

# BIRD POPULATIONS

*A journal of global avian demography and biogeography*

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Volume 12

2013

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*Published annually by The Institute for Bird Populations*

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Published by  
**The Institute for Bird Populations**

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*A journal of global avian biogeography*

Volume 12

2013

*Bird Populations* 12:1-6  
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## FIRST ACCOUNT OF A NESTING POPULATION OF MONK PARAKEETS, *MYIOPSITTA MONACHUS*, WITH NODULE-SHAPED BILL LESIONS IN KATEHAKI, ATHENS, GREECE<sup>1</sup>

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*Abstract.* A population of Monk Parakeets is herein documented for the first time in Greece. These birds were found nesting in Parko Scholis Chorofylakis Dimotiko, Katehaki, Athens, a location likely where the population founders' originated from an existing zoological garden. Characteristics of the population (21 birds) were its high site fidelity, earlier fledging date (no later than 12 June 2010), and higher than average number of fledglings per pair (1.9 per pair) than reported for populations elsewhere. Also of importance was the presence of bill lesions on adult individuals who were feeding fledglings. Disease in naturalized parrot populations is not well documented. Monk Parakeet incidence and pattern of disease is important to define their role as disease reservoirs in new areas and likewise, how they, themselves, are impacted by existing avian disease in host ecosystems.

*Key words:* bird disease, Greek birds, Monk Parakeet, non-native birds, parrots, urban birds

### PRIMER REGISTRO DE ANIDACION DE LA COTORRA ARGENTINA EN GRECIA, INCLUYENDO INDIVIDUOS CON LESIONES EN EL PICO

*Resumen.* Documentamos por primera vez la presencia de una población de cotorras argentinas (*Myiopsitta monachus*) en Grecia. Las aves fueron encontradas anidando en Parko Scholis Chorofylakis Dimotiko, Katehaki, Atenas, localidad de origen de los fundadores de la población desde un parque zoológico. La población (21 individuos) se caracteriza por una marcada filopatría, una fecha más temprana de abandono del nido (antes del 12 de junio 2010) y un mayor número de pollos

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por pareja (1.9) que en otras poblaciones. También documentamos la presencia de lesiones en el pico de los individuos adultos que alimentaban a los volantones. Las enfermedades en poblaciones naturalizadas de loros no están bien documentadas. La incidencia de cotorras argentinas y enfermedades asociadas son importantes para determinar su papel como reservorios de patógenos en áreas nuevas, así como evaluar el impacto sobre ellas mismas de las enfermedades aviares en los ecosistemas colonizados.

*Palabras clave:* enfermedad aviar, aves griegas, cotorra argentina, aves exóticas,

## INTRODUCTION

The Monk Parakeet (*Miyopsitta monachus* Boddaert 1783) is among the most geographically widespread naturalized parrot worldwide. Occurring in more than five European countries (Diederik and Erik 2009), no populations have heretofore been reported for Greece. However, in 2010 a small population was found by the author in Athens, Greece, and reported here are characteristics of this colony. Monk Parakeet Monk Parakeet

## METHODS

The population of Monk Parakeets was located in Parko Scholis Chorofylakis Dimotiko, (park center, latitude 37°59'21.46"N, longitude 23°46'14.73"E; Google Inc. 2010), planted with mostly mature, 12 to 20 m Aleppo pine (*Pinus halepensis*) creating a 75% closed canopy (Fig. 1). The dimensions of the forested park were approximately 237 m along its Mesogeion Boulevard northern border, 190 m along its Trikalon Street western border, 130 m along an access road on the southern border, and 315 m along an unnamed paved road on the eastern boarder (Google Inc. 2010). Monk Parakeet observations were opportunistically collected by walking the park's formal pathways for half-days on June 8, 12, 19, 25 and July 12, 2010 usually between 11:00 – 16:00 or 14:00 – 18:00. A Canon GL-2 video camera with a 2.2x telephoto filter and a Canon digital still camera were used to document the observations and provide enhanced viewing opportunities. During the observation days, daytime temperatures were about 32° and evening temperatures about 24° C. There was no precipitation after 15 June. Wind speed was low, approximately 1 Beaufort (1-5 km/hr).

## RESULTS

### HABITAT.

The surrounding area was heavily urbanized with multi-story buildings. Trees surrounding the park included dozens of Mediterranean red-bud tree (*Cercis siliquastrum*) planted along Mesogeion Boulevard, mature fruiting Eucalyptus (*Eucalyptis spp.*), and Ironwood trees (*Casuarina spp.*) to the south of the park. The Parko Scholis Chorofylakis Dimotiko contained a small zoological garden (Fig. 1) with well



FIGURE 1. Aleppo pine forest at the zoological garden within the Parko Scholis Chorofylakis Dimotiko. Monk Parakeet nest structures were present in these trees.

maintained multi-enclosure aviaries housing other parrots, including Monk Parakeets. One of the latter captives had bill lesions, identical to some of the wild parakeets, and game birds. The presence of Monk Parakeets in the aviary indicates that the zoological garden may be the source of the founders of the wild population. There was also a tub of water for a pony that was accessible to the wild Monk Parakeets at any time of the day. During my observations the wild Monk Parakeets did not land upon the zoological garden aviaries nor did they detectably communicate with the captive Monk Parakeets.

The city of Athens, Greece, experiences a Mediterranean climate with cool rainy winters and very hot, dry summers (Founda et al. 2004). Monk Parakeets tolerate temperate climates very well (Weathers and Caccamise 1975, Hyman and Pruett-Jones 1995). However, summertime temperatures in Athens can be extreme, commonly reaching 40° C or higher (Founda et al. 2004), with a highest temperature of 48° C on 10 July 1977 (Sarantopoulos 1977) and <10 mm of rain in each of the months of June - September (Mean monthly precipitation Athens, Greece 2009). Weathers and Caccamise (1975) showed that Monk Parakeets rapidly lost weight if deprived of water and concluded that Monk Parakeets are appropriately adapted to colonizing most habitats except for waterless deserts. The summertime climate in Athens is similar to a waterless desert and, therefore, Monk Parakeets at this location may be more dependent upon artificial sources of water, such as from the in-park zoological garden, potentially slowing their dispersal away from the Parko Scholis Chorofylakis Dimotiko. This may help to explain the clumped pattern of nest placement exclusively around the zoological garden. Monk Parakeet nest structures were no more than 200 m from any other nesting structure and from the zoological garden within the Parko Scholis Chorofylakis Dimotiko. This nest placement (dispersal pattern) was much denser than the dispersal distances of between 300 m and 1230 m in their native Argentinean habitat (Martin and Bucher 1993). Surrounding urban parks <1000 m away from the Parko Scholis Chorofylakis Dimotiko had similar vegetation structure (Aleppo Pine) and

abundant natural food (pine seeds, figs, weed seeds), but they did not have a water source. The presence of water at the zoological garden may well contribute to the concentration of nests and persistence of population members at the zoological garden in the Parko Scholis Chorofylakis Dimotiko. However, in Chicago, Illinois, U.S.A., where rainfall is more evenly distributed throughout the year, naturalized Monk Parakeets also build nest structures in an aggregated distribution (Hyman and Pruett-Jones 1995). Thus, other factors may be responsible for the low dispersal tendencies, namely, release site fidelity.

Monk Parakeets, compared to other parrot species, do not normally disperse far from their natal locations (Martin and Bucher 1993). Several naturalized populations of parrots in the Hawaiian Islands exhibit remarkable fidelity to the location from which they were released (Author pers. obs., Runde and Pitt 2008), thus the strong trend of the Katakaki Monk Parakeet population to nest very close to one another may be based upon this tendency. The choice to cluster nest structures around the in-park zoological garden may also be related to the lower tree density in that portion of the park. This tree spacing allows nest-occupying parakeets better visibility and predator escape.

#### PARAKEET ACTIVITY.

Monk Parakeet activities during the observation periods included tree and ground foraging, feeding fledglings and roosting in park trees. There was a marked absence of nest structure maintenance; only one pair, on one occasion, flew to a nest carrying nest material. Monk Parakeets foraged on a diverse array of plants: they were seen frequently foraging on the seeds of open Aleppo pine cones; 12 were seen foraging on mature, unripe fig fruit from a wild Capri fig tree (*Ficus carica*); and two fed upon dry Mediterranean red-bud tree legumes. Monk Parakeets also frequently foraged on weed seeds in the park under pine trees in groups of four to eight birds. Feral Rock Pigeon (*Columba livia*) also ground-foraged in these same locations.

#### POPULATION AND NESTING.

Fledgling Monk Parakeets were identifiable due to their shorter central retricies, begging

behaviors, and white eye-ring (Hyman and Pruett-Jones 1995). While perched in an ironwood tree, a single adult fed three fledglings, another adult parakeet in a pine tree fed two fledglings, another pair fed one fledgling at the nest structure in a pine tree as another fledgling looked out from the chamber entrance and two adults with nodule-shaped lesions at the base of the bill (Fig. 2) fed two fledglings in a pine tree. The nodule-shaped lesions present on the two parakeets were pink and red colored, smooth, and clustered around the base of the bill at the gape (Fig. 2). The number of fledglings per pair out of four pairs in this population was above the average number of 1.5 fledglings per pair reported from wild-reproducing Monk Parakeets in Argentina (Navarro et al. 1992). In Chicago, the first date of fledging was on 2 July (Hyman and Pruett-Jones 1995). In this Athenian population, flock-flying fledglings were present from 12 June and possibly earlier, since flighted fledglings were present at the start of the observation period.

I estimated a minimum of 21 Monk Parakeets in the population by counting all birds seen or heard at one time so as to avoid duplicate counts. It was likely that there were more than 21 parakeets in the entire population. There were nine different nest structures, each in a different Aleppo pine. One or two adult parakeets flew to each nest structure. All nest structures had one entrance, though one nesting structure had two. Among other populations 1-2 parakeets at each nest entrance has been reported (see Martella 1985, Navarro et al. 1992, Hyman and Pruett-Jones 1995) but in contrast the Parko Scholis Chorofylakis Dimotiko structures had low number of nest chambers. Within a group of 12 active nests, in Spain, there were nest structures with two, three, and up to eight chambers (entrances) (Nores 2009) and in Chicago from one to seven chambers with usually an average of 1.8 active chambers per nesting structure (Hyman and Pruett-Jones 1995). Explanations for the smaller nest structure sizes in the Parko Scholis Chorofylakis Dimotiko may be due to the smaller size or growth complexity of park Aleppo pine host trees. Monk Parakeets in Barcelona, Spain, strongly favored the construction of nesting structures in the tallest *Phoenix* spp. palms even when there were Aleppo pines present (Sol et al. 1997). It



FIGURE 2. A wild adult Monk Parakeet, photographed in Athens, showing nodule-like pink lesions at the base of the bill.

may be possible that Aleppo pines in this park are not as suitable for construction of large, multi-chambered nest structures based upon this preference. Alternatively, Monk Parakeets may only add additional chambers to a nesting structure after the population becomes larger, when suitable nesting trees become less available (Author speculation).

#### INDICATIONS OF DISEASE.

One pair feeding fledglings had multiple-clustered swollen pink and red-colored nodule-shaped lesions at the base of their bills indicating chronic illness. These symptoms are often a sign of avian pox (Pawar et al. 2010). Their close proximity to a wide variety of captive domesticated and wild-caught bird species in the zoological garden aviaries and/or close contact with areas where Rock Pigeons ground-forage might have increased avian pox exposure and/or facilitated inter-species transmission (Pawar et al. 2010). Monk Parakeets also come in close contact with feral Rock Pigeons in other urban areas (Nores 2009), adding broader relevance to this finding. Species present in the

zoological garden aviaries included but were not limited to: Indian Peafowl (*Pavo cristatus*), domestic chickens (*Gallus gallus domesticus*), Rock Partridge (*Alectoris graeca*), Burrowing Parrot (*Cyanoliseus patagonus*), Rose-ringed Parakeet (*Psittacula krameri manillensis/ borealis*), Cockatiel (*Nymphicus hollandicus*); Monk Parakeet, and Peach-faced Lovebird (*Agapornis roseicollis*). One Monk Parakeet in the aviary exhibited similar nodule-shaped lesions at the base of the bill identical to what wild individuals had. Since only Monk Parakeets (caged and wild) were seen to have such bill lesions out of all the other captive bird species it is conceivable that the ailment might be specific to parrots.

As well, psitticine beak and feather disease (Pbfd) is important to consider when encountering parrots that have skin, bill or feather abnormalities; skin abnormalities around the bill can be the first signs of Pbfd (Ortiz-Catredral et al. 2010). Pbfd is endemic to parrots and has been found in approximately 40 captive and wild parrot species (Ortiz-Catredral et al. 2010). Wild Australasian and African species are most commonly infected but the traffic in wild – caught parrots in the pet bird trade have led to the proliferation of the disease in parrot species from most geographic regions (Ortiz-Catredral et al. 2010). The virus causes weight loss, keratin structure defects (bill, feathers) (Kock et al. 2010) and the destruction of lymph material resulting in immune system suppression (Ritchie et al. 2003). The cause of death is usually by secondary infection (Ritchie et al. 2003), though wild birds would probably succumb to predators or starvation first. That said, the wild and captive Monk Parakeets with the bill lesions were in perfect plumage, had no abnormalities to the bill itself, and appeared to be at normal weight and activity levels. Nonetheless, the presence of pox-like nodules/lesions in an adult reproducing pair allude to their ability to potentially serve as a reservoir for disease in this locality, though further investigation is required to confirm the disease agent causing the nodules/lesions.

## DISCUSSION

Potential water and food resources may limit Katehaki Athens Monk Parakeet geographic distribution to urban parks as in Spain (Sol et al.

1997). Nonetheless, they are successfully reproducing and if the trend continues, their numbers will likely increase in the future. This population of Monk Parakeets, a significant new record for Greece, provides a unique opportunity to study the population growth and pattern of range expansion of a species from its release point. Additionally, this study is, to the author's knowledge, one of the first documenting potential chronic disease in reproducing, naturalized Monk Parakeets.

## ACKNOWLEDGEMENTS

Thanks to Elina Tsavdari for introducing me to Katehaki, Athens.

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# HABITAT LOSS OF CRITICALLY ENDANGERED VULTURES IN NAMERI NATIONAL PARK-ASSAM<sup>1</sup>

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*Abstract.* Assam, comprising the eastern Himalayas, is one of the Mega bio-diversity hotspots of the world. It forms part of two bird areas, viz. eastern Himalaya and Assam plains, with many endemic species. Nameri National Park is a part of the North Bank Landscape (NBL) of Brahmaputra River bordering Assam and Arunachal Pradesh as established by the World Wildlife Fund; it also is a part of the Eastern Himalayan Bio-diversity Hotspot and habitat of resident and migratory bird. There are 374 avian species (resident and migratory) recorded in Nameri National Park. This includes, as reported in the International Union for Conservation of Nature (IUCN) Red List, four Critically Endangered vultures: White-rumped Vulture (*Gyps bengalensis*), Slender-billed Vulture (*Gyps tenuirostris*), Red-headed Vulture (*Sarcogyps calvus*) and Long-billed Vulture (*Gyps indicus*). The paper highlighted the present status of birds of prey in Nameri National Park and the adjoining areas.

*Key words:* Critically endangered vultures, diclofenac, Himalayas

## PERDIDA DE HABITAT DE BUITRES CRITICAMENTE AMENAZADOS EN EL PARQUE NACIONAL NAMERI, ASSAM, INDIA

*Resumen.* Assam, junto los Himalayas orientales, es uno de los mega hotspots de biodiversidad del mundo. Forma parte de dos áreas avifaunísticas, el Himalaya oriental y las llanuras de Assam, con numerosas especies endémicas. El Parque Nacional Nameri forma parte del Paisaje de la Rivera Norte (North Bank Landscape, NBL) del río Brahmaputra que bordea Assam y Arunachal Pradesh tal y como determinó el World Wildlife Fund. También forma parte del Hotspot de Biodiversidad del Himalaya Oriental y contiene hábitats para aves residentes y migratorias. Hay 374 especies de aves (residentes y migratorias) registradas en el Parque Nacional Nameri. La lista incluye, tal y como se reporta en la Lista Roja de la UICN, cuatro especies de buitre críticamente amenazadas: buitre dorsiblanco bengalí (*Gyps bengalensis*), buitre picofino (*Gyps tenuirostris*), buitre cabecirrojo (*Sarcogyps calvus*), y buitre piquilargo (*Gyps indicus*). El artículo presenta el estado actual de las aves de presa en el Parque Nacional Nameri y áreas aledañas.

*Palabras clave:* India, buitres en peligro crítico, diclofenaco, Himalayas

## INTRODUCTION

Nameri National Park (Latitude 26°50' / to 27°03' / N and Longitude 92°39' to 92°59' E) covers an area of 200 km<sup>2</sup> in the foothills of the eastern Himalayas in Assam. It is contiguous

with Pakhui Wildlife Sanctuary in Arunachal Pradesh to the north, and together they exceed 1,000 km<sup>2</sup> with elevations ranging from 79 to over 1,500 meters. The park is bounded by the Bor-Dikorai River and Sijussa Camp in the east.

<sup>1</sup>Received 28 June 2012; accepted 6 December 2012

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Its western border aligns with the Jia-Bhoreli River and is adjacent to Balipara Reserve Forest, while its northern border is contiguous with Pakhui Wildlife Sanctuary of Arunachal Pradesh. The southern border is marked by the confluence of Jia-Bhoreli and Bor-Dikorai rivers. The park is criss-crossed by the tributaries of Jia-Bhoreli river including Diji, Dinai, Doigurung, Nameri, Dikorai, Khari.

The terrain is undulating, with lower areas at elevation between 80–100 m along the Jia-Bhoreli and its tributaries, and with higher areas at 200–225 m in the central and northern parts of the park. Soils are characterized by sandy or sandy loam alluvial deposits. Numerous small rivers and perennial streams originating in Arunachal Pradesh run through the park and feed into the Jia-Bhoreli River. Many rivers shift their course during the rainy season and form dry riverbeds during the winter. Forest and woodland cover the majority of the park (94%, 188 km<sup>2</sup>). Grasslands are found along the banks of the Jia-Bhoreli River and its tributaries and cover an area of 10 km<sup>2</sup> (5%). The remaining 2 km<sup>2</sup> (1%) is formed by various river beds. Nameri is covered by Tropical Evergreen, Semi-Evergreen, Moist Deciduous forests with cane and bamboo brakes and narrow strips of open grassland along rivers. Grasslands comprise <10% of the total area of the park, while the Semi-Evergreen and Moist Deciduous species dominate the area. The vegetation of the park is a mosaic of four major forest types (Champion and Seth 1968): (1) Eastern Alluvial Secondary Semi-Evergreen Forest (2) Low Alluvial Savannah Woodland (3) Eastern Dillenia Swamp Forest and (4) Wet Bamboo Forest (usually found along streams or on badly drained hollows), with areas of cane brakes formed by *Calamus tenuis*. The subtropical monsoon climate of the region is characterised by heavy rainfall, averaging of 3,500 mm per annum. The predominance of the southwest monsoon causes precipitation to be highly seasonal (Barthakur 1986). Most of the rain falls between May and September, i.e. the summer (hot) season. Winters (October to April) are usually cool and dry, although rains are not uncommon. The average temperature in the area varies from a low of 5°C in winter to a high of 37°C in summer. The relative humidity varies between 65 and 90% or more. Parts of the area were declared as Naduar

Reserve Forest (Present East Buffer) in 1876 and Nameri Wildlife Sanctuary in 1985. The Nameri National Park was formed in 1998.

Pollution, drainage, habitat destruction, hunting and collection of eggs and nestlings are some of the causes that threaten the birds with extinction in the park and vicinity (Datta et al. 1998). Another major cause is poisoning by diclofenac, which is a non-steroidal anti-inflammatory veterinary drug (NSAID) that causes kidney failure in birds upon eating the carcasses of treated cattle. In India, 99% of vulture species population decreases is thought to be due to poisoning by diclofenac. These factors also play an important role in decreasing the number of the park's avian species, which were abundant in earlier decades.

There are 374 species of resident and migratory birds that so far have been identified in Nameri National Park (Das 2010).

Many of the species are resident, non-migratory owing to its cover by primary forest having multi-season fruit bearing trees (Dymond 1998). Included are four critically endangered vultures as described below (see also Table 1 and Figure 1).

#### WHITE-RUMPED VULTURE (*GYPES BENGALENSIS*)

It is an Old World vulture closely related to the Eurasian Griffon Vulture (*Gyps fulvus*). At one time it was believed to be closer to the White-backed Vulture of Africa and was known as the Oriental White-backed Vulture.

The White-rumped Vulture is a typical, medium-sized vulture, with an unfeathered head and neck, very broad wings, and short tail feathers. It is much smaller than the Eurasian Griffon. It has a white neck ruff. The adult's whitish back, rump, and underwing coverts contrast with the otherwise dark plumage. The body is black and the secondaries are silvery grey. The head is tinged in pink and bill is silvery with dark ceres. The nostril openings are slit-like. In flight, the adults show a dark leading edge of the wing and has a white wing-lining on the underside. The undertail coverts are black. This is the smallest of the *Gyps* vultures, but is still a very large bird. It weighs 3.5-7.5 kg (7.7-16.5 lbs), measures 75–93 cm (30–37 in) in length, and has a wingspan of 1.92–2.6 m (6.3–8.5 ft).

White-rumped Vultures always nest on large

TABLE 1. Summary of information about vultures in Nameri National Park.

Species	IUCN Status	Habitat	Notes
White-rumped Vulture	Critically Endangered (CR)	S, G, D, A	This species was recorded seven times, usually involving 2–3 birds, mostly seen soaring. When 10 wild elephants ( <i>Elephas maximus</i> ) died in the area due to poisoning during July–August 2001, no vultures were seen on the carcasses.
Long-billed Vulture	Critically Endangered (CR)	S, G, D, A	Between 2001 to 2002, this species was recorded five times, usually involving 2–3 birds, mostly seen soaring over Dharikati village.
Slender-billed Vulture	Critically Endangered (CR)	S, G, D, A	It was not observed during 1996, but small flocks of up to six birds were seen 4–5 times a year during 1997–2001, mainly between November and March. None has been seen since 2001.
Red-headed Vulture	Critically Endangered (CR)	S, G, D, A	Singles were seen soaring at Potasali on 16 April 2002 and feeding on a carcass along the Khari River on 10th July in the same year.

S = Secondary forest (with an open canopy regenerating naturally after human and /or natural disturbance)  
 G = Grasslands (various serial stages of riverine vegetation including short grass on sandy islets through to areas being colonised by trees)  
 D = Disturbed areas (cultivation, settlements etc. in the fringe areas of the park)  
 A = Aerial



FIGURE 1. The four critically endangered vultures in Nameri National Park.

trees near habitations even when there are seemingly appropriate cliffs in the vicinity. The preferred nesting trees are Bhelu (*Tetrameles nudiflora*), Satiana (*Alstonia scholaris*), Bon jalakia (*Cryptocarya amygdalina*), Urium (*Bischofia javanica*), Bola (*Morus laevigata*), Madar (*Erythrina suberosa*) (Hendriks, 1998). The main nesting period is November to March with eggs being laid mainly in January. Nests are usually in clusters and isolated nests tend to be those of younger birds. Solitary nests are never used regularly and are sometimes taken over by the Red-headed Vulture (*Sarcogyps calvus*) and large owls such as *Bubo coromandus*. Nests are nearly 1 m in diameter and 0.3 m in thickness. Prior to laying an egg, the nest is lined with green leaves. The single egg is white with a tinge of bluish-green. Females are reported to destroy the nest on loss of an egg. They are usually silent but make hissing and roaring sounds at the nest or when jostling for food

This species was very common when surveys were conducted during 1995-2000, especially in the Gangetic plains of India and was often seen nesting on the avenue trees within large cities in the region. This species, as well as the Indian Vulture (*Gyps indicus*) and Slender-billed Vulture (*Gyps tenuirostris*) have suffered a 99% population decrease in India and nearby countries since the early 1990s. The decline has been widely attributed to poisoning by diclofenac, as discussed above

The Indian White-rumped Vulture is mostly resident. Like other vultures it is a scavenger, feeding mostly on carcasses of dead animals (Penhallurick 2001). In Nameri National Park between 1996 and 1998, this species was recorded seven times, usually involving 2-3 birds. When ten wild elephants died in the area due to poisoning during July-August 2001, no vultures were seen on the carcasses (Baruah, 2004). Their absence is noteworthy and presumably related to the catastrophic decline of *Gyps* vultures in the Indian subcontinent.

#### LONG-BILLED VULTURE (*GYP S INDICUS*)

It is an Old World vulture, closely related to the Griffon Vulture. It breeds mainly on hilly crags in central and peninsular India. The birds in the northern part of its range once considered a subspecies are now considered to be distinct, the Slender-billed Vulture. These were lumped

together under the name Long-billed Vulture. Two races remain: *Gyps indicus indicus* found in northern India and further east, and *Gyps indicus tenuirostris* found in the plains of the Indus and Ganges rivers. Two individuals of the nominal race were seen during 2007 in the Bogijuli area of the park near high forest (Singh 1991).

This species breeds mainly on cliffs, but is known to use trees in Rajasthan. Like other vultures it is a scavenger, feeding mostly from carcasses of dead animals, which it finds by soaring over savannah and around human habitation. They often move in flocks.

The Long-billed Vulture is a typical vulture, with a bald head, very broad wings and short tail feathers. It has suffered a 99% population decrease in Pakistan and India; between 2000-2007 annual decline rates of this species and the Slender-billed Vulture averaged >16%. The cause of this has been identified as poisoning by the veterinary drug diclofenac.

#### RED-HEADED VULTURE (*SARCOGYP S CALVUS*)

Red-headed Vulture, also known as the Asian King Vulture, Indian Black Vulture or Pondicherry Vulture, is an old world vulture once found throughout South Asia. The range has become localized primarily to Nepal and northern, north-eastern India. The widespread use and subsequent poisoning by the drug diclofenac, along with carprofen, flunixin, ibuprofen and phenylbutazone, has caused its population to collapse. The population of this species has essentially halved every other year since the late 1990s. What once was a plentiful species numbering in the hundreds of thousands has come dangerously close to extinction in less than two decades. A few individuals exist within the park.

It is a medium-sized vulture, 76 - 86 cm (30 to 34 in) in length, weighing 3.5-6.3 kg (7.7-14 lb) and having a wingspan of 1.99-2.6 m (6.5-8.5 ft). The adult has a prominent deep red-to-orange naked head, which is paler among juveniles. It has a black body with pale grey band at the base of flight feathers.

#### SLENDER-BILLED VULTURE (*GYP S TENUIROSTRIS*)

The Slender-billed Vulture is a recently recognized species of old world vulture. It was

once included with its relative, the Indian Vulture, under the name of 'Long-billed Vulture'. However, these two species have non-overlapping distributions and can be immediately told apart by trained observers, even at considerable distances. The Indian Vulture is found only to the south of the Ganges and breeds on cliffs, while the Slender-billed Vulture is found along the Sub-Himalayan regions and into Southeast Asia. It nests in trees.

This vulture is mostly grey with a pale rump and grey under-tail coverts. The thighs have whitish down. It is rare, with most records being of soaring birds. Small flocks of up to six birds were seen 4–5 times a year during 1997–2001 near Potasali, 14<sup>th</sup> mile area of the park, mainly between November and March. None has been seen since 2001, again presumably linked to the general decline of *Gyps* vultures (Talukdar and Das 1997).

The population of this species and the Indian Vulture has declined by 97% and in India annual decline rates for both species averaged over 16% between 2000–2007. Wild populations remain in northern and eastern India through southern Nepal and Bangladesh, with a small population in Burma. The Royal Society for the Protection of Birds (RSPB) estimated the Slender-billed Vulture to number about 1,000 birds in 2009, and predicts total extinction in the wild within the next decade.

Its decline is largely due to the use of diclofenac in working farm animals, especially in India.

## CONCLUSION

Veterinary use of the nonsteroidal anti-inflammatory drug diclofenac is a major cause of the catastrophic collapse of *Gyps* vulture populations in the Indian subcontinent. Three species of vultures endemic to South Asia, which together used to number in the tens of millions, are now at high risk of extinction and are listed as critically endangered. Populations of Oriental white-backed (*Gyps bengalensis*), long-billed (*Gyps indicus*) and slender-billed vultures (*Gyps tenuirostris*) have declined by

more than 95% since the early 1990s, and continue to decline at an annual rate of 22–48%.

Diclofenac is a widely available drug in the Indian subcontinent, where it is used for the symptomatic treatment and management of inflammation, fever, and/or pain associated with disease or injury in domestic livestock. Vultures are exposed to the drug when they consume carcasses of cattle that were treated with diclofenac shortly before death. Following experimental exposure to diclofenac or diclofenac-contaminated tissues, *Gyps* vultures die within days from kidney failure with clinical signs of extensive visceral gout (formation of uric acid crystals within tissue). These clinical signs and diclofenac residues in vulture tissues have been found in carcasses of wild *Gyps* vultures from across India, Pakistan, and Nepal, and the proportion of vulture carcasses with signs of diclofenac poisoning is consistent with this being the main, and possibly the only, cause of the vulture decline in Nameri National Park and adjoining areas of Assam.

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# WATERBIRD ASSEMBLAGE IN RURAL PONDS OF SAMAKHIALI REGION, KUTCH DISTRICT, GUJARAT, INDIA<sup>1</sup>

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*Abstract.* Waterbird species richness was investigated in five rural ponds of Samakhiali region, Kutch District, Gujarat. During September 2011 - May 2012, a total of 53 species of waterbirds from 14 families were recorded. Out of these, 30 were residents and 23 were winter visitors. Among the bird species recorded, Darter (*Anhinga melanogaster*), Painted Stork (*Mycteria leucocephala*), Oriental White Ibis (*Threskiornis melanocephalus*), Black-tailed Godwit (*Limosa limosa*) and Eurasian Curlew (*Numenius arquata*) are listed as Near Threatened by IUCN, indicating the importance of these ponds. It is expected that this study would provide a preliminary database for the waterbirds of this area useful for further research and assessment.

*Key words:* India, Gujarat, near threatened waterbird species, rural ponds

## COMUNIDAD DE AVES ACUATICAS EN LAGUNAS RURALES DE LA REGION DE SAMAKHIALI, DISTRITO KUTCH, GUJARAT, INDIA

*Resumen.* La diversidad de especies de aves acuáticas fue investigada en cinco lagunas rurales de la región Samakhiali, Distrito Kutch, Gujarat. Entre septiembre de 2011 y mayo de 2012, fueron registradas un total de 53 especies de aves acuáticas de 14 familias. De éstas, 30 fueron residentes y 23 visitantes invernales. Entre las especies registradas se encuentran la anhinga común (*Anhinga melanogaster*), tántalo indio (*Mycteria leucocephala*), ibis oriental (*Threskiornis melanocephalus*), aguja colinegra (*Limosa limosa*) and zarapito real (*Numenius arquata*), todas listadas como amenazadas por la UICN, lo que indica la importancia de estas lagunas. Esperamos que este estudio aporte una base de datos preliminar sobre las aves acuáticas de esta área que sea útil para investigación y manejo en el futuro.

*Palabras clave:* India, Gujarat, aves acuáticas amenazadas, lagunas rurales

## INTRODUCTION

Human civilizations have typically been founded around water bodies, mainly on the banks of rivers and lakes, with ponds often constructed nearby. Depending on size, artificial impoundments often eventually support various flora and fauna including birds. Birds are one of the most important indicators of the health of ecosystems such as rural ponds,

because they respond to both secondary and primary factors and can be monitored relatively easily (Koskimies 1989). Also, because of their mobility, birds react very rapidly to changes in their habitats (Louette et al. 1995).

Wetlands are among the world's most productive and biologically diverse ecosystems (Gibbs 1993). Wetlands and waterbirds are inseparable, and most wetlands support a rich

<sup>1</sup>Received 28 June 2012; accepted 11 February 2013

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array of waterbird communities representing the breadth of trophic levels (Grimmett and Inskipp 2007). Activities of waterbirds are often considered an indicator of wetland ecosystem quality and those species at or near the top of the foodweb can reflect changes originating among a range of ecosystem components (Custer and Osborne 1977). Various ponds and other wetlands in any area serve as a balancing reservoir for sustaining native flora and fauna (Grimmett and Inskipp 2007, Surana et al. 2007). The present work attempt a cataloguing of waterbirds that inhabit rural ponds of Samakhiali region of Bhachau Taluk, Kutch District, Gujarat, India (Fig. 1). Systematic avian surveys are rare in this area.

## MATERIALS AND METHODS

Observations were made at five rural ponds, and are located as follows (Fig. 1): 'Samakhiali Pond' at latitude 23°18' 25"N and longitude 70°30' 23"E, covering about 1.51 km<sup>2</sup>; 'Ambliala Pond' at 23°15' 01"N and 70°29' 32"E, covering 1.83 km<sup>2</sup>; 'Laliana Pond' at 23°16' 09"N and 70°32'32"E, covering 1.92 km<sup>2</sup>; 'Jangi Pond 1' at

23°13'32"N and 70°34' 03"E, covering 0.32 km<sup>2</sup>; and 'Jangi Pond 2' at 23°13' 27"N and 70°33'55"E, covering 1.56 km<sup>2</sup>. These ponds are surrounded by human habitations and agricultural fields. Local people use these ponds for their domestic and livelihood needs.

The wetlands were visited twice monthly, September 2011 - May 2012, and waterbirds were counted directly (Bibby et al. 2000). Morning visits occurred between 06:00 and 08:00hrs and those in evening between 16:00 and 18:00hrs (Namgail et al. 2009). For watching, counting and species identification, observations were aided by binoculars. Photography was done using a digital camera with zoom lenses. The birds were identified by their characteristic features in accordance with standard identification manuals and field guides, e.g. Ali and Ripley (1983), Kazmierczak (2000) and Grimmett et al. (2001). The checklist of species was prepared following the nomenclature of Manakadan and Pittie (2001; Table 1)

## RESULTS AND DISCUSSION

A total of 53 species of waterbirds belonging to



FIGURE 1. Locations of ponds studied, Gujarat, India.

TABLE 1. Checklist of waterbirds in rural ponds of Samakhiali region, Kutch District, Gujarat, during September 2011 to May 2012.

Scientific Name	Common Name	Status <sup>a</sup>
FAMILY PODICIPEDIDAE		
1 <i>Tachybaptus ruficollis</i> (Pallas, 1764)	Little Grebe	Resident
FAMILY PHALACROCORACIDAE		
2 <i>Phalacrocorax niger</i> (Vieillot, 1817)	Little Cormorant	Resident
3 <i>Phalacrocorax fuscicollis</i> (Stephens, 1826)	Indian Shag	Winter Visitor
4 <i>Phalacrocorax carbo</i> (Linnaeus, 1758)	Great Cormorant	Winter Visitor
FAMILY ANHINGIDAE		
5 <i>Anhinga melanogaster</i> (Pennant, 1769)	Darter	Resident
FAMILY ARDEIDAE		
6 <i>Egretta garzetta</i> (Linnaeus, 1766)	Little Egret	Resident
7 <i>Ardea cinerea</i> (Linnaeus, 1758)	Grey Heron	Resident
8 <i>Ardea purpurea</i> (Linnaeus, 1766)	Purple Heron	Resident
9 <i>Casmerodius albus</i> (Linnaeus, 1758)	Large Egret	Resident
10 <i>Mesophoyx intermedia</i> (Wagler, 1829)	Median Egret	Resident
11 <i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret	Resident
12 <i>Ardeola grayii</i> (Sykes, 1832)	Indian Pond Heron	Resident
13 <i>Butorides striatus</i> (Linnaeus, 1758)	Little Green Heron	Resident
14 <i>Nycticorax nycticorax</i> (Linnaeus, 1758)	Black-crowned Night Heron	Resident
FAMILY CICONIIDAE		
15 <i>Mycteria leucocephala</i> (Pennant, 1769)	Painted Stork	Resident
16 <i>Anastomus oscitans</i> (Boddaert, 1783)	Asian Openbill-Stork	Winter Visitor
FAMILY THRESKIORNITHIDAE		
17 <i>Plegadis falcinellus</i> (Linnaeus, 1766)	Glossy Ibis	Resident
18 <i>Threskiornis melanocephalus</i> (Latham, 1790)	Oriental White Ibis	Resident
19 <i>Pseudibis papillosa</i> (Temminck, 1824)	Black Ibis	Resident
20 <i>Platalea leucorodia</i> (Linnaeus, 1758)	Eurasian Spoonbill	Resident
FAMILY PHOENICOPTERIDAE		
21 <i>Phoenicopterus ruber</i> (Linnaeus, 1758)	Greater Flamingo	Winter Visitor
FAMILY ANATIDAE		
22 <i>Dendrocygna javanica</i> (Horsfield, 1821)	Lesser Whistling Duck	Resident
23 <i>Sarkidiornis melanotos</i> (Pennant, 1769)	Comb Duck	Resident
24 <i>Anas poecilorhyncha</i> (J.R. Forester, 1781)	Spot-billed Duck	Resident
25 <i>Anas clypeata</i> (Linnaeus, 1758)	Northern Shoveller	Winter Visitor
26 <i>Anas querquedula</i> (Linnaeus, 1758)	Gargany	Winter Visitor
27 <i>Anas crecca</i> (Linnaeus, 1758)	Common Teal	Winter Visitor
FAMILY GRUIDAE		
28 <i>Grus virgo</i> (Linnaeus, 1758)	Demoiselle Crane	Winter Visitor
FAMILY RALLIDAE		
29 <i>Amaurornis phoenicurus</i> (Pennant, 1769)	White-breasted Waterhen	Resident
30 <i>Porphyrio porphyrio</i> (Linnaeus, 1758)	Purple Moorhen	Resident
31 <i>Gallinula chloropus</i> (Linnaeus, 1758)	Common Moorhen	Resident
32 <i>Fulica atra</i> (Linnaeus, 1758)	Common Coot	Resident
FAMILY CHARADRIIDAE		
33 <i>Charadrius dubius</i> (Scopoli, 1786)	Little Ringed Plover	Resident
34 <i>Charadrius alexandrinus</i> (Linnaeus, 1758)	Kentish Plover	Resident
35 <i>Vanellus malabaricus</i> (Boddaert, 1783)	Yellow-wattled Lapwing	Resident
36 <i>Vanellus indicus</i> (Boddaert, 1783)	Red-wattled Lapwing	Resident
FAMILY RECURVIROSTRIDAE		
37 <i>Himantopus himantopus</i> (Linnaeus, 1758)	Black-winged Stilt	Resident
FAMILY SCOLOPACIDAE		
38 <i>Limosa limosa</i> (Linnaeus, 1758)	Black-tailed Godwit	Winter Visitor



TABLE 1. Continued.

Scientific Name	Common Name	Status
39 <i>Numenius arquata</i> (Linnaeus, 1758)	Eurasian Curlew	Winter Visitor
40 <i>Tringa erythropus</i> (Pallas, 1764)	Spotted Redshank	Winter Visitor
41 <i>Tringa totanus</i> (Linnaeus, 1758)	Common Redshank	Winter Visitor
42 <i>Tringa stagnatilis</i> (Bechstein, 1803)	Marsh Sandpiper	Winter Visitor
43 <i>Tringa ochropus</i> (Linnaeus, 1758)	Green Sandpiper	Winter Visitor
44 <i>Tringa glorioles</i> (Linnaeus, 1758)	Wood Sandpiper	Winter Visitor
45 <i>Xenus cinereus</i> (Guldenstadt, 1774)	Terek Sandpiper	Winter Visitor
46 <i>Actitis hypoleucos</i> (Linnaeus, 1758)	Common Sandpiper	Winter Visitor
47 <i>Calidris minuta</i> (Leisler, 1812)	Little Stint	Winter Visitor
FAMILY LARIDAE		
48 <i>Larus ichthyaetus</i> (Pallas, 1773)	Pallas's Gull	Winter Visitor
49 <i>Sterna hirundo</i> (Linnaeus, 1758)	Common Tern	Winter Visitor
50 <i>Sterna aurantia</i> (J.E. Gray, 1831)	River Tern	Resident
51 <i>Sterna albifrons</i> (Pallas, 1764)	Little Tern	Winter Visitor
52 <i>Gelochelidon nilotica</i> (Gmelin, 1789)	Gull-billed Tern	Winter Visitor
53 <i>Chlidonias hybridus</i> (Pallas, 1811)	Whiskered Tern	Winter Visitor

<sup>a</sup>Grimmett et al. (2001)

6 orders and 14 families were seen among the five rural ponds (Table 1). Included were five Near Threatened (IUCN 2012) species, namely, Darter (*Anhinga melanogaster*), Painted Stork (*Mycteria leucocephala*), Oriental White Ibis (*Threskiornis melanocephalus*), Black-tailed Godwit (*Limosa limosa*) and Eurasian Curlew (*Numenius arquata*) (Fig. 2); Eurasian Spoonbill (*Platalea leucorodia*), additionally, is included in Schedule - I of the Indian Wildlife (Protection) Act, 1972. The dominant families, Ardeidae and Scolopacidae, were represented by 9 and 10 species respectively. The most dominant order, Charadriiformes, was represented by a wide range of species including lapwings, plovers, sandpipers, gulls and terns; the next most represented order, Ciconiiformes, included egrets, herons, storks, ibis and spoonbills (Fig. 3).

Out of these 53 species, 30 (56.6%) were residents and 23 (43.4%) were winter visitors. The significant number of winter migratory waterbirds can be attributed partly to the fact that the study area is located close to the major, western Indian migratory avian flyway (Khacher 1996). Prominent winter migratory species included Greater Flamingo (*Phoenicopterus ruber*), Gargany (*Anas querquedula*), Common Teal (*Anas clypeata*), Northern Shoveller (*Anas crecca*), Demoiselle Crane (*Grus virgo*), Black-tailed Godwit (*Limosa limosa*),

Spotted Redshank (*Tringa erythropus*), Marsh Sandpiper (*Tringa stagnatilis*), Green Sandpiper (*Tringa ochropus*), Wood Sandpiper (*Tringa glorioles*), Eurasian Curlew (*Numenius arquata*), Little Stint (*Calidris minuta*), Pallas's Gull (*Larus ichthyaetus*) and Little Tern (*Sterna albifrons*) (Table 1). One highlight of the study was the record of around 1,200 migratory Demoiselle Cranes (*Grus virgo*) at Laliana Pond during December 2011. Demoiselle Cranes, basically birds of dry grasslands, are the second most abundant crane species in this part of the world. India is the wintering ground for the Demoiselle Crane, which travels from northern parts of Asia, Magnolia and China covering over 2000 km in 5 to 7 days to inhabit wetlands and agricultural fields in India.

Some of the species like Little Grebe (*Tachybagptus ruficollis*), Little Cormorant (*Phalacrocorax niger*), Little Egret (*Egretta garzetta*), Cattle Egret (*Bubulcus ibis*), Indian Pond Heron (*Ardeola grayii*), Painted Stork (*Mycteria leucocephala*), Black Ibis (*Pseudibis papillosa*), Spot-billed Duck (*Anas poecilorhyncha*), Red-wattled Lapwing (*Vanellus indicus*), Black-winged Stilt (*Himantopus himantopus*) and Common Coot (*Fulica atra*) were recorded throughout the study period in all the ponds. For some species, there were only one or two records, namely, Darter (*Anhinga melanogaster*),



Darter (*Anhinga melanogaster*)



Painted Stork (*Mycteria leucocephala*)



Oriental White Ibis (*Threskiornis melanocephalus*)



Black-tailed Godwit (*Limosa limosa*)



Eurasian Curlew (*Numenius arquata*)

FIGURE 2. Near threatened bird species recorded at the rural ponds studied; photos: A. Mohamed Samsoor Ali

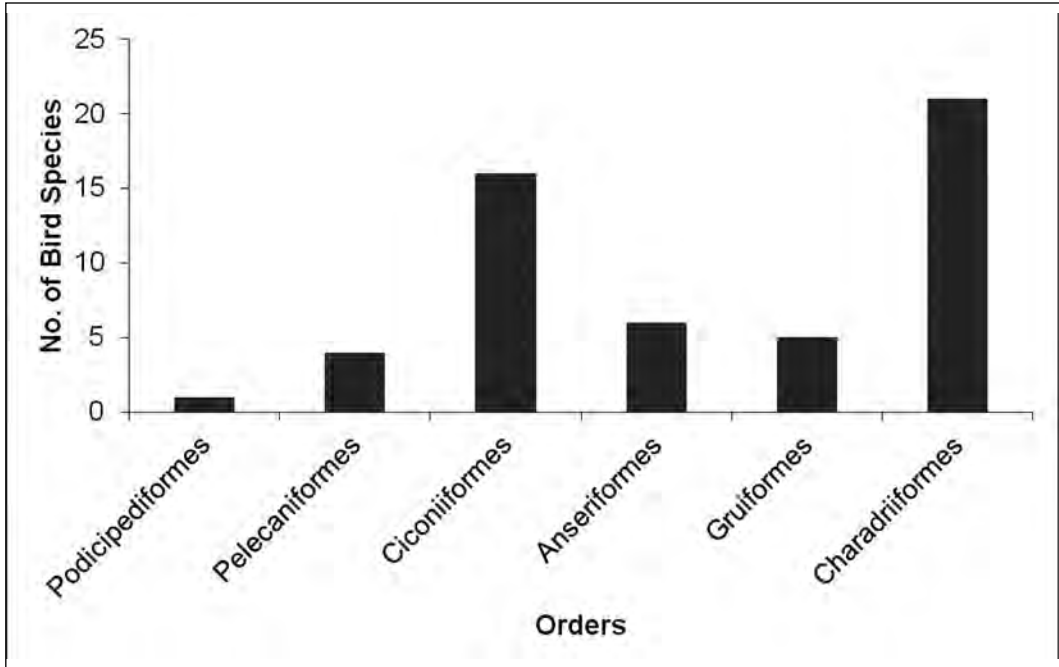


FIGURE 3. Waterbird richness, by taxonomic order, among of the rural ponds studied.

Asian Openbill-Stork (*Anastomus oscitans*), Greater Flamingo (*Phoenicopterus ruber*), Little Ringed Plover (*Charadrius dubius*), Spotted Redshank (*Tringa erythropus*), Eurasian Curlew (*Numenius arquata*), Little Stint (*Calidris minuta*) and Common Tern (*Sterna hirundo*).

The wetland dependent birds such as Small Blue Kingfisher (*Alcedo atthis*), White-breasted Kingfisher (*Halcyon smyrnensis*), Lesser Pied Kingfisher (*Ceryle rudis*), Common Swallow (*Hirundo rustica*), Red-rumped Swallow (*Hirundo daurica*), Large Pied Wagtail (*Motacilla maderaspatensis*) and Yellow Wagtail (*Motacilla flava*) were also seen around the ponds. The tree species of *Acacia nilotica*, *Azadirachta indica*, *Ficus benghalensis*, *Prosopis juliflora*, *Phoenix sylvestris* and *Pongamia pinnata* found at the banks of the ponds gave shelter and roosting sites to doves, koel, bulbuls, babblers and parakeets. Human habitations around the village ponds also supported large number of Indian Peafowl (*Pavo cristatus*), Blue Rock Pigeon (*Columa livia*) and House Sparrow (*Passer domesticus*), which often fed on grains scattered by local people.

A number of anthropogenic pressures affect the ponds and their avifauna. Water from the ponds is used for domestic purposes, as well as cattle grazing and bathing; predatory dogs are a disturbance as well. On the other hand, the occurrence of waterbirds indicates the healthy status of these rural ponds providing water, safe habitat and essential nesting/ roosting sites. The ponds also support fishes, amphibians, molluscs, aquatic insects and their larvae, all of which are a good food source for waterbirds. As water depth, quality and trophic structure are the important habitat characteristics that influence the abundance and diversity of waterbirds in ponds, proper maintenance of these ponds would further increase the waterbird populations.

The results of this study highlight the importance of rural ponds as a habitat for waterbirds including migratory species as well as species with conservation priorities. The results also point towards the need for conserving waterbird populations in rural wetlands and associated landscapes. However, further research should identify seasonal and interannual patterns of

abundance as well as the physio-chemical parameters, food availability and other wetland characteristics that potentially affect these patterns. This would ultimately result in better understanding of the population dynamics and ecology of waterbirds of our rural landscapes.

### ACKNOWLEDGEMENTS

We are grateful to the Director, SACON, and to Genting Energy Ltd, for use of facilities and support.

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# AVIFAUNA OF THE OUSSUDU LAKE AND ITS ENVIRONS, PUDUCHERRY, INDIA AND CONSERVATION CONCERNS<sup>1</sup>

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*Abstract.* Herein we present a checklist, including conservation status of the avifauna of Oussudu (Ousteri) Lake and its environs, Puducherry, India. Surveys were conducted at 15 d intervals between November 2010 and March 2011. A total of 166 bird species of 111 genera and 56 families were recorded in and around the lake. Of these, 75 species were aquatic; 120 species were resident and 46 species were migratory. The present investigation added 6 families, 12 genera and 27 species to the existing avifaunal list of Oussudu. The lake is undergoing serious pressures due to rapid urbanization, weed infestation, discharge of industrial effluents, developmental activities, industrialization, uncontrolled fishing, hunting and poaching. The present study advocates for an urgent and stringent management plan and necessary implementation mechanism for the lake.

*Key words:* Avifauna conservation, IBA, NWCP, Oussudu Lake, Puducherry, wetlands

## AVIFAUNA DEL LAGO OUSSUDU Y SUS ALREDEDORES, PUDUCHERRY, INDIA, Y PROBLEMATICA DE CONSERVACION

*Resumen.* Presentamos una lista que incluye el estado de conservación de la avifauna del Lago Oussudu (Ousteri) y sus zonas aledañas, en Puducherry, India. Los muestreos se efectuaron en intervalos de 15 días entre noviembre de 2010 y marzo de 2011. Un total de 166 especies de aves de 111 géneros y 56 familias. De éstas, 75 especies fueron acuáticas, 120 especies fueron residentes, y 46 migratorias. El presente trabajo añadió 6 familias, 12 géneros y 27 especies a la lista existente de Oussudu. El lago está sometido a grandes presiones debidas a la urbanización, infestación vegetal, descarga de residuos industriales, actividades de desarrollo, industrialización, pesca incontrolada, caza y furtivismo. El presente estudio aboga por la implementación urgente de un estricto plan de manejo para el lago.

*Palabras clave:* conservación de avifauna, IBA, NWCP, Lago Oussudu, Puducherry, humedales

## INTRODUCTION

In India, wetlands occupy an estimated 15.26 million hectares, which is ~4.6% of the geographical area of the country (SAC 2011). These wetlands harbor hundreds of bird species, including both resident and migratory species.

Of the 1340 bird species reported from India (Ali and Ripley 1987; Manakadan and Pittie 2004), 310 species are dependent on wetlands (Kumar et al. 2005). Wetlands in India, as elsewhere, are under tremendous anthropogenic pressures, which greatly influence the structure of bird

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communities (Kler 2002, Verma et al. 2004, Reginald et al. 2007). Water birds have long attracted the attention of the public and scientists because of their beauty, abundance, visibility and social behaviour, as well as for their recreational and economic importance. In addition, water birds have become indicators of wetland quality and parameters for assessing restoration success and regional biodiversity (Kumar and Gupta 2009). Wetlands in urban areas are usually exploited due to several anthropogenic activities. However, such activities often lead to alteration of the wetland to which, in turn, the avifauna responds by changes in species composition and density.

The Government of India has been implementing the National Wetlands Conservation Programme (NWCP) in close collaboration with the State/UT Governments since the year 1985-1986. The programme aims at the conservation of wetlands to prevent their further degradation and to ensure their judicious use for the benefit of local communities and overall conservation of biodiversity. Under this programme, the Ministry of Environment and Forests has identified 115 wetlands that require urgent conservation and management interventions.

Puducherry, well known for aquatic habitats, has a total of 82 major and minor wetlands in and around the town, and among them Oussudu and Bahour are the major ones. These wetlands provide livelihood for the residents around the region in the form of agricultural produce, fish, fuel, fiber, fodder, and host of other day-to-day necessities. Oussudu is the largest lake in the Puducherry region and is home to hundreds of bird species including several migratory ones that flock in large numbers. It is also one of the largest breeding sites for the Common Coot (*Fulica atra*) in South India (Chari and Abbasi 2003, Abbasi and Chari 2008). The lake is also known for a variety of fishes, mussels and crabs (Chari and Abbasi 2003). However, recently the lake and its surroundings are facing increased threats and pressures from several anthropogenic activities (encroachment, poaching and pollution) as well as from rapid urbanizations and infrastructure developments in the immediate vicinity of the lake. In that context, the present investigation was carried out in order to determine the bird community

structure of the lake and discuss a potential management plan.

## METHODS

### STUDY AREA

Oussudu Lake, located at 11°56' to 11°58' N and 79°44' to 79°45' E, is a large shallow wetland situated along the eastern boundary of Puducherry, India (Figure 1). It is the most important fresh-water lake of the Puducherry region, and is 12 km from Puducherry town on the Western side on Puducherry-Villupuram-Valuthavur main road. The lake is rich in flora and fauna and is known to provide several ecological services, as well as several livelihood options for the local human community. It is an inter-state lake with a watershed area of 800 ha, and is almost equally shared between Puducherry (390 ha) and Tamil Nadu (410 ha; Alexander and Pusharaj 2010). Much of the Oussudu bank along the Tamil Nadu side consists of rural settlements, while the Pondicherry side is predominantly urban or suburban (Abbasi and Chari 2008), causing much stress on the lake. The lake is largely fed by direct precipitation, runoff from the catchment and an intermittent river, the Shankarabharani. Several tanks and ponds surround Oussudu (important ones listed in Table 1).

In the recent past, Oussudu Lake was identified as a wetland of national importance under the National Wetland Conservation Programme of the Ministry of Environment and Forest (MoEF 2009), India. The Bombay Natural History Society (BNHS), Mumbai, a member of Birdlife International, has designated Oussudu as an Important Bird Area (IBA) of India; over 20,000 birds belonging to nearly 40 migratory species used to inhabit or winter at Oussudu (Chari and Abbasi 2003). The Asian Wetland Bureau declared Oussudu Lake as one of the 115 significant wetlands in Asia. It also has been identified as a heritage sites by IUCN (International Union for Conservation of Nature and Natural Resources), ranking it among the most important wetlands of Asia. During 2008, the Government of Puducherry declared Oussudu Lake as a bird sanctuary.

The climate in and around Oussudu Lake is

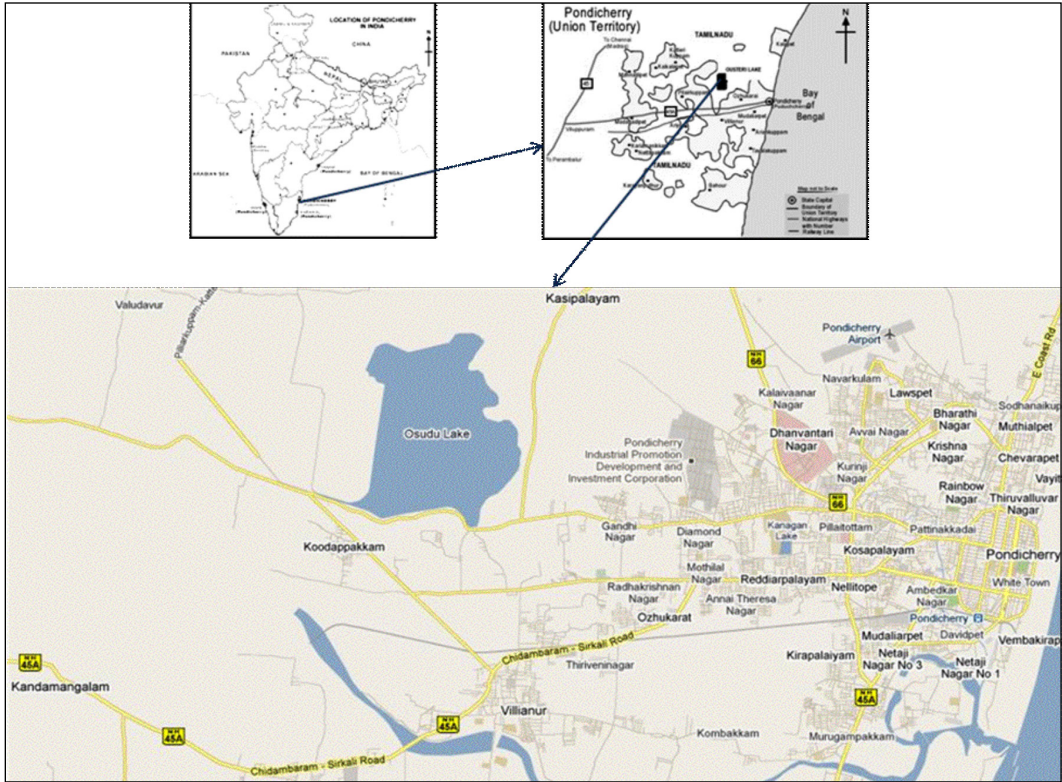


FIGURE 1. Location of Oussudu Lake, Puducherry.

TABLE 1. Major tanks around the Oussudu Lake, Puducherry.

Sl. No.	Name of the Tank/Eri	Capacity (Mm <sup>3</sup> )
1	Thondamanatham tank	0.34
2	Ariyur tank	0.04
3	Kadaperi eri	0.16
4	Karasur tank	0.34
5	Sedarapet Periya eri	0.42
6	Sedarapet Sitheri	0.13
7	Thuthipet tank	0.27
8	Katteriputhu Thangel	0.12
9	Kateripazham Thangal	0.17

humid and tropical. Benefiting from both monsoons, the average annual rainfall of Oussudu and its surrounding region is 1300 mm, of which ~60% occurs during north-east monsoon from September-January (Chari and Abbasi 2003). The remainder of rainfall is scattered sporadically throughout the year. The mean monthly temperature ranges from 21.3°C to 30.2°C. The lake’s water level fluctuates

seasonally and in certain years (rainless months), the lake may dry out completely. Due to such wide hydrological fluctuations across the annual cycle, different niches are created in the lake, resulting in interesting patterns of flora and fauna (Abbasi 1997). There are patches of amphibious and aquatic vegetation in the northern portion of the lake, and these support spawning fish and roosting birds.

## METHODOLOGY

The birdlife communities in and around the study area were documented by direct observations (Bibby et al. 1992), random walk and opportunistic surveys. Observations were made during October 2010 through March 2011 in seven intensive surveys. Surveys were conducted systematically every fortnight, walking on fixed routes through the study area. Birds were observed during 06:00 h – 10:00 h and 16:00 h – 19:00 h following the line-transect method (Burnham et al. 1980, Bibby et al. 1992). Observations were carried out on both sides of transect with the help of 7 x 35 and 10 x 50 m binoculars. In total, 15 such transects were laid in and around the study area. We recorded bird species along with habitat type, season and frequency of occurrence. In addition, opportunistic surveys were also carried out. Identification of birds was done using Ali and Ripley (1987) and Grimmett et al. (1998, 2001); nomenclature followed Manakadan and Pittie (2004). The status of birds (Table 1) was categorized as Resident (R), Migratory (M), Aquatic (A) and Terrestrial (T) as per Grimmett et al. (2001). Bird abundance was based on the following criteria: common, >10 sightings; fairly common, 6-10 sightings; uncommon, 3-5 sightings; and rare, 1-2 sightings.

## RESULTS AND DISCUSSION

In total, 166 bird species belonging to 111 genera and 56 families were recorded during the study period (Table 2). Accipitridae was the dominant family with 13 species, followed by Ardeidae and Scolopacidae with 11 species each, and Anatidae (10 species). Among the 166 bird species recorded, 75 were aquatic and the rest were terrestrial. About 120 species were resident breeding and the rest were migratory. The present study added 6 families, 12 genera and 27 species to the existing avifaunal list of Oussudu (Table 2). Of the 166 species recorded, line transects resulted in documentation of 135 avian species (Table 2), of which, Little Egret (*Egretta garzetta*) was dominant with 355 individuals, followed by Common Myna (*Acridotheres tristis*) with 338 individuals, Asian Palm-Swift (*Cypsiurus balasiensis*) with 337 individuals, White-headed Babbler (*Turdoides affinis*) with 282 individuals and Indian Pond Heron (*Ardeola*

*grayii*) with 245 individuals.

Eight species falling under the Near Threatened category, and one each of Critically Endangered species and Endangered species (IUCN 2007), were recorded during the study period (Table 2). Of the 166 species recorded, 15 species fall under Schedule-I as per Indian Wildlife Protection Act (IWPA 1972). Though Painted Stork (*Mycteria leucocephala*), Asian Open bill-Stork (*Anastomus oscitans*), Northern Shoveller (*Anas clypeata*), Northern Pintail (*Anas acuta*), Mallard (*Anas platyrhynchos*), Common Teal (*Anas crecca*), Garganey (*Anas querquedula*), and Common Pochard (*Aythya ferina*) were very commonly recorded by Chari et al. (2008), we rarely sighted in our study.

## CONSERVATION CONCERNS AND MEASURES

Oussudu plays a vital role in recharging the ground water aquifers for Puducherry and protecting them from seawater ingress; Puducherry is largely dependent on these aquifers for its drinking water supply (Chari and Abbasi 2007). In recent times, however, the lake and its watershed has been exposed to enormous pressures due to increasing population, industrialization and urbanization. The serious threats include reclamation, agriculture, siltation, weed invasion, poaching, etc. Weed species such as *Eichornia crassipes*, *Salvinia molesta*, *Pistia stratiotes* and *Ipomoea carnea* have been invading the wetland area of Oussudu. Almost 14% of the lake is infested by *Eichornia crassipes* (Water hyacinth). Thus, infestation by weeds is a serious issue that could directly affect the biodiversity of the lake and water quality. Apart from aquatic weeds, *Prosopis juliflora* is also present along the roadside. Removal of this species is of utmost importance as it invades other wetlands at much higher rates (Chandra et al. 2009).

Fishing in the area has become a routine practice, which if unchecked could soon result in cultural (rapid) eutrophication, siltation, and ultimate death of the lake. The diversity of fish species in the lake attracts people for fishing. While the Government of Puducherry has banned fishing in Oussudu Lake, uncontrolled fishing was often seen in the lake during the surveys. Unbridled fishing activity using fishing nets has led to the killing of water snakes and



TABLE 2. List of bird species observed in and around Oussudu Lake

Sl. No.	Family	Common name	Scientific name	Habitat	Status	IUCN status	IWPA Status	Abundance
1	Podicipedidae	Little Grebe	<i>Tachybaptus ruficollis</i>	A	R	LC	S-IV	C
2	Pelecanidae	*Great White Pelican	<i>Pelecanus onocrotalus</i>	A	M	LC	S-IV	Re
3		Spot-billed Pelican	<i>Pelecanus philippensis</i>	A	R	NT	S-IV	UC
4	Phalacrocoracidae	Little Cormorant	<i>Phalacrocorax niger</i>	A	R	LC	S-IV	C
5		Indian Shag	<i>Phalacrocorax fuscicollis</i>	A	R	LC	S-IV	C
6		Great Cormorant	<i>Phalacrocorax carbo</i>	A	R	LC	S-IV	C
7	Anhingidae	Darter	<i>Anhinga melanogaster</i>	A	R	NT	S-IV	UC
8	Ardeidae	Little Egret	<i>Egretta garzetta</i>	A	R	LC	S-IV	C
9		Grey Heron	<i>Ardea cinerea</i>	A	R	LC	S-IV	UC
10		Purple Heron	<i>Ardea purpurea</i>	A	R	LC	S-IV	UC
11		Large Egret	<i>Casmerodius albus</i>	A	R	LC	S-IV	UC
12		Median Egret	<i>Mesophoyx intermedia</i>	A	R	LC	S-IV	C
13		Cattle Egret	<i>Bubulcus ibis</i>	A	R	LC	S-IV	C
14		Indian Pond Heron	<i>Ardeola grayii</i>	A	R	LC	S-IV	C
15		Little Green Heron	<i>Butorides striatus</i>	A	R	LC	S-IV	C
16		Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	A	R	LC	S-IV	UC
17		Black Bittern	<i>Dupetor flavicollis</i>	A	R	LC	S-IV	UC
18		Great Bittern	<i>Botaurus stellaris</i>	A	M	LC	S-IV	UC
19	Ciconiidae	Painted Stork	<i>Mycteria leucocephala</i>	A	R	NT	S-IV	UC
20		Asian Openbill-Stork	<i>Amstomus oscitans</i>	A	R	LC	S-IV	FC
21		White-necked Stork	<i>Ciconia episcopus</i>	A	R	LC	S-IV	Re
22	Threskiornithidae	Oriental White Ibis	<i>Threskiornis melanocephalus</i>	A	R	NT	S-IV	Re
23		Black Ibis	<i>Pseudibis papillosa</i>	A	R	LC	S-IV	Re
24		Eurasian Spoonbill	<i>Platalea leucorodia</i>	A	R	NT	S-I	Re
25	Phoenicopteridae	*Greater Flamingo	<i>Phoenicopterus ruber</i>	A	M	LC	S-IV	Re
26		*Lesser Flamingo	<i>Phoenicopterus minor</i>	A	M	NT	S-IV	Re
27	Anatidae	Cotton Teal	<i>Nettion coromandianus</i>	A	R	LC	S-IV	C
28		Eurasian Wigeon	<i>Anas penelope</i>	A	M	LC	S-IV	C
29		Mallard	<i>Anas platyrhynchos</i>	A	M	LC	S-IV	UC
30		Spot-billed Duck	<i>Anas poecilorhyncha</i>	A	R	LC	S-IV	UC
31		Northern Shoveller	<i>Anas clypeata</i>	A	M	LC	S-IV	UC
32		Northern Pintail	<i>Anas acuta</i>	A	M	LC	S-IV	UC
33		Garganey	<i>Anas querquedula</i>	A	M	LC	S-IV	UC
34		Common Teal	<i>Anas crecca</i>	A	M	LC	S-IV	C

TABLE 2. Continued

Sl. No.	Family	Common name	Scientific name	Habitat	Status	IUCN status	IWPA Status	Abundance
35.		Unidentified Duck	<i>Anas sp.</i>	A	M	LC	-	FC
36.		Common Pochard	<i>Aythya ferina</i>	A	M	LC	S-IV	Re
37.	Accipitridae	Black-shouldered Kite	<i>Elanus caeruleus</i>	T	R	LC	S-I	UC
38.		Black Kite	<i>Mitrus migrans</i>	T	R	LC	S-I	C
39.		Brahminy Kite	<i>Haliastur indus</i>	T	R	LC	S-I	C
40.		*White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	A	R	LC	S-I	Re
41.		*Crested Serpent Eagle	<i>Spilornis cheela</i>	T	R	LC	S-I	Re
42.		Western Marsh Harrier	<i>Circus aeruginosus</i>	A	M	LC	S-I	C
43.		Pallid Harrier	<i>Circus macrorurus</i>	T	M	NT	S-I	UC
44.		Pied Harrier	<i>Circus melanoleucos</i>	T	M	LC	S-I	UC
45.		Shikra	<i>Accipiter badius</i>	T	M	LC	S-I	UC
46.		Besra Sparrowhawk	<i>Accipiter virgatus</i>	T	M	LC	S-I	UC
47.		Black Eagle	<i>Ictinaetus malayensis</i>	T	R	LC	S-I	UC
48.	Pandionidae	*Osprey	<i>Pandion haliaetus</i>	T	M	LC	S-I	Re
49.	Falconidae	Common Kestrel	<i>Falco tinnunculus</i>	T	R	LC	S-I	Re
50.	Phasianidae	Grey Francolin	<i>Francolinus pondicerianus</i>	T	R	LC	S-IV	C
51.		Indian Peafowl	<i>Pavo cristatus</i>	T	R	LC	S-I	Re
52.	Rallidae	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	A	R	LC	S-IV	UC
53.		Purple Moorhen	<i>Porphyrio porphyrio</i>	A	R	LC	S-IV	C
54.		Common Moorhen	<i>Gallinula chloropus</i>	A	R	LC	S-IV	C
55.		Common Coot	<i>Fulica atra</i>	A	R	LC	S-IV	C
56.	Jacaniidae	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	A	R	LC	S-IV	C
57.		*Bronze-winged Jacana	<i>Metopidius indicus</i>	A	R	LC	S-IV	Re
58.	Charadriidae	Grey Plover	<i>Pluvialis squatarola</i>	A	M	LC	S-IV	Re
59.		Little Ringed Plover	<i>Charadrius dubius</i>	A	M	LC	S-IV	Re
60.		Yellow-wattled Lapwing	<i>Vanellus malabaricus</i>	A	R	LC	S-IV	C
61.		*Grey-headed Lapwing	<i>Vanellus cinereus</i>	A	M	LC	S-IV	Re
62.		Red-wattled Lapwing	<i>Vanellus indicus</i>	A	R	LC	S-IV	C
63.	Scolopacidae	Common Snipe	<i>Gallinago gallinago</i>	A	M	LC	S-IV	C
64.		Common Redshank	<i>Tringa totanus</i>	A	M	LC	S-IV	Re
65.		Green Sandpiper	<i>Tringa ochropus</i>	A	M	LC	S-IV	C
66.		Wood Sandpiper	<i>Tringa glareola</i>	A	M	LC	S-IV	C
67.		Common Sandpiper	<i>Actitis hypoleucos</i>	A	M	LC	S-IV	C
68.		#Spoonbill Sandpiper	<i>Calidris pygmaeus</i>	A	M	CE	S-IV	Re
69.		Little Stint	<i>Calidris minuta</i>	A	M	LC	S-IV	FC

TABLE 2. Continued

Sl. No.	Family	Common name	Scientific name	Habitat	Status	IUCN status	IWPA Status	Abundance
70.		*Dunlin	<i>Calidris alpina</i>	A	M	LC	S-IV	Re
71.		Curlew Sandpiper	<i>Calidris ferruginea</i>	A	M	LC	S-IV	UC
72.		Broad-billed Sandpiper	<i>Limicola falcinellus</i>	A	M	LC	S-IV	UC
73.		*Ruff	<i>Philomachus pugnax</i>	A	M	LC	S-IV	Re
74.	Recurvirostridae	Black-winged Stilt	<i>Himantopus himantopus</i>	A	R	LC	S-IV	FC
75.	Laridae	River Tern	<i>Sterna aurantia</i>	A	R	NT	S-IV	C
76.		Black-naped Tern	<i>Sterna sumatrana</i>	A	M	LC	S-IV	C
77.		Common Tern	<i>Sterna hirundo</i>	A	M	LC	S-IV	C
78.		Black-bellied Tern	<i>Sterna acuticauda</i>	A	M	EN	S-IV	C
79.		Whiskered Tern	<i>Chlidonias hybridus</i>	A	M	LC	S-IV	UC
80.		Black Tern	<i>Chlidonias niger</i>	A	M	LC	S-IV	C
81.	Columbidae	Blue Rock Pigeon	<i>Columba livia</i>	T	R	LC	S-IV	C
82.		Little Brown Dove	<i>Streptopelia senegalensis</i>	T	R	LC	S-IV	C
83.		Spotted Dove	<i>Streptopelia chinensis</i>	T	R	LC	S-IV	C
84.		Red Collared-Dove	<i>Streptopelia tranquebarica</i>	T	R	LC	S-IV	C
85.	Psittacidae	Rose-ringed Parakeet	<i>Psittacula krameri</i>	T	R	LC	S-IV	C
86.	Cuculidae	Pied-crested Cuckoo	<i>Clamator jacobinus</i>	T	R	LC	S-IV	C
87.		*Red-winged Crested Cuckoo	<i>Clamator coromandus</i>	T	M	LC	S-IV	Re
88.		Brainfever Bird	<i>Hierococcyx varius</i>	T	R	LC	S-IV	C
89.		Drongo Cuckoo	<i>Surniculus lugubris</i>	T	R	LC	S-IV	UC
90.		Asian Koel	<i>Eudynamis scolopacea</i>	T	R	LC	S-IV	C
91.		Small Green-billed Malkoha	<i>Phaenophaeus viridirostris</i>	T	R	LC	S-IV	C
92.		Greater Coucal	<i>Centropus sinensis</i>	T	R	LC	S-IV	C
93.		Lesser Coucal	<i>Centropus bengalensis</i>	T	R	LC	S-IV	Re
94.	Tytonidae	Barn Owl	<i>Tyto alba</i>	T	R	LC	S-IV	Re
95.	Strigidae	Spotted Owllet	<i>Athene brama</i>	T	R	LC	S-IV	C
96.	Caprimulgidae	Common Indian Nightjar	<i>Caprimulgus asiaticus</i>	T	R	LC	S-IV	UC
97.	Apodidae	Asian Palm-Swift	<i>Cypsiurus balastensis</i>	T	R	LC	-	C
98.		House Swift	<i>Apus affinis</i>	T	R	LC	-	C
99.	Hemiprocnidae	*Crested Tree-swift	<i>Hemiprocne coronata</i>	T	R	LC	-	Re
100.	Alcedinidae	Small Blue Kingfisher	<i>Alcedo atthis</i>	A	R	LC	S-IV	C
101.		*Stork-billed Kingfisher	<i>Halcyon capensis</i>	A	R	LC	S-IV	Re
102.		White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	A	R	LC	S-IV	C
103.		*Black-capped Kingfisher	<i>Halcyon pileata</i>	A	R	LC	-	Re

TABLE 2. Continued

Sl. No.	Family	Common name	Scientific name	Habitat	Status	IUCN status	IWPA Status	Abundance
104.		Lesser Pied Kingfisher	<i>Ceryle rudis</i>	A	R	LC	S-IV	UC
105.	Meropidae	Small Bee-eater	<i>Merops orientalis</i>	T	R	LC	-	C
106.		Blue-tailed Bee-eater	<i>Merops philippinus</i>	T	R	LC	-	C
107.		Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	T	R	LC	-	C
108.	Coraciidae	Indian Roller	<i>Coracias benghalensis</i>	T	R	LC	S-IV	C
109.	Upupidae	Common Hoopoe	<i>Upupa epops</i>	T	R	LC	S-IV	C
110.	Capitonidae	White-cheeked Barbet	<i>Megalaima viridis</i>	T	R	LC	S-IV	UC
111.		Coppersmith Barbet	<i>Megalaima laemacephala</i>	T	R	LC	S-IV	C
112.	Picidae	Common Golden-backed Woodpecker	<i>Dinopium javanense</i>	T	R	LC	S-IV	FC
113.		*Lesser Golden-backed Woodpecker	<i>Dinopium benghalense</i>	T	R	LC	S-IV	FC
114.	Pittidae	Indian Pitta	<i>Pitta brachyura</i>	T	R	LC	S-IV	Re
115.	Alaudidae	*Bengal Bush-Lark	<i>Mirafra assamica</i>	T	R	LC	S-IV	Re
116.		Ashy-crowned Sparrow-Lark	<i>Eremopterix grisea</i>	T	R	LC	S-IV	Re
117.	Hirundinidae	*Common Swallow	<i>Hirundo rustica</i>	T	M	LC	-	C
118.		House Swallow	<i>Hirundo tahitica</i>	T	R	LC	-	C
119.		Red-rumped Swallow	<i>Hirundo daurica</i>	T	R	LC	-	C
120.	Motacillidae	Large Pied Wagtail	<i>Motacilla madraspatensis</i>	A	R	LC	S-IV	C
121.		Yellow Wagtail	<i>Motacilla flava</i>	A	M	LC	S-IV	C
122.		Grey Wagtail	<i>Motacilla cinerea</i>	A	M	LC	S-IV	C
123.		Paddyfield Pipit	<i>Anthus rufulus</i>	T	R	LC	S-IV	C
124.	Campephagidae	Common Woodshrike	<i>Tephrodornis pondicerianus</i>	T	R	LC	S-IV	Re
125.	Pycnonotidae	Red-vented Bulbul	<i>Pycnonotus cafer</i>	T	R	LC	S-IV	C
126.		White-browed Bulbul	<i>Pycnonotus luteolus</i>	T	R	LC	S-IV	C
127.	Irenidae	*Common Iora	<i>Aegithina tiphia</i>	T	R	LC	S-IV	C
128.	Laniidae	*Bay-backed Shrike	<i>Lanius vittatus</i>	T	R	LC	-	FC
129.		*Southern Grey Shrike	<i>Lanius meridionalis</i>	T	R	LC	-	Re
130.	Turdinae	Oriental Magpie-Robin	<i>Copsychus saularis</i>	T	R	LC	S-IV	FC
131.		Indian Robin	<i>Saxicoloides fulicata</i>	T	R	LC	S-IV	C
132.		Pied Buschat	<i>Saxicola caprata</i>	T	R	LC	S-IV	C
133.	Timaliinae	*Rufous-bellied Babbler	<i>Dumetia hyperythra</i>	T	R	LC	S-IV	UC
134.		*Jungle Babbler	<i>Turdoides striatus</i>	T	R	LC	S-IV	UC
135.		White-headed Babbler	<i>Turdoides affinis</i>	T	R	LC	S-IV	C
136.	Sylviinae	*Franklin's Prinia	<i>Prinia hodgsonii</i>	T	M	LC	S-IV	C
137.		Jungle Prinia	<i>Prinia sylvatica</i>	T	R	LC	S-IV	C

TABLE 2. Continued

Sl. No.	Family	Common name	Scientific name	Habitat	Status	IUCN status	IWPA Status	Abundance
138.		Ashy Prinia	<i>Prinia socialis</i>	T	R	LC	S-IV	C
139.		Plain Prinia	<i>Prinia inornata</i>	T	R	LC	S-IV	C
140.		Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	T	M	LC	S-IV	UC
141.		Common Tailorbird	<i>Orthotomus sutorius</i>	T	R	LC	S-IV	C
142.		Greenish Leaf-Warbler	<i>Phylloscopus trochiloides</i>	T	M	LC	S-IV	UC
143.	Monarchinae	Asian Paradise-Flycatcher	<i>Terpsiphone paradisi</i>	T	R	LC	S-IV	UC
144.	Rhipidurinae	*White-browed Fantail	<i>Rhipidura aureola</i>	T	R	LC	S-IV	Re
145.	Dicaeidae	Thick-billed Flowerpecker	<i>Dicaeum agile</i>	T	R	LC	S-IV	C
146.		Tickell's Flowerpecker	<i>Dicaeum erythrorhynchos</i>	T	R	LC	S-IV	UC
147.		Purple-rumped Sunbird	<i>Nectarinia zeylonica</i>	T	R	LC	S-IV	C
148.		Purple Sunbird	<i>Nectarinia asiatica</i>	T	R	LC	S-IV	C
149.		Loten's Sunbird	<i>Nectarinia lotenia</i>	T	R	LC	S-IV	C
150.	Nectariniidae	* White-throated Munia	<i>Lonchura malabarica</i>	T	R	LC	S-IV	Re
151.	Estrildidae	Spotted Munia	<i>Lonchura punctulata</i>	T	R	LC	S-IV	C
152.		Black-headed Munia	<i>Lonchura malacca</i>	T	R	LC	S-IV	C
153.	Passerinae	House Sparrow	<i>Passer domesticus</i>	T	R	LC	S-IV	Re
154.	Ploceinae	Baya Weaver	<i>Ploceus philippinus</i>	T	R	LC	S-IV	C
155.	Sturnidae	Brahminy Starling	<i>Sturnus pagodarum</i>	T	R	LC	S-IV	UC
156.		*Rosy Starling	<i>Sturnus roseus</i>	T	M	LC	S-IV	Re
157.		Common Myna	<i>Acridotheres tristis</i>	T	R	LC	S-IV	C
158.	Oriolidae	Eurasian Golden Oriole	<i>Oriolus oriolus</i>	T	R	LC	S-IV	C
159.		*Black-headed Oriole	<i>Oriolus xanthornus</i>	T	R	LC	S-IV	Re
160.	Dicruridae	Black Drongo	<i>Dicrurus macrocerus</i>	T	R	LC	S-IV	C
161.		Ashy Drongo	<i>Dicrurus leucophaeus</i>	T	M	LC	S-IV	C
162.		White-bellied Drongo	<i>Dicrurus caerulescens</i>	T	R	LC	S-IV	C
163.	Artamidae	Ashy Woodswallow	<i>Artamus fuscus</i>	T	R	LC	-	C
164.	Corvidae	Indian Treepie	<i>Dendrocitta vagabunda</i>	T	R	LC	S-IV	C
165.		House Crow	<i>Corvus splendens</i>	T	R	LC	S-IV	C
166.		Jungle Crow	<i>Corvus macrorhynchos</i>	T	R	LC	S-IV	C

\*: New Additions, #: Doubtful Occurrence (no photograph/evidence), A: Aquatic, T: Terrestrial, M: Migratory, R: Resident, CE: Critically Endangered, EN: Endangered, NT: Near Threatened, S-I: Schedule I, S-IV: Schedule IV, C: Common, Re: Rare, FC: Fairly Common, UC: Uncommon

several aquatic birds (pelicans, coots, darters). Fishing also causes direct disturbance to birds due to reduced availability of fish species, some of which the birds consume as food. Aquatic plants such as *Hydrilla verticillata*, *Najas minor*, etc. are food for many birds of Oussudu. During fishing, these aquatic macrophytes entangle in the fishing net, and thus are removed causing disturbance and imbalance in the biodiversity composition of the lake.

Hunting of birds in and around the Oussudu sanctuary is another important issue that needs attention. During the present study, we found that several families of the Narikurava community (a tribe) were engaged in hunting of birds, which had become their chief source of livelihood. There is an encroachment by a hamlet of around 15 families of Narikurava on Villianur-Pathukanu junction road. This settlement hunts several species of resident and migratory aquatic birds. The birds such as Asian Koel (*Endynamys scolopacea*; state bird of Puducherry), Great Bittern (*Botaurus stellaris*), Common Moorhen (*Gallinula chloropus*), White-breasted Water-hen (*Amaurornis phoenicurus*), Common Myna, Common Coot (*Fulica atra*), egrets, and cormorants were commonly hunted and sold for Rs. 150/- to Rs. 200/- per kg. In order to stop such hunting, alternative and appropriate sources of livelihood and employment need to be found for this community.

The Suthukeni Canal is essentially the only means of water movement / discharge of sewage and storm water to the lake. It is currently a channel, into which considerable quantity of municipal and non-point source effluents flow in. Rubber and glass industries, and the agricultural lands located around Oussudu Lake release runoff water with various chemicals into the lake. Several tanning and leather industries occur along the shores, with disposal of effluent from these industries likely affecting the lake's ecology. In addition, the agricultural fields around the lake contribute significant amounts of N, P, and K fertilizers and pesticides through run-off. Such runoff can stimulate the growth of aquatic macrophytes and plankton, resulting in eutrophication. Heavy metals and several pesticides, as an outcome of application of agrochemicals in nearby agriculture fields, may bio-accumulate

(macrophytes to fishes, etc.) in the wetland ecosystem and ultimately affect the apex of the food chain, i.e. birds.

It is apt that steps should be taken to bring adjoining parts of the lake under protection. Mechanisms to manage the area jointly by both governments and people of Tamil Nadu and Puducherry need to be developed. In view of the present scenario with threats to its existence and functioning, Oussudu sanctuary needs active conservation and management interventions. It is also expected that Oussudu would lose its ecological integrity, if proper coordinated efforts are not taken by management authorities and non-government organizations including the general public to save this fragile wetland ecosystem. This may include activities such as protection, prevention of encroachment and control of polluting activities, eco-restoration and initiating habitat improvement programs.

#### ACKNOWLEDGEMENTS

We would like to thank Dr. P.A. Azeez, Director, Sálím Ali Centre for Ornithology and Natural History (SACON) for encouragement and facilities; Dr A. Anilkumar, Conservator of Forests, Puducherry Forest Division, Puducherry, for logistics and constant support to carry out the study. We greatly acknowledge the help from Mr P. Subramanian and Dr S. Bhupathy during the study period.

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*A journal of global avian demography and biogeography*

Volume 12

2013

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