

## Research Article

# Interactive Phenomenon of Plants and Avian Diversity in Vettangudi Birds Sanctuary, Southern India

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## Abstract

**Background and Objective:** Vegetation distribution and its dependency by animals, especially avian population facilitates significant ecological interactions. This study was carried out to study the floristic composition and avian fauna diversity, to understand the dependency of avian species on the vegetation. **Methodology:** The study was carried out in Vettangudi birds Sanctuary, Sivaganga district, Southern India. Vegetation diversity was undertaken and avian population diversity analysis was done at repeated monthly intervals for 2 consecutive years. **Results:** A total of 70 bird species belonging to 69 genus and 35 families were enumerated in the habitat. A higher number of local residents with the distant migrants, including the overseas migrants were observed. Avian species richness index was found positively correlated high with the occurrence of bird species in the habitat, rather than their individuals. The utilization nature of birds abode in the pond, on the vegetation community was observed. **Conclusion:** Birds specifically utilize the plants community, for the essential requirements, thereby the synergistic association among the biotic diversity in the temporary pond habitat could be found. This investigative report would be useful in developing appropriate guidelines in the wildlife management system of similar wetland habitats.

**Key words:** Vettangudi birds sanctuary, species richness, ecological relations, avian diversity, wildlife management

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

## INTRODUCTION

Wetlands are biologically diverse and significantly much productive ecosystems and also form as the most fragile<sup>1</sup>. Wetland and avian fauna are inseparable elements, causing much improved ecological functioning<sup>2</sup>. Avian fauna diversity forms an important ecological factor in most of the wetland ecosystems, as they occupy several tropic levels in the food web of wetland nutrient cycle. The ecological health of any wetland ecosystem is mainly based on the existence of avian fauna, which forms the terminal links through establishing several aquatic food chains. In response to this phenomenon, birds' habitat preference for their stay reflects the prevailing ecological conditions of the wetland ecosystem<sup>3</sup>. Birds are ideal bio-indicators and useful models to study the different nature of constraints caused to the environment. Ecological condition of the local landscape is generally investigated on the community structure of birds, which is the primary step taken for avian conservation<sup>4</sup>. Unfurling the spatial pattern by means of biodiversity monitoring is one of the crucial steps to adapt conservation strategies of avian diversity<sup>5</sup>. As a number of bird species inhabiting in various altitudinal belts or life zones depend on climatic changes accompanied by corresponding changes in vegetation. Bird population has been documented in several studies<sup>6-8</sup>. However, a comprehensive account on the occurrence of avian population to specific habitats with corresponding availability of resources attracting the birds community is essential. Pond resources, especially the dependent nature of faunal communities over the producers of floristic components are required to be monitored<sup>9</sup>. Therefore, a survey was carried out, to assess the aquatic vegetation, dry-benthic zone vegetation and avian species diversity and distribution in Vettangudi birds sanctuary, Sivagangai district, Southern India. This study was investigated with an idea to have acknowledge on the birds population and their varying nature of utilization on floristic community, occurred in the Vettangudi birds sanctuary pond habitat.

## MATERIALS AND METHODS

**Study area:** Perriya Kollukudipatty pond (PKPTY) is located in Kollukudipatty village, Sivagangai district, Tamil Nadu, India (10°06.57'N longitude and 78°30.81'E latitude), spreads to an area of 13.66 ha. The general eco-climatic condition is sub-tropical, semi-arid condition, with the temperature ranges between 20°C (minimum) and 39°C (maximum) and receiving average annual rainfall of about 45 mm. The shallow and temporary or ephemeral nature of this pond gets filled with

water only for a shorter duration between November and February, every year, completely depends upon the storm inflow, due to monsoon precipitation. Two other ponds viz., Chinna Kollukudipatty and Vettangudipatty are closely adjoining to PKPTY pond. However, PKPTY pond is the only habitat, preferred by local migrants and distant migratory birds in large number. This ecosystem has utility service towards ecotourism, as bird sanctuary functioning since, June, 1977. A tree stand of about eighty individual of *Acacia nilotica* is established in the pond, to facilitate the migratory birds to stay in the ponds for nesting and breeding purposes. Naturally occurring pragmatics and *Typha angustata* plants are used by the ducks and few other water fowls for their nesting and brooding purposes. The pond is fairly protected well from the grazing cattle over the desiccate benthic rangeland surface, during the summer period.

**Vegetation and birds diversity analysis:** The survey was conducted on vegetation and birds, between November, 2012 and October, 2013, for 1 year period in PKPTY site of Vettangudi birds sanctuary. Survey was carried out in 2 consequent days in every month. During each survey, both the aquatic and the dry benthic surface vegetation was done, along with the data collection on birds community which was done in early morning 5.00-8.00 am and evening 5.00-6.30 pm. All out search method was used in the enumeration of vegetation. Every month survey record was done by calculating the average population of birds in the respective survey on 2 days and four sessions, each time. Birds population was counted using Point Count Protocol<sup>10-13</sup>, using Nikon Action 16×50 4.1 zooming binocular and photographic documentation was made. Then they were identified by using Standard taxonomic key of birds<sup>10</sup>. Species richness index was calculated for every month, using the following equation:

$$\text{Species richness index} = \frac{\text{Total number of species}}{\text{Log (total number of individuals)}}$$

## RESULTS AND DISCUSSION

Survey record revealed the occurrence of a total of 70 species belonging to 69 genus and 35 families (Table 1). Resident and local migrants outnumbered the distant and overseas migrant, approximately in 2:1 ratio. Relatively poor occurrence (14 percent) of vagrant and uncommon avian population was observed. Further it was found that larger number of species representation to the Ardeidae family, followed by Accipitridae (6 species) and Cuculidae (5 species), whereas, single species representation was found for 20 avian

Table 1: Birds population occurred in PKPTY pond of Vettangudi birds sanctuary during November, 2012 to October, 2013

Birds common name	Zoological name	Family	Residency status	Conservation status
Painted stork	<i>Mycteria leucocephala</i>	Ciconiidae	M	Near threatened
Purple heron	<i>Ardea purpurea</i>	Ardeidae	M	Least concern
Osprey	<i>Pandion haliaetus</i>	Accipitridae	V	Least concern
Crested serpent eagle	<i>Spilornis cheela</i>	Accipitridae	V	Least concern
Singing bush lark	<i>Mirafraga cantillans</i>	Alaudidae	UC	Least concern
Eurasian golden oriole	<i>Oriolus oriolus</i>	Oriolidae	C	Least concern
Great thick-knee	<i>Esacus recurvirostris</i>	Burhinidae	P	Near threatened
Glossy ibis	<i>Plegadis falcinellus</i>	Threskiornithidae	P	Least concern
Black kite	<i>Milvus migrans</i>	Accipitridae	V	Least concern
Common snipe	<i>Gallinago gallinago</i>	Scolopacidae	P	Least concern
Garganey	<i>Anas querquedula</i>	Anatidae	P	Least concern
Scaly breasted munia	<i>Lonchura punctulata</i>	Estrildidae	V	Least concern
Common hoopoe	<i>Upupa epops</i>	Upupidae	V	Least concern
Grey heron	<i>Ardea cinerea</i>	Ardeidae	M	Least concern
Eurasian spoonbill	<i>Platalea leucorodia</i>	Threskiornithidae	M	Least concern
Oriental magpie-robin	<i>Copsychus saularis</i>	Muscicapidae	R	Least concern
Black rumped flameback	<i>Dinopium benghalense</i>	Picidae	R	Least concern
Great cormorant	<i>Phalacrocorax carbo</i>	Phalacrocoracidae	M	Least concern
Black ibis	<i>Pseudibis papillosa</i>	Threskiornithidae	M	Least concern
Lesser cuckoo	<i>Cuculus poliocephalus</i>	Cuculidae	R	Least concern
Small green billed malkoha	<i>Phaenicophaeus viridirostris</i>	Cuculidae	R	Least concern
Red vented Bulbul	<i>Pycnonotus cafer</i>	Pycnonotidae	R	Least concern
Asian koel	<i>Eudynamis scolopacea</i>	Cuculidae	R	Least concern
Pied cuckoo	<i>Clamator jacobinus</i>	Cuculidae	R	Least concern
Pied thrush	<i>Zoothera wardii</i>	Turdidae	R	Least concern
Red wattled lapwing	<i>Vanellus indicus</i>	Charadriidae	C	Least concern
Common coot	<i>Fulica atra</i>	Rallidae	P	Least concern
Shikra	<i>Accipiter badius</i>	Accipitridae	V	Least concern
Common moorhen	<i>Gallinula chloropus</i>	Rallidae	P	Least concern
Asian paradise Flycatcher	<i>Terpsiphone paradisi</i>	Monarchidae	UC	Least concern
Eurasian collared dove	<i>Streptopelia decaocto</i>	Columbidae	C	Least concern
Black winged stilt	<i>Himantopus himantopus</i>	Recurvirostridae	P	Least concern
Black Bittern	<i>Ixobrychus flavicollis</i>	Ardeidae	UC	Least concern
Rock pigeon	<i>Columba livia</i>	Columbidae	C	Least concern
Common sandpiper	<i>Actitis hypoleucos</i>	Scolopacidae	P	Least concern
Indian blue robin	<i>Luscinia brunnea</i>	Muscicapidae	R	Least concern
Purple rumped sunbird	<i>Nectarinia zeylonica</i>	Nectariniidae	R	Least concern
Greater coucal	<i>Centropes sinensis</i>	Cuculidae	R	Least concern
Common teal	<i>Anas crecca</i>	Anatidae	P	Least concern
Median egret	<i>Mesophoyx intermedia</i>	Ardeidae	M	Least concern
Little grebe	<i>Tachybaptus ruficollis</i>	Podicipedidae	C	Least concern
Common kingfisher	<i>Alcedo atthis</i>	Alcedinidae	C	Least concern
Paddyfield pipit	<i>Anthus rufulus</i>	Motacillidae	UC	Least concern
Darter	<i>Anhinga melanogaster</i>	Anhingidae	M	Near threatened
Laughing dove	<i>Streptopelia senegalensis</i>	Columbidae	C	Least concern
White breasted waterhen	<i>Amaurornis phoenicurus</i>	Rallidae	C	Least concern
Spotted dove	<i>Streptopelia chinensis</i>	Columbidae	C	Least concern
Great egret	<i>Casmerodius albus</i>	Ardeidae	M	Least concern
White breasted kingfisher	<i>Halcyon smyrnensis</i>	Alcedinidae	C	Least concern
Ashy drongo	<i>Dicrurus leucophaeus</i>	Dicruridae	R	Least concern
Ashy wood swallow	<i>Artamus fuscus</i>	Artamidae	C	Least concern
Rufous treepie	<i>Dendrocitta vagabunda</i>	Corvidae	C	Least concern
Green backed heron	<i>Butorides striatus</i>	Ardeidae	C	Least concern
Indian robin	<i>Saxicoloides fulicata</i>	Muscicapidae	R	Least concern
Purple sunbird	<i>Nectarinia asiatica</i>	Nectariniidae	R	Least concern
Little cormorant	<i>Phalacrocorax niger</i>	Phalacrocoracidae	M	Least concern
White browed wagtail	<i>Motacilla maderaspatensis</i>	Motacillidae	C	Least concern
Asian palm swift	<i>Tachymarptis melba</i>	Apodidae	C	Least concern
House sparrow	<i>Passer domesticus</i>	Passeridae	R	Least concern
Indian pond heron	<i>Ardeola grayii</i>	Ardeidae	C	Least concern

Table 1: Continue

Birds common name	Zoological name	Family	Residency status	Conservation status
Rose ringed parakeet	<i>Psittacula krameri</i>	Psittacidae	C	Least concern
Black drongo	<i>Dicrurus macrocercus</i>	Dicruridae	R	Least concern
Indian peafowl	<i>Pavo cristatus</i>	Phasianidae	R	Least concern
Cattle egret	<i>Bubulcus ibis</i>	Ardeidae	C	Least concern
Little egret	<i>Egretta garzetta</i>	Ardeidae	M	Least concern
Jungle crow	<i>Corvus macrorhynchos</i>	Corvidae	C	Least concern
Common myna	<i>Acridotheres tristis</i>	Sturnidae	R	Least concern
Oriental white ibis	<i>Threskiornis melanocephalus</i>	Threskiornithidae	M	Near threatened
Asian openbill stork	<i>Anastomus oscitans</i>	Ciconiidae	M	Least concern
House crow	<i>Corvus splendens</i>	Corvidae	R	Least concern

R: Resident, P: Part of Asia and spend the Northern winter in sub-Saharan, M-Intra: Indian migrant species breed in and part of India and post breeding season in a different area or appears only seasonally in another part, V: Vagrant species, out of its normal range, C: Common species invariably encountered single or insignificant, within range, UC: Uncommon, not regularly encountered within its normal habitat

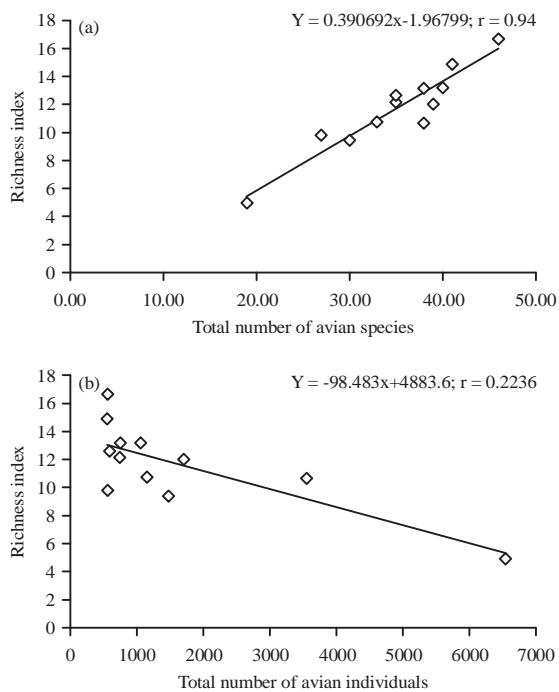


Fig. 1(a-b): Regression analysis of (a) Number of avian species vs. species richness and (b) Total number of individuals vs. species richness, observed during the study period between November, 2012 and October, 2013

families. Greater thick knee was the only near threatened species and all other species comes under the least concern species, categorized by IUCN. Oriental white ibis population is endemic to this region.

The highest number of species was observed in November, 2012 and least number of species was observed in the month of April, 2013. Bird's distribution and abundance varies with habitat<sup>14</sup>, Climate condition, food resource and evolutionary history of the area<sup>15</sup>. Number of species, rather

than the number of individuals forms the major determinant of species richness, which was computed using regression analysis, shown in Fig. 1. This result corroborates with the findings from the previous study<sup>16</sup>.

The edge reefs like *Typha domingensis* Pers. form shelter for the aquatic insects, further being the feed for the perching birds. The aquatic floating submerged and emergent hydrophytes are used for feeding the water birds, which was noted in the previous reports<sup>9,17</sup> and this is in agreement with the observation of this study.

The experimental pond area also contains the aquatic plants *Lemna minor* L., *Wolffia globosa* (Roxb.) Hartog and Plas, *Aponogeton natans* (L.) Engl. and K. Krause., *Cyanotis axillaris* (L.) D. Don ex Sweet., *Ipomoea aquatica*, Forsskal., *Hydrolea zeylanica* (L.) Vahl., *Nymphaeanouchali* var. *pubescens* (Willd.) Hook.f. and Thomson and *Typha domingensis* Pers. Such a diverse plant community is beneficial to migrating and wintering water birds, as they utilize the vegetation for their different needs including food, weaving material for their nests, worms and insect catch<sup>18</sup>. Birds were observed with the consumption of different plant parts, including foliage, fruits and seeds produced by the wetland plants, which has been supported from the previously available records<sup>19</sup>.

The experimental pond is ephemeral in nature and the regular shifting of wetland into the dry rangeland of benthic surface, following desiccation causes cyclic regeneration. This situation further leads to concomitantly changing floristic groups from aquatic vegetation into moist swamps further to emergent grasses and herbaceous vegetation. The present study results further supports the view on the temporary pond habitat posses rich vegetation diversity and similar report was shown in the previous research study by Sleeter *et al.*<sup>20</sup>. The vegetation changes are found to be important for the birds, visiting to the pond habitat for their varying nature of utility.

A total of 31 vegetation species, 26 species were enumerated on the raised bund and 25 of surface dwelling herbaceous stragglers and weak stem climbers vegetation were observed. The interaction among the ecological components viz., plants with environment, plants with animals and interrelationships among plants were also observed in the present study. Raised edges of the pond and water storage surface of the pond was found with several tree species viz., *Acacia nilotica*, *Prosopis juliflora*, *Parkinsonia aculeate*, which are found used by fairly large-sized oriental white ibis (*Threskiornis melanocephalus*), Asian open-bill stork (*Anastomus oscitans*), Darter (*Anhinga melanogaster*). Whereas, the junctions of the branches with the main trunk of the trees were found as comfortable nesting area to Indian Pond-heron (*Ardeola grayii*), little cormorant (*Phalacrocorax niger*). Further, the soft hollow stem pieces are used by these birds of tree niches to spread on the nest to keep their laid eggs safely and also provide the best physical condition for hatching. It is also noticed that the bark fiber of tender shoots of *Ipomoea* sp. and other wiry plants like *Oxystelma esculentum* (L.f.) Sm. and *Pergularia daemia* (Forsskal) Chiov., were found used by the weaver birds to interwoven the nests. Climber stem of *Ipomoea obscura* (L.) Ker-Gawl was found used by the birds in the weaving of nests. Floristic diversity in the Vettangudi bird sanctuary pond was found conducive for the diversified avian species, visiting to the experimental habitat. Succession, associated with the temporary aquatic habitats were found in earlier studies by Vorisek *et al.*<sup>21</sup>, further supports the findings of the study results.

Habitat diversity plays a pivotal role in wildlife management, especially to its conservation. The experimental temporary pond habitat of Vettangudi birds sanctuary was found attracting Darter, Oriental Ibis, which is considered as Near Threatened category of IUCN. In this manner, such avian faunal communities are conserved in Vettangudi sanctuary, through the aggregation of vegetation community. The pivotal role of floristic population in the wildlife conservation has been given due consideration by researchers<sup>6,22,23</sup>.

### CONCLUSION

The study results have the strong implications over the habitat of Vettangudi birds sanctuary pond resources provide the interlinking principles for the ecological functioning. Understanding such relationships of the ecological components is, therefore, essential to manage the ecological conditions of the habitat and further to apply this knowledge in the sustainable wildlife management process.

### SIGNIFICANCE STATEMENT

A survey was made to document the floristic composition and migratory birds population in the ephemeral pond ecosystem of Vettangudi birds sanctuary, Southern India and their biotic interaction. Species aggregation was found with higher correlation index with the species richness, when compared with the total number of individuals and species richness. This study will help the researchers to uncover the critical area of wildlife management that many researchers and wildlife managers were not able to explore.

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