, trunk shape and canopy shape. The condition of the trees was described as good, medium or bad. The GBH was noted using dbh tape. Height of the nest tree, height of the nest above ground, and height of living canopy were measured. In order to compare nest tree characteristics within the same forest stand, the same numbers of non-nest trees were selected from neighboring areas.

Kruskal-Wallis Anova test was used to compare variable of nesting and non-nesting trees. The non-parametric chi-square test was used to test the association between variables. Appropriate data transformations were made whenever needed. For hypothesis testing $P < 0.05$, $P < 0.01$ and $P = 0.00$ were considered and these levels of significance were indicated at appropriate places. Statistical inferences were made by following Sokal & Rohlf (1995) and Zar (2003). All the statistical analysis were carried out using the Minitab statistical software (Version 12) and SPSS (Statistical Package for Social Science: Nie et al. 1975).

Full grown White-rumped Vulture juvenile on the nest in Moyar Valley

Results

The White-rumepd Vulture nest ecology study was carried out in 2012 and 2014 to understand the nest features and nest tree characteristics in Moyar Valley. The loose colonies of White-rumped vulture have been found along the perennial rivers in the Nilgiri North Forest Division (n=12) followed by Mudumalai Tiger Reserve (n=24) of Moyar Valley. White-rumped Vulture breeding season starts from September to April and some of pairs breed up to till June. The White-rumped Vultures mostly preferred *Terminalia arjuna* (91.67%) followed by *Terminalia bellirica* (5.56%) and *Pterocarpus marsupium* (2.78%) for nest building. Altogether both nesting tress (n=32) and non- nesting trees (n=82) were attempted to study the nest features and nest tree characteristics. All the nests of White-rumped Vulture recorded were live tree species with few dry canopies. The Kruskal-Wallis ANOVAs statistics was used to investigate difference between the nest trees and non-nest trees. Difference could not be detected between nest trees and randomly selected trees

Table: Kruskal - Wallis ANOVAs for White-rumped Vulture nesting and non-nesting trees in Nilgiri North Forest Division, Tamil Nadu, India.

Variables	Nest tree (n = 32)	Non-nest tree (n = 83)	Kruskal-Wallis ANOVA		
			χ^2	df	P Value
Number of branches	8.47±0.70	6.02±0.34	8.096	1	0.004
Girth at breast height (m)	4.66±0.26	3.28±0.13	24.724	1	0.000
Tree height (m)	43.53±1.50	30.02±1.54	28.252	1	0.000
Canopy cover (%)	10.42±0.51	8.85±0.34	6.875	1	0.009
Distance to nearest water source (m)	19.78±10.06	15.71±3.71	1.156	1	0.282
GBH of Nest branch	43.31±3.02	27.43±1.12	21.873	1	0.000
Distance to human habitation (m)	1605.56±189.53	1967.07±107.82	3.042	1	0.081
Distance to road (km)	25.83±1.24	23.48±0.70	3.042	1	0.081

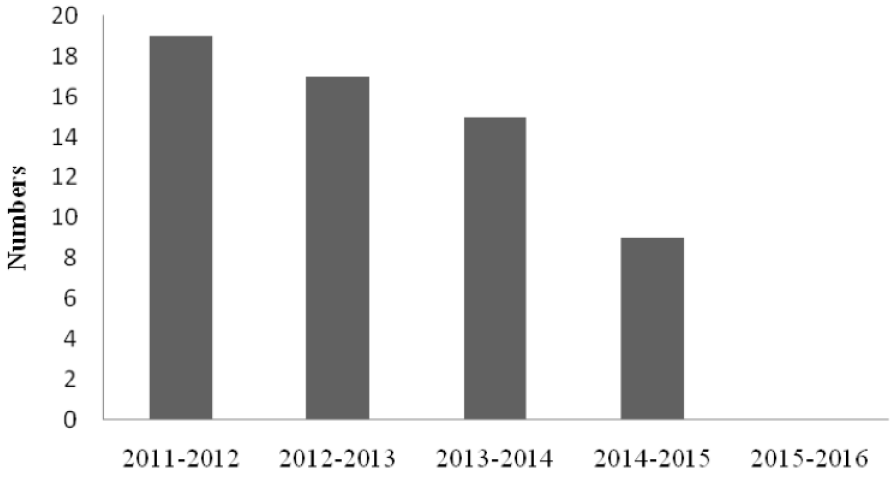
in terms of canopy cover, number of branches, distance to water source, road and human settlement. The structure of the nest trees was similar to random non-nest trees and there was a statistical significant difference between nest trees and randomly selected non nest trees in terms GBH of nest tree (χ^2 = 24.72, P = 0.000), number of available branches (χ^2 = 8.09, P = 0.08), tree height (χ^2 = 28.25, P = 0.000), canopy cover (χ^2 = 6.87, P = 0.000) and GBH of the nest branch (χ^2 = 21.8, P = 0.000) (Table).

White-rumped Vulture usually constructs platform nests by using the twigs of the same nesting tree species as well other available tree species with and without needles. The nest placement of White-rumped Vultures was recorded according to the position within canopy of nesting trees. The majority of the nests were facing west direction followed by north, east, southeast, southwest, south and northwest directions. The twig size ranged between 4.3cm and 4.3cm long and 15mm diameter to 23mm diameter of twigs. Nests were lined with green leaves of *Terminalia* species, *Pongamia* species, *Lantana* species, various grass species and debris etc. Fresh nesting materials were added to the nest by adult vultures to increase the size of the nest and to provide a platform structure according to the growth of the nestling as the nestling will require for performing wing exercise, wing over leg exercise and jumping. Every breeding cycle the White-rumped Vultures repaired and reused the old nests by adding fresh nest materials.

Discussion

In India, White-rumped Vultures normally breed on the canopy of the trees such as *Ficus benghalensis*, *Ficus religiosa*, *Mangifera indica*, *Dalbergia sissoo*, *Acacia* sp and *Terminalia arjuna* (Ali & Ripley 1983). The study area constitutes various tree species, but most preferred trees for nesting of White-rumped Vultures were *Terminalia arjuna* followed by *Terminalia bellirica* and *Pterocarpus marsupium*. These trees generally have few thick

branches; an oval-shaped canopy and the tree height were comparatively taller than other available tree species in the Moyar Valley. In addition, open canopy could help the adult vultures for easily accessing their nests. The oval shape open canopy cover of the trees provides greater shelter from predator and inclement weather while, at the same time, provide support to the nests (Solonen 1982). Similar studies in African vultures revealed that there is a clear tendency for nest site selection within well foliaged trees along with water course with the nest placed in a prominent fork like branches within the tree canopy (Irwin 1981; Mundy 1982; Mundy et al. 1992; Roche 2006). Thakur et al. (2012) reported that there is no direct observations and dependence of White-rumped Vulture species on water source at nesting sites of Kangra Valley in Himachal Pradesh. However, there is some definite role of water bodies in selection of nest sites as elucidated by Al & Ripley (1983). Similarly, in the present study, although river flows along the breeding habitat in Moyar Valley, its role is not understood. The nesting orientations of the White-rumped Vulture were that maximum nest built on the west side of the tree canopy than the north side. The main meteorological factors that might influence nest orientation and reproductive success are temperature early in the breeding season, direct solar radiation during hotter days, and avoidance of other inclement conditions (Dimitris et al. 2000).

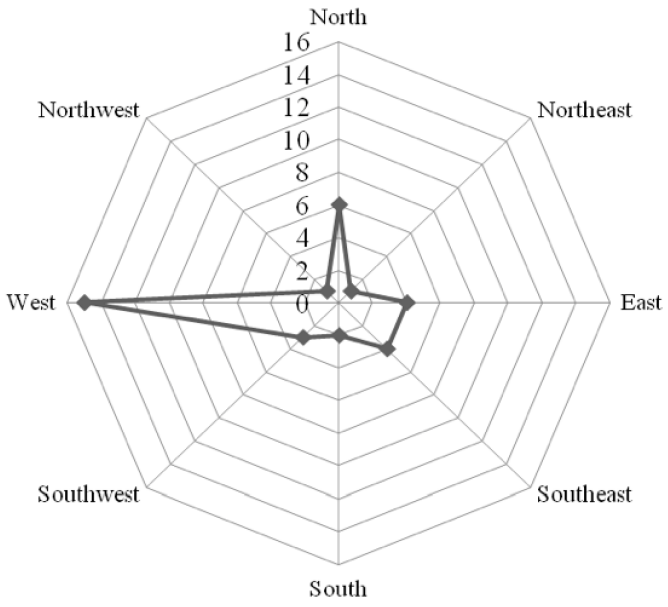


Number of White-rumped Vulture nests in Siriyur

During nest building, White-rumped Vultures frequently added green twigs to their nests throughout the breeding season. Newton (1979) recorded similar observation on other raptors species and the maintenance of optimum humidity have been suggested for this behaviour. The most widely acceptable explanation is that raptors bring green vegetation to their nests to advertise territory occupancy (Newton 1979). A further explanation is that the continual addition of nesting material increases the size of the nest to accommodate the increasing size and activity of the nestlings, particularly when they begin to exercise their wings (Newton 1979). Gyps vultures usually have a clutch of one egg or two eggs (Grossman & Hamlet 1964). Ali & Ripley (1983) reported a clutch of one egg and later on in rare cases a clutch of two eggs reported in Keoladeo National Park, Bharatpur in India (Prakash 1999). During the present study, a clutch of one egg was recorded throughout the study period.

The majority of the White-rumped Vultures have been breeding in the Nilgiri North Forest Division of Moyar Valley. There are number of villages in and around the study area who rear livestock for their livelihood for manure collection and milking purpose. These cattle also serve as a food source for vultures. The main threats for the White-

rumped Vulture species in the landscape are illegal usage of vulture killer, non-steroidal anti-inflammatory drugs such as diclofenac, aceclofenac, carprofen, flunixin, ketoprofen, nimesulide and phenlybutazone on livestock by quacks, para-veterinarians, livestock inspectors and veterinarians. Other anthropogenic threats for vultures are farmers apply pesticides on leftover livestock carcasses to kill the wild predators such as tiger, leopard and dhole and in the process vultures also get killed in numbers (Venkitachalam 2016). In addition Mariamman temple festivals being celebrated in Siriyur during the peak White-rumped Vulture breeding season and due to these festivals a sharp decline of nest numbers was noticed in Siriyur. We recommend that for better management, the Nilgiri North Forest Division should be declared as vulture sanctuary for securing last stronghold breeding populations of White-rumped Vultures in Tamil Nadu.



Orientation of White-rumped Vulture nests in relation to nest tree trunk

References

Ali, S. & S.D. Ripley (1983). *Handbook of the Birds of Indian and Pakistan Compact Edition*. Oxford University Press, New Delhi, 737pp.

Bamford, A.J., A. Monadjem & C.W. Hardy (2009). Nesting habitat preference of the African White-backed Vulture *Gyps africanus* and the effects of anthropogenic disturbance. *Ibis* 151: 51–62.

BirdLife International (2017). *Gyps bengalensis.* The IUCN Red List of Threatened Species 2017: e.T22695194A118307773. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22695194A118307773.en.

Dimitris, E.B., C.G. Vlachos & J.H. Gram (2000). Nest features and nest-tree characteristics of Short-toed Eagle (*Circaetus gallicus*) in the Dadia-Lefkimi-Soufli Forest, northeastern Greece. *Journal of Raptor Research* 34(4): 293–298.

Fuller, M.R. & J.A. Mosher (1987). *Raptor Survey Techniques*. B.A. Giron Pendleton, 37–65pp.

Green, R.E., I. Newton, S. Shultz, A.A. Cunningham, M. Gilbert, D. Pain & Prakash (2004). Diclofenac poisoning as a cause of vulture population declines across the Indian subcontinent. *Journal of Applied Ecology* 41: 793–800.

Grossman, M.L. & J. Hamlet (1964). *Birds of Prey of the World.* Bonanza Books, New York.

Irwin, M.P.S. (1981). *The Birds of Zimbabwe*. Quest Publishing, Bulawayo.

Jha, K.K. (2015). Distribution of Vultures in Uttar Pradesh, India. *Journal of Threatened Taxa* 7(1): 6750–6763; http://doi.org/10.11609/JoTT.o3319.6750-63

Mundy, P.D., B.J. Ledger & S. Piper (1992). *The Vultures of Africa*. Acorn Books, Russel Friedman Books and Vulture Study Group, Johannesburg.

Mundy, P.J. (1982). *The Comparative Biology of Southern African Vultures*. Vulture Study Group, Johannesburg.

Newton, I. (1979). *Population ecology of Raptors*. Buteo Books, Vermillion, South Dakota, 383pp.

Nie, N.H., C.H. Hull, J.G. Jenkins, K. Steinbrenner & D.H. Bent (1975). *SPSS: Statistical Package for the Social Sciences (2ndEdition).* McGraw-Hill, New York.

Oaks, J.I., M. Gilbert, M.Z. Virani, R.T. Watson & C.U. Meteyer (2004). Diclofenac residues as the cause of vulture population declines in Pakistan. *Nature* (427): 630–633.

Prakash, V., R.E. Green, D.J. Pain, S.P. Ranade, S.P. Saravanan, S. Prakash, N, Venkitachalam, R. Cuthbert, A.R. Rahmani & A.A. Cunningham (2007). Recent changes in populations of resident Gyps Vultures in India. *Journal of the Bombay Natural History Society* 104(2): 129–135.

Prakash, V. (1999). Status of vultures in Keoladeo National Park, Bharatpur, Rajasthan, with special reference to population crash in *Gyps* species. *Journal of the Bombay Natural History Society* (96): 365–378.
Rasmussen, P.C. & S.J. Parry (2001). The taxonomic status of the Long-billed Vulture *Gyps indicus*, *Vulture News* (44): 18–21.
Ramakrishnan, B., G. Kannan, A. Samson, K. Ramkumar & S. Ramasubramaniam (2014). Nesting of White-rumped Vulture (*Gyps bengalensis*) in the Segur Plateau of the Nilgiri North Forest Division, Tamil Nadu, India. *Indian Forester* 140(10): 1014–1018.
Cuthbert, R.J., M.A. Taggart, M. Saini, A. Sharma, A. Das, M.D.Kulkani, P. Deori, S. Ranade, R.N. Shingarpure, T.H. Galligan & R.E. Green (2015). Continuing mortality of vultures in India associated with illegal veterinary use of diclofenac and a potential threat from nimesulide. *Oryx* 1–9; http://doi.org/10.1017/S003060531500037X
Sokal, R.R. & F.T. Rohlf (1981). *Biometry*. W.F.Freeman and Company, New York, 859pp.
Roche, C. (2006). Breeding records and nest site preference of Hooded Vultures in the greater Kruger National Park. *Ostrich* 77(1): 99–101.
Solonen, T. (1982). Nest sites of the Common Buzzard (*Buteo buteo*) in Finland. *Ornis Fenn* 59: 191–192.
Thakur, M.L. & R.C. Kataria (2012). Breeding records and nest site preference of Indian White-backed Vulture in Kangra Valley of Himachal Pradesh, India. International Journal for Science and Nature 3(2): 350–353.
Venkitachalam, R (2016). In-situ Conservation of Vultures in Tamil Nadu, India. *SACON Newsletter* 13(4): 5-6.
Venkitachalam, R (2018). Population Estimation of Vultures in Moyar Valley, Tamil Nadu: Road Transect Survey. Workshop of Securing Vulture Population in Southern India. Udhagamandalam, The Nilgiris.
Zar, J.H. (2003). *Biostatistical Analysis*. Pearson Education Pvt. Ltd., Singapore, 663pp.

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