

## Effect of habitat alteration on the avian inhabitants of a water body with special reference to *Dendrocygna javanica*

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### Abstract

Wetlands are one of the most threatened habitats due to their vulnerability and scope for their inclusion in developmental changes and urbanization process. They provide home for a variety of wildlife. The study area is a 2.5 acre water body situated within the heart of Thrissur city. Large number of birds was seen in the water body from the months of September to February. Fourteen species of aquatic birds belonging to 7 different families were identified in Vadakkechira with 35.71% being common and 35.71% uncommon. Abundant and rare species comprised 7.14% and 21.43% respectively. 57.14% were resident to the area, 35.71% were local migrants and 7.14% were long distance migrants. The dominant species was *Dendrocygna javanica*. A downward trend in the number of birds was noticed during the period 2002 to 2012. The pond became infested with *Salvinia* indicative of enriched nutrient loading in the water body. Reduced levels of dissolved Oxygen and reduced pH were recorded in 2012. Increase in the level of CO<sub>2</sub> and temperature was noticed during the period. Recreational activities and even the presence of large number of birds in previous years and altered land use might have contributed to the modification of this habitat, resulting in the decline of bird population.

Key words : Wetland, Avian fauna, *Dendrocygna*, *Salvinia*

### INTRODUCTION

Wetlands play an important role in maintaining the regional biodiversity. There are numerous factors contributing towards sustaining the biodiversity of a water body. The urban setting of a water body always confers it with unique ecological and social values. The ability of water bodies to contain pollutants and their capacity to offer flood protection makes them an integral part of urban landscape. These sites often become an important habitat for wild life and provide local residents an interface to interact with nature.

Urbanization may replace native habitats and deplete resources in its surrounding areas to support urban economies<sup>[1]</sup>. Urban areas are expected to grow substantially in coming years. By 2030, the percentage of the world's population living in urban areas is projected to increase from the current 49% to approximately 61%<sup>[2]</sup>. The resulting habitat changes and degradation could be assessed using birds as biological models, as they are good ecological indicators<sup>[3]</sup>.

Wetlands provide home for large variety of wildlife including birds, mammals, fish, amphibians, insects and plants<sup>[4]</sup>. Approximately 23% of the bird species found in India<sup>[5]</sup> are known to be dependent on wetlands<sup>[6]</sup>. Deteriorating habitats fail to sustain the flora and fauna which may gradually result in either their modification and adjustment or the fading out of the species from the area. Even a subtle change in the micro environment can result in a sensitive outcome of the avian population of a locale. This study looks into the bird population in a water body which is situated right in the centre of Thrissur city and subjected to various anthropogenic influences.

#### Study Area

Vadakkechira, built by Sakthan Thampuran (1751-1805), the architect of modern Thrissur, for water management and irrigation purposes, is a 2.5 acre pond and is identified as one of the important landmark of Thrissur. Being situated in the heart of city, it lies very close to the bus station. Petrol stations, high rise

apartments, commercial buildings and road side vendors are seen in close by locations.

### METHODS

Total count method was employed for estimating bird population<sup>[7]</sup> in the water body. Data was collected during the time period 2002 to 2012. Birds were identified and classified according to Ali and Ripley<sup>[8,9]</sup>. The common and scientific names are after Manakadan and Pittie<sup>[5]</sup> and taxonomy according to Inskipp *et al.*<sup>[10]</sup> and Ripley<sup>[11]</sup>. Observation was done every month between 0600 hrs to 0900 hrs in the morning and 1500 hrs to 1800 hrs in the evening.

Species richness, species composition and frequency of occurrence were assessed<sup>[12]</sup>. The bird species found more than 1000 individuals per day was categorized as very abundant, those between 201 and 1000 individuals as abundant, those found between 51 and 200 as very common and those between 21 and 50 as common species. Bird species with population between 7 and 20 individuals per day were classified as fairly common and those observed between one and six in number as uncommon. Birds seen one to six individuals per season was described as rare. Bird species having infrequent occurrence were termed as very rare species.

Samples for estimating dissolved Oxygen was collected in 125 ml glass bottles and fixed immediately with Manganous Chloride solution (Winkler A), followed by alkaline Potassium Iodide (Winkler B) solution. Dissolved Oxygen (DO) was analyzed by modified Winkler method<sup>[13,14]</sup>. Temperature of the water was determined in the field using a standard degree centigrade thermometer of range 0°C to 50°C with 0.1°C accuracy. Water pH was measured using Systronics pH analyzer model 321 (accuracy ±0.01).

### RESULTS

The study area situated within the city is home to avian species, both resident and migratory. The data obtained in 2002

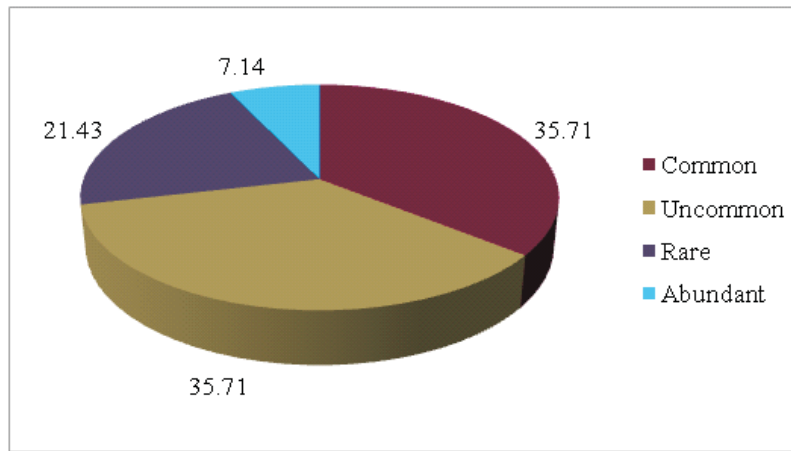
**Table 1:** List of water birds recorded from Vadakkechira

Family	Scientific name	Common name	Abundance	Status
Podicipedidae	<i>Tachybaptus ruficollis</i> (Pallas, 1764)	Little Grebe	U	R
Phalacrocoracidae	<i>Phalacrocorax carbo</i> (Linnaeus, 1758)	Great Cormorant	U	LM
	<i>Phalacrocorax niger</i> (Vieillot, 1817)	Little Cormorant	U	R
Anhingidae	<i>Anhinga melanogaster</i> (Pennant, 1769)	Darter	C	LM
Ardeidae	<i>Ardeola grayii</i> (Sykes, 1832)	Indian Pond-Heron	C	R
	<i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret	C	R
	<i>Egretta garzetta</i> (Latham, 1790)	Little Egret	U	R
	<i>Ardea purpurea</i> (Linnaeus, 1766)	Purple Heron	R	R
	<i>Mesophoyx intermedia</i> (Wagler, 1827)	Intermediate Egret	R	R
Threskiomithidae	<i>Threskiornis melanocephalus</i> (Linnaeus, 1766)	Asian White Ibis	R	LM
Anatidae	<i>Dendrocygna javanica</i> (Horsfield, 1821)	Lesser Whistling Duck	A	LM
	<i>Anas acuta</i> (Linnaeus, 1758)	Northern Pintail	C	M
	<i>Nettapus coromandelianus</i> (Gmelin, 1789)	Cotton Teal	U	LM
Rallidae	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	White Breasted Waterhen	C	R

Abundance: A -Abundant, C -Common, U -Uncommon, R -Rare  
 Status: R -Resident, LM -Local Movement, M -Migrant

**Table 2:** Water bird population during different years of study.

Bird	2002	2004	2006	2008	2012	Total
<i>Tachybaptus ruficollis</i>	16	-	26	-	-	42
<i>Phalacrocorax carbo</i>	37	36	12	8	2	95
<i>Phalacrocorax niger</i>	32	16	-	-	-	48
<i>Anhinga melanogaster</i>	279	313	69	47	18	726
<i>Ardeola grayii</i>	162	143	111	70	-	486
<i>Bubulcus ibis</i>	76	97	167	278	27	645
<i>Egretta garzetta</i>	76	-	37	-	-	113
<i>Ardea purpurea</i>	2	-	1	-	1	4
<i>Mesophoyx intermedia</i>	3	2	2	-	-	7
<i>Threskiornis melanocephalus</i>	-	4	-	-	-	4
<i>Dendrocygna javanica</i>	3750	4222	3254	1437	238	12901
<i>Anas acuta</i>	235	298	138	86	-	757
<i>Nettapus coromandelianus</i>	12	2	10	-	-	24
<i>Amaurornis phoenicurus</i>	230	287	205	156	34	912



**Fig. 1:** Occurrence status of birds of Vadakkechira.

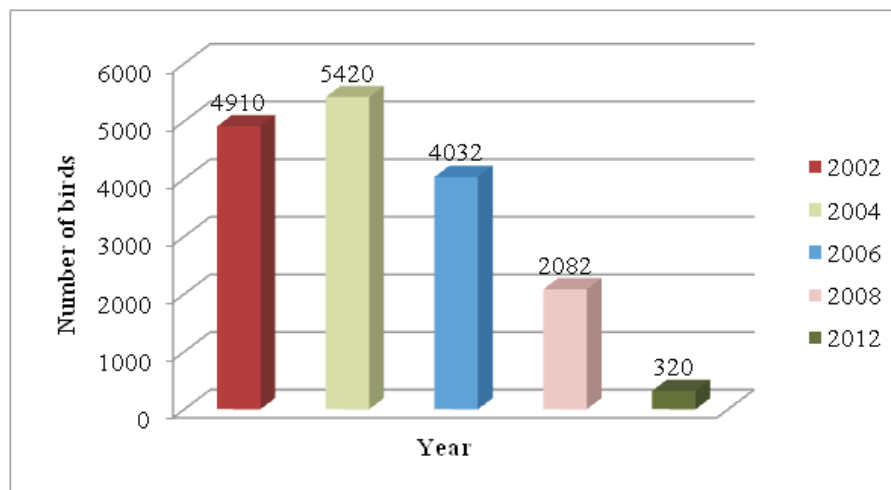
was taken as the baseline and the data obtained in following years were compared with it. A total of 13 species of birds belonging to 6 different families were identified in 2002. *Threskiornis melanocephalus*, the Asian White Ibis was spotted in 2004 which took the total species number to fourteen. It belonged to the family Threskiomithidae. This was the only year in which this particular bird species was recorded from the area. Data of 2002 identified eight species as residents and four species as exhibiting local movement. The only long distance migrant observed in this study was *Anas acuta*, commonly called the Northern Pintail. Asian White Ibis spotted in 2004 exhibited local movement. 57.14% of the species were residents, 35.71% were local migrants and 7.14% were trans-continental migrants.

Local occurrence status of the avian fauna showed 35.71% of birds to be common and 35.71% to be uncommon (Fig: 1). Abundant and rare species comprised 7.14% and 21.43% respectively. Seasonal variations influenced the bird population. Least number of birds was spotted during the June - August time. This coincided with the heavy rains of South-West monsoon which is locally called 'Kalavarsham'. Birds were abundant from October to February. The study showed a downward trend in the number of birds from 2002 to 2012 (Table: 2). The maximum number of 5420 birds was recorded in 2004. There was a steady

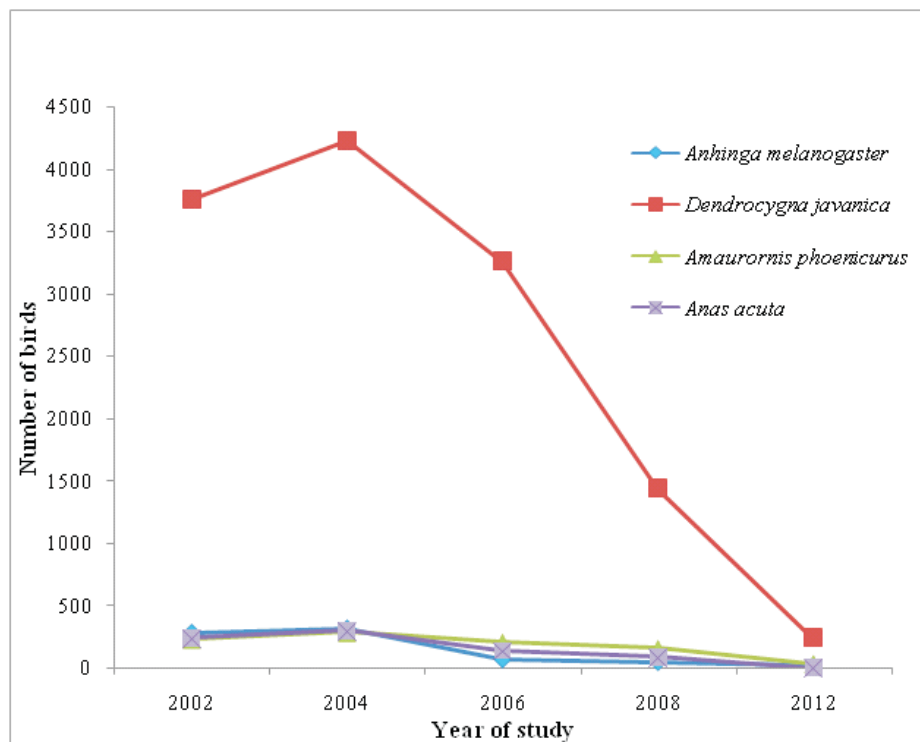
decline in the number during the subsequent years of study. 2006 recorded 4032 birds, 2008 had 2082 birds and the minimum number of 320 in 2012 (Fig: 2). The declining trend was noticed in several species with *Dendrocygna javanica* showing the most conspicuous results (Fig: 3).

Many of the water birds showed seasonal entry and cleared off after the season. Vadakkechira area was found to be abuzz with water birds during the months November to February. The most dominant species identified according to their number was *Dendrocygna javanica* (Fig: 4), which came in flocks to occupy the water body. The most abundant genus *Dendrocygna* contributed 76.95% of the total waterfowl population.

*Dendrocygna javanica* also known as the Lesser Whistling Duck or the Indian Whistling Duck or Lesser Whistling Teal were found to be gregarious feeders seen in large numbers in the pond. They dabble as well as dive in water. This bird has a long grey bill, long head and longish legs. It has a buff coloured head, neck and under parts, and a darker crown. The back and wings are darkish grey, and there are chestnut patches on the wings and tail. All plumages are similar. Large number of birds started arriving during October and their entry continued in November and December, which presented a remarkable sight. They produced a wheezy, whistling "seasick, seasick" call, uttered in flight. The



**Fig. 2:** Abundance of birds in different years



**Fig. 3:** Population trend of birds in Vadakkechira during the years of study

birds began departing from the study area during February in large numbers, flying back probably to their breeding grounds.

During the survey done in 2012, considerable change was noticed in the habitat with heavy growth of weeds which choked the entire pond. Profuse growth of *Salvinia* was present in the water (Fig: 5). The 2012 study showed the pond to be relatively deserted during most of the months. Very few numbers of birds (320) made their entry into the pond. *Dendrocygna javanica* were the ones seen mostly in the water body (74.37%). A significant decrease in the number of *Dendrocygna* and also in the total number of birds was noted during this year. The study record of previous years showed clearly that, once the birds made their entry into the pond, their number increased steadily in succeeding months. In contrast to this, 2012 study showed dwindling number of birds even after their first appearance.

The variables that determine the microclimate of an area do exert their influence on the biotic components, thus, determining the suitability of an environment to maintain life. The study showed reduction in dissolved Oxygen and pH of water during the 2012 study. Dissolved Oxygen came down to  $5.9 \pm 1.24$  mg/l in 2012 from a value of  $7.0 \pm 0.86$  in 2008 (Table: 3). pH came down

to  $6.2 \pm 1.1$ , making the water slightly acidic. The average day time temperature increased from  $26.51 \pm 1.65$  in 2008 to  $30 \pm 2.36$  in 2012. The dissolved  $\text{CO}_2$  was found to be increased in 2012 compared to previous years.

## DISCUSSION

Urban wetlands are getting intensively altered by human activities. They have often been accorded lower priority in protection and management by regulators and policy makers. During the past century, wetland areas have been reduced by more than 50% globally. However, growing recognition of the important functions of urban wetlands like water filtration, flood control and as a source of recharge for water table has resulted in the reversal of this attitude. In addition to their aesthetic value, they also provide breathing space in densely populated areas.

Wetlands act as habitat for migratory water birds and also as centers of biotic networking. The water bodies and green patches within the city limits are progressively being subjected to stress due to anthropogenic activities which drastically influence the bird population of these habitats. Ecological studies on the composition and structure of biological communities are an

**Table 3:** Ecological variables of the water body during different years

Parameter	2002	2004	2006	2008	2012
Dissolved $\text{O}_2$ mg/l	$6.29 \pm 1.74$	$6.4 \pm 1.49$	$6.3 \pm 1.36$	$7.0 \pm 0.86$	$5.9 \pm 1.24$
Dissolved $\text{CO}_2$ mg/l	$3.01 \pm 1.09$	$3.11 \pm 0.89$	$3.23 \pm 1.28$	$3.08 \pm 1.76$	$3.87 \pm 2.13$
pH	$7.02 \pm 0.31$	$6.9 \pm 0.33$	$6.92 \pm 0.43$	$7.05 \pm 0.36$	$6.2 \pm 1.1$
Temperature $^{\circ}\text{C}$	$27 \pm 1.34$	$26.64 \pm 2.03$	$27 \pm 2.35$	$26.51 \pm 1.65$	$30 \pm 2.36$



**Fig. 4:** *Dendrocygna javanica*

effective way of identifying the regional biodiversity and it helps in evaluating the habitat quality, productivity and stability. The site of study attracted large number of birds and their arrival was something intently looked forward to by the people of Thrissur. These birds started appearing in large numbers from October every year. 2012 showed a drastic decrease in the population of different species of birds which may be due to various reasons. 2012 showed the entire water body to be filled with *Salvinia*. An apparent reason for the decrease in the number of birds may be the choking of water body by the obnoxious growth of *Salvinia molesta*, which spreads over the water surface in a very short period.

*Salvinia molesta*, a floating fern native to South America spread widely throughout the tropics and subtropics in the last half of the twentieth Century. It forms a dense mat over slow moving water bodies and can result in economic as well as ecological problems. Initially, *Salvinia* forms a single layer over water, but with continued growth, the mat become multi-layered. The prevalence of this fast growing weed tends to reduce the habitat available for water fowls. Plants and animals for their sustenance and growth depend on open waters which can provide sufficient quantity of sunlight, oxygen, and space. Water under the heavy mats of *Salvinia* was found to have lower Oxygen concentration. Photosynthesis by submerged plants will be inhibited by the *Salvinia* cover. A major portion of the dissolved Oxygen may be consumed by decaying growth of *Salvinia*. Higher levels of Carbon dioxide result in the lowering of the pH of water. The water temperature was found to be raised during the study in 2012. Similar results have been reported in *Salvinia* covered areas by Mitchell <sup>[15]</sup> and Thomas and Room <sup>[16]</sup>. Thick

mats support other colonizing plants, and the high biomass and stability of these mats make it difficult to dislodge and destroy them <sup>[17]</sup>.

The variation in dissolved Oxygen levels ranged between the highest value of  $7.0 \pm 0.86$  in 2008 and the minimum value of  $5.9 \pm 1.24$  in 2012. Low levels of DO in the water indicate stress for aquatic organisms. In a healthy lotic ecosystem the level of DO is generally close to saturation (7 mg/l). The low content of DO might be due to the high Oxygen consumption by oxidisable matter present in the water. Organic matter is a key food source for benthic fauna, though excess of it can have a negative effect through Oxygen depletion <sup>[18,19,20]</sup>. DO levels are considered as one of the limiting factors for wetland ecosystem. The oxygen depletion not only affects the biotic community but also the self-purification capacity of water.

pH variations in the water body may be due to the accumulation of Carbon dioxide by reduced photosynthesis <sup>[21, 22]</sup>. The amount of sunlight reaching the water column through the thick layers of *Salvinia* gets restricted, which influence the level of CO<sub>2</sub> in water. pH would normally be higher in warmer waters due to increased photosynthesis and enhanced plant growth which results in lowered CO<sub>2</sub> levels <sup>[23]</sup>. But in the study site, the pH is reduced due to the accumulation of CO<sub>2</sub> owing to decreased photosynthesis resulting from shortage of sunlight.

## CONCLUSION

Vadakkechira and nearby areas have high human traffic and is a recreational spot where people come to enjoy the serene beauty of tranquilizing water and greenery. Poor management of recreational activities, changes in surrounding land use and also construction activities in the vicinity may have contributed to the changes in the study site. Another possible rationale is that the excessive bird population present during the previous years caused eutrophication through their droppings. Identifying the real threat and introducing the appropriate conservation measures can help to preserve the local water body, which could be an important move towards conserving bird diversity of the area. A detailed ecological study may help to establish a relationship between the environmental changes resulting from human activities and the declining bird population of the area.

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**Fig. 5: a)** Vadakkechira covered with *Salvinia* **b)** Decaying vegetation cover

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