

## RESEARCH ARTICLE



# Temporal variations of large wading birds in the Point Calimere Wildlife Sanctuary, Tamil Nadu, India

**OPEN ACCESS****Received:** 16.12.2020**Accepted:** 30.12.2020**Published:** 11.01.2021**Rajendran Jagadheesan<sup>1,2</sup>, Jeganathan Pandiyan<sup>1,2\*</sup>****1** Department of Zoology and Wildlife Biology, A.V.C. College (Autonomous), Mannampandal, 609 305, Tamil Nadu, India**2** The Institution affiliated to the Bharathidasan University, Tiruchirapalli, Tamil Nadu, India

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\* **Corresponding author.**

[dunlinpandiyan@gmail.com](mailto:dunlinpandiyan@gmail.com)

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## Abstract

**Objectives:** To assess the temporal variations of the large wading birds in the Point Calimere Wildlife Sanctuary and to suggest management recommendations for the better management of the wading birds visited in the sanctuary seasonally. **Methods and Statistical analysis:** The population characteristic of large wading birds was carried out by employing a 'direct count' method. The one-way analysis of variance (ANOVA) was performed to understand the impact of various seasons on the population characteristics of large wading birds. **Findings:** In total, 13 species of large wading birds were observed. Among the 13 species, the Black-headed Ibis and Painted stork are Near Threatened category (IUCN, 2020). Greater Flamingos showed the highest density than the other large wading birds observed from the PCWLS. The density, diversity and species richness of large wading birds were relatively greater in monsoon than the other seasons studied. The population characteristics of large wading birds varied significantly among the months and seasons ( $P < 0.001$ ). **Novelty and applications :** The diversity of large wading birds is declined when compared to the previous studies. The study revealed that the PCWLS is required intensive assessment of the various ecological factors of the sanctuary for managing various species of waterbirds visited seasonally.

**Keywords:** Conservation; large wading birds; population; waterbirds; wetlands

## 1 Introduction

Waterbirds are persistently associated with the freshwater, coastal and marine habitats<sup>(1)</sup>. Numerous species of waterbirds are well known for their long-distance migration<sup>(2,3)</sup>. The waterbirds migrate annually from their breeding grounds to wintering grounds to meet out their energetic demands<sup>(4)</sup>. More than 2000 wetlands about 4.1 million hectares of wetlands are identified in India<sup>(5)</sup>. All these wetlands are supporting several species of migratory waterbirds and shorebirds, in which, 42 wetlands are designated as Ramsar sites in India<sup>(6)</sup>. In addition to that 465 Important Bird Areas (IBA) are also

supporting various species of waterbirds in India seasonally<sup>(7)</sup>.

Generally, the waterbirds inhabit wetlands for feeding, breeding, nesting or roosting<sup>(8)</sup>. Waterbirds are effectively using the wetlands as a most viable habitat; on the other hand, the wetlands are also supporting numerous species of waterbirds since the wetlands providing necessary nutrients for the waterbirds. In the wetland ecosystem the waterbirds are regarded as the most significant role in the food web and trophic structure<sup>(9)</sup>. The abundance and distribution of waterbirds are influenced by several factors in which the temporal factors are one of the major ecological factors, which is playing a major role in the viability of the population of waterbirds<sup>(3)</sup>. The abundance and distribution of waterbirds mostly depend on the quality of wetlands<sup>(10)</sup>. In addition to that, the waterbirds are one of the good bioindicators and which is facilitating to the exploration of various environmental problems<sup>(11)</sup>. Since the wetlands are providing sufficient energy for the various species of waterbirds the wetlands are attracting migratory and resident bird species waterbirds<sup>(12)</sup>. Nevertheless, the assessment of bird density, diversity and species richness of waterbirds is the most critical aspect because these characteristics could enable the status of the various species of waterbirds in a given wetland habitat<sup>(13,14)</sup>.

The Point Calimere Wildlife Sanctuary (PCWLS) is an important wetland in southern India and is the only Ramsar site in Tamil Nadu, India. The PCWLS is supporting numerous species of waterbirds annually<sup>(12,15-17)</sup>. But a recent study described that the population of waterbirds in PCWLS is declined due to various ecological factors<sup>(18)</sup>. In India, wetlands are facing severe threats due to various pollutions<sup>(19)</sup>. The population of waterbirds is declined due to the degradation of wetlands through various natural processes and man-made activities. Therefore the present study intended to evaluate the density, diversity and species richness of waterbirds especially large wading birds to understand their status and distribution in the PCWLS and to suggest the management recommendations of the sanctuary.

## 2 Materials and Methodology

### 2.1 Study Area

The Point Calimere Wildlife Sanctuary (PCWLS), is situated in the Vedarnyam swamp at 10°18'N, 79°51'E in the state of Tamil Nadu in Nagapattinam District, India (Figure 1). The sanctuary belongs to the bar-built category under the four basic sub-classification of coastal habitats<sup>(20)</sup>. The PCWLS receives water only during the monsoon season. The swampland is located in the western part of the PCWLS and the total area of the swamp belt is 30 km long and 9 km wide, which is the viable and significant habitat for waterbirds. Inside the swamp area, two salt production companies are functioning with large scale production of industrial slats. The sanctuary will get the rainwater during the monsoon season during the month of October – December. The average temperature of the sanctuary is 32°C. The sanctuary is supporting numerous species of migratory, resident migratory and resident waterbirds annually<sup>(18)</sup>.

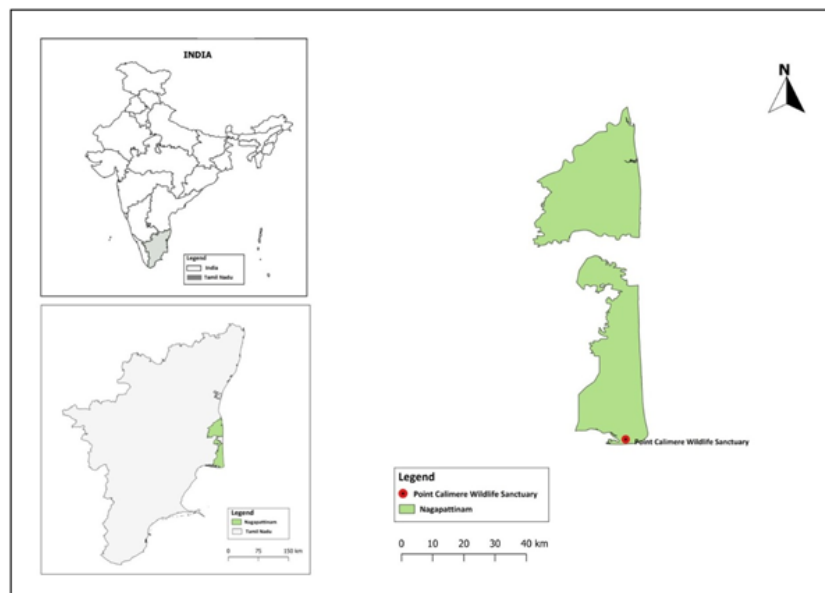


Fig 1. Map of the study area point Calimere Wildlife Sanctuary, Tamil Nadu, India

## 2.2 Waterbird counts

The study was conducted from 2015 to 2016 covering pre-migratory, migratory and post-migratory seasons. One hectare of the sampling area was selected based on the aggregation of large wading birds in the sanctuary. 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<sup>(3,21)</sup> for the entire study periods. Observations were made from early morning 06.00 am to 11.00 am. No birds were disturbed during the survey. The arrival or departure of the large wading birds was cautiously identified and counted.

## 2.3 Data analysis

The density of large wading birds was calculated as a number per hectare<sup>(3)</sup> and the species richness and diversity were also calculated by using standard procedures<sup>(22,23)</sup>. The one-way analysis of variance (ANOVA) was performed to understand the time factor such as seasons and months in relation to the population characteristics of large wading birds such as density, diversity and species richness. The data were analysed by using the Minitab 18.0 and SPSS 25.0 and the results were interpreted with standard statistical procedures<sup>(24)</sup>.

## 3 Results and Discussion

The study found 13 species of large wading birds from the Point Calimere Wildlife Sanctuary, during the study period. However, among the 13 species, two species were Near Threatened category such as Black-headed Ibis and Painted stork, four were resident and the rest of the species were resident migratory (RM) categories (Table 1). The Greater Flamingos showed the highest density ( $452.6 \pm 94.64$  No./ha) and the Striated heron showed minimum density ( $0.1 \pm 0.07$  No./ha) when compared to the other species (Table 1). The density, diversity and species richness of large wading birds were relatively greater in monsoon than the other seasons studied (Table 2). The month of January, 2016, showed the highest density, diversity and species richness when compared to the other months studied (Figures 2, 3 and 4). The large wading bird density, diversity and species richness showed significant differences among the months and seasons studied ( $p < 0.001$ ) (Table 3, Figures 3 and 4).

**Table 1.** Density of large wading birds (No./Ha) recorded from the Point Calimere Wildlife Sanctuary from August 2015- April 2016. (Values are Mean  $\pm$  SE)

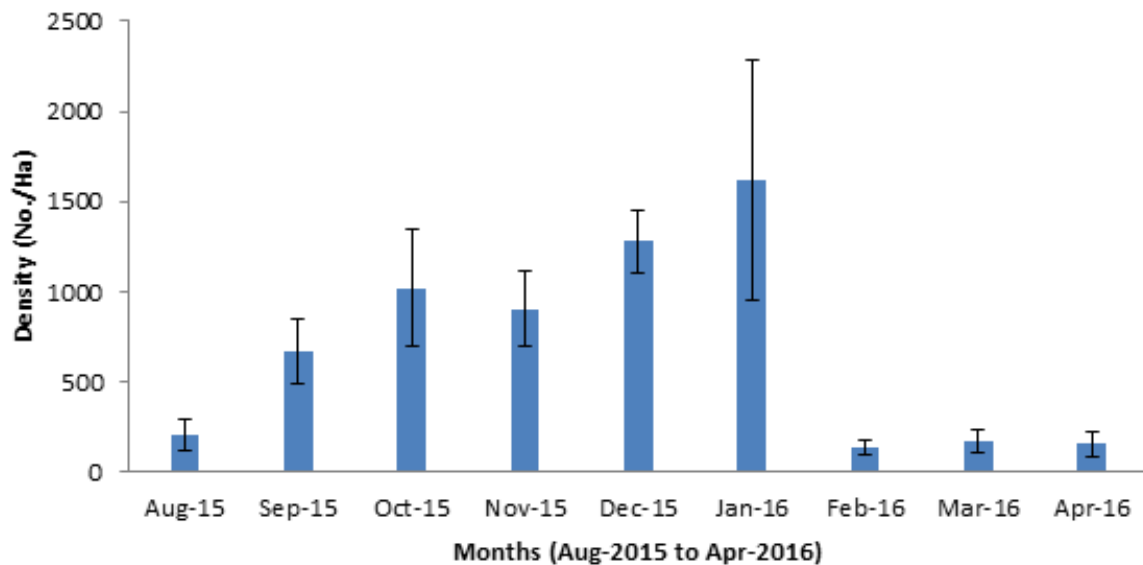
S. No.	Species Name	Density (No./ha.)
1	Cattle egret ( <i>Egretta garzetta</i> )	1.1 $\pm$ 1.14
2	Great egret ( <i>Ardea alba</i> )	31.0 $\pm$ 3.26
3	Inter-mediate egret ( <i>Ardea intermedia</i> )	16.3 $\pm$ 2.95
4	Little egret ( <i>Egretta garzetta</i> )	40.0 $\pm$ 5.03
5	Western-reef egret ( <i>Egretta gularis</i> )	1.8 $\pm$ 0.48
6	Striated heron ( <i>Butorides striata</i> )	0.1 $\pm$ 0.07
7	Indian pond heron ( <i>Ardeola grayii</i> )	23.4 $\pm$ 3.79
8	Grey heron ( <i>Ardea cinerea</i> )	4.9 $\pm$ 0.90
9	Purple heron ( <i>Ardea purpurea</i> )	0.3 $\pm$ 0.16
10	Greater flamingo ( <i>Phoenicopterus roseus</i> )	452.6 $\pm$ 94.64
11	Black-headed ibis ( <i>Threskiornis melanocephalus</i> )	7.2 $\pm$ 3.44
12	Eurasian spoonbill ( <i>Platalea leucorodia</i> )	19.0 $\pm$ 4.64
13	Painted stork ( <i>Mycteria leucocephala</i> )	88.8 $\pm$ 12.55

**Table 2.** Seasonal variation of large wading bird density(No./Ha) recorded from the Point Calimere Wildlife Sanctuary during August2015- April 2016. (Values are Mean ± SE).

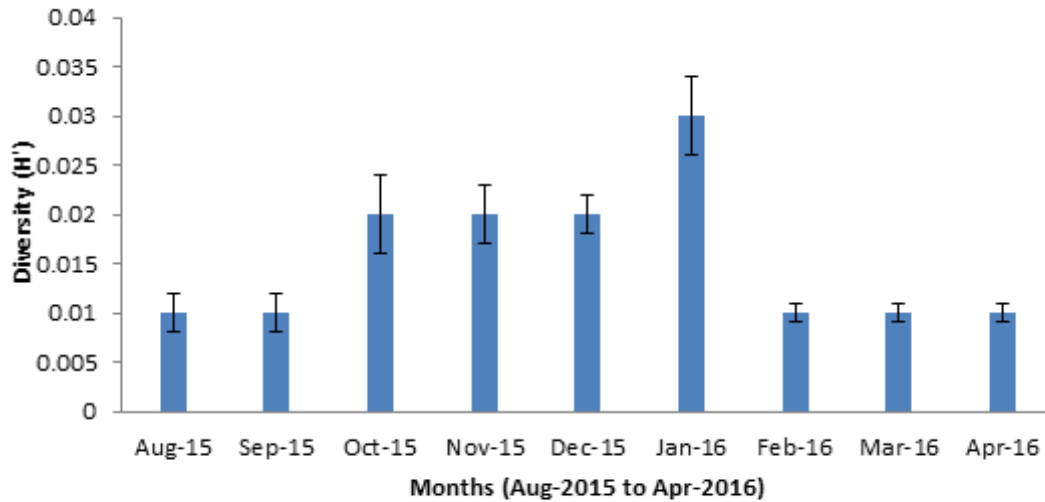
S.No.	Large Wading birds	Point Calimere Wildlife Sanctuary Seasons (Aug-2015 to Apr-2016)		
		Pre-Monsoon	Monsoon	Post-Monsoon
1	Cattle egret	-	3.44±3.444	-
2	Great egret	18.72±3.762	45.61±5.436	28.78±5.851
3	Intermediate egret	3.17±1.898	24.61±5.891	21.33±5.272
4	Little egret	14.28±3.004	66.89±9.673	38.94±7.304
5	Western reef egret	-	3.78±1.195	1.89±0.626
6	Striated heron	0.06±0.056	0.11±0.111	0.28±0.195
7	Indian pond heron	20.11±9.868	30.83±3.786	19.39±4.295
8	Grey heron	4.11±1.075	9.72±1.988	0.89±0.411
9	Purple heron	0.22±0.173	0.78±0.461	-
10	Greater flamingo	412.33±119.465	907.22±216.36	38.28±18.62
11	Black headed ibis	-	21.33±9.657	0.39±0.389
12	Eurasian spoonbill	9.61±3.111	47.5±10.859	-
13	Painted stork	152.5±23.6	106.06±16.282	7.83±3.163

**Table 3.** Seasonal variations of large wading bird density, diversity and richness recorded from the Point Calimere Wildlife Sanctuary during August 2015- April 2016. (Values are Mean ± SE).

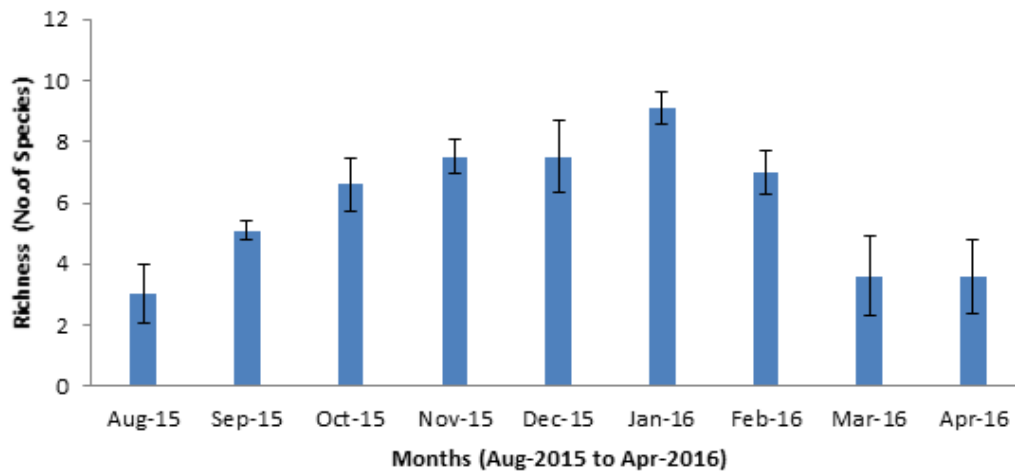
S.No.	Population Characteristics of large wading birds	Seasons			ANOVA P Value
		Pre-Monsoon	Monsoon	Post-Monsoon	
1	Density (No./ha.)	635.11±142.457	1267.89±236.281	158±31.118	P<0.001
2	Diversity (H')	0.01±0.002	0.02±0.003	0.01±0.001	P<0.001
3	Richness (Number of species)	4.94±0.557	8.06±0.482	4.78±0.712	P<0.001



**Fig 2.** Monthly variations of large wading bird density(No./ha.) recorded from the Point Calimere Wildlife Sanctuary, Kodikkarai from August 2015- April 2016. (Values are Mean ± SE).



**Fig 3.** Monthly variations of large wading bird diversity(H') recorded from the Point Calimere Wildlife Sanctuary, Kodikkarai from August 2015- April 2016. (Values are Mean ± SE).



**Fig 4.** Monthly variations of species richness of large wading birds recorded from the Point Calimere Wildlife Sanctuary, Kodikkarai from August 2015- April 2016. (Values are Mean ± SE).

The study found that 13 species of large wading birds recorded from the sanctuary, but the results revealed that the species of large wading birds and their population is declined when compared to the previous studies. In fact, a study reported that more than 250 species of waterbirds were using the Point Calimere Wildlife Sanctuary (PCWLS)<sup>(25)</sup>. Another study has revealed that the sanctuary supports 110 species of waterbirds in which 34 large wading birds have effectively used the sanctuary seasonally<sup>(26)</sup>, several species of large wading birds used the swamp lands PCWLS as viable habitats during their migration<sup>(27)</sup> A study envisaged that various species of waterbirds including shorebirds utilized the swamp lands of PCWLS as significant foraging grounds<sup>(12)</sup>. Studies mentioned that the PCWLS sanctuary has supported various species of waterbirds especially numerous species of large wading birds as a potential feeding ground annually<sup>(28-30)</sup>. One of the Ramsar’s Reports (2002) described that 31 large wading birds out of 119 waterbird species were recorded from the PCWLS<sup>(31)</sup>. A report from the PCWLS

inferred that nearly 23 species of large wading birds were recorded from the Point Calimere Wildlife Sanctuary<sup>(32)</sup>. However, the present study found that the population and diversity of large wading birds are lower than the previous studies. The decline of the large wading bird population in the PCWLS might be due to the effect of various ecological factors that degraded the sanctuary. PCWLS is reported degraded as a result of human pressures<sup>(17)</sup> and various ecological factors and pollution<sup>(12)</sup>. Another study also reported that the population of waterbirds is drastically declined in the PCWLS when compared to the previous studies due to various ecological pressures<sup>(3)</sup>

The study found that the bird density, diversity and species richness showed significant variations among the seasons and months ( $P < 0.001$ ). It is also inferred that the time factors such as seasons and months are playing a major role in the population characteristic of large wading birds in a given wetland habitat. Several studies stated that the seasons and years could influence the abundance, density and species richness of waterbird species. In addition to that the temporal factors such as annual, seasons and months etc., could regulate the population of waterbirds temporally since these factors are facilitating the dispersal, immigration, emigration of avian communities. Studies also described that the population and species composition varied among the various species of waterbirds driven by the seasons and which could be associated with the immigration and emigration of waterbirds<sup>(33-36)</sup>. However, the waterbird species diversity and species composition are governed by the quality of aquatic habitats such as resource availability, nesting and roosting sites.<sup>(37-39)</sup>

The large wading birds are feeding, nesting, roosting on any kind of aquatic habitat with appropriate water level. The population characteristics of large wading birds could be changed on the basis of water level, availability of food, physical and chemical features of water and soil, etc. A few studies have been documented in relation to the status and distribution of large wading birds and their requirements in a given wetland rather than major attention of waterbirds. Studies also implied that the species composition and viability of large wading birds are purely determined by the size of wetlands, existences of prey, depth of water, vegetation cover and slopes of water body etc.<sup>(40,41)</sup>

## 4 Conclusion

Globally, several wetlands are degraded due to the negative influence of various ecological factors<sup>(40,42)</sup>. Indeed, the wetland habitats are vanishing and the wetlands should be conserved because the wetlands are supporting numerous species of waterbirds and other aquatic organisms seasonally. Nevertheless, the Point Calimere Wildlife Sanctuary is one of the Ramsar sites in India and which is also providing suitable habitat for various species of waterbirds including migratory, resident migratory and resident waterbird species annually. The current study found that 13 species of large wading birds and are effectively using the Point Calimere Wildlife Sanctuary as potential foraging grounds seasonally. But the results of the present study showed that the PCWLS is not supporting a maximum number of large wading birds when compared to the previous studies. Therefore, the PCWLS is to be assessed with an intensive survey of various ecological factors such as physical and chemical characteristics of soil and water, assessment of food and prey availability for the waterbirds, threats, pollution, and other factors that are directly or indirectly affecting the waterbird communities for proper monitoring, management and conservation of waterbirds.

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