J. Ecophysiol. Occup. Hlth. 16(1 & 2), 2016, 13–21

DOI : 10.15512/joeoh/2016/v16i1&2/15694

A Study on Avifaunal Diversity Status in Lakes of Dharwad, Karnataka State

Rubina M. Nadaf and C. B. Ganesh*

Department of studies in Zoology, Karnataka University, Dharwad – 580 003

Abstract: *The present study was conducted to determine the avifaunal diversity in lakes of Dharwad city. Of the three lakes studied, highest number of species was recorded in Sadhankeri followed by Kelageri and Nuggikeri lakes. A total of 53 species of birds spread over 31 families and 15 orders were documented in three lakes of Dharwad. Maximum species of birds belonged to Passeriformes followed by Charadriiformes, Pelecaniformes, Anseriformes, Coraciiformes, Cuculiformes, Accipitriformes, Gruiformes and Columbiformes, whereas Psittaciformes, Piciformes, Bucerotiformes, Ciconiiformes, Suliformes and Podicipediformes consisted of one species each. The Passeriformes was dominant with 10 families, whereas Charadriiformes, Coraciiformes and Pelecaniformes contributed to five, three and two families each, respectively. The richness in avian diversity in these lakes might be due to availability of food and favorable ecological conditions that support breeding and nesting behaviors.*

Key words: Avian Diversity, Biodiversity, Kelageri, Nuggikeri, Sadhankeri

Introduction

Bird diversity includes the collection of variety of all bird species. Out of more than 9,000 species of birds of the world, the Indian subcontinent contains about 13% of the world's birds Grimmett *et al.,* (1998). The avian habitat is roughly divided into forests, shrubs, and wetlands, although many species require a mixed type of habitat. Wetlands are major habitats that provide water, food, shelter and form sites for nesting and rearing of young ones of resident and migratory birds Mitsch and Gosselink (2000). Wetland birds perform important functions in the ecosystem as main vectors by maintaining biotic connections between catchments for aquatic plants and invertebrates Amezaga *et al*., (2002). A few notable field surveys on avian diversity have been conducted in major wetlands of India Nazneen *et al*., (2001); Bhat *et al*., (2009); Saikia and Devi, (2011); Balkhande *et al.,* (2012).

Whereas the birds act as key indicators for assessing the status of ecosystem health, the avifauna also plays various roles such as scavengers, pollinators and predators of insect pests. However, the birds are affected due to natural or any human-induced disturbances Maurer *et al.,* (1981); Wiens (1989), therefore, assessing the bird diversity of a habitat over time and space is important to know about the status of avian community. Dharwad is a city located on the edge of Western Ghats and regarded as gateway of Malenadu. The city consists of number of lakes such as Kelageri, Sadhankeri and Nuggikeri, which are located at a distance of 2-7 km apart. Although these lakes are home for plenty of birds, detailed information regarding their diversity status is lacking. Thus, the objective of the present study is to prepare a checklist of birds in Sadhankeri, Kelageri and Nuggikeri lakes of Dharwad city.

***Email: ganeshcb23@gmail.com**

Materials and Methods

Dharwad is an undulating city, which lies on the geographical coordinates 15°27'30"N and 75°00'30"E (Elevation 731.52m) that covers 200.23km^2. The study was carried out in three selected lakes, namely Sadhankeri, Kelageri and Nuggikeri. Both Sadhankeri and Kelageri lakes are located on north-east outskirts of Dharwad (Figure 1). These are the small lakes where storage reservoir is designed for irrigation purpose and the water quality is good. Sadhankeri lake area is surrounded by huge plants and trees and serves the purpose of tourism; whereas fishing is done in Kelageri Lake. Birds migrate to these lakes in November-December months. Another Lake Nuggikeri is situated around 7 km from Dharwad, which at the bank has an ancient Hanuman temple. Currently this lake is being developed by the corporation for the purpose of tourism. The local as well as migratory birds are attracted to the flowering and fruit yielding trees found in the outskirts of these lakes. Some of the birds are also attracted by the water bodies and nearby forest areas.

The Birds were sighted with the help of prismatic binoculars (10×40) around the lake areas and their field characteristics were

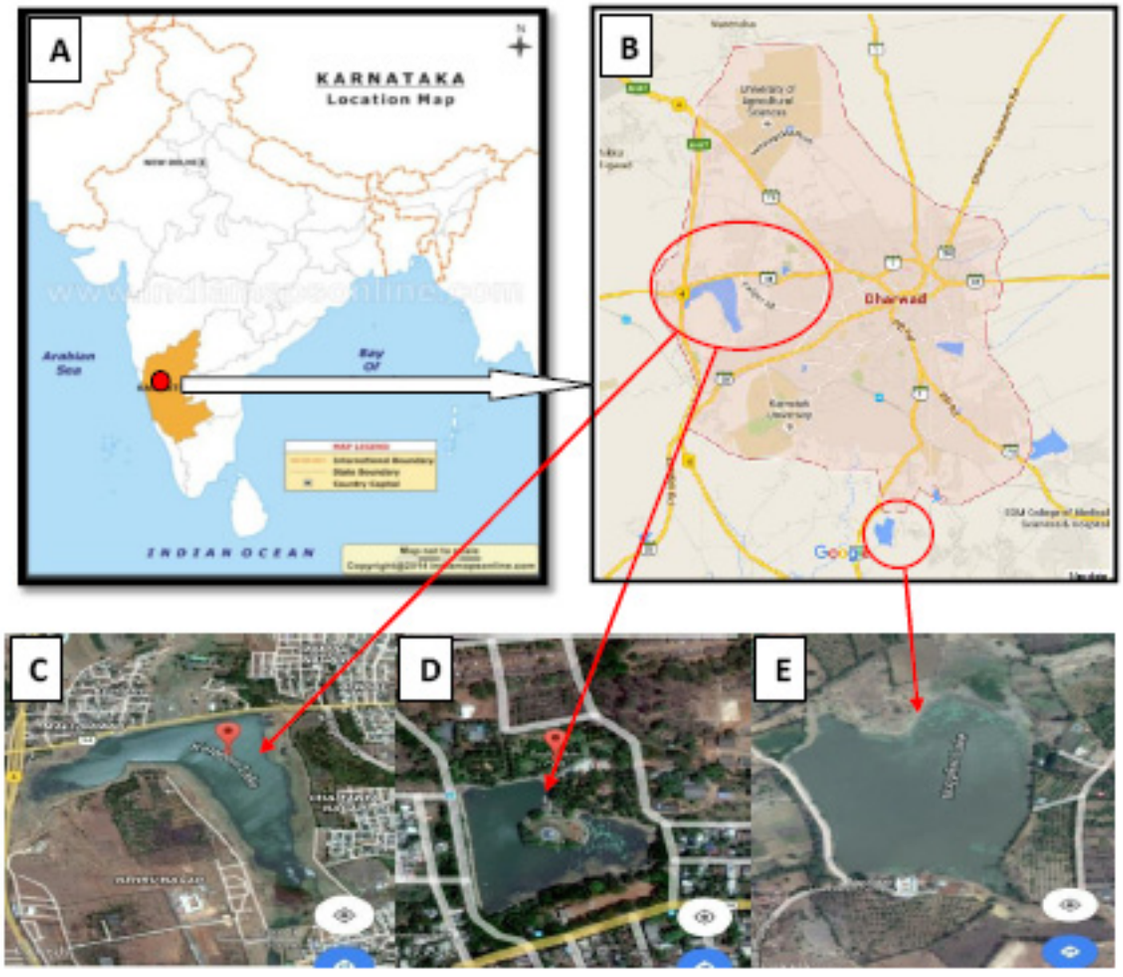

Fig. 1 Map of India showing location of Karnataka state **(A)**, Dharwad city **(B)** and Kelageri **(C)**, Sadhankeri **(D)** and Nuggikeri **(E)** Lakes

noted down during the study. Birds sighted were categorized as common and migratory on the basis of regular observations. Based on regularly updated checklist prepared during the study period, the detailed census of birds was conducted by direct count method. The study was conducted thrice in a week, from November-2015 to April-2016. The observations were done from early morning to late evening in the study areas. Appropriate field guides (Ali, 2002; Grimmett *et al.,* 2011), were used for identification of birds. The list of bird species were arranged familywise (Manakadan and Pittie 2001).

The following formula was used for calculating percent occurrence of birds in each order/ family.

$$\text{Percent occurrence} = \frac{\text{Number of species in each order / family}}{\text{Total no. of different species seen}} \times 100$$

Results and Discussion

Many studies have reported the avifaunal diversity throughout India. For instance, 58 species of birds belonging to nine orders and 29 families in the Bamanwada lake and its surrounded areas Chilke (2012), 64 species belonging to 36 families at Kawardha in Kabirdham District of Chattisgharh Vishwakarma *et al*., 2014), 60 species from Rishi lake in Karanja (lad) of Washim district Kedar and Patil (2005) and 126 species of birds near Krishna River basin of Maharashtra Kumbar and Ghadage, (2014) have been recorded. The present study documented occurrence of 53 species of birds spread over 31 families and 15 orders (Table 1) in three lakes of Dharwad city. The present study reveals highest percentage of birds belonging to Passeriformes (24.52%), followed by Charadriiformes (16.98%), Pelecaniformes and Anseriformes (11.32% each), Coraciiformes, Cuculiformes, Accipitriformes, Gruiformes and Columbiformes (3.77% each), and Psittaciformes, Piciformes, Bucerotiformes, Ciconiformes, Suliformes and Podicipediformes (1.88% each; Fig. 2).

Passeriformes is generally known as the largest and most diverse commonly recognized clade of birds. Dominance of passerine birds was reported in the Arki hills region of Himachal Pradesh Thakur *et al., (*2010), in Tawa reservoir and its surrounding areas at Hoshangabad district of Madhyapradesh Joshi and Shrivastava (2012), and in Katgal region of Western Ghats, Uttara Kannada district Bhat and Ganesh (2014). In contrast, Ahsan and Hannan (2002) recorded highest percentage of non-passerine birds (57%) over passerine birds (43%) in Karnaphuli River delta and adjacent areas of Chittagong, Bangladesh. Likewise in Karnataka state, dominance of non-passerines over passerine birds was observed at Kurugodu of Bellary district Konkal and Ganesh (2014) and Belagavi district Patil and Ganesh (2014). Similar dominance of non-passerines (75.48%) over passerine birds (24.52%) was noticed in the present study. Furthermore, the analysis of percent occurrence of different families in each order showed dominance of families belonging to Passeriformes (32.25%), followed by Charadriiformes (16.12%), Coraciiformes (9.61%), Pelecaniformes (6.45%), Anseriformes (3.22%), Cuculiformes, Accipitriformes, Gruiformes, Columbiformes, Psittaciformes, Piciformes, Bucerotiformes, Ciconiformes, Suliformes and Podicipediformes (3.22% each; Figure 3). However, the dominance of Charadriiformes birds was reported in the Kachchh, which lies in the western part of Gujarat state Gajera *et al.,* (2012), Accipitriformes birds around Chhatarpur district Dubey (2014) and Anatidae birds in Khodiyar wetland of Gujarat state Mukherji and Mukherji (2016). These variations might be due to the differences in ecological conditions and adaptations of the birds to specific habitat.

Bird migration is the regular seasonal movement. The migratory birds move towards Dharwad area from subcontinent to obtain the advantages of favorable conditions. During winter season, the birds visit lakes of Dharwad to acquire home for breeding, nesting and feeding. In the present study,

Table 1: Check list of Avifauna in Kelageri, Sadhankeri and Nuggikeri Lakes at Dharwad

Sl. No.	COMMON NAME	SCIENTIFIC NAME	FAMILY	Status	LAKES		
					N	S	K
ORDER: PASSERIFORMES							
1	Black drongo	*Dicrurus macrocercus*	Dicruridae	C	+	+	-
2	Booted warbler	*Iduna caligata*	Sylviidae	M	-	+	-
3	Dusky crag martin	*Hirundo concolor*	Hirundinidae	C	-	-	+
4	Grey-winged blackbird	*Turdus boulboul*	Turdidae	C	-	+	-
5	Tickell's blue flycatcher	*Cyornis tickellia*	Muscicapidae	C	-	+	-
6	White browed wagtail	*Motacilla madaraspatensis*	Motocillidae	C	-	+	-
7	Purple-rumped sunbird	*Nectarinia zeylonica*	Nectariniidae	C	+	-	-
8	Red vented bulbul	*Pycnonotus cafer*	Pycnonotidae	C	+	-	+
9	Square tailed bulbul	*Hypsipetes ganeesa*	Pycnonotidae	C	-	-	+
10	Jungle babbler	*Turdoides striata*	Timaliidae	C	-	+	-
11	House crow	*Corvus splendens*	Corvidae	C	+	+	+
12	Barn swallow	*Hirundo rustica*	Hirundinidae	C	+	-	-
13	Pied bush chat	*Saxicola caprata*	Muscicapidae	C	+	-	-
ORDER : CHARADRIIFORMES							
14	Black-winged stilt	*Himantopus himantopus*	Recurvirostridae	C	-	-	+
15	Bar-tailed godwit	*Limosa lapponica*	Scolopacidae	M	-	-	+
16	Common greenshank	*Tringa nebularia*	Scolopacidae	M	-	-	+
17	Terek sandpiper	*Xenus cinereus*	Scolopacidae	M	-	+	-
18	Red-wattled lapwing	*Vanellus indicus*	Charadriidae	C	+	-	+
19	Yellow-wattled lapwing	*Vanellus malabaricus*	Charadriidae	C	-	+	-
20	Common sandpiper	*Actitis hypoleucos*	Scolopacidae	M	+	-	-
21	Pheasant-tailed jacana	*Hydrophasianus chirurgus*	Jacanidae	C	-	+	-
22	Indian river tern	*Sterna aurantia*	Loridae	M	+	-	-
ORDER : PELECANIFORMES							
23	Black-headed ibis	*Threskiornis melanocephalus*	Threskiornithidae	C	+	-	+
24	Grey heron	*Ardea cinerea*	Ardeidae	C	-	+	-
25	Little egret	*Egretta garzetta*	Ardeidae	C	+	+	+
26	Large egret	*Ardea alba*	Ardeidae	C	+	+	+
27	Purple heron	*Ardea purpurea*	Ardeidae	C	+	+	+
28	Indian pond heron	*Ardeola grayii*	Ardeidae	C	+	+	+
ORDER :ANSERIFORMES							
29	Spot-billed duck	*Anas poecilorhyncha*	Anatidae	C	-	+	+
30	White-winged duck	*Asarcornis scutulata*	Anatidae	C	-	+	-

31	Mallard	*Anas platyrhynchos*	Anatidae	C	-	+	-
32	Cotton pygmy goose	*Nettapus coromandelianus*	Anatidae	C	-	-	+
33	Greylag goose	*Anser anser*	Anatidae	M	-	+	-
34	Domestic goose	*Anser anser domesticus*	Anatidae	C	-	+	-
ORDER : CORACIIFORMES							
35	Common kingfisher	*Alcedo atthis*	Alcedinidae	C	+	+	+
36	Green bee-eater	*Merops orientalis*	Meropidae	C	+	+	-
37	White-throated kingfisher	*Halcyon smyrnensis*	Alcedinidae	C	-	-	+
38	Indian roller	*Coracias benghalensis*	Coraciidae	C	-	+	-
39	Pied kingfisher	*Ceryle rudis*	Alcedinidae	C	+	+	-
ORDER :CUCULIFORMES							
40	Asian koel	*Eudynamys scolopaceus*	Cuculidae	C	+	+	-
41	Crow pheasant	*Centropus sinensis*	Cuculidae	C	+	+	+
ORDER :ACCIPITRIFORMES							
42	Brahminy kite	*Haliastur indus*	Accipitridae	C	-	+	+
43	Besra sparrowhawk	*Accipiter virgatus*	Accipitridae	C	-	-	+
ORDER : GRUIFORMES							
44	Common coot	*Fulica atra*	Rallidae	M	+	-	+
45	Purple swamphen	*Porphyrio porphyrio*	Rallidae	C	-	-	+
ORDER :COLUMBIFORMES							
46	Spotted dove	*Spilopelia chinensis*	Columbidae	C	-	-	+
47	Rock pigeon	*Columba livia*	Columbidae	C	-	+	-
ORDER :PSITTACIFORMES							
48	Alexandrine parakeet	*Psittacula eupatria*	Psittacidae	C	-	+	-
ORDER :PICIFORMES							
49	Coppersmith barbet	*Psilopogon haemacephalus indica*	Megalaimidae	C	-	+	+
ORDER :BUCEROTIFORMES							
50	Indian grey hornbill	*Ocyceros birostris*	Bucerotidae	C	+	+	-
ORDER :CICONIFORMES							
51	Asian openbill stork	*Anastomus oscitans*	Ciconiidae	C	+	-	+
ORDER :SULIFORMES							
52	Little cormorant	*Microcarbo niger*	Phalacrocoracidae	C	-	+	+
ORDER :PODICIPEDIFORMES							
53	Little grebe	*Tachybaptus ruficollis*	Podicipedidae	C	-	+	-

Note: C-Common , M-Migratory, N-Nuggikeri, S-Sadhanakeri, K-Kelageri.

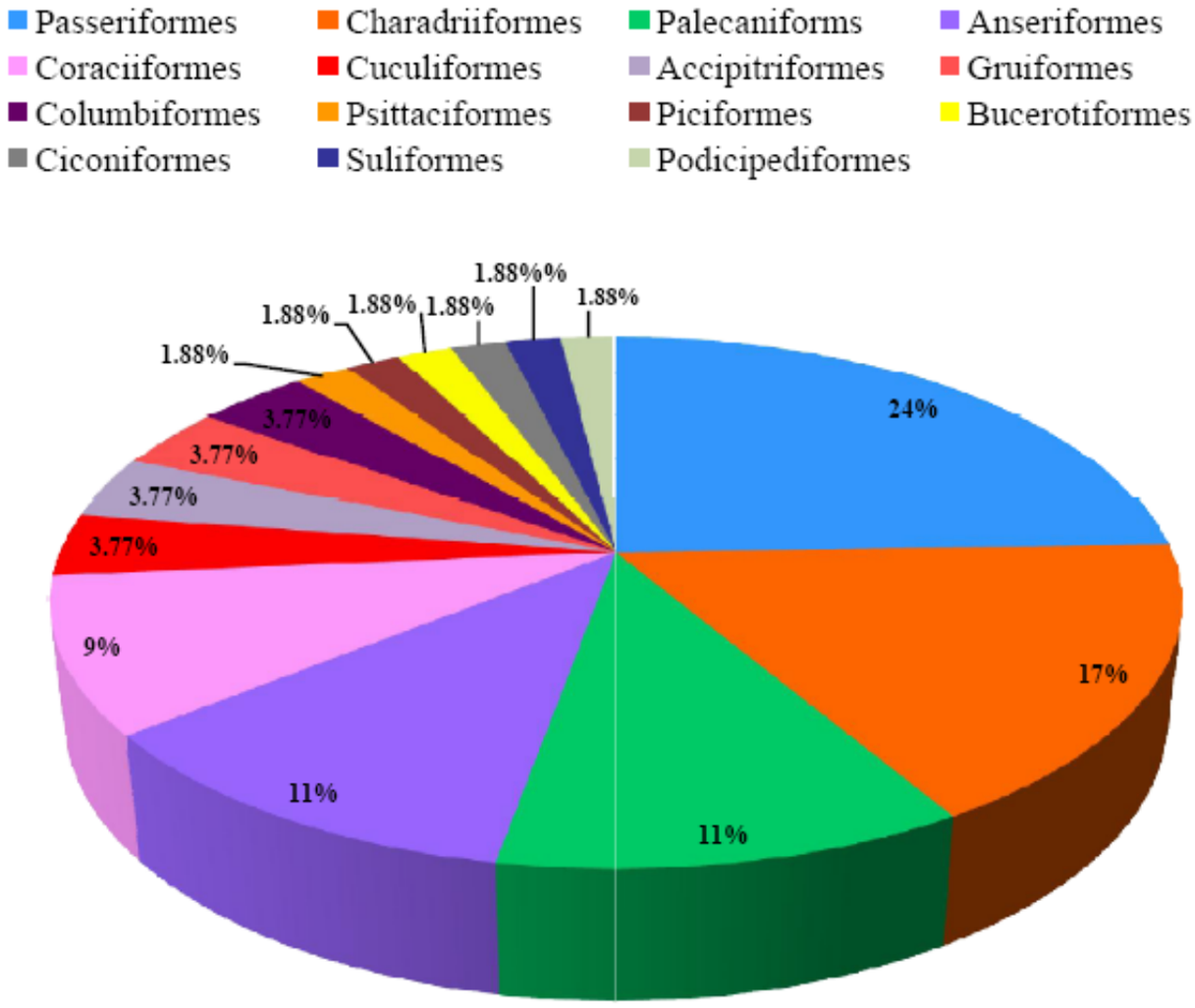

Fig. 2 Percent occurrence of bird species belonging to different orders

majority of the species appear to be residents as shown by their dominance (84.90%) in these lakes compared to migratory birds (15.10%; Figure 4; Table 1). Kumbar and Ghadage, (2014) reported 126 species of birds belonging to 30 families near Krishna River basin of Maharashtra, of which 91 species were resident, 16 migratory, 12 resident and local migratory and 7 species were resident and migratory in nature, whereas Mukherji and Mukherji (2016) documented 38 resident species and 33 migratory species in Khodiyar wetland of Gujarat state.

Melles *et al.* (2003) suggested that species richness is decreased with increasing urbanization. However, maximum number of species was observed in lakes situated in urban area in the present study as shown by highest abundance of species in Sadhankeri (62.26%) followed by Kelageri (49.1%) and Nuggikeri (41.5%; Figure 5). This could be due to the presence of fruit yielding trees, flowering plants and/or availability of food fish in and around these lakes.

In conclusion, although this study was carried out for a limited period as a part of M.Sc

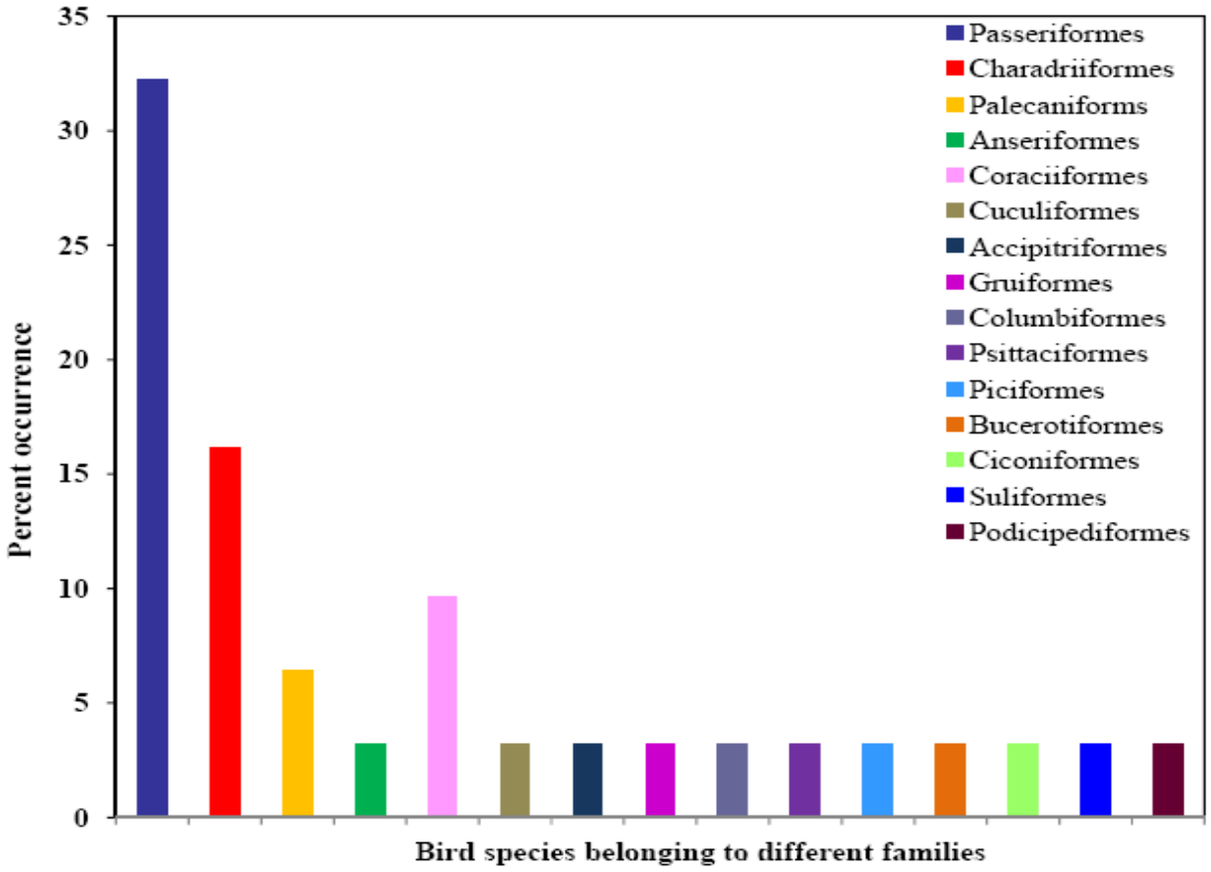

Fig.3 Percent occurrence of bird species belonging to different families

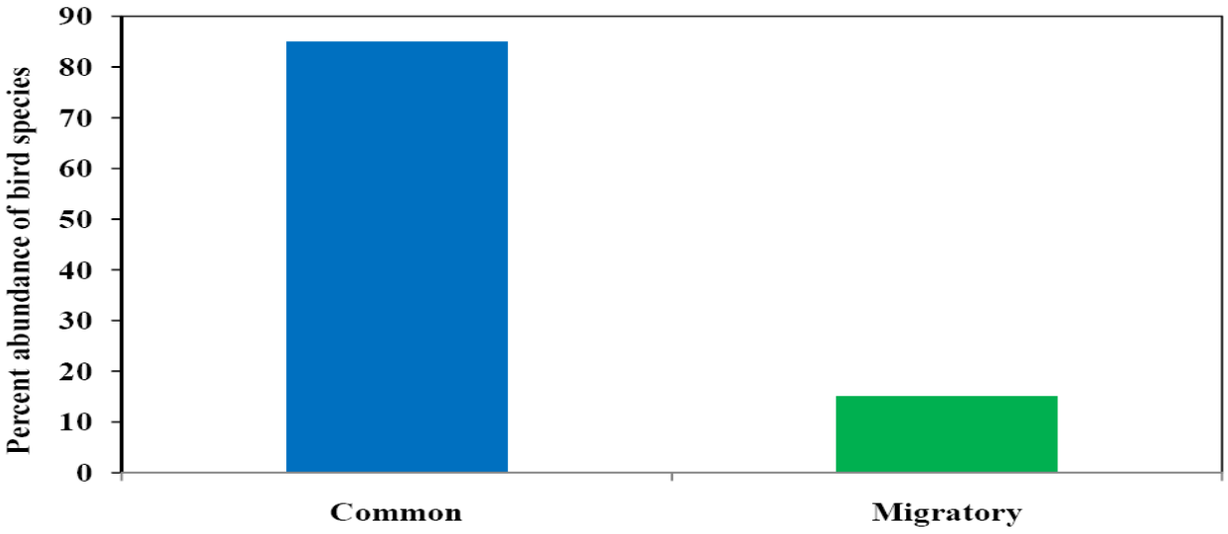

Fig. 4 Percent abundance of bird species in different lakes of Dharwad.

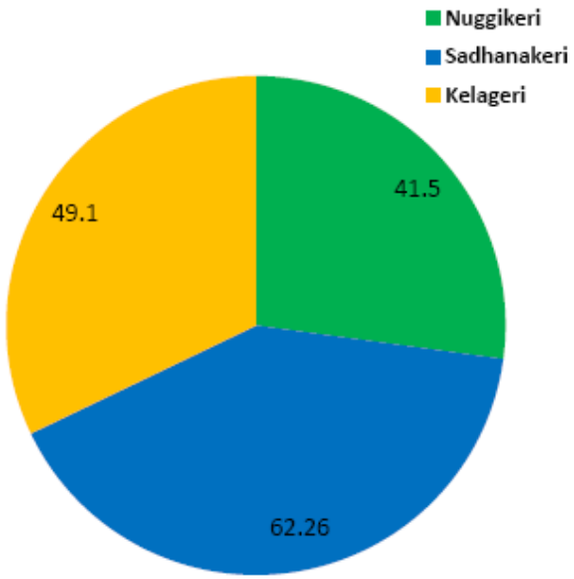

Fig. 5 Percent distribution of birds in three different lakes of Dharwad

dissertation work, the results reveal occurrence of highest number of species in Sadhankeri followed by Kelageri and Nuggikeri lakes in Dharwad city. While further studies involving different seasons would be necessary for the characterization of resident/migratory birds' status in these lakes, currently there are some indications of accelerating anthropogenic activities. Especially, pressure from tourism can potentially harm breeding behavior of birds and might result in significant habitat alteration. In addition, increase in urbanization due to construction of buildings, cutting of the forest areas and reduction in crop fields might lead to further depletion in the bird diversity over a period of time. There is a need for execution of necessary precautions by the concerned authorities in order to prohibit destructive activities and conserve the avifaunal diversity in these lakes.

Acknowledgements

The authors are thankful to the Chairman, Department of Studies in Zoology, Karnatak University, Dharwad for facilities and support.

References

Ahsan, M.F. and Hannan, M.A. (2002) Birds of the Karnaphuli River Delta and Adjacent Areas in Chittagong, Bangladesh. *Zoos' Print J,* **17,** 875-882.

Ali, S. (2002). The Book of Indian Birds, BNHS. Oxford University Press, Bombay.

Amezaga, J.M., Santamaria, L. and Green, A.J. (2002) Biotic wetlands connectivity supporting a new approach for wetland policy. *Acta. Oecologica.*, **23**, 213-223.

Balkhande, J.V., Balkhande, S.V., Bhowate, C.S. and Kulkarni A.N. (2012) A Check List of Birds Near the River Purna, Dist. Parbhani, Maharashtra. *Bionotes*, **14,** 110-112.

Bhat, R. and Ganesh, C.B. (2014) Bird Diversity and Status in Western Ghats of Katgal (Uttar Kannada Dist.), Karnataka State. *Ecol. Environ. Conserv.*, **20**, 181-186.

Bhat, P.I., Cristopher,S.S. and Hosetti, B.B. (2009) Avifaunal Diversity of Anekere Wetland, Karkala, Udupi District, Karnataka, India. *J. Env. Biol.*, **30,** 1059-1062.

Chilke, A.M. (2012) Avian Diversity in and Around Bamanawada Lake of Rajura, District-Chandrapur (Maharashtra). *Annals of Biol. Res.,* **3**, 2014-2018.

Dubey A.K. (2014) Bird Diversity at Chhatarpur District, Madhya Pradesh, India. *Int. J. Global. Sci. Res.*, **1**, 25-32.

Gajera N.B., Mahato, A.K.R. and Vijay Kumar, V. (2012) Wetland Birds of Arid Region-A Study on their Diversity and Distribution Pattern in Kachchh. *Columban. J. Life. Sci.,* **13**, 47-51.

Grimmett, R., Inskipp, C. and Inskipp, T. (1998) Birds of the Indian Subcontinent. *Oxford University Press*, New Delhi.

Grimmett, R., Inskipp, C. and Inskipp, T. (2011) Birds of the Indian Subcontinent. 2nd ed. London:*Oxford University Press & Christopher Helm*. pp. 528.

Joshi, P. and Shrivastava, V.K. (2012) Ecological study and Bird diversity of Tawa reservoir and its surrounding areas of Hoshangabad District (Madhya Pradesh), *The Bioscan.,* **7**, 129-133.

Kedar G.T. and Patil G.P. (2005) Avifaunal Diversity of Rishi Lake, Karanja (Lad), Maharashtra With Reference to Food Preference and Feeding Habits. *J. Aquat. Biol.,* **20**, 35-38.

Konkal, P. and Ganesh, C.B. (2014) Avifaunal Diversity and Status in Kurugodu, Bellary District, Karnataka State. *Ecol. Environ. Conserv.,* **20**, 1777-1782.

Kumbar S.M. and Ghadage A.B. (2014) Preliminary Study on Avian Fauna of the Krishna River Basin Sangli

District, Western Maharashtra, India. *J. Environ. Biol.,* **35**, 1005-11.

Manakadan, R. and Pittie, A. (2001) Standardized Common and Scientific Names of the Birds of the Indian Subcontinent. *Buceros*., **6**, 1-37.

Maurer, B.A., MacArthur, L.B. and Whitmore, R.C. (1981) Effect of Logging on Guild Structure of Forest Bird Community on West Virginia. *Ecology*., **35**, 11-13.

Melles, S., Glenn, S. and Martin, K. (2003) Urban Bird Diversity and Landscape Complexity: Species-Environment Associations Along a Multi-Scale Habitat Gradient. *Conserv. Ecol.,* **7,** 5.

Mitsch, W.J. and Gosselink, J.G. (2000) Wetlands (third edition). John Wiley & Sons, New York, *2000*. pp 920.

Mukherji, M.D. and Mukherji, R. (2016) Impacts of Human Disturbance on the Avifaunal Density and Diversity. *Int. J. Recent. Adv. Engg. Tech.,* **4**, 66-71.

Nazneen, K., Gururaja, K.V., Reddy, A.H.M. and Krishnamurthy, S.V. (2001) Birds of Kuvempu University Campus, Shimoga District, Karnataka. *Zoos' Print. J.,* **16**, 557-560.

Patil, V.C. and Ganesh, C.B. (2014) Status of Bird Diversity in Belagavi District, Karnataka State. *Indian J. Ecol.,* **41**, 74-77.

Saikia, P.K. and Devi, O.S. (2011) A Checklist of Avian Fauna at Jeypore Reserve Forest, Eastern Assam, India with Special Reference to Globally Threatened and Endemic Species in the Eastern Himalayan Biodiversity Hotspot. *J. Threat. Taxa.,* **3,** 1711–1718.

Thakur, M.L., Mattu, V.K., Lal, H., Sharma, V.N., Raj, H. and Thakur, V. (2010) Avifauna of Arki Hills, Solan (Himachal Pradesh), India. *Indian Birds,* 5, 162–166.

Vishwakarma, A., Hemrom, A. and Yadav, K.C. (2014) Status of Terrestrial & Wetland Birds in Karwardha, Kabirdham District in Chattisgharh, India. *Int. J. Sci. Res. Publ.,* **4**, 1-7.

Wiens, A. (1989). The Ecology of Bird Community. Volume I. Foundation & Pattern. UK: Cambridge University Press.