DENSITY, DIVERSITY AND SPECIES RICHNESS OF WATERBIRDS IN PERIYAKULAM LAKE, TIRUCHIRAPPALLI, TAMIL NADU, SOUTHERN INDIA.

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Abstract

Objectives: To collected data on the population characteristics of waterbirds. **Methods**: The data were collected from January 2011 to December 2013. Birds were counted using direct count method. counting a suitable vantage point was selected and all visible birds were counted. This method was very useful for counting the water birds. **Findings:** During the study period the waterbirds belonged to 37 species and 31 genus, included under 14 families and 7 orders were recorded. Among the 37 species, 5 species were migratory, 17 species were resident and 15 species were resident migratory. Among them 5 species are categorized as Near Threatened and the remaining 32 species are Least Consent as per the IUCN categories, (2020). This is the first kind of works in this study area. These results are viable and the contributions have been made for evolving strategies in relation to management of inland wetland habitats. **Novelty and applications:** The highest bird density was recorded during the year 2013 (961.3±194.66 No/ha.) and lowest during the year 2011 (329.9±43.15 No./ha.). Diversity of waterbirds showed maximum during the year 2013 and lowest during the year 2011, which were 0.03±0.004 and 0.02±0.002 respectively. The richness of the waterbird species were also showed highest value during the year 2013 and lowest species richness during the year 2011, which were 23.2±1.27 and 14.7±0.68 respectively. The density, diversity and waterbird species richness showed significant variations among the years ($P<0.05$).

Keywords: Population wetlands, Diversity, Waterbirds, Conservation, South India.

1. INTRODUCTION

Wetland is an important for native and migratory birds for foraging, roosting and breeding purposes [1], [2] stated that the wetlands also harbour faunal groups such as invertebrates, fish, amphibians, reptiles, birds and mammals. Most of the wetlands in India are directly or indirectly linked with major river systems. India has totally 27403 wetlands of which 23444 are inland wetlands and remaining 3959 are coastal wetlands [3]. Nowadays, wetlands are the most threatened habitats because of their vulnerability of exploitation for development [4]. The conservation of wetlands and its biodiversity is one of the very big tasks [5]. Globally

most of the wetlands are degraded due to various factors [4]. The wetlands are the most productive and biologically diverse in the world but very fragile ecosystems [6]. The wetlands are among the most important ecosystems on earth. Wetlands also have been called "biological supermarket" because of the extensive food chain and rich biodiversity that they support [7]. [7] Described that the wetlands are described as "kidney of the landscape" because they function as the downstream receivers of water and waste from both natural and human resources. Wetlands are the most productive and vital ecosystems of the world [8] and occupy about 6% of the earth's surface [9].

The term wetland refers to lowlands covered with shallow and sometimes temporary or intermittent waters. They are referred to by such names as marshes, swamps, bogs, wet meadows, potholes, sloughs and river. Overflow lands, shallow, lakes, and ponds usually with emergent vegetation as a conspicuous feature are included in the definition. "Wetlands" have been defined as swamps and other damp areas of land but in common parlance the word is used interchangeably with "Lakes", which denotes a large body of water surrounded by land. However internationally accepted term of wetlands describes them (Ramsar convention) as "area of marsh, fen, peat land 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 six meters" [10]. Nowdays most of the wetlands are degraded and it is due to poor rainfall. Due to the lake of water in the wetlands most of the wetlands are not viable for the waterbirds. But some of the wetlands receive moderate water source from the conventional or regular river chennles. These wetlands are most important and getting attraction to the waterbirds besides perennial waterbodies or wetlands. The researchers or ecologists especially wetlands specialists should take initiatives to conserve these wetlands atleast for the sake of the survival of near threatened and vulnerable birds species rather than benefit of human kinds. The wetlands are providing significant contribution to the aquatic species as substrate or shelter especially for waterbirds [11, 12]. The Periyakulam lake supports to several Near Threatened and Vulnerable species of waterbirds [11, 12]. The conservation of waterbirds is one of the vital responsibilities of many pioneering naturalists and waterbird conservation has evolved around the world and have been involved in the establishment of international organizations such as IUCN. Waterbirds are known for their provisioning services like natural indicator for vertebrates and invertebrates as well as important component

of wetland ecosystem. There are about 9000 species of birds in the World, out of which approximately 23% (310 of 1340) of the bird species found in India [13], which are known to be dependent on wetlands [14]. The birds' population is dwindling continuously for the last few decades and more than hundred species of birds have become either endemic or endangered [15]. Periyakulam lake supports to several Near Threatened and Vulnerable species of waterbirds [11, 12]. Current study the birds are categoried based on their feeding habits. It is also very interesting because the population of different categories density, diversity and richness of birds varied significant annually. The bird population characteristics include density, diversity and species richness.

2.MATERIALS AND METHODOLOGY

2.1Assessment of the population of waterbirds

Birds were counted using direct count method [16]. For direct counting a suitable vantage point was selected and all visible birds were counted. This method was very useful for counting the water birds. This counting was made without any bias and to ensure accuracy. 'Total count' method was followed for bird census wherever possible, and it was made walking round the wetlands or from specific vantage points [17]. Wherever the area was not completely covered, the percentage of coverage was marked. Systematic water birds count was carried out at different sites (three random sites were selected), each during January 2011 to December 2013. During counts, each site was divided into many sections in each section the birds were counted. All the birds on the ground or in the water were counted using binocular and any bird flying across the observer was also included in the counting. Birds flying behind the observer were not counted. Migratory, wintering, breeding/ summering and resident water birds were commonly encountered in the wetlands during the monsoon season [11, 12]. The birds were counted by using binocular (7x50) and spotting scope (20x60). The total count (direct count) method was applied for the bird survey fortnightly at each month, birds were counted individually for the respective species (21, 22).

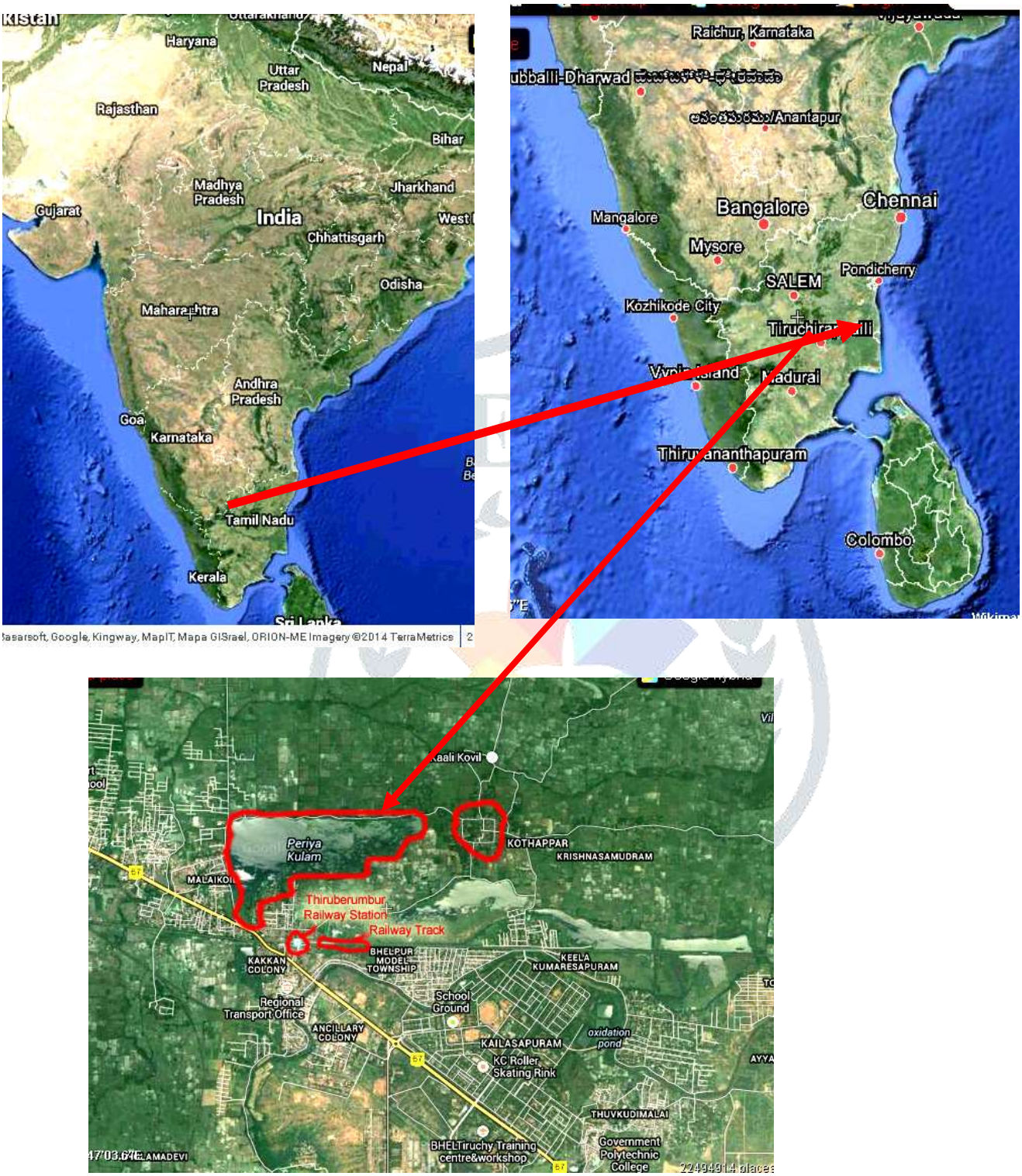
Study area

Periaykulam Lake (10 º .78 N; 78 º .77 E) is located in the Koothapar Village of Thiruvarampur, Tiruchirapalli District, Tamil Nadu, Southern India. It covers an area of 74.085 ha. The major water source

for this lake is Cauvery River via Uyyakondan canal. The water resource is largely used for agriculture and inland aquaculture. About 629.84 ha agricultural land is irrigated from this lake. This tank is situated between 142- Thiruverumbur village on the west and No. 143- Koothapar village on the east commanding to irrigation of wet lands of these villages and Nagavalli and Vengur village in Tiruchirapalli Taluk. It receives drainage water from its free basin of 0.86 sq.m. besides the surplus of four upper tanks and the 4 supply canals from the Uyyakondan channel through a sluice at its left bank about 1 mile from the Thiruverumbur Railway station and surplus over a masonry weir 63' - 4" long at the right bank and also over a way escape towards the right of the weir.

The escape is capable of disposing of the surplus with a M.W.L. depth of 2 feet over crest Since the natural rocky escape is very uneven, it is proposed to construct a weir of 19' - 8", long to the left of weir in continuation to make up a total length of 83' - 0", and this will discharge 645 c/s with a head of 2 feet. This wetland attracts thousands of water birds comprising of resident and migrant species. Major flora includes *Eichhornia crassipes*, *Phragmites karka*, *Zizania latifolia*, *Cyanodon* sp., *Limnophila* sp., *Sagittaria* sp., *Saccharum latifolium*, *Erianthus pucerus*, *Erianthus ravennae*, *Leersia hexandra*, and *Cyperus rotundus*. The wetland have many faunal communities such as *Euphlyctis hexadactylus*, *Mirghal sp*. *Ctenopharyngodon idella*, *Oreochromis mossambicus*, *Salmophasia bacaila*, *Puntius filamentosus*, *Catla catla* and *Labeo rohita*; and the water insects include *Rhithrogena germanica* and dragon flies. In addition to that various species of algae and other flora and fauna were present in the lake.

Fig 2.1: Map shows the Koothapar Periyakulam Wetland, Tiruchirappalli District, Tamilnadu, Southern India.



2.2 Density: Calculation of water birds density

The density of water birds were calculated as Number/hacter.

2.3 Diversity

Species diversity has two components: The species richness in the community and species evenness or equitability [18]. The diversity was measured most directly as number of species and expressed as an index that incorporated the interplay of species richness and relative abundance of species into single value for the given community [19]. A number of indices have been used to calculate diversity.

2.4 Species Richness

Species richness was calculated using the number of species recorded in various habitat types. Species richness was measured by the number of water bird species recorded from different habitats of the wetland during monthly censuses [18].

3. OBSERVATIONS AND RESULTS

The waterbirds belonged to 37 species and 31 genera, included under 14 families and 7 orders were recorded from the Koothapar Periyakulam lake during period of January 2011 to December 2013. Among the 37 species, 5 species were migratory, 17 species were resident and 15 species were resident migratory, in which 5 species are categorized as "**Near Threatened"** Species and the remaining 32 species were Least Concern as per the IUCN categories, (2020). The Koothapar Periyakulam lake facilitates one of the significant wetland habitats for the waterbirds including migratory waterbirds.

3.1 Bird density, Diversity and Species richness of annual variations

The Water birds were counted for the period of three years January 2011 to December 2013 and for each year twelve months and four different seasons the observation were made. Totally 37 species of birds overall were recorded in the lake for the entire study period. All the 37 species were recorded from the lake during the year 2012 (Table 1). The bird density, diversity and species richness were also determinred. Among the 37 species of Water birds the Indian Little Cormorant (*Phalacrocorax niger*) (96.4±22.53 No/ha) showed highest density and Spot-billed pelican (*Pelecanus philippensis)* (0.02±0.01No/ha) showed lowest density (Table 2). The highest bird density was recorded during the year 2013 (961.3±194.66 No/ha.) and lowest during the year 2011 (329.9±43.15 No./ha.). Diversity of Water birds showed maximum during the year 2013 and lowest during the year 2011, which were 0.03±0.004 and 0.02±0.002 respectively. The richness of the

water birds species were also showed highest value during the year 2013 and lowest species richness during the year 2011, which were 23.2±1.27 and 14.7±0.68 respectively (Table 1 and Fig. 1).

Table1. Overall year wise variations of bird density (No./ha) recorded from January 2011 to December 2013. (Values are Mean ± SE).

S. No	Species name	2011	2012	2013
1	Little grebe	13.1±4.67	34.1±5.73	35.4±7.85
2	Spot billed pelican	0	0.04±0.04	0.04±0.04
3	Indian little cormorant	43.2±9.97	66±15.30	96.4±22.53
4	Dater	19.3±4.01	44.6±6.26	24.3±6.27
5	Grey heron	7.9±2.87	8.4±1.92	8.8±2.82
6	Purple heron	7.6±1.71	10.2±2.03	7.3±1.67
7	Black-crowned night heron	19.6±4.59	36.2±7.81	37.6±10.00
8	Indian pond heron	0.5±0.5	7.9±3.33	8.9±4.24
9	Little egret	30.5±7.61	44±9.49	45.1±12.50
10	Large egret	18.5±4.23	14.8±3.57	31.4±9.16
11	Cattle egret	27.5±2.38	43.3±11.31	69.3±13.60
12	Asian openbill stork	3.5±1.11	13.2±6.05	13.5±5.76
13	Painted stork	4.8±2.42	3±1.98	8.2±5.43
14	Oriental white ibis	1.1±0.87	7.3±3.76	7.2±3.25
15	Glossy ibis	6.5±5.61	24.6±12.55	31±7.87
16	Eurasian spoonbill	0	1.1±1.02	3.1±2.51
17	Spot-billed duck	12.4±4.24	22.1±4.63	50.2±16.44
18	Lesser whistling duck	0	8.6±3.98	32.7±12.75
19	White-breasted water hen	1±0.46	3.6±1.57	2.7±0.66
20	Purple moorhen	16.3±3.77	36.8±8.66	51.6±15.88
21	Common coot	45±16.61	84.9±16.06	88.3±20.11
22	Pintail snipe	0	12±6.69	16.5±8.41
23	Wood sandpiper	1.2±0.48	11.4±5.40	31±10.87
24	Marsh sandpiper	1±0.41	1.7±0.68	11.5±8.87
25	Common sandpiper	0.1±0.08	1±0.49	1±0.46

26	Common redshank	0.5±0.28	0.8±0.57	0.2±0.21
27	Common greenshank	0.4±0.23	2±1.03	8.1±5.10
28	Pacific-golden plover	0.6±0.60	4.1±3.79	0
29	Black-winged stilt	19.2±5.98	36.5±6.76	55.4±19.03
30	Red wattled lapwing	20.7±3.03	24±4.33	27.5±5.01
31	Yellow wattled lapwing	0.3±0.20	3.5±2.48	0
32	River tern	0.7±0.51	16.2±5.99	34.3±6.58
33	Whiskered tern	0.1±0.18	30.4±8.47	58.5±12.85
34	Little tern	0	63.5±21.11	56.4±14.62
35	White-breasted kingFisheser	3.4±1.23	5.1±1.22	3±0.65
36	Lesser pied kingFisheser	2.2±0.63	8.6±1.77	4.7±0.72
37	Small blue kingFisheser	0	0.3±0.25	0.5±0.31

Table 2. Overall year wise variations of characteristics of birds recorded from January 2011 to December 2013. (Values are Mean ± SE).

S. No.	**Characteristic of Birds**	**Year**		
		2011	**2012**	**2013**
1	Density (No. /ha.)	329.9 ± 43.15	737.6 ± 99.76	961.3 ± 194.66
2	Diversity (H')	0.01 ± 0.001	0.02 ± 0.002	0.02 ± 0.004
3	Richness (No. of species)	14.7 ± 0.68	19.7 ± 1.10	23.2 ± 1.27

Fig1. Overall year wise variations of density of birds recorded from January 2011 to December 2013. (Values are Mean ± SE)

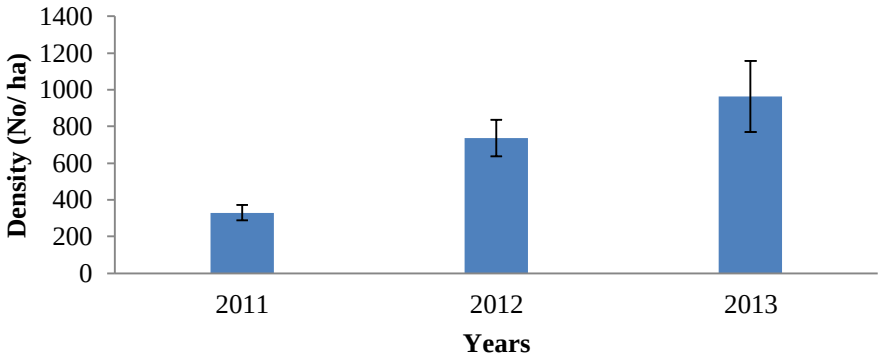


Fig 2. Overall year wise variations of diversity of birds recorded from January 2011 to December 2013. (Values are Mean ± SE)

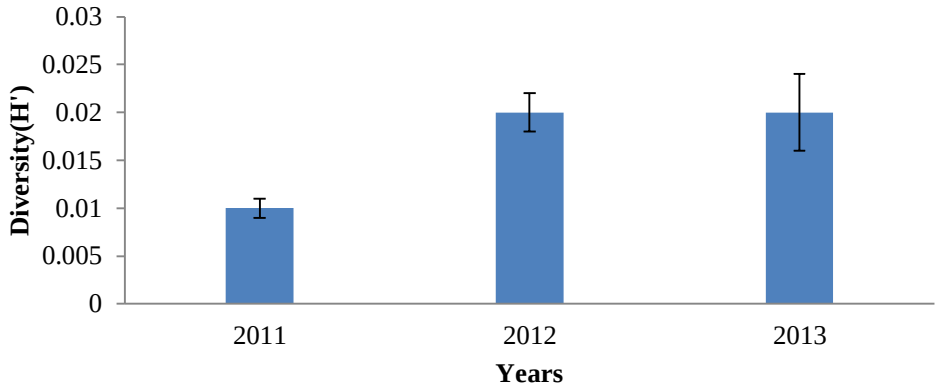
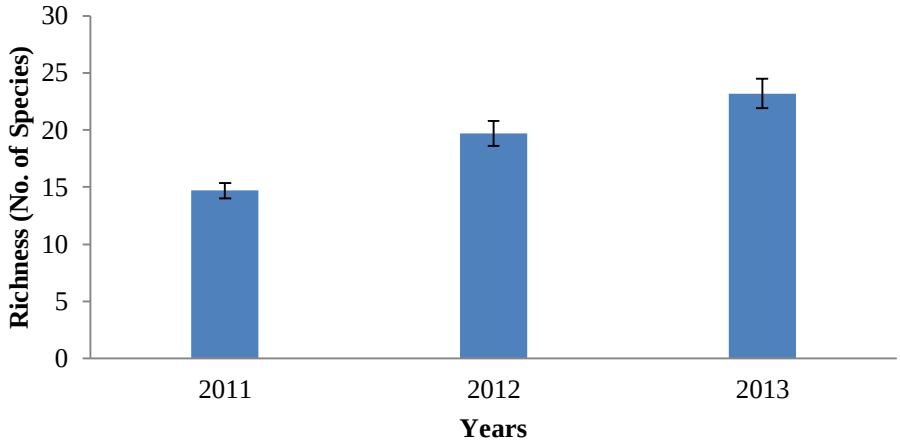


Fig 3. Overall year wise variations of Species richness of birds recorded from January 2011 to December 2013. (Values are Mean ± SE)



The Periyakulam lake attracts many waterbirds including migratory, resident migratory and local species, and the lake is generally considered as one of the significant wetlands in the Trichirapalli District, Tamil Nadu, India [11,12,20], which can be declared as one of the Important Bird Areas (IBA) in India. Totally waterbirds 37 species, included under 31 genera, 14 families and 7 orders, were recorded in the Koothapar Periyakulam lake from January 2011 to December 2013. Among the 37 species, 5 species were migratory, 17 species were resident and 15 species resident migratory. Among then 5 species are belonged to Near Threatened category and the remaining 32 species are Least Concern as per the IUCN categories of 2017. The Kothappar Periyakulam wetland facilitates one of the significant wetland habitats for the water birds

including migratory water birds. The density, diversity and species richness of birds were highly significantly among the overall years.

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