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Article in *Proceedings of the Zoological Society* · September 2020

DOI: 10.1007/s12595-020-00349-z

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Avifaunal Diversity of Winter Season in Kopra Reservoir of Bilaspur, Chhattisgarh, India

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Received: 1 April 2020 / Revised: 1 September 2020 / Accepted: 3 September 2020
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Abstract Wetlands are an important habitat for all kinds of dependent water birds. They are vital habitats for resident as well as migratory birds for foraging, roosting and breeding activities. Kopra wetland is an important and suitable bird habitat for both resident and migratory birds in Chhattisgarh. This wetland fulfills the need of water for the surrounding agricultural land and it also acts as a site for food as well as a roosting ground to many resident and migratory bird species. Every year a huge number of birds including Waterfowl, waders and Terrestrial Birds migrate to this wetland between the months of October to March. A study was carried out to estimate the avifaunal diversity during three consecutive winter seasons from 2016 to 2018 and estimated 133 avifauna species belonging to 18 orders and 47 families. Out of 133 avifauna 80 resident and 53 migratory species were recorded, including four Near Threatened species which are Painted Stork (*Mycteria leucocephala*), Black-headed Ibis (*Threskiornis melanocephalus*), Eurasian Curlew (*Numenius arquata*), Black-tailed Godwit (*Limosa limosa*) and one Vulnerable (VU) Woolly-necked Stork (*Ciconia episcopus*) and one Endangered (EN) Egyptian Vulture (*Neophron percnopterus*).

Keywords Wetland · Avifauna · Population · Conservation strategy

Introduction

Wetlands are extensively important for groundwater recharge, recreational activity, retention, and regulation of pollutants and it supports many aquatic floral and faunal species for sustaining their life (Crisman 2001). The water-dependent avifauna and their habitat are affected by various factors like food availability, hunting and poaching threats, the size of the wetland (Paracuellos 2006), and the abiotic changes in the wetlands (Jaksic 2004; Lagos et al. 2008; Vishwakarma et al. 2018). Not only the birds but all the organisms, belonging to the plant and the animal communities are affected by the physical characteristics of the environment (Wilson and Keddy 1986; Gaudet and Keddy 1995; Weiher et al. 1996; Euliss et al. 2004; Gillis et al. 2008; Rajashekara and Venkatesha 2017). In a wetland ecosystem, these biotic factors are mostly dependent on the seasons and hydrology (Hussain 1995).

Praveen et al. (2018) concluded that the number of species across the Indian geographical boundaries is 1306. With that figure, India accounts for 12% of the total number of bird species in the world, amounting to 10,135 among the 1306 species. The previous study and published paper on avifauna pertaining to Chhattisgarh state is by D'Abreu (1931), he did intensive work on central India provenance and listed 430 species of birds, which also covers adjacent states including Chhattisgarh. Porte et al. (2018) conducted a study in nearby 25 km in ten wetlands in Ratanpur town and recorded 29 avifauna species.

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Chhattisgarh state consist of 27,823 wetlands (including smaller than 2.25 ha) and area covered by wetlands are 337,966 ha that is around 2.5% of the total geographical area of the state. The major wetland types are River/Stream accounting for about 53% of the wetlands (179,088 ha), Reservoirs (90,389 ha), and Tanks/Ponds (40,226 ha) (<http://chtenvis.nic.in/Forest.html>). Kopra wetland is a unique habitat matrix that changes throughout the year. The present study is based on the documentation and estimation of avifaunal species found in and around the Kopra wetland and how the diversity changes throughout the year with a focus on the winters as the migratory species arrive. By providing resting, roosting, foraging, and nesting habitats, wetland habitat can be restored with diverse benefits for waterbird (Erwin and Beck 2007; O'neal et al. 2008). The effectively managed wetlands can provide alternative or complementary habitats for water birds and mitigate the adverse effects of wetland loss and degradation (Sinha 2011).

Study Area

Kopra reservoir is one of the suitable habitats for water-birds near Bilaspur city, Chhattisgarh and it was established in the year 1993 in the Mahanadi basin for the purpose of irrigation. This is a seasonal wetland which is placed in the GPS coordinate 22° 3' 40" N to 22° 4' 15" N latitude and 82° 2' 30" E to 82° 3' 31" E longitude geographical location (Fig. 1). The Kopra wetland is situated in the Raipur–Bilaspur bypass in Sakri Village of Bilaspur district of Chhattisgarh, India. It is around 10 km from Bilaspur city. The Length of the wetland is 1680 m and 113 TCM total volume content (India-WRIS 2012). The main purpose of establishing this dam was to provide irrigation facilities to surrounding villages for the purpose of agriculture. The wetland contains shallow water that is suitable for duck species and the surrounding marshy area is suitable feeding habitat for waders and stork species apart from this surrounding grassland and scattered trees species support diverse avifauna. The wetland is filled with many aquatic plant species such as *Ipomea carnea*, *Otella alismoides*, *Stratiotes aloides* and *Cyperaceae* species like *Schoenoplectus articulatus*, *Schoenoplectus lacustris*, etc., paddy fields and scattered tree species of babool (*Acacia nilotica*), Imli (*Temerandous indica*), Palas (*Butea monosperma*), Peepal (*Ficus religiosa*), Bargad (*Ficus bengalensis*), Arjun (*Terminalia arjuna*), etc. which are foraging substrates for the visiting and resident species.

Methods

Observations were made in three different winter years 2016 to 2018 from October to March each year in two phases; the first phase in the morning 06:30 h to 09:30 h and the second phase in the evening 16:00 h to 18:00 h (Vishwakarma et al. 2020) on random visits to the wetland accounting to around 300 h. Avian species were monitored through direct observation method to estimate the total number of bird species and their individuals in and around the wetland. All the authors visited the wetland in every winter season randomly to initially target the migratory ducks, waders, and other terrestrial avifauna species. Observations were made using binocular Nikon Aculon 10 × 50 and Cameras Canon 600D and 700D with 150–600 Tamron lens and Nikon P900 83X Zoom lens and recorded the species and for identification Grimmett et al. 2013 were referred. Monitoring is done in North West, West, and Southwest directions generally because these directions were easily accessible to reach near the wetland. Ducks and waders spend their most of the time in that directions only for foraging activity, due to availability of sufficient aquatic food and grassland availability which provide an appropriate quantity of food. During observation, a proper distance is maintained between birds and observer because birds are very sensitive to anthropogenic activity (Bibby et al. 2000).

Result

In this survey, a total of 1113 ± 474 number of birds individuals of 133 avifauna species belonging to 18 Order and 47 families were recorded. In which 80 resident and 53 migratory species were recorded (Fig. 2) including four Near Threatened (NT) species which are Painted Stork (*Mycteria leucocephala*), Black-headed Ibis (*Threskiornis melanocephalus*), Eurasian Curlew (*Numenius arquata*), Black-tailed Godwit (*Limosa limosa*) and one Vulnerable (VU) Woolly-necked Stork (*Ciconia episcopus*) and one Endangered (EN) Egyptian Vulture (*Neophron percnopterus*). In our result the dominant avifauna species were found in the order Passeriformes 34% ($n = 45$), followed by Charadriiformes 15.3% ($n = 20$), Pelecaniformes 12.2% ($n = 16$), Anseriformes 10.7% ($n = 14$) and Accipitriformes 6.9% ($n = 9$) (Table 1). A total of 53 migratory avian species were found and the dominant species were from the order Charadriiformes (15) followed by Passeriformes (13), Anseriformes (11), Pelecaniformes (05), and Accipitriformes (03). The dominant resident species was found in the order Passeriformes (32) followed by Pelecaniformes (11) and Accipitriformes (06).

Fig. 1 Map showing Location of Kopra reservoir and its size

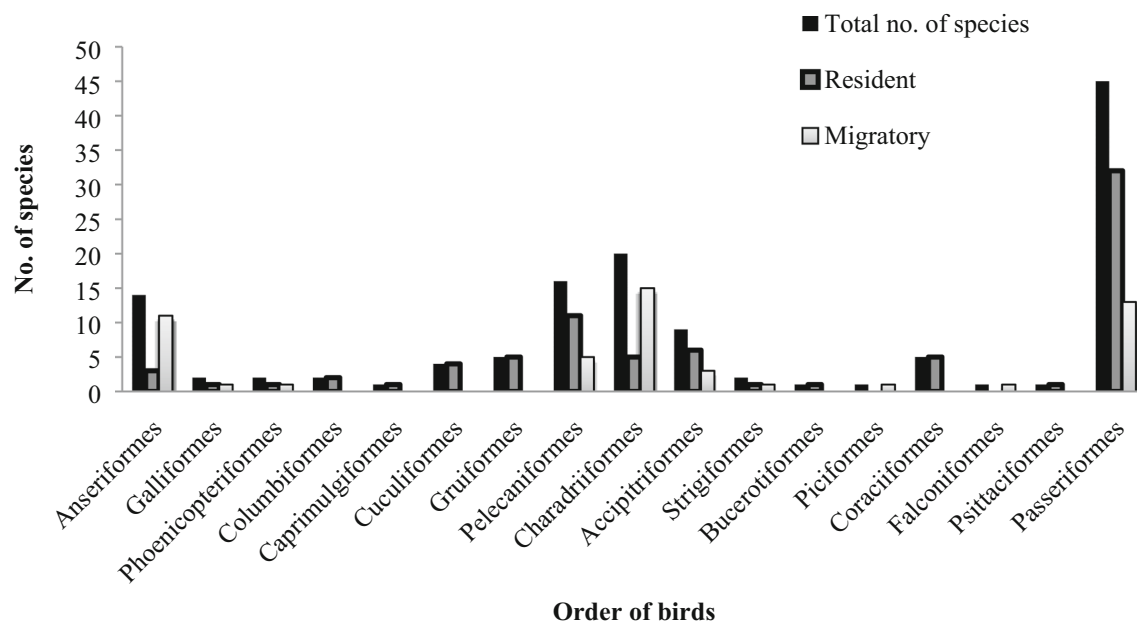
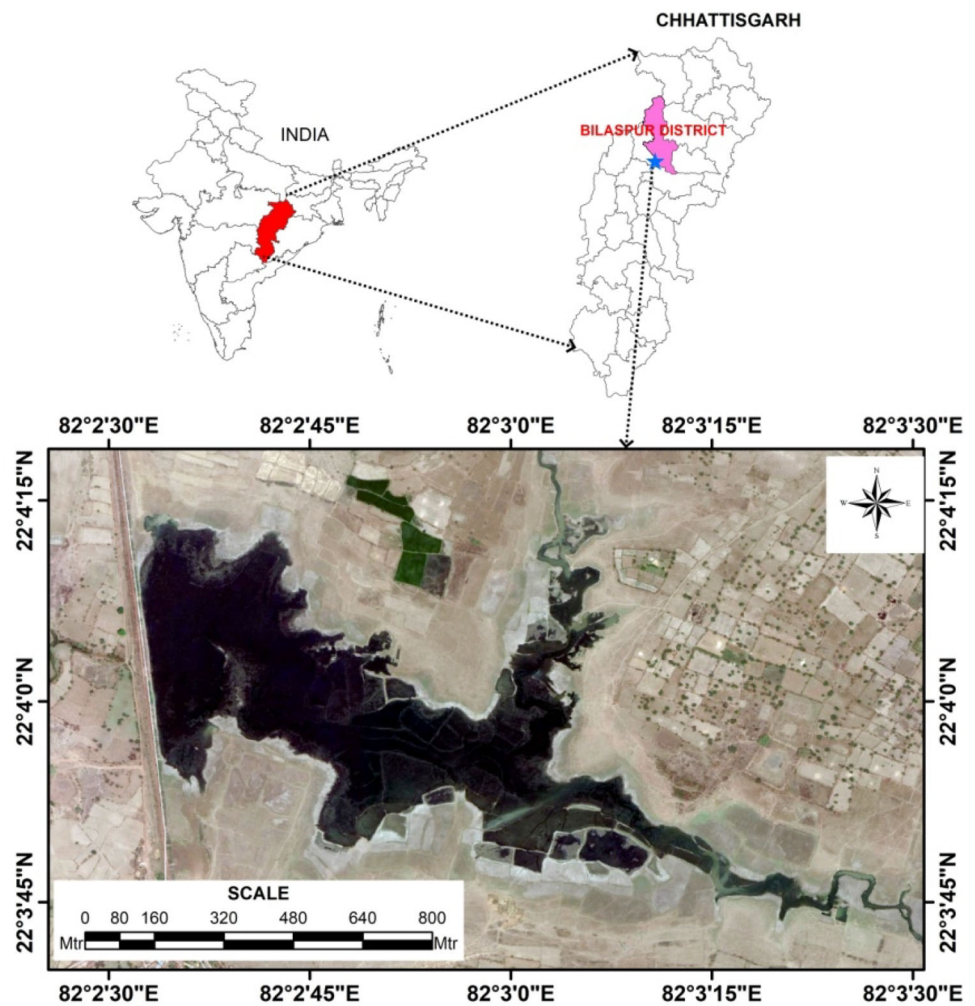


Fig. 2 Order wise distribution of species

Table 1 Order wise total no. of species and their status

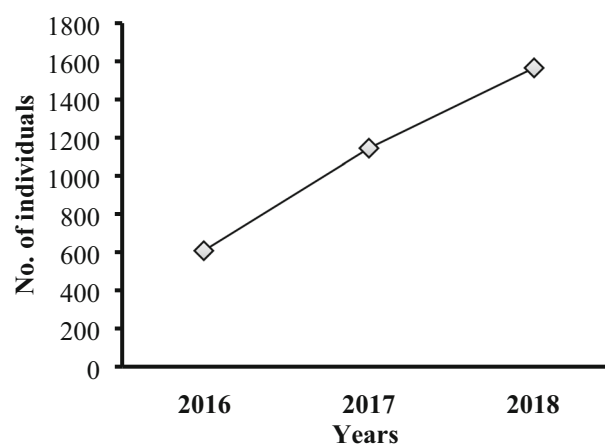
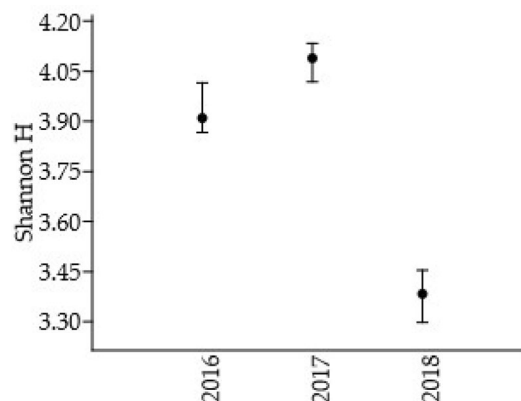
Order	Resident	Migratory	Total no. of species	Percent (%)
Passeriformes	32	13	45	34
Charadriiformes	5	15	20	15.3
Pelecaniformes	11	5	16	12.2
Anseriformes	3	11	14	10.7
Accipitriformes	6	3	9	6.9
Gruiformes	5	0	5	3.8
Coraciiformes	5	0	5	3.8
Cuculiformes	4	0	4	3.1
Galliformes	1	1	2	1.5
Phoenicopteriformes	1	1	2	1.5
Columbiformes	2	0	2	1.5
Strigiformes	1	1	2	1.5
Caprimulgiformes	1	0	1	0.8
Bucerotiformes	1	0	1	0.8
Piciformes	0	1	1	0.8
Falconiformes	0	1	1	0.8
Psittaciformes	1	0	1	0.8

The number of individuals recorded in 2016 winter was 611 ($4.5_{\text{mean}} \pm 0.71_{\text{SE}}$), 2017 were 1146 (8.42 ± 1.17) and 2018 was 1566 (11.51 ± 3.29) (Fig. 3). The species richness was higher in winter of 2017 (113) followed by winter 2016 (99) and winter 2018 (93) (Fig. 4).

Discussion

In this survey 133 avifauna species belonging to 18 Order and 47 families were recorded. In which 80 residents and 53 migratory species were recorded. It is observed that during winters, when the water level resides and the food is easily accessible then only the majority of the migratory species of Waterfowl and wading birds are observed in large numbers, apart from that ground birds like Grey Francolin, Paddy field Pipit, Ashy-crowned Sparrow Lark forage the grasslands surrounding the water body.

The reservoir is away from urban influences and partially protected from the heavy traffic of the state highway and agricultural fields. The reservoir is used as a source of irrigation and also for domestic purposes. The trees around the reservoir provide shelter for the avifauna and also act as a nesting site for them. This wetland though small in size is potent enough to sustain the load of a large population of ducks as well as other avifauna as we have counted flocks of more than 200 birds at a time. Sharma et al. (2014) recorded 143 species of birds from Gidhwa & Parsada Wetlands, Nandghat, Bemetara, Chhattisgarh. Chandrakar and Dhuria (2019) Reported 81 bird species from Guru Ghasidas University Campus, Bilaspur, Rahalkar and Tiwari (2014) reported 55 avian species from the Dulahara

**Fig. 3** Number of Individuals in different wintering years**Fig. 4** Bird species richness in different wintering years

Pond, Ratanpur. Porte et al. (2018) recorded 29 avifauna species in ten wetlands nearby 25 km at Ratanpur town.

Comparing the data of the past 3 years we see that a higher number of individuals have been recorded each consecutive year which may be due to more intensive visits being carried out during 2018. A decline in the species richness is seen which is a cause of concern. The main threats that birds face are anthropogenic pressure due to domestic activities and fishing and Organic water pollution from household drainage runoff.

Kopra reservoir is an attraction to many bird watchers and from the last few years, most of the bird watchers visit the wetland for photography the migratory birds. Although the wetland is surrounded by villages but we did not encounter any hunting being carried out by the locals but since the locals use the wetland for their daily chores like

bathing, washing clothes, and washing their vehicles which are degrading the water quality of the reservoir which can have a long term effect on the wetland. This wetland should be declared as a conservation reserve (since the land is owned by the government) to conserve this wetland throughout the year from Water pollution and regular monitoring and maintenance must be carried out by the authorities.

Acknowledgements The authors express our sincere thanks to Mr. Biswajit Das of Remote sensing lab NERIST, Arunachal Pradesh for the preparation of the map. We also thank Mr. Rajendra Gupta and Mr. AMK Bharos for the identification of species.

Appendix 1

S. no.	Common name	Zoological name	Winter 2016	Winter 2017	Winter 2018	IUCN status
1	Ashy Prinia	<i>Prinia socialis</i>	1	1	3	LC
2	Ashy-crowned Sparrow Lark	<i>Eremopterix griseus</i>	8	17	22	LC
3	Asian Koel	<i>Eudynamis scolopaceus</i>	1	0	0	LC
4	Asian Openbill	<i>Anastomus oscitans</i>	25	35	28	LC
5	Asian Palm Swift	<i>Cypsiurus balasiensis</i>	6	17	30	LC
6	Asian Pied Starling	<i>Gracupica contra</i>	10	9	3	LC
7	Asian Short-toed Lark	<i>Alaudala cheleensis</i>	0	25	0	LC
8	Bar-headed Goose	<i>Anser indicus</i>	0	55	13	LC
9	Barn Swallow	<i>Hirundo rustica</i>	10	17	0	LC
10	Bar-tailed Godwit	<i>Limosa lapponica</i>	0	3	0	LC
11	Bay-backed Shrike	<i>Lanius vittatus</i>	2	0	2	LC
12	Black Bittern	<i>Ixobrychus flavicollis</i>	1	0	0	LC
13	Black Drongo	<i>Dicrurus macrocercus</i>	10	6	8	LC
14	Black Kite	<i>Milvus migrans</i>	8	20	22	LC
15	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	6	17	15	NT
16	Black-headed Munia	<i>Lonchura atricapilla</i>	2	13	4	LC
17	Black-tailed Godwit	<i>Limosa limosa</i>	0	5	0	NT
18	Black-winged Kite	<i>Elanus caeruleus</i>	1	0	2	LC
19	Black-winged Stilt	<i>Himantopus himantopus</i>	4	15	13	LC
20	Bluethroat	<i>Luscinia svecica</i>	1	11	2	LC
21	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	0	1	0	LC
22	Booted Eagle	<i>Hieraaetus pennatus</i>	0	2	0	LC
23	Brahminy Starling	<i>Sturnia pagodarum</i>	3	0	4	LC
24	Bronze-winged Jacana	<i>Metopidius indicus</i>	40	52	35	LC
25	Brown Shrike	<i>Lanius cristatus</i>	0	2	0	LC
26	Brown-headed Gull	<i>Chroicocephalus brunnicephalus</i>	0	2	0	LC
27	Cattle Egret	<i>Bubulcus ibis</i>	9	7	26	LC
28	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	1	1	0	LC
29	Citrine Wagtail	<i>Motacilla citreola</i>	2	3	2	LC
30	Common Coot	<i>Fulica atra</i>	30	50	11	LC
31	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	1	1	3	LC

32	Common Hoopoe	<i>Upupa epops</i>	1	2	7	LC
33	Common Iora	<i>Aegithina tiphia</i>	1	0	0	LC
34	Common Kingfisher	<i>Alcedo atthis</i>	1	4	3	LC
35	Common Moorhen	<i>Gallinula chloropus</i>	1	5	0	LC
36	Common Myna	<i>Acridotheres tristis</i>	2	5	7	LC
37	Common Pochard	<i>Aythya ferina</i>	0	20	12	LC
38	Common Quail	<i>Coturnix coturnix</i>	0	3	0	LC
39	Common Sandpiper	<i>Actitis hypoleucos</i>	4	11	6	LC
40	Common Snipe	<i>Gallinago gallinago</i>	15	34	0	LC
41	Common Tailorbird	<i>Orthotomus sutorius</i>	1	0	0	LC
42	Cotton Teal	<i>Nettapus coromandelianus</i>	5	4	20	LC
43	Crested Lark	<i>Galerida cristata</i>	2	4	0	LC
44	Egyptian Vulture	<i>Neophron percnopterus</i>	0	4	0	EN
45	Eurasian Curlew	<i>Numenius arquata</i>	0	2	0	NT
46	Eurasian Spoonbill	<i>Platalea leucorodia</i>	0	3	0	LC
47	Eurasian Wigeon	<i>Mareca penelope</i>	2	2	8	LC
48	Eurasian Wryneck	<i>Jynx torquilla</i>	1	0	2	LC
49	Gadwall	<i>Mareca strepera</i>	8	19	13	LC
50	Garganey	<i>Anas querquedula</i>	6	9	22	LC
51	Great Cormorant	<i>Phalacrocorax carbo</i>	0	17	5	LC
52	Great Crested Grebe	<i>Podiceps cristatus</i>	1	1	0	LC
53	Great Egret	<i>Ardea alba</i>	2	2	6	LC
54	Greater Coucal	<i>Centropus sinensis</i>	1	3	4	LC
55	Greater Painted-snipe	<i>Rostratula benghalensis</i>	0	4	2	LC
56	Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	2	1	0	LC
57	Green Bee-eater	<i>Merops orientalis</i>	20	5	17	LC
58	Green Sandpiper	<i>Tringa ochropus</i>	0	3	0	LC
59	Grey Francolin	<i>Francolinus pondicerianus</i>	1	1	2	LC
60	Grey Heron	<i>Ardea cinerea</i>	1	5	10	LC
61	Grey Wagtail	<i>Motacilla cinerea</i>	2	1	3	LC
62	Greylag Goose	<i>Anser anser</i>	1	6	2	LC
63	House Crow	<i>Corvus splendens</i>	2	0	0	LC
64	House Sparrow	<i>Passer domesticus</i>	5	3	7	LC
65	Indian Golden Oriole	<i>Oriolus kundoo</i>	1	2	2	LC
66	Indian Pond Heron	<i>Ardeola grayii</i>	4	13	24	LC
67	Indian Robin	<i>Saxicoloides fulicatus</i>	2	0	5	LC
68	Indian Roller	<i>Coracias benghalensis</i>	1	5	3	LC
69	Indian Silverbill	<i>Euodice malabarica</i>	8	18	6	LC
70	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	4	0	0	LC
71	Intermediate Egret	<i>Ardea intermedia</i>	2	5	4	LC
72	Jacobin Cuckoo	<i>Clamator jacobinus</i>	1	0	0	LC
73	Jungle Babbler	<i>Turdoides striata</i>	8	0	11	LC
74	Kentish Plover	<i>Charadrius alexandrinus</i>	2	0	0	LC
75	Large-billed Crow	<i>Corvus macrorhynchos</i>	2	0	6	LC
76	Laughing Dove	<i>Spilopelia senegalensis</i>	5	8	12	LC
77	Lesser Whistling Duck	<i>Dendrocygna javanica</i>	15	18	6	LC
78	Lesser Whitethroat	<i>Sylvia curruca</i>	0	3	0	LC
79	Little Cormorant	<i>Microcarbo niger</i>	4	32	45	LC
80	Little Egret	<i>Egretta garzetta</i>	5	5	2	LC
81	Little Grebe	<i>Tachybaptus ruficollis</i>	10	6	17	LC
82	Little Pratincole	<i>Glareola lactea</i>	0	6	0	LC

83	Little Ringed Plover	<i>Charadrius dubius</i>	2	20	19	LC
84	Little Stint	<i>Calidris minuta</i>	8	2	0	LC
85	Long-tailed Shrike	<i>Lanius schach</i>	1	5	1	LC
86	Marsh Sandpiper	<i>Tringa stagnatilis</i>	2	3	1	LC
87	Northern Pintail	<i>Anas acuta</i>	25	98	287	LC
88	Northern Shoveler	<i>Spatula clypeata</i>	2	7	75	LC
89	Oriental Honey Buzzard	<i>Pernis ptilorhynchus</i>	1	1	0	LC
90	Oriental Magpie Robin	<i>Copsychus saularis</i>	1	0	23	LC
91	Osprey	<i>Pandion haliaetus</i>	0	2	1	LC
92	Paddyfield Pipit	<i>Anthus rufulus</i>	5	5	13	LC
93	Painted Stork	<i>Mycteria leucocephala</i>	0	3	7	NT
94	Peregrine Falcon	<i>Falco peregrinus</i>	0	2	1	LC
95	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	15	32	25	LC
96	Pied Bushchat	<i>Saxicola caprata</i>	0	3	2	LC
97	Pied Kingfisher	<i>Ceryle rudis</i>	1	7	3	LC
98	Plain Prinia	<i>Prinia ornata</i>	4	3	2	LC
99	Purple Heron	<i>Ardea purpurea</i>	1	5	3	LC
100	Purple Sunbird	<i>Cinnyris asiaticus</i>	1	5	10	LC
101	Purple Swampphen	<i>Porphyrio porphyrio</i>	8	0	4	LC
102	Purple-rumped Sunbird	<i>Leptocoma zeylonica</i>	0	2	5	LC
103	Red Munia	<i>Amandava amandava</i>	8	23	37	LC
104	Red-crested Pochard	<i>Netta rufina</i>	50	54	335	LC
105	Red-vented Bulbul	<i>Pycnonotus cafer</i>	1	5	7	LC
106	Red-wattled Lapwing	<i>Vanellus indicus</i>	2	7	12	LC
107	Rock Pigeon	<i>Columba livia</i>	12	5	10	LC
108	Rose-ringed Parakeet	<i>Psittacula krameri</i>	0	2	0	LC
109	Rosy Starling	<i>Pastor roseus</i>	50	40	0	LC
110	Ruddy Shelduck	<i>Tadorna ferruginea</i>	0	12	0	LC
111	Ruddy-breasted Crake	<i>Porzana fusca</i>	0	1	0	LC
112	Sanderling	<i>Calidris alba</i>	0	2	7	LC
113	Scaly-breasted Munia	<i>Lonchura punctulata</i>	5	15	23	LC
114	Shikra	<i>Accipiter badius</i>	1	2	6	LC
115	Short-eared Owl	<i>Asio flammeus</i>	0	1	0	LC
116	Siberian Stonechat	<i>Saxicola maurus</i>	0	3	0	LC
117	Spotted Owlet	<i>Athene brama</i>	1	3	3	LC
118	Temminck's Stint	<i>Calidris temminckii</i>	20	12	0	LC
119	Tricoloured Munia	<i>Lonchura malacca</i>	0	4	7	LC
120	Tufted Duck	<i>Aythya fuligula</i>	6	5	0	LC
121	White Wagtail	<i>Motacilla alba</i>	2	3	6	LC
122	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	2	0	3	LC
123	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	4	2	17	LC
124	White-eyed Buzzard	<i>Butastur teesa</i>	1	2	3	LC
125	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	5	4	8	LC
126	Wire-tailed Swallow	<i>Hirundo smithii</i>	15	25	34	LC
127	Wood Sandpiper	<i>Tringa glareola</i>	2	7	0	LC
128	Woolly-necked Stork	<i>Ciconia episcopus</i>	0	5	0	VU
129	Yellow-throated Sparrow	<i>Petronia xanthocollis</i>	2	2	7	LC
130	Yellow wattled lapwing	<i>Vanellus malabaricus</i>	11	7	8	LC
131	Zitting Cisticola	<i>Cisticola juncidis</i>	0	2	1	LC
132	Western Marsh Harrier	<i>Circus aeruginosus</i>	0	0	1	LC
133	Golden Oriole	<i>Oriolus kundoo</i>	0	0	1	LC

Photo plate

Photo plate**References**

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ENVIS Centre: Chhattisgarh Environment Conservation Board 2015 by Ministry of Environment & Forest, Govt. of India. <http://chtnvis.nic.in/Forest.html>.

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