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Research Article

A Study on the Avifauna of Palakkal Kole Wetland, Thrissur: A Ramsar Site of South India

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Abstract

Background: Kole wetland, a highly productive habitat forms a unique ecosystem that supports large number of birds. Palakkal Kole wetland, Thrissur, which is part of Vembanad Kole is a Ramsar site and this study identifies the species richness and composition of avian fauna of this wetland. **Materials and Methods:** Bird survey was done by line transect method, direct counting, point counting and block counting methods. **Results:** Sixty five species of birds belonging to 12 orders and 28 families were recorded from Palakkal Kole. Two vulnerable species, *Ciconia episcopus* and *Clanga clanga* and 5 near threatened species were recorded from the area. *Anhinga melanogaster*, *Pelecanus philippensis*, *Threskiornis melanocephalus*, *Mycteria leucocephala* and *Limosa limosa* seen in this habitat are near threatened species. About 66.15% of birds in Palakkal Kole are water dependent foragers. About 43.08% of the avian fauna of this area are aquatic carnivores. Waders have the highest species representation in Kole wetlands. About 6570 birds were recorded during the study with maximum number of birds during the month of January. Shannon Wiener diversity index was highest in February. Charadriiformes were the most represented order with 15 species, followed by Passeriformes and Pelecaniformes. Pelecaniformes was the most abundant order with maximum number of birds during the months January-April. Twenty species showed trans-continental migration, 15 local migration and 30 species were resident to the area. **Conclusion:** Wetlands provide habitat for large number of birds including several threatened and near threatened bird species. *Mycteria leucocephala* identified as a vagrant visitor to the wetlands of Malabar and South Kerala by earlier researchers was found to have extended its range. The conservation of vulnerable and threatened species and their habitats require prioritization. Migratory birds connect continents and countries and act as excellent environmental indicators.

Key words: Wetland, avifauna, diversity, species richness, feeding habit

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Wetlands are dynamic, highly productive ecosystems supporting huge biotic communities adapted to shallow and often changing water regimes. They support substantial biodiversity by providing habitat for large number of birds, mammals, reptiles and invertebrates. The Kole lands of Thrissur are part of one of the largest wetland systems on the South-West coast of India, namely the Vembanad Kole, which was declared as Ramsar site in 2002. Ramsar sites are wetlands considered to be of international importance identified by Ramsar convention. Thrissur Kole is spread over Thrissur and Malappuram districts and forms one of the major fresh water wetlands of Kerala state. The Karuvannur river divides Thrissur Kole land into North and South Kole, which acts as flood basin during the South-West monsoon. 'Kole' is a Malayalam word which denotes bumper yield. During the monsoon season, the whole area remains inundated and this highly fertile land has well defined phases of cultivation.

Extensive studies on wetlands and their avifauna have been carried out in different geographic areas. These include ecosystem studies, food and feeding habits of birds, their behavior, breeding biology and population studies¹⁻⁶. Studies conducted by Ali and Vijayan^{7,8} in Bharatpur and Ali and Neelakantan⁹ at point Calimer, Vedaranyam are commendable. The adverse effect of habitat destruction and degradation of water bird population have been pointed out by Robertson and Kushlan¹⁰, Bock and Lepthien¹¹ and Custer *et al.*¹². The population of marsh land birds has been used as a biological indicator of habitat quality^{12,13}.

Food habits of water birds in India have been studied by Mukherjee¹⁴ and Pandit¹⁵. Other studies in India include breeding ecology of bronze winged jacana and pheasant-tailed jacana in the Keoladeo National Park⁸. Availability of food and South-West monsoon were reported to be the limiting factors for breeding and clutch size of water birds in India. Kurup¹⁶ reported on the birds of Kadalundi and Purathur estuaries of the Malabar coast of Kerala. Jayson¹⁷ and Nameer¹⁸ conducted detailed ecological studies on the avifauna of Vembanad Kole wetland. Kuruvilla¹⁹ studied the avian diversity of wetlands situated in urban environment.

This study is an attempt to identify the species richness and composition of avian fauna present in Palakkal Kole wetland, Thrissur, which is part of Vembanad Kole. Identifying the species composition of a habitat will provide better understanding of the ecosystem and its functioning. Studying the biodiversity index will offer a better perceptive regarding the stability of an ecosystem.

MATERIALS AND METHODS

Census area: The Kole wetlands of Palakkal, a part of Thrissur Kole in Thrissur district was the study area. Palakkal is situated at a distance of 6 km from Thrissur, at geographical co-ordinates of 10°28' 15" N and 76°12' 40" E. The study site has many different milieus such as deep and shallow waters, open mudflats, grassland and paddy fields. It also includes bunds, dykes and trees which provide different types of microhabitat for the birds.

Methodology: Survey methods included line transects method²⁰ and direct counting method. Point count method²¹ was also employed by observing the birds from an elevated area. Block count method was used for large aggregations of birds. The time of observation was from 630-1030 h during the months November, 2015 to April, 2016. Migratory birds visit the area during these months. Birds were identified with the help of 8×40 binoculars and classified according to the hand books and checklist of Ali and Ripley²², Ali²³ and Praveen *et al.*²⁴. The common and scientific names are after Manakadan and Pittie²⁵ and taxonomy according to Ripley and Dillon²⁶ and Inskipp *et al.*²⁷.

The birds were categorized based on their IUCN status. The habit and habitat of birds were recorded and they were categorized into different ecological groups on the basis of their activities. The feeding habit and guild of different species were collected from available literature. Bird species were also classified as resident, local migrant, migrant and vagrant. Shannon Wiener diversity index was studied.

RESULTS

Wetlands are important bird habitats, utilized for their activities like breeding, nesting and rearing the young. During the survey conducted in the Kole wetland, 65 species of birds belonging to 12 orders and 28 families were identified and recorded (Table 1). The IUCN status of the birds showed that 58 belonged to the least concern category, five had near threatened status and two species were vulnerable. *Ciconia episcopus* commonly called the wooly necked stork and *Clanga clanga* commonly called the greater spotted eagle were the vulnerable species recorded from the area. *Anhinga melanogaster*, *Pelecanus philippensis*, *Threskiornis melanocephalus*, *Mycteria leucocephala* and *Limosa limosa* were the near threatened species. Out of the 65 species, 20 were long distance migrants, 15 showed local migration and 30 species were resident to the area.

Table 1: List of birds studied in Palakkal Kole wetlands

Scientific names	IUCN status	Residential status	Feeding habit	Feeding guild
Order: Suliformes				
Family: Phalacrocoracidae				
<i>Microcarbo niger</i>	LC	R	Diver	Carnivore
<i>Phalacrocorax carbo</i>	LC	LM	Diver	Carnivore
Family: Anhingidae				
<i>Anhinga melanogaster</i>	NT	R	Diver	Carnivore
Order: Podicipediformes				
Family: Podicipedidae				
<i>Tachybaptus ruficollis</i>	LC	R	Diver	Carnivore
Order: Pelecaniformes				
Family: Ardeidae				
<i>Ardea cinerea</i>	LC	LM	Large wader	Carnivore
<i>Ardea purpurea</i>	LC	R	Large wader	Carnivore
<i>Egretta garzetta</i>	LC	R	Large wader	Carnivore
<i>Mesophoyx intermedia</i>	LC	R	Large wader	Carnivore
<i>Ardea alba</i>	LC	R	Large wader	Carnivore
<i>Bubulcus ibis</i>	LC	R	Large wader	Carnivore
<i>Ardeola grayii</i>	LC	R	Large wader	Carnivore
Family: Pelecanidae				
<i>Pelecanus philippensis</i>	NT	LM	Swimmer	Carnivore
Family: Threskiornithidae				
<i>Threskiornis melanocephalus</i>	NT	LM	Large wader	Carnivore
Order: Anseriformes				
Family: Anatidae				
<i>Dendrocygna javanica</i>	LC	R	Swimmer	Herbivore
<i>Nettapus coromandelianus</i>	LC	LM	Swimmer	Herbivore
<i>Anas acuta</i>	LC	M	Swimmer	Herbivore
<i>Anas poecilorhyncha</i>	LC	LM	Swimmer	Herbivore
<i>Anas querquedula</i>	LC	M	Swimmer	Herbivore
Order: Ciconiiformes				
Family: Ciconiidae				
<i>Mycteria leucocephala</i>	NT	M	Large wader	Carnivore
<i>Anastomus oscitans</i>	LC	M	Large wader	Carnivore
<i>Ciconia episcopus</i>	V	LM	Large wader	Carnivore
<i>Ciconia ciconia</i>	LC	M	Large wader	Carnivore
Order: Accipitriformes				
Family: Accipitridae				
<i>Circus aeruginosus</i>	LC	M	Arboreal terrestrial forager	Carnivore
<i>Haliastur indus</i>	LC	R	Arboreal terrestrial forager	Carnivore
<i>Clanga clanga</i>	V	LM	Arboreal terrestrial forager	Carnivore
<i>Hieraaetus pennatus</i>	LC	M	Arboreal terrestrial forager	Carnivore
Order: Gruiformes				
Family: Rallidae				
<i>Porphyrio poliocephalus</i>	LC	R	Small wader	Omnivore
<i>Amaurornis phoenicurus</i>	LC	R	Small wader	Omnivore
Order: Charadriiformes				
Family: Jacanidae				
<i>Metopidius indicus</i>	LC	R	Small wader	Carnivore
<i>Hydrophasianus chirurgus</i>	LC	LM	Small wader	Carnivore
Family: Charadriidae				
<i>Vanellus indicus</i>	LC	R	Small wader	Omnivore
<i>Pluvialis fulva</i>	LC	M	Small wader	Omnivore
<i>Charadrius dubius</i>	LC	M	Small wader	Omnivore
<i>Pluvialis squatarola</i>	LC	M	Small wader	Omnivore
<i>Himantopus himantopus</i>	LC	LM	Small wader	Omnivore
Family: Scolopacidae				
<i>Tringa glareola</i>	LC	M	Small wader	Carnivore
<i>Tringa ochropus</i>	LC	M	Small wader	Carnivore
<i>Actitis hypoleucos</i>	LC	M	Small wader	Omnivore
<i>Tringa nebularia</i>	LC	M	Small wader	Carnivore
<i>Limosa limosa</i>	NT	M	Small wader	Omnivore

Table 1: Continue

Scientific names	IUCN status	Residential status	Feeding habit	Feeding guild
Family: Sternidae				
<i>Chlidonias hybrida</i>	LC	M	Aerial aquatic forager	Carnivore
<i>Sterna hirundo</i>	LC	LM	Aerial aquatic forager	Carnivore
Family: Glareolidae				
<i>Glareola lactea</i>	LC	LM	Small wader	Insectivore
Order: Columbiformes				
Family: Columbidae				
<i>Columba livia</i>	LC	R	Terrestrial feeder	Granivore
<i>Spilopelia chinensis</i>	LC	LM	Terrestrial feeder	Granivore
Order: Cuculiformes				
Family: Cuculidae				
<i>Centropus sinensis</i>	LC	R	Terrestrial feeder	Omnivore
Order: Coraciiformes				
Family: Alcedinidae				
<i>Ceryle rudis</i>	LC	R	Arboreal aquatic forager	Carnivore
<i>Halcyon smyrnensis</i>	LC	R	Arboreal aquatic forager	Carnivore
<i>Alcedo atthis</i>	LC	R	Arboreal aquatic forager	Carnivore
<i>Pelargopsis capensis</i>	LC	R	Arboreal aquatic forager	Carnivore
Family: Meropidae				
<i>Merops philippinus</i>	LC	M	Aerial forager	Insectivore
Order: Passeriformes				
Family: Hirundinidae				
<i>Hirundo rustica</i>	LC	M	Aerial forager	Insectivore
Family: Motacillidae				
<i>Anthus rufulus</i>	LC	LM	Terrestrial feeder	Carnivore
<i>Motacilla flava</i>	LC	M	Terrestrial feeder	Insectivore
<i>Motacilla alba</i>	LC	M	Terrestrial feeder	Insectivore
Family: Dicruridae				
<i>Dicrurus macrocercus</i>	LC	R	Terrestrial feeder	Omnivore
Family: Corvidae				
<i>Corvus splendens</i>	LC	R	Terrestrial feeder	Omnivore
Family: Cisticolidae				
<i>Cisticola juncidis</i>	LC	R	Terrestrial feeder	Insectivore
<i>Orthotomus sutorius</i>	LC	R	Terrestrial feeder	Insectivore
<i>Prinia socialis</i>	LC	R	Terrestrial feeder	Insectivore
<i>Prinia inornata</i>	LC	R	Terrestrial feeder	Insectivore
Family: Pycnonotidae				
<i>Pycnonotus jocosus</i>	LC	R	Terrestrial feeder	Omnivore
Family: Muscicapidae				
<i>Copsychus saularis</i>	LC	R	Terrestrial feeder	Insectivore
Family: Sturnidae				
<i>Acridotheres tristis</i>	LC	R	Terrestrial feeder	Omnivore
Family: Acrocephalidae				
<i>Acrocephalus dumetorum</i>	LC	LM	Terrestrial feeder	Insectivore

V: Vulnerable, NT: Near threatened, LC: Least concern, M: Migrant, LM: Local migrant, R: Resident

Wetlands being a highly productive area attract birds with varying feeding habits. Birds were categorized according to their feeding guild. Thirty three species were carnivorous, 5 were herbivorous, 14 omnivorous, 11 insectivorous and 2 granivorous. Birds were further classified as aquatic and terrestrial feeders. The data of Palakkal Kole is presented in Fig. 1. Aquatic carnivores topped the list in Palakkal (43.08%). Aquatic herbivores comprised 7.69%. Anatidae family was represented by five species of aquatic herbivores. It was noted that 43 species of birds in Palakkal area depended on aquatic habitat for their feeding (66.15%).

Charadriiformes were the most represented order in the study area with 15 species. The next represented order Passeriformes had 14 species. This data represented in percentage is shown in Fig. 2. Pelecaniformes had 9 species and Coraciiformes and Anseriformes had 5 species each. Charadriiformes are mostly small waders, while Pelecaniformes are large waders. Order Ciconiiformes also comprise large waders. Passeriformes include terrestrial birds which are seen in other habitats as well.

Birds seen in large numbers during the study included *Egretta garzetta*, *Microcarbo niger* and *Porphyrio poliocephalus*. Raptors like brahmyn kite, Western marsh

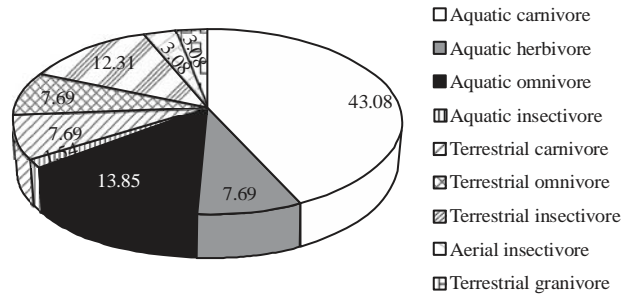


Fig. 1: Feeding guild of birds of Palakkal Kole

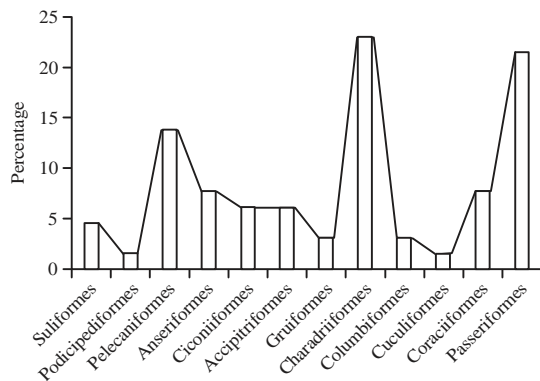


Fig. 2: Species wise percentage distribution of birds belonging to different orders from Palakkal Kole wetlands

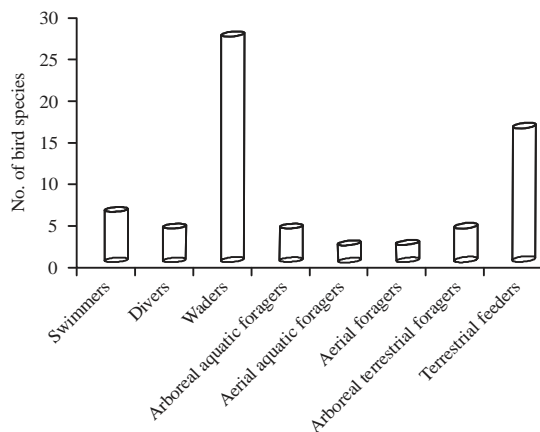


Fig. 3: Feeding habit of birds of Palakkal Kole wetland

harrier, greater spotted eagle and booted eagle were recorded. The common divers found in the Kole are *Tachybaptus ruficollis*, *Microcarbo niger*, *Phalacrocorax carbo* and *Anhinga melanogaster*. The small waders were represented by 15 species and large waders by 12 species. The swimmers consist of 6 species. Arboreal aquatic foragers like King fisher's were represented by four species namely *Ceryle rudis*, *Halcyon smyrnensis*, *Alcedo atthis* and

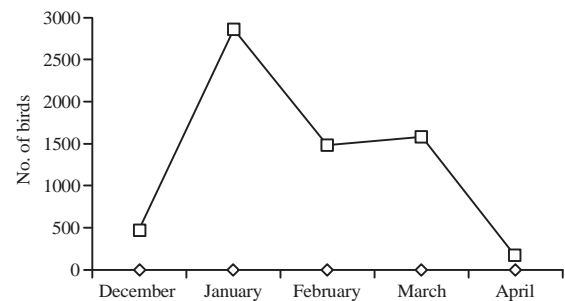


Fig. 4: Abundance of birds in Palakkal Kole

Pelargopsis capensis. The data regarding the feeding habit of birds is given in Fig. 3. Waders seem to have the highest species representation in Kole wetlands.

Species diversity, species richness and abundance: Sixty five species of birds were recorded from Palakkal Kole area, among which 43 were aquatic foragers. The total numbers recorded shows the abundance of birds. About 6570 birds were recorded during the study period. Maximum number of birds was recorded in the month of January (2857), followed by March (Fig. 4). The minimum number of 174 was recorded during the month of April (Table 2), which denotes the end season of the migratory birds in Kole area. A profound increase in the number of birds during January is attributed to the local and trans-continentals migrants. Pelecaniformes was the most abundant order with maximum number of birds during the period January-April due to the large population of egrets occupying the area. Anseriformes made its presence only during the months of January and February (Fig. 5). Long distance migrants like *Anas acuta* and *Anas querquedula* take shelter in this wetland. *Nettapus coromandelianus* and *Anas poecilorhyncha* are the local migrant ducks coming to this habitat. *Mycteria leucocephala*, the painted stork with a population of 298 was sighted during the months January-March. Two hundred and sixty Asian open billed storks were recorded during the study.

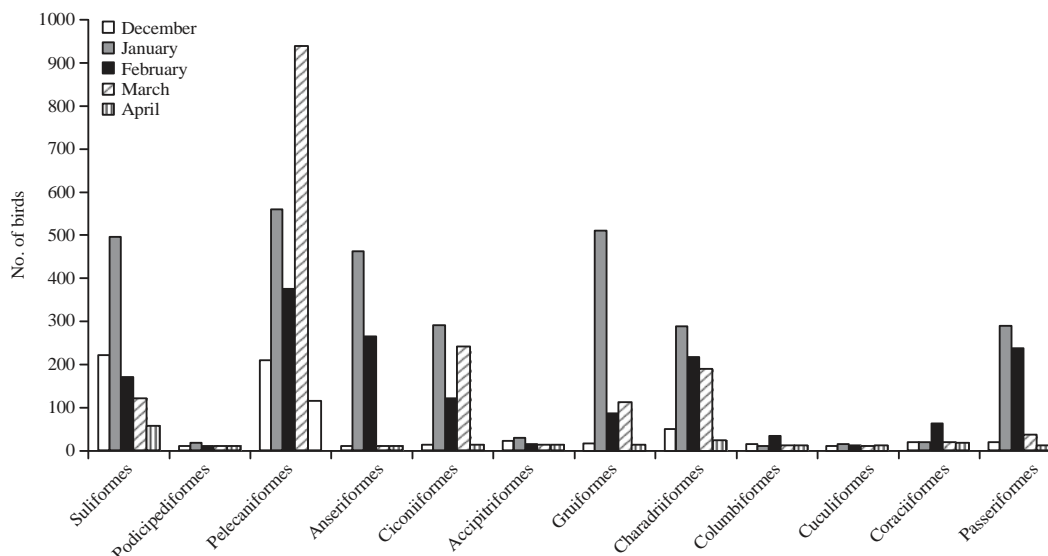


Fig. 5: Order wise distribution of birds during different months from Kole wetlands

Table 2: Bird population of Palakkal Kole

Orders	December	January	February	March	April
Suliformes	210	485	161	110	44
Podicipediformes	0	6	0	0	0
Pelecaniformes	198	549	366	929	105
Anseriformes	0	451	255	0	0
Ciconiiformes	0	280	112	232	0
Accipitriformes	10	18	5	2	2
Gruiformes	2	501	73	100	0
Charadriiformes	40	277	206	181	13
Columbiformes	0	0	22	0	0
Cuculiformes	0	2	0	0	2
Coraciiformes	7	9	52	7	7
Passeriformes	8	279	227	24	1
Total	475	2857	1479	1585	174

The maximum number of 49 species was recorded during the month of February. Eighteen species were recorded in December, 41 in January, 21 in March and 15 in April. Shannon index showed the highest value of 2.86 during the month of February followed by 2.79 in January.

DISCUSSION

Kole land runs parallel to the sea and are low-lying tracts located 0.5-1 m below the mean sea level. The flood from the rivers brings enormous quantities of nutrient rich alluvium, which gets deposited in the Kole lands. The cyclical nutrient recharging of the wetlands during the flood season, renders the area, one of the most fertile lands of Kerala. This rich soil is exploited for cultivation/rearing of rice, vegetables, livestock and fish and all these activities depend upon the annual rise and fall of the floods²⁸.

Kole lands provide ideal habitat for both resident and migratory avian fauna. Many birds need functional access to a wetland or wetland products during their life cycle. Large numbers of birds are wetland dependent, during their migratory and breeding season. The census conducted in the Palakkal Kole during the migratory season recorded 6570 birds. Out of the 65 species of birds recorded during the study, 58 belonged to the least concern category, 5 had near threatened status and 2 species belonged to vulnerable category. *Ciconia episcopus* and *Clanga clanga* were the vulnerable species. Sixty four woolly necked storks were recorded during the study but there was only one sighting of *Clanga. Anhinga melanogaster*, *Pelecanus philippensis*, *Threskiornis melanocephalus*, *Mycteria leucocephala* and *Limosa limosa* seen in this habitat are near threatened species. Coastal wetlands in India provide habitat for several federally listed threatened and near threatened bird species²⁹.

Twenty species recorded were long distance migrants showing trans-continental migration and 15 were local migrants. Visitors from Central Asian countries are included as migrants, where as winter visitors from other parts of Indian subcontinent exhibit local movement³⁰. Migrants travel annually along the Central Asian Flyway (CAF), the flyway which extends from Central Siberia through the Himalayas to the Indian subcontinent. This data show cases the importance of Palakkal wetland as a stopover for migrant birds. Thirty species of resident birds were recorded which complete different phases of their life in the wetland itself.

Availability of food in good quantity and quality constitutes one of the prime requisites of birds, which in turn attracts them in large numbers to the surplus areas. Wetland being a highly productive area caters to the needs of avifauna with diverse feeding habits. Aquatic carnivores topped the list in Palakkal Kole with 28 species. Wetlands nurture birds with unrelated trophic niche and fulfill the feeding requirements of piscivorous, herbivorous, carnivorous, insectivorous and omnivorous species³¹. The water fowls of Palakkal Kole grouped on the basis of their activities and feeding habit showed wader population to be the major ecological group with 27 species. Charadriiformes comprising small waders were the most represented order followed by Pelecaniformes, the large waders. Anatidae was represented by four species of herbivores categorized as swimmers. The presence of Asian open billed stork in large numbers was noted. *Mycteria leucocephala*, the painted stork, a near threatened species was seen in large numbers during this survey. The painted stork, evaluated by earlier researchers¹⁷ as a vagrant visitor to the wetlands of Malabar and South Kerala has spread beyond the region they are generally found. They may have extended their range either due to changes in population size and/or environmental conditions. Vagrants travel outside the lines and establish themselves in a new area to expand their species' range, thus supporting the new area's diversity.

Porphyrio poliocephalus, the grey headed swamp hen was seen in hundreds and is reported as a menace to the farmers of the area. Other birds seen in large numbers during the study included *Microcarbo niger* and *Egretta garzetta*. Woolly necked stork recorded during the survey is a vulnerable species according to IUCN status. The conservation of these birds and their habitats requires prioritization. The avifaunal population acts as an important health indicator, revealing the productivity of an ecosystem³². Wetlands do support large biological diversity in addition to providing a wide array of ecosystem goods and services to mankind³³.

CONCLUSION

The Kole land is an important Ramsar site of South India which remains submerged in water for about 6 months a year, characterizing a unique ecosystem. These wetlands accommodate avian fauna occupying different trophic levels, thus reflecting the ecological status of the area. The heterogeneity of wetlands is one of the most important factors that augment its avian biodiversity. The avifauna does connect far off lands and are excellent environmental indicators at both global and local scales.

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