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Documentation of Avian Species Composition and Assemblage in Agricultural Landscapes of Karnal, Haryana

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ABSTRACT:
Avian communities maintain ecological balance by eliminating pests, providing ecosystem services, and acting as biological indicators, thereby playing a pivotal role in conserving agricultural landscapes' integrity and stability; thus from an environmental monitoring standpoint, assessment of bird aggregations in various landscapes is necessary. A three-year (2021, 2022 and 2023) bird survey was conducted to document the checklist, density, and diversity of bird species assemblage of agricultural landscapes in the Karnal district of Haryana, India, to obtain the richness of birds in different agricultural habitats. A total of 79 bird species from 36 families and 14 orders were recorded; two bird species (Alexandrine Parakeet and Black-Headed Ibis) are listed as Near Threatened in the 'IUCN' (2010) category. Seventeen avian species with global declining population trends are present in the study area. The Passeriformes order, with 44 species, is the most diverse in the study area. In all habitats, analysis of food and feeding guilds, as well as perching activity, revealed that the insectivorous guild (29) is dominant, followed by Omnivore (25), Carnivore (11), Granivore (7), Frugivore (5), and Nectarivore (2). The results of this study indicate that, in order to enhance the quality of bird habitat in agricultural landscapes, biodiversity-friendly farming practices should be adopted.

Keywords:
Aves, Agriculture Landscape, Biodiversity-friendly agriculture, Conservation

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INTRODUCTION

Birds provide vital ecosystem services and functions such as pollination because of their taxonomic and niche range (Sekercioglu, 2012; Whelan *et al*., *2015*). Since birds are significant and efficient organisms that control pests of agricultural lands, they are integrated with

farmers in everyday activities (Stoeckli *et al.,* 2017; Jacobson *et al.*, 2003), serving various functions like insect pests management in crops (Tremblay *et al.*, 2001), rodent predators (Labuschagne *et al.*, 2016), scavengers (Plaza *et al.*, 2019), seed dispersers (Heleno *et al.*, 2011), and pollinators (Gaston, 2022). The dual role of birds as benefactors and destroyers in agriculture is very well known as they help in seed dispersal, cross-pollination, and predation, playing a significant role in biological control of crop pests (Kiran *et al.,* 2022; Dahiya *et al.,* 2022). Birds are sensitive to ecological changes due to ecological niche of apex predators as they exhibit heightened sensitivity to significant alterations in ecosystems, rendering them valuable bio-indicators of agricultural transformations (Egwumah *et al.,* 2017; Grande *et al.,* 2018). The global avian biodiversity has been approximated to encompass a total of 10,896 distinct species, accompanied by 20,046 subspecies, distributed among 40 taxonomic orders, 245 families, and 2,313 genera (Gill and Donsker, 2019). However, agriculture expansion, intensification and agrochemical use (pesticides and fertilizers) have significant implications on environment in terms of habitat loss and climate change having profound effects on distribution patterns of numerous avian species, both at local and global scale (Sodhi *et al.,* 2008; Flohre *et al.,* 2011). Farmland biodiversity, especially bird species, is declining worldwide with observable concerning trends (Traba and Morales, 2019; Hallman *et al.*, 2014). Colonial avian species residing within sanctuaries or seasonal wetlands in close proximity to agricultural landscapes exhibit heightened susceptibility to agricultural chemicals (Moreau *et al.*, 2022; Stanton *et al.*, 2018). The state of Haryana, often called the "food mine" of India, is a major contributor to the country's central pool in terms of food grain production and agrochemical consumption. Karnal district of Haryana is one amongst the agriculturally developed regions of Haryana. The goal of the attempted current study is to document the species diversity and composition of the avian fauna in different agricultural landscapes of Karnal District, Haryana.

MATERIAL AND METHODS

Study Area: The district Karnal lies between 29.41° north latitude and 76.59° east longitudes (Fig. 1). The climate of Karnal is humid, sub-tropical with dry-winter with four distinct seasons distinguished as: dry (March–June), the hot rainy (monsoon) season (July– September), the post monsoon season (October–November). The highest annual temperature of Karnal district is 31, while annual low temperature is about 21.73. The two sites selected for the study are agricultural fields of Regional Research Center, Karnal and nearby Famer's field which are dominantly mix-crop and Paddy-Wheat crop area, respectively.

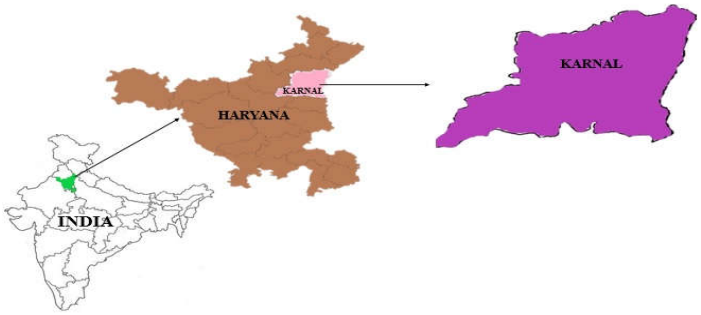

Figure 1: Study Area Map

Data collection

Fortnight field surveys were conducted for three consecutive years (2021, 2022 and 2023) in the *Kharif* crop season to observe the avian species visiting the selected crop fields using Scan sampling and Point count-line transects method. Binoulars (8x42, 8°) and COOLPIX NIKON P900 camera were used to observe and photograph

the visiting avian species from 06.00–10.00 A.M. and 16.00–18.00 P.M. in a range of up to 25 m radius on one-km transect point. The harsh weather conditions such as rainy, windy, foggy and cloudy were avoided to minimize error in observations. Standard field guides (Ali 2002; Grimmett *et al*. 2011) along with authentic avian databases such as IUCN, Oriental Bird Club image database, Merlin bird ID and e-bird were used for identification and documentation of avian checklist. Feeding guilds were categorized on the basis of feeding activities and available literature into six feeding guilds i.e. Insectivorous, Carnivorous, Omnivorous, Frugivorous, Grainivorous and Nectarivorous (Ali, 2002). The Residential status assessment of observed avian species was done on the basis of existence and non-existence of bird andcategorizedas - resident, winter visitor and summer visitor (Grimmett *et al*., 2011; Kumar and Sahu, 2019). The local abundance status was assigned onthe basis of percentage of sightings and number of sighting in field visits basis (Mackinnon & Phillips, 1993) - Common (C) - seven to nine times (80–100%), Very Common (VC) - less than ten times (60 - 79.9%), Uncommon (UC) - three to six times (20–59.9%) and Rare (RA) - once or twice (19.9%). The conservation and global population trend status of observed avian species (decreasing, increasing, stable or unknown) were collected from IWPA (1972), CITES (2012) and IUCN Red List (2020).The relative diversity index (RDi) analysis of avian families was calculated by formula given by La Torre-Cuadros *et al*. (2007):

RDi = Total number of species in a family (n_i)/ Total number of species (N) × 100 Eq.1

RESULTS

A total of 79 bird species of 36 families, and 14 orders were recorded (Table 1). The order Passeriformes was with maximum number of bird species (44) while order Columbiformes, Cuculiformes and Pelecaniformes had 5 bird species each followed by Coraciiformes(4), Accipitriformes (3),Charadriiformes (3), Galliformes (2), Psitaciiformes (2), Strigifomes (2) and the remaining with Gruiiformes(1), Bucerotiformes (1), Upupiformes (1) and Piciformes (1).

Table 1: Birds species recorded in the selected agricultural landscapes of Karnal district, Haryana

Order												
Family												
Sr. No.	**Common name**	**Scientific name**	**Karnal**		**Guild Status**	**Residential Status**	**Abundance Status**	**GPT**	**Conservation Status**			**Habitat**
			RRC	**FF**					**IUCN (2022)**	**IWPA (1972)**	**CITES (2012)**	
Accipitriformes Family-1; Species-3												
Accipitridae												
1	Black Kite	*Milvus migrans* (Boddaert, 1783)	+	+	Ca	R	UC	→	LC	I	II	T
2	Black-winged Kite	*Elanus caeruleus* (Desfontaines, 1789)	+	+	O	R	UC	→	LC	I	-	T
3	Shikra	*Accipiter badius* (Gmelin, 1788)	+	+	Ca	R	VC	→	LC	I	II	T
Bucerotiformes Family-1; Species-1												
Bucerotidae												
4	Indian Grey Hornbill	*Ocyceros birostris* (Scopoli, 1786)	+	+	O	WM	Ra	→	LC	IV	-	T
Columbiformes Family-1; Species-5												
Columbidae												
5	Eurasian Collared Dove	*Streptopelia decaocto* (Frivaldszky, 1838)	+	+	G	R	VC	↑	LC	IV	-	T
6	Laughing Dove	*Spilopelia senegalensis* (Linnaeus, 1766)	+	+	G	R	C	→	LC	IV	-	T
7	Rock Dove	*Columba livia* (Gmelin, 1789)	+	+	G	R	VC	↓	LC	IV	-	T

8	Yellow-Footed Green-Pigeon	*Treron phoenicopterus* (Latham, 1790)	+	+	F	R	C	↑	LC	IV	-	T
9	Spotted Dove	Streptopelia chinensis (Scopoli, 1786)	+	+	G	R	C	↑	LC	IV	-	T
Coraciiformes Family-3; Species-4												
Alcedinidae												
10	White – breasted Kingfisher	*Halcyon smyrnensis* (Linnaeus, 1758)	+	+	Ca	R	VC	↑	LC	IV	-	B
Coraciidae												
11	Indian Roller	*Coracias benghalensis* (Linnaeus, 1758)	+	+	Ca	R	VC	↑	LC	IV	-	T
Meropidae												
12	Asian Green Bee-Eater	*Merops orientalis* (Latham, 1802)	+	+	In	R	VC	↑	LC	IV	-	T
13	Blue-Cheeked Bee-Eater	*Merops persicus* (Pallas, 1773)	+	+	In	SM	VC	↑	LC	IV	-	T
Charadriiformes Family-3; Species-3												
Burhinidae												
14	Indian Thick-Knee	*Burhinus indicus* (Salvadori, 1865)	+	+	O	R	VC	↓	LC	IV	-	T
Charadriidae												
15	Red-Wattled Lapwing	*Vanellus indicus* (Boddaert, 1783)	+	+	In	R	C	?	LC	IV	-	T
Recurvirostridae												
16	Black - Winged Stilt	*Himantopus himantopus* (Linnaeus, 1758)	+	+	Ca	R	C	↑	LC	IV	-	T
Cuculiformes Family-1; Species-5												
Cuculidae												
17	Greater Coucal	*Centropus sinensis* (Stephens, 1815)	+	+	O	R	C	→	LC	IV	-	T
18	Eastern Koel	*Eudynamys scolopaceus* (Linnaeus, 1758)	+	+	O	R	C	→	LC	IV	-	T
19	Common Hawk-Cuckoo	*Hierococcyx varius* (Vahl, 1797)	+	+	In	R	UC	→	LC	IV	-	T
20	Grey bellied Cuckoo	*Cacomantis passerinus* (Vahl, 1797)	+	+	In	SM	Ra	→	LC	IV	-	T
21	Jacobin Cuckoo	*Clamator jacobinus* (Boddaert, 1783)	+	+	O	SM	UC	→	LC	IV	-	T
Galliformes Family-1, Species-2												
Phasianidae												
22	Black Francolin	*Francolinus francolinus* (Linnaeus, 1766)	+	+	O	R	C	→	LC	IV	-	T
23	Grey Francolin	*Francolinus pondicerianus* (Gmelin, 1789)	+	+	O	R	C	→	LC	IV	-	T
Gruiformes Family-1; Species- 1												
Rallidae												
24	Bhite-Breasted Waterhen	*Amaurornis phoenicurus* (Pennant, 1769)	+	+	O	R	VC	?	LC	IV	-	B
Passeriformes Family-18; Species-44												
Acrocephalidae												
25	Paddyfield Warbler	*Acrocephalus Agricola* (Jerdon, 1845)	+	+	In	R	C	↓	LC	IV	-	T
Alaudidae												
26	Ashy – Crowned Sparrow -	*Eremopterix griseus* (Scopoli, 1786)	+	+	O	R	UC	→	LC	IV	-	T

	Lark											
27	Crested Lark	*Galerida cristata* (Linnaeus, 1758)	+	+	O	R	UC	↓	LC	IV	-	T
Cisticolidae												
28	Ashy Prinia	*Prinia socialis* (Sykes, 1832)	+	+	In	R	VC	→	LC	IV	-	T
29	Plain Prinia	*Prinia inornata (Sykes, 1832)*	+	+	In	R	VC	→	LC	IV	-	T
30	Common Tailorbird	*Orthotomus sutorius* (Pennant, 1769)	+	+	N	R	C	→	LC	IV	-	T
31	Yellow – Bellied Prinia	*Prinia flaviventris* (Delessert,1840)	+	+	In	R	Ra	↓	LC	IV	-	T
Corvidae												
32	House Crow	*Corvus splendens* (Vieillot, 1817)	+	+	O	R	C	→	LC	IV	-	T
33	Rufous Treepie	*Dendrocitta vagabunda* (Latham, 1790)	+	+	In	R	VC	↓	LC	IV	-	T
Dicruridae												
34	Black Drongo	*Dicrurus macrocercus* (Vieillot, 1817)	+	+	In	R	C	?	LC	IV	-	T
Estrildidae												
35	Indian Silverbill	*Euodice malabarica* (Linnaeus, 1758)	+	+	G	R	VC	→	LC	IV	-	T
36	Scaly – Breasted Munia	*Lonchura punctulata* (Linnaeus, 1758)	+	+	G	R	VC	→	LC	IV	-	T
Hirundinidae												
37	Wire – Tailed Swallow	*Hirundo smithii* (Leach, 1818)	+	+	In	SM	UC	↑	LC	IV	-	T
38	Streak Throated Swallow	*Petrochelidon fluvicola* (Blyth, 1855)	+	+	In	SM	UC	↑	LC	IV	-	T
Leiotrichidae												
39	Large Grey Babbler	*Argya malcolmi* (Sykes, 1832)	+	+	O	R	VC	→	LC	IV	-	T
40	Jungle Babbler	*Argya striata*(Dumont, 1823)	+	+	O	R	VC	→	LC	IV	-	T
41	Striated Babbler	*Argya earlei* (Blyth, 1844)	+	+	O	R	Ra	↓	LC	IV	-	T
42	Common Babbler	*Argya caudate* (Dumont, 1823)	+	+	O	R	C	→	LC	IV	-	T
43	Paddyfield Pipit	*Anthus rufulus* (Vieillot, 1818)	+	+	In	R	UC	→	LC	IV	-	T
44	Tree Pipit	*Anthus trivialis* (Linnaeus, 1758)	+	+	In	R	UC	↓	LC	IV	-	T
Motacillidae												
45	White – Browed Wagtail	*Motacilla maderaspatensis* (Gmelin, 1789)	+	+	In	R	C	→	LC	IV	-	T
46	White Wagtail	*Motacilla alba* (Linnaeus, 1758)	+	+	In	WM	C	→	LC	IV	-	T
47	Grey Wagtail	*Motacilla cinerea* (Tunstall, 1771)	+	+	In	WM	UC	→	LC	IV	-	T
48	Western Yellow Wagtail	*Motacilla flava* (Linnaeus, 1758)	+	+	In	WM	UC	↓	LC	IV	-	T
Muscicapidae												
49	Black Redstart	*Phoenicurus ochruros* (Gmelin, 1774)	+	+	In	WM	UC	↑	LC	IV	-	T
50	Blurthroat	*Cyanecula svecica* (Linnaeus, 1758)	+	+	In	WM	UC	→	LC	IV	-	T
51	Brown	*Oenanthe fusca*	+	+	In	R	C	→	LC	IV	-	T

	Rockchat	(Blyth, 1851)										
52	Common Stonechat	*Saxicola torquatus* (Linnaeus, 1766)	+	+	In	R	C	→	LC	IV	-	T
53	Indian Robin	*Saxicoloides fulicatus* (Linnaeus, 1766)	+	+	In	R	C	→	LC	IV	-	T
54	Oriental Magpie - Robin	*Copsychus saularis* (Linnaeus, 1758)	+	+	In	R	VC	→	LC	IV	-	T
55	Pied Bushchat	*Saxicola caprata* (Linnaeus, 1766)	+	+	In	R	VC	→	LC	IV	-	T
Nectariniidae												
56	Purple Sunbird	*Cinnyris asiaticus* (Latham, 1790)	+	+	N	R	C	→	LC	IV	-	T
Passeridae												
57	House Sparrow	*Passer domestic s*(Linnaeus, 1758)	+	+	G	R	C	↓	LC	IV	-	T
Phylloscopidae												
58	Common Chiffchaff	*Phylloscopus collybita* (Vieillot, 1817)	+	+	O	R	VC	↑	LC	IV	-	T
Ploceidae												
59	Baya Weaver	*Ploceus philippinus* (Linnaeus, 1766)	+	+	O	R	C	→	LC	IV	-	T
Pycnonotidae												
60	Red – Vented Bulbul	*Pycnonotus cafer* (Linnaeus, 1766)	+	+	F	R	C	↑	LC	IV	-	T
61	White – Eared Bulbul	Pycnonotus leucotis (Gould, 1836)	+	+	O	R	Ra	↓	LC	IV	-	T
Sturnidae												
62	Asian – Pied Starling	*Gracupica contra* (Linnaeus, 1758)	+	+	O	PM	Ra	↑	LC	IV	-	T
63	Brahminy Starling	*Sturnia pagodarum* (Gmelin, 1789)	+	+	O	R	Ra	?	LC	IV	-	T
64	Common Myna	*Acridotheres tristis* (Linnaeus, 1766)	+	+	O	R	C	↑	LC	IV	-	T
65	Common Starling	*Sturnus vulgaris* (Linnaeus, 1758)	+	+	O	R	Ra	↓	LC	IV	-	T
66	Rosy Starling	*Pastor roseus* (Linnaeus, 1758)	+	+	O	PM	UC	?	LC	IV	-	T
Sylviidae												
67	Lesser Whitethroat	*Sylvia curruca* (Linnaeus, 1758)	+	+	O	WM	Ra	→	LC	IV	-	T
Zosteropidae												
68	Indian White -Eye	*Zosterops palpebrosus* (Temminck, 1824)	+	+	In	R	Ra	↓	LC	IV	-	T
Pelecaniformes Family-2; Species-5												
Ardeidae												
69	Indian Pond heron	*Ardeola grayii* (Sykes, 1832)	+	+	Ca	R	C	?	LC	IV	-	A
70	Cattle Egret	*Bubulcus ibis* (Linnaeus, 1758)	+	+	Ca	R	C	↑	LC	IV	-	B
71	Little Egret	*Egretta garzetta* (Linnaeus, 1766)	+	+	Ca	R	C	↑	LC	IV	-	B
Threskiornithidae												
72	Black Headed Ibis	*Threskiornis melanocephalus* (Latham, 1790)	+	+	Ca	SM	Ra	↓	NT	IV	-	T
73	Red Naped Ibis	*Pseudibis papillosa* (Temminck, 1824)	+	+	Ca	R	C	↓	LC	IV	-	T
Piciformes Family-1; Species-1												
Megalaimidae												
74	Brown Headed Barbet	*Psilopogon zeylanicus* (Gmelin, 1788)	+	+	F	R	C	→	LC	IV	-	T

Psittaciformes Family-1; Species- 2												
Psittacidae												
75	Alexandrine Parakeet	*Palaeornis eupatria* (Linnaeus, 1766)	+	+	F	R	UC	↓	NT	IV	-	T
76	Rose- Ringed Parakeet	*Alexandrinus krameri* (Scopoli, 1769)	+	+	F	R	C	↑	LC	IV	-	T
Strigiformes Family-1; Species-2												
Strigidae												
77	Spotted Owlet	*Athene brama* (Temminck, 1821)	+	+	In	R	VC	→	LC	IV	II	T
78	Indian Scops - Owl	*Otus bakkamoena* (Pennant, 1769)	+	+	Ca	R	UC	→	LC	IV	II	T
Upupiformes Family-1; Species-1												
Upupidae												
79	Common Hoopoe	*Upupa epops* (Linnaeus, 1758)	+	+	In	R	VC	↓	LC	IV	-	T

LC = Least Concern, NT= Near Threatened, + = presence of birds species, - = Absence of birds species, O = Omnivore, Ca = Carnivore, In = Insectivore, G = Grainivore, F = Frugivore, N = Nectarivore, R = Resident, WM = Winter Migrant, SM = Summer Migrant, C = Common, UC = Uncommon, VC = Very Common, Ra = Rare, ↓ = Decreasing, ↑ = Increasing, → = Stable, ? = Unknown, LC = least concern, NT = Near Threatened, T- Terrestrial; A- Aquatic; B- Both terrestrial and aquatic, GPT= Growth Population Trend, Ba = Bajekan, Ph = Phoolkan, RRC = Regional Research Center, FF = Farmer's field, IUCN = International Union for Conservation of Nature, IWPA = Indian Wildlife Protection Act, CITES = Convention on International Trade in Endangered Species of Wild Fauna and Flora

Relative diversity data analysis (Table 2) revealed that Muscicapidaeis the most diverse and pre-dominant family in the study area (7 species, RDi = 8.86). Leiotrichidae, (6 species, RDi = 7.59) ,Columbidae, Cuculidae and Sturnidae (5 species, RDi = 6.32) Cisticolidae and Motacillidae (4 species, RDi = 5.06) Accipitridae and Ardeidae (3 species, RDi = 3.79), Meropidae, Phasianidae, Alaudidae, Corvidae, Estrilidae, Pycnonotidae, Hirundinidae, Psittacidae, Strigidae, Scolopacidae and Threskiornithidae (2 species, RDi = 2.53) while 16 families viz. Bucerotidae, Alceidinidae, Coraciidae, Bruhinidae, Charadriidae, Recurvirostridae, Acrocephalidae, Dicruridae, Rallidae, Nectarinidae, Passeridae, Phylloscopidae, Ploceidae, Sylviidae, Zosteropidae, Megalimidae and Upupidae (1 species, RDi = 1.26) were least present in the study area.

The percent composition (Table 3) of different orders shows that Passeriformes (44 species) is the most abundant order with a total percentage of 55.70 followed by Pelecaniformes (5) and Columbiformes (5) with 6.32 percent each. The order Accipitriformes (3) and Gruiiformes (3) have percent composition of with 3.79 percent and the orders having least percent composition are bucerotiformes (1), Piciformes (1) and Upupiformes with only 1.26 percent.

Table 2: Family-wiseRelatve Diversity index (RDi)

Family	No. of Species	RDi
Bucerotidae, Alceidinidae, Coraciidae, Bruhinidae, Charadriidae, Recurvirostridae, Acrocephalidae, Rallidae, Dicruridae, Nectariniidae, Passeridae, Phylloscopidae, Ploceidae, Sylviidae, Zosteropidae, Megalimidae, Upupidae	1	1.26
Meropidae, Phasianidae, Alaudidae, Corvidae, Estrilidae, Hirundinidae, Pycnonotidae, Threskiornithidae, Psittacidae, Strigidae	2	2.53
Accipitridae, Ardeidae	3	3.79
Cisticolidae, Motacillidae	4	5.06
Columbidae, Cuculidae, Sturnidae	5	6.32
Leiotrichidae	6	7.59
Muscicapidae	7	8.86

Table 3: Order-wise percent composition

Avian order	No. of species	Percentage
Accipitriformes	3	3.79
Bucerotiformes	1	1.26
Columbiformes	5	6.32
Coraciiformes	4	5.06
Charadriiformes	3	3.79
Cuculiformes	5	6.32
Galliformes	2	2.53
Gruiiformes	1	1.26
Passeriformes	44	55.70
Pelecaniformes	5	6.32
Piciformes	1	1.26
Psittaciformes	2	2.53
Strigiformes	2	2.53
Upupiformes	1	1.26

The presence of a greater number of insectivore birds may be due to availability of variety of insects in observed area. The feeding guild revealed that Insectivore (29 species) is highly dominated guild, followed by Omnivore (25 species), Carnivore (11 species), Granivore (7) and Frugivore (5 species) and Nectarivore with only two species. Out of the total 79 species, sixty-four species were resident species followed by seven species of winter migrants, six species were summer migrant while only two species were passage migrant.

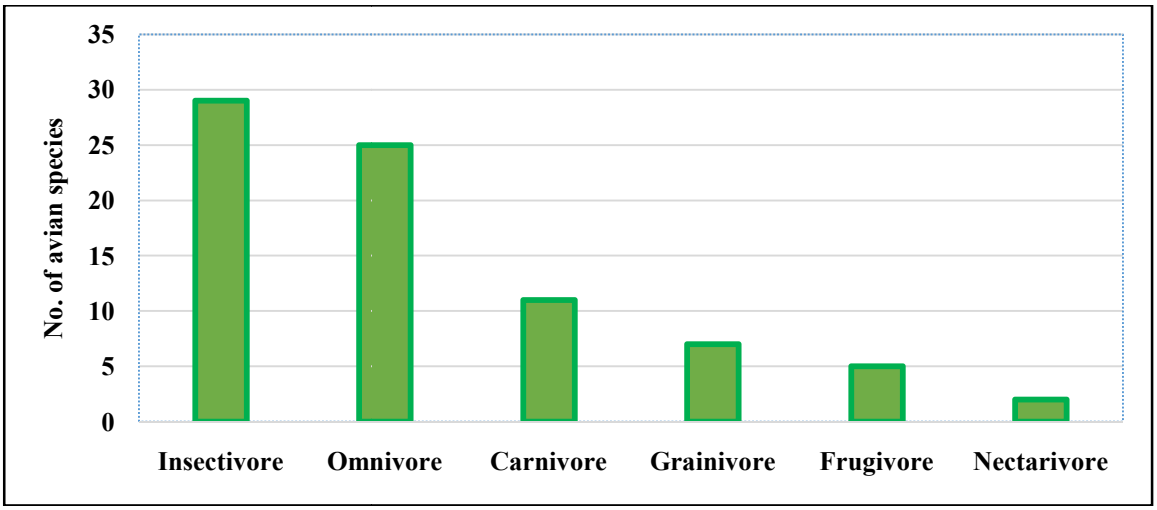

Figure 2: **Foraging guild status of observed avian species**

According to IUCN red list (2021), two species (Alexandrine Parakeet and Black-headed ibis) were categorized under Near Threatened (NT) with decreasing population trend and the remaining were least concern with stable (38), decreasing (17) and 18 species with increasing and 6 species with unknown population trend were recorded from the study area.

Local abundance status revealed that 30 species were Common, 17 were Uncommon, 21 were Very common and 11 were rare species.

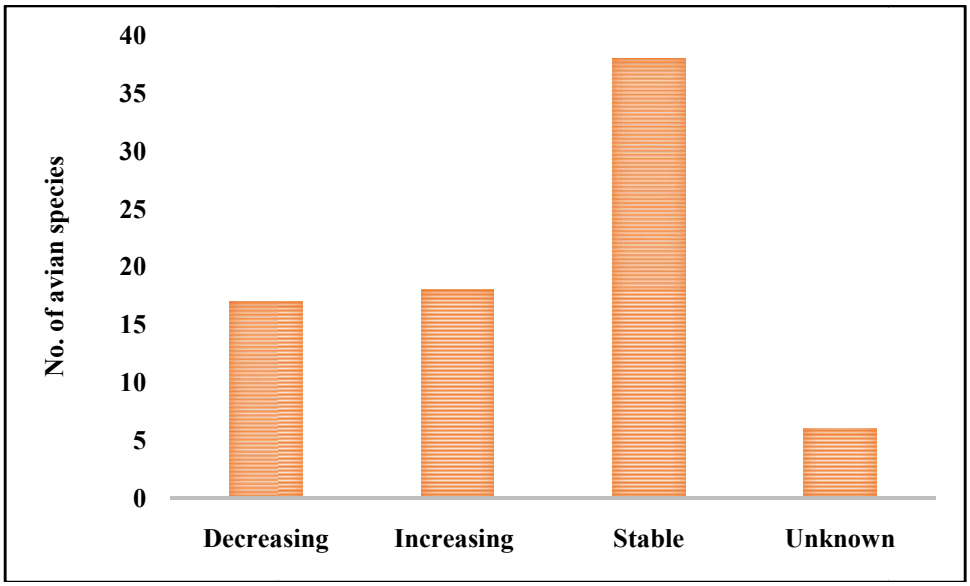

Figure 3: **Global population trend of observed avian species**

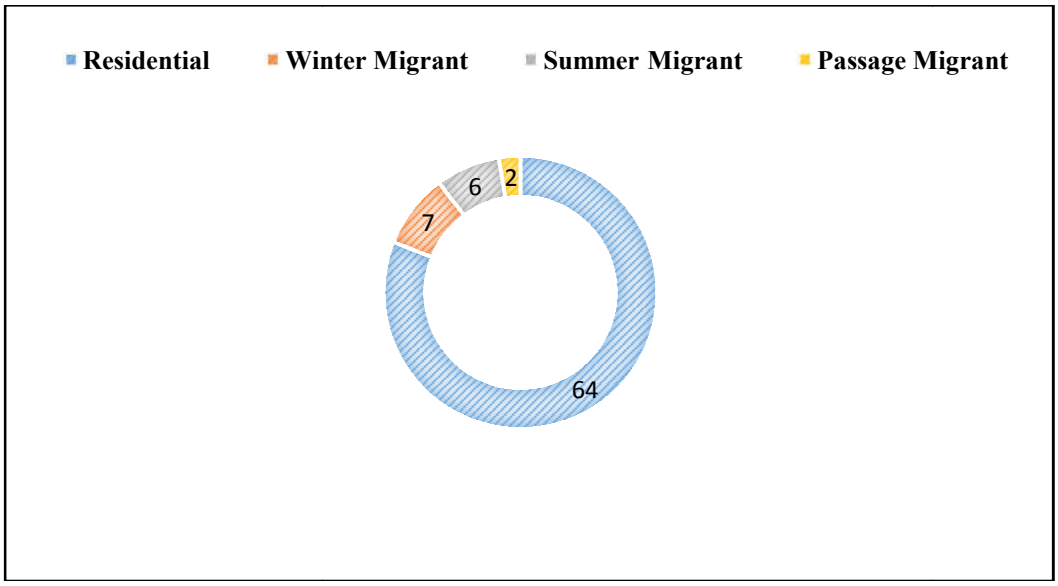

Figure 4: Residential status of observed avian species

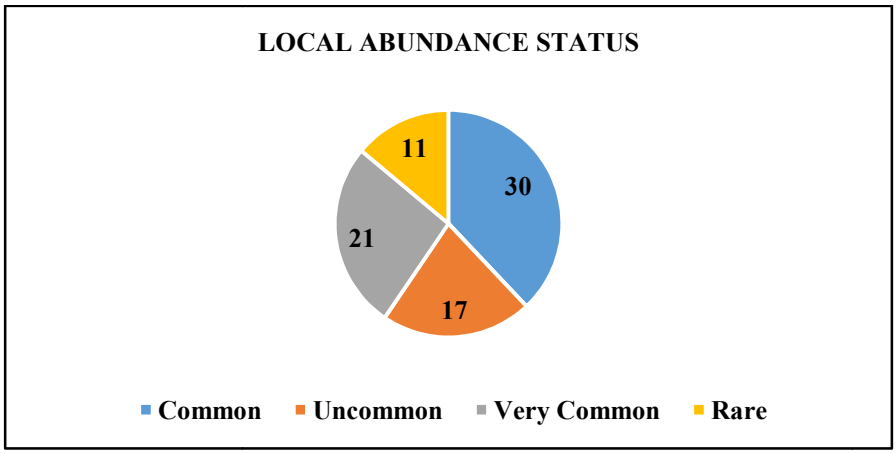

Figure 5: Local abundance status of observed avian species

DISCUSSION

The current state of avian species diversity is analogous to several studies carried out in India's various agricultural landscapes. Abdar (2014) in the Western Ghats, Maharashtra; Hossain and Aditya (2016) in Burdwan, West Bengal; Narayana et al. (2019) and Gupta and Singh (2014) in Yamuna Nagar, Haryana conducted ornithological surveys in various agricultural landscapes of India and found 97, 144, 128 and 79 bird species, respectively, with Passerifromes being the most common avian taxa. According to Narayana et al. (2015) and Narayana et al. (2019), the avian diversity in agri-fields of Nalgonda, Peddagattu, and Sherpally area of Telangana, India, showed Insectivore as dominant group of birds species which may aid in biological pest control activities of area. Scientific management techniques should be used to protect insectivorous bird species in agricultural areas. Similar bird communities were linked to greater structural similarity between habitats (Andrade et al. 2018). However, the habitat diversity may be impacted by urbanization or other

developmental activity at a particular site, which could lead to a decline in the number of birds. The findings of this study support the idea that, in order to increase the habitat quality for birds in agricultural settings, biodiversity-friendly farming practices should be adopted. It is necessity of the time to undertake a number of conservation initiatives to preserve the region's agricultural environment, including habitat management techniques like wetlands and vegetation restoration as well as expanding the variety of plants and trees to preserve the avifaunal richness of the area.

CONCLUSION

Information on the interactions between plants and birds can be obtained by comparing crop kinds with the variety of the avifaunal population. This list of the birds species presented in the selected agro-ecosystem serves as a baseline for data on their usage patterns. The feeding habits of birds and their value in managing insect pests on crops. The degree of agricultural use, as well as the quantity and variety of birds in the agricultural environment, are provided by this study. This study presents the advantageous and depredatory characteristics of bird species for their practical management strategies, and the decrease in pesticide use in crops. Effective conservation techniques will be recommended based on current research to use natural predators to reduce insect pests of crops in agricultural settings. In the agroecosystem, insectivorous birds must be promoted by the application of suitable management techniques (Narayana et al. 2016). In agricultural ecosystems, the conservation of bird species depends on environmentally friendly management practices. In order to establish species-specific relationships and create conservation strategies for agricultural birds, further research over a longer time span is required.

Conflict of Interest:
There is no conflict of interest between authors.

REFERENCES

1. Abdar, M. R. (2014). Seasonal diversity of birds and ecosystem services in agricultural area of Western Ghats, Maharashtra state, India. *Journal of Environmental Science, Toxicology and Food Technology*, 8(1), 100-105.
2. Ali, S. (2002) In: The Book of Indian Birds, 13, Oxford University Press, Mumbai.
3. Andrade, R., Bateman, H. L., Franklin, J. and Allen, D. (2018). Waterbird community composition, abundance, and diversity along an urban gradient. *Landscape and Urban Planning 170*, 103-111.
4. Egwumah, F. A., Egwumah, P. O. and Edet, D. I. (2017). Paramount roles of wild birds as bioindicators of contamination. *International Journal of Avian & Wildlife Biology*, 2(6), 194-200.
5. Flohre, A., Fischer, C., Aavik, T., Bengtsson, J., Berendse, F., Bommarco, R. and Tscharntke, T. (2011). Agricultural intensification and biodiversity partitioning in European landscapes comparing plants, carabids, and birds. *Ecological Applications*, 21(5), 1772-1781.
6. Gaston, K. J. (2022). Birds and ecosystem services. *Current Biology*, 32(20), R1163-R1166.
7. Grande, J. M., Orozco-Valor, P. M., Liébana, M. S. and Sarasola, J. H. (2018). Birds of prey in agricultural landscapes: The role of agriculture expansion and intensification. *Birds of Prey: Biology and Conservation in the XXI Century*, 197-228.
8. Grimmett, R., Inskipp, C. and Inskipp, T. (2001). Birds of the Indian Subcontinent. *2nd ed. London: Oxford University Press & Christopher Helm*, 1-528pp.
9. Gupta, N. and Singh, N. (2014). The abundance of avifauna in an agricultural landscape: a benefit of community conservation initiatives in Haryana, India. *Indian Journal of Science and Technology*, 7(4), 537-541.
10. Hallmann, C. A., Foppen, R. P., Van Turnhout, C. A., De Kroon, H. and Jongejans, E. (2014). Declines in insectivorous birds are associated with high neonicotinoid concentrations. *Nature*, *511*(7509), 341-343.
11. Heleno, R. H., Ross, G., Everard, A. M. Y., Memmott, J. and Ramos, J. A. (2011). The role of avian 'seed predators' as seed dispersers. *Ibis*, *153*(1), 199-203.

12. Hossain, A. and Aditya, G. (2016). Avian diversity in agricultural landscape: records from Burdwan, West Bengal, India. *Proceedings of Zoological Society*, 69(1), 38-51.

13. Jacobson, S. K., Sieving, K. E., Jones, G. A. and Van Doorn, A. (2003). Assessment of farmer attitudes and behavioral intentions toward bird conservation on organic and conventional Florida farms. *Conservation Biology*, *17*(2), 595-606.

14. Kiran, Singh, D., Kour, A., Priya, Delu, V. and Kumar, R. (2022). Different strategies adopted by birds to sustain ecosystem: A review. *The Pharma Innovation*, 11(9), 412-422.

15. Kumar, P. and Sahu, S. (2019). Avian Diversity in Agricultural Landscapes of District Panipat, Haryana, India. *Asian Journal of Conservation Biology*, 8(2), 188-198.

16. Labuschagne, L., Swanepoel, L. H., Taylor, P. J., Belmain, S. R. and Keith, M. (2016). Are avian predators effective biological control agents for rodent pest management in agricultural systems?. *Biological Control*, 101, 94-102.

17. La Torre-Cuadros, M. D. L. Á., Herrando-Pérez, S. and Young, K. R. (2007). Diversity and structural patterns for tropical montane and premontane forests of central Peru, with an assessment of the use of higher-taxon surrogacy. *Biodiversity and Conservation*, 16, 2965-2988.

18. MacKinnon, J. and Phillipps, K. (1993). A field guide to the birds of Borneo, Sumatra, Java and Bali. Oxford: Oxford University Press.

19. Moreau, J., Rabdeau, J., Badenhausser, I., Giraudeau, M., Sepp, T., Crépin, M. and Monceau, K. (2022). Pesticide impacts on avian species with special reference to farmland birds: a review. *Environmental Monitoring and Assessment*, *194*(11), 790.

20. Narayana, B. L., Rao, V. V. and Pandiyan, J. (2015). Avifaunal diversity in different croplands of Nalgonda district, Telangana, Southern India. *International Journal of Current Research*, 7(7), 17677-17682.

21. Narayana, B. L., Rao, V. V. and Reddy, V. V. (2019). Composition of birds in agricultural landscapes Peddagattu and Sherpally area: a proposed uranium mining sites in Nalgonda, Telangana, India. *Proceedings of Zoological Society*, 72, 380-400.

22. Plaza, P. I., Blanco, G., Madariaga, M. J., Boeri, E., Teijeiro, M. L., Bianco, G. and Lambertucci, S. A. (2019). Scavenger birds exploiting rubbish dumps: Pathogens at the gates. *Transboundary and Emerging Diseases*, 66(2), 873-881.

23. Dahiya, P., Singh, D., Delu, V., Yodha, K., Dahiya, T., Kour, A. and Punia, N. (2022). Role of birds in agroecosystem: A review on agricultural and economic ornithology. *The Pharama Innovation*, 11(7), 2300-2314.

24. Sekercioglu, C. H. (2012). Bird functional diversity and ecosystem services in tropical forests, agroforests and agricultural areas. *Journal of Ornithology*, 153(Suppl 1), 153-161.

25. Sodhi, N. S., Posa, M. R. C., Lee, T. M. and Warkentin, I. G. (2008). Perspectives in ornithology: Effects of disturbance or loss of tropical rainforest on birds. *The Auk*, 125(3), 511-519.

26. Stanton, R. L., Morrissey, C. A. and Clark, R. G. (2018). Analysis of trends and agricultural drivers of farmland bird declines in North America: A review. *Agriculture, Ecosystems & Environment*, *254*, 244-254.

27. Stoeckli, S., Birrer, S., Zellweger-Fischer, J., Balmer, O., Jenny, M. and Pfiffner, L. (2017). Quantifying the extent to which farmers can influence biodiversity on their farms. *Agriculture, Ecosystems & Environment*, 237, 224-233.

28. Traba, J. and Morales, M. B. (2019). The decline of farmland birds in Spain is strongly associated to the loss of fallowland. *Scientific Reports*, 9(1), 9473.

29. Tremblay, A., Mineau, P. and Stewart, R. K. (2001). Effects of bird predation on some pest insect populations in corn. *Agriculture, Ecosystems & Environment*, 83(1-2), 143-152.

Whelan, C. J., Şekercioğlu, Ç. H. and Wenny, D. G. (2015). Why birds matter: from economic ornithology to ecosystem services. *Journal of Ornithology*, 156, 227-23.

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