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Avian faunal diversity in adjoining forest habitats along the Sharda River system near the Indo-Nepal border, India

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Abstract An extensive survey was conducted along the Sharda River system at the Indo-Nepal border using the line-transect and direct observation methods from August 2017 to July 2019. A total of 203 bird species belonging to 63 families and 16 orders were observed throughout the study period. The highest number of individuals recorded from Sharda Sagar Dam (17,799, 32%), followed by Surai Reserved Forest (13,208, 24%), Pancheshwar (9,363, 17%), Jauljibi (8,977, 16%), and Tawaghat (6,062, 11%), whereas the number of species was higher in Surai Reserved Forest (109) followed by Sharda Sagar Dam (82), Pancheshwar (80), Jauljibi (76) and Tawaghat (66). Different diversity indices were used to analyze the avian diversity and show variation across different study sites. One-way ANOVA and *post hoc* tests were performed to understand the significant difference of avian species diversity in different study areas. The results showed a strong indication of avian diversity.

Keywords: avifauna, diversity, river, forest, agricultural area, wetland

Összefoglalás 2017 augusztusától 2019 júliusáig kiterjedt madártani felmérést végeztek az indiai-nepáli határon lévő Sharda folyórendszer mentén, vonal transzekt és közvetlen megfigyelési módszerekkel. A vizsgálati időszak alatt összesen 203 madárfajt figyeltek meg, amelyek 63 családba és 16 rendbe tartoztak. A legtöbb egyedet a Sharda Sagar Dam területén (17 799, 32%), majd a Surai erdőrezervátumban (13 208, 24%), Pancheshwarban (9363, 17%), Jauljibiban (8977, 16%) és Tawaghatban (6062, 11%) regisztrálták, míg a fajok száma a Surai erdőrezervátumban (109), majd a Sharda Sagar Dam területén (82) volt a legmagasabb. Ezt követte Pancheshwar (80), Jauljibi (76) és Tawaghat (66). Különböző diverzitási indexeket használtak a madarak diverzitásának elemzésére és a különböző vizsgálati helyszínek közötti eltérések kimutatására. Egyszempontú varianciaelemzést (ANOVA) és *post hoc* tesztet alkalmaztak a különböző területek diverzitásában tapasztalható jelentős különbségek megértéséhez. Az eredmények jól mutatták a madárfajok sokféleségét.

Kulcsszavak: madárfauna, diverzitás, folyó, erdő, mezőgazdasági terület, vizes élőhely

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Introduction

Birds are excellent indicators of all ecosystems and contribute significantly to various biodiversity monitoring programs based on changes in their community structure, especially in understanding habitat alteration and management (Vielliard 2000, Fraixedas *et al.* 2020).

The distribution of birds in a particular area depends on various factors, including the availability of suitable food, roosting and nesting sites (Aggarwal *et al.* 2008, Singh *et al.* 2019, Ding *et al.* 2023).

Various studies on bird communities have been made to estimate the effects of habitat fragmentation as the response to different environmental gradients through changes in species composition, decreased overall regional diversity, increased population densities and changes in community structure (Huste & Boulinier 2011, Santos *et al.* 2024). Furthermore, as birds are highly mobile, they respond quickly to changes in their habitat, which makes them well suited as response organisms to study the ecological effects of interventions in natural systems through urbanization, industrialization, etc. (Peng *et al.* 2024).

Riparian zones have essential roles in supporting biodiversity, balancing the temperature of the aquatic habitat and providing woody debris. Riparian zones act as ecological corridors offsetting the effects of landscape fragmentation connecting other isolated habitats. Riparian areas provide food and cover for bird species and serve as colonization and dispersal corridors, whereby birds can spread from riparian corridors to adjacent green spaces (Keten *et al.* 2020). Riparian corridors are considered among the most diverse and complex habitats on earth because they occur at land-water junctions, and act as a buffer between uplands and streams and are often considered ecological hotspots (DeFries *et al.* 2023).

High species richness and abundance are considered the standard features in riparian zones (Guo *et al. 2*019). The notion that riparian habitats support a rich and abundant fauna compared to surrounding non-riparian habitats has significant consequences for species conservation since river networks dissect landscapes and provide a natural framework for conservation planning and connectivity strategies (Xu *et al.* 2023). The habitat function of riparian corridors could be important to re-establish connectivity since some rivers may be a source of spillover effects at the landscape level (Brudvig *et al.* 2009, Didham 2010, Montes-Rojas *et al.* 2024). Riparian corridors also play a role in biodiversity conservation in intense agricultural landscapes because they represent remnants of both wetlands and forest habitats once available for wildlife (Catteral *et al.* 2007, He *et al.* 2023).

The Indian Himalayan region is well recognized for its broad altitudinal range and ecological values, offering a powerful test system for understanding biodiversity. However, it is realized that research on avian community composition and diversity in and around the Sharda River system in the Western Himalayas of Uttarakhand has not received enough attention. The present investigation aimed to explore the avian species diversity and their conservation status along the different altitudinal gradient of Sharda River system.

Material and Method

Study area

The Sharda River or Mahakali River is also called Kaliganga in the Uttarakhand state of India. The Kali River originates from the Greater Himalayas at Kalapani, at an altitude of 3,600 m asl in the Pithoragarh district of Uttarakhand. This river forms India's continuous eastern boundary with Nepal on its upper course. The river changes its name several times throughout its run, generally below significant tributary rivers. The area around Pancheshwar is called Kali Kumaun. Once the Kali River descends from the Himalayan foothills and the Gangetic plain, including the large barrage across the river at Banbassa near Tanakpur, its name changes to the Sharda River. The present study was conducted in forest habitats along the Sharda River system at different study sites i.e. Tawaghat, Jauljibi, Pancheshwar, Surai Reserved Forest and Sharda Sagar Dam at different altitudes from 185 to 1,300 m asl *(Figure 1)*.

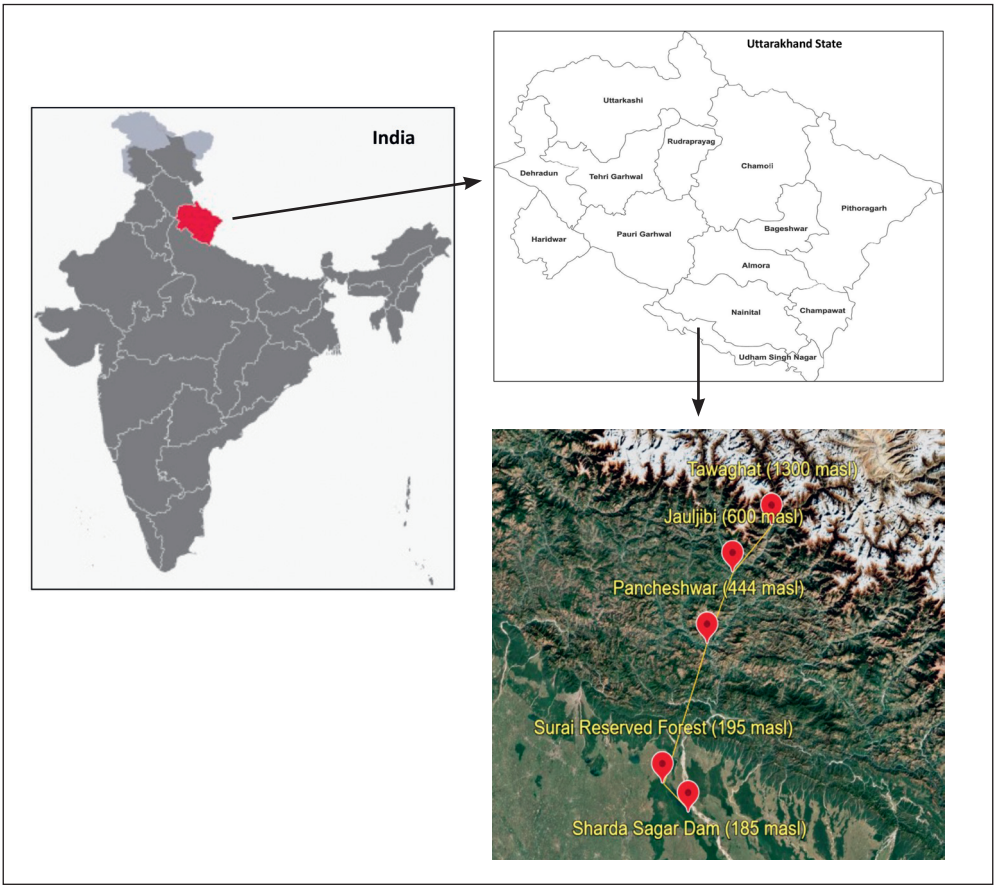

Figure 1. Map showing the different study sites along the altitudinal gradients of Sharda River system
1. ábra A Sharda folyórendszer mentén található kutatási helyek térképe

Field survey

The field survey was conducted along the altitudinal zones around the Sharda River system, in different study sites from August 2017 to July 2019, using field binoculars and Nikon point-shoot cameras. As per Grimmett *et al.* (2011), identification was made, and GPS was used to mark the location. For bird counting, two standard methods, i.e. the line-transect method and the point count method were used. The transect length was 1 km, and the width was 50 m on both sides. A total of 216 transects and 4,320 points were laid during the first year of study. The same transects and points were revised in the second year. 432 transects and 8,640 points were laid in all three study sites during the study period. Surveys and observations were made twice daily when avifauna is usually most active (05:00 am to 10:00 am and 03:00 pm to 06:00 pm).

Table 1. An overview of the study areas, including their geographical location and dominant vegetation structures along the Sharda River system

1. táblázat A kutatási területek földrajzi elhelyezkedésének és a domináns vegetáció bemutatása

S.No.	Study area	Altitude (m asl)	Latitude	Longitude	Vegetation
1	Tawaghat	1300	29°57′29.42″	80°36′02.20″	banj oack *(Quercus leucotricopora)*, chir pine *(Pinus roxburghii)*
2	Jauljibi	600	29°45′09.78″	80°22′45.49″	sal *(Shorea robusta)*, chebulic myrobalan *(Terminalia chebula)*, beleric myrobalan *(Terminalia bellirica)*
3	Pancheshwar	444	29°26′41.84″	80°14′33.70″	pure sal, mix sal
4	Surai Reserved Forest	195	28°43′20.47″	79°54′35.49″	pure and mix sal, open grasslands, ravine, swamps and plantations of teak *(Tectona grandis)* and Tasmanian blue gum *(Eucalyptus globulus)*
5	Sharda Sagar Dam	185	29°49′48.28″	80°03′18.14″	grasslands, swamps, agricultural land and plantations of teak and Tasmanian blue gum

Statistical analysis

Shannon–Wiener's diversity index was used to calculate the avian diversity of the study area by the following formula:

$$H' = \sum Pi(lnPi)$$

where, Pi proportion of each species in the sample, ln natural log of the number.
Margalef's formula was used to calculate species richness as follows:

$$SR = (S - 1)/logN$$

where S = total number of species and N = total number of individuals present in the sample. Equitability or evenness was calculated by:

$$Equitability = H'/H_{max}$$

where H' = Shannon–Wiener's index, H_{max} = ln (total number of species)
The relative diversity index (RDi) of various avian families recorded in the selected study sites was calculated using the following formula:

$$RDi = Numberofspecies \in afamily/Totalnumberofspecies \times 100$$

Pearson's correlation coefficient and ANOVA test were used to determine bird's relationship with altitudinal gradients. Post Hoc tests were performed using LSD (least significant difference) for the multiple comparisons between different habitats and avian species diversity. All the findings were analyzed using PAST version 3.20 (Hammer *et al.* 2001).

Results

A total of 203 species of birds belonging to 63 families and 16 orders were recorded from all study sites during the entire study period. Out of the 16 orders, the most dominant was Passeriformes, which comprises 32 families (50.79%), whereas out of the 63 families, the most dominant one was Muscicapidae, which comprises 17 species. The relative abundance of birds varied from 0.01 to 5.93% *(Appendix I)*. The most dominant species was Rock Pigeon

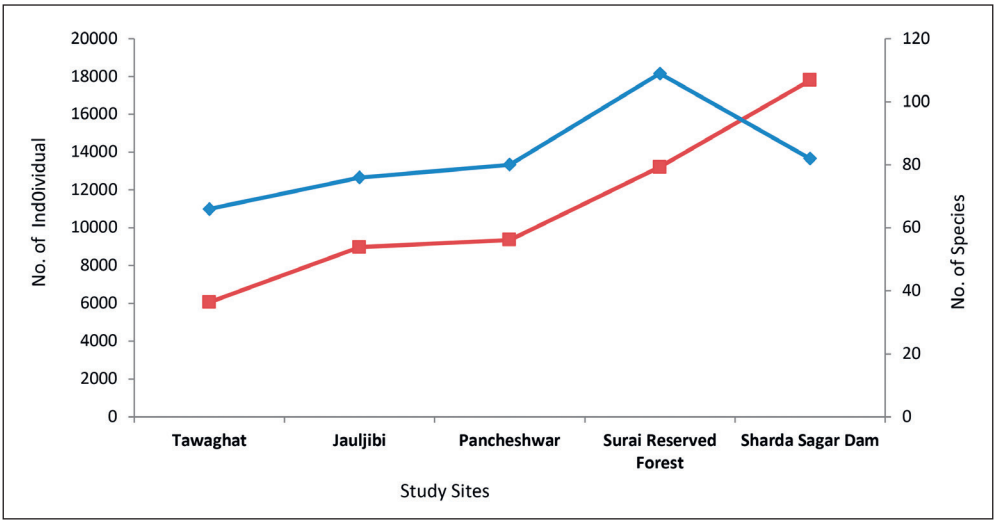

Figure 2. Avian diversity in terms of number of individuals (red) and species (blue) in different study sites (August 2017 – July 2019)

2. ábra A madarak diverzitása azok egyedszáma (piros) és fajszáma (kék) alapján a különböző kutatási területeken 2017 augusztusa és 2019 júliusa között

(Columba livia), which comprises 3,286 individuals (5.93%). The number of bird species and individuals varied across different study sites. The highest number of individuals were recorded from Sharda Sagar Dam (17,799, 32%) followed by Surai Reserved Forest (13,208, 24%), Pancheshwar (9,363, 17%), Jauljibi (8,977, 16%) and Tawaghat (6,062, 11%), whereas the number of species was highest in Surai Reserved Forest (109) followed by Sharda Sagar Dam (82), Pancheshwar (80), Jauljibi (76) and Tawaghat (66), respectively *(Figure 2)*.

The diversity indices varied across different study sites and seasons. Shannon–Wiener's diversity was highest in Surai Reserved Forest (4.25) followed by Sharda Sagar Dam (4.06), Pancheshwar (3.99), Jauljibi (3.98) and Tawaght (3.77). Margalef's species richness was highest in Surai Reserved Forest (11.38) followed by Pancheshwar (8.64), Sharda Sagar Dam (8.28), Jauljibi (8.24) and Tawaghat (7.46). Equitability was highest in Sharda Sagar Dam and Juljibi (0.92) followed by Surai Reserved Forest and Pancheshwar (0.91) and lowest in Tawaghat (0.90) *(Table 2)*. The one-way ANOVA showed that the different altitudinal gradients along the Sharda River system indicated avian diversity ($F = 34.716$; $P < 0.001$).

Post hoc tests were performed using LSD for the multiple comparisons between different habitats and avian species diversity. A significant difference was observed between the forest system of Surai Reserved Forest and all the other study sites ($P < 0.001$). Similarly, Tawaghat showed a significant difference among Jauljibi ($P < 0.05$), Pancheshwar ($P < 0.01$), and Sharda Sagar Dam ($P < 0.01$). The results indicate that the highest avian species

Table 2. Diversity Indices of avian species in different study sites along Sharda River system during the study period (August 2017 – July 2019)

2. táblázat A különböző diverzitási indexek a Sharda folyórendszer mentén található kutatási területeken 2017 augusztusa és 2019 júliusa között

Diversity Indices	Tawaghat	Jauljibi	Pancheshwar	Surai Reserved Forest	Sharda Sagar Dam
Shannon–Wiener's diversity (H)	3.77	3.98	3.99	4.25	4.06
Species richness (Margalef)	7.46	8.24	8.64	11.38	8.28
Equitability (J)	0.90	0.92	0.91	0.91	0.92
No. of species	66	76	80	109	82
Individuals	6062	8977	9363	13208	17799

Table 3. Effect of habitats at different altitudes on species diversity of avian fauna along the Sharda River System. Statistical analysis based on *post hoc* test performed using LSD.

3. táblázat A különböző tengerszint feletti magasságokon található élőhelyek hatása a Sharda folyórendszer mentén élő madárfajok diverzitására. A statisztikai elemzések az LSD segítségével elvégzett *post hoc* teszteken alapulnak

Study Sites	Jauljibi	Pancheshwar	Surai Reserved Forest	Sharda Sagar Dam
Tawaghat	0.017	0.002	0.000	0.003
Jauljibi		0.197	0.000	0.282
Pancheshwar			0.000	0.812
Surai Reserved Forest				0.000

diversity in Surai Reserved Forest must be due to rich vegetation and nesting grounds *(Table 3)*. Based on the conservation priorities, all avian species were categorized according to the IUCN Red List, as follows: 1 species was found under endangered category (EN), 2 species under critically endangered category (CR), 4 species under near threatened category (NT), 6 species were categorized under vulnerable category (VU) and the remaining 190 species were ranked as least concern category (LC) *(Appendix I)*.

Discussion

The results of the present study indicate that the area is home to many avian species. During the study period, 203 bird species were recorded from the study area. The highest number of bird species were observed in Surai Reserved Forest followed by Sharda Sagar Dam, Pancheshwar, Jauljibi and Tawaghat, respectively. In contrast, the highest number of individuals were recorded from Sharda Sagar Dam followed by Surai Reserved Forest, Pancheshwar, Jauljibi and Tawaghat. According to the findings of this study, the existence of forest has a substantial impact on bird variety, and the dam region attracts a large number of migratory and aquatic birds. The findings are consistent with previous research in West Africa and Sri Lanka (Dawson *et al.* 2011, Subasinghe *et al*. 2014). There is evidence that heterogeneous habitats allow more species to coexist because they either match the habitat requirements or can be ascribed to lower competition due to geographical isolation (May 1986).

The forest, which is of mixed type and covers the largest area of the study sites along the river, is primarily made up of *Quercus leucotricopora*, *Pinus roxburghii, Shorea robusta*, *Terminalia chebula, Terminalia bellirica, Tectona grandis* and *Eucalyptus globulus,* while the Sharda Sagar Dam is covered in shrubs, ferns, and other plant species. These plants offer diverse water bird guilds, a form of edge habitat in addition to food, nesting and breeding habitats, as well as protection from predators. Generalist and opportunistic species that feed on insects, fruits and seeds choose mixed woods as their preferred habitats (Basile 2021).

Based on these findings, it is possible to conclude that bird communities are highly related to plant species richness, supporting the findings of Block and Brennan (1993), Augenfeld *et al*. (2008), Earnst and Holmes (2012) as well as Tanalgo *et al*. (2015). According to our findings, forest and shrub-land environments supported more bird diversity and abundance than other habitat types, owing to vegetation cover for sheltering and nesting, food availability and a lack of predation accessibility. In other words, forest and shrub-land ecosystems serve as micro-refuges for birds, resulting in greater richness and diversity of bird species in these environments. Low species richness at mountain range summits can be linked to smaller area, harsher climatic conditions, lower productivity and resource constraints (Acharya *et al*. 2011).

The study's findings indicate that the present study is the first report on avian fauna of the Sharda River system along the altitudinal gradient after independence (1947). Surai Reserved Forest showed the highest number of avian species, whereas Sharda Sagar Dam

found the highest number of individuals. It supports that the dam area is an ideal habitat for all birds, including the migratory species. Our results showed that different habitats, i.e. forests, an agricultural area and wetlands along the Sharda Rives system, are highly productive, and attract a wide range of local and migratory bird species. Thus, the present study is an ideal attempt to understand the present status of knowledge regarding the local and migratory birds. Furthermore, conservation awareness programs among the local people are required to sensitize the people about the sustainable use of the forest, which is home to many plants and animals, including fascinating creatures like birds.

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Appendix 1. Checklist of avian fauna, their relative abundance and their IUCN status in different study sites along Sharda River system during the study period (August 2017 to July 2019)

1. melléklet A Sharda folyórendszer mentén található kutatási területeken 2017 augusztusa és 2019 júliusa között megfigyelt madárfajok listája, azok relatív abundanciája és IUCN státusza

Order	Family	Species common name	Scientific name	Relative abundance (%)	IUCN status
Anseriformes	**Anatidae**	Fulvous Whistling Duck	*Dendrocygna bicolor* (Vieillot, 1816)	0.67	LC
		Lesser Whistling Duck	*Dendrocygna javanica* (Horsfield, 1821)	1.24	LC
		Ruddy Shelduck	*Tadorna ferruginea* (Pallas, 1764)	0.23	LC
		Bar-headed Goose	*Anser indicus* (Latham, 1790)	0.08	LC
		Red-crested Pochard	*Netta rufina* (Pallas, 1773)	0.83	LC
		Common Pochard	*Aythya ferina* (Linnaeus, 1758)	0.54	VU
		Ferruginous Duck	*Aythya nyroca* (Guldenstadt, 1770)	0.54	NT
		Tufted Duck	*Aythya fuligula* (Linnaeus, 1758)	0.53	LC
		Gadwall	*Mareca strepera* (Linnaeus, 1758)	0.41	LC
		Mallard	*Anas platyrhynchos* (Linnaeus, 1758)	0.08	LC
		Cotton Pygmy Goose	*Nettapus coromandelianus* (J.F. Gmelin, 1789)	0.44	LC
		Common Merganser	*Mergus merganser* (Linnaeus, 1758)	0.03	LC
Galliformes	**Phasianidae**	Indian Peafowl	*Pavo cristatus* (Linnaeus, 1758)	0.11	LC
		Red Junglefowl	*Gallus gallus* (Linnaeus, 1758)	0.03	LC
Columbiformes	**Columbidae**	Rock Pigeon	*Columba livia* (J.F. Gmelin, 1789)	5.93	LC
		Oriental Turtle Dove	*Streptopelia orientalis* (Latham, 1790)	2.30	LC
		Eurasian Collard Dove	*Streptopelia decaocto* (Frivaldszky, 1838)	0.86	LC
		Spotted Dove	*Streptopelia chinensis* (Scopoli, 1786)	2.74	LC
		Emerald Dove	*Chalcophaps indica* (Linnaeus, 1758)	0.02	LC
		Wedge-tailed Green Pigeon	*Treron sphenurus* (Vigors, 1832)	0.02	LC
Caprimulgiformes	**Caprimulgidae**	Large-tailed Nightjar	*Caprimulgus macrurus* (Horsfield, 1821)	0.11	LC
	Apodidae	Little Swift	*Apus affinis* (J.E. Gray, 1830)	3.27	LC

Order	Family	Species common name	Scientific name	Relative abundance (%)	IUCN status
Cuculiformes	**Cuculidae**	Common Hawk Cuckoo	*Hierococcyx varius* (Vahl, 1797)	0.01	LC
		Indian Cuckoo	*Cuculus micropterus* (Gould, 1838)	0.04	LC
		Greater Coucal	*Centropus sinensis* (Stephens, 1815)	0.18	LC
		Asian Koel	*Eudynamys scolopaceus* (Linnaeus,1758)	0.06	LC
Gruiformes	**Rallidae**	White-breasted Waterhen	*Amaurornis phoenicurus* (Pennant, 1769)	0.15	LC
		Purple Swamphen	*Porphyrio porphyrio* (Linnaeus, 1758)	1.04	LC
		Common Moorhen	*Gallinula chloropus* (Linnaeus, 1758)	1.22	LC
		Eurasian Coot	*Fulica atra* (Linnaeus, 1758)	2.07	LC
	Gruidae	Sarus Crane	*Antigone antigone* (Linnaeus, 1758)	0.05	VU
		Demoiselle Crane	*Grus virgo* (Linnaeus, 1758)	0.03	LC
Pelecaniformes	**Ciconiidae**	Lesser Adjutant	*Leptoptilos javanicus* (Horsfield, 1821)	0.06	VU
		Asian Openbill	*Anastomus oscitans* (Boddaert, 1783)	0.63	LC
		Woolly-necked Stork	*Ciconia episcopus* (Boddaert, 1783)	0.09	VU
	Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus* (J.F. Gmelin, 1789)	0.07	LC
		Yellow Bittern	*Ixobrychus sinensis* (J.F. Gmelin, 1789)	0.09	LC
		Indian Pond Heron	*Ardeola grayii* (Sykes, 1832)	0.43	LC
		Cattle Egret	*Bubulcus ibis* (Linnaeus, 1758)	0.69	LC
		Grey Heron	*Ardea cinerea* (Linnaeus, 1758)	0.10	LC
		Purple Heron	*Ardea purpurea* (Linnaeus, 1766)	0.14	LC
		Intermediate Egret	*Ardea intermedia* (Wagler, 1829)	0.41	LC
		Little Egret	*Egretta garzetta* (Linnaeus, 1766)	0.89	LC
	Threskiornithidae	Red-naped Ibis	*Pseudibis papillosa* (Temminck, 1824)	0.27	LC
	Phalacrocoracidae	Little Cormorant	*Microcarbo niger* (Vieillot, 1817)	0.78	LC
		Indian Cormorant	*Phalacrocorax fuscicollis* (Stephens, 1826)	0.29	LC
Charadriiformes	**Burhinidae**	Great Thick-knee	*Esacus recurvirostris* (Cuvier, 1829)	0.13	NT

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	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus* (Linnaeus, 1758)	0.48	LC
	Charadriidae	Common Ringed Plover	*Charadrius hiaticula* (Linnaeus, 1758)	0.12	LC
		River Lapwing	*Vanellus duvaucelii* (Lesson, 1826)	0.32	NT
		Red-wattled Lapwing	*Vanellus indicus* (Boddaert, 1783)	1.25	LC
	Rostratulidae	Greater Painted-snipe	*Rostratula benghalensis* (Linnaeus, 1758)	0.19	LC
	Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus* (Scopoli, 1786)	0.61	LC
		Bronze-winged Jacana	*Metopidius indicus* (Latham, 1790)	0.78	LC
	Scolopacidae	Common Snipe	*Gallinago gallinago* (Linnaeus, 1758)	0.15	LC
		Common Sandpiper	*Actitis hypoleucos* (Linnaeus, 1758)	0.08	LC
		Green Sandpiper	*Tringa ochropus* (Linnaeus, 1758)	0.03	LC
		Wood Sandpiper	*Tringa glareola* (Linnaeus, 1758)	0.08	LC
		Temminck's Stint	*Calidris temminckii* (Leisler, 1812)	0.21	LC
	Laridae	Brown-headed Gull	*Chroicocephalus brunnicephalus* (Jerdon, 1840)	0.47	LC
		Black-headed Gull	*Chroicocephalus ridibundus* (Linnaeus, 1766)	0.41	LC
		Pallas's Gull	*Larus ichthyaetus* (Pallas, 1773)	0.05	LC
Accipitriformes	**Accipitridae**	Red-headed Vulture	*Sarcogyps calvus* (Scopoli, 1786)	0.04	CR
		Indian Vulture	*Gyps indicus* (Scopoli, 1786)	0.04	CR
		Himalayan Vulture	*Gyps himalayensis* (Hume, 1869)	0.15	NT
		Griffon Vulture	*Gyps fulvus* (Hablizl, 1783)	0.17	LC
		Crested Serpent Eagle	*Spilornis cheela* (Latham, 1790)	0.12	LC
		Mountain Hawk-Eagle	*Nisaetus nipalensis* (Hodgson, 1836)	0.17	LC
		Black Eagle	*Ictinaetus malaiensis* (Temminck, 1822)	0.08	LC
		Steppe Eagle	*Aquila nipalensis* (Hodgson, 1833)	0.49	EN
		Golden Eagle	*Aquila chrysaetos* (Linnaeus, 1958)	0.06	LC

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		Indian Spotted Eagle	*Clanga hastata* (Lesson, 1831)	0.04	VU
		Eurasian Sparrowhawk	*Accipiter nisus* (Linnaeus, 1758)	0.25	LC
		Oriental Honey Buzzard	*Pernis ptilorhynchus* (Temminck, 1821)	0.09	LC
		Black-winged Kite	*Elanus caeruleus* (Desfontaines, 1789)	0.12	LC
		Black Kite	*Milvus migrans* (Boddaert, 1783)	1.07	LC
		Shikra	*Accipiter badius* (J.F. Gmelin, 1788)	0.13	LC
Strigiformes	**Tytonidae**	Common Barn Owl	*Tyto alba* (Scopoli, 1769)	0.01	LC
	Strigidae	Asian Barred Owlet	*Glaucidium cuculoides* (Vigors, 1831)	0.32	LC
		Jungle Owlet	*Glaucidium radiatum* (Tickell, 1833)	0.07	LC
		Spotted Owlet	*Athene brama* (Temminck, 1821)	0.13	LC
		Spot-bellied Eagle Owl	*Bubo nipalensis* (Hodson, 1836)	0.01	LC
Bucerotiformes	**Bucerotidae**	Oriental Pied Hornbill	*Anthracoceros albirostris* (Shaw & Nodder, 1807)	0.11	LC
		Indian Grey Hornbill	*Ocyceros birostris* (Scopoli, 1786)	0.21	LC
	Upupidae	Common Hoopoe	*Upupa epops* (Linnaeus, 1758)	0.23	LC
Piciformes	**Picidae**	Common Golden-backed	*Dinopium javanense* (Ljungh, 1797)	0.18	LC
		Lesser Golden-backed Woodpecker	*Dinopium benghalense* (Linnaeus, 1758)	0.13	LC
		Rufous Woodpecker	*Micropternus brachyurus* (Vieillot, 1818	0.03	LC
		Greater Golden-backed Woodpecker	*Chrysocolaptes lucidus* (Scopoli, 1786)	0.14	LC
		Grey-headed Woodpecker	*Picus canus* (J.F. Gmelin, 1788)	0.43	LC
		Brown-capped Pygmy Woodpecker	*Dendrocopos moluccensis* (J.F. Gmelin, 1788)	0.03	LC
		Speckled Piculet	*Picumnus innominatus* (E. Burton, 1836)	0.03	LC
		Lesser Yellow-naped Woodpecker	*Picus chlorolophus* (Vieillot, 1818)	0.21	LC

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		Yellow-crowned Woodpecker	*Dendrocopos mahrattensis* (Latham, 1801)	0.05	LC
		Brown-fronted Woodpecker	*Dendrocopos auriceps* (Vigors, 1831)	0.06	LC
		Grey-capped Pygmy Woodpecker	*Dendrocopos canicapillus* (Blyth, 1845)	0.01	LC
	Ramphastidae	Great Barbet	*Psilopogon virens* (Boddaert, 1783)	0.42	LC
		Brown-headed Barbet	*Psilopogon zeylanicus* (J.F. Gmelin, 1788)	0.26	LC
		Blue-throated Barbet	*Psilopogon asiaticus* (Latham, 1790)	0.11	LC
		Coppersmith Barbet	*Psilopogon haemacephalus* (Statius Muller, 1776)	0.03	LC
Coraciiformes	**Meropidae**	Green Bee-eater	*Merops orientalis* (Latham, 1801)	0.59	LC
		Blue-tailed Bee-eater	*Merops philippinus* (Linnaeus, 1767)	0.15	LC
	Coraciidae	Indian Roller	*Coracias benghalensis* (Linnaeus, 1758)	0.20	LC
	Alcedinidae	Pied Kingfisher	*Ceryle rudis* (Linnaeus, 1758)	0.12	LC
		Crested Kingfisher	*Megaceryle lugubris* (Temminck, 1834)	0.26	LC
		White-throated Kingfisher	*Halcyon smyrnensis* (Linnaeus, 1758)	0.36	LC
Falconiformes	**Falconidae**	Common Kestrel	(*Falco tinnunculus* (Linnaeus, 1758)	0.03	LC
Psittaciformes	**Psittaculidae**	Slaty-headed Parakeet	*Psittacula himalayana* (Lesson, 1832)	0.28	LC
		Plum-headed Parakeet	*Psittacula cyanocephala* (Linnaeus, 1766)	0.89	LC
		Rose-ringed Parakeet	*Psittacula krameri* (Scopoli, 1769)	3.06	LC
Passeriformes	**Pittidae**	Indian Pitta	*Pitta brachyura* (Linnaeus, 1766)	0.07	LC
	Eurylaimidae	Long-tailed Broadbill	*Psarisomus dalhousiae* (Jameson, 1835)	0.05	LC
	Campephagidae	Long-tailed Minivet	*Pericrocotus ethologus* (Bangs & J.C. Phillips, 1914)	0.31	LC
		Scarlet Minivet	*Pericrocotus flameus* (J.R. Forster, 1781)	0.48	LC
	Oriolidae	Black-hooded Oriole	*Oriolus xanthornus* (Linnaeus, 1758)	0.10	LC
		Indian Golden Oriole	*Oriolus kundoo* (Sykes, 1832)	0.07	LC

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	Aegithinidae	Common Iora	*Aegithina tiphia* (Linnaeus, 1758)	0.02	LC
	Dicruridae	Black Drongo	*Dicrurus macrocercus* (Vieillot, 1817)	2.20	LC
		Hair-crested Drongo	*Dicrurus hottentottus* (Linnaeus, 1766)	0.40	LC
		Crow-billed Drongo	*Dicrurus annectens* (Hodgson, 1836)	0.10	LC
		Lesser Racket-tailed Drongo	*Dicrurus remifer* (Temminck, 1823)	0.09	LC
		Greater Racket-tailed Drongo	*Dicrurus paradiseus* (Linnaeus, 1766)	0.06	LC
	Rhipiduridae	White-throated Fantail	*Rhipidura albicollis* (Vieillot, 1818)	0.27	LC
		Yellow-bellied Fantail	*Chelidorhynx hypoxanthus* (Blyth, 1843)	0.23	LC
	Laniidae	Long-tailed Shrike	*Lanius schach* (Linnaeus, 1758)	0.72	LC
	Corvidae	Rufous Treepie	*Dendrocitta vagabunda* (Latham, 1790)	0.18	LC
		Grey Treepie	*Dendrocitta formosae* (Swinhoe, 1863)	0.43	LC
		Yellow-billed Blue Magpie	*Urocissa flavirostris* (Blyth, 1846)	0.22	LC
		Red-billed Blue Magpie	*Urocissa erythroryncha* (Boddaert, 1783)	0.36	LC
		Common Green Magpie	*Cissa chinensis* (Boddaert, 1783)	0.01	LC
		House Crow	*Corvus splendens* (Vieillot, 1817)	1.03	LC
		Indian Jungle Crow	*Corvus macrorhynchos* (Wagler, 1827)	1.69	LC
	Monarchidae	Indian Paradise-flycatcher	*Terpsiphone paradise* (Linnaeus, 1758)	0.04	LC
	Dicaeidae	Fire-breasted Flowerpecker	*Dicaeum ignipectus* (Blyth, 1843)	0.34	LC
	Nectariniidae	Crimson-backed Sunbird	*Leptocoma minima* (Sykes,1832)	0.18	LC
		Black-throated Sunbird	*Aethopyga saturata* (Hodgson, 1836)	0.02	LC
		Green-tailed Sunbird	*Aethopyga nipalensis* (Hodgson, 1836)	0.02	LC
		Purple Sunbird	*Cinnyris asiaticus* (Latham, 1790)	0.12	LC
	Ploceidae	Baya Weaver	*Ploceus philippinus* (Linnaeus, 1766)	0.22	LC
	Estrildidae	White-rumped Munia	*Lonchura striata* (Linnaeus, 1766)	0.49	LC

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		Scaly-breasted Munia	*Lonchura punctulata* (Linnaeus, 1758)	0.75	LC
	Passeridae	House Sparrow	*Passer domesticus* (Linnaeus, 1758)	2.28	LC
		Russet Sparrow	*Passer cinnamomeus* (Gould, 1836)	0.74	LC
	Motacillidae	Tree Pipit	*Anthus trivialis* (Linnaeus, 1758)	0.26	LC
		Paddyfield Pipit	*Anthus rufulus* (Vieillot, 1818)	0.19	LC
		Yellow Wagtail	*Motacilla flava* (Linnaeus, 1758)	1.93	LC
		White Wagtail	*Motacilla alba* (Linnaeus, 1758)	1.95	LC
		White-browed Wagtail	*Motacilla maderaspatensis* (J.F. Gmelin, 1789)	0.80	LC
		Grey Wagtail	*Motacilla cinerea* (Tunstall, 1771)	0.31	LC
	Fringillidae	Common Rosefinch	*Erythrina erythrina* (Pallas, 1770)	0.09	LC
		Yellow-breasted Greenfinch	*Chloris spinoides* (Vigors, 1831)	0.93	LC
	Stenostiridae	Grey-headed Canary-flycatcher	*Culicicapa ceylonensis* (Swainson, 1820)	0.81	LC
	Paridae	Great Tit	*Parus major* (Vieillot, 1818)	0.71	LC
		Green-backed Tit	*Parus monticolus* (Vigors, 1831)	0.15	LC
		White-naped Tit	*Machlolophus nuchalis* (Jerdon, 1845)	0.36	VU
		Black-lored Tit	*Machlolophus xanthogenys* (Vigors, 1831)	0.59	LC
		Black-throated Tit	*Aegithalos concinnus* (Gould, 1855)	0.13	LC
	Alaudidae	Crested Lark	*Galerida cristata* (Linnaeus, 1758)	0.08	LC
	Cisticolidae	Ashy Prinia	*Prinia socialis* (Sykes, 1832)	0.16	LC
		Rufescent Prinia	*Prinia rufescens* (Blyth, 1847)	0.45	LC
		Plain Prinia	*Prinia inornata* (Sykes, 1832)	1.03	LC
		Common Tailorbird	*Orthotomus sutorius* (Pennant, 1769)	0.86	LC
	Hirundinidae	Barn Swallow	*Hirundo rustica* (Linnaeus,1758)	2.18	LC

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		Plain Martin	*Riparia paludicola* (Vieillot, 1817)	0.31	LC
	Pycnonotidae	Black Bulbul	*Hypsipetes leucocephalus* (J.F. Gmelin, 1789)	0.70	LC
		Himalayan Bulbul	*Pycnonotus leucogenis* (J.E. Grey, 1835)	2.51	LC
		Red-vented Bulbul	*Pycnonotus cafer* (Linnaeus, 1766)	2.08	LC
		Red-whiskered Bulbul	*Pycnonotus jocosus* (Linnaeus, 1758)	1.19	LC
		Ashy Bulbul	*Hemixos flavala* (Blyth, 1845)	0.05	LC
	Phylloscopidae	Grey-cheeked Warbler	*Seicercus poliogenys* (Blyth, 1847)	0.14	LC
		Green Warbler	*Phylloscopus nitidus* (Blyth, 1843)	0.10	LC
	Zosteropidae	Oriental White-eye	*Zosterops palpebrosus* (Temminck, 1824)	1.39	LC
	Timaliidae	Black-chinned Babbler	*Cyanoderma pyrrhops* (Blyth, 1844)	0.12	LC
	Leiothrichidae	Jungle Babbler	*Turdoides striata* (Dumont, 1823)	1.09	LC
		White-crested Laughingthrush	*Garrulax leucolophus* (Hardwicke, 1816)	0.45	LC
		White-throated Laughingthrush	*Garrulax albogularis* (Gould, 1836)	0.18	LC
		Streaked Laughingthrush	*Trochalopteron lineatum* (Vigors, 1831)	0.84	LC
	Sittidae	Chestnut-bellied Nuthatch	*Sitta castanea* (Lesson, 1830)	0.22	LC
		Velvet-fronted Nuthatch	*Sitta frontalis* (Swainson, 1820)	0.14	LC
		Wallcreeper	*Tichodroma muraria* (Linnaeus, 1766)	0.19	LC
	Sturnidae	Common Myna	*Acridotheres tristis* (Linnaeus, 1766)	4.08	LC
		Common Starling	*Sturnus vulgaris* (Linnaeus, 1758)	0.29	LC
		Asian Pied Starling	*Gracupica contra* (Linnaeus, 1758)	1.34	LC
		Bank Myna	*Acridotheres ginginianus* (Latham, 1790)	0.92	LC
	Cinclidae	Brown Dipper	*Cinclus pallasii* (Temminck, 1820)	0.35	LC
	Muscicapidae	Oriental Magpie Robin	*Copsychus saularis* (Linnaeus, 1758)	0.53	LC
		Verditer Flycatcher	*Eumyias thalassinus* (Swainson, 1838)	0.11	LC
		Rusty-tailed Flycatcher	*Muscicapa ruficauda* (Swainson, 1838)	0.27	LC

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		Ferruginous Flycatcher	*Muscicapa ferruginea* (Hodgson, 1845)	0.09	LC
		Rufous-bellied Niltava	*Niltava sundara* (Hodgson, 1837)	0.06	LC
		Little Forktail	*Enicurus scouleri* (Vigors, 1832)	0.69	LC
		Spotted Forktail	*Enicurus maculatus* (Vigors, 1831)	0.47	LC
		Blue Whistling Thrush	*Myophonus caeruleus* (Scopoli, 1786)	0.92	LC
		Plumbeous Water Redstart	*Rhyacornis fuliginosa* (Vigors, 1831)	0.14	LC
		White-capped Redstart	*Chaimarrornis leucocephalus* (Vigors, 1831)	0.11	LC
		Black Redstart	*Phoenicurus ochruros* (S.G. Gmelin, 1774)	0.05	LC
		Blue Rock Thrush	*Monticola solitarius* (Linnaeus, 1758)	0.10	LC
		Common Stonechat	*Saxicola torquatus* (Linnaeus, 1766)	0.31	LC
		Brown Rock Chat	*Oenanthe fusca* (Blyth, 1851)	0.23	LC
		Pied Bushchat	*Saxicola caprata* (Linnaeus, 1766)	0.40	LC
		Grey Bushchat	*Saxicola ferreus* (J.E. & G.R. Gray, 1847)	0.11	LC
		Greenish Leaf Warbler	*Seicercus trochiloides* (Sundevall, 1837)	0.11	LC
	Turdidae	Grey-winged Blackbird	*Turdus boulboul* (Latham, 1790)	0.10	LC