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Cover: *Minervarya cepfi* & *Nyctibatrachus petraeus*—mix media. © P Kritika



Avifaunal diversity of the central Western Ghats in Uttara Kannada, Karnataka, India

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Abstract: Birds are present across diverse ecosystems and play critical roles as seed dispersers, pest controllers, and indicators of environmental change. Documenting avian diversity in a landscape is essential for recognising its ecological significance, identifying priority areas for conservation, and safeguarding critical habitats. Here, we present a baseline checklist of the avifaunal diversity of the ecologically sensitive areas of the central Western Ghats during the summer season, encompassing the forests of Karwar Forest Division, Yellapur Forest Division, and Kali Tiger Reserve. Using a combination of systematic grid-based point count and opportunistic surveys, we documented a total of 206 species belonging to 66 families and 18 orders. Species richness was highest in the semi evergreen forest, followed by moist deciduous, and tropical evergreen forest. We recorded 20 species endemic to the Indian subcontinent, of which 13 species were exclusively endemic to the Western Ghats. Our findings provide valuable baseline data for future ecological assessments and conservation planning in this ecologically sensitive region of the Western Ghats.

Keywords: Biodiversity hotspot, bird assemblage, conservation, ecologically sensitive areas, endemic, Kali Tiger Reserve, Non-Protected Area, Protected Area, species richness.

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Author contributions: Conceptualisation: GVG. Data curation: RP, NR. Formal analysis: RP, NR. Funding acquisition: GVG. Investigation: GVG. Methodology: RP, NR, SJDF, GVG. Supervision: GVG. Project administration: GVG. Validation: GVG, SJDF, RP, NR. Visualisation: GVG, RP, NR, SJDF. Writing – original draft: RP, NR. Writing – review and editing: GVG, SJDF, RP, NR.

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INTRODUCTION

Birds occupy a wide range of habitats globally and play vital ecological roles such as seed dispersal, pollination, pest control, and scavenging (Ali 2002; Sekercioglu 2006; Whelan et al. 2008; Archana et al. 2024). Due to their mobility and sensitivity to environmental changes, birds serve as key indicators for monitoring habitat quality and biodiversity trends (Menon & Shahabuddin 2021; Aarif et al. 2025). In India, recent assessments indicate that nearly 60% of bird species show long-term declines, with 40% currently experiencing population reductions (State of India's Birds 2023). These trends highlight the urgency of documenting avifaunal diversity, particularly in ecologically sensitive regions.

In particular, tropical and subtropical forests around the world support an exceedingly high number of birds as compared to other regions (Pillay et al. 2021). However, anthropogenic disturbances such as deforestation, logging, and the conversion of forests to agroforests or urban areas have resulted in the disruption of bird communities in forests (Barlow et al. 2006; Sekercioglu 2012; Matuoka et al. 2020). The Western Ghats, one of the eight 'hottest' biodiversity hotspots in the world (Myers et al. 2000), support a rich bird community shaped by diverse topography and climatic variations. Within the Western Ghats, Gadgil et al. (2011) defined ESA as areas "that are ecologically and economically important, but vulnerable even to mild disturbances, and hence demand careful management". The 6th Draft Notification of the Western Ghats ESA identifies an area of 20,668 km² in the state of Karnataka to be ecologically sensitive, which majorly encompasses the mountains of the Ghats (Gazette of India 2024). Within this region, the Uttara Kannada district contains the largest contiguous tropical forests in peninsular India and harbours 441 of Karnataka's 556 recorded bird species (Praveen et al. 2025). While several studies have documented avian diversity in different parts of this district (Davidson 1898a,b; Daniels et al. 1990, 1992; Barve & Warriar 2013; Ramachandra et al. 2013; Bhat & Ganesh 2014), very few surveys have been conducted in the Anshi-Dandeli area (Kotangale & Ghosh 2000; Puttaraju 2014), which remains largely unexplored in terms of its avifaunal diversity. Thus, the present study aims to provide an overview of the region's bird diversity and establish a baseline dataset for future studies aimed towards addressing avian conservation efforts within this landscape.

STUDY AREA

The study was carried out in the forests of the central Western Ghats in the Uttara Kannada District of Karnataka. The area spanned across three forest divisions: Karwar Forest Division, Kali Tiger Reserve, and Yellapur Forest Division (bounded by the latitudes 14.691°–15.016° N and the longitudes 74.286°–74.627° E) (Image 1). The landscape is primarily dominated by southern tropical wet evergreen and semi evergreen forests. However, the eastern portion of the Yellapur Forest Division transitions to tropical dry deciduous forests. The Kali Tiger Reserve (KTR) is a critical part of this region, encompassing two key protected areas: Dandeli Wildlife Sanctuary (886.41 km²) and Anshi National Park (417.34 km²). Together, these contiguous areas form the "Dandeli-Anshi Tiger Reserve" (DATR), renamed as the KTR, which encompasses a total area of over 1,300 km². Kali Tiger Reserve is a part of a larger contiguous forest tract extending over 10,000 km² across the states of Karnataka and Goa. The tiger reserve serves as the major catchment for the Kali River and its tributaries, Nagzari and Kaneri. Geographically, KTR shares its northern boundary with Bhimgad Wildlife Sanctuary of Belgaum Division. To the east, it borders the Haliyal Division, while to the south and south-east, it adjoins the reserved forests of Yellapur and Karwar divisions. The western boundary connects to protected areas in Goa.

In addition to the main river Kali, many streams and rivulets drain the heavy rainfall of the area into the Arabian Sea. The climate here is characterised by hot and humid summer and warm winter with the mean annual temperature varying between 25°C and 28°C. The mean annual rainfall exceeds 2,000 mm in most of the areas. The region comprises of predominantly red and laterite soils on the leeward side of the Sahyadris (Western Ghats) and alluvium-derived soils in the coastal plains; however, in regions where the native forest cover remains undisturbed, continuous litter deposition and organic matter accumulation contribute to the humus-rich, well-drained soils that support high levels of plant productivity and overall biodiversity. Based on the classification of Champion & Seth (1968), we classified the vegetation within our study area into three major natural forest types. Additionally, two anthropogenically modified categories—mixed forests (secondary forests) and plantations—were recognised to account for variation in land-use history and vegetation structure across the landscape. Brief descriptions of these categories are given below:

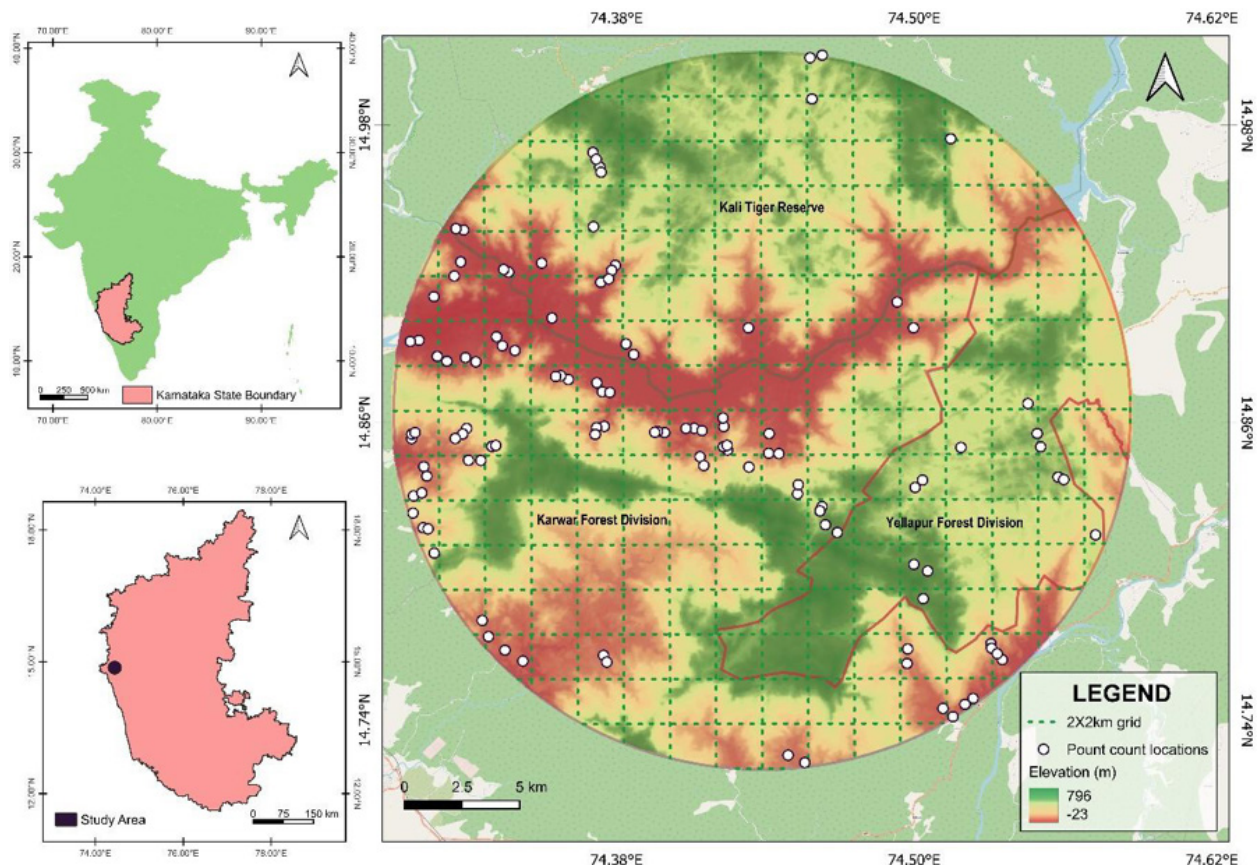


Image 1. Map of the study area showing the forest divisions and point count locations.

Tropical evergreen forests – southern tropical wet evergreen forests (1A/C4: West coast tropical evergreen forests) (Champion & Seth 1968) occur in areas with high rainfall and minimal dry periods, particularly within the KTR and parts of Karwar Division. Characterised by a multi-storied structure with dense canopy cover, they harbour a rich assemblage of evergreen tree species such as *Dipterocarpus indicus*, *Myristica dactyloides*, *Hopea parviflora*, and *Vateria indica* forming critical habitats for endemic avian and arboreal species.

Semi-evergreen forests – southern tropical semi-evergreen forests (2A/C2: West coast semi evergreen forests) (Champion & Seth 1968) forms an ecotonal zone between evergreen and moist deciduous forests, often found in areas subject to partial disturbance or on lower slopes. Species composition includes a mixture of evergreen and deciduous elements, with characteristic trees such as *Terminalia paniculata*, *Lagerstroemia microcarpa*, and *Tectona grandis* as common species. They are accompanied by evergreen species like *Diospyros candolleana* and *Cinnamomum malabathrum*, which eventually mix and result in a semi-deciduous canopy. As a result of seasonal canopy dynamics, semi

evergreen forests have more diverse understories that consist of light-loving and shade-tolerant species.

Moist deciduous forests – southern Indian moist deciduous forests (3B/C2: Southern moist mixed deciduous forests) (Champion & Seth 1968) are found primarily in the eastern parts of Yellapur Forest Division and lower rainfall zones, these forests are characterised by species such as *Tectona grandis*, *Terminalia tomentosa*, *Xylia xylocarpa*, and *Dalbergia latifolia*. They often occur in a mosaic with semi-evergreen patches. Shrubs, small trees, and saplings are seen dominating the understory layers by species like the Indian gooseberry *Phyllanthus emblica* or the Flame of the Forest *Butea monosperma*. Along with that, the presence of lianas and epiphytes further complements the vertical stratification of these forests. Woody vines, or lianas, such as *Bauhinia racemosa*, are typical components within the tree vegetation. The relatively open canopy structure provides habitat for a different set of avifauna compared to evergreen forests.

Mixed forests (Secondary forests): In several parts of the landscape, especially near villages and degraded tracts, forests have undergone secondary succession,

resulting in a heterogeneous 'mixed forest'. These are characterised by a combination of species from the semi evergreen and moist deciduous categories, often regenerating after selective logging, shifting cultivation, or fire. They provide important foraging grounds for generalist bird species.

Plantations

Large patches of monoculture plantations are also present within the study area, particularly of Teak *Tectona grandis*, Acacia *Acacia auriculiformis*, and Eucalyptus *Eucalyptus* spp. While structurally different from natural forests, these habitats nevertheless support certain bird species adapted to modified environments, though overall diversity tends to be lower compared to natural forest types.

METHODS

We conducted bird surveys over a five-month period from February 2024 to June 2024. This period defined the entire summer season (March to May) and the onset of the monsoon (June). A systematic point count survey methodology was employed, following Bibby et al. (2000). The study area was divided into a grid system comprising 225 grids, each measuring 2 x 2 km. Due to the short duration of the survey, logistical challenges and accessibility of dense forests based on the forest department staff availability and recommendations, we randomly chose 40% of the grids for sampling, ensuring coverage across all three forest divisions. Within the selected grids, a total of 118 survey station were established (Image 1, Table 1). At each survey station, point counts were conducted with a fixed radius of 100 m. Each point count was conducted for a standardised duration of 10 min, with a minimum distance of 400 m maintained between survey points to minimise the risk of double counting individuals. Thus, the overall duration of surveys for point count was limited to 1,180 min, which corresponds to approximately 20 h. Additionally, we conducted opportunistic bird surveys across different habitats to maximise sampling effort for forest, riverine and nocturnal birds as well. For this, we specifically relied on daily eBird lists to keep a track of the species recorded during this period when point counts were not being conducted. During this period, a total of 218 eBird lists were created corresponding to a total survey effort of approximately 94 h (approximately 5,626 min). Our surveys were scheduled during peak bird activity periods - early morning (0630 h) and late

Table 1. Number of point count stations and size of stations sampled for birds in the study area.

Forest Division	Point count plot size	Number of point count stations
Karwar Forest Division	100 m	85
Kali Tiger Reserve (Anshi-Dandeli Area)	100 m	22
Yellapur Forest Division	100 m	11
Total		118

afternoon (1600 h) to maximise bird detections. All bird species observed or heard during the survey were identified and recorded based on visual and auditory cues. Field observations were conducted using Nikon Prostaff 7s 8 x 42 binoculars, and photographs were taken of most species for documentation with a Nikon P900 and Nikon D5600. To minimise potential observer bias during point count surveys, two trained observers were consistently involved at each sampling location. One observer was responsible for detecting and identifying bird species and documenting detections, while the second observer simultaneously recorded species identity, counts, and associated metadata for each point count station. This division of roles helped reduce errors related to miscounting, double counting, or overlooking individuals, thereby increasing the reliability of the dataset. Species identification was done by standard field guides (Ali 2002; Grimmett et al. 2011; Billerman et al. 2022). For taxonomy and nomenclature, we particularly followed the eBird and Clements et al. (2024) and Praveen et al. (2025). We further categorised the species as Resident (R), Summer Migrant (SM), Winter Migrant (WM) or Local Migrant (LM) based on field observations and descriptions provided in Grimmett et al. (2011) and SoIB (2023). Conservation status and legal protection were determined according to the IUCN Red List of Threatened Species (2024) and the Wildlife (Protection) Amendment Act 2022.

Analysis

We evaluated key metrics such as species richness and total species abundance across the entire survey area by categorising the habitats into different forest types, viz., semi evergreen (Southern tropical semi evergreen forests), tropical evergreen (Southern tropical wet evergreen forests), moist deciduous (Southern Indian moist deciduous forests), mixed forests (Secondary forests), and plantations. In addition to species richness and abundance, we calculated Shannon diversity index to quantify species diversity, taking into account both the abundance and evenness of the species present

(Shannon & Weaver 1963).

Shannon - Wiener index $H' = -\sum p_i \times \ln(p_i)$

where $\sum$ = Sum, p_i = proportion of the entire community made up of species 'i', $\ln$ is the natural logarithm, and S is the species richness or the total number of species observed in a community.

We also calculated the maximum possible diversity (H_{max}) to determine the theoretical maximum diversity. Furthermore, we used Pielou's evenness Index (Pielou 1966) to assess the evenness of species distribution. The index was calculated as: Pielou's evenness index $J = H' / \ln(S)$, where H' is the Shannon diversity index and S is the total number of species. $\ln(S)$ is denoted as H_{max} or maximum possible diversity. In order to assess the adequacy of our survey effort, we generated a species accumulation curve based on our observed species richness. To examine patterns of species dominance and relative abundance within the bird communities, we also included a rank-abundance curve across different habitat types. Furthermore, we compared the species detection between the communities of different forest types to understand the preliminary ecological patterns associated with habitat variation. All statistical analyses and visualisations were conducted using the R statistical software (R Core Team 2024).

RESULTS

A total of 206 avian species were documented, representing 66 families and 18 orders during the survey (Table 2). Passerines comprised 49.75% (103 species) of the total species recorded. Among the non-Passeriformes, the family Accipitridae exhibited the highest diversity with 12 species, followed by Ardeidae (11) and Picidae (8). Within the Passeriformes, the family Muscicapidae was the most diverse, with 12 species. Notably, 20 of these species are endemic to the Indian subcontinent, and 13 are exclusively endemic to the Western Ghats (Table 3). Based on point-count data (excluding opportunistic records), we recorded 2,674 individuals representing 147 species. The Shannon–Wiener diversity index for the study area was $H' = 4.24$, and Pielou's evenness Index was $J' = 0.85$, indicating a relatively even distribution of species rather than dominance by a few taxa. These indices suggest a diverse bird community across the region, but the results should be viewed as preliminary, given the limited temporal coverage and replication. Forest-specific H' and J' are provided in Table 4.

In our dataset, a higher number of species was

observed in semi evergreen forests (113 species) compared to moist deciduous (102 species), and tropical evergreen forests (87 species). However, given that the surveys were restricted to one summer season, with incomplete coverage of all grids and replication, these results should be interpreted cautiously as preliminary patterns rather than definitive differences among forest types (Table 4). Further, based on our point-count surveys, we observed a comparatively higher species abundance in the semi evergreen forest (970 individuals), followed by moist deciduous forest (713 individuals), and tropical evergreen forest (701 individuals). The boxplot reflects these preliminary patterns observed within our study area (Image 2). In particular, semi evergreen forests exhibited the highest median and the widest spread of values, including several extreme outliers, suggesting that this forest type may harbour particularly rich bird assemblages and site-level heterogeneity. In contrast, plantations reflected the lower species detections, with a narrow range and low median values, which may be reflective of relatively poor and uniform habitat quality for bird communities, though this could be a result of less sampling effort in these habitats. Moist deciduous forests had a moderately intermediate range of species detection per point with wider variability than mixed forests, suggesting that they may provide important resources for avifauna, but with differences depending on local site conditions.

Additionally, with the help of a species rank abundance curve, we also found that White-cheeked Barbet *Psilopogon viridis* was most abundant in semi evergreen forests and tropical evergreen forests (Image 3). Apart from that, Purple Sunbird *Cinnyris asiaticus* and Greater Racket-tailed Drongo *Dicrurus paradiseus* were the most abundant species in moist deciduous and mixed forest types, respectively. Although these patterns highlight possible differences in richness and abundance among forest types, they are best interpreted as indicative trends. Since the survey was restricted to a single season with incomplete spatial coverage and no replication, our results might limit the robustness of cross-habitat comparisons. Future studies with multi-season sampling and greater replication will be necessary to confirm whether the patterns reported here reflect broader ecological differences among forest types.

Status of Foraging Guilds of Birds

Based on the heterogeneity of the foraging ecology of birds or how different groups of birds exploit the same class of food resources within the study area, the status of birds was assessed. Eight different categories

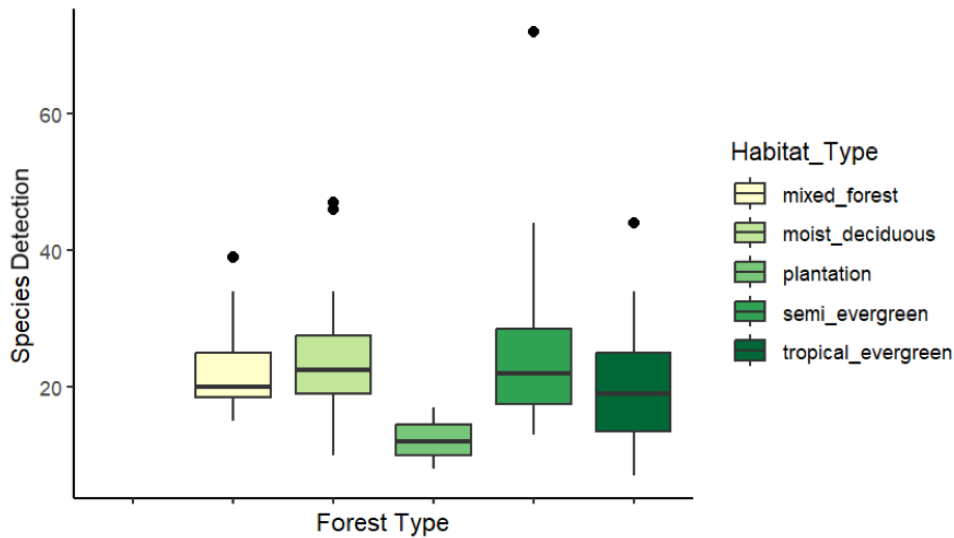


Image 2. Boxplot representing species detection based on the different forest types in the study area.

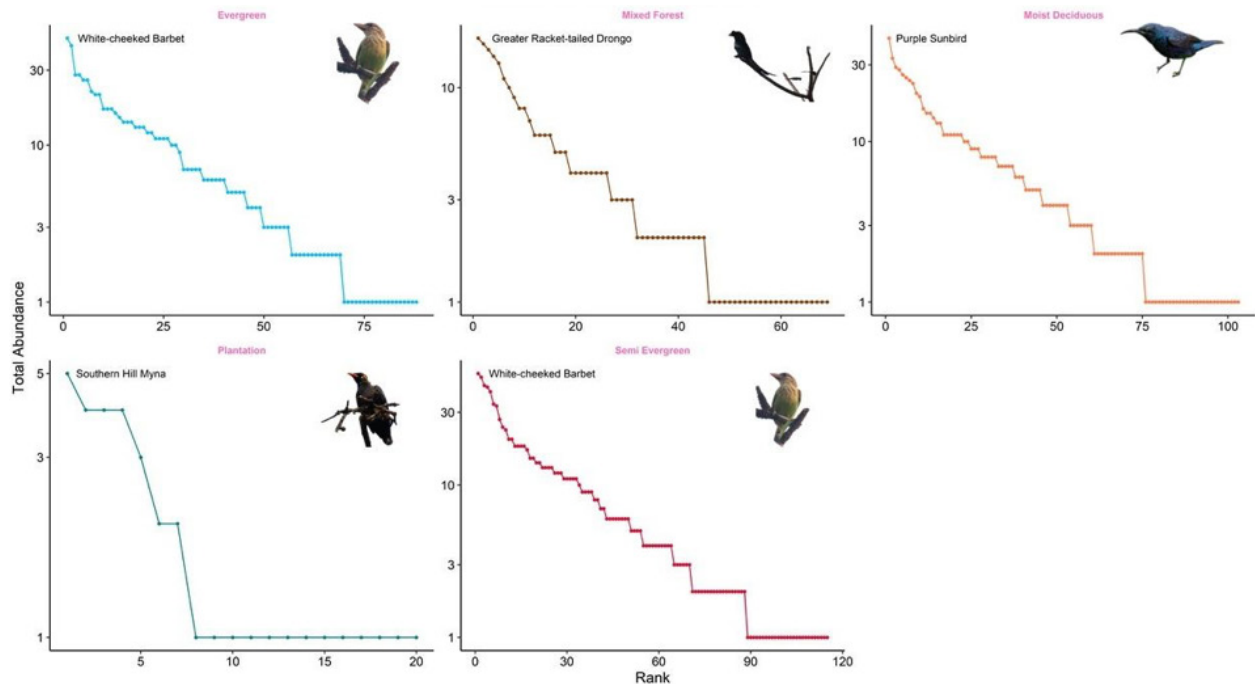


Image 3. Species rank abundance curve for different forest types in the study area.

of foraging guilds were identified, including carnivorous, frugivorous, granivorous, herbivorous, insectivorous, molluscivorous, omnivorous, and piscivorous birds. Of the 206 species, insectivorous birds were detected in the highest numbers (65), followed by omnivorous (51), carnivorous (46), and frugivorous (29) birds (Image 4). Interestingly, only a single species of molluscivore (*Anastomus oscitans*) was recorded, which specialises in feeding extensively on snails, especially apple snails

(*Pila*).

Migratory Status of Birds

Karnataka lies along the Central Asian Flyway, a well-defined pathway for migratory birds traveling between their breeding grounds in Siberia and their non-breeding grounds in India and other regions. Based on the survey period, which typically started from the end of February and lasted till June, bird species were classified into four

Table 2. List of avian species recorded from the study area.

Order/Family/Common name	Scientific name	IUCN Red List status	WPA status	MS
Galliformes (1)				
Phasianidae (3)				
Indian Peafowl	<i>Pavo cristatus</i> (Linnaeus, 1758)	LC	Sch I	R
Red Spurfowl	<i>Galloperdix spadicea</i> (Gmelin, 1789)	LC	Sch II	R
Grey Junglefowl	<i>Gallus sonneratii</i> (Temminck, 1813)	LC	Sch I	R
Columbiformes (1)				
Columbidae (8)				
Rock Pigeon	<i>Columba livia</i> (Gmelin, 1789)	LC	Not sch	R
Nilgiri Wood-Pigeon	<i>Columba elphinstonii</i> (Sykes, 1832)	VU	Sch I	R
Spotted Dove	<i>Spilopelia chinensis</i> (Scopoli, 1786)	LC	Sch II	R
Asian Emerald Dove	<i>Chalcophaps indica</i> (Linnaeus, 1758)	LC	Sch II	R
Orange-breasted Green-Pigeon	<i>Treron bicinctus</i> (Jerdon, 1840)	LC	Sch II	R
Grey-fronted Green-Pigeon	<i>Treron affinis</i> (Jerdon, 1840)	LC	Sch II	R
Green Imperial-Pigeon	<i>Ducula aenea</i> (Linnaeus, 1766)	NT	Sch II	R
Malabar Imperial-Pigeon	<i>Ducula cuprea</i> (Jerdon, 1840)	LC	Sch II	R
Cuculiformes (1)				
Cuculidae (7)				
Greater Coucal	<i>Centropus sinensis</i> (Stephens, 1815)	LC	Sch II	R
Blue-faced Malkoha	<i>Phaenicophaeus viridirostris</i> (Jerdon, 1840)	LC	Sch II	R
Asian Koel	<i>Eudynamis scolopacea</i> (Linnaeus, 1758)	LC	Sch II	R
Banded Bay Cuckoo	<i>Cacomantis sonneratii</i> (Latham, 1790)	LC	Sch II	LM
Fork-tailed Drongo-Cuckoo	<i>Surniculus dicruroides</i> (Hodgson, 1839)	LC	Sch II	LM
Common Hawk-Cuckoo	<i>Hierococcyx varius</i> (Vahl, 1797)	LC	Sch II	LM
Indian Cuckoo	<i>Cuculus micropterus</i> (Gould, 1838)	LC	Sch II	SM
Caprimulgiformes (4)				
Caprimulgidae (2)				
Jerdon's Nightjar	<i>Caprimulgus atripennis</i> (Jerdon, 1845)	LC	Sch II	R
Savanna Nightjar	<i>Caprimulgus affinis</i> (Horsfield, 1821)	LC	Sch II	R
Podargidae (1)				
Sri Lanka Frogmouth	<i>Batrachostomus moniliger</i> (Blyth, 1849)	LC	Sch I	R
Apodidae (4)				
White-rumped Spinetail	<i>Zonavena sylvatica</i> (Tickell, 1846)	LC	Sch II	R
Brown-backed Needletail	<i>Hirundapus giganteus</i> (Temminck, 1825)	LC	Sch II	R
Little Swift	<i>Apus affinis</i> (Gray, 1830)	LC	Sch II	R
Asian Palm Swift	<i>Cypsiurus balasensis</i> (Gray, 1829)	LC	Sch II	R
Hemiprocidae (1)				
Crested Treeswift	<i>Hemiprocne coronata</i> (Tickell, 1833)	LC	Sch I	R
Gruiformes (1)				
Rallidae (2)				
Common Moorhen	<i>Gallinula chloropus</i> (Linnaeus, 1758)	LC	Sch II	R
White-breasted Waterhen	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	LC	Sch II	R
Charadriiformes (4)				
Charadriidae (3)				
Red-wattled Lapwing	<i>Vanellus indicus</i> (Boddaert, 1783)	LC	Sch II	R
Tibetan Sand-Plover	<i>Anarhynchus atrifrons</i> (Wagler, 1829)	LC	Sch II	WM
Greater Sand-Plover	<i>Anarhynchus leschenaultii</i> (Lesson, 1826)	LC	Sch II	WM
Scolopacidae (1)				
Common Sandpiper	<i>Actitis hypoleucos</i> (Linnaeus, 1758)	LC	Sch II	WM

Order/Family/Common name	Scientific name	IUCN Red List status	WPA status	MS
Turnicidae (1)				
Yellow-legged Buttonquail	<i>Turnix tanki</i> (Blyth, 1843)	LC	Sch II	R
Laridae (1)				
River Tern	<i>Sterna aurantia</i> (Gray, 1831)	VU	Sch I	R
Ciconiiformes (1)				
Ciconiidae (4)				
Asian Openbill	<i>Anastomus oscitans</i> (Boddaert, 1783)	LC	Sch II	R
Black Stork	<i>Ciconia nigra</i> (Linnaeus, 1758)	LC	Sch II	WM
Asian Woolly-necked Stork	<i>Ciconia episcopus</i> (Boddaert, 1783)	NT	Sch II	R
Lesser Adjutant	<i>Leptoptilos javanicus</i> (Horsfield, 1821)	NT	Sch I	R
Suliformes (2)				
Anhingidae (1)				
Oriental Darter	<i>Anhinga melanogaster</i> (Pennant, 1769)	LC	Sch II	R
Phalacrocoracidae (2)				
Little Cormorant	<i>Microcarbo niger</i> (Vieillot, 1817)	LC	Sch II	R
Indian Cormorant	<i>Phalacrocorax fuscicollis</i> (Stephens, 1826)	LC	Sch II	R
Pelecaniformes (2)				
Threskiornithidae (2)				
Glossy Ibis	<i>Plegadis falcinellus</i> (Linnaeus, 1766)	LC	Sch II	R
Black-headed Ibis	<i>Threskiornis melanocephalus</i> (Latham, 1790)	LC	Sch II	R
Ardeidae (11)				
Black-crowned Night Heron	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	LC	Sch II	R
Malayan Night Heron	<i>Gorsachius melanolophus</i> (Raffles, 1822)	LC	Sch II	R
Little Egret	<i>Egretta garzetta</i> (Linnaeus, 1766)	LC	Sch II	R
Western Reef-Egret	<i>Egretta gularis</i> (Bosc, 1792)	LC	Sch II	R
Striated Heron	<i>Butorides striata</i> (Linnaeus, 1758)	LC	Sch II	R
Indian Pond-Heron	<i>Ardeola grayii</i> (Sykes, 1832)	LC	Sch II	R
Eastern Cattle-Egret	<i>Ardea coromanda</i> (Boddaert, 1783)	NE	Sch II	R
Great Egret	<i>Ardea alba</i> (Linnaeus, 1758)	LC	Sch II	R
Intermediate Egret	<i>Ardea intermedia</i> (Wagler, 1829)	LC	Sch II	R
Grey Heron	<i>Ardea cinerea</i> (Linnaeus, 1758)	LC	Sch II	R
Purple Heron	<i>Ardea purpurea</i> (Linnaeus, 1766)	LC	Sch II	R
Accipitriformes (2)				
Pandionidae (1)				
Osprey	<i>Pandion haliaetus</i> (Linnaeus, 1758)	LC	Sch I	WM
Accipitridae (12)				
Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i> (Temminck, 1821)	LC	Sch II	R
Crested Serpent-Eagle	<i>Spilornis cheela</i> (Latham, 1790)	LC	Sch I	R
Changeable Hawk-Eagle	<i>Nisaetus cirrhatus</i> (Gmelin, 1788)	LC	Sch I	R
Rufous-bellied Eagle	<i>Lophotriorchis kienerii</i> (de Sparre, 1835)	NT	Sch I	R
Black Eagle	<i>Ictinaetus malaiensis</i> (Temminck, 1822)	LC	Sch I	R
Crested Goshawk	<i>Lophospiza trivirgata</i> (Temminck, 1824)	LC	Sch I	R
Shikra	<i>Tachyspiza badia</i> (Gmelin, 1788)	LC	Sch I	R
Black Kite	<i>Milvus migrans</i> (Boddaert, 1783)	LC	Sch II	R
Brahminy Kite	<i>Haliastur indus</i> (Boddaert, 1783)	LC	Sch I	R
White-bellied Sea-Eagle	<i>Ichthyophaga leucogaster</i> (Gmelin, 1788)	LC	Sch I	R
Grey-headed Fish-Eagle	<i>Ichthyophaga ichthyaetus</i> (Horsfield, 1821)	NT	Sch I	R
White-eyed Buzzard	<i>Butastur teesa</i> (Franklin, 1831)	LC	Sch I	R
Strigiformes (2)				

Order/Family/Common name	Scientific name	IUCN Red List status	WPA status	MS
Tytonidae (1)				
Eastern Barn-Owl	<i>Tyto javanica</i> (Gmelin, 1788)	LC	Sch I	R
Strigidae (5)				
Indian Scops-Owl	<i>Otus bakkamoena</i> (Pennant, 1769)	LC	Sch II	R
Brown Fish-Owl	<i>Ketupa zeylonensis</i> (Gmelin, 1788)	LC	Sch I	R
Jungle Owlet	<i>Glaucidium radiatum</i> (Tickell, 1833)	LC	Sch II	R
Spotted Owlet	<i>Athene brama</i> (Temminck, 1821)	LC	Sch II	R
Brown Boobook	<i>Ninox scutulata</i> (Raffles, 1822)	LC	Sch II	R
Trogoniformes (1)				
Trogonidae (1)				
Malabar Trogon	<i>Harpactes fasciatus</i> (Pennant, 1769)	LC	Sch II	R
Bucerotiformes (2)				
Upupidae (1)				
Eurasian Hoopoe	<i>Upupa epops</i> (Linnaeus, 1758)	LC	Sch II	WM
Bucerotidae (3)				
Great Hornbill	<i>Buceros bicornis</i> (Linnaeus, 1758)	VU	Sch I	R
Malabar Grey Hornbill	<i>Ocyrceros griseus</i> (Latham, 1790)	VU	Sch I	R
Malabar Pied-Hornbill	<i>Anthraceroceros coronatus</i> (Boddaert, 1783)	NT	Sch I	R
Coraciiformes (3)				
Meropidae (3)				
Asian Green Bee-eater	<i>Merops orientalis</i> (Latham, 1801)	LC	Sch II	R
Blue-tailed Bee-eater	<i>Merops philippinus</i> (Linnaeus, 1767)	LC	Sch II	R
Chestnut-headed Bee-eater	<i>Merops leschenaulti</i> (Vieillot, 1817)	LC	Sch II	R
Alcedinidae (3)				
Common Kingfisher	<i>Alcedo atthis</i> (Linnaeus, 1758)	LC	Sch II	R
Stork-billed Kingfisher	<i>Pelargopsis capensis</i> (Linnaeus, 1766)	LC	Sch II	R
White-throated Kingfisher	<i>Halcyon smyrnensis</i> (Linnaeus, 1758)	LC	Sch II	R
Coraciidae (1)				
Indian Roller	<i>Coracias benghalensis</i> (Linnaeus, 1758)	LC	Sch II	R
Piciformes (2)				
Megalaimidae (4)				
Malabar Barbet	<i>Psilopogon malabaricus</i> (Blyth, 1847)	LC	Sch II	R
Coppersmith Barbet	<i>Psilopogon haemacephalus</i> (Müller, 1776)	LC	Sch II	R
Brown-headed Barbet	<i>Psilopogon zeylanicus</i> (Gmelin, 1788)	LC	Sch II	R
White-cheeked Barbet	<i>Psilopogon viridis</i> (Boddaert, 1783)	LC	Sch II	R
Picidae (8)				
Speckled Piculet	<i>Picumnus innominatus</i> (Burton, 1836)	LC	Sch II	R
Heart-spotted Woodpecker	<i>Hemicircus canente</i> (Lesson, 1832)	LC	Sch I	R
Brown-capped Pygmy Woodpecker	<i>Yungipicus nanus</i> (Vigors, 1832)	LC	Sch II	R
Malabar Flameback	<i>Chrysocolaptes socialis</i> (Koelz, 1939)	NE	Sch II	R
Rufous Woodpecker	<i>Micropternus brachyurus</i> (Vieillot, 1818)	LC	Sch II	R
Black-rumped Flameback	<i>Dinopium benghalense</i> (Linnaeus, 1758)	LC	Sch II	R
Lesser Yellownape	<i>Picus chlorolophus</i> (Vieillot, 1818)	LC	Sch II	R
White-bellied Woodpecker	<i>Dryocopus javensis</i> (Horsfield, 1821)	LC	Sch II	R
Falconiformes (1)				
Falconidae (2)				
Common Kestrel	<i>Falco tinnunculus</i> (Linnaeus, 1758)	LC	Sch II	WM
Peregrine Falcon	<i>Falco peregrinus</i> (Tunstall, 1771)	LC	Sch I	R
Psittaciformes (1)				

Order/Family/Common name	Scientific name	IUCN Red List status	WPA status	MS
Psittaculidae (5)				
Alexandrine Parakeet	<i>Psittacula eupatria</i> (Linnaeus, 1766)	NT	Sch II	R
Rose-ringed Parakeet	<i>Psittacula krameri</i> (Scopoli, 1769)	LC	Sch II	R
Plum-headed Parakeet	<i>Psittacula cyanocephala</i> (Linnaeus, 1766)	LC	Sch II	R
Malabar Parakeet	<i>Psittacula columboides</i> (Vigors, 1830)	LC	Sch II	R
Vernal Hanging-Parrot	<i>Loriculus vernalis</i> (Sparrman, 1787)	LC	Sch II	R
Passeriformes (35)				
Pittidae (1)				
Indian Pitta	<i>Pitta brachyura</i> (Linnaeus, 1766)	LC	Sch II	LM
Campephagidae (3)				
Small Minivet	<i>Pericrocotus cinnamomeus</i> (Linnaeus, 1766)	LC	Sch I	R
Orange Minivet	<i>Pericrocotus flammeus</i> (Forster, 1781)	LC	Sch II	R
Black-headed Cuckooshrike	<i>Lalage melanoptera</i> (Rüppell, 1839)	LC	Sch II	R
Oriolidae (2)				
Indian Golden Oriole	<i>Oriolus kundoo</i> (Sykes, 1832)	LC	Sch II	R
Black-hooded Oriole	<i>Oriolus xanthornus</i> (Linnaeus, 1758)	LC	Sch II	R
Artamidae (1)				
Ashy Woodswallow	<i>Artamus fuscus</i> (Vieillot, 1817)	LC	Sch II	R
Vangidae (2)				
Malabar Woodshrike	<i>Tephrodornis sylvicola</i> (Jerdon, 1839)	LC	Sch II	R
Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i> (Sykes, 1832)	LC	Sch II	R
Aegithinidae (1)				
Common Iora	<i>Aegithina tiphia</i> (Linnaeus, 1758)	LC	Sch II	R
Dicruridae (6)				
Black Drongo	<i>Dicrurus macrocercus</i> (Vieillot, 1817)	LC	Sch II	R
Ashy Drongo	<i>Dicrurus leucophaeus</i> (Vieillot, 1817)	LC	Sch II	R
White-bellied Drongo	<i>Dicrurus caerulescens</i> (Linnaeus, 1758)	LC	Sch II	R
Bronzed Drongo	<i>Dicrurus aeneus</i> (Vieillot, 1817)	LC	Sch II	R
Hair-crested Drongo	<i>Dicrurus hottentottus</i> (Linnaeus, 1766)	LC	Sch II	R
Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i> (Linnaeus, 1766)	LC	Sch II	R
Monarchidae (2)				
Black-naped Monarch	<i>Hypothymis azurea</i> (Boddaert, 1783)	LC	Sch II	R
Indian Paradise-Flycatcher	<i>Terpsiphone paradisi</i> (Linnaeus, 1758)	LC	Sch II	R
Laniidae (3)				
Brown Shrike	<i>Lanius cristatus</i> (Linnaeus, 1758)	LC	Sch II	WM
Bay-backed Shrike	<i>Lanius vittatus</i> (Valenciennes, 1826)	LC	Sch II	R
Long-tailed Shrike	<i>Lanius schach</i> (Linnaeus, 1758)	LC	Sch II	R
Corvidae (3)				
Rufous Treepie	<i>Dendrocitta vagabunda</i> (Latham, 1790)	LC	Sch II	R
House Crow	<i>Corvus splendens</i> (Vieillot, 1817)	LC	Not sch	R
Large-billed Crow	<i>Corvus macrorhynchos</i> (Wagler, 1827)	LC	Sch II	R
Stenostiridae (1)				
Grey-headed Canary-Flycatcher	<i>Culicicapa ceylonensis</i> (Swainson, 1820)	LC	Sch II	R
Paridae (1)				
Cinereous Tit	<i>Parus cinereus</i> (Vieillot, 1818)	NE	Sch II	R
Alaudidae (1)				
Malabar Lark	<i>Galerida malabarica</i> (Scopoli, 1786)	LC	Sch II	R
Cisticolidae (3)				
Common Tailorbird	<i>Orthotomus sutorius</i> (Pennant, 1769)	LC	Sch II	R

Order/Family/Common name	Scientific name	IUCN Red List status	WPA status	MS
Grey-breasted Prinia	<i>Prinia hodgsonii</i> (Blyth, 1844)	LC	Sch II	R
Ashy Prinia	<i>Prinia socialis</i> (Sykes, 1832)	LC	Sch II	R
Acrocephalidae (1)				
Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i> (Blyth, 1849)	LC	Sch II	WM
Hirundinidae (5)				
Dusky Crag-Martin	<i>Ptyonoprogne concolor</i> (Sykes, 1832)	LC	Sch II	R
Barn Swallow	<i>Hirundo rustica</i> (Linnaeus, 1758)	LC	Sch II	WM
Wire-tailed Swallow	<i>Hirundo smithii</i> (Leach, 1818)	LC	Sch II	R
Eastern Red-rumped Swallow	<i>Cecropis daurica</i> (Laxmann, 1769)	LC	Sch II	R
Streak-throated Swallow	<i>Petrochelidon fluvicola</i> (Blyth, 1855)	LC	Sch II	R
Pycnonotidae (7)				
Yellow-browed Bulbul	<i>Acritillas indica</i> (Jerdon, 1839)	LC	Sch II	R
Square-tailed Bulbul	<i>Hypsipetes ganeesa</i> (Sykes, 1832)	LC	Sch II	R
Grey-headed Bulbul	<i>Microtarsus priocephalus</i> (Jerdon, 1839)	NT	Sch II	R
Flame-throated Bulbul	<i>Rubigula gularis</i> (Gould, 1836)	LC	Sch II	R
White-browed Bulbul	<i>Pycnonotus luteolus</i> (Lesson, 1841)	LC	Sch II	R
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i> (Linnaeus, 1758)	LC	Sch II	R
Red-vented Bulbul	<i>Pycnonotus cafer</i> (Linnaeus, 1766)	LC	Sch II	R
Phylloscopidae (5)				
Tickell's Leaf Warbler	<i>Phylloscopus affinis</i> (Tickell, 1833)	LC	Sch II	WM
Green Warbler	<i>Phylloscopus nitidus</i> (Blyth, 1843)	LC	Sch II	WM
Greenish Warbler	<i>Phylloscopus trochiloides</i> (Sundevall, 1837)	LC	Sch II	WM
Large-billed Leaf Warbler	<i>Phylloscopus magnirostris</i> (Blyth, 1843)	LC	Sch II	WM
Western Crowned Warbler	<i>Phylloscopus occipitalis</i> (Blyth, 1845)	LC	Sch II	WM
Sylviidae (1)				
Lesser Whitethroat	<i>Curruca curruca</i> (Linnaeus, 1758)	LC	Sch II	WM
Paradoxornithidae (1)				
Yellow-eyed Babbler	<i>Chrysomma sinense</i> (Gmelin, 1789)	LC	Sch II	R
Zosteropidae (1)				
Indian White-eye	<i>Zosterops palpebrosus</i> (Temminck, 1824)	LC	Sch II	R
Timaliidae (2)				
Dark-fronted Babbler	<i>Dumetia atriceps</i> (Jerdon, 1839)	LC	Sch II	R
Indian Scimitar-Babbler	<i>Pomatorhinus horsfieldii</i> (Sykes, 1832)	LC	Sch II	R
Pellorneidae (1)				
Puff-throated Babbler	<i>Pellorneum ruficeps</i> (Swainson, 1832)	LC	Sch II	R
Leiothrichidae (3)				
Brown-cheeked Fulvetta	<i>Alcippe poiocephala</i> (Jerdon, 1841)	LC	Sch II	R
Jungle Babbler	<i>Argya striata</i> (Dumont, 1823)	LC	Sch II	R
Yellow-billed Babbler	<i>Argya affinis</i> (Jerdon, 1845)	LC	Sch II	R
Sittidae (1)				
Velvet-fronted Nuthatch	<i>Sitta frontalis</i> (Swainson, 1820)	LC	Sch II	R
Sturnidae (7)				
Southern Hill Myna	<i>Gracula indica</i> (Cuvier, 1829)	LC	Sch I	R
Rosy Starling	<i>Pastor roseus</i> (Linnaeus, 1758)	LC	Sch II	WM
Indian Pied Starling	<i>Gracupica contra</i> (Linnaeus, 1758)	LC	Sch II	R
Brahminy Starling	<i>Sturnia pagodarum</i> (Gmelin, 1789)	LC	Sch II	R
Malabar Starling	<i>Sturnia blythii</i> (Jerdon, 1845)	NE	Sch II	R
Common Myna	<i>Acridotheres tristis</i> (Linnaeus, 1766)	LC	Sch II	R
Jungle Myna	<i>Acridotheres fuscus</i> (Wagler, 1827)	LC	Sch II	R

Order/Family/Common name	Scientific name	IUCN Red List status	WPA status	MS
Turdidae (2)				
Orange-headed Thrush	<i>Geokichla citrina</i> (Latham, 1790)	LC	Sch II	R
Indian Blackbird	<i>Turdus simillimus</i> (Jerdon, 1839)	LC	Sch II	R
Muscicapidae (12)				
Dark-sided Flycatcher	<i>Muscicapa sibirica</i> (Gmelin, 1789)	LC	Sch II	WM
Asian Brown Flycatcher	<i>Muscicapa dauurica</i> (Pallas, 1811)	LC	Sch II	WM
Indian Robin	<i>Copsychus fulicatus</i> (Linnaeus, 1766)	LC	Sch II	R
Oriental Magpie-Robin	<i>Copsychus saularis</i> (Linnaeus, 1758)	LC	Sch II	R
White-rumped Shama	<i>Copsychus malabaricus</i> (Scopoli, 1786)	LC	Sch II	R
Tickell's Blue Flycatcher	<i>Cyornis tickelliae</i> (Blyth, 1843)	LC	Sch II	R
Indian Blue Robin	<i>Larivora brunnea</i> (Hodgson, 1837)	LC	Sch II	WM
Malabar Whistling-Thrush	<i>Myophonus horsfieldii</i> (Vigors, 1831)	LC	Sch II	R
Taiga Flycatcher	<i>Ficedula albicilla</i> (Pallas, 1811)	LC	Sch II	WM
Red-breasted Flycatcher	<i>Ficedula parva</i> (Bechstein, 1792)	LC	Sch II	WM
Blue-capped Rock-Thrush	<i>Monticola cinclorhyncha</i> (Vigors, 1831)	LC	Sch II	WM
Blue Rock-Thrush	<i>Monticola solitarius</i> (Linnaeus, 1758)	LC	Sch II	WM
Dicaeidae (3)				
Thick-billed Flowerpecker	<i>Pachyglossa agilis</i> (Tickell, 1833)	LC	Sch II	R
Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i> (Latham, 1790)	LC	Sch II	R
Nilgiri Flowerpecker	<i>Dicaeum concolor</i> (Jerdon, 1840)	LC	Sch II	R
Nectariniidae (5)				
Purple-rumped Sunbird	<i>Leptocoma zeylonica</i> (Linnaeus, 1766)	LC	Sch II	R
Crimson-backed Sunbird	<i>Leptocoma minima</i> (Sykes, 1832)	LC	Sch II	R
Purple Sunbird	<i>Cinnyris asiaticus</i> (Latham, 1790)	LC	Sch II	R
Loten's Sunbird	<i>Cinnyris lotenius</i> (Linnaeus, 1766)	LC	Sch II	R
Little Spiderhunter	<i>Arachnothera longirostra</i> (Latham, 1790)	LC	Sch II	R
Irenidae (1)				
Asian Fairy-bluebird	<i>Irena puella</i> (Latham, 1790)	LC	Sch II	R
Chloropseidae (2)				
Jerdon's Leafbird	<i>Chloropsis jerdoni</i> (Blyth, 1844)	LC	Sch II	R
Golden-fronted Leafbird	<i>Chloropsis aurifrons</i> (Temminck, 1829)	LC	Sch II	R
Estrildidae (3)				
Scaly-breasted Munia	<i>Lonchura punctulata</i> (Linnaeus, 1758)	LC	Sch II	R
Black-throated Munia	<i>Lonchura kelaarti</i> (Jerdon, 1863)	LC	Sch II	R
White-rumped Munia	<i>Lonchura striata</i> (Linnaeus, 1766)	LC	Sch II	R
Passeridae (2)				
House Sparrow	<i>Passer domesticus</i> (Linnaeus, 1758)	LC	Sch II	R
Yellow-throated Sparrow	<i>Gymnoris xanthocollis</i> (Burton, 1838)	LC	Sch II	R
Motacillidae (7)				
Forest Wagtail	<i>Dendronanthus indicus</i> (Gmelin, 1789)	LC	Sch I	WM
Grey Wagtail	<i>Motacilla cinerea</i> (Tunstall, 1771)	LC	Sch II	R
White-browed Wagtail	<i>Motacilla maderaspatensis</i> (Gmelin, 1789)	LC	Sch II	WM
White Wagtail	<i>Motacilla alba</i> (Linnaeus, 1758)	LC	Sch II	WM
Paddyfield Pipit	<i>Anthus rufulus</i> (Vieillot, 1818)	LC	Sch II	R
Long-billed Pipit	<i>Anthus similis</i> (Jerdon, 1840)	LC	Sch II	R
Tawny Pipit	<i>Anthus campestris</i> (Linnaeus, 1758)	LC	Sch II	WM

IUCN—International Union for Conservation of Nature | LC—Least Concern | VU—Vulnerable | EN—Endangered | CR—Critically Endangered | NE—Not Evaluated | WPA—Indian Wildlife Protection (Amendment) Act, 2022 | Sch-I—Schedule List I species | Sch-II—Schedule List II species | MS—Migratory status | R—Resident | SM—Summer migrant | WM—Winter migrant | LM—Local migrant.

different categories of migration: residents (present throughout the year), summer migrants, winter migrants, and local migrants (Grimmett et al. 2011; Billerman et al. 2022; SolB 2023). Of the 206 species observed, 174 (84.54%) were categorised as resident, while 32 species (15.45%) were migratory. The migratory species included 27 winter visitors, one summer visitor, and four locally migrating species. During the survey period, only 27 winter migrants were observed, compared to the total list of 80 recorded thus far (based on secondary sources and the consolidated checklist).

Species of Conservation Significance

The study area hosts a diverse range of bird species, many of which are of significant conservation concern. Table 5 highlights categories under various conservation framework for the 206 species recorded from the study area.

IUCN Red List Categories

Least Concern (LC): A majority of 190 species are classified as 'Least Concern', indicating that they currently face no immediate threat of extinction.

Vulnerable (VU): Four species, namely, Nilgiri Wood Pigeon *Columba elphinstonii*, River Tern *Sterna aurantia*, Malabar Grey Hornbill *Ocyrceros griseus*, and Great Hornbill *Buceros bicornis*, are categorised as 'Vulnerable', reflecting a high risk of extinction in the wild.

Near Threatened (NT): Eight species are categorised as 'Near Threatened', meaning they are close to qualifying for a threatened category in the near future.

Not Evaluated (NE): Four species including Cinereous Tit *Parus cinereous*, Eastern Cattle-Egret *Ardea coromanda*, Malabar Starling *Sturnia blythii*, and Malabar Flameback *Chrysocolaptes socialis*, were not currently evaluated or recognised by the IUCN Red List.

National Level Legal Protections

Wildlife (Protection) Amendment Act 2022, Schedule I: According to the recent Wildlife Amendment 2022, 29 species found in the study area are listed under Schedule I. This designation affords them the highest level of protection under Indian law, reflecting their critical conservation status.

State Level Priorities

Apart from the IUCN Red List, based on the latest report of State of India's Birds 2023, species included in the list of high priority, such as the Osprey *Pandion haliaetus*, Blue Rock-Thrush *Monticola solitarius*, and Forest Wagtail *Dendronanthus indicus* are of high

conservation concern.

DISCUSSION

Our study represents the first attempt to establish a baseline inventory of avifaunal diversity in the Kaiga-Karwar region of Uttara Kannada District, Karnataka, where 206 species were recorded over the course of the survey period. Furthermore, combining primary data with secondary sources based on eBird and Kaiga Bird Marathon data, we found that the area harbours a total of 325 species belonging to 20 orders and 76 families (Refer to supplementary section for consolidated checklist). This corresponds to 58% of the birds found in the state of Karnataka and 23% of the total number of bird species recorded across the Indian subcontinent (till the last checklist update) (Praveen et al. 2025). Considering the short period of the survey and limitations in accessing certain remote areas within the study area, our baseline survey resulted in (excluding opportunistic sightings) 175 resident species and 20 endemic species, out of which 13 are exclusively endemic to the Western Ghats. In terms of species richness, the species accumulation curve shows that the sampling efforts within the study area appear sufficient to capture most of the species (Image 5). However, there is a likelihood of detecting some more species with additional sampling. The overall Shannon–Wiener diversity index ($H' = 4.24$) indicates a highly diverse bird community, a finding consistent with the ecological significance of this landscape as part of a global biodiversity hotspot. The relatively high Pielou's evenness value ($J' = 0.85$) further suggests that bird communities were not dominated by a few species, but rather that abundances were distributed relatively evenly across the recorded assemblages. Together, these indices indicate a preliminary trend towards a structurally balanced community. Based on our dataset, the results from the boxplots revealed higher median detection and wider variability in semi evergreen and tropical evergreen forests, whereas plantations indicated a comparatively lower and more uniform detection. Even though our results are preliminary, they are broadly consistent with earlier studies from the Western Ghats, which demonstrate that structurally complex forest habitats support higher bird assemblages compared to simplified or monoculture landscapes (Raman 2006; Ranganathan et al. 2010; Karanth et al. 2016). Specifically, indications of an elevated number of detections in semi evergreen and evergreen forests within these forested areas also indicate patterns reported by Hariharan et al. (2022), who

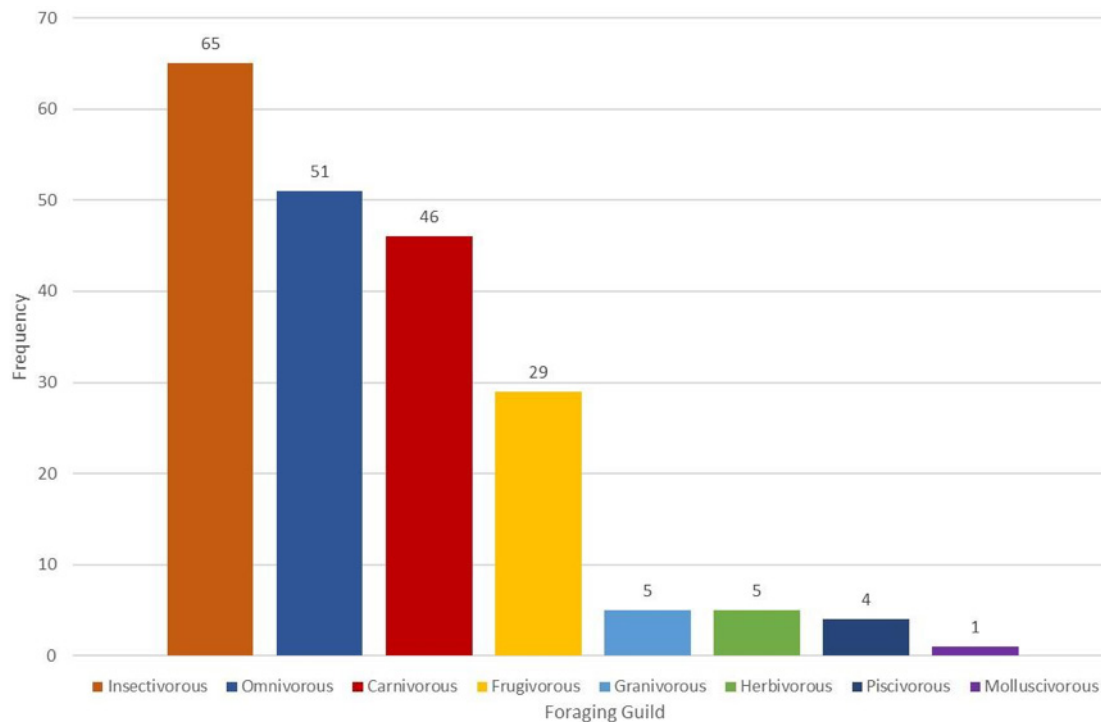


Image 4. Foraging guilds status of birds in the study area constituting both point count and opportunistic data.

Table 3. Birds species endemic to Western Ghats recorded in the study area.

	Common name	Scientific name
1	Nilgiri Wood-Pigeon	<i>Columba elphinstonii</i>
2	Grey-fronted Green-Pigeon	<i>Treron affinis</i>
3	Malabar Imperial-Pigeon	<i>Ducula cuprea</i>
4	Malabar Grey Hornbill	<i>Ocyrceros griseus</i>
5	Malabar Barbet	<i>Psilopogon malabaricus</i>
6	Malabar Flameback	<i>Chrysocolaptes socialis</i>
7	Malabar Parakeet	<i>Psittacula columboides</i>
8	Malabar Woodshrike	<i>Tephrodornis sylvicola</i>
9	Grey-headed Bulbul	<i>Microtarsus priocephalus</i>
10	Flame-throated Bulbul	<i>Rubigula gularis</i>
11	Malabar Starling	<i>Sturnia blythii</i>
12	Nilgiri Flowerpecker	<i>Dicaeum concolor</i>
13	Crimson-backed Sunbird	<i>Leptocoma minima</i>

found that mixed-species flocks preferentially used semi evergreen and evergreen habitats over more degraded habitats, reflecting the higher resource diversity and structural complexity of these forests. Together, these studies underscore the conservation importance of semi evergreen and evergreen forests in sustaining diverse avian communities within the Western Ghats.

Our rank-abundance curve based on our baseline survey efforts showed the dominance of White-cheeked Barbet *Psilopogon viridis*, an obligate frugivore in both semi evergreen and tropical evergreen forests, while the abundance of Greater Racket-tailed Drongo *Dicrurus paradiseus* was higher in the mixed forests. The dominance of medium-sized frugivore species, such as the White-cheeked Barbet, highlights the importance of fruit-bearing trees, as this species primarily feeds on fruits and plays a key role in seed dispersal. Overall, 29 frugivore species, such as the Malabar Imperial-Pigeon *Ducula cuprea*, Nilgiri Wood-Pigeon, Grey-headed Bulbul *Microtarsus priocephalus*, Flame-throated Bulbul *Rubigula gularis*, were also observed in a variety of habitats within the study area. Although our data are preliminary and limited in temporal and spatial replication, the presence of a diverse frugivore assemblage across multiple habitats suggests that fruiting resources may play an important role in structuring local bird communities. Similar patterns have been reported elsewhere in the Western Ghats, where both forest cover and fruit crop size were shown to influence frugivore visitation and seed dispersal services (Gopal et al. 2020).

Furthermore, the semi evergreen and tropical evergreen forests of the Anshi-Dandeli region are critical

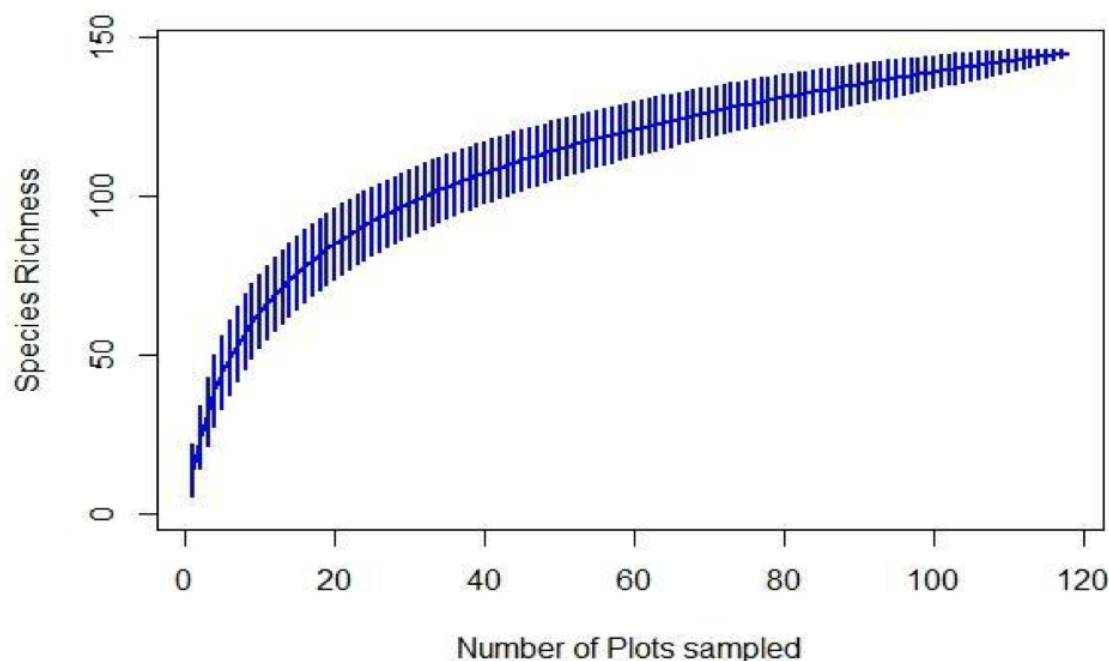


Image 5. Species accumulation curve in the study area based on point count locations.

Table 4. Species richness by forest types in the study area.

Forest type	Shannon-Weiner diversity index (H')	Pielou's evenness index (J')	Species richness	Total abundance of species	Most abundant species	Ratio of the most abundant species/ Total abundance
Mixed forest	3.824	0.663	69	253	grtd (17)	0.067
Moist deciduous	4.102	0.581	102	713	pusu (44)	0.062
Plantation	2.78	0.805	20	37	shmy (5)	0.135
Semi evergreen	4.152	0.557	113	970	wcba (54)	0.056
Tropical evergreen	3.975	0.605	87	701	wcba (48)	0.068

grtd—Greater Racket-tailed Drongo | pusu—Purple Sunbird | shmy—Souther Hill Myna | wcba—White-cheeked Barbet.

habitats for large frugivores such as the Great Hornbill, Malabar Pied Hornbill *Anthraceros coronatus*, and Malabar Grey Hornbill. According to Mudappa & Raman (2009), the Kali (Anshi-Dandeli) area is one of the key regions for the conservation of the Malabar Pied Hornbill. Besides the protected areas, the Great Hornbills have a stronghold in the Tiger Reserve as well as adjacent reserve forests, where key nesting and feeding habitats are available. During the present survey, a congregation of 14 foraging individuals of Great Hornbills were observed at a time on different *Ficus* spp. near Hartuga Village. Moreover, the trees adjacent to the riverine areas, especially around Kali, act as major roosting sites for Malabar Pied Hornbills (Sneha & Davidar 2011).

The Kali River system further supports a diverse assemblage of riverine bird species, many of which are likely dependent on aquatic invertebrates and fish found

within this habitat. Notably, species belonging to the families of Ardeidae, Ciconiidae, and Phalacrocoracidae were also observed during the survey period. Additionally, several riverine raptors, including the Brahminy Kite *Haliastur indus*, White-bellied Sea-Eagle *Ichthyophaga leucogaster*, Black Kite *Milvus migrans*, and Osprey, were regularly recorded roosting and hunting across multiple locations. Interestingly, we also observed an intriguing behaviour of mass congregation of these raptors near the Kadra Dam spillway, particularly in the afternoons on weekends, coinciding with the large-scale dumping of poultry waste. This pattern may be suggestive of a strong association between raptor activity and anthropogenic food subsidies in the region, which requires further evaluation in the future.

In addition to our systematic surveys, opportunistic observations yielded records of cryptic species such as

Table 5. Status of species of conservation significance (SCS) in the study area.

SCS	Categories	Frequency
IUCN Red List categories	Least Concern	189
	Near Threatened	10
	Vulnerable	4
	Not Evaluated	3
National & international legal protections	WPA-Schedule I	29
State of India's Birds 2023	High Priority	9
	Moderate Priority	55

Malayan Night Heron *Gorsachius melanolophus*, and the Sri Lankan Frogmouth *Batrachostomus moniliger*. However, some species commonly reported from the region, including Legge's Hawk Eagle *Nisaetus kelaarti*, Black-backed Dwarf Kingfisher *Ceyx erithaca*, and Blue-eared Kingfisher *Alcedo meninting* along with resident-endemic species such as the White-bellied Blue Flycatcher *Cyornis pallidipes*, White-bellied Treepie *Dendrocitta leucogastra*, and Rufous Babbler *Argya subrufa* were not detected during our primary survey. This likely reflects seasonal and methodological limitations rather than a true absence.

Migratory Birds

The Western Ghats, with its diverse forest types and perennial water sources, serve as a critical stopover site for many species. For the birds travelling between their breeding grounds in the Palearctic and wintering habitats in southern and southeastern Asia, the study area acts as a vital migratory corridor. In this study, we documented 32 migratory species, including 27 winter migrants. Notable among them were warblers such as Blyth's Reed Warbler *Acrocephalus dumetorum*, Large-billed Leaf Warbler *Phylloscopus magnirostris*, and Western-crowned Warbler *Phylloscopus occipitalis*. The occurrence of these species in these areas highlights that the region is an important habitat for migratory birds. Although our surveys documented a number of migratory species, the richness observed was lower compared to the 80 species previously reported from the broader region. A likely explanation for this discrepancy is the temporal window of sampling, which was restricted to the summer months (February–June). This period coincides with the northward migration of many winter visitors, thereby reducing their detectability within the study area. Consequently, our data may underrepresent the diversity and habitat use of migratory species. To address this limitation, future studies should adopt a multi-seasonal framework to

capture temporal variation in species presence and provide a more robust understanding of migratory dynamics in the region. The study area within the KTR, as well as reserve forests encompassing Karwar forest division and Yellapur forest division, plays a crucial role in safeguarding the avian biodiversity of the Western Ghats. Our baseline surveys documented a rich diversity of bird species across different habitats, ranging from tropical evergreen to moist deciduous forests. Recent landscape-level analyses highlight that the Uttara Kannada district has lost nearly a third of its evergreen forest cover in the past four decades, accompanied by a sharp rise in built-up areas and monoculture plantations (Ramachandra et al. 2024). Such land-use changes alter the structure and functioning of forest ecosystems, threaten resource bases, and reduce habitat quality for forest-dependent species. Additionally, our observations of juvenile Grey-headed Fish Eagles *Ichthyophaga ichthyaetus* and White-bellied Sea Eagles *Ichthyophaga leucogaster* during boat surveys (as observed by RP, NR on 01st April 2024 and 04th April 2024 respectively) may indicate local breeding, suggesting that the riverine habitats of the Kali river could serve as potential breeding sites for these species. Overall, our findings emphasise that safeguarding the ecological integrity of these habitats within this region is central to conserving the avifaunal diversity of the Western Ghats. However, the current dataset, being restricted to a single season, represents only a preliminary baseline. Given ongoing land-use changes and the ecological sensitivity of this landscape, long-term and multi-seasonal monitoring of bird communities across habitat types is essential to track temporal dynamics, detect early warning signals of change, and inform adaptive conservation strategies.

REFERENCES

- Ali, S. (2002). *The Book of Indian Birds*, 13th edition. Bombay Natural History Society & Oxford University Press, Mumbai, 326 pp.
- Aarif, K.M., A. Nefla, K.A. Rubeena, Y. Xu, Z. Bouragaoui, M. Nasser, C.T. Shifa, T.R. Athira, K. Jishnu, J. Anand, S. Manokaran, P.P. Moosa, A. Gopinath, O.R. Reshi, K.M. Rajaneesh, H. Byju, T.V. Joydas, K.P. Manikandan, M.I. Naikoo & C. Sonne (2025). Assessing environmental change and population declines of large wading birds in southwestern India. *Environmental and Sustainability Indicators* 25: 100572. <https://doi.org/10.1016/j.indic.2024.100572>
- Archana, T.R., A. Nefla, H. Byju, S. Almaroofi, O.R. Reshi, A.S. Alatawi & K.M. Arif (2024). Effects of plant and avian frugivore interaction networks on landscape patterns and seed dispersal functions in the southern Western Ghats, India. *Ornithological Science* 23(1): 35–43. <https://doi.org/10.2326/osj.23.35>
- Barlow, J., C.A. Peres, L.M.P. Henriques, P.C. Stouffer & J.M. Wunderle (2006). The responses of understorey birds to forest fragmentation, logging and wildfires: An Amazonian synthesis. *Biological*

- Conservation 128(2): 182–192. <https://doi.org/10.1016/j.biocon.2005.09.028>
- Barve, S. & R. Warrier (2013). Bird diversity of the Sharavathy landscape, Karnataka. *Indian Birds* 8(3): 57–61.
- Bhat, R.A. & C.B. Ganesh (2014). Bird diversity and status in western ghats of Katgal (Uttara Kannada Dist.), Karnataka State. *Ecology Environment and Conservation* 20(1): 181–186.
- Bibby, C.J., N.D. Burgess, D.A. Hill & S.H. Mustoe (2000). *Bird Census Techniques*, 2nd edition. Academic Press Inc, 302 pp.
- Billerman, S.M., B.K. Keeney, P.G. Rodewald & T.S. Schulenberg (Eds.) (2022). *Birds of the World*. Cornell Laboratory of Ornithology, Ithaca, New York, USA. <https://birdsoftheworld.org/bow/home>. Accessed on 20.xii.2024.
- Champion, H.G. & S.K. Seth (1968). *A Revised Survey of the Forest Types of India*. Manager of Publications, Delhi, 404 pp.
- Clements, J.F., P.C. Rasmussen, T.S. Schulenberg, M.J. Iliff, T.A. Fredericks, J.A. Gerbracht, D. Lepage, A. Spencer, S.M. Billerman, B.L. Sullivan, M. Smith & C.L. Wood (2024). The eBird/Clements checklist of Birds of the World: v2024. <https://www.birds.cornell.edu/clementschecklist/download/>. Downloaded on 20.vi.2024.
- Daniels, R.J.R., N.V. Joshi & M. Gadgil (1990). Changes in the bird fauna of Uttara Kannada, India, in relation to changes in land use over the past century. *Biological Conservation* 52(1): 37–48. [https://doi.org/10.1016/0006-3207\(90\)90013-F](https://doi.org/10.1016/0006-3207(90)90013-F)
- Daniels, R.J., N.V. Joshi & M. Gadgil (1992). On the relationship between bird and woody plant species diversity in the Uttara Kannada district of south India. *Proceedings of the National Academy of Sciences* 89(12): 5311–5315. <https://doi.org/10.1073/pnas.89.12.5311>
- Davidson, J.A.G. (1898a). The birds of North Kanara. *Journal of the Bombay Natural History Society* 11(4): 652–679.
- Davidson, J.A.G. (1898b). The birds of North Kanara. Part II. *Journal of the Bombay Natural History Society* 12(1): 43–72.
- Gadgil, M., R.R. Daniels, K.N. Ganeshaiah, S.N. Prasad, M.S.R. Murthy, C.S. Jha, B.R. Ramesh & K.A. Subramanian (2011). Mapping ecologically sensitive, significant and salient areas of Western Ghats: proposed protocols and methodology. *Current Science* 100(2): 175–182.
- Grimmett, R., C. Inskipp & T. Inskipp (2011). *Birds of the Indian Subcontinent*, 2nd Edition. Helm Field Guides, Oxford, UK, 528 pp.
- Gopal, A., D. Mudappa, T.R.S. Raman & R. Naniwadekar (2020). Forest cover and fruit crop size differentially influence frugivory of select rainforest tree species in Western Ghats, India. *Biotropica* 52(5): 871–883. <https://doi.org/10.1111/btp.12810>
- Hariharan, P., P. Bangal, H. Sridhar & K. Shanker (2022). Habitat use by mixed-species bird flocks in tropical forests of the Western Ghats, India. *Journal of Tropical Ecology* 38(6): 393–400. <https://doi.org/10.1017/S026646742200030X>
- IUCN (2024). The IUCN Red List of Threatened Species. Version 2024-1. <https://www.iucnredlist.org>. Accessed on 3.iv.2024.
- Karanth, K.K., S. Vishnupriya, S. Dalvi, S. Arjun, P. Ravishankar, S. Sharma, P. Robbins & A. Chhatre (2016). Producing Diversity: Agroforests Sustain Avian Richness and Abundance in India's Western Ghats. *Frontiers in Ecology and Evolution* 4: 111. <https://doi.org/10.3389/fevo.2016.00111>
- Kotangale, J.P. & T.K. Ghosh (2000). Avifauna Diversity in and Around Kaiga in Uttara Kannada District of Karnataka State. *Environment Conservation Journal* 1(1): 1–7. <https://doi.org/10.36953/ecj.2000.010101>
- Matuoka, M.A., M. Benchimol, J.M. de Almeida-Rocha & J.C. Morante-Filho (2020). Effects of anthropogenic disturbances on bird functional diversity: A global meta-analysis. *Ecological Indicators* 116: 106471. <https://doi.org/10.1016/j.ecolind.2020.106471>
- Menon, T. & G. Shahabuddin (2021). Assessing woodpeckers as indicators of bird diversity and habitat structure in managed forests. *Biodiversity and Conservation* 30: 1689–1704. <https://doi.org/10.1007/s10531-021-02164-0>
- Mudappa, D. & T.R.S. Raman (2009). A conservation status survey of hornbills (Bucerotidae) in the Western Ghats, India. *Indian Birds* 5(4): 90–102.
- Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A. Da Fonseca & J. Kent (2000). Biodiversity hotspots for conservation priorities. *Nature* 403(6772): 853–858. <https://doi.org/10.1038/35002501>
- Pielou, E.C. (1966). The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology* 13(1): 131–144. [https://doi.org/10.1016/0022-5193\(66\)90013-0](https://doi.org/10.1016/0022-5193(66)90013-0)
- Pillay, R., M. Venter, J. Aragon-Osejo, P. González-del-Piiego, A.J. Hansen, J.E. Watson & O. Venter (2021). Tropical forests are home to over half of the world's vertebrate species. *Frontiers in Ecology and the Environment* 20(1): 10–15. <https://doi.org/10.1002/fee.2420>
- Praveen, J., S. Subramanya & V.M. Raj (2025). A checklist of the birds of Karnataka, India (v7.0). Website: <http://www.indianbirds.in/indian-states/>. Accessed on 20.vi.2025.
- Puttaraju, K. (2014). Avifaunal diversity of the Southern Western Ghats with special reference to Kaiga - Karwar region - A checklist. *Journal of Aquatic Biology and Fisheries* 2(2): 512–519. <https://keralamarinelife.in/JournalofAquaticBiologyandFisheries.html>
- R Core Team (2024). R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. <https://r-project.org>
- Ramachandra, T.V., S. Bharath, M.D. Subashchandran, G.R. Rao, M. Vishnu & B. Prasanna (2024). Monitoring land use dynamics and diversity of flora in Uttara Kannada district, Karnataka, Central Western Ghats, India, pp 21–46. In: Dutta, D., A. Kundu & N.R. Patel (eds.). *Vegetation Dynamics and Crop Stress*. Academic Press. <https://doi.org/10.1016/b978-0-323-95616-1.00002-x>
- Ramachandra, T.V., S. Chandran, N.V. Joshi & B. Setturu (2013). Land use changes with the implementation of developmental projects in Uttara Kannada District. Sahyadri Conservation Series 31, ENVIS Technical Report 61, ENVIS, Centre for Ecological Sciences, Indian Institute of science, Bangalore, 94 pp.
- Raman, T.R.S. (2006). Effects of Habitat Structure and Adjacent Habitats on Birds in Tropical Rainforest Fragments and Shaded Plantations in the Western Ghats, India. *Biodiversity and Conservation* 15(4): 1577–1607. <https://doi.org/10.1007/s10531-005-2352-5>
- Ranganathan, J., J. Krishnaswamy & M.O. Anand (2010). Landscape-level effects on avifauna within tropical agriculture in the Western Ghats: Insights for management and conservation. *Biological Conservation* 143(12): 2909–2917. <https://doi.org/10.1016/j.biocon.2010.04.018>
- Sekercioglu, C.H. (2006). Increasing awareness of avian ecological function. *Trends in Ecology & Evolution* 21(8): 464–471. <https://doi.org/10.1016/j.tree.2006.05.007>
- Sekercioglu, C.H. (2012). Bird functional diversity and ecosystem services in tropical forests, agroforests, and agricultural areas. *Journal of Ornithology* 153(1): 153–161. <https://doi.org/10.1007/s10336-012-0869-4>
- Shannon, C.E. & W. Weaver (1963). *The Mathematical Theory of Communication*, 1st Edition). University of Illinois Press, 144 pp.
- Sneha, V. & P. Davidar (2011). Status Survey of the Malabar Pied Hornbill in the Dandeli region, Northern Western Ghats, India. *The Raffles Bulletin of Zoology* 24: 45–51.
- SoIB (2023). State of India's Birds, 2023: Range, trends, and conservation status. The SoIB Partnership, 119 pp. <https://doi.org/10.5281/zenodo.11124590>
- The Gazette of India (2024). Ministry of Environment, Forest and Climate Change Notification, July 2024. <https://moef.gov.in/storage/tender/1723024218.pdf>. Downloaded on 31.viii.2024.
- Whelan, C.J., D.G. Wenny & R.J. Marquis (2008). Ecosystem services provided by birds. *Annals of the New York Academy of Sciences* 1134(1): 25–60. <https://doi.org/10.1196/annals.1439.003>

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