



# Village Ponds as Unexplored Habitation Sites for Resident Migratory and Migratory Bird Species in Punjab State, India

Gurkirat Singh Sekhon, Randeep Kaur Aulakh and Tejdeep Kaur Kler

Department of Zoology, Punjab Agricultural University, Ludhiana-141 004, India  
E-mail: [gurkiratsekhon@gmail.com](mailto:gurkiratsekhon@gmail.com)

**Abstract:** Village ponds are recognized as integral constituents of agricultural landscape throughout the world. Objective of the present study was to assess the abundance, diversity and composition of avian fauna inhabiting village ponds in winter season. Line/ point transect methods were followed to record bird data at three selected locations in Punjab State from November 2019 to February 2020. Overall, 59 species of birds including 45 resident, 11 resident migratory and 3 migratory species belonging to 15 orders and 30 families were recorded. Order Passeriformes was most represented in both abundance and species richness. Study revealed six feeding guilds of birds; out of these carnivores (20 species) were most abundant followed by omnivores (19 species) and insectivores (13 species). Three species of winter migratory namely *Motacilla cinerea*, *Calidris minuta* and *Spatula clypeata* were recorded foraging in mixed species flocks. The six resident migratory species were water dependent in nature with three species each of omnivores and carnivores guilds. At present, significance of avian diversity of village ponds is often overlooked therefore, their potential as bird habitats of both resident and migratory must be documented, protected, and restored in Punjab State.

**Keywords:** Village ponds, Resident migratory, Migratory bird

Ponds being small lentic water bodies (<2 ha in size) can hold water for at least a quarter of the year (Williams et al 2010) are present throughout the world and includes both anthropogenic and naturally formed ponds (Biggs et al 2005). Ponds aid in enhancing biodiversity of aquatic and terrestrial species that are dependent directly or indirectly on these freshwater ecosystems (C  r  ghino et al 2014). There are several studies of interactions at the aquatic-terrestrial interface. Ponds are known to be a prominent habitat for waterfowl populations (Rajakumar 2012). Many birds seem to associate with ponds due to its various attributes in providing rich nutrition and adequate breeding sites etc. In India, 1340 species of birds have been reported; 330 out of these species are dependent on water bodies (Ali 2002, Kumar and Gupta 2009, Kler and Kumar 2015). Kler (2009) in Punjab State recorded 14 species of water birds out of a total of 51 species belonging to 25 families in 13 orders inhabiting along the banks of Sirhind canal. Different orders of water bird species include Anseriformes, Charadriiformes, Ciconiiformes, Gruiformes, Gaviformes, Pelecaniformes and Procellariiformes (Paracuellos 2006). Bird diversity assessment study at village ponds in Sangrur district of Punjab State had shown a total of 36 species belonging to 24 families and 13 orders (Kaur et al 2018).

Birds play a vital role in increasing the biodiversity of ponds. Thus, their population characteristics i.e. size and composition act as bio indicators to pond health as they are

largely sensitive to habitat disturbances. Ponds having vast ecological and economic value typically due to their high productivity enhances the avian diversity around them. Unfortunately, freshwater bodies like ponds in general are being exposed to huge scale anthropogenic stress (Prasad et al 2002) which has detrimental effects on the bird community characteristics (Verma et al 2004). Current study was planned with an objective to get insight into relevance of water bodies both natural ponds in villages and manmade ponds in district Ludhiana, Punjab State for providing niches to bird populations and also to propose readily implementable local level conservation measures. Present communication has highlighted the village pond habitats as significant sites for particularly for bird diversity and specifically for supporting the resident migratory and migratory bird species.

## MATERIAL AND METHODS

The present investigations on avian diversity and abundance were carried out at three selected ponds in district Ludhiana; two of these selected ponds were natural and situated in villages Jhamat (30°54'15.0"N 75°44'43.0"E) and Malakpur (30°55'44.7"N 75°44'09.4"E) and third pond was selected in Punjab Agricultural University campus (30° 54' 22.3"N 75°48'36.1"E), Ludhiana from November 2019 to February 2020. These ponds have been referred as Pond A, B and C respectively in result details. Habitat features of

selected ponds were different from each other's, pond A of area 1.01 ha was surrounded by residential houses; pond B of 1.21 ha was bordered by crop fields on three sides and residential area on one side. Pond C was manmade (1.61 ha area), surrounded by crop fields and having treated water from sewage plant.

Bird surveys were conducted following Line/Point count transect methods at the selected ponds. Data was recorded on bird species inhabiting or foraging in the specified transects (Verner 1985, Buckland et al 2015). Observations were made between 8am to 10am in said months on weekly basis. The population number of bird species encountered was recorded within the selected transects. Bushnell binoculars (7X50) were used for noting morphological features of birds; identification was made as per reference of Ali (2002). Camera Nikon D3300 was used for bird photography. Birds were grouped in different feeding guilds and trophic levels as given by Kler and Kumar (2015). The checklist of bird species was prepared according to Manakadan and Pittie (2001). Vegetation structure (trees, shrubs and weeds) of catchment area around selected ponds was also recorded. Reference books like *Trees of Delhi: A field guide* (Krishen 2006) and *The Book of Indian Trees* (Sahni 1998) were consulted for vegetation identification. Bird community structure characteristics like relative abundance, species richness, species evenness and species diversity (Shanon- Weiner Index) were evaluated using standard methods given by Krebs (1985). Two-way Anova and Correlation analysis was applied on values of statistical parameters to find out any significant variance or association in bird species at the selected ponds. Analyses were performed with SPSS v 16.0. Sorensen's similarity coefficient was calculated as given by Southwood (1966).

## RESULTS AND DISCUSSION

Present investigation revealed fifty nine species of birds falling under 15 orders and 30 families at selected ponds. Order Passeriformes was the most abundant and consisted of 11 families with 24 bird species (Fig. 1). Order Charadriiformes was second with 4 families; it consisted of 5 species. Passeriformes constituted 40.67 % of total species richness. Species belonging to order Charadriiformes formed 8.47% of total species richness followed by Order Gruiformes with 6.77%. Four orders namely Accipitriformes, Anseriformes, Columbiformes and Pelecaniformes followed with 5% each. There were 13 insectivores, 20 carnivores (soil invertebrate and small invertebrate feeders), 19 omnivores, 3 granivores and 2 frugivores cum grainivores and one species of nectarivore at selected ponds. Out of total 59 observed bird species, recorded 32, 37 and 40 species of birds at ponds A,

B and C respectively. There were 26 species of resident birds (82.01%), 25 species (72.41%) and 31 species (85.24%) at ponds A, B and C in winter months respectively (Fig. 2). The 11 species of resident migratory species; out of these 5 species, 9 and 8 species were noted at ponds A, B and C respectively. Combined relative abundance (%) of resident migratory species was 17.54, 24.45 and 14.46 at ponds A, B and C respectively. Data analysis showed there were 3 migratory bird species visiting and inhabiting studies ponds; out of these one species each was found at ponds A and C and 3 species were at pond B. Species of migratory birds constituted combined relative abundance 0.45, 3.14 and 0.30 percent at ponds A, B and C respectively. Six species of resident migratory and two species of migratory birds were water dependent in nature. There were significant difference between resident, resident migratory and migratory bird species. Species richness was highest (42) at pond C and lowest at pond A (33). Species diversity value and species evenness was highest at pond C followed by pond B and pond A (Table 2). Sorensen's coefficient of similarity index showed more similarity in bird fauna between ponds A and C as compared to other ponds (Table 3).

At pond A, the highest relative abundance 25.44% was of Rock Pigeon followed by Common Myna, Common Moorhen and House Crow and Indian Spot-billed Duck. Migratory species Little Stint was observed foraging with Black-winged Stilt in shallow waters near banks of pond A. The most abundant species at pond B was Rock Pigeon (20.28%) followed by Common Moorhen, Common Myna, House Crow and Common Swallow. Large flocks of Common Swallow (20 to 30) were observed flying over pond waters during aerial foraging endeavors. Mixed flocks of Indian Spot-billed Duck, Lesser Whistling Duck and Northern Shoveler were recorded foraging and hiding in pond vegetation. Pheasant-tailed Jacana was observed only at Pond B. The five most abundant species at pond C were Black-winged Stilt (11.60%) followed by Black Kite, Red-wattled Lapwing, House Crow and Common Moorhen. Composite groups of Black-winged Stilt, Northern Shoveler and Common Sandpiper were noted swimming and involved in foraging activities. Black Kites were noticed flying overhead in circles and congregations were also noted near pond banks in evenings at pond C. There were significant difference between relative abundance of different species observed at the studied ponds A, B and C and non-significant difference in overall abundance of different ponds. In Punjab State, net area sown is 4119 thousand hectares out of total geographical area of 5033 thousand hectares (Anonymous 2022). Out of total cultivated area of 4119 thousand hectares in Punjab State, combined area under studied ponds comes

**Table 1.** Bird species present at selected ponds

Bird species	Scientific name	Pond A	Pond B	Pond C	Trophic groups	Resident status
Order: Passeriformes, Family: Sturnidae						
Common Myna	<i>Acridotheres tristis</i>	11.80	8.57	5.51	I, F	R
Asian Pied Starling	<i>Sturnus contra</i>	1.39	0.00	0.00	I, F	R
Bank Myna	<i>Acridotheres ginginianus</i>	0.00	0.44	2.11	I, F	R
Brahminy Starling	<i>Sturnia pagodarum</i>	4.42	0.62	1.05	I, F	R
Family: Hirundinidae						
Common Swallow	<i>Hirundo rustica</i>	2.30	6.39	0.00	I	R
Wire-tailed Swallow	<i>Hirundo smithii</i>	0.00	2.55	0.00	I	R
Family: Pycnonotidae						
Red-vented Bulbul	<i>Pycnonotus cafer</i>	1.85	0.99	0.75	I, P, F	R
Family: Muscicapidae						
Indian Robin	<i>Saxicoloides fulicatus</i>	0.00	1.20	0.00	I	R
Brown Rock Chat	<i>Cercomela fusca</i>	0.00	0.28	0.59	I	R
Black Redstart	<i>Phoenicurus ochruros</i>	0.00	0.00	0.49	I	RM
Oriental Magpie Robin	<i>Copsychus saularis</i>	0.00	0.14	0.00	I	R
Family: Motacillidae						
White Wagtail	<i>Motacilla alba</i>	0.15	0.00	0.00	I, SI	RM
White-browed Wagtail	<i>Motacilla maderaspatensis</i>	0.30	0.38	0.29	I, SI	R
Grey Wagtail	<i>Motacilla cinerea</i>	0.00	2.01	0.00	SI	M
Paddy Field Pipit	<i>Anthus rufulus</i>	0.00	0.00	1.37	I	R
Family: Estrildidae						
Scaly-breasted munia	<i>Lonchura puctulata</i>	3.43	0.00	0.39	I, G	R
Indian Silverbill	<i>Euodice malabarica</i>	0.00	1.71	0.00	G	R
Family: Dicuridae						
Black Drongo	<i>Dicrurus adsimilis</i>	0.72	0.55	0.85	I	R
Family: Corvidae						
House Crow	<i>Corvus splendens</i>	7.27	7.76	8.31	O	R
Rufous Treepie	<i>Dendrocitta vagabunda</i>	1.91	0.00	0.81	I, SV	R
Family: Cisticolidae						
Common Tailorbird	<i>Orthotomus sutorius</i>	1.58	0.00	0.49	I	R
Plain Prinia	<i>Prinia inornata</i>	0.70	0.00	3.18	I	R
Family: Leiothrichidae						
Jungle Babbler	<i>Turdoides striatus</i>	1.24	2.00	4.98	I, F	R
Family: Nectariniidae						
Purple Sunbird	<i>Cinnyris asiaticus</i>	0.96	0.00	0.00	P	R
Order: Gruiformes, Family: Rallidae						
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	0.00	3.41	0.00	I, SI, G, P	R
Common Moorhen	<i>Gallinula chloropus</i>	8.90	12.64	6.82	I, SI, G, P	RM
Purple Swampphen	<i>Porphyrio porphyrio</i>	0.00	0.76	0.00	SI, P, I	RM
Common Coot	<i>Fulica atra</i>	0.00	0.53	0.44	P, I, SI	RM
Order: Charadriiformes, Family: Recurvirostridae						
Black-winged Stilt	<i>Himantopus himantopus</i>	4.36	0.59	11.60	I	R
Family: Jacanidae						
Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	0.00	0.11	0.00	I, SI	R

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**Table 1.** Bird species present at selected ponds

Bird species	Scientific name	Pond A	Pond B	Pond C	Trophic groups	Resident status
Family: Charadriidae						
Red-wattled Lapwing	<i>Vanellus indicus</i>	0.30	4.40	8.80	I, SI	R
Family: Scolopacidae						
Common Sandpiper	<i>Actitis hypoleucos</i>	0.35	0.91	1.78	I, SI	RM
Little Stint	<i>Calidris minuta</i>	0.45	0.28	0.00	SI	M
Order: Anseriformes, Family: Anatidae						
Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	6.78	5.26	2.98	SV, P	RM
Lesser Whistling Duck	<i>Dendrocygna javanica</i>	0.00	1.72	3.24	SI, SV	R
Northern Shoveler	<i>Spatula clypeata</i>	0.00	0.85	0.30	P, SI	M
Order: Columbiformes, Family: Columbidae						
Rock Pigeon	<i>Columba livia</i>	25.44	20.28	1.09	G	R
Eurasian Collared Dove	<i>Streptopelia decaocto</i>	2.67	3.65	1.49	G	R
Laughing Dove	<i>Streptopelia senegalensis</i>	0.78	0.00	0.00	P, G, I	R
Order: Psittaciformes, Family: Psittacidae						
Rose-ringed Parakeet	<i>Psittacula krameri</i>	4.14	0.32	3.73	F, P, G	R
Alexandrine Parakeet	<i>Psittacula eupatria</i>	0.00	0.00	0.30	F, P	R
Order: Pelecaniformes, Family: Ardeidae						
Cattle Egret	<i>Bubulcus ibis</i>	0.50	1.19	2.30	I, SI	R
Indian Pond Heron	<i>Ardeola grayii</i>	0.91	0.88	1.43	I, SI, SV	R
Purple Heron	<i>Ardea purpurea</i>	0.00	0.11	0.00	I, SI, SV	RM
Family: Threskiornithidae						
Indian Black Ibis	<i>Pseudibis papillosa</i>	0.00	0.00	1.63	I, G	R
Order: Podicipediformes, Family: Podicipedidae						
Little Grebe	<i>Tachybaptus ruficollis</i>	0.86	4.86	1.51	I, SI, SV	R
Order: Cuculiformes, Family: Cuculidae						
Asian Koel	<i>Eudynamys scolopaceus</i>	0.57	0.00	0.00	I, F	R
Greater Coucal	<i>Centropus sinensis</i>	0.91	0.52	0.93	I, SI, SV	RM
Order: Bucerotiformes, Family: Bucerotidae						
Indian Grey Hornbill	<i>Ocyrceros birostris</i>	1.55	0.00	0.57	F, I	R
Family: Upupidae						
Common Hoopoe	<i>Upupa epops</i>	0.00	0.29	0.28	I	RM
Order: Piciformes, Family: Picidae						
Common Golden-backed Woodpecker	<i>Dinopium javanense</i>	0.00	0.00	0.28	I	R
White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	0.21	0.56	0.00	I, SV	R
Order: Galliformes, Family: Phasianidae						
Indian Peafowl	<i>Pavo cristatus</i>	0.00	0.00	5.76	G, P, I, SV	R
Grey Francolin	<i>Ortygornis pondicerianus</i>	0.00	0.00	0.44	I, G	R
Order: Accipitriformes, Family: Accipitridae						
Black Kite	<i>Milvus migrans</i>	0.00	0.00	9.81	SV	R
Shikra	<i>Accipiter badius</i>	0.00	0.00	0.64	I, SI, SV	R
Black-winged Kite	<i>Elanus caeruleus</i>	0.00	0.00	0.24	I, SI, SV	R
Order: Suliformes, Family: Phalacrocoracidae						
Little Cormorant	<i>Microcarbo niger</i>	0.00	0.29	0.44	SV	RM
Order: Strigiformes, Family: Strigidae						
Spotted Owlet	<i>Athene brama</i>	0.30	0.00	0.00	I, SV	R

Trophic groups

I-Insects, SI- Small Invertebrates, SV- Small Vertebrates, F- Fruits, P- Plants, G- Grains

out to be 3.83 ha which is a fraction of area inhabited by 59 species of birds including 45 resident species, 11 resident migratory and 3 migratory bird species. Present observations pointed out these ponds as significant habitats for accommodating and supporting diversity of terrestrial and water dependent avian fauna.

Vegetation features of studied ponds comprised of 22 tree species, 11 weed species and 4 other (cereal, fodder and vegetable) crops There were recorded 10 tress species at pond C followed by 9 ponds at A and 2 at B. Dhek /Bakayan (*Melia azedarach*), Peepal (*Ficus religiosa*) and Sarin (*Albizia lebbbeck*) were found at banks at ponds A and C. Wheat and paddy were the cultivated crops in the vicinity of pond B and C. Alfred et al (2001) reported that birds of Family Anatidae consisting of ducks and geese formed the most abundant group of winter migrants to the Indian subcontinent. Different studies have emphasized the vital role of freshwater bodies like wetlands in harboring migratory and residential bird species (Vijayan 2004, Rathod et al 2016 and Krishnamoorthi et al 2020). Céréghino et al (2014) pointed out about large lacuna in biodiversity related basic knowledge associated with pond ecosystems. Location specific or proper guidelines are lacking to restore or preserve ponds locally and at global level (Chen et al 2019).

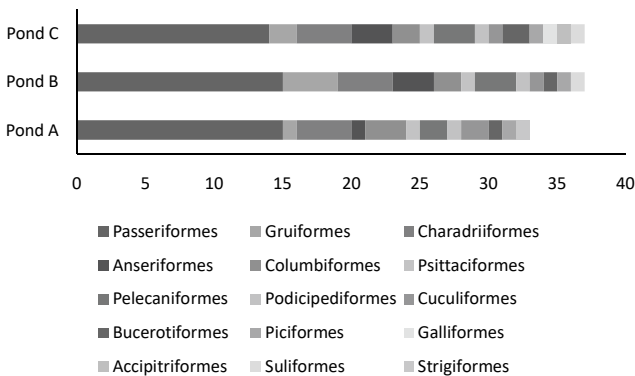


Fig 1. Comparative representation of different bird orders at selected ponds

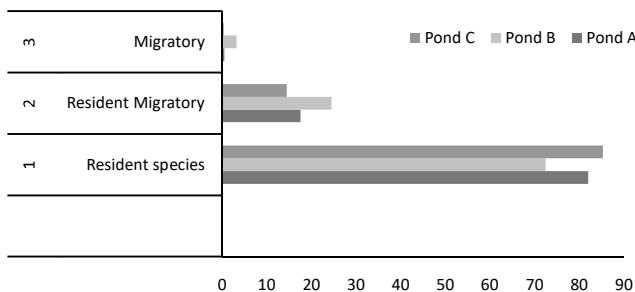


Fig. 2. Relative abundance (%) of bird species according to their resident status in studied ponds

Table 2. Bird community characteristics at studied ponds

Community characteristics	Pond A	Pond B	Pond C
Species richness	33	38	42
Species diversity	2.738386	2.877752	3.157504
Species evenness	0.783177	0.791116	0.844779

Table 3. Sorenson's coefficient of similarity of bird species at studied ponds

	Pond A	Pond B	Pond C
Pond A	1	0.627	0.657
Pond B	0.627	1	0.649
Pond C	0.657	0.649	1

National and international treaties are almost non-existent to protect water bodies in agricultural areas which has accelerated losses in their number, area and state in last 50 years (Bridgewater and Kim 2021, Goyal et al 2021). The present study bring out undeniable significance of rural ponds as an abode of avian diversity in comparison to well recognized and well documented Ramsar wetland habitats. Therefore, timely and urgent interventions are needed for location specific and situation specific habitat improvement measures to sustain avian fauna of diverse residential status and foraging guilds.

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