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# Seasonal diversity of diving birds in the Periyakulam Lake, Tiruchirappalli, Tamil Nadu, India

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## Abstract

Wetlands are the major feeding habitats for water birds. The water birds were estimated weekly by using total count method during 06.00 am to 06.00 pm. Totally seven species of diving birds were observed from Junuary-2011 to December-2012. The overall diving bird density was recorded maximum during the monsoon period of Year I and Year II i.e. 261.33±41.345/ha and 428.72±49.388/ha respectively. The density, diversity and species richness varied significantly between the years and among the seasons ($P<0.05$). The present study proves the Periyakulam lake is one of the viable habitats for the diving bird population.

**Key words**: conservation, coots, cormorants, diving bird, lakes, wetlands.

## INTRODUCTIONS

Wetlands are known as "biological supermarkets" because of the extensive food chain and rich biodiversity, and also unique habitats for a wide range of flora and fauna (Mitsch and Gosselink, 2000). In a wetland, multiple sub-habitats or microhabitats are available in a small area which attracts different species of water birds. Being ecologically important with high nutritional value and productivity, wetlands support good diversity of birds (Paracuellos, 2006). Lakes as one of the wetlands is a highly complex water, land interactive system, and the most fertile - productive ecosystems in the world (Wetzel, 2001). Besides, the fresh water wetlands are considered as extremely significant area all over the world for the wildlife protection, recreation, sediment control and flood prevention (Sivaperuman and Jayson, 2000). They act as important habitats for feeding, roosting, nesting and rearing young ones (Weller, 1999; Stewart, 2001). In fact the freshwater wetlands act as stop-over sites for many winged visitors such as migratory birds, diving and other water birds.

Most of the inland wetlands are facing critical consequences due to many reasons including anthropogenic pressures in India (Pandiyan and Asokan, 2015). The foremost threats to wetlands of Tamil Nadu region include increased siltation, eutrophication due to run-off from catchments, conversion for agriculture, receding open water areas as a result of expanding reed beds, construction of canals and over grazing (Kannan and Pandiyan, 2012). The present study deals with the current status of inland divers with reference to density, diversity and species richness of the diving birds of Periyakulam wetland in Tiruchirappalli, Tamilnadu.

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### Study area

Periaykulam lake ($10^{o}.78$ N; $78^{o}.77$ E) is located in the Koothappar Village of Thiruvarampur, Tiruchirapalli District, Tamil Nadu, India. It covers an area of 74.085 ha. The major water source to 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 wetland attracts thousands of water birds comprising of resident and migrant species. Major flora includes *Eichhornia crassipes*, *Phragmites karka*, *Zizania latifolia*, *Cyanodon* spp., *Limnophila* sp., *Sagittaria* sp., *Saccharum latifolium*, *Erianthus pucerus*, *Erianthus ravennae*, *Leersia hexandra*, and Cyperus rotundus; the birds include *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.

## MATERIALS AND METHODS

### Bird counting

Water birds were counted individually using the 'direct count' method following the method described by Yates and Goss-Custard (1991). Since lake appeared relatively homogenous, birds were counted with 7 × 50m binocular and 20 x 60m spotting scope from vantage points of the lake. Two counts of 3.00h duration were made every day on clear and sunny days to minimize bias arising from variation in weather. During the census, arrival or departure of flocks of birds was carefully counted to avoid missing or duplication of records. Care was taken to see that the birds were not disturbed due to the visits for counting.

**Seasons**

The study period was divided into four different seasons based on the migration chronology of water birds. The Pre-Monsoon season (PrM) includes the months of July, August and September, when birds arrive or pass the lake for wintering; the Monsoon season (Mon) includes the months of October, November and December; the Post Monsoon season (PoM) includes the months of January, February and March; and the Summer season (Sum) includes the months of April, May and June (Pandiyan *et al*., 2006)

**Data analysis**

Density of aerial foraging birds was calculated as number per hectare. Species richness was calculated based on the number of waterbird species recorded in the lake (Verner, 1985), and species diversity was calculated by using the Shannon– Wiener Index (H': Shannon & Wiener, 1949). Individual bird density was calculated as number per hectare of the lake in each season. The General Linear Model (GLM) was applied to determine the impact on the characteristic features of the density, diversity and species richness among the seasons. All the statistics were run by using SPSS 16.0. Results of the analyses were interpreted using standard statistical procedures (Sokal and Rohlf, 1981).

**RESULTS**

Totally seven species of diving birds were observed from January 2011 to December 2012 (Table-1). The Spot billed Duck, Common Coot, Darter and Indian Little Cormorant were recorded throughout the year and across the seasons. The Spot billed pelican was recorded only during the post monsoon season of Year II (Table 1). The density of Common Coot was recorded more during the monsoon season of Year II than other species recorded in the lake. The overall density and diversity were also higher during the monsoon season of Year II and the species richness was higher during the post monsoon season of Year II (Table 1). Among the seven species the Darter (*Anhinga melanogaster)* and the Spot billed pelican (*Pelecanus philippensis*) are under Near Threatened category as per the report of IUCN, and the Spot-billed duck (*Ans poecilorhyncha*) and Lesser Whistling Duck (*Dendrocygna javanica*) were the migratory water birds. The density, diversity and species richness varied significantly between the years and among the seasons ($P<0.05$). The present study revealed that the diving bird population used the lake as a significant foraging habitat seasonally and some of the species throughout the year in the lake.

**DISCUSSION**

Seven species of diving birds were recorded in the Periyakulam lake during January 2011-December 2012. Water birds shift their habitat and foraging to inland wetland habitats due to availability of prey in the inland wetlands. In addition, the inland wetlands could fulfill energy demand of water birds and enable them to build up nutrient reserves to meet out their breeding activities (Mohanraj and Pandiyan, 2014). Freshwater wetlands are highly important habitats for wide array of water birds and their importance depends on size, diversity of vegetation, water quality, food resources and topography. Generally birds are the most conspicuous and significant component of freshwater wetland ecosystems and their presence or absence may indicate the ecological conditions of the particular area.

Among the seven species of diving birds the density of Common coot was the highest followed by Indian Little Cormorant, Darter and Spot-billed duck. This could be due to the richness of food resources such as fishes, amphibians, reptiles and aquatic insects, etc. In addition to that the water depth was another important variable influencing the habitat selection of water birds (Colwell and Taft, 2000; Isola *et al*., 2002), because it directly determines the accessibility of prey while foraging (Collazo *et al*., 2002; Darnell and Smith, 2004). Water level of the Periyakulam lake was at minimum depth (PWD unpublished data) throughout the study period, which attracted the diving birds to the lake. It has been reported that the habitats with moderate water depth supported the maximum density of diving birds (Hattori and Mae, 2001).

Floating and other heterogeneous plants were found, which are the another most significant substrates for the diving birds especially ducks. The present data of the study showed that the duck and other diving species were present through out the year. Ducks preferred moderate and deep open water bodies rich in submerged vegetation for foraging and loafing as reported by Rajpar and Zakaria (2011). This could be due to higher diversity and richness of food resources such as aquatic insects, fishes and amphibians that occur in submerged vegetation as reported by Meerhoff *et al*., (2003). Species composition differed between the years and among the seasons because of habitat, seasonal movement patterns, local and regional habitat changes, large-scale population changes and climatic conditions (Ericia et al., 2005). Available habitat surface, the amount and type of food resources (which in turn are affected by water quality, salinity, hydrodynamic regime, sediment, soil texture and moisture), and the configuration of particular sites affected the number and species of water birds present (Hill et al., 1993).

The overall diving bird density, diversity and species richness varied between the years and among the seasons ($P<0.05$). The water bird population structure (species richness, distribution, diversity and density) is influenced by different factors such as availability and richness of food resources, water depth, size of the

effective foraging area (Burkert et al., 2004; Gillis et al., 2008; Lentz-Cipollini and Dunson, 2006) and the abiotic changes in the wetlands (Jaksic, 2004; Lagos et al., 2008; Wrona et al., 2006).

In addition, density dependent factors could also drive the birds to shift their habitat use (Summers and Underhill, 1991; Vickery et al., 1995). The species that are unable to respond to fluctuating inter tidal food supplies, supplement their diet with prey from non-inter tidal habitats i.e. inland wetlands (Goss-Custard, 1969; Goss-Custard and Durell, 1983, Velasquez and Hockey, 1992; Caldow et al., 1999; Masero et al., 2000; Masero and Perez-Hurtado, 2001). Birds are known to use the wetlands more frequently during monsoon season than the other seasons (Velasquez and Hockey, 1992). But in the present study it was found that during post monsoon and summer also the birds used the lake because of the presence of water. The water is the main resource for the utilization of wetland habitats (Goss-Custard and Durell, 1983), which is most likely abundant during winter season in inland wetlands. Birds use wetlands as a source of drinking water, feeding, resting, shelter and social interactions (Steward, 2007). The over all study indicates that the water birds can utilize the wetlands as a viable foraging ground and other purposes if water is present. If water is present the other limonitic profile could be enriched, If the limonitic profile is enriched the ecosystem will be viable for rest of the associates. Hence, conservation of wetlands with moderate water level will support the waterbirds especially diving birds.

**Conservation implication**

The present study showed that the Periyakulam lake is one of the major feeding grounds for many species of water birds especially diving birds such as ducks, coots, cormorants and darter. Proper awareness programe regarding the importance of birds will ultimately help the protection of birds of this region. The local people use water that has leaked out from this lake for agricultural activities and thereby polluted water would reach all the adjoining bird visiting areas. On the other hand uncontrolled fishing depletes the food sources of wetland birds. Small sized gill nets are used for fishing which results in the removal of even small sized fishes, indirectly affecting the availability of feed for water birds. Being this area is one of the main habitats for wetland birds in South India it should be declared as a protected site as Important Bird Area and to be conserved as Bird Sanctuary. The Periyakulam lake also supports two Near Threatened species and two migratory species of water birds among the seven species recorded in the lake, which implies that this lake is the most important and viable habitat for these species including migratory and resident water birds.

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