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Seasonal Dynamics and Ecological Significance of Bird Diversity in Tipeshwar Wildlife Sanctuary, Maharashtra, India

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Abstract

This study aimed to assess the bird richness and abundance in the Tipeshwar Wildlife Sanctuary, located in the Yavatmal district of Maharashtra, India. The comprehensive survey identified a total of 256 bird species within the sanctuary, shedding light on the dynamic patterns of bird abundance across various seasons. The findings indicate an increase in bird population during the monsoon and winter months, contrasting with a decline observed in the summer and pre-monsoon periods. These results contribute to the understanding of the avian community within the Tipeshwar Wildlife Sanctuary, emphasizing its role as a habitat with a healthy environmental setup conducive to supporting diverse bird populations. The variations in bird abundance throughout the seasons underscore the dynamic nature of avian communities within this ecosystem.

Keywords: Bird Diversity, Maharashtra, Shannon Index, Species Richness, Tipeshwar Wildlife Sanctuary, Yavatmal,

Introduction

Nestled in the Yavatmal district of Maharashtra, the Tipeshwar Wildlife Sanctuary stands as a thriving ecosystem hosting a diverse avian community, making it a focal point for conservation, tourism, and community empowerment. Birds, acting as key indicators of environmental health and biodiversity, provide insights into the global ecological balance (Smith and Jones, 2018; Whittaker, 1972). This comprehensive study of bird populations contributes to a broader understanding of ecological systems, aligning with the principles of holistic wildlife conservation.

Tipeshwar, renowned for its avian life, is also home to the flagship species, the tiger. Studying bird diversity alongside flagship species-focused conservation enriches our understanding of interconnected ecosystems (Anderson et al., 2016; Caro & O'Doherty, 1999), ensuring conservation efforts extend beyond tigers to benefit the entire spectrum of flora and fauna. The avian diversity of Tipeshwar acts as a magnet for eco-tourism, significantly contributing to local economies while promoting a harmonious relationship between conservation and tourism (Buckley, 2004). The vibrant birdlife in the sanctuary becomes a tourism attraction, aligning with the core objectives of sustainable tourism practices and conservation.

A robust understanding of bird diversity empowers field staff and guides, enhancing their capacity to provide immersive experiences to visitors. Well-informed guides play a pivotal role in ecotourism, facilitating nature interpretation and education (McGill et al., 2007; Gössling et al., 2012). This empowerment extends beyond birdwatching to encompass a broader appreciation of the entire ecosystem. The study of bird diversity in Tipeshwar contributes to bridging knowledge gaps in holistic wildlife conservation (Pimm et al., 2014). It aids

in understanding how various taxonomic groups interact within the ecosystem, fostering a more comprehensive conservation philosophy (Smith and Jones, 2018).

Bird diversity forms the cornerstone of ecotourism's nature education and interpretation objectives, enriching the nature-based experiences of visitors and promoting environmental awareness (Honey, 2008). Interpretation programs are centred around birdlife contribute to the broader goal of fostering an intimate connection between visitors and the sanctuary (Human et al. 2020) underscored the critical role of comprehending species richness and abundance for devising effective conservation strategies within protected areas. Recognizing bird diversity as a pivotal indicator of environmental health (Smith and Jones, 2018), the investigation into the seasonal dynamics of bird populations in this sanctuary gains significance. Anderson et al. (2016) have previously emphasized the pivotal contribution of protected areas in biodiversity conservation.

The nuanced concept of species diversity, extensively discussed in ecological literature (Magurran, 1988), necessitates a holistic evaluation considering both species richness and abundance. McGill et al. (2007) demonstrated the interconnectedness of these factors in their work on community ecology. Incorporating the principles of community ecology (McGill et al., 2007), this research provides insights into how bird populations interact within the sanctuary's ecological tapestry. Such understanding is foundational for implementing targeted conservation measures that go beyond species-specific approaches. The uniqueness of the Tipeshwar Wildlife Sanctuary's ecosystem underscores the need for tailored conservation strategies, considering the complex relationships between bird species.

This study of bird diversity in Tipeshwar transcends its ornithological significance, becoming a conduit for promoting holistic wildlife conservation, sustainable tourism practices, and community engagement. It signifies the interconnectedness of all life forms within the sanctuary and underscores the importance of preserving this delicate balance. In this context, present study is designed to assess the Seasonal Dynamics and Ecological Significance of Bird Diversity in Tipeshwar Wildlife Sanctuary, Maharashtra, India

Material and Methods:

Study area: The Tipeshwar Wildlife Sanctuary situated in Yavatmal District of Indian state Maharashtra. It is located between of 78º20’22’’ to 78º47’56’’ East and 19º50’59’’ to 19º55’44’’ North with total area of 148.63 sq. km. It constitutes compact patches of dense forest cover with meadows and a seasonal wetland. It has great utility from the point of view of wildlife and bio-diversity conservation. The main portion of this protected area constitutes the dry teak bearing forest. The climatic condition of this area is characterized by a hot summer, well-distributed rainfall during the south-west monsoon season and generally dry weather during rest of the year. The cold season is from December to February (Yavatmal Gazetteer 2019).

Survey method: The bird survey was conducted from the study sites for a period of 1 year between 1 Dec. 2017 to 30 Nov. 2018; using standard point count method. Study area was visited once in a week from early morning (6:00 AM) to afternoon (11:00 AM) during good weather periods. Binocular (Nikon 10×40 8.2 0) and camera (Nikon D700, 150-500 Sigma lens) was used for bird watching and to photograph them. Bird calls also count in the survey.

Species identification: Photographs taken from field were identified and classified on the basis of the “The Book of Indian Birds” by Ali (eds.1996) and “Pocket Guide of Birds of the Indian Subcontinent” by Grimmet

and Inskipp (eds.2000). Diversity of bird was taxonomically classified and categorized on threaten scale by using latest IUCN Red list (Ali 1996; Grimmet and Inskipp 2000).

Data analysis:

The mean values of the pooled species occurrence data were used to calculate the monthly and Stations diversity and to categorize the local status of species. Species occurrence analysis such as Relative Occurrence, Mean % occurrence carried out by Microsoft excel programme (Menhinick, 1964; Basavarajappa, 2006). The similarity association matrix upon which the cluster based was computed using the nearest neighbour pair linkage algorithm of Euclidean distance index for presence and absence data (Hammer *et al.,* 2001).
The Diversity data as Shannon diversity, Margalef richness and Pielou equitability quantified with the help of PAST Version 1.60 software (Hammer *et al.,* 2001). The differences between the diversity and evenness indices of among different study months and Stations were statistically analysed by ANOVA. The statistical analyses were performed by following (Zar, 1999) with using the SPSS version-10 software.

Result and Discussion:

The investigation into the avian diversity of the Tipeshwar Wildlife Sanctuary has yielded significant findings, shedding light on the ecological dynamics of this region. The study meticulously documented an impressive presence of 256 distinct bird species within the sanctuary, showcasing the richness of avian biodiversity (Table 1). Among these, 171 species were identified as local residents, 75 as winter migrants, 7 as local migrants, 2 as passage migrants, and 1 as a monsoon visitor. Further classification revealed that 118 species were very common, 80 were common, 50 were uncommon, 7 were rare, and 1 was classified as very rare. The examination of bird abundance revealed a discernible seasonal pattern. Abundance reached its peak during the monsoon and winter months, indicating favorable conditions for avian populations during these periods. In contrast, a noticeable decline in bird abundance was observed during the summer and pre-monsoon periods.
The application of the Shannon index played a pivotal role in assessing species diversity within the sanctuary. Beyond quantifying the sheer number of species, the index provided valuable insights into the evenness of their distribution within the population. This nuanced approach to diversity measurement adds depth to our understanding of the ecological intricacies of Tipeshwar, emphasizing the importance of not only species richness but also the equitable distribution of these species within the ecosystem. These results significantly contribute to our knowledge of the avian community within the Tipeshwar Wildlife Sanctuary, providing a foundation for informed conservation strategies and further ecological studies.
The findings from the investigation into the bird diversity of the Tipeshwar Wildlife Sanctuary reinforce the sanctuary's ecological significance. The identified bird species, seasonal abundance patterns, and the insights gained from the Shannon index collectively contribute to a holistic understanding of the sanctuary's avian community. This comprehensive knowledge is integral for formulating effective conservation strategies and promoting sustainable practices that ensure the continued thriving of both bird populations and the broader ecosystem. The comprehensive study of bird diversity in the Tipeshwar Wildlife Sanctuary underscores the ecological importance of avian communities as indicators of environmental health and biodiversity (Smith and Jones, 2018; Whittaker, 1972). The thriving avian community in Tipeshwar contributes significantly to the overall ecological balance, aligning with the principles of holistic wildlife conservation (Lindenmayer et al., 2010; Rosenzweig, 1995). The dynamics of bird populations, as indicated by the Shannon index, provide nuanced insights into the health and resilience of the sanctuary's ecosystem (MacArthur, 1955; Magurran, 1988).
The coexistence of diverse bird species with the sanctuary's flagship species, the tiger, highlights the interconnected nature of ecosystems (Anderson et al., 2016; Caro & O'Doherty, 1999). Studying bird diversity alongside flagship species-focused conservation advocates for a comprehensive approach to safeguarding the entire spectrum of flora and fauna (Kissling et al., 2018; Simberloff, 1998). This inclusive strategy ensures that conservation efforts transcend individual species, contributing to the holistic well-being of the ecosystem. The avian diversity of Tipeshwar emerges as a scientific asset and a catalyst for eco-tourism (Smith and Jones, 2018; Buckley, 2004). Birdwatching tourism, driven by vibrant birdlife, becomes a sustainable attraction, offering economic benefits to local communities (Gupta and Kumar, 2015; Stralberg et al., 2015). The discussion emphasizes the harmonious relationship between conservation and tourism. Additionally, a robust understanding of bird diversity empowers field staff and guides, enhancing the quality of eco-tourism experiences and promoting broader ecosystem appreciation (Newsome et al., 2015; Stenseke et al., 2016).

The study significantly contributes to bridging knowledge gaps in holistic wildlife conservation (Smith and Jones, 2018; Pimm et al., 2014). By unraveling interactions between various taxonomic groups within the ecosystem, the study fosters a more comprehensive conservation philosophy (Lindenmayer and Fischer, 2013; Noss, 1990). This knowledge is pivotal for crafting targeted conservation strategies that account for intricate relationships between diverse species, including birds, mammals, and plants. Bird diversity, forming the cornerstone of ecotourism's nature education and interpretation objectives, enhances visitors' nature-based experiences (Anderson et al., 2016; Honey, 2008). Interpretation programs centered around birdlife contribute to the broader goal of fostering an intimate connection between visitors and the sanctuary. This aligns with the core objectives of ecotourism, emphasizing nature education and environmental sensitivity (Ballantyne et al., 2007; Buckley, 2019).

Table 1: Bird diversity of Tipeshwar wildlife Sanctuary, Maharashtra, India

Sr. No.	Bird Species, Family, Order		Res. Status	Occ. Status	Abundance in the year
	Order: GALLIFORMES (Francolins, Quails) **Family : Phasianidae**				
1.	Grey Francolin	*Francolinus pondicerianus*	Rs	VC	296
2.	Painted Francolin	*Francolinus pictus*	Rs	VC	107
3.	Common Quail	*Coturnix coturnix*	WM	C	50
4.	Rain Quail	*Coturnix coromandelica*	Rs	C	50
5.	Jungle Bush Quail	*Perdicula asiatica*	Rs	C	118
6.	Rock Bush Quail	*Perdicula argoondah*	Rs	C	100
7.	Indian Peafowl	*Pavo cristatus*	Rs	VC	121
	Family : Turnicidae (Buttonquails)				
8.	Barred Buttonquail	*Turnix suscitator*	Rs	C	38
9.	Small Buttonquail	*Turnix sylvatica*	Rs	C	02
10.	Yellow-legged Buttonquail	*Turnix tanki*	Rs	UC	02
	Order: ANSERIFORMES (Ducks, Geese) **Family : DENDROCYGNDIAE**				
11.	Lesser Whistling-Duck	*Dendrocygna javanica*	Rs	VC	37
	Family : ANATIDAE				
12.	Indian Spot-billed Duck	*Anas poecilorhyncha*	Rs	VC	39
13.	Ruddy Shelduck	*Tadorna ferruginea*	WM	VC	23
	Order: PICIFORMES (Woodpeckers, Barbets) **Family : PICIDAE**				
14.	Eurasian Wryneck	*Jynx torquilla*	WM	VC	12
15.	Yellow-crowned Woodpecker	*Dendrocopos mahrattensis*	Rs	VC	42
16.	Brown-capped Pigmy Woodpecker	*Dendrocopos nanus*	Rs	VC	38
17.	White-naped Woodpecker	*Chrysocolaptes festivus*	Rs	VC	07
18.	Common Flame Black	*Dryocopus javensis*	Rs	VC	12
	Family : MEGALAIMIDAE				
19.	Brown-headed Barbet	*Megalaima zeylanica*	Rs	UC	01
20.	Coppersmith Barbet	*Megalaima haemacephala*	Rs	VC	33
	Order: BUCEROTIFORMES : Hornbills **Family : BUCEROTIDAE**				
21.	Indian Grey Hornbill	*Ocyceros birostris*	Rs	VC	12
	Order: UPEPIFORMES (Hoopoes) **Family : UPUPIDAE**				
22.	Common Hoopoe	*Upupa epops*	Rs	VC	152
	Order: CORACIIFORMES (Rollers, Kingfishers, Bee-eaters) **Family : CORACIIDAE**				

23.	Indian Roller	*Coracias benghalensis*	Rs	VC	621
24.	European Roller	*Coracias garrulus*	PM	UC	01
	Family : ALCEDINIDAE				
25.	Common Kingfisher	*Alcedo atthis*	Rs	VC	96
	Family : HALCYONIDAE				
26.	White Throated Kingfisher	*Halcyon smyrnensis*	Rs	VC	162
27.	Stork billed Kingfisher	*Halcyon capensis*	Rs	UC	01
	Family : CERYLIDAE				
28.	Pied Kingfisher	*Ceryle rudis*	Rs	VC	71
	Family : MEROPIDAE				
29.	Blue-tailed Bee-eater	*Merops philippinus*	WM	UC	07
30.	Blue-cheeked Bee-eater	*Merops persicus*	PM	UC	05
31.	Green Bee-eater	*Merops orientalis*	Rs	VC	414
	Order: CUCULIFORMES : Cuckoos **Family : CUCULIDAE**				
32.	Pied Cuckoo	*Clamator jacobinus*	MV	C	18
33.	Common Hawk Cuckoo	*Hierococcyx varius*	Rs	C	07
34.	Indian Cuckoo	*Cuculus micropterus*	WM	UC	01
35.	Eurasian Cuckoo	*Cuculus canorus*	WM	C	03
36.	Grey-bellied Cuckoo	*Cacomantis passerinus*	WM	C	16
37.	Asian Koel	*Eudynamys scolopacea*	Rs	VC	72
38.	Sirkeer Malkoha	*Taccocua (Phaenicophaeus leschenaultii)*	Rs	VC	120
	Family : CENTROPODIDAE				
39.	Southern Coucal	*Centropus (sinensis)Parroti*	Rs	VC	208
	Family : PSITTACIDAE				
40.	Alexandrine Parakeet	*Psittacula eupatria*	Rs	UC	15
41.	Rose-ringed Parakeet	*Psittacula krameri*	Rs	VC	462
42.	Plum-headed Parakeet	*Psittacula cyanocephala*	Rs	VC	344
	Order: APODIFORMES : Swifts **Family : APODIDAE**				
43.	Little Swift	*Apus affinis*	Rs	VC	35
44.	Asian Palm Swift	*Cypsiurus belasiensis*	Rs	VC	25
	Family : HEMIPROCNIDAE				
45.	Crested Tree Swift	*Hemiprocne coronata*	LM	C	12
	Order: STRIGIFORMES : Owls, Nightjars **Family : TYTONIDAE**				
46.	Barn Owl	*Tyto alba*	Rs	VC	15
	Family :STRIGIDAE				
47.	Indian Scops Owl	*Otus bakkamoena*	Rs	UC	02
48.	Indian Eagle-Owl	*Bubo bubo*	Rs	C	04
49.	Brown Fish- Owl	*Ketupa zeylonensis*	Rs	UC	04
50.	Mottled Wood Owl	*Strix ocellata*	Rs	C	05
51.	Brown Wood Owl	*Strix leptogrammica*	Rs	UC	03
52.	Spotted Owlet	*Athene brama*	Rs	VC	164
53.	Jungle Owlet	*Glaucidium radiatum*	Rs	UC	02
54.	Brown Hawk- Owl	*Ninox scutulata*	Rs	UC	01
	Family : CAPRIMULGIDAE				
55.	Grey (Indian Jungle) Nightjar	*Caprimulgus indicus*	LM	C	03

56.	Indian Nightjar	*Caprimulgus asiaticus*	Rs	VC	121
57.	Savanna Nightjar	*Caprimulgus affinis*	LM	C	12
	Order: COLUMBIFORMES : Pigeons **Family : COLUMBIDAE**				
58.	Rock Pigeon	*Columba livia*	Rs	VC	247
59.	Yellow-footed Green Pigeon	*Treron Phoenicopterus*	Rs	VC	65
60.	Orange-breasted Green-Pigeon	*Treron bicincta*	LM	R	01
61.	Oriental Turtle Dove	*Streptopelia orientalis*	WM	UC	01
62.	Eurasian Collared-Dove	*Streptopelia decaocto*	Rs	VC	288
63.	Red Collared-Dove	*Streptopelia tranquebarica*	Rs	C	167
64.	Spotted Dove	*Streptopelia chinensis*	Rs	VC	91
65.	Laughing(Little Brown) Dove	*Streptopelia senegalensis*	Rs	VC	458
	Order: GRUIFORMES : Cranes, Crakes **Family : RALLIDAE**				
66.	Brown Crake	*Amaurornis akool*	Rs	C	03
67.	Spotted Crake		WM	UC	01
68.	Baillon's Crake	*Porzana pusilia*	WM	UC	01
69.	White-breasted Waterhen	*Amanrornis phoenicurus*	Rs	VC	12
70.	Purple Swamphen	*Porphyrio porphyrio*	Rs	VC	05
71.	Common Moorhen	*Gallinula chloropus*	Rs	VC	06
72.	Common (Eurasian) Coot	*Fulica atra*	Rs	VC	12
	Order: CICONIIFORMES **Family : PTEROCLIDAE : Sandgrouse**				
73.	Chestnut-bellied Sandgrouse	*Pterocles exustus*	Rs	UC	08
74.	Painted Sandgrouse	*Pterocles indicus*	Rs	C	15
	Family : SCOLOPACIDAE				
75.	Pintail Snipe	*Gallinago stenura*	WM	C	03
76.	Common Snipe	*Lymnocryptes minimus*	WM	C	08
77.	Common Greenshank	*Tringa nebularia*	WM	C	02
78.	Common Redshank	*Tringa totanus*	WM	C	02
79.	Wood Sandpiper	*Tringa glareola*	WM	C	09
80.	Green Sandpiper	*Tringa Ochropus*	WM	C	02
81.	Common Sandpiper	*Actitis hypoleucos*	WM	C	13
82.	Little Stint	*Calidris minuta*	WM	C	25
83.	Temminck's Stint	*Calidris temminckii*	WM	C	09
84.	Marsh Sandpiper	*Tringa stagnatilis*	WM	UC	02
	Family : ROSTRATULIDAE				
85.	Greater Painted Snipe	*Rostratula benghalensis*	Rs	C	05
	Family : BURHINIDAE				
86.	Indian Thick-knee	*Burhinus (oedicnemus) indicus*	Rs	C	09
87.	Great Thick-kne	*Esacus recurvirostris*	Rs	C	03
	Family : CHARADRIIDAE				
88.	Black-winged Stilt	*Himantopus himantopus*	WM	VC	29
89.	Little Ringed Plover	*Charadrius dubius*	WM	VC	26
90.	Kentish Plover	*Charadrius alexandrinus*	WM	VC	12
91.	Yellow-wattled Lapwing	*Vanellus malabaricus*	Rs	VC	76
92.	Red-wattled Lapwing	*Vanellus indicus*	Rs	VC	255
	Family : GLAREOLIDAE				
93.	Indian Courser	*Cursorius coromandelicus*	Rs	C	09

94.	Small Pratincole	*Glareola lacteal*	Rs	VC	16
	Family : LARIDAE - Gull, Tern				
95.	River Tern	*Sterna aurantia*	LM	VC	26
96.	Little Tern	*Sterna albifrons*	WM	UC	09
	Family : ACCIPITRIDAE – Raptors, Scavengers				
97.	Osprey	*Pandion haliaetus*	WM	C	03
98.	Black-shouldered Kite	*Elanus caeruleus*	Rs	VC	99
99.	Black Kite	*Milvus migrans*	Rs	C	07
100	Shikra	*Accipiter badius*	Rs	VC	36
101	Eurasian Sparrow Hawk	*Accipiter nisus*		UC	01
102	Changeble Hawk Eagle	*Spizhaetus cirrhatus*	Rs	C	07
103	Bonelli's Eagle	*Hieraaetus fasciatus*	Rs	C	04
104	Booted Eagle	*Hieraaetus Pennatus*	WM	UC	03
105	Tawny Eagle	*Aquila rapax*	Rs	UC	01
106	Black Eagle	*Ictinaetus malayensis*	WM	R	01
107	Indian (Lesser) Spotted Eagle	Clanga (Aquila) hastotr	Rs	UC	01
108	Pallid Harrier	*Circus macrourus*	WM	UC	01
109	Montagu's Harrier	*Circus pygargus*	WM	UC	01
110	Eurasian (Western) Marsh Harrier	*Circus aeruginosus*	WM	C	03
111	Pied Harrier	*Circus melanoleucos*	WM	UC	01
112	Short-toed Snake Eagle	*Circaetus gallicus*	Rs	C	02
113	Crested Serpent Eagle	*Spilornis cheela*	Rs	VC	36
114	Oriental Honey Buzzard	*Pernis ptilorhyncus*	Rs	VC	36
115	White-eyed Buzzard	*Butastur teesa*	Rs	VC	42
	Family : FALCONIDAE				
116	Common Kestrel	*Falco tinnunculus*	Rs	C	04
117	Peregrine Falcon	*Falco peregrinus*	WM	UC	01
	Family : PODICIPEDIDAE Grebes				
118	Little Grebe	*Tachybaptus ruficollis*	Rs	VC	16
	Family : ANHINGIDAE				
119	Darter	*Anhinga melanogaster*	Rs	VC	10
	Family : PHALACROCORACIDAE				
120	Little Cormorant	*Phalacrocorax niger*	Rs	VC	56
121	Indian Cormorant	*Phalacrocorax fuscicollis*	Rs	C	05
122	Great Cormorant	*Phalacrocorax carbo*	Rs	C	15
	Family : ARDEIDAE - Egrets, Herons				
123	Little Egret	*Egretta garzetta*	Rs	VC	86
124	Great Egret	*Casmerodius albus*	Rs	VC	04
125	Intermediate Egret	*Mesophoyx intermedia*	Rs	C	01
126	Cattle Egret	*Bubulcus ibis*	Rs	VC	237
127	Grey Heron	*Ardea cinerea*	Rs	VC	26
128	Purple Heron	*Ardea purpurea*	Rs	VC	20
129	Striated Heron	*Butorides striatus*	Rs	VC	33
130	Indian Pond Heron	*Ardeola grayii*	Rs	VC	86
131	Black - Crowned Night Heron	*Nycticorax nycticorax*	Rs	VC	24
132	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Rs	C	04
133	Yellow Bittern	*Ixobrychus sinensis*	Rs	C	01
134	Black Bittern	*Dupetor flavicollis*	Rs	C	02
	Family : PHOENICOPTERIDAE - Ibis				
135	Glossy Ibis	*Plegadis falcinellus*	WM	C	09

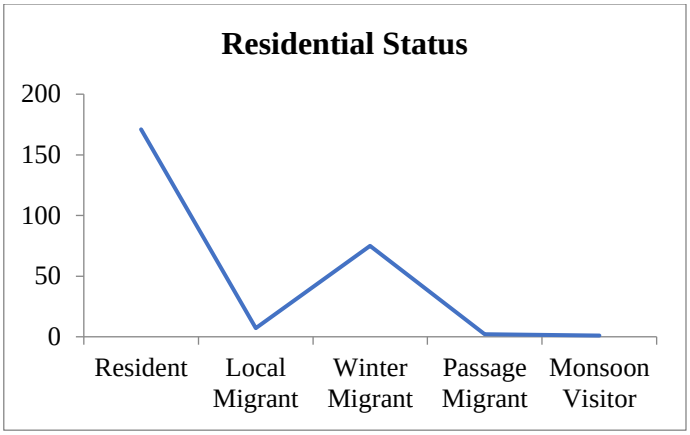
136	Black - headed Ibis	*Threskiornis melanocephalus*	Rs	VC	21
137	Black Ibis	*Pseudibis papillosa*	Rs	VC	49
138	Eurasian Spoonbill	*Platalea leucorodia*	LM	C	16
	Family : CICONIIDAE - Storks				
139	Painted Stork	*Myeteria leucocephala*	Rs	VC	18
140	Asin Openbill	*Anastomus oscitans*	Rs	VC	16
141	Black Stork	*Ciconia nigra*	WM	UC	03
142	Woolly-necked Stork	*Ciconia episcopus*	Rs	VC	15
143	Lesser Adjutant		LM	V	01
	Order: PASSERIFORMES **Family : PITTIDAEZ**				
144	Indian pitta	*Pitta brachyura*	WM	C	03
	Family : IRENIDAE				
145	Jerdon's Leafbird	*Chloropsis cochinchinensis*	Rs	UC	01
	Family : LANIIDAE				
146	Isabelline Shrike	*Lanius isabellinus*	WM	UC	01
147	Bay-backed Shrike	*Lanius vittatus*	Rs	VC	79
148	Long - tailed Shrike	*Lanius schach*	Rs	VC	86
149	Grey-backed shrike	*Lanius tephronotus*	Rs	VC	11
150	Brown Shrike	*Lanius cristatus*	WM	C	69
151	Southern Grey Shrike	*Lanius meridionalis*	Rs	UC	04
	Family :CORVIDAE				
152	Rufos Treepie	*Dendrocitta vagabunda*	Rs	VC	21
153	House Crow	*Corvus splendens*	Rs	VC	165
154	Jungle Crow	Crow *Corvus macrorhynchos*	Rs	C	01
155	Eurasian Golden Oriole	*Oriolus oriolus*	Rs	VC	09
156	Black-hooded Oriole	*Oriolus xanthornus*	Rs	UC	01
157	Large Cuckoo-Shrike	*Coracina macei*	Rs	UC	01
158	Black headed Cuckoo-Shrike	*Coracina melanoptera*	Rs	C	05
159	Small Minivet	*Pericrocotus cinnamomeus*	Rs	VC	15
160	White-bellied Minivet	*Pericrocotus erythropygius*	WM	R	01
161	Black Drongo	*Dicrurus macrocercus*	Rs	VC	70
162	White bellied Drongo	*Dicrurus caerulescens*	Rs	C	27
163	Ashy Drongo	*Dicrurus leucophaeus*	Rs	UC	01
164	White-bellied Drongo	*Dicrurus caerulescens*	Rs	C	16
165	White-Spotted Fantail	*Rhipidura albicollis*	Rs	C	24
166	White-browed Fantail	*Rhipidura aureola*	Rs	C	30
167	Asian Paradise-Flycatcher	*Terpsiphone paradisi*	Rs	C	51
168	Common Iora	*Aegithina tiphia*	Rs	VC	18
169	Common Woodshrike	*Tephrodornis pondicerianus*	Rs	VC	67
	Family : MUSCICAPIDAE				
170	Blue Rock Thrush	*Monticola solitarius*	WM	C	17
171	Orange-headed Thrush	*Zoothera citrina*	Rs	C	21
172	Indian Blackbird	Turdus (merula) simillimus	Rs	R	01
173	Red-breasted Flycatcher	Ficedula parva	WM	C	12
174	Red throated Flycatcher	Ficedula albicilla	WM	UC	01
175	Ultramarine Flycatcher	Ficedula superciliaris	WM	UC	01
176	Tickell's Blue Flycatcher	Cyornis tickelliae	Rs	C	44
177	Verditer Flycatcher	Eumyis thalassina	WM	UC	01
178	Grey-headed Canary Flycatcher	Culicicapa ceylonensis	WM	UC	01

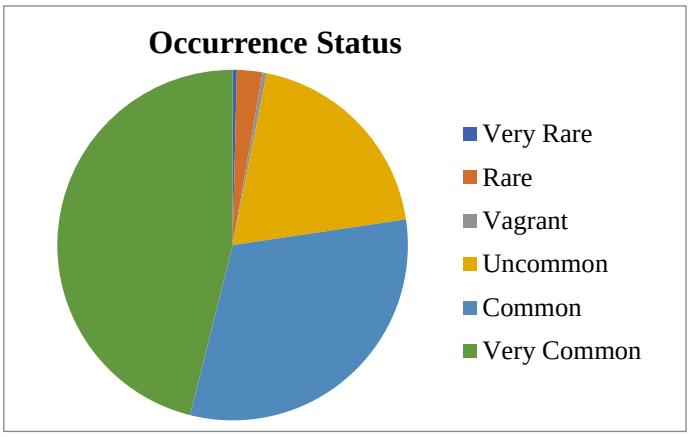
179	Asian Brown Flycatcher	Muscicapa dauurica	Rs	C	17
180	Black-naped Monarch	Hypothymis azurea	Rs	VC	19
181	Bluethroat	Luscinia svecica	WM	C	01
182	Oriental Magpie Robin	Copsychus saularis	Rs	VC	69
183	Indian Robin	Saxicoloides fulicata	Rs	VC	216
184	Black Redstart	Phoenicurus ochruros	WM	VC	41
185	Common stonechat	Saxicola torquata	WM	VC	56
186	Pied Bush Chat	Saxicola caprata	Rs	VC	59
187	Brown-Rock Chat	Cercomela fusca	Rs	VC	34
188	Isabelline Wheatear	*Oenanthe isabellina*	WM	R	01
	Family : STURNIDAE				
189	Chestnut -tailed Starling	*Sturnia malabarica*	WM	C	21
190	Brahminy Starling	*Sturnus pagodarum*	Rs	VC	516
191	Rosy starling	*Sturnus roseus*	WM	VC	297
192	Asian Pied Starling	*Sturnus contra*	Rs	VC	165
193	Common Myna	*Acridotheres tristis*	Rs	VC	520
	Family : SITTIDAEM				
194	Chestnut-bellied Nuthatch	*Sitta castanea*	Rs	UC	01
	Family : CERTHIIDAE				
195	Spotted Creeper	*Salpornis spilonotus*	Rs	R	01
	Family : PARIDAE				
196	Great Tit	*Parus major*	Rs	VC	121
197	Indian Yellow Tit	*Parus xanthogenys*	Rs	C	20
	Family : HIRUNDINIDAE				
198	Dusky Crag Martin	*Hirundo concolor*	Rs	VC	72
199	Barn Swallow	*Hirundo rustica*	WM	C	16
200	Wire-tailed Swallow	*Hirundo smithii*	Rs	VC	399
201	Red-rumped Swallow	*Hirundo daurica*	Rs	VC	312
202	Streak-throated Swallow	*Hirundo fluvicola*	WM	UC	19
	Family : PYCNONOTIDAE				
203	Red -vented Bulbul	*Pycnonotus cafer*	Rs	VC	499
204	White-browed Bulbul	*Pycnonotus luteolus*	Rs	VC	20
	Family : CISTICOLIDAE				
205	Zitting Cisticola	*Cisticola juncidis*	Rs	VC	15
206	Jungle Prinia	*Prinia sylvatica*	Rs	VC	25
207	Ashy Prinia	*Prinia socialis*	Rs	VC	267
208	Plain Prinia	*Prinia inornata*	Rs	VC	19
209	Grey-breasted Prinia	*Prinia hodgsonii*	Rs	C	07
	Family : ZOSTEROPIDAE				
210	Oriental White-eye	*Zosterops palpebrosus*	Rs	VC	36
	Family : SYLVIIDAE				
211	Blyth's Reed Warbler	*Acrocephalus dumetorum*	Rs	C	02
212	Clamorous Reed Warbler	*Acrocephalus stentoreus*	WM	UC	01
213	Booted Warbler	*Hippolais caligata*	WM	C	01
214	Paddyfield Warbler		WM	C	02
215	Greenish Warbler	*Phylloscopus trochiloides*	WM	UC	01
216	Sulpher-bellied Warbler	*Phylloscopus griseolus*	WM	UC	01
217	Common Tailor Bird	*Orthobomus sutorius*	Rs	VC	165
218	Common Chiffchaff	*Phylloscopus collybita*	WM	C	07
219	Orphean Warbler	*Sylvia hortensis*	WM	UC	08

220	Lesser Whitethroat	*Sylvia curruca*	WM	C	36
221	Tawny-bellied Babbler	*Dumetia hyperythra*	Rs	C	39
222	Yellow-eyed Babbler	*Chrysomma sinense*	Rs	VC	109
223	Common Babbler	*Turdoides caudatus*	Rs	VC	72
224	Large Grey Babbler	*Turdoides malcolmi*	Rs	VC	85
225	Jungle Babbler	*Turdoides striatus*	Rs	VC	61
	Family : ALAUDIDAE				
226	Indian Bush Lark	*Mirafra erythroptera*	Rs	C	63
227	Ashy-crowned Sparrow Lark	*Eremopterix grisea*	Rs	VC	98
228	Greater Short-toed Lark	*Calandrella brachydactyla*	WM	UC	06
229	Sykes's Lark	*Galerida deva*	Rs	VC	67
230	Crested Lark		WM	UC	02
231	Singing Bushlark	*Mirafra cantillans*	Rs	VC	61
	Family : NECTARINIDAE				
232	Purple-rumped Sunbird	*Nectarinia zeylonica*	Rs	VC	67
233	Purple Sunbird	*Nectarinia asiatica*	Rs	VC	81
	Family : PASSERIDAE				
234	Forest wagtail	Dendronanthus indicus	WM	VR	01
235	White Wagtail	*Motacilla alba*	WM	C	36
236	White browed Wagtail	*Motacilla maderaspatensis*	Rs	VC	61
237	Citrine Wagtail	*Motacilla citreola*	WM	C	12
238	Grey Wagtail	*Motacilla cinerea*	WM	C	10
239	Yellow Wagtail	*Motacilla flava*	WM	VC	67
240	Paddyfield pipit	*Anthus rufulus*	Rs	VC	72
241	Tawny Pipit	*Anthus campestris*	WM	C	01
242	Blyth's Pipit	*Anthus godlewskii*	WM	C	01
243	Richard's Pipit	*Anthus richardi*	WM	UC	01
244	Olive-backed Pipit	*Anthus hodgsoni*	WM	UC	01
245	House Sparrow	*Passer domesticus*	Rs	VC	399
246	Chestnut-shouldered Petronia	*Petronia xanthocollis*	Rs	VC	429
247	Baya Weaver	*Ploceus philippinus*	Rs	VC	399
248	Red Avadavat (Munia)	*Amandava amandava*	Rs	VC	427
249	Indian Silverbill	*Lonchura malabarica*	Rs	VC	400
250	Black-headed Munia	*Lonchura malacca*	Rs	VC	67
251	Scaly-breasted Munia	*Lonchura punctulata*	Rs	VC	430
	Family : FRINGILLIDAE				
252	Common Rosefinch	*Carpodacus erythrinus*	Rs	C	36
253	Crested Bunting	*Melophus lathami*	Rs	C	03
254	Grey-necked Bunting	*Emberiza buchanani*	WM	UC	01
255	Black-headed Bunting	*Emberiza melanocephala*	WM	C	19
256	Red-headed Bunting	*Emberiza bruniceps*	WM	UC	12

Key to abbreviations:
Res. Status = Residential Status; **Rs** - Resident, **LM** - Local Migrant; **WM** - Winter Migrant;**PM** - Passage Migrant, **MV** - Monsoon Visitor
Occ. Status = Occurrence Status; **VR** – Very Rare; **R**- Rare; **V**- Vagrant; **UC** – Uncommon; **C** – Common; **VC** – Very Common;

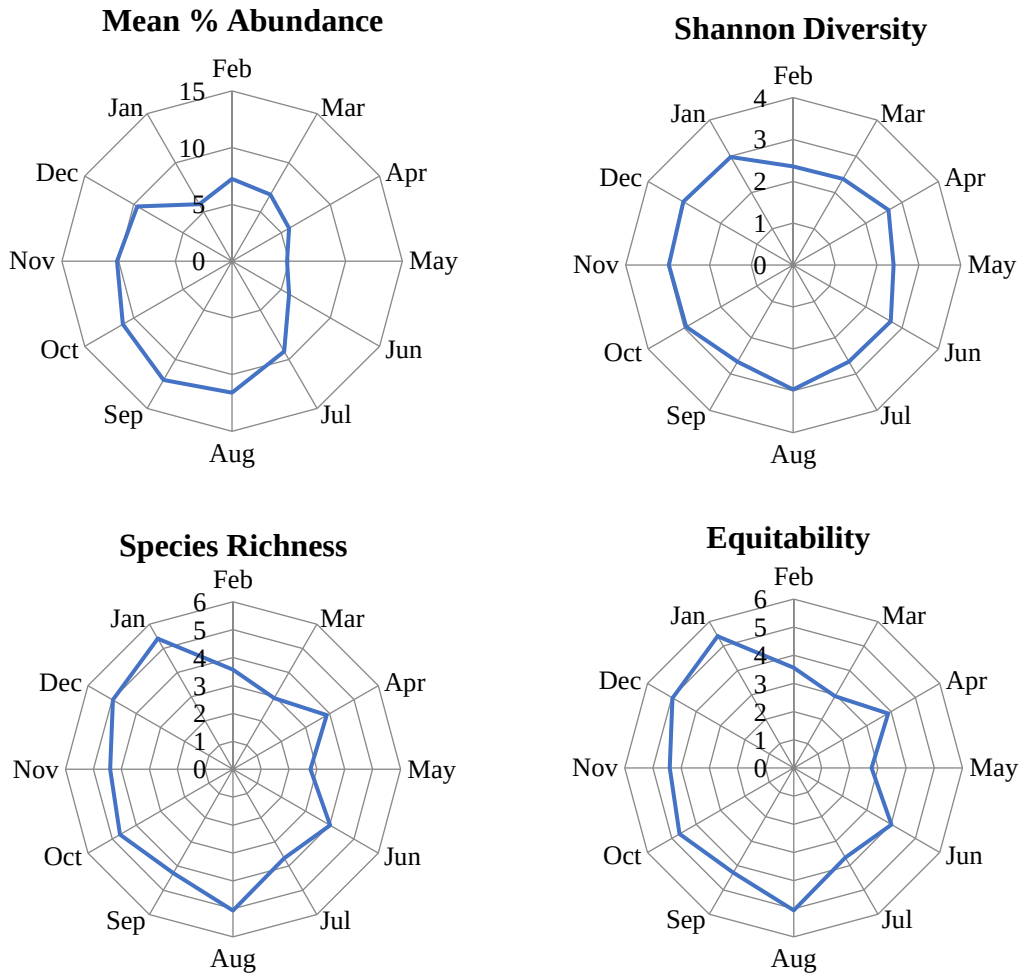
Figure 3: Residential status and occurrence of birds in Tipeshwar wildlife Sanctuary, Maharashtra, India





The study transcends its ornithological significance, becoming a conduit for promoting holistic wildlife conservation, sustainable tourism practices, and community engagement. It emphasizes the interconnectedness of all life forms within the Tipeshwar sanctuary, underscoring the importance of preserving this delicate balance. The research's scientific contributions extend beyond the realm of ornithology, making it a pivotal resource for crafting comprehensive conservation strategies (Kareiva *et al*., 2007; Soule, 1985). The documentation of 256 distinct bird species within the Tipeshwar Wildlife Sanctuary underscores the remarkable avian biodiversity of the region (Anderson *et. al.,* 1999). This extensive list serves as a foundational resource for future ecological studies and conservation efforts (Gaston, 1991; Gotelli, 2001). The diversity of bird species identified contributes to the overall richness of the sanctuary's ecosystem, reinforcing its status as a critical habitat for avian life. The observed seasonal patterns in bird abundance reveal the dynamic nature of avian populations within the sanctuary (Anderson *et. al.* 2016). Understanding these fluctuations is crucial for implementing conservation strategies that account for seasonal variations, ensuring the sustained well-being of bird populations (Danchin *et al.,* 2004; Dhondt, 2010). The decline in bird abundance during the summer and pre-monsoon periods raises questions about potential environmental stressors during these times, warranting further investigation.

Figure 4: The values of the diversity indices in different months observed through the random sampling.



The monthly comparison of species diversity attributed in fauna in study area revealed that faunal diversity was highest during winter moderate during monsoon while lower during summer. A trend in Mean % Abundance was noted to be nearly similar to that of Shannon Diversity though Species Richness and Species Equitability shows contradictory pattern. The application of the Shannon index adds sophistication to our understanding of species diversity within the sanctuary (Ballantyne *et. al.,* 2007). This analysis, considering both the number and evenness of species, provides a nuanced perspective on the ecological intricacies of Tipeshwar (Chao et al., 2014; Jost, 2006). Insights gained contribute valuable information for targeted conservation measures. A more even distribution of species may indicate a healthier and more resilient ecosystem, further emphasizing the sanctuary's ecological robustness.

Conclusion:

The comprehensive investigation into the bird diversity of the Tipeshwar Wildlife Sanctuary has yielded substantial findings that underscore the ecological significance of this vibrant ecosystem. The documentation of 256 distinct bird species, analysis of seasonal abundance patterns, and application of the Shannon index have collectively enhanced our understanding of the avian community within the sanctuary. The identified bird species reflect a rich and diverse avian biodiversity thriving in Tipeshwar, solidifying its status as a critical habitat for various bird species. The observed seasonal patterns in bird abundance provide valuable insights into the dynamic nature of avian populations, emphasizing the need for targeted conservation efforts that account for these fluctuations.

The application of the Shannon index has added a layer of sophistication to our understanding of species diversity within the sanctuary. This nuanced approach, considering both the number and evenness of species, contributes to a more comprehensive conservation philosophy. The findings reinforce the interconnectedness of various taxonomic groups within the ecosystem, emphasizing the importance of preserving the delicate balance for holistic wildlife conservation.

Suggestions for Conservation and Future Research:

Habitat Preservation: Given the richness of bird diversity, it is imperative to focus on habitat preservation within the Tipeshwar Wildlife Sanctuary. Conservation efforts should prioritize maintaining diverse ecosystems to ensure the well-being of various bird species. Seasonal Conservation Strategies: The observed seasonal abundance patterns highlight the need for tailored conservation strategies based on the specific environmental conditions during different times of the year. This approach will contribute to the sustained well-being of avian populations. Community Engagement: Engaging local communities in conservation efforts is crucial. The economic benefits derived from birdwatching tourism can be reinvested in local communities, fostering a sense of ownership and promoting sustainable practices.

Education and Awareness: Nature education and interpretation programs, especially focused on birdlife, should be expanded. These programs can enhance visitors' experiences, fostering a deeper connection with the sanctuary and promoting environmental sensitivity. Continued Research: Continuous monitoring of bird populations and further research into the factors influencing seasonal variations in abundance is essential. Understanding potential stressors during specific periods will contribute to more effective conservation strategies.

In conclusion, the findings provide a robust foundation for the ongoing conservation of Tipeshwar Wildlife Sanctuary. By integrating the identified bird species, seasonal abundance patterns, and the insights gained from the Shannon index, conservation efforts can be tailored to ensure the continued thriving of both bird populations and the broader ecosystem.

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