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Research Article

CONSERVATION STATUS, FEEDING GUILDS, AND DIVERSITY OF BIRDS IN BJM GOVERNMENT COLLEGE CAMPUS, KOLLAM KERALA

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ABSTRACT

An ongoing study has examined the diversity, richness, abundance and feeding behaviour of birds on the BJM college campus in Chavara, Kollam. Data were collected from December 2023 to December 2024 using the point-counting method. In total, 62 birds in 27 families were recorded. Four endangered species of birds have been observed (Oriental darter, black-headed ibis, painted stork and woolly stork). Habitat suitability index (HSI) of Painted stork, Wolly Necked Strok species was 0.80. Furthermore, Oriental Darter and Black headed ibis HSI was 0.70. Correspondence analysis showed the least link between arboreal habitats and scavengers, while the strongest link was found between the aerial habitat and the carnivores. This research provides information on bird diversity, including threats and feeding groups, which sheds light on the importance of habitats.

Keywords: Habitat suitability index, Richness, Abundance, Feeding behaviours, Scavengers.

INTRODUCTION

Guild, a fundamental concept of bird ecology, is formed when a group of birds uses the same ecological resources (Balestrieri *et al.,* 2015). Each guild has different tolerance limits and resource needs depending on its environment, which is influenced by several factors such as food availability, predator presence and different environmental factors (Katwal *et al.,* 2016). Historically, birds have been considered excellent model systems for studying all biodiversity groups, as they occupy all climate zones and habitat types (McCain and Grytnes 2010). Variety and number of birds fluctuate with changes in vegetation and habitat characteristics (Blake, 2007). For example, bird feeding groups are strongly linked to their habitat and the availability of food. Snep *et al.,* 2015 recommend differentiating richness graduations between different guilds in order to better understand the structure of the bird community and its habitat selection processes. Habitat structure affects diet, microhabitat and body size; guilds of feeding animals (Watson *et.al.,* 2004; Mohd-Azlan *et. al.,* 2015). Habitats are crucial to the survival of all species, and as ecosystems are facing many challenges, such as deforestation, over-exploitation, over-grazing, and habitat loss (Baig and Al-Subaiee, 2009), it is important to assess their extent and the patterns of these ecosystems in different geographical areas. The Habitat Suitability Index (HISI) helps to assess how well a habitat can support a species under current conditions (Theuerkauf and Lipczynski, 2016). Meanwhile, campuses with fragmented and uneven habitats can still sustain significant biodiversity, especially in grasslands and wetlands (Panda *et al.,* 2020). However, it seems that the abundance of unused resources such as food, shelter, nest sites and breeding grounds attracts birds to the site (Oslava and Mošanskou, 2017). College campuses with their concrete buildings, recreational parks and private gardens offer a breeding and resting place for birds, together with additional food supply (Ottoni *et al.,* 2009). Conversely, in areas where urban development is widespread and vegetation sparse (Donnelley and Marzluff 2004; Leveau and Leveau 2020), diversity can be limited. Based on these details, the current study was carried out on the campus of BJM in the city of Kollam.

The objective of current research is therefore to outline the diversity of species and investigate feeding guilds by microhabitat type and ecological conditions of birds in and around the BJM College Campus in Kollam, Kerala.

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MATERIAL AND METHODS

Study area

The current study was conducted at the premises of the BJM Government College in Chavara, Kollam. It is located between 8.99 N, 76.53 E, 9.4 N, and 76.29 E. It covers 6 acres. The campus is characterized by built-up areas (buildings, paved roads), wetlands, scattered grasslands or natural ecosystems, tree groves, and open fields. Open water and wetland areas sustain a variety of aquatic and semi-aquatic plants, which offer a wide variety of resources for the bird population. Linked to these aquatic plants are a diverse community of zooplankton, aquatic and terrestrial arthropods, such as insects, mollusks, and fish, which are the primary food source for macrofauna, especially birds.

Bird Survey

The diversity of avian fauna was studied over a duration of 1 year, from December 2023 to December 2024. Surveys were conducted regularly every two weeks. The birds were monitored from 07:00 AM to 10:00 AM and 04:00 PM to 07:00 PM. The line transect method was utilized in the research during each visit. Birds were spotted using Olympus binoculars (8 × 40), and images were captured with a Nikon P950 camera. Identification of bird species was conducted with the help of a field guide. Following Grimmett *et al.,*2011, bird identification was done using Praveen and Jayapal (2023) as a taxonomic reference. According to Mackinnon and Phillipps (1993), sighting frequency determines abundance status and can be classified as Common (CO), Fairly Common (FC), Uncommon (UC), or Rare (RA). The presence-absence method was employed to determine the residential status (resident, summer migrant, or winter migrant) (Kumar & Sharma, 2018). The assessment of conservation status and global population trend was guided by the IUCN's Red List (2022).

Guild classifications

Birds have been classified into different feeding guilds according to their diet and their feeding environment (DeGraaf *et al.,* 1985; Gray *et al.,* 2005., Prajapati and Prajapati 2013; Ding *et al.,* 2019).

Habitat Suitability index

Parameters for the globally threatened species included cultivated land, the presence of lakes and wetlands, availability of food, vegetation cover, the presence of scattered trees and shrubs, disturbances, geographical location and the presence of breeding grounds. The weightings for each parameter have been determined on the basis of sightings, submitted observations, species biology, and opinions of wildlife experts (Mölndgen *et al.,* 1999). The habitat suitability index for endangered species has been estimated by the following formula (Hess and Bey, 2000): HSI = (SI1 + SI2 + SI3 + SI4 + ... + SI6 + SI7 + SI8) A further classification of the scores is given in Table 1.

Table 1. Habitat suitability index score categorization.

Category	HSI score	Suitability
Poor	< 0.50	Least suitable
Below Average	0.50 - 0.59	Less suitable
Average	0.60 - 0.69	Less suitable
Good	0.70 - 0.79	Moderately suitable
Excellent	> 0.8	Highly suitable

Data analysis

The correlation analysis and the relative abundance were calculated using PAST 4 statistical software and Microsoft Excel. The observations were recorded for the purpose of compiling and interpreting data on the bird feed guild (Grimmett *et al.,* 2014) and for the information on distribution, population and occurrence (McKinston and Ripley, 1993; Aarif *et al.,* 2017).

RESULTS AND DISCUSSION

In total, 62 species of birds from 27 families were recorded in the study area (2022-2023). The predominant group (Table 2) was the Ardeidae family, consisting of seven species (RDi= 11.29). The composition of species in terrestrial and aquatic habitats is different, including 35 terrestrial and 27 aquatic species. The residents constitute 56 species, among which 26 species (46.42. %) were very common, 25 species (44.46 %) common category, 5 species (8.9 %) were uncommon. Among the 5 species of winter migrants, 3 species (60. %) were common and 2 species (40 %) were uncommon. Under the Passage visitor category, *Bubulcus ibis* was the only regular visitor and are under the uncommon (Table 1). The data for the conservation status was referred from the IUCN Red List. From the total 62 species, 58 species belong to the Least Concern category (93.5%), where the population trend of 25 species (43%) is stable, 12 species (20.6%) are decreasing, 8 species (13.78%) are increasing, and the population trend of 13 species (22.4%) is unknown. There are 4 species (6.42%) under the Near Threatened category with decreasing population trends: Painted Stork (*Mycteria leucocephala),* Black-headed Ibis (*Threskiornis melanocephalus*), and Oriental Darter (*Anhinga melanogaster).* Woolly-necked Stork (*Ciconia episcopus)* (Table 1).

Out of the total species, 18 species (29%) occupied various niches within the site habitat. The data representation distinctly indicated that the terrestrial habitat outnumbered the other habitats in species abundance (29.9%) because of its varied vegetation cover. Receding to terrestrial habitat (27.9%) includes open water habitat, ground, open bank, lake marsh, arboreal, and aerial, with the least abundance found in floating vegetation (5%). The avian species were categorized into eight feeding groups. Insectivores included 16 families, omnivores included 11 families, and carnivores included 8 families. Conversely, piscivores encompassed four families, frugivores covered five families, granivores covered three families, and nectivores also covered three families. The structure of feeding guilds determined by their occurrence in various habitats was analysed to grasp the significance of these habitats for distinct groups. The research indicated that Insectivores, comprising 29%, were the prevailing group, with the majority of species found across all habitat types. Terrestrial habitat exhibited the highest dominance by containing the majority of feeding guilds with increased species abundance (24.2%). Correspondence Analysis was employed to examine the connection between various microhabitats and the structure of feeding guilds. The weakest connection was noted between the arboreal habitat and Scavengers, while the strongest connection was found between Terrestrial and Omnivores (Figure 1).

The Oriental darter species prefers the habitat with wetlands, lakes, open water bodies, swamps, scattered trees, and bare lands and feeds on lizards, insects, etc., in clean and healthy water bodies. The habitat suitability index was estimated to be 0.70, and the major factors that caused decline in HSI were reduction in breeding sites and increase in disturbance. The Ciconiidae family **(**painted stork, woolly-necked stork) supported a great number of individuals because of its temperature and habitat conditions for various plant, animal, reptile, and invertebrate species, making the area appropriate for bird foraging, resting, and breeding. Shrubs and bushes provided foraging, breeding, and resting habitat for avian species and suggested that these could also serve as important foraging habitats. The habitat suitability index was estimated to be 0.80, and the major factors that caused a decline in HSI were a reduction in breeding sites and an increase in disturbance. The black-headed ibis prefers the habitat with wetlands, lakes, open water bodies, swamps, scattered trees, and bare lands and feeds on lizards, insects, etc., in clean and healthy water bodies. The habitat suitability index was estimated to be 0.70, and the major factors that caused decline in HSI were reduction in breeding sites and increase in disturbance.

Table 2. Checklist of Avifauna based on the Families, Conservation Status & their population trend, residential and frequency status, feeding and habitat preferences.

Common Name	Scientific Name	IUCN Status	Population trend	Residential status	Feeding Guild	Frequency of Occurrence	Habitat
Family: Ardeidae							
Indian pond heron	*Ardeola grayii*	LC	U	R	C /I	VC	4/3
Cattle egret	*Bubulcus ibis*	LC	I	PV	I/C	UC	4/3
Little egret	*Egretta garzetta*	LC	I	R	I/C	UC	4/3
Intermediate egret	*Ardea intermedia*	LC	D	R	C /I	VC	4/3
Great egret	*Ardea alba*	LC	U	R	C /I	C	4/3
Purple heron	*Ardea purpurea*	LC	D	R	C /I	VC	3
Black-crowned Night Heron	*Nycticorax nycticorax*	LC	D	R	C /I	C	4/3
Family: Accipitridae							
Brahminy kite	*Haliastur indus*	LC	D	R	C/S	VC	7/6/1
Black kite	*Milvus migrans*	LC	S	R	C/S	VC	7/6/1
Family: Phalacrocoracidae							
Indian cormorants	***Phalacrocorax fuscicollis***	LC	U	WV	P	C	1
Little cormorants	*Microcarbo niger*	LC	U	R	P	VC	1
Family: Anhingidae							
Oriental darter	*Anhinga melanogaster*	NT	D	R	P/C	C	1
Family: Rallidae							

Grey headed swanphen	*Porphyrio poliocephalus*	LC	U	R	V/O	VC	**3**
White breasted waterhen	*Amaurornis phoenicurus*	LC	U	R	I /O	VC	**3**
Eurasian Coot	*Fulica atra*	LC	I	R	V/O	VC	3/2/1
Water cock	*Gallicrex cinerea*	LC	I	R	V/O	VC	3/2/1
			Family: Jacanidae				
Bronze winged jacana	*Metopidus indicus*	LC	I	R	C/I	VC	4/3
Pheasant-tailed Jacana	***Hydrophasianus chirurgus***	LC	D	R	I/O	C	2/3
			Family: Alcedinidae				
White throated king fisher	*Halcyon smyrnensis*	LC	U	R	I/C	VC	5
Common King fisher	*Alcedo atthis*	LC	U	R	P/I	VC	3/1
Pied King fisher	*Ceryle rudis*	LC	U	R	P/I	VC	1/5
			Family: Anatidae				
Lesser whistling duck	*Dendrocygna javanica*	LC	D	R	V/O	C	2/1/3
Indian Spot-billed Duck	*Anas poecilorhyncha*	LC	D	R	V/O	VC	2/1/3
			Family: Threshkiornithidae				
Black headed ibis	*Threskiornis melanocephalus*	NT	D	R	C/I	C	4
			Family: Ciconiidae				
Asian open bill	*Anastomus oscitans*	LC	U	WV	C/I	UC	4
Painted stork	*Mycteria leucoceohala*	NT	D	R	P/C	C	4
Wolly necked stork	*Ciconia episcopus*	**NT**	D	R	C/I	C	8
			Family: Charadriidae				
Red wattled lapwing	*Vanellus indicus*	LC	U	R	I	VC	8
Yellow-wattled Lapwing	Vanellus malabaricus	LC	S	R	I	C	8
			Family: Cuculidae				
Asian koel	*Eudynamys melanorhyncus*	LC	S	R	F/O	VC	6
Greater Coucal	*Centropus sinensis*	LC	S	R	C/O	C	5/8
Gray-bellied Cuckoo	*Cacomantis passerinus*	LC	S	R	I	C	5
Common Hawk-Cuckoo	*Hierococcyx varius*	LC	S	R	I/F	UC	6
			Family: Scolopacidae				
Common sand piper	*Actitis hypoleucos*	LC	I	WV	I/O	UC	4
Wood Sandpiper	*Tringa stagnatilis*	LC	S	WV	I/O	C	4
			Family: Meropidae				

Blue tailed bee eater	*Merops philippinus*	LC	I	R	I	VC	5
			Family: Nectaranidae				
Purple-rumped Sunbird	*Leptocoma zeylonica*	LC	S	R	N	C	6
Purple Sunbird	*Cinnyris asiaticus*	LC	S	R	N	C	6
			Family: Sturnidae				
Common myna	*Acridotheres tristis*	LC	I	R	O	VC	5
Jungle Myna	*Acridotheres fuscus*	LC	D	R	O	VC	5
			Family: Passeridae				
House Sparrow	*Passer domesticus*	LC	D	R	G/O	C	5
Yellow-throated Sparrow	*Gymnoris xanthocollis*	LC	S	R	G/O	C	5
			Family: Dicaeidae				
Purple Sunbird	*Cinnyris asiaticus*	LC	S	R	N	C	6
Thick-billed Flower pecker	*Dicaeum agile*	LC	S	R	F/I/N	C	6
Pale-billed Flower pecker	*Dicaeum erythrorhynchos*	LC	S	R	F/I/N	C	6
			Family: Estrildidae				
Tricolored Munia	*Lonchura malacca*	LC	S	R	G/O	UC	5
Indian Silver bill	*Euodice malabarica*	LC	S	R	G/O	C	5
Scaly-breasted Munia	*Lonchura punctulata*	LC	S	R	G/O	C	5
			Family: Corvidae				
House Crow	*Corvus splendens*	LC	S	R	O/S	VC	5
Large-billed Crow	*Corvus macrorhynchos*	LC	S	R	O/S	C	5
Indian Jungle Crow	*Corvus culminatus*	LC	S	R	O/S	C	5
			Family: Oriolidae				
Indian Golden Oriele	*Oriole Oriolus kundoo*	LC	U	R	F/O	C	6
			Family: Columbidae				
Rock Pigeon	*Columba livia*	LC	R	R	G/F	VC	5
			Family: Apodidae				
Indian Swiftlet	*Aerodramus unicolor*	LC	D	R	I	UC	7
			Family: Acrocephalidae				
Paddy field Warbler	*Acrocephalus agricola*	LC	D	WV	I	C	5
			Family: Aegithinidae				
Common Iora	*Aegithina tiphia*	LC	U	R	I	VC	6
			Family: Cisticolidae				
Common	*Orthotomus*	LC	S	R	I/N	VC	5

Tailor bird	*sutorius*						
Ashy Prinia	*Prinia socialis*	LC	S	R	I	VC	5
Plain Prinia	*Prinia inornata*	LC	S	R	I	VC	5
Zitting Cisticola	*Cisticola juncidis*	LC	S	R	I	VC	5
			Family: Bucerotidae				
Indian Gray Hornbill	*Ocyceros birostris*	LC	S	R	F/O	C	6
			Family: Ploceidae				
Baya Weaver	*Ploceus philippinus*	LC	S	R	G/O	C	5

Threat Status: NT - Near Threatened; LC - Least Concern. Population trend: S – stable; D – decreasing; I – increasing; U – unknown. Residential status: R = resident; WV = winter visitor; PV = passage migrant. Feeding specialization: carnivores(C); insectivores(I); frugivores(F); granivores(G); nectivores(N); omnivores(O); scavenger(S); vegetable matter(V); piscivores (P). Frequency of occurrence: V = very common; C = common; UC = uncommon; Ra = rare; Rp = reported. Habitat: 1. Open water; 2. Among the floating vegetation; 3. Lake marsh; 4. Open bank; 5. Terrestrial; 6. Arboreal; 7. Arial; 8. Ground.

Table 3. Relative diversity index (RDI) of all the families of avifauna.

Families	Total no. of species	RDI %
Ardeidae	7	11.29
Rallidae	4	6.45
Cuculidae		
Cisticolidae		
Alcedinidae	3	4.83
Ciconiidae		
Corvidae		
Dicaeidae		
Accipitridae	2	3.22
Phalacrocoracidae		
Jacannidae		
Anatidae		
Charadriidae		
Scolopacidae		
Nectariniidae		
Sturnidae		
Passeridae		
Estrildidae		
Anhingidae	1	1.61
Threskiornithidae		
Meropidae		
Oriolidae		
Columbidae		
Apodidae		
Acrocephalidae		
Aegithinidae		
Bucerotidae		

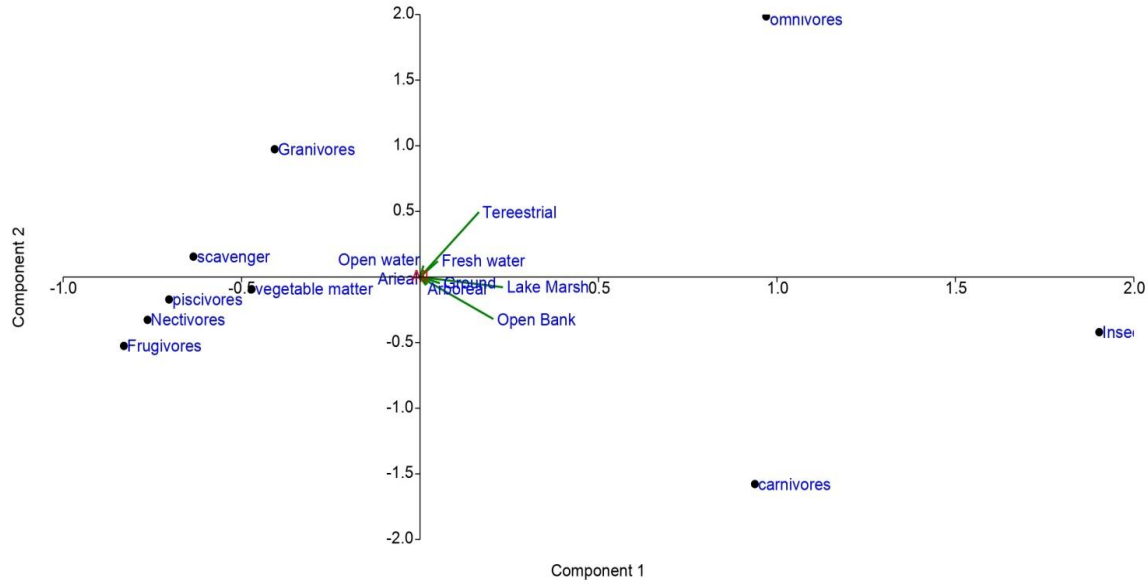

Figure 1. Correspondence Analysis of Avifaunal Diversity and Feeding Guilds of BJM College Campus.

Determining the relationship among various habitats and avian diversity is a very important aspect of research. The presence of maximum species in a habitat depends on a variety of factors, primarily food availability, shelter or security, and nesting space. In the study area, agriculture land also supports many resident and migratory birds. Vegetative diversity and microhabitats are one of the key elements contributing to the richness of biodiversity. Unlike terrestrial habitats, the main factor that could explain the substantially lower diversity of water birds compared to terrestrial birds is the increased water level, which floods the shores and marshland. The lake level changes significantly every year, leading to temporary mud plains, which are vital for wading birds. Certain migratory birds, such as the Little Tern (*Sternula albifrons),* come to the lake only in certain years when the water level falls and the marshy banks are covered with reeds. Variety of habitats and availability of food have led to an increase in the abundance and richness of species. The primary cause of the variation in habitat preference among bird species may stem from diverse types of vegetation and plentiful food sources including insects, fish, frogs, lizards, mice, and plant material. Nonetheless, additional factors encompass weather (precipitation), social interactions, and predators (Caldwell 1986, Butler and Vennesland 2000, Rivers 2000). In the study area, there is a good amount of marsh and swamp lands, which provide excellent habitats for frogs and toads to breed. Among the aquatic vegetation, Water Hyacinth (*Pontederia crassipes*) being invasive covers approximately about 35%, The remaining aquatic vegetation cover includes, water Hydrilla, Vallisneria, Spirodela spp. Azolla. With a variety of aquatic vegetation and terrestrial scrubs and bushes hosts a wide array of insect population of about more than 30 species of Lepidopterans and Odonata. More than 13 species of fish, from tiny Gambusia to Barbs, Tilapia to Carps, Minnows to, and Catfishes act as a *Ophiocephalus* food resource for a wide range of birds from divers to wader and Herons. The trees, such as the *Acacia arebica* and, and even electric poles/lines *Cocos nucifera* provide good perch sites for resident and migratory Raptors.

CONCLUSION

This study seeks to establish a database detailing the richness and abundance of birds categorized by habitat and food guild, marking the first exploration of the connection between birds and food guilds within an educational institute in the Kollam area. The BJM College vicinity is home to various bird species, which benefits the progress of ornithological research in the area. Urban farming regions, gardens, and wetlands served as food sources for birds and seemed to support the greatest diversity of bird species. Consequently, creating small parks and different green spaces on the college campus can help improve bird diversity in the urban environment. The insect-eating group, recognized for its variety of species, emphasized the importance of farming areas in and around city environments. The findings of the study emphasize the necessity of creating greenspace zones and addressing the deterioration of agricultural land to secure the lasting protection of these biodiversity-rich ecosystems.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

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AI TOOL DECLARATION

The authors declares that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

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