

Original Research Paper

Evaluation Of The Avian Diversity Survey In D'Ering Memorial Wildlife Sanctuary, Arunachal Pradesh

Daniel Mize¹, Ripin Taba, Rajat Chetry and Temin Payum²

Ecology and Wildlife Biology Unit, Department of Zoology, Rajiv Gandhi University, Doimukh, Arunachal Pradesh, India.

²Jawaharlal Nehru College, Pasighat, Arunachal Pradesh, India.¹Corresponding author: mizezoology@yahoo.co.in

Received: September 25, 2014; revised: November 27, 2014; accepted: December 23, 2014

Abstract: A survey was undertaken in the month of November and December 2012, to evaluate the species diversity of birds in D'Ering Memorial Wildlife Sanctuary (DWS). The study result in record of altogether 55 species belongs to 27 families from D'Ering Memorial Wildlife Sanctuary. Among the fifty nine species recorded, nine species are listed as threatened species in the IUCN red list. Out of the nine threatened species, three species fall in Critically Endangered (CR) category, four species fall in Endangered (EN) category and two species fall in Near Threatened (NR) category. Two species were recorded for the first time in the sanctuary. The record of 55 species in short period indicates that DWS is a highly diversity of bird species. Also, provide significant information on the distribution of threatened birds in Arunachal Pradesh, which would be first hand information to prioritize DWS as site in case of action to protect those recorded threatened species.

Key words: Avifauna, Wildlife Sanctuary, Threatened species

Introduction

Arunachal Pradesh, North eastern state of India, at coordinate 26° 40' to 29° 27' N and 91° 35' to 97° 24' E is the main constituent of Eastern Himalayan biodiversity hotspot region (Sen and Mukhopadhyay, 1999; Meyers *et al.*, 2000; Sinha *et al.*, 2004, Mize and Tsomu, 2012). Befittingly, the state is bountiful home to diverse array of flora and fauna and thereby making state as the undoubted riches terrestrial biodiversity region in India. Hence, the state is considered as biodiversity frontier in India (Borges, 2005; Mishra and Datta, 2007 and Borang *et al.*, 2008). Although Arunachal Pradesh is the riches terrestrial biodiversity state India but wildlife is not properly documented due to remote location, rugged mountainous terrain, poor road communication and other infrastructures (Sinha *et al.*, 2004; Borges, 2005; Mishra and Datta, 2007 and Borang *et al.*, 2008). Recent description of new species of monkey *Macaca munzala* (Sinha *et al.*, 2004), a bird *Liochicla bugunorum* (Athreya, 2006), subspecies of Scalater's monal

Lophophorus scaleteri arunachalensis (Kumar and Singh, 2004) and also record of Leaf deer *Muntiacus putaoensis* and Chinese goral *Nemorhaedus caudatus*, new to Indian sub continent (Datta *et al.*, 2003 and Mishra *et al.*, 2006) during the last decade is the evidence of relatively less explored rich wildlife of the state. Recent spate of description of new species assure more new wildlife inventory in the state, particularly more ornithological discoveries as birds are most diverse in higher vertebrate group so in the state. Survey is needed in more and more unexplored areas for new inventory and to acquire baseline data on avifauna diversity of the state as most part of the state is still less explored (Borges, 2005 and Mishra and Datta, 2007). D'Ering Memorial Wildlife Sanctuary (DWS) at 27°56' 16'' N, 95°26' 45'' E is one of the less explored areas in view of bird diversity. Few earlier studies done on the birds of DEWS were report on population status and distribution of Bengal Florican (Rahmani *et al.*,

1990), population status of Swamp Francolin (Singh, 1995), 113 species of bird including 14 species of waterfowl (Barman, 1996), occurrence of white-winged wood duck (Choudhury, 1996), and publish checklist listing 109 species (Leepage, 2010). Review of the ornithological work show that DWS is a less explored important bird area (IBA) as literature and report on the birds of DWS is quite scanty and work done was also in 90's thereafter no recent publication birds of DWS is not known. Since, avifauna is relatively less explored in DWS, study of avifauna of DWS is imperative for new inventory and also to determined the population status and occurrence of threatened birds in the sanctuary. Therefore, present study was undertaken for new inventory, to evaluate species diversity and to assess threatened species in DWS. In this paper, we summarize the results on the species diversity and threatened species recorded during our survey in DWS (Fig.1.).

Materials and methods

Study area

The present survey was carried out in D'Ering Memorial Wildlife Sanctuary (DWS), located in East Siang district of Arunachal Pradesh, is one of the Important Birds Area (IBA) in Arunachal Pradesh (Rahmani and Islam, 2004). DWS lies at (27°56' 16'' N, 95°26' 45'' E), cover an area of 190 km², located between Siang and Sibya rivers, which criss-cross the sanctuary. Sanctuary is spread over the floodplain of Sibia and Siang rivers with altitude range from 100 to 150 m asl. Average Temperature during summer is 36° C and during winter it is 8° C and humidity is as high as 90% during June and July. As high as 75% of the sanctuary area is under Savannah grassland vegetation and 15% of area is under Tropical Semi-Evergreen forest. Dominant species of grasses found in the sanctuary are *Phragmites karka*, *Arundo donax*, *Neyraudia reynaudiana*, *Erianthus ravannae*, *Imperata cylindrica*, *Saccharum spontaneum* and *S. arundinaceum*. Dominant trees species in the sanctuary are *Zizyphus mauritania*, *Albizia procera*, *Bombax ceiba*, *Dalbergia sisoo*, *Dellinia indica*, *Daubanga grandiflora*, *Gmelina arborea* and *Amoora wallichii*.



Fig.1. Map of study area D'Ering Memorial Wildlife Sanctuary

Survey

During the survey, we followed the protocol of line transects method to survey the species diversity of bird (Burnham *et al.*, 1980 and Javed and Kaul, 2002). Bird species diversity was surveyed along a predetermined walked transects. Transects were laid along the main trail used by the forest official in the sanctuary. Birds observed within visual range on both sides of transects line were recorded. Birds observe up to 50 m on both sides of the walk transects were photographically documented by using Canon EOS 60D with 300mm zoom lens. Birds beyond 50 m on both sides of the walked transects were observed with 16X40 DPSI Olympus binocular. Transect were walked between 0700 hours and 1600 hours. The linear distance of transect covered during the day depend upon topographic situation of the area. Birds sighted while resting at base camp, sit down for rest after the walked transects of the day is finish and returning from the base camp were also recorded.

Identification and classification.

Birds recorded were identified using several Field guides on birds, (Ali and Ripley, 1987, Ali, 2002; Grewal *et al.*, 2002; Kazmierzak *et al.*, 2003 and Grimmet *et al.*, 2009). For classification of the birds, we followed the classification used in the checklist of the birds in oriental region, Oriental Bird Club (OBC) (Inskipp *et al.*, 2001).

Table 1 : Birds recorded in the D'Ering Memorial Wildlife Sanctuary

Common name	Scientific name & author	IUCN status	Status in WLP Act, 1972
Accipitridae			
White Backed Vulture	<i>Gyps bengalensis</i> , Gmelin,1788	Critically Endangered	Scheduled I
Indian Vulture	<i>Gyps indicus Scopoli</i> ,1786	Critically Endangered	Scheduled I
Himalayan Griffon	<i>Gyps himmalayansis</i> , Hume,1869	Near threatened	
Slender Billed Vulture	<i>Gyps tenurostris</i> , Grey, 1844	Critically Endangered	Scheduled I
Eurasian Griffon	<i>Gyps fulvus</i> , Hablizi, 1783		
Cinereous Vulture	<i>Aegypius monachus</i> , Linnaeus,1766	Near threatened	Scheduled I
Hen Harrier	<i>Circus cyaneus</i> , Linnaeus, 1766	Least concerned	
Steppe Eagle	<i>Acqiula nipalensis</i> , Hodgson, 1833	Least concerned	
White-tailed eagle	<i>Haliaeetus albicilla</i> , Linnaeus, 1758	Least concerned	
Alaudidae			
Indian Bushlark	<i>Mirafra erythroptera</i> , Blyth, 1845	Least concerned	
Alcedinidae			
White-Breasted Kingfisher	<i>Halcyon smyrnensis</i> , Linnaeus, 1758	Least concerned	
Pied Kingfisher	<i>Ceryle rudis</i> , Linnaeus, 1758	Least concerned	
Anatidae			
Lesser Whistling Duck	<i>Dendrocygna javanica</i> , Horsfield, 1821	Least concerned	
Ruddy shelduck	<i>Tadorna ferruginea</i> , Pallas, 1764	Least concerned	
White Winged Duck	<i>Asarcornis scutulata</i> ,Muller, 1842	Endangered	Scheduled I
Common merganser	<i>Mergus merganser</i> , Linnaeus, 1758	Least concerned	
Anhingidae			
Oriental Darter	<i>Anhinga melanogaster</i> , Pennant, 1769	Near threatened	Scheduled I
Ardeidae			
Indian Pond Heron	<i>Ardeola grayii</i> , Sykes, 1832	Least concerned	
Grey Heron	<i>Ardea cinerea</i> , Linnaeus, 1758	Least concerned	
Great White Egret	<i>Ardea alba</i> , Linnaeus, 1758	Least concerned	
Little Egret	<i>Egretta garzetta</i> , Linnaeus, 1766	Least concerned	
Cinnamon Bittern	<i>Ixobrychus cinnamomeous</i> , Gmelin,1789	Least concerned	
Campephagidae			
Long-tailed minivet	<i>Pericrocotus ethologus</i> , Bangs & Phillips,1914	Least concerned	
Charadriidae			
Red-Wattled Lapwing	<i>Vanellus indicus</i> , Boddaert, 1783	Least concerned	
Chloropseidae			
Golden-Fronted Leafbird	<i>Chloropsis aurifrons</i> , Temminck, 1827	Least concerned	
Ciconiidae			
Black Stork	<i>Ciconia nigra</i> , Linnaeus, 1758	Least concerned	
Black-Necked Stork	<i>Ephippiorynchus asiaticus</i> , Latham, 1790	Near threatened	Scheduled I
Asian Openbill	<i>Anastomus oscitanus</i> , Boddaert, 1783	Least concerned	
Columbidae			
Eurasian Collared Dove	<i>Streptopelia decaocto</i> , Frivaldszky, 1838	Least concerned	
Spotted Dove	<i>Streptopelia chinensis</i> , Scopoli, 1786	Least concerned	
Coraciidae			
Indian Roller	<i>Coracias benghalensis</i> , Linnaeus, 1758	Least concerned	
Corvidae			
Rufous Treepie	<i>Dendrocitta vagabunda</i> , Latham, 1790	Least concerned	
House Crow	<i>Corvus Spendens</i> , Vieillot, 1817	Least concerned	

Jungle Crow	<i>Corvus macrorhynchos</i> , Lesson, 1831	Least concerned	
Cuculidae			
Lesser caucal	<i>Centropus bengalensis</i> , Gmelin, 1788	Least concerned	
Dicruridae			
Black drongo	<i>Dicrurus macrocercus</i> , Vieillot, 1817	Least concerned	
Greater Racket-tailed drongo	<i>Dicrurus paradiseus</i> , Linnaeus, 1766	Least concerned	
Laniidae			
Long Tailed Shrike	<i>Lanius schach</i> , Linnaeus, 1758	Least concerned	
Laridae			
Little Tern	<i>Sternula albifrons</i> , Pallas, 1764	Least concerned	
Saunders's tern	<i>Sternula saundersi</i> , Hume, 1877	Least concerned	
Black-bellied tern	<i>Sterna acuticauda</i> , Gray, 1832	Endangered	Scheduled I
Muscicapidae			
Common stonechat	<i>Saxicola torquatus</i> , Linnaeus, 1766	Least concerned	
White-crowned fork-tail	<i>Enicurus leschenaulti</i> , Vieillot, 1818	Least concerned	
Slaty-backed fork-tail	<i>Enicurus schistaceus</i> , Hodgson, 1836	Least concerned	
Oriolidae			
Black Hooded Oriole	<i>Oriolus xanthornus</i> , Linnaeus, 1758	Least concerned	
Phalacrocoracidae			
Indian cormorant	<i>Phalacrocorax fuscicollis</i> , Stephens, 1826	Least concerned	
Great Cormorant	<i>Phalacrocorax carbo</i> , Linnaeus, 1758	Least concerned	
Phasianidae			
Red junglefowl	<i>Gallus gallus</i> , Linnaeus, 1758	Least concerned	
Picnonotidae			
Red-Vented Bulbul	<i>Picnonotus cafer</i> , Linnaeus, 1766	Least concerned	
White throated bulbul	<i>Alophoixus flaveolus</i> , Gould, 1836	Least concerned	
Remizidae			
White-crowned penduline Tit	<i>Remiz coronatus</i> , Severtsov, 1873	Least concerned	
Scolopacidae			
Common Sandpiper	<i>Actitis hypoleucos</i> , Linnaeus, 1758	Least concerned	
Sturnidae			
Jungle myna	<i>Acridotheres fuscus</i> , Wagler, 1827	Least concerned	
Timaliidae			
White-crested laughing thrush	<i>Garrulax leucolophus</i> , Hardwicke, 1815	Least concerned	
Upupidae			
Common Hoopoe	<i>Upupa epops</i> , Linnaeus, 1758	Least concerned	

Results

In the survey undertaken to study the bird diversity at DWS in month of November and December, 2012, we have recorded 55 species belong to 27 families as listed in table 1.

Family Accipitridae was dominant with nine species, followed by Ardeidae with five species, Anatidae with four species, Ciconiidae, Corvidae and Muscicapidae each with three species, Alcedinidae, Columbidae, Dicruridae,

Phalacrocoracidae and Picnonotidae each with two species, and the rest Alaudidae, Anhingidae, Campephagidae, Charadriidae, Chloropseidae, Coraciidae, Cuculidae, Laniidae, Oriolidae, Phasianidae, Remizidae, Scolopacidae, Sturnidae Timaliidae and Upupidae each with one species.

Among the fifty five species, nine species were confirmed as threatened species. Out of nine threatened species, three

species Indian White Backed Vulture *Gyps bengalensis*, Indian Vulture *Gyps indicus* and Slender Billed Vulture *Gyps tenurostris* are listed as Critically Endangered (CR) species, two species White Winged wood Duck *Asarcornis scutulata* and Black-bellied Tern *Sterna acuticauda* are listed as Endangered (EN) species and four species Oriental Darter *Anhinga melanogaster*, Himalayan Griffon *Gyps himalayensis*, Cinereous Vulture *Aegypius monachus* and Black-necked Stork *Ephippiorynchus asiaticus* are listed as near threatened (NR) species in IUCN red list (IUCN, 2012 and Rahmani, 2012).

Among the fifty five species, two species Cinereous vulture and Steppe Eagle were sighted for the first time in the DWS.

Discussion

In the present study, survey is undertaken to find out the avian species in the DWS as avifaunal diversity is remained relatively less explored as indicated by literature available. This study was an effort to estimate the number of bird species in DEWS as done in various region of India by other workers (Devi et al., 2012; Donar et al., 2012; Mize and Tsomu, 2012; Chopra et al., 2013; Motup and Sahi, 2013 and Gupta, 2013). During the survey 55 species including 9 threatened species were recorded from DWS, it substantiate DWS as an important ecosystem sustaining high bird diversity and habitat threatened species. Though species diversity recorded in the present study is not at par with as reported by earlier worker but it gives more insight into population status as well as health of the habitat at the moment.

As birds are the most threaten groups of wildlife in the state due to overexploitation (Mishra and Datta, 2007; Aiyadurai et al., 2010; Aiyadurai, A., 2011; Aiyadurai, 2012; Mize and Tsomu, 2012 and Solanki and Chutia, 2013). Repeated survey of birds is necessary in various region of the state to monitor any fluctuation in bird population and also to know number of species exist at the time and for new inventory (Jerdon, 1870; Godwin- Austin, 1877; Bailey, 1913 and 1915; Backers, 1913 and 1914; Ali and Ripley, 1948; Ripley,

1948 and 1961; Sen & Mukhopadyay, 1999; Borang, 2004; Athreya, 2006 and Choudhury, 2010). With this objective, survey was undertaken in DWS as it is one of the relatively less explored wildlife sanctuaries in the state. Though new species was not discovered during the survey but the occurrence of the 9 threatened species and record of two species for the first time ordains DWS as important bird area (IBA) in the state. Records of the nine threatened species provide more insight into distribution pattern of the threatened species in Arunachal Pradesh and it would be greatly useful to pin point future *in situ* conservation programme. Further, records of two species for the first time indicate toward possibilities of more new recording in future. Thus, avifaunal survey in DWS is needed frequently for complete documentation of avifaunal species exist in DWS. The present study was an important information regard to species exist, distribution and to monitor population fluctuation of bird, particularly threatened birds in the DWS and as a whole of state. Further, intensive survey is needed for new inventory and complete documentation of bird in the sanctuary.

Acknowledgements

We are thankful to University Grants Commission (UGC), New Delhi for providing financial support and Centre with Potential for Excellence in Biodiversity (CPEB), Rajiv Gandhi University for infrastructure to carry out the survey. We are also thankful to Principal Chief Conservator of Forest (WL &BD) and others officers, Department of Environment and Forest Govt. of Arunachal Pradesh for necessary permission and support to conduct the survey in the DWS.

References

- Athreya, R. 2006.** A new species of liocichla (Aves: Timaliidae) from Eaglenest wildlife sanctuary, Arunachal Pradesh, India. Indian Birds. 2(4): 82-95.
- Aiyadurai, A. 2012.** Birds hunting in Mishmi hills of Arunachal Pradesh, North-eastern India. Indian Birds. 7(5): 134 -137.

- Aiyadurai, A. 2011.** Wildlife hunting and conservation in North-east India: a need for an interdisciplinary understanding. *International Journal of Galliformes Conservation*. 2: 61-73.
- Aiyadurai, A, Singh, N. J. and Gulland, E. J. M. 2010.** Wildlife by indigenous tribe: A case study from Arunachal Pradesh, North-east India. *Oryx*. 44(4): 564-572.
- Ali, S. 2002.** The book of Indian birds. Oxford University Press, New Delhi.Pp: 156-347
- Ali, S. and Ripley, S.D. 1987.** Handbook of the birds of India and Pakistan. Oxford University Press, New Delhi.Pp: 10-239.
- Ali, S. and Ripley, S.D. 1948.** The birds of Mishmi Hills. *Journal of Bombay Natural History Society*, 48: 1-37.Pp: 136-247.
- Backer, E.C.S. 1913.** On the small collection of birds from the Mishmi hills, North-East frontier of India. *Records of Indian Museum*. 9:251-254.
- Backer, E.C.S. 1914.** Description of new birds from north-east frontier of India. *Bulletin of British Ornithological Club*. 35:17-19.
- Bailey, F.M. 1913.** Some notes on mammals and birds from southern eastern Tibet. *Journal of Bombay Natural History Society*. 22: 366-371.
- Bailey, F.M. 1915.** Notes from southern Tibet. *Journal of Bombay Natural History Society*. 24:71-78.
- Barman, R. 1996.** Birds of D'Ering Memorial Wildlife Sanctuary, Arunachal Pradesh. *Newsletter for birdwatchers*.36: 47-49.
- Borang, A., Bhatt, B.B., Tamuk, M., Borkotoki, A. and Kalita, J. 2008.** Butterflies of Dihang-Dibang Biosphere Reserve of Arunachal Pradesh, Eastern Himalyas, India. *Bulletin of Arunachal Forest Research*. 24 (1&2): 41-53.
- Borang, A. 2004.** Checklist of birds of Dihang- Dibang Biosphere Reserve, Arunachal Pradesh. *Himalayan Biosphere Reserves*. 6 (1&2):21-41.
- Burnham, K.P., Anderson, D.R. and Laake, J.L. 1980.** Estimate of density from line transect sampling of biological populations. *Wildlife Monograph*. 72: 202.
- Chopra, G., Tyor , A.K. and Kumari, S. 2013.** A study on wetland avian species of Sultanpur national park Gurgaon,Haryana(India). *The Ecoscan*. 7(1&2):21-26.
- Choudhury, A.U. 1996.** Survey of White-winged Wood Duck and Bengal florican in Tinsukia district and adjacent areas of Assam and Arunachal Pradesh, Rhino Foundation for Nature, Guwahati, Assam.
- Borges, R.M. 2005.** The frontiers of India's biological diversity. *Tropinet*. 16(3):1-3.
- Datta, A., Pansa, J., Madhusudan, M.D. and Mishra C. 2003.** Discovery of the leaf deer *Muntiacus putaoensis* in Arunachal Pradesh: an addition to the large mammals of India. *Current Science*. 84:101-102.
- Devi, O.S., Islam,M., Das, J. and Saikia, P.K. 2012.** Avian- Fauna of Gauhati University campus, Jalukbari, Assam. *The Ecoscan*. 6(3&4):165-170.
- Donar, A. S., Reddy, K. R. and Deshpande, D.P. 2012.** Avifaunal diversity of Nipani reservoir, Belgaum district Karnataka. *The Ecoscan*. 1(Special issue): 27-33.
- Godwin-Austin, H.H. 1877.** Description of three new species of birds of the genera *pellorneum*, *actinura* and *pomatorhinus* lately collected in the neighbourhood of Saddy, Assam, by Mr. M.J. Ogle of the Topographical Survey. *Journal of Asiatic Society Bengal*. 46(2): 41-45.
- Grimmett, R., Inskipp, C. and Inskipp, T. 1999.** Pocket guide to the birds of Indian Subcontinent. New Delhi: Oxford University Press.Pp:10 -378.
- Gupta, N. 2013.** Study on the biodiversity of waters birds in selected reservoirs of Bokaro district. *The Ecoscan*. 7(1&2): 89-94.
- Inskipp, T., Lindsey, A. and Duckworth, W.A. 2001.** Checklist of the birds of the oriental region. *Oriental Bird Club*, available at www.orientalbirdclub.org/publications/checklist
- IUCN, 2014.** The IUCN Red list of Threatened Species/ 2014.2/ available online at www.iucnredlist.org.
- Javed, S. and Kaul, R. 2002.** Field method for bird survey. *Indian Bird Conservation Network (IBCN) and Bombay Natural History Society, Mumbai*.Pp: 50-117.
- Jerdon,T.C. 1870.** Notes on some new species of birds from the North-Eastern frontier of India. *Proceeding of Asiatic Society Bengal*.Pp: 59-61.

- Kazmierczak, K. 2003.** Birds of India, Srilanka, Pakistan, Nepal, Bhutan, Bangladesh and Maldives. Om Books International, New Delhi. Pp:8-402.
- Kumar, S.R. and Singh, P. 2003.** A new subspecies of Scalater's Monal *Lophophorus scaleteri* from western Arunachal Pradesh, India. Bulletin of the British Ornithologist' Club. 124: 16-27.
- Lepage, D. 2014.** Checklist of the birds of Arunachal Pradesh. Avibase, the world birds database. Available online at: <http://avibase.bsceoc.org/checklist>.
- Meyers, N., Mittermier, R., Mittermeier, C., Da Fonseca, G. and Kent, J. 2000.** Biodiversity hotspots for conservation priorities. Nature. 403:853-858.
- Mishra, C., Madhusudan, M.D. and Datta, A. 2006.** Mammals of the high altitudes of western Arunachal Pradesh, eastern Himalaya: an assessment of threats and conservation needs. Oryx. 40:29-35.
- Mishra, C. and Datta, A. 2007.** A new bird species from eastern Himalayan Arunachal Pradesh- India's biological Frontier. Current Science. 92 (9):1205-1206.
- Mize, D. and Tsomu, T. 2012.** Avifauna species recorded from the Rono Hills of Arunachal Pradesh, The Ecoscan. 6 (3&4): 177-180, 2012.
- Motup, T. and Sahi, D.N. 2013.** Avifaunal diversity of district kargil- a Trans-Himalayan region of J & K state. The Ecoscan. 7 (1&2):73-78.
- Rahmani, A.R., Narayan, G., Rosalind, L., Sankaran, R. and Ganguli-Lachungpa, U. 1990.** Tatus of Bengal florican in India. Journal of Bombay Natural History Society. 88: 349-375.
- Rahmani, A.R. 2012.** Threatened bird of India and its conservation implication. Oxford University Press & Indian Bird Conservation Network, Mumbai. Pp: 138-835.
- Rahmani, A.R. and Islam, M. 2004.** Important bird areas in India: Priority site for conservation. Indian Bird Conservation Network, Mumbai, India. Pp: 169-230.
- Ripley, S.D. 1961.** Some bird records from northern Burma with a description of a new sub species. Journal of Bombay Natural History Society. 58: 279-283.
- Ripley, S.D. 1948.** New birds from Mishmi hills. Proceedings of Biological Society Washington. 61:99-105.
- Sen, A.K. and Mukhopadhyay, S.K. 1999.** Avian fauna of Mouling National Park, Arunachal Pradesh, India. Current Science. 76: 1305-1308.
- Sinha, A., Aparajita Datta, A., Madhusudan, M.D. and Mishra, C. 2005.** *Macaca munzala*: A New Species from Western Arunachal Pradesh, Northeastern India. International Journal of Primatology. 26 (4):977-989.
- Solanki, G. S. and Chutia, P. 2013.** Patterns of birds hunting in Arunachal Pradesh and implications for biodiversity conservation. Tropical Ecology. 54(2): 263-267.