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Avian Diversity of Lohardaga Forest Division, Jharkhand, India.

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Abstract: Lohardaga Forest Division is a biodiversity rich area, but its avifaunal diversity has not been properly studied and the avifauna of Lohardaga Forest Division is still unknown. In order to fill up this lacuna, this survey was carried out to document the avifaunal diversity and abundance in the Lohardaga Forest Division for ongoing and future biodiversity actions. A total number of 3,213 birds belonging to 147 species grouped into 56 families were recorded from Lohardaga Forest Division during the study period. Out of these 2,270 were recorded from wetland habitats and 943 birds were recorded from forest habitats. Birds recorded from wetland habitats belongs to 78 species grouped into 28 family and birds recorded from forest habitats belongs to 77 species grouped into 28 families. The maximum number of birds was recorded at site 1, (1426) followed by Site 3, (642), site 8 (207), site 2 (202), and the minimum number was seen at site 5 (106). The Anatidae family shows the highest species richness in the study sites (9 species), followed by Ardeidae and Muscicapidae (8 species each), Accipitridae (7 species), Cuculidae (6 species), Cisticolidae, Charadriidae (5 species each), Sturnidae, Rallidae, Phasianidae, Motacillidae, Megalaimidae, Dicaeidae, Columbidae, Campephagidae (4 species each), Scolopacidae, Picidae, Oriolidae, Corvidae, Ciconiidae, Alcedinidae (3 species each), Threskiornithidae, Strigidae, Pycnonotidae, Psittaculidae, Podicipedidae, Phalacrocoracidae, Apodidae, Leiothrichidae, Laridae, Laniidae, Jacanidae, Hirundinidae, Estrildidae (2 species each) and Zosteropidae, Vangidae, Upupidae, Tytonidae, Turdidae, Timaliidae, Sittidae, Rhipiduridae, Ploceidae, Pittidae, Pellorneidae, Passeridae, Nectariniidae, Monarchidae, Meropidae, Falconidae, Coraciidae, Caprimulgidae, Bucerotidae, Alaudidae, Aegithinidae (1 species each). Among the avifauna, 114 (78%) were residents, 31 (20%) were winter migrants, 1 (1%) summer migrants and 1 (1%) Local migratory. The species richness of the selected sites varied from 28 to 67, while overall diversity value ranged from 0.94 to 3.86. Relative abundance of species recorded during this study was 43 rares, 21 irregulars, 53 scarces, 21 commons and 9 abundants. Among the recorded species all were placed in Least Concern category as per IUCN 3.1. According to Wildlife Protection Act, 1972 six Schedule-I species, 135 Schedule-IV species, one Schedule-V species were recorded, and rest were recorded in Not Listed category.

Keywords- Lohardaga Forest Division, Ranchi West Forest Division, Chhotanagpur plateau, South Koel River, Jharkhand.

I. Introduction

Avian population has a central role in ecosystem functioning and ecosystem services. Birds are bio-indicators and appraise the health of environment and ecosystems, they can determine environmental integrity using their functions and populations. Birds play pivotal ecological roles both in forest and farmland ecosystems, notably pollination, seed dispersal, and pest control (Whelan et al. 2008; Mulwa et al. 2012). In addition to above, there is positive role of birds in nutrient cycling and soil formation. They also richly contribute to the recolonization and restoration of disturbed ecosystem (Sekercioglu et al. 2004; Sekercioglu 2006). The importance of local landscapes for avian conservation can only be understood by knowing the structure of the bird community of that region (Kattan & Franco 2004). Bird diversity of both temperate and tropical forests has been studied by many workers from time to time (MacArthur & MacArthur 1961; Terborgh et al. 1990; Thiollay 1994; Robinson et al. 2000; Latta et al. 2003; Blake 2007). Avian fauna are regarded as important indicators of a country's environmental health (Collar and Andrew, 1988) and their high and low diversities are directly related with the environmental condition of the area.

Birds are one of the most diversified of all creatures living on the earth today and distributed almost throughout the world. They are the only true flyers and can freely move across all geographical barriers. Birds play an important role in ecosystem by being as a part of the food web. They are potential pollinators and bio-indicators. Birds are facing several threats such as deforestation, hunting, habitat loss and climatic changes. They occupy various types of habitats, from open field to forest, desert to High Mountain and even in ice zone where it is quite tough for a human or other animals to live. Birds are ideal bio indicators and useful models for studying a variety of environmental problems, and

the importance of local landscapes for avian conservation can only be understood by knowing the structure of the bird community in the region concerned (Kattan & Franco, 2004). Increasing anthropogenic pressure, change in land use patterns, commercial exploitation of waterbodies and seasonal wetlands, forest fire, rampant grazing, overuse of pesticides and herbicides rapidly eats up natural habitats of birds. Most deforestation has happened in biodiversity-rich tropical forests (Asner et al. 2009: Hansen et al. 2012; Harney 2015). These areas are expected to face even more pressures in the future, largely due to agricultural expansion and increased industrialization (Tilman and Fargione 2001: Dobrovolski et al. 2011: Wagh and Tiwari 2020). Bird diversity is influenced by habitat heterogeneity (MacArthur & MacArthur, 1961). Change in structural and compositional diversity of native vegetation would alter the composition of the bird community (Fleishman et al., 1991; Leito et al., 2006; Acevedo & Aide, 2008). Apparently, many of bird populations in India have been dwindling due to direct or indirect impacts of the increase in the human population and poaching (Das, 2006).

A wetland is an any kind of land area that is submerged by water. Systematic study of wetlands started just after the International Convention of Wetlands held in Ramsar or Iran in 1971 which is known as Ramsar Convention. Ecologically wetlands are of great significance for an area as they perform a number of vital functions in maintaining the overall balancing of nature, flood and soil erosion control, water storage and purification etc. Wetland supports congregation of large number of migratory and resident species of birds as it has high nutritional value as well as productivity. As per (Ali & Repley 1983), 273 species of birds in India can be considered as waterfowls, the birds that depend on wetland ecosystem. India has a total of 310 wetland species of birds of which 130 species are migrants and 173 residents while the status of seven species is not known (Kumar et al. 2005). In 2015, Asian Wetland bird Census a total of 78 wetland species of birds including 11 threatened bird species were recorded during the census in Jharkhand (Prakash et al. 2015). Out of 78 species, 26 species were resident birds while 23 were resident migrants and the rest 29 were migratory birds. In 2016, Asian Wetland bird Census a total of 71 species of wetland were sighted belonging to 18 families (Prakash et al. 2016). Out of these 54 species were water birds and 17 species were wetland dependent birds. Out of 71 species, 25 species were resident birds while 21 species were resident migrants, and rest 25 species were migratory birds.

A recent study conducted on wetland birds in Gumla Forest Division shows 41 species of wetland and wetland dependent birds belonging to 13 families. Out of these 33 species were wetland birds (WB) and 8 species were wetland dependent birds (WDB). Out of 41 species, 17 species were resident birds (R) while 9 species were resident migrants (RM), and rest 15 species were winter migratory (WM) birds (Xaxa et al. 2023). Of the 9026 species of birds found around the world, India harbours about 1300 species, belonging to 88 families (Manakadan and Pittie, 2001; Rasmussen and Anderton, 2005) which is over 13% of the world's birds. (Dutta et al. 2004) recoded a total of 465 species and sub species of birds in Bihar and Jharkhand of which 317 species are resident and 148 are migratory. However, avifauna of Jharkhand state, carved out of Bihar in 2000, is least studied (Islam and Rahmani,2004; Narwade et al.,2006). Very few studies (Ball 1874; Lopez & Mundkar 1997; Gupta 2004) have been made on the species composition of birds in different parts of Jharkhand (India). Lohardaga Forest Division is a biodiversity rich area, but its avifaunal diversity has not been properly studied and the avifauna of Lohardaga Forest Division is still unknown. In order to fill up this lacuna, this survey was carried out to document the avifaunal diversity and abundance in the Lohardaga Forest Division for ongoing and future biodiversity actions.

II. Study Sites

The present study has been carried out in The Ranchi West Forest Division, presently known as Lohardaga forest division, Jharkhand (India). The division is situated within 23^0 40' N latitude and 84^0 14' E longitude. The division is bounded by forests of Latehar, Daltonganj South in north and by the forests of Gumla division in the south. In the east lies the Ranchi East Division while west to the Palamau district. The Lohardaga division covers the south - western part of Chhotanagpur plateau. The forests of Lohardaga Forest Division belong to following types: (A). Northern Tropical Dry Deciduous Forests. It has two sub-types: (1). Dry Peninsular Sal-Type 5B/C 1C. (2). Northern Dry Mixed Deciduous Forest-Type 5B/62. (B). Degraded Stage of Dry Deciduous Forests. It has one sub-types. (1). Dry Deciduous Scrub-Type DE I. (C). Bamboo Brakes, and (D). Northern Tropical Dry Deciduous Forest. The topography of Lohardaga Forest Division is undulating and rugged. Plateau formation locally known as 'Pat' is the most striking feature of the tract and is found on almost all the hills in smaller or larger extent. Pakahar, Bagru, Karang, Salaiya, Dumarpat, Tuimu and Mandua parts of tract are in fact the seat of bauxite deposits in the fringe. The elevation range of the division vary approximately between 610 and 640 m aMSL. In plain areas and around 1000m aMSL in plateau region. The division experience warm humid climate with three well defined seasons i.e., Summer, Winter, and Monsoon. The winters commence from middle November and extend up to middle of March. December is the coldest month. During winter, the temperature goes down to 4^0c. Summer starts from middle of March and continues up to middle of June, when the temperature shoots up 42^0c. The monsoon sets in by the middle of June and continue till the middle of October. The annual normal rainfall in the division is 1137 mm. 83.5% of total rainfall occurs during the monsoon months only i.e., middle of June to middle of October. The district experiences maximum precipitation in July (Figure-1).

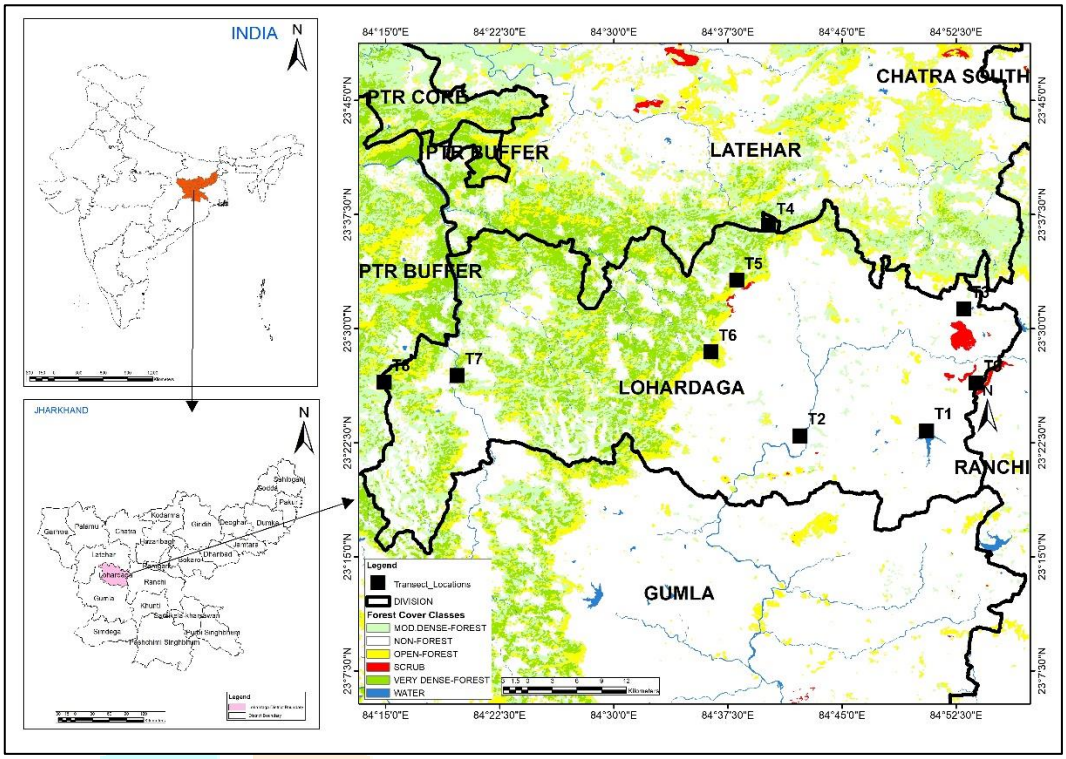

Figure 1. Location of the study Sites in Lohardaga Forest Division, Jharkhand (Source: Forest Survey of India, 2011)

Table: 1. Details of study sites for bird sampling in Lohardaga Forest Division.

Transects (Study sites)	Places	Geographical Parameters		Altitude (m)
		Latitude (N)	Longitude (E)	
Site 1	Nandini Dam	23.38819	84.84262	697
Site 2	Chitri (Koyal River)	23.38257	84.70395	665
Site 3	Chandlaso dam	23.52144	84.88316	699
Site 4	ChulhaPani hills	23.6131	84.66957	885
Site 5	Pakhar hills	23.55293	84.63448	940
Site 6	Bagru hills	23.47446	84.60628	990
Site 7	Beti forest	23.44842	84.32824	645
Site 8	Netarhat hills	23.44187	84.24718	1092
Site 9	Chalho hills	23.44041	84.89676	773

III. Materials and Methods

Methodology: Different Reserved Forests (RF) in the study area were surveyed (Fig. 2 A, B). Because the study area is highly undulating terrain, forest roads or trails were used as transect instead of line transects. During the transect walk, data on sighting of bird species and number of individual sighted were recorded. For aquatic birds and water dependent birds, different water bodies like rivers and ponds/dams were surveyed. The entire study area was divided into two habitat segments viz. – Forest areas and Wetland areas. Birds were sighted with the aid of binoculars Nikon 8245 ACULON A211 8 X 42 and photographs were taken with still camera Cannon Power Shot SX50HS from 6:00 to 9:00 hr. and 16:00 to 19: hr. Species were identified directly in the field and where identification could not be done, photographs were taken. They were identified with the help of field guides (Grimmett et al. 1999; Kazmierczak & Singh 2001; Ali 2001). Nocturnal birds like owls and nightjars were surveyed and identified in evening or night using spotlight and reference call. In addition, opportunistic sightings were also recorded of the birds. The comprehensive checklist of the birds was prepared in the study area by adding these species with the species recorded on the transect. Bird checklist was prepared following taxonomic nomenclature of (Manakadan and Pittie, 2001). Birds were classified resident-migratory status and feeding guilds as per (Ali and Riley, 1987). (Birdlife International, 2016) was followed for threat category. Bird species were ranked into following abundance categories (Ramírez-Albores & Ramírez 2002): abundant (total of 40 or more individuals recorded daily), common (17 to 39 individuals recorded daily), scarce (11 to 16 individuals recorded), irregular (five to 10 individuals recorded) and rare (one to four individuals recorded). Taxonomy adopted here is after (Inskipp et al.,1996).

Figure 2. Different habitat segments for bird study in Lohardaga Forest Division (A, B. Wetland habitats and C, D. Forest habitats).

Data Analysis

The cumulative number of species observed in each site was considered as the species richness for that site. Based on the present investigations a bird list was compiled. Shannon-Wiener diversity index (H') (Shannon and Wiener, 1963) was calculated for each site by the formula below:

$$H' = \log_{10} N - \left\{ \sum_{i=1}^{S} n_i \log_{10} n_i \right\} \frac{1}{N}$$

$$H' = -\sum_{i=1}^{S} P_i (\log_2 P_i)$$

Where, H'= Index of species diversity derived from information statistics
S = Total number of species in the count
Pi = ni / N = Proportion of total sample belonging to the ith species
ni = Number of individuals of the species 'i'
N = Total number of individuals in the count

Simpson's index of diversity was calculated by the formula below:(Simpson, 1949)
Simpson's index is a measure of dominance. The value of Cd ranges between 0 and 1. With this index, 0 represents infinite diversity and 1, no diversity. That is, the bigger the value of Cd, the lower the diversity.

$$D = 1 - \sum_{i=1}^{S} \left(\frac{n_i}{N} \right)^2$$

Where, D = Diversity
S = Total number of species in the count
ni = Number of individuals of the species 'i'
N = Total number of individuals in the count

Shannon wiener evenness

$$E = \frac{H'}{\ln S}$$

Where, S = Species richness
H' = Shannon's index of diversity

Usually 'E' approaches to zero, as a single species becomes more and more dominant in a community. The data were calculated using the Window's Microsoft Excel.

IV. Result And Discussion

A total number of 3,213 birds belonging to 147 species (Table 2) grouped into 56 families were recorded from Lohardaga Forest Division during the study period. Out of these 2,270 were recorded from wetland habitats and 943 birds were recorded forest habitats. Birds recorded from wetland habitats belongs to 78 species grouped into 28 family and birds recorded from forest habitats belongs to 77 species grouped into 28 families (Figure 2). The maximum number of birds was recorded at site 1, (1426) followed by Site 3, (642), site 8 (207), site 2 (202), and the minimum number was seen at site 5 (106) (Figure 4).

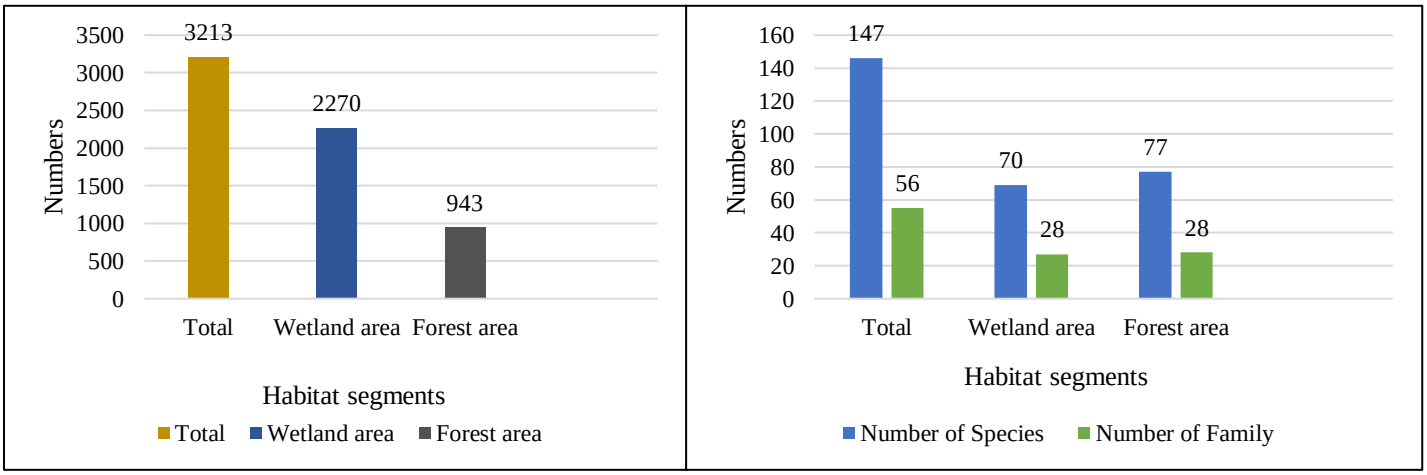

Figure 2. Total count of birds, Species richness and family size for different habitat segments in Lohardaga Forest Division.

Table 2. Birds of Lohardaga Forest Division, recorded from the present study in Lohardaga Forest Division.

Scientific Name	Common Name	Status			Migratory Status	Different study sites in Lohardaga Forest Division								
		Abundance	IUCN	WPA		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Family: Accipitridae														
Milvus migrans	Black Kite	C	LC	IV	RE	3	6	2	1	3	1	2		7
Elanus axillaris	Black Shoulder Kite	R	LC	IV	RE	2					1	1		2
Haliastur indus	Brahminy Kite	S	LC	IV	RE	2								
Spilornis cheela	Crested Serpent Eagle	S	LC	I	RE						1		2	
Circus aeruginosus	Eurasian Marsh Harrier	S	LC	IV	W	1	1							
Pernis ptilorhynchus	Oriental Honey Buzzard	S	LC	I	RE								1	1
Accipiter badius	Shikra	S	LC	I	RE				1			1		1
Family: Acrocephalidae														
Acrocephalus dumetorum	Blyth's Reed Warbler	S	LC	IV	RE						2	1		
Family: Aegithinidae														
Aegithina tiphia	Common Iora	I	LC	IV	RE				3	2	1	3	6	1
Family: Alaudidae														
Eremopterix grisea	Ashy-Crowned Sparrow Lark	S	LC	IV	W					1				
Family: Alcedinidae														
Alcedo atthis	Common Kingfisher	C	LC	IV	RE	2		1						
Ceryle rudis	Pied Kingfisher	S	LC	IV	RE	2	1							
Halcyon smyrnensis	White-Throated Kingfisher	S	LC	IV	RE	2	2	1	1		10		1	1
Family: Anatidae														
Anser indicus	Bar-Headed Goose	A	LC	IV	W	12								
Anas crecca	Eurasian Green-Winged Teal	A	LC	IV	W	18								
Mareca penelope	Eurasian Wigeon	C	LC	IV	W	6								
Mareca strepera	Gadwall	C	LC	IV	W	32								
Dendrocygna javanica	Lesser Whistling Duck	C	LC	IV	W	980	26	540						
Anas acuta	Northern Pintail	I	LC	IV	W	4								
Netta rufina	Red Crested Pochard	I	LC	IV	W	12								
Tadorna ferruginea	Ruddy Shelduck	R	LC	IV	W	25	4							
Aythya fuligula	Tufted Duck	S	LC	IV	W	45								
Family: Apodidae														
Cypsiurus balasiensis	Asian Palm Swift	R	LC	NL	RE	4	3	2						
Apus affinis	House Swift	R	LC	NL	RE					4	6			
Family: Ardeidae														
Nycticorax nycticorax	Black Crowned Night Heron	A	LC	IV	RE	2	1							1
Bubulcus ibis	Cattle Egret	C	LC	IV	RE	16	10	6	1	3	2	8		8
Ardea alba	Great Egret	C	LC	IV	RE	8	6	4				1		4
Ardea cinerea	Grey Heron	C	LC	IV	W	1								
Ardeola grayii	Indian Pond Heron	S	LC	IV	RE	6	8	3						4
Mesophoyx intermedia	Intermediate Egret	S	LC	IV	RE	4								
Egretta garzetta	Little Egret	S	LC	IV	RE	6	12	4			4			2
Ardea purpurea	Purple Heron	S	LC	IV	W	1								
Family: Bucerotidae														
Ocycerous birostris	Indian Grey Hornbill	R	LC	I	RE						2	1	4	
Family: Campephagidae														

Lalage melanoptera	Black Headed Cuckooshrike	I	LC	IV	RE				1	1			2	
Coracina macei	Large Cuckoo Shrike	R	LC	IV	RE	6			1			2		
Pericrocotus cinnamomeus	Little Minivet	S	LC	IV	RE				2		2		4	4
Pericrocotus speciosus	Scarlet Minivet	S	LC	IV	RE							2		
Family: Caprimulgidae														
Caprimulgus asiaticus	Indian Nightjar	S	LC	IV	RE								2	
Family: Charadriidae														
Vanellus cinereus	Grey Headed Lapwing	C	LC	IV	W		2							
Charadrius alexandrinus	Kentish Plover	R	LC	IV	W			2						
Charadrius dubius	Little Ringed Plover	S	LC	IV	W	2	4	2						
Vanellus indicus	Red-Wattled Lapwing	S	LC	IV	RE	4	6	3	2	2	2		2	
Vanellus malabaricus	Yellow-Wattled Lapwing	S	LC	IV	W		2							
Family: Ciconiidae														
Anastomus oscitans	Asian Openbill Stork	C	LC	IV	RE	8	18	4						
Leptoptilos javanicus	Lesser Adjutant Stork	R	VU	IV	LM	5								
Ciconia episcopus	Woolly-Necked Stork	S	LC	IV	RE	4								
Family: Cisticolidae														
Prinia socialis	Ashy Prinia	I	LC	IV	RE				2		1	1	3	1
Prinia hodgsonii	Grey Breasted Prinia	R	LC	IV	RE				2			6		3
Prinia inornata	Plain Prinia	R	LC	IV	RE				1		1		2	
Orthotomus sutorius	Tailor Bird	S	LC	IV	RE	2			4			2		1
Cisticola juncidis	Zitting Cisticola	S	LC	IV	S				1				1	
Family: Columbidae														
Spilopelia senegalensis	Laughing Dove	A	LC	IV	RE					2	4	4	2	
Columba livia	Rock Pigeon	C	LC	IV	RE		10		3	4	2	8	18	15
Spilopelia chinensis	Spotted Dove	I	LC	IV	RE			2	2		10	4	5	1
Treron phoenicoptera	Yellow Footed Green Pigeon	R	LC	IV	RE				2			5	3	
Family: Coraciidae														
Coracias benghalensis	Indian Roller	R	LC	IV	RE		2		1	2	1		1	
Family: Corvidae														
Corvus splendens	House Crow	C	LC	V	RE	10				4	2	8		
Corvus macrorhynchus	Large-Billed Crow	I	LC	V	RE				2	2	4	4		
Dendrocitta vagabunda	Rufous Treepie	R	LC	IV	RE				2			1	4	1
Family: Cuculidae														
Eudynamys scolopaceus	Asian Koel	I	LC	IV	RE				2		1	6	2	2
Cacomantis sonneratii	Banded Bay Cuckoo	R	LC	IV	RE					1			1	
Hierococcyx varius	Common Hawk Cuckoo	S	LC	IV	RE					1	2	1	1	
Cuculus canorus	Eurasian Cuckoo	S	LC	IV	RE				1	1	1	1		
Centropus sinensis	Greater Coucal	S	LC	IV	RE					1		2		1
Clamator jacobinus	Jacobin Cuckoo	S	LC	IV	W								1	1
Family: Dicaeidae														
Dicaeum agile	Thick-Billed Flowerpecker	R	LC	IV	RE				2	2	1		4	
Dicrurus macrocercus	Black Drongo	A	LC	IV	RE	7	8	12	3	12	6	22	1	8
Dicrurus paradiseus	Greater Racket Tailed Drongo	C	LC	IV	RE				1				1	
Dicrurus caerulescens	White-Bellied Drongo	S	LC	IV	RE				4	1	2	8	2	
Family: Estrildidae														
Lonchura malacca	Black-Headed Munia	I	LC	IV	RE									3
lonchura punctulata	Scaly Breasted Munia	S	LC	IV	RE								12	
Family: Falconidae														
Falco tinnunculus	Common Kestrel	S	LC	I	RE	1	1							

Family: Hirundinidae														
Hirundo rustica	Barn Swallow	C	LC	IV	RE						1	1		
Hirundo smithii	Wire-Tailed Swallow	S	LC	IV	RE	20			2	3				
Family: Jacanidae														
Metopidius indicus	Bronze Winged Jacana	R	LC	IV	RE	2		4						
Hydrophasianus chirurgus	Pheasant Tailed Jacana	R	LC	IV	RE	2		4						
Family: Laniidae														
Lanius cristatus	Brown Shrike	S	LC	NL	RE	2								1
Lanius schach	Long Tailed Shrike	S	LC	IV	RE				1	1				
Family: Laridae														
Chroicocephalus ridibundus	Black-Headed Gull	S	LC	IV	W	4								
Sterna aurantia	River Tern	S	LC	IV	RE		2							
Family: Leiothrichidae														
Turdoides striata	Jungle Babbler	C	LC	IV	RE				4	2	6	12	8	
Turdoides affinis	Yellow-Billed Babbler	I	LC	IV	RE						8		4	
Family: Megalaimidae														
Psilopogon asiaticus	Blue-Throated Barbet	I	LC	IV	RE								2	
Psilopogon zeylanicus	Brown Headed Barbet	R	LC	IV	RE				4				2	
Psilopogon haemacephalus	Coppersmith Barbet	R	LC	IV	RE				3	1		2	4	2
Stactolaema olivacea	Green Barbet	S	LC	IV	RE					1	2		2	
Family: Meropidae														
Merops orientalis	Green Bee-Eater	A	LC	IV	RE	22	8	5	2			6	7	8
Monarchidae														
Terpsiphone paradisi	Indian Paradise-Flycatcher	R	LC	IV	W				2	2			2	1
Family: Motacillidae														
Anthus rufulus	Paddy-Field Pipit	A	LC	IV	RE	12	20	4						8
Motacilla alba	White Wagtail	R	LC	IV	RE	1				4	2			
Motacilla maderaspatensis	White-Browed Wagtail	S	LC	IV	RE	1								
Motacilla flava	Yellow Wagtail	S	LC	IV	RE	1	2							
Family: Muscicapidae														
Monticola solitarius	Blue Rock Thrush	R	LC	IV	W	2								
Saxicoloides fulicata	Indian Robin	R	LC	IV	RE				2	1	2		1	1
Copsychus saularis	Oriental Magpie Robin	R	LC	IV	RE				1		1		2	1
Saxicola caprata	Pied Bush Chat	R	LC	IV	RE							1	2	2
Ficedula albicilla	Taiga Flycatcher	S	LC	IV	W							1	1	1
Cyornis tickelliae	Tickell's Blue Flycatcher	S	LC	IV	RE				2				1	1
Eumyias thalassinus	Verditer Flycatcher	S	LC	IV	RE			2					2	1
Copsychus malabaricus	White-Rumped Shama	S	LC	IV	RE				1			2		1
Family: Nectariniidae														
Cinnyris asiaticus	Purple Sunbird	C	LC	IV	RE				4	2	1	4	6	3
Family: Oriolidae														
Oriolus larvatus	Black Headed Oriole	I	LC	IV	RE				2	2		6	2	1
Oriolus xanthornus	Black Hooded Oriole	R	LC	IV	RE				1			1	1	
Oriolus oriolus	Golden Oriole	S	LC	IV	RE				4			1	2	
Family: Passeridae														
Passer domesticus	House Sparrow	C	LC	IV	RE							4	3	18
Family: Pellorneidae														
Pellorneum ruficeps	Puff-Throated Babbler	R	LC	IV	RE				1	2			3	
Family: Phalacrocoracidae														
Phalacrocorax carbo	Great Cormorant	C	LC	IV	W	6								

Phalacrocorax niger	Little Cormorant	R	LC	IV	RE	8	4	2				2		5
Family: Phasianidae														
Ortygornis pondicerianus	Grey Francolin	I	LC	IV	RE				2	5	4	4		
Pavo cristatus	Indian Peafowl	R	LC	I	RE				2	1		2	4	
Perdicula asiatica	Jungle Bush Quail	R	LC	IV	RE					2		4		3
Gallus gallus	Red Jungle Fowl	R	LC	IV	RE						1	2	4	1
Family: Picidae														
Dinopium benghalense	Black Rumped Flameback	R	LC	IV	RE				3				2	
Dinopium javanense	Common Flameback	R	LC	IV	RE				1		1	1	2	
Leiopicus mahrattensis	Yellow-Crowned Woodpecker	S	LC	IV	RE				1	1			2	
Family: Pittidae														
Pitta brachyura	Indian Pitta	R	LC	IV	RE				2	3	2		2	1
Family: Ploceidae														
Ploceus philippinus	Baya Weaver	I	LC	IV	RE					5		2		8
Family: Podicipedidae														
Podiceps cristatus	Great Crested Grebe	I	LC	IV	W	12	2							
Tachybaptus ruficollis	Little Grebe	R	LC	IV	RE	4		2						
Family: Psittaculidae														
Psittacula cyanocephala	Plum-Headed Parakeet	I	LC	IV	RE					3			4	4
Psittacula krameri	Rose Ring Parakeet	I	LC	IV	RE				1	6	3		4	
Family: Pycnonotidae														
Pycnonotus jocosus	Red Whiskered Bulbul	A	LC	IV	RE				2			2	3	2
Pycnonotus cafer	Red-Vented Bulbul	R	LC	IV	RE				20	2	10		18	2
Family: Rallidae														
Gallinula chloropus	Common Moorhen	C	LC	IV	RE	2		4						
Fulica atra	Eurasian Coot	R	LC	IV	W	22								
Porphyrio poliocephalus	Grey Headed Swamphen	R	LC	IV	RE	2		4						
Amaurornis phoenicurus	White-Breasted Water Hen	S	LC	IV	RE				1				1	
Family: Rhipiduridae														
Rhipidura albicollis	White-Throated Fantail	S	LC	IV	RE				1					1
Family: Scolopacidae														
Actitis hypoleucos	Common Sandpiper	I	LC	IV	W	8	2	4						
Rostratula benghalensis	Common Snipe	I	LC	IV	W	6	2	4						
Tringa glareola	Wood Sandpiper	R	LC	IV	W	2	3							
Tringa nebularia	Common Greenshank	S	LC	IV	W		2							
Family: Sittidae														
Sitta cinnamoventris	Chestnut Bellied Nuthatch	S	LC	IV	RE						1	1		
Family: Strigidae														
Strix ocellata	Mottled Wood-Owl	S	LC	IV	RE								1	
Athene brama	Spotted Owlet	S	LC	IV	RE								1	1
Family: Sturnidae														
Sturnia pagodarum	Brahminy Starling	A	LC	IV	RE				2				2	8
Sturnia malabarica	Chestnut Tailed Starling	C	LC	IV	RE							2		1
Acridotheres tristis	Common Myna	I	LC	IV	RE	16	9		2		2	2	2	21
Gracupica contra	Pied Starling	S	LC	IV	RE	4	6	8	2		2		2	
Family: Threskiornithidae														
Threskiornis melanocephalus	Black Headed Ibis	C	LC	IV	W	4	2							
Pseudibis papillosa	Red-Naped Ibis	R	LC	IV	RE	12	5	7		2	2	3		4
Family: Timaliidae														
Cyanoderma pyrrhops	Black Chinned Babbler	R	LC	IV	RE				1	3		2		2
Family: Turdidae														

Zoothera citrina	Orange-Headed Thrush	S	LC	IV	W						1	1	
Family: Tytonidae													
Tyto alba	Barn Owl	S	LC	IV	RE		1				1		
Family: Upupidae													
Upupa epops	Common Hoopoe	R	LC	NL	RE	4	1	2	1		1		
Family: Vangidae													
Tephrodornis pondicerianus	Common Woodshrike	R	LC	IV	RE		2		1	2	2	2	
Family: Zosteropidae													
Zosterops palpebrosus	Indian White Eye	I	LC	IV	RE			1	2	2	4	2	

Status: A- Abundant, C- Common, I- Irregular, R- Rare, S- Scarce; LC- Least Concern, VU- Vulnerable, NL- Not Listed; IUCN (International Union for Conservation of Nature 3.1): IWPA (Indian Wildlife Protection Act 1972); Migratory Status: RE- Resident, W- Winter Migratory, S- Summer Migratory, LM- Local Migratory.

The Anatidae family shows the highest species richness in the study sites (9 species), followed by Ardeidae and Muscicapidae (8 species) Accipitridae (7 species), Cuculidae (6 species), Cisticolidae, Charadriidae (5 species each), Sturnidae, Rallidae, Phasianidae, Motacillidae, Megalaimidae, Dicaeidae, Columbidae, Campephagidae (4 species each), Scolopacidae, Picidae, Oriolidae, Corvidae, Ciconiidae, Alcedinidae (3 species each), Threskiornithidae, Strigidae, Pycnonotidae, Psittaculidae, Podicipedidae, Phalacrocoracidae, Apodidae, Leiothrichidae, Laridae, Laniidae, Jacanidae, Hirundinidae, Estrildidae (2 species each) and Zosteropidae, Vangidae, Upupidae, Tytonidae, Turdidae, Timaliidae, Sittidae, Rhipiduridae, Ploceidae, Pittidae, Pellorneidae, Passeridae, Nectariniidae, Monarchidae, Meropidae, Falconidae, Coraciidae, Caprimulgidae, Bucerotidae, Alaudidae, Aegithinidae (1 species each). Among the avifauna, 114 (78%) were residents, 31 (20%) were winter migrants, 1 (1%) summer migrants and 1 (1%) Local migratory (Figure 4). The species richness of the selected sites varied from 28 to 67, while overall diversity value ranged from 0.94 to 3.86 (Figure 5). Relative abundance of species recorded during this study was 43 rares, 21 irregulars, 53 scarces, 21 commons and 9 abundants (Figure 5). Among the recorded species all were placed in Least Concern category. According to Wildlife Protection Act, 1972 six Schedule-I species were recorded one Schedule-V species 135 species were in Schedule-IV and rest were in Not Listed category (Figure 3).

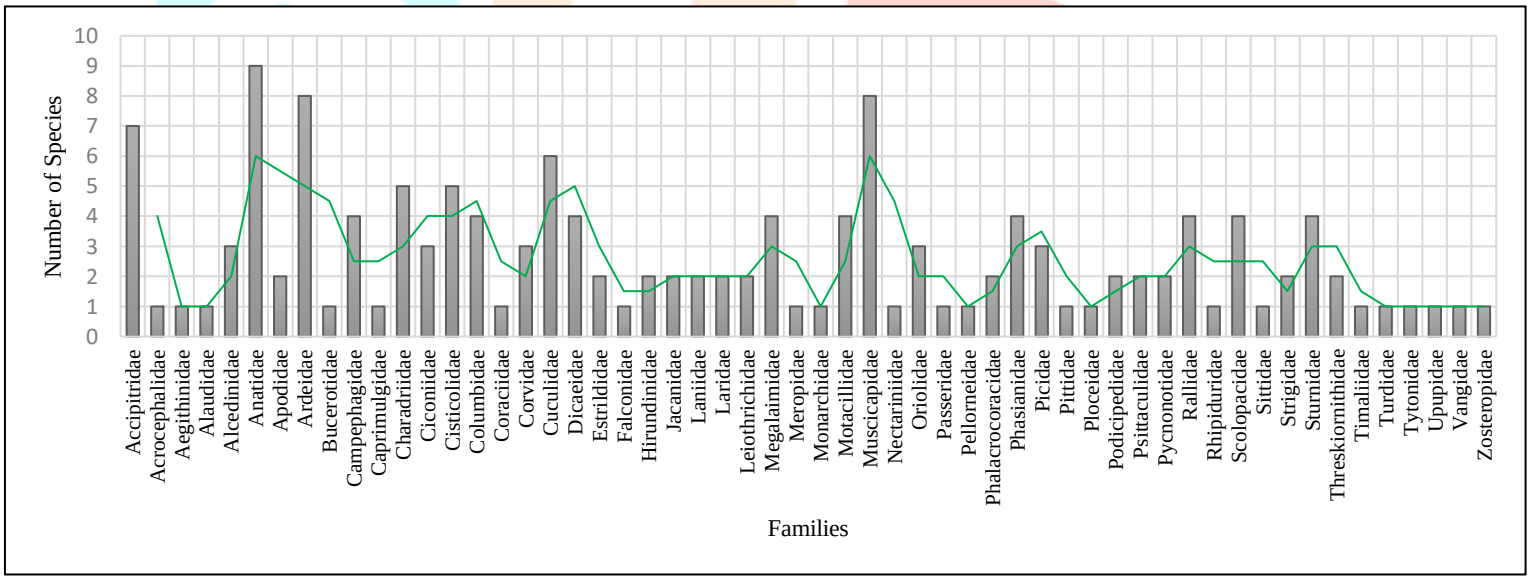

Figure 3. Number of species represented by different families of birds in Lohardaga Forest Division.

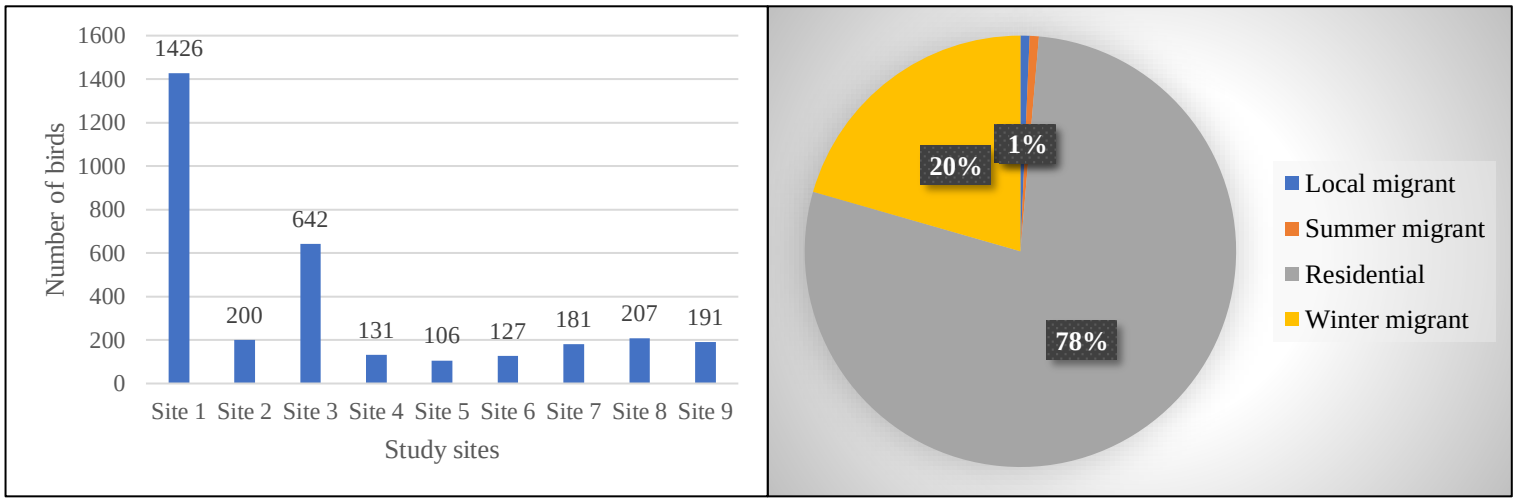

Figure 4. Total count and Migratory status of birds for study sites in Lohardaga Forest Division.

Transects (Sites)	Species richness	Diversity value
Site 1	61	1.76
Site 2	34	3.15
Site 3	28	0.94
Site 4	60	3.78
Site 5	43	3.54
Site 6	47	3.53
Site 7	55	3.63
Site 8	67	3.86
Site 9	55	3.51

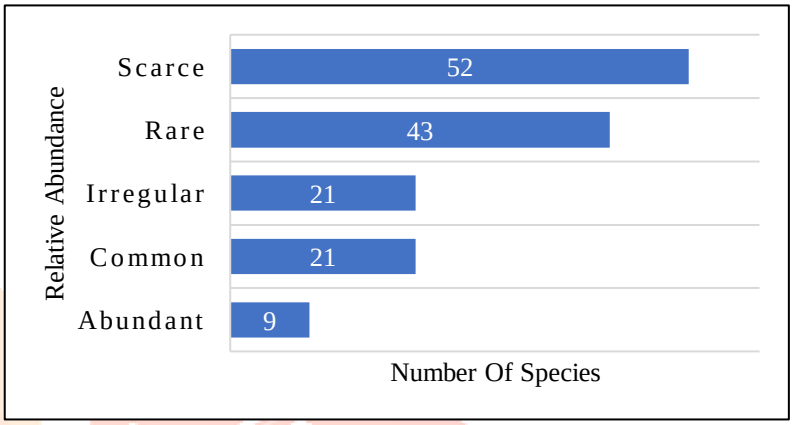

Figure 5. Species richness, Diversity value and Relative abundance of birds for study sites in Lohardaga Forest Division.

Discussion

The 146 bird species recorded in the study represents about 31.4% of the species in Jharkhand and Bihar (Dutta et al. 2004, reported a total of 465 species) This study has shown that study sites in Lohardaga Forest Division supports a high diversity of birds. The high richness of birds in this area can be attributed to the high habitat heterogeneity of both inland aquatic and terrestrial habitats of the study region. It lies in an important ecological zone of southern of Chhotanagpur Plateau falling in the bio-geographic zone of Deccan Peninsula having high Sal forests association in the region. Therefore, different habitats in this area attract and support variety of bird species. The study area has a good diversity of fruiting trees and shrubs and is rich in the diversity and abundance of insects, which provide food to the variety of bird species. Seasonal and perennial fruit bearing trees and plants such as *Ficus benghalensis, F. religiosa, Zizyphus* sp. etc. are quite common. Hence, some species of frugivorous birds were observed as residents in this place.

Maximum bird activity was observed at Nandani dam. The most striking feature of this site was sighting of five individuals of Lesser Adjutant stork (*Leptoptilos javanicus*) which was sighted after 149 years in Lohardaga Forest Division (Prabhat Khabar, February 7, 2023). In India, it has been reported from many areas (Rahmani 2012), but its largest population is in Assam, West Bengal, and Bihar where it is found in fair numbers (BirdLife International 2013; Chaudhury 2000; Mishra et al. 2004). In Jharkhand a few (maximum of four in 2011) adult individuals of this adjutant have been sighted at Udhuwa Lake Bird Sanctuary in Sahibganj district, Jharkhand (Mishra 2004; Prakash et al. 2012), but there are no records of its breeding from the area. In February 2013, 15 adult Lesser Adjutants and five nestlings were recorded during a road survey of birds in Ambadih Tola (23º 38' 54" N; 85º 53' 02" E) and Uttasara village, 6 km north of the Peterwar block in Bokaro district, Jharkhand. A small breeding colony of three pairs had constructed three massive platform nests on the top of a tall *Ficus benghalensis* tree, located very close to human habitations (Dwivedi et al. 2013). Other than these, there are only two sightings of *L. javanicus* from Jharkhand: Lohardaga district in western Jharkhand (Ball 1874) and a single individual in 2012 from Rangamatia, Saraikela-Kharsawan district (The Telegraph, June 13, 2010). Furthermore, migratory birds such as Bar-Headed Goose, Green-Winged Teal, Eurasian Wigeon, Gadwall, Northern Pintail, Red Crested Pochard, Ruddy Shelduck, Tufted Duck and Lesser Whistling Ducks, were found to be using the water bodies for foraging.

The presence of North and the South Koel River system creates a reasonable habitat for waterbirds and wetland dependent birds. This addition of birds to the overall numbers favourably contributed to the bird diversification in the area. Some resident waterbirds like cormorants, egrets and herons inhabit in the river and water bodies of the region. They generally feed upon planktons, fishes, amphibians, and invertebrates from reservoir. Deforestation, mining, forest fires, encroachments of forest area were observed and are the main reasons for the deterioration of the existing forests in the study area. These threats must be prevented to sustain bird life of the area.

PHOTO PLATE- I

Description of Photo Plate-I: 1. Bar-headed Goose, 2. Green-winged Teal, 3. Eurasian wigeon, 4. Gadwall, 5. Lesser Whistling Duck, 6. Northern pintail, 7. Red crested pochard, 8. Ruddy shelduck, 9. Tufted duck, 10. Common Moorhen, 11. Eurasian Coot, 12. Grey-headed swamphen, 13. White-breasted Water hen, 14. Little Grebe, 15. Great Crested Grebe, 16. Great Cormorant, 17. Little Cormorant, 18. Black-headed Gull, 19. Pied kingfisher, 20. White-throated kingfisher, 21. Common Kingfisher, 22. Bronze-winged Jacana, 23. Pheasant tailed Jacana.

PHOTO PLATE- II

Description of Photo Plate II: 24. Asian Openbill Stork, 25. Lesser adjutant stork, 26. Woolly-Necked Stork, 27. Grey-headed Lapwing, 28. Kentish plover, 29. Little Ringed Plover, 30. Red-wattled lapwing, 31. Cattle Egret, 32. Great egret, 33. Little Egret, 34. Grey Heron, 35. Indian Pond Heron. 36. Black Headed Ibis, 37. Red-Naped Ibis, 38. Common Greenshank, 39. Wood Sandpiper, 40. Common snipe, 41. Yellow footed green pigeon, 42. Verditer flycatcher, 43. Blue-throated Barbet, 44. White-bellied Drongo, 45. Indian Paradise-Flycatcher (Female), 46. Tickell's Blue Flycatcher, 47. Red Whiskered Bulbul.

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