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Study on seasonal variations of wetland birds in Vellode bird sanctuary, Erode, Tamil Nadu, India

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Abstract

Birds are well-known biological indicator of the health of an ecosystem. This study was conducted during July 2019 to February 2020 in Vellode bird sanctuary. The species diversity, richness, relative diversity, evenness, density and relative abundance were calculated. Totally 72 species of birds belonging to 38 families and 17 orders were recorded. The maximum diversity was recorded in winter (3.47 ± 0.05) and the least diversity was recorded in monsoon (3.34 ± 0.05). The species richness and total density were recorded high in winter season and least in monsoon season. This sanctuary complex supports three IUCN Red listed Near Threatened species (Oriental darter *Anhinga melanogaster*, Painted Stork *Mycteria leucocephala* and Spot billed Pelican *Pelecanus philippensis*) and 68 Least Concern species.

Keywords: Wetland, water birds, diversity, vellode

Introduction

The class Aves contains more species distributed over the entire earth than other class of vertebrates (Desalgn and Subramanian, 2015) [8]. Birds form an important component of an ecosystem (Kait *et al.*, 2014) [13] as a part of a food web, potential pollinators and bio indicators (Pradhan *et al.*, 2013) [18]. In worldwide, 9930 species of birds exist and belonging to 204 families (Cox, 2010) [7]. The Indian subcontinent, a part of the vast Oriental Bio-geographic regions, has very rich in biodiversity. Indian biodiversity includes a large number of species of invertebrates, 2546 species of fishes, 204 species of amphibians, 440 species of reptiles, 1266 species of birds and 400 species of mammals. India consists 13% of the world's bird fauna (Grimmett *et al.*, 1998). Out of 1266 species of birds, 302 species are water birds, 57 species are endemic, 3 species are breeding endemic and 85 species are threatened (TH) (Birdlife International, 2019) [6].

Avians are playing a significant role as seed dispersal agents, scavengers, pollinators, control the insect pest, bio-fertilizer and an important indicator to evaluate the quantitative and qualitative of different habitats (Niemi 1985) [17]. The birds are also an identifier of both terrestrial and aquatic changes and are used as a potent indicator of long-term environmental disturbances such as water pollution, anthropogenic damages, air pollution, habitat distraction and urbanization. Birds are excellent indicators of water quality and measures of biodiversity (Gupta *et al.*, 2011) [11]. The birds that are ecologically dependent on wetlands are called waterfowl or aquatic birds (Ramsar Convention, 1975). Wetland is an "Area of marsh, fen, peatland or water whether natural or artificial, permanent or temporary with water, that is static or flowing, fresh, brackish or salt including areas of marine water, the depth of which does not exceed 6 meters" (Ramsar convention, 2004; Guptha *et al.*, 2011) [20, 11]. Discharge of sewage and agricultural runoff are the two major factors for entering various nutrients in the wetland ecosystem and resulting in the death of those ecosystems (Sudhira and Kumar, 2000) [23]. Vellode bird sanctuary plays a vital role in harbouring shelter for many wetland birds, still now there is no systematic study on wetland birds with respect to season, diversity, evenness, richness and density. Hence this work was taken with the prime objective to make an inventory of the wetland birds in Vellode Bird Sanctuary.

Materials and methods**Study area**

The bird diversity assessment was carried out in Vellode Bird Sanctuary of Erode range, Erode Forest Division. The Vellode Bird Sanctuary is located between 11°15'20" N to 11°04'50" N

and 77°38'40" E to 77°39'30" E and it falls in Vadamugam Vellode village, Perundururai Taluk, Erode district of Tamil Nadu. This sanctuary is located above 240 MSL. It was declared as a bird sanctuary in the year 1997. The total area of the sanctuary is 77.185 ha. The source of the water is the seepage of the lower Bhavani project canal. Mostly, the large number of avian population was observed in the month of November to February. The average maximum and minimum temperature in Vellode Bird Sanctuary is 40^o C and 21^o C. The average annual rainfall is 708.3 mm.

Methodology

The field survey was conducted every month from July-2019 to February-2020 using the total count method. Wherever possible, by walking in and around the wetlands or from specific vantage points should be selected and count all the birds (Gupta *et al.*, 2011) [11]. The bird survey was conducted during dusk and dawn times (6:30 am to 10:00 am in morning and 4:00 pm to 6:30 pm in evening) and observations were carried out by using Binocular (Nikon 7x50) and Photographs of birds by using Camera (Nikon P900). Bird identification was confirmed from the book viz., Birds of the Indian Subcontinent (Grimmett *et al.*, 1999) [10] and The Book of Indian Birds (Salim Ali, 1996) [11].

$$\text{Relative Abundance} = \frac{\text{Number of individual of species}}{\text{Number of individual of all species}} \times 100$$

The density is an utterance of the numerical strength of a particular species where the total number of individuals of each species in a particular season divided by the total area of the wetland (Ramamurthy and Rajakumar, 2014) [19]. Pielou's evenness index was used to estimated the species evenness of Vellode Bird Sanctuary (Ekhande *et al.*, 2012) [9].

$$\text{Evenness/Equitability} = H'/H'_{\max}$$

Where, H' = Value recoded from Shannon-Weiner diversity index, H' _{max} = maximum possible value of H'.

Results and discussion

The results revealed that 72 species of birds belonging to 38 families and 17 orders were found to be in Vellode bird sanctuary. During this study, 68 Least Concern and three Near Threatened species were observed: Oriental darter *Anhinga melanogaster*, Painted Stork *Mycteria leucocephala* and Spot billed Pelican *Pelecanus philippensis*. This research finding was in line with findings of Guptha *et al.*, (2011) [11], with a total of 78 species of birds belonging to 33 families and three species of Near Threatened as observed in Coimbatore, Trichy, Perambalur and Thiruvavur district wetlands. This study revealed that the Shannon-Weiner index of bird diversity was maximum as found in the winter season (3.47 ± 0.05) and the minimum was recorded in monsoon season (3.34 ± 0.05) (Table.1 and Figure.1). Similar findings were found by Ekhande *et al.*, (2012) [9] on analyzing the species diversity in Yashwant Lake. They reported that the maximum diversity during winter (3.5 ± 0.02) and minimum in monsoon (2.4 ± 0.02). The maximum richness was recorded in the winter season (60) and minimum in monsoon season (58) (Table.1 and Figure.2). A similar finding was found by Mishra *et al.*, (2016) [16] in Bakhira Tal, Dist. Santkabar Nagar, Uttar Pradesh, India with maximum species richness was recorded

Data analysis

Shannon-Weiner index of diversity (Shannon and Wiener, 1963) [22] was used to assess the bird species diversity in Vellode Bird Sanctuary.

The formula for calculating the Shannon diversity index is

$$H' = - \sum P_i \ln P_i$$

Where H' = Shannon index of diversity,

P_i = the proportion of the ith species in the landscape element,

Ln P_i = Natural logarithm of the proportion of each species.

Relative diversity (RDi) was calculated for each families and it was defined as the ratio of the total number of species in a particular family to total number species in a recorded season (Mazumdar, 2019) [15].

Richness was calculated by counting a number of bird species recorded in season (Harisha and Hosetti, 2009) [12]. The formula for calculating the richness is Species richness = Number of bird species recorded.

The Relative Abundance (Anjos, 2004 and Ayenalem & Bekele, 2008) [3, 4] was analyzed from the collected data during the study period using the following formula:

in the winter season (28 Sp.) and minimum in summer season (20 Sp.). Among the species evenness, winter season had the maximum evenness (1.41 ± 0.01) and lowest in monsoon season (1.14 ± 0.01) (Table.1 and Figure.1). The results were in accordance with findings of Anika and Parasharya (2013) [2] with maximum evenness during summer (0.6273 ± 0.0518) and minimum in winter (0.5117 ± 0.0285).

Density

The highest total density was observed in monsoon season (1556.99 ± 39.15 /sq.km) and the lowest observed in the winter season (948.18 ± 21.57 /sq.km) (Table.1). This result was in line with the results of Rathod and Padate (2007) [21] who stated that, the highest density was recorded during winter (859.72 ± 583.89) and minimum density in monsoon (292.42 ± 193.76). In the monsoon season, Great cormorant had the highest species density (184/sq.km) followed by Little cormorant (177/sq.km), Spot-billed Pelican (108/sq.km), Painted stork (90.7/sq.km) and Eurasian Hoopoe (1.30/sq.km), Green Billed Malkoha (1.30/sq.km), Laughing Dove (1.30/sq.km), Pied Bushchat (1.30/sq.km) and Coppersmith Barbet (1.30/sq.km) with the lowest density. In the winter season, Little egret (128/sq.km) recorded for highest density which was followed by Indian Spot Billed Duck (91.9/sq.km), Indian Pond Heron (50.5/sq.km) and the lowest density as recorded in Pied Kingfisher, Large Pied Wagtail, Jungle Crow, Indian Roller, Indian Robin, Golden Oriole, Coppersmith Barbet, Laughing Dove and Common Kingfisher were 1.30/sq.km (Table.2). This result was in consonance with the results of Kidwai *et al.*, (2013) who reported that, highest and lowest densities in Sal forest were of Plum-headed parakeet (11.63 / sq.km) and blue whistling thrush (0.06 / sq.km) respectively.

Relative diversity

In the monsoon season, the maximum relative diversity was found in Ardeidae family (13.8) followed by Columbidae, Estrildidae, Phalacrocoracidae, Rallidae and Threskiomithidae (5.20) and other families had RD value less than 3.50. In the winter season, Ardeidae (13.3) was the most dominant family followed by Alcedinidae, Anatidae, Columbidae, Estrildidae, Rallidae, Threskiomithidae and Scolopacidae (5.00) and all the remaining families had the RD value less than 3.50. Similar findings were reported by Mazumdar (2019) [15] in the human-modified wetland of Okhla bird sanctuary. He reported that the highest relative diversity was recorded from Ardeidae (4.30) family followed by Anatidae (3.84), Recurvirostridae (2.25), Sturnidae (2.18) Columbidae (2.12), Lariidae (2.12) and Cisticolidae (1.92).

Relative abundance

In monsoon season a highest relative abundance were

observed in Great Cormorant (11.8%) followed by little Cormorant (11.4%), Indian Spot Billed Duck (7.65%) and lower relative abundance were recorded in Eurasian Hoopoe, Green Billed Malkoha, Laughing Dove, Pied Bushchat and Coppersmith Barbet (0.08%). In winter season, the highest relative abundance was observed in Little Egret (13.5%) and followed by Indian Spot Billed Duck (9.70%), Indian Pond Heron (5.33%) and lower relative abundance were recorded in Pied Kingfisher, Large Pied Wagtail, Jungle Crow, Indian Roller, Indian Robin, Golden Oriole, Coppersmith Barbet, Laughing Dove and Common Kingfisher (0.13%) (Table.2). Bibi *et al.*, (2003) reported similar findings in Taunsa Barrage wildlife sanctuary, Pakistan and observed Eurasian Coot was the most abundant species (13.3%) followed by Cattle Egret (12.3%), Little White Egret (11.5%), Common Pochard (8.9%), House Crow (5.8%) etc.

Table 1: Avian species diversity, total density richness and evenness during monsoon and winter seasons

S. No.	Season	Diversity	Total density(sq.km)	Richness	Evenness
1.	Monsoon	3.34 ± 0.05	1556.99 ± 39.15	58	1.14 ± 0.01
2.	Winter	3.47 ± 0.05	948.186 ± 21.57	60	1.41 ± 0.01

Table 2: Avian species density and relative abundance during monsoon and winter seasons

S. No.	Species Name	Monsoon		Winter	
		Density (sq.km)	RA (%)	Density (sq.km)	RA (%)
1.	Asian Openbill Stork	6.50	0.42	0.00	0.00
2.	Ashy Prinia	6.50	0.42	2.59	0.28
3.	Ashy wood swallow	6.50	0.42	5.18	0.55
4.	Barn Swallow	36.3	0.75	7.77	0.82
5.	Baya Weaver	11.7	2.33	0.00	0.00
6.	Black crowned night Heron	88.1	5.70	22.0	2.32
7.	Black Drongo	6.50	0.41	6.47	0.68
8.	Black headed Ibis	45.3	2.91	38.8	4.09
9.	Black Kite	0.00	0.00	2.59	0.28
10.	Black Winged Stilt	24.6	1.60	23.3	2.45
11.	Blue-tailed Bee-eater	20.7	1.33	31.1	3.27
12.	Brahminy Starling	0.00	0.00	13.0	1.37
13.	Cattle Egret	11.7	0.75	5.18	0.55
14.	Common Coot	59.6	3.90	22.0	2.32
15.	Common Kingfisher	3.90	0.25	1.30	0.13
16.	Common Moorhen	27.2	1.75	9.06	0.96
17.	Common Myna	7.80	0.50	11.6	1.23
18.	Common Sandpiper	11.7	0.75	14.2	1.50
19.	Common Snipe	0.00	0.00	2.59	0.28
20.	Coppersmith Barbet	1.30	0.08	1.30	0.13
21.	Eurasian collared Dove	14.2	0.92	9.06	0.96
22.	Eurasian Hoopoe	1.30	0.08	0.00	0.00
23.	Eurasian Spoonbill	5.20	0.33	0.00	0.00
24.	Garganey	0.00	0.00	15.5	1.64
25.	Glossy Ibis	59.6	3.83	24.6	2.60
26.	Golden Oriole	0.00	0.00	1.30	0.13
27.	Great Cormorant	184	11.8	45.3	4.80
28.	Great Egret	15.5	0.99	29.7	3.14
29.	Green Billed Malkoha	1.30	0.08	0.00	0.00
30.	Green Sandpiper	5.20	0.33	23.3	2.45
31.	Grey Heron	33.7	2.20	15.5	1.64
32.	House Crow	0.00	0.00	13.0	1.37
33.	Indian Peafowl	35.0	2.25	25.9	2.80
34.	Indian Pond Heron	27.2	1.75	50.5	5.33
35.	Indian Robin	0.00	0.00	1.30	0.13
36.	Indian Roller	0.00	0.00	1.30	0.13
37.	Indian Spot Billed Duck	119	7.65	91.9	9.70
38.	Intermediate Egret	38.9	2.50	25.9	2.73
39.	Jungle Babbler	5.18	0.33	3.88	0.41

40.	Jungle Crow	0.00	0.00	1.30	0.13
41.	Large Pied Wagtail	3.90	0.25	1.30	0.13
42.	Laughing Dove	1.30	0.08	1.30	0.13
43.	Lesser Whistling Duck	18.1	1.20	0.00	0.00
44.	Little Cormorant	177	11.4	47.9	5.05
45.	Little Egret	33.7	2.20	128	13.5
46.	Little Grebe	38.9	2.50	15.5	1.64
47.	Little Ringed Plover	2.60	0.17	0.00	0.00
48.	Northern Pintail	0.00	0.00	2.59	0.28
49.	Oriental darter	3.90	0.25	16.8	1.80
50.	Paddy Field Pipit	11.7	0.75	5.18	0.55
51.	Painted Stork	90.7	5.82	0.00	0.00
52.	Pheasant Tailed Jacana	0.00	0.00	3.88	0.41
53.	Pied Bushchat	1.30	0.08	6.47	0.68
54.	Pied Kingfisher	0.00	0.00	1.30	0.13
55.	Purple Heron	11.7	0.75	9.06	0.96
56.	Purple-rumped Sunbird	6.50	0.41	14.2	1.50
57.	Purple Sunbird	0.00	0.00	7.77	0.82
58.	Purple Swamphen	13.0	0.83	16.8	1.80
59.	Red-naped Ibis	0.00	0.00	3.88	0.41
60.	Red Vented Bulbul	13.0	0.83	3.88	0.41
61.	Red Wattle Lapwing	7.80	0.50	15.5	1.64
62.	River Tern	10.2	0.70	0.00	0.00
63.	Rose Ringed Parakeet	14.2	0.92	24.6	2.60
64.	Scaly Breasted Munia	3.90	0.25	3.88	0.41
65.	Singing Bush lark	0.00	0.00	2.59	0.28
66.	Small Bee-eater	14.2	0.92	0.00	0.00
67.	Spot billed Pelican	108	6.91	0.00	0.00
68.	Spotted Dove	2.60	0.17	3.88	0.41
69.	Spotted Owllet	3.90	0.25	0.00	0.00
70.	Tri-colored Munia	2.60	0.17	3.88	0.41
71.	White Breasted Kingfisher	2.60	0.17	3.88	0.41
72.	White Throated Munia	2.60	0.17	3.88	0.41

*RA- Relative Abundance

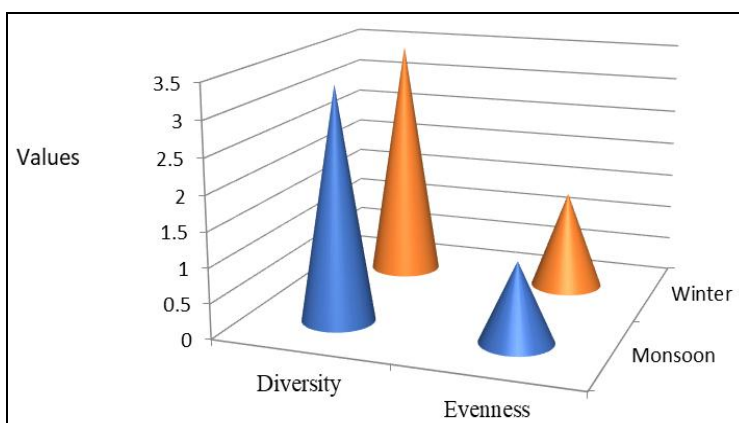


Fig 1: Avian diversity (Shannon- Weiner diversity indices) and evenness in Monsoon and winter seasons of Vellode Bird Sanctuary

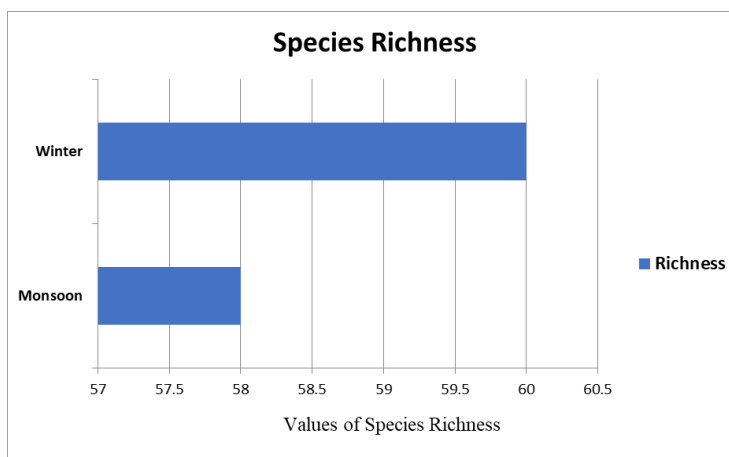


Fig 2: Species richness in Monsoon and winter seasons of Vellode Bird Sanctuary

Conclusion

Vellode bird sanctuary serves as an important feeding and wintering ground for large number of resident and migratory waterbirds. This study gives a new insight, information and knowledge on the avifauna of Vellode bird sanctuary, Erode district. The near threatened species like Painted Stork, Spot Billed Pelican, Oriental Darter and others are to be safe guarded with specific conservation strategies in conjunction with the information's available through this study.

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