Assessment of Avifaunal Diversity and Threats to them in Phewa Wetland, Nepal

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Abstract : We assessed species diversity and relative abundance during February - March by employing transect method in four line transects and 30 point count stations, and associated threats by direct observations and consultation with people (n= 1) living in vicinity of Phewa wetland. We counted 2651 bird individuals of 148 species belonging to 104 Genera of 44 Families under 11 Orders. Anatidae and Passeriformes with 11% and 39%, respectively were the dominant family and order among the recorded species. Out of these, seven bird species were globally threatened and 12 were nationally threatened. Terrestrial birds had higher species diversity (H'= 3.27), species richness (R= 11.98) and species evenness (e= 0.74) as compared to wetland birds (H' = 3.07, R= 8.44 and e = 0.73). Common pigeon (7.50%) was the most abundant bird followed by lesser whistling duck (6.98%). People in the vicinity of Phewa wetland reported that water pollution caused by domestic sewages and waste water disposal was the major threat to birds and their habitat. Phewa wetland is providing crucial habitat to adequate residential and migratory bird species for which it should be protected for further enhancement of number of avian species.

Key words: Relative abundance, species diversity, terrestrial bird, wetland bird, globallay and nationally threatened species

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Introduction

Wetlands, being the transition phase between terrestrial and aquatic habitats, are rich source of biological diversity. They have diverse utilitarian value for different living organisms; however, birds use wetlands basically for breeding, nesting and feeding purposes (Mutagwaba 2010; Parchizadeh, Williams 2018). These wetland birds play vital role in aquatic ecosystem by acting as predators, pollinators and bio-indicators of ecological condition of water bodies (Green, Elmberg 2014).

Among 886 bird species recorded from Nepal (DNPWC, BCN 2018); 40 are globally threatened, 19 are near threatened (IUCN 2018) and 200 are wetland dependent (Baral 2009). The wetlands of Nepal support a total of 40 (27%) of nationally threatened bird species. At present, 10 globally significant wetlands with the total area of 60,561 ha have been declared as Ramsar Sites of international significance as they support large number of residential and migratory birds. Lake cluster of Pokhara Valley, the largest Ramsar site with nine lakes and area of 262 km^2 within the Chitwan-Annapurna Landscape, harbors 128 species of vertebrates that include 32 species of mammals (18 Families), 140 birds (37 Families), 24 reptiles, 27 fishes and 11 amphibians (Tamrakar 2008). Phewa, the largest in this cluster and second largest in the country provides home for 104 bird species (43 water birds and 14 migratory species) (MOFE 2018). Gautam and Kafle (2007) in an annual survey from August 2003 to July 2004 recorded a total of 43 species of water birds of 14 families. Furthermore, Giri and Chalise (2008) studied seasonal diversity and population status of water birds from 2007 to 2008, and recorded a total of 39 species belonging to 17 families.

Nepal's wetlands are facing tremendous anthropogenic pressure (IUCN 2004), which includes industrial pollution, intensification of agriculture, land encroachment, deforestation, over-fishing, eutrophication, sedimentation, siltation, soil erosion, pollution and diminution because of which they are degrading rapidly and hazardously (Baral, Inskipp 2005; Giri, Chalise 2008; Acharya, Rajbhandari 2012). All of these disturbances threaten wetland ecosystems, and can greatly influence the population structure and diversity of the bird community supported by that ecosystem (Birdlife International, Corsby 2003). The loss of wetland communities leads to loss of plant diversity, reduction in primary production and consequently loss of faunal diversity of wetland ecosystem due to loss of habitat, food, decreased aeration of sediments and increased nutrient levels (Epaphras et al. 2007; Armstrong et al. 2008). A comparative analysis of the four National Red Data Lists from 1996 to 2010 of the critically endangered (CR) birds and their dependency in the habitat reveals that 28 species listed under this category are wetland dependent species which

implies 35% of total wetland bird species in Nepal are considered threatened, far more than other habitat types (Baral et al. 2012).

Phewa wetland is also facing extreme anthropogenic pressure especially siltation and sedimentation. Consequently, the feeding and nesting sites of bird species are gradually modified affecting their survival in this wetland. Therefore, a thorough study is essential to analyze the status of avifaunal diversity in current habitat condition and to update the existing checklist provided by Gautam and Kafle (2007). Hence, we conducted this study with the aim to document species composition and relative abundance of bird fauna, and to identify threats faced by them in Phewa wetland. Additionally, this baseline information on bird diversity will provide starting point to bird scientists to track changes in population of particular bird species.

Materials and Methods

Study Area

Phewa, the largest lake of lake- cluster of Pokhara valley and the second largest lake of Nepal, is a semi-natural freshwater lake. It is located at an altitude of 784 m in Pokhara metropolitan city, Gandaki province of Nepal, and its water surface occupies an area of 4.33 km^2 (Figure 1). As per the feasibility study, a total of 5.9 km^2 of Phewa wetland area was taken. The lake area provides home to several important species including globally threatened migratory birds, such as critically endangered Baer's pochard (*Aythya baeri*) and Indian griffon *(Gyps indicus)* and threatened mammals such as clouded leopard (*Neofelis nebulosa*), common leopard (*Panthera pardusfusca*) and Indian pangolin (*Manis crassicaudata*) (MOFE 2018). The vegetation in the area is a mosaic of sub-tropical and temperate broad-leaved forests, including *Sal* (*Shorea robusta*) in the south, riparian forests (*Acacia catechu* and *Dalbergia sisoo)* along the banks of Seti river and its tributaries, and *Schima-Castanopsis* forests in the north and west. Sedimentation due to heavy loads of sediments during and after road construction and debris flow from Harpan and Andheri khola (streams) have resulted in decrease in core water area of Phewa lake at 4% over the past 20 years (MOFE 2018) whereas forest, grassland, shrub land and urbanization have been increasing (Dixit et al. 2015). The main drivers of degradation include conversion of watershed and lake reservation lands into private land including agricultural land, haphazard building and road construction, reclamation of lake area and encroachment, sedimentation and siltation, pollution and eutrophication, spread of alien invasive species such as water hyacinth (*Eichhornia crassipes*), overharvesting of fish and illegal poaching (MOFE 2018).

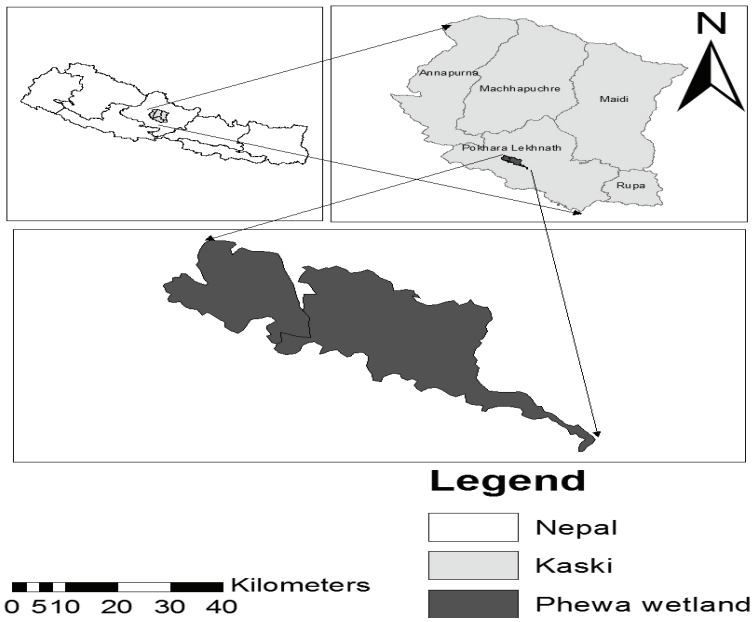

Figure 1 : Location Map of Phewa Wetland

Methods

Data Collection

Bird Survey

By dividing the study area into two strata as water surface and sedimentation area, absolute count of birds was made following Gregory et al. (2004) and Ralph et al. (1995) along four line transects and 30 point count stations in respective strata. Species were recorded along with their numbers during two months between 07.00 and 10.00 AM since peak activities of birds lasts 1- 2 hours after sunrise. The birds were then identified at species level with a popular guide, Helm Field Guide "Birds of Nepal" (Nepali version) (Grimmett et al. 2003) and whenever possible, photographs were taken and calls also recorded to aid in identification process. Field observations were not carried out during adverse environment condition.

Household survey

Considering households within 1 km from the edge of lake to be well knowledgeable about status of the lake and birds, altogether 91 respondents comprising farmers, boaters, hoteliers and elites were interviewed with semi-structured questionnaire in order to collect information regarding status of bird fauna and their habitat as well as natural and anthropogenic threats to wetland and their habitat.

Data analysis

BirdLife International, Crosby (2017) was followed for nomenclature and classification of recorded bird species. IUCN Red List Series (2018) and Inskipp et al. (2016) were followed to assess the global and national conservation status of species. The relative abundance of each observed species was determined in percentage by dividing numbers of individuals of particular recorded species by total number of individuals of recorded species. Following Khan (2005), abundance status of the species was assessed as very common, common, uncommon and rare based on their respective observation rates of 75–100%, 50–74%, 25–49% and <25%. The species diversity was determined using diversity indices:

Shannon – Wiener Diversity Index (1949): $H' = -\sum \frac{ni}{N} \; in \frac{ni}{n}$

i. Margalef's Richness Index (Margalef 1958): $R = \frac{S-1}{inN}$ and

ii. Pielou's Evenness Index (Pielou 1966): $E = \frac{H'}{in\, S}$

Where, ni = species abundance, N = total abundance, s = total number of species and ln = logarithm to base e.

Threats identified through direct observation and household survey, were ranked statistically and most promising threat was identified using the weighted mean.

Results and Discussion

Species Composition

This study revealed 2651 bird individuals of 148 species belonging to 103 genera and spread over 44 families of 11 orders (Annex 1). Out of the total recorded bird species, 63 (57%) were wetland-dependent birds and 85 (43%) terrestrial birds, which depict that the wetland is highly important habitat supporting diverse birdspecies to perform multiple activities, such as foraging, breeding, loafing and roosting. Some species, such as river lapwing (*Vanellus duvaucelii*), short eared owl (*Asio flammeu*) and greater scaup (*Greater Scaup)* were sighted for the first time in this wetland (Ghimire 2018 pers.comm.). Gautam and Kafle (2007) had recorded a total of 43 species of waterbirds of 14 families from August 2003 to July 2004 and Giri and Chalise (2008) recorded 39 species of water birds of 17 families from 2007 to 2008. This variation in total number of recorded bird species may be due to the season of study as our study was carried out during transition period between winter and summer and with focus on overall composition of avifaunal species.

Among families, Anatidae emerged as the dominant family (11%) followed by Accipitridae (8%), Ardediae (5%) and so on (Figure 2). Similarly, Passeriformes was the most dominant order with 57 (39%) species of 21 families followed by Falconiformes (Figure 3). In contrast, Giri and Chalise (2008) had recorded Ciconiiformes as the dominant order with 18 species in their one-year survey of water birds while our study recorded only 12 species of order Ciconiiformes. This discrepancy may be the result of habitat modification as recent studies suggest that siltation and sedimentation are gradually reducing effective depth and surface area of Phewa Lake (Heyojoo, Takhachhe 2014; MOFE 2018). Water level is a major factor that directly or indirectly influences waterbird species composition and relative abundance in the wetland (Rajpar and Zakaria 2011).

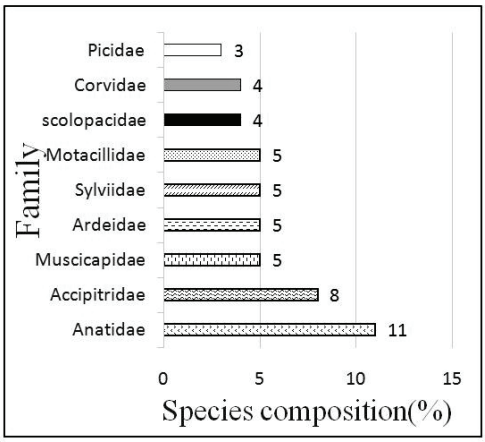

Figure 2 : Species Composition based on Order

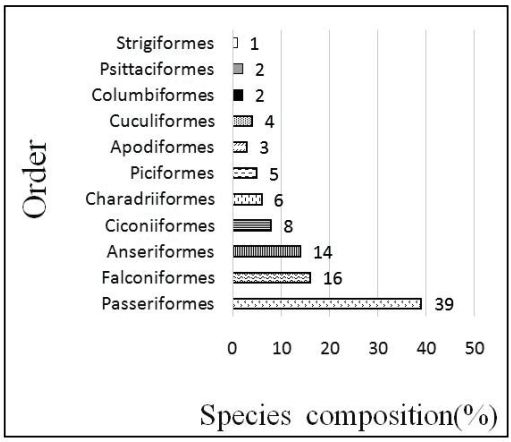

Figure 3 : Species Composition based on Family

Of the total recorded species, 78 were resident followed by winter migrant with 70 species (Figure 4). In addition, the abundance category showed that of 148 bird species, 63 species were Rare, 46 species Uncommon, 18 species Common and 21 species Very common (Figure 5).

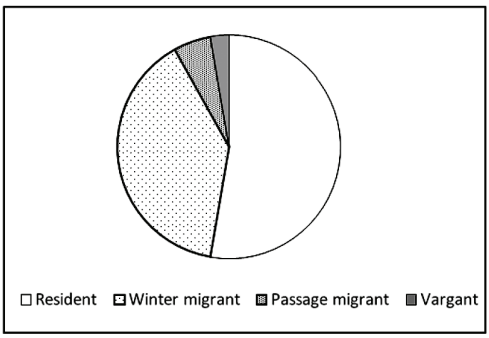

Figure 4 : Migratory Status of Avifauna in Phewa

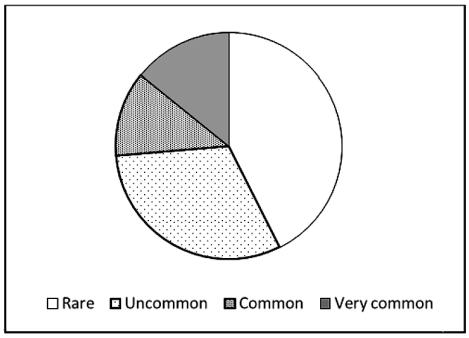

Figure 5 : Abundance Status of Avifauna in Phewa

Conservation Status of Recorded Bird Fauna

Of the recorded species, seven were globally threatened, viz. common pochard (*Aythya ferina*) Asian wollyneck stork (*Ciconia episcopus*), Egyptian vulture (*Neophron percnopterus*), steppe eagle (*Aquila nipalensis*), white-rumped vulture (*Gyps bengalensis*), slender-billed vulture (*Gyps tenuirostris*) and yellow breasted bunting (*Emberiza aureola*), and 12 were nationally threatened, viz. ferruginous duck (*Aythya nyroca*), black stork (*Ciconia nigra*), Egyptian vulture (*Neophron percnopterus*), Himalayan vulture (*Gyps himalayensis*), short-eared owl (*Asio flammeus*), steppe eagle (*Aquila nipalensis*), great bittern (*Botaurus sterallis*), northern pintail (*Anas acuta*), cinereous vulture (*Aegypius monachus*), white-rumped vulture (*Gyps bengalensis*), slender-billed vulture (*Gyps tenuirostris*) and yellow breasted bunting (*Gyps bengalensis*). In addition, black stork *(Ciconia nigra)*, the protected species by NPWC Act (1973) of Nepal, listed in Schedule I was also recorded.

Species Diversity

The overall Shannon Wiener Diversity Index (H'), Margalef's Richness Index (R) and Pielou's Evenness Index (e) were 3.83, 18.64 and 0.77, respectively. Terrestrial birds had the highest Shannon Wiener Diversity Index (H'= 3.27), Margalef's Richness Index (R= 11.98) and Pielou's Evenness Index (e= 0.74) compared to wetland birds (Table 1). This means that terrestrial birds have higher species richness, and are also, evenly distributed than water birds. Similar results have been recorded by Rajpar and Zakaria (2010) at Paya Indah Wetland Reserve, Malaysia and Zakaria, Rajpur (2013) in Man-made marsh, Malaysia. Such dominancy of terrestrial birds over wetland birds seems normal as terrestrial birds being generalists can use all available habitats within the wetland. In addition, the lake is providing diverse habitat such as swamp, dry land, open water body, patches of shrubs and forest edge and abundant food resources, such as insects, grains and safe roosting and breeding sites.

Table 1 : Comparison of Bird Diversity Indices between Terrestrial Birds and Wetland Birds

Indices	Terrestrial bird	Wetland bird	Overall
Diversity Indices: Shannon's Index (H')	3.27	3.077	3.83
Richness Indices: Margalef's Index (S)	11.98	8.44	18.64
Evenness Indices: Pielou's Index (e)	0.74	0.73	0.77

Relative Abundance

The maximum relative abundance was recorded for common pigeon (7.50%) followed by lesser whistling duck (6.98%). Common pigeon was abundant among terrestrial birds, and they were found in wetland areas and human

settlements exhibiting foraging, loafing and breeding activities. Besides, lesser whistling duck was the most abundant among the recorded water birds. It is because ducks prefer deep open water bodies rich in submerged vegetation for foraging and loafing (Rajpar and Zakaria 2011), and similar habitat condition is prevalent in sedimentation part of Phewa wetland. Comparison of relative abundance of abundant terrestrial birds and wetland birds is presented in Table 2.

Table 2 : Comparison of Relative Abundance of Top Five Abundant Terrestrial Birds and Wetland Birds

SN	Wetland Bird		Terrestrial Bird		Overall	
	Species	RA	Species	RA	Species	RA
1	Lesser- whistling duck	12.03	Common pigeon	17.86	Common pigeon	7.50
2	Great cormorant	11.82	Black kite	13.57	Lesser-whistling duck	6.98
3	Common teal	10.76	House crow	9.19	Great cormorant	6.86
4	Purple swamp hen	10.71	Barn swallow	6.83	Common teal	6.24
5	Cattle egret	7.53	House sparrow	5.03	Purple swamp hen	6.21

Threats to Bird Fauna and their Habitat

Pollution due to domestic sewages and waste water disposal, habitat destruction due to road construction, disturbances to the birds due to recreational activities including boating, fishing, and paragliding as well as anthropogenic activities, namely, cattle grazing, removal of vegetation, logging, and colonization of lake by water hyacinth were the threats directly observed during the field visits. These threats were also highlighted by Gautam, Kafle (2007) in Phewa wetland, and similar threats are present in other lakes of lake-cluster of Pokhara valley (MOFE 2018). Majority of respondents reported water pollution as the major threats for avifauna and their habitat (Table 3).

Table 3 : Rating of Threats to Bird Fauna and their Habitat

Threats	Rate / % Respondents					Weighted mean
	1 ◄ ► 5					
	Very high	High	Medium	Low	Very low	
Water pollution	24.8	22	20.8	23.2	9.2	2.7
Infrastructural development	21.2	24	20	15.6	19.2	2.87
Invasive species	16	20.8	29.6	20	13.6	2.94
Habitat destructive activities	18.4	23.2	16	19.2	23.2	2.99
Recreational activities	8	18.4	20.4	35.2	18	3.37

Conclusion

This study recorded 2651 bird individuals of 148 species belonging to 104 Genera, 44 Families and 11 Orders. The dominant family was Anatidae and dominant order was Passeriformes. Resident birds emerged as the most predominant with 78 species followed by the winter migrant with 70 species. Of 148 species, seven species were globally threatened and 12 species nationally threatened. Common pigeon was the most abundant bird followed by lesser-whistling duck. As per the abundance status, 63 species were rare, 46 species uncommon, 18 species common and 21 species very common. People reported pollution as a major threat followed by infrastructural development, colonization of invasive species, anthropogenic activities and recreational activities. It is concluded that the area has good potential for bird watching tourism that can integrate economic gain with biodiversity conservation. In this regard, concerned authority need to educate wetland land owners on importance and ecological role of birds in the wetland habitat. Species specific conservation plans and policies of highly threatened species should be prepared and implemented by the local government. In addition, regular monitoring of bird species should be done in and around the wetland areas to assess their status in the corresponding habitat.

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Literature Cited

Acharya, P.M., Rajbhandari, S.L. (2012): Investigation of Population Status and Habitats of *Lutrogale perspicillata* in Narayani River, Chitwan National Park. A second phase research report submitted to The Rufford Small Grants Foundation, UK.

Armstrong, D., Richard, Y., Ewen, J., Dimond, W. (2008): Avoiding hasty conclusions about effects of habitat fragmentation. *Avian Conservation and Ecology*, *3*(1).

Baral, H.S. (2009): Updated status of Nepal's wetland birds. *Banko Janakari*, 30-35.

Baral, H.S., Inskipp, C. (2005): Important Bird Areas in Nepal: Key Sites for Conservation. Bird Conservation Nepal, Kathmandu.

Baral, H.S., Regmi, U.R., Poudyal, L.P., Acharya, R. (2012): Status and Conservation of Birds in Nepal. Biodiversity Conservation in Nepal: A Success Story. Department of National Parks and Wildlife Conservation, Kathmandu, 71-100.

BirdLife International, Crosby, M.J. (2003): Saving Asia's Threatened Birds: a Guide for Government and Civil Society. BirdLife International, Cambridge, UK.

Dixit, A., Karki, M., Shukla, A. (2015): Vulnerability and Impacts Assessment for Adaptation Planning in Panchase Mountain Ecological Region, Nepal. Government of Nepal, United Nations Environment Programme, UNDP, IUCN, German Federal Ministry for the Environment. Nature Conservation, Building and Nuclear Safety and Institute for Social and Environmental Transition-Nepal, Kathmandu, Nepal.

DNPWC, BCN. (2018): Birds of Nepal: An Official Checklist. Department of National Parks and Wildlife Conservation, Kathmandu, Nepal.

Epaphras, A.M., Gereta, E., Lejora, I.A., Mtahiko, M.G. (2007): The importance of shading by riparian vegetation and wetlands in fish survival in stagnant water holes, Great Ruaha River, Tanzania. *Wetlands Ecology and Management*, 15(4): 329-333.

Gautam, R., Kafle, G. (2007): A preliminary survey of water birds in Phewa lake, Kaski. *Environmental Conservation*, 28(4): 345-356.

Giri, B., Chalise, M.K. (2008): Seasonal diversity and population status of water birds in Phewa lake, Pokhara, Nepal. *Journal of Wetlands Ecology*, 3-7.

Green, A.J., Elmberg, J. (2014): Ecosystem services provided by water birds. *Biological Reviews*, 89(1): 105-122.

Gregory, R.D., Gibbons, D.W., Donald, P.F., Sutherland, W.J., Newton, I., Green, R.E. (2004): Bird ecology and conservation; a handbook of techniques. *Ecology and Conservation*, 17-56.

Grimmett, R., Inskipp, C., Inskipp, T., Baral, H.S. (2003): Birds of Nepal. Nepali edition. Helm Field Guide.

Heyojoo, B.P., Takhachhe, P. (2014): An assessment of lake area shrinkage through geospatial approach: case study of Phewa lake of Kaski district, Nepal. *International Journal of Multidisciplinary and Current Research*, 2: 725-728.

Inskipp, C., Baral, H.S., Phuyal, S., Bhatt, T.R., Khatiwada, M., Inskipp, T., Poudyal, L. (2016): The Status of Nepal's Birds: The National Red List Series. Zoological Society of London, UK.

IUCN Nepal. (2004): A Review of the Status and Threats to Wetlands in Nepal. IUCN Nepal, Kathmandu.

IUCN. (2018): The IUCN Red List of Threatened Species. Version 2017-3 (www.iucnredlist.org)

Khan, M.M.H. (2005): Species diversity, relative abundance and habitat use of the birds in the Sundarban East Wildlife Sanctuary, Bangladesh. *FORKTAIL*, 21: 79–86.

Margalef, R. (1958): Temporal succession and spatial heterogeneity in phytoplankton. *Perspectives in Marine Biology*, 323-349.

MoFE. (2018): Integrated Lake Basin Management Plan of Lake Cluster of Pokhara Valley, Nepal (2018-2023). Ministry of Forests and Environment, Kathmandu, Nepal.

Mutagwaba, S.J. (2010): Diversity and Distribution of Avifauna Resource: A Case of Lake Burigi Wetland, North Western Tanzania. Doctoral dissertation, Sokoine University of Agriculture (SUA), Morogoro, Tanzania.

Parchizadeh, J., Williams, S.T. (2018): Water birds targeted in Iran's wetlands. *Science.* 359(6378): 877-878.

Pielou, E.C. (1966): The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology*, 13*:* 131-144.

Rajpar, M.N., Zakaria, M. (2010): Indah Wetland Reserve, Selangor Peninsular Malaysia. *Journal of Biological Sciences*, 10(7): 658-666.

Rajpar, M.N., Zakaria, M. (2011): Bird species abundance and their correlationship with microclimate and habitat variables at Natural Wetland Reserve, Peninsular Malaysia. *International Journal of Zoology*, *2011,*

Ralph, C.J., Droege, S., Sauer, J.R. (1995): Managing and monitoring birds using point counts: standards and applications. *In:* Ralph, C. John, Sauer, John R. and Droege, Sam, Technical editors. Monitoring Bird Populations by Point Counts. Gen. Tech. Rep. PSW-GTR-149. US Department of Agriculture, Forest Service, Pacific Southwest Research Station, Albany, CA. 161-168, 149 pp.

Shannon, C.E., Weiner, W. (1949): The Mathematical Theory of Communication. University of Illinois Press, Urbana. 117 pp.

Tamrakar, R. (2008): Status and Biodiversity of Lakes and Ponds of Lekhnath Municipality. Project paper, Bachelor's degree, Institute of Forestry, Pokhara, Nepal.

Zakaria, M., Rajpar, M. (2013): Density and diversity of water birds and terrestrial birds in man-made Marsh, Malaysia (Ketumpatan dan Kepelbagaian Burung Air dan Burung Daratan di Rawa Buatan Manusia, Malaysia). *Sains Malaysiana*, 42(10): 1483-1492.

ANNEX 1

List of Birds Found in the Study Area

S.N	Species	Scientific name	Family	Order	BT	MS	NCS	IS	RA
1	Lesser whistling-duck	*Dendrocygna javanica*	Anatidae	Anseriformes	WB	R	LC	LC	7
2	Greater white-fonted goose	*Anser albifrons*	Anatidae	Anseriformes	WB	V	V	LC	0.15
3	Ruddy shelduck	*Tadorna ferruginea*	Anatidae	Anseriformes	WB	W	NT	LC	1.34
4	Gadwall	*Anas strepera*	Anatidae	Anseriformes	WB	W	LC	LC	0.7
5	Eurasian pigeon	*Anas penelope*	Anatidae	Anseriformes	WB	W	LC	LC	0.23
6	Mallard	*Anas platyrhynchos*	Anatidae	Anseriformes	WB	W	LC	LC	4.07
7	Northern shoveler	*Anas clypeata*	Anatidae	Anseriformes	WB	W	LC	LC	0.06
8	Northern pintail	*Anas acuta*	Anatidae	Anseriformes	WB	W	EN	LC	0.18
9	Common teal	*Anas crecca*	Anatidae	Anseriformes	WB	W	LC	LC	6.28
10	Red-crested pochard	*Netta rufina*	Anatidae	Anseriformes	WB	W	LC	LC	0.03
11	Common pochard	*Aythya ferina*	Anatidae	Anseriformes	WB	W	NT	VU	0.15
12	Ferruginous duck	*Aythya nyroca*	Anatidae	Anseriformes	WB	W	VU	NT	0.09
13	Tufted duck	*Aythya fuligula*	Anatidae	Anseriformes	WB	W	LC	LC	1.43
14	Goosander	*Mergus merganser*	Anatidae	Anseriformes	WB	W	LC	LC	0.04
15	Greater scaup	*Aythya marila*	Anatidae	Anseriformes	WB	V	V	LC	0.22
16	Bean goose	*Anser fabalis*	Anatidae	Anseriformes	WB	V	V	LC	0.03
17	Bar-headed goose	*Anser indicus*	Anatidae	Anseriformes	WB	V	NT	LC	0.34
18	Little grebe	*Tachybaptus ruficollis*	Podicipedidae	Anseriformes	WB	W	LC	LC	0.37
19	Great crested grebe	*Podiceps cristatus*	Podicipedidae	Anseriformes	WB	W	LC	LC	0.14
20	Black-necked grebe	*Podiceps nigricollis*	Podicipedidae	Anseriformes	WB	W	LC	LC	0.04
21	Asian wollyneck stork	*Ciconia episcopus*	Ciconiidae	Ciconiiformes	WB	W	NT	VU	0.31
22	Black stork	*Ciconia nigra*	Ciconiidae	Ciconiiformes	WB	W	VU	LC	0.34
23	Black-crowned night heron	*Nycticorax nycticorax*	Ardeidae	Ciconiiformes	WB	R	LC	LC	1.37
24	Indian pond heron	*Ardeola grayii*	Ardeidae	Ciconiiformes	WB	R	LC	LC	0.71
25	Grey heron	*Ardea cinerea*	Ardeidae	Ciconiiformes	WB	W	LC	LC	0.5
26	Cattle egret	*Bubulcus ibis*	Ardeidae	Ciconiiformes	WB	R	LC	LC	4.4
27	Great egret	*Casmerodius albus*	Ardeidae	Ciconiiformes	WB	W	LC	LC	0.18
28	Intermediate egret	*Mesophoyx intermedia*	Ardeidae	Ciconiiformes	WB	R	LC	LC	2.07
29	Little egret	*Egretta garzetta*	Ardeidae	Ciconiiformes	WB	R	LC	LC	3.2

30	Great bittern	*Botaurus sterallis*	Ardeidae	Ciconiiformes	WB	P	EN	LC	0.04
31	Great cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	Ciconiiformes	WB	W	NT	LC	6.9
32	Little cormorant	*Phalacrocorax niger*	Phalacrocoracidae	Ciconiiformes	WB	W	NT	LC	0.29
33	Common kestrel	*Falco tinnunculus*	Falconidae	Falconiformes	TB	R	LC	LC	0.06
34	Black kite	*Milvus migrans*	Accipitridae	Falconiformes	TB	R	LC	LC	5.7
35	Osprey	*Pandion haliaetus*	Accipitridae	Falconiformes	TB	W	LC	LC	0.28
36	Egyptian vulture	*Neophron percnopterus*	Accipitridae	Falconiformes	TB	R	VU	EN	0.25
37	White-rumped vulture	*Gyps bengalensis*	Accipitridae	Falconiformes	TB	R	CR	CR	0.12
38	Slender-billed vulture	*Gyps tenuirostris*	Accipitridae	Falconiformes	TB	R	CR	CR	0.04
39	Himalayan vulture	*Gyps himalayensis*	Accipitridae	Falconiformes	TB	W	VU	NT	0.3
40	Griffon vulture	*Gyps fulvus*	Accipitridae	Falconiformes	TB	P	DD	LC	0.03
41	Cinereous vulture	*Aegypius monachus*	Accipitridae	Falconiformes	TB	W	EN	NT	0.05
42	Himalayan buzzard	*Buteo buteo*	Accipitridae	Falconiformes	TB	W	DD	LC	0.04
53	Steppe eagle	*Aquila nipalensis*	Accipitridae	Falconiformes	TB	W	VU	EN	0.09
44	Shikra	*Accipiter badius*	Accipitridae	Falconiformes	TB	P	LC	LC	0.07
45	Booted eagle	*Hieraaetus pennatus*	Accipitridae	Falconiformes	TB	P	LC	LC	0.04
46	White-breasted waterhen	*Amauromis phoenicurus*	Rallidae	Falconiformes	TB	R	LC	LC	0.35
47	Purple swamp hen	*Porphyrio porphyrio*	Rallidae	Falconiformes	WB	R	LC	LC	6.23
48	Common moorhen	*Gallicrex chloropus*	Rallidae	Falconiformes	WB	R	LC	LC	0.41
49	Eurasian coot	*Fulica atra*	Rallidae	Falconiformes	WB	R	LC	LC	1.55
50	Common crane	*Grus grus*	Gruidae	Falconiformes	WB	W	NT	LC	0.04
51	Jack snipe	*Lymnocryptes minimus*	Scolopacidae	Falconiformes	WB	W	LC	LC	0.14
52	Pin-tailed snipe	*Gallinago stenura*	Scolopacidae	Falconiformes	WB	W	LC	LC	0.09
53	Common snipe	*Gallinago gallinago*	Scolopacidae	Falconiformes	WB	W	LC	LC	0.21
54	Green sandpiper	*Tringa ochropus*	Scolopacidae	Falconiformes	WB	W	LC	LC	0.08
55	Common sandpiper	*Actitis hypoleucos*	Scolopacidae	Falconiformes	WB	W	LC	LC	0.08
56	Common greenshank	*Tringa nebularia*	Scolopacidae	Falconiformes	WB	W	LC	LC	0.04
57	Bronzed-winged jacana	*Metopidius indicus*	Jacanidae	Charadriiformes	WB	R	LC	LC	0.32
58	River lapwing	*Vanellus duvaucelii*	Charadeiidae	Charadriiformes	WB	W	NT	NT	0.04
59	Grey-headed lapwing	*Vanellus cinereus*	Charadeiidae	Charadriiformes	WB	W	LC	LC	0.2
60	Red-wattled lapwing	*Vanellus indicus*	Charadeiidae	Charadriiformes	WB	R	LC	LC	0.3
61	Little-ringed plover	*Charadrius dubius*	Charadeiidae	Charadriiformes	WB	W	LC	LC	0.14

62	Greater painted-snipe	*Rostratula benghalensis*	Rostratulidae	Charadriiformes	WB	R	LC	LC	0.04
63	Pallas's gull	*Ichthyaetus ichthyaetus*	Laridae	Charadriiformes	WB	P	LC	NA	0.04
64	Steppe gull	*Larus barabensis*	Laridae	Charadriiformes	WB	P	LC	NA	0.04
65	Whiskered tern	*Chlidonias hybridus*	Laridae	Charadriiformes	WB	P	LC	LC	0.07
66	Common pigeon	*Columba livia*	Columbidae	Columbiformes	WB	R	LC	LC	7.56
67	Oriental turtle dove	*Streptopelia orientalis*	Columbidae	Columbiformes	TB	W	LC	LC	0.21
68	Spotted dove	*Stigmatopelia chinensis*	Columbidae	Columbiformes	TB	R	LC	NA	0.21
69	Rose-ringed parakeet	*Psittacula krameri*	Psittacidae	Psittaciformes	TB	R	LC	LC	0.63
70	Slaty-headed parakeet	*Pssitacula himalayana*	Psittacidae	Psittaciformes	TB	W	LC	LC	0.27
71	Alexandrine parakeet	*Psittacula eupatria*	Psittacidae	Psittaciformes	TB	R	NT	NT	0.04
72	Asian Koel	*Eudynas scolopaceus*	Cuculidae	Cuculiformes	TB	R	LC	NA	0.02
73	Green-billed malkoha	*Phaenicophaeus tritis*	Cuculidae	Cuculiformes	TB	R	LC	LC	0.09
74	Common hawk cuckoo	*Hierococcyx varius*	Cuculidae	Cuculiformes	TB	R	LC	LC	0.04
75	Greater coucal	*Centropus sinensis*	Centropodidae	Cuculiformes	TB	R	LC	LC	0.09
76	Short-eared owl	*Asio flammeus*	Strigidae	Cuculiformes	TB	P	VU	LC	0.04
77	Spotted owlet	*Athene brama*	Strigidae	Cuculiformes	TB	R	LC	LC	0.18
78	Asian barred owlet	*Glaucidium cuculoides*	Strigidae	Strigiformes	TB	R	LC	LC	0.05
79	Himalayan swiftlet	*Collocalia brevirostris*	Apodidae	Apodiformes	TB	R	LC	LC	0.05
80	Alpine swift	*Tachymarptis melba*	Apodidae	Apodiformes	TB	R	LC	LC	0.15
81	House swift	*Apus affinis*	Apodidae	Apodiformes	TB	R	LC	LC	0.33
82	White-throated kingfisher	*Halcyon smyrnensis*	Alcedinidae	Apodiformes	WB	R	LC	LC	0.55
83	Common kingfisher	*Alcedo atthis*	Alcedinidae	Apodiformes	WB	R	LC	LC	0.08
84	Blue-throated barbet	*Megalaima asiatica*	Megalaimidae	Piciformes	TB	R	LC	LC	0.28
85	Great barbet	*Megalaima virens*	Megalaimidae	Piciformes	TB	R	LC	LC	0.28
86	Coppersmith barbet	*Megalaima haemacephala*	Megalaimidae	Piciformes	TB	R	LC	LC	0.19
87	Fulvous-breasted woodpecker	*Dendrocopos macei*	Picidae	Piciformes	TB	R	LC	LC	0.03
88	Lesser yellownape	*Picus chlorolophus*	Picidae	Piciformes	TB	R	LC	LC	0.04
89	Greater yellownape	*Picus flavinucha*	Picidae	Piciformes	TB	R	LC	LC	0.03
90	Grey-headed woodpecker	*Picus canus*	Picidae	Piciformes	TB	R	LC	LC	0.02
91	Greater flameback	*Chrysocolaptes guttacristatus*	Picidae	Piciformes	TB	R	LC	LC	0.02

92	Long-tailed Minivet	*Pericrocotus ethologus*	Campephagidae	Passeriformes	TB	R	LC	LC	0.06
93	Large cuckooshrike	*Coracina macei*	Campephagidae	Passeriformes	TB	R	LC	LC	0.07
94	Long-tailed shrike	*Lanius schach*	Laniidae	Passeriformes	TB	R	LC	LC	0.21
95	Grey-backed shrike	*Lanius tephronotus*	Laniidae	Passeriformes	TB	W	LC	LC	0.02
96	Bronzed drongo	*Dicrurus aeneus*	Dicruridae	Passeriformes	TB	R	LC	LC	0.03
97	Black drongo	*Dicrurus macrocercus*	Dicruridae	Passeriformes	TB	R	LC	LC	0.37
98	Spangled drongo	*Dicrurus hottentottus*	Dicruridae	Passeriformes	TB	R	LC	LC	0.31
99	Yellow-bellied fantail	*Rhipidura hypoxantha*	Corvidae	Passeriformes	TB	W	LC	LC	0.04
100	Maroon oriole	*Oriolus traillii*	Oriolidae	Passeriformes	TB	R	LC	LC	0.04
101	Red-billed blue magpie	*Urocissa erythrorhyncha*	Corvidae	Passeriformes	TB	R	LC	LC	0.28
102	Grey treepie	*Dendrocitta formosae*	Corvidae	Passeriformes	TB	R	LC	LC	0.28
103	House crow	*Corvus splendens*	Corvidae	Passeriformes	TB	R	LC	LC	3.88
104	Large-billed crow	*Corvus macrorhynchos*	Corvidae	Passeriformes	TB	R	LC	LC	1.41
105	Rufous treepie	*Dendrocitta vagabunda*	Corvidae	Passeriformes	TB	R	LC	LC	0.11
106	Black-lored tit	*Machlolophus xanthogenys*	Paridae	Passeriformes	TB	R	LC	LC	0.12
107	Great tit	*Parus major*	Paridae	Passeriformes	TB	R	LC	LC	0.26
108	Plain martin	*Riparia chinensis*	Hirundinidae	Passeriformes	TB	R	LC	LC	0.79
109	Barn swallow	*Hirundo rustica*	Hirundinidae	Passeriformes	TB	R	LC	LC	2.89
110	Red-rumped swallow	*Cecropis daurica*	Hirundinidae	Passeriformes	TB	R	LC	LC	0.24
111	Nepal house martin	*Delichon nipalense*	Hirundinidae	Passeriformes	TB	R	LC	LC	0.46
112	Himalyan bulbul	*Pycnonotus leucogenys*	Pycnonotidae	Passeriformes	TB	R	LC	LC	0.23
113	Red-vented Bulbul	*Pycnonotus cafer +C24*	Pycnonotidae	Passeriformes	TB	R	LC	LC	1.07
114	Chestnut-headed tesia	*Cettia castaneocoronata*	Sylviidae	Passeriformes	TB	W	LC	LC	0.03
115	Common tailorbird	*Orthotomus sutorius*	Sylviidae	Passeriformes	TB	R	LC	LC	0.34
116	Dusky warbler	*Phylloscopus fuscatus*	Sylviidae	Passeriformes	TB	W	LC	LC	0.23
117	Smoky warbler	*Phylloscopus fuligiventer*	Sylviidae	Passeriformes	TB	W	LC	LC	0.05
118	Buff-barred warbler	*Phylloscopus pulcher*	Sylviidae	Passeriformes	TB	W	LC	LC	0.05
119	Hume's leaf warbler	*Phylloscopus humei*	Sylviidae	Passeriformes	TB	W	LC	LC	0.1
120	Greenish warbler	*Phylloscopus trochiloides*	Sylviidae	Passeriformes	TB	W	LC	LC	0.38
121	Grey-hooded warbler	*Phylloscopus xanthoschistos*	Sylviidae	Passeriformes	TB	R	LC	LC	0.08

122	Blue whistling thrush	*Myophonus caeruleus*	Turdidae	Passeriformes	TB	R	LC	LC	0.22
123	White-creasted laughingthrush	*Garrulax leucolophus*	Timaliidae	Passeriformes	TB	R	LC	NA	1.09
124	Jungle myna	*Acridotheres fuscus*	Sturnidae	Passeriformes	TB	R	LC	LC	0.77
125	Common myna	*Acridotheres tristis*	Sturnidae	Passeriformes	TB	R	LC	LC	1.64
126	Oriental magpie robin	*Copsycus saularis*	Muscicapidae	Passeriformes	TB	R	LC	LC	0.37
127	Plumbeous water redstart	*Rhyacornis fuliginosa*	Muscicapidae	Passeriformes	TB	W	LC	LC	0.2
128	Common stonechat	*Saxicola torquatus*	Muscicapidae	Passeriformes	TB	R	LC	LC	1.06
129	Pied bushchat	*Saxicola caprata*	Muscicapidae	Passeriformes	TB	R	LC	LC	0.1
130	Taiga flycatcher	*Ficedula albicilla*	Muscicapidae	Passeriformes	TB	W	LC	LC	0.15
131	Grey-headed canary flycatcher	*Culicicapa ceylonensis*	Muscicapidae	Passeriformes	TB	W	LC	LC	0.18
132	Slaty-blue flycatcher	*Ficedula tricolor*	Muscicapidae	Passeriformes	TB	W	LC	LC	0.04
133	Bluethroat	*Luscinia svecica*	Muscicapidae	Passeriformes	TB	W	LC	LC	0.02
134	Oriental white-eye	*Zosterops palpebrosus*	Zosteropidae	Passeriformes	TB	R	LC	LC	0.58
135	Grey wagtail	*Motacilla cinerea*	Motacillidae	Passeriformes	WB	W	LC	LC	0.19
136	Citrine wagtail	*Motacilla citreola*	Motacillidae	Passeriformes	WB	W	LC	LC	0.05
137	White wagtail	*Motacilla alba*	Motacillidae	Passeriformes	WB	W	LC	LC	0.75
138	White-browed wagtail	*Motacilla maderaspatensis*	Motacillidae	Passeriformes	WB	W	LC	LC	0.53
139	Paddyfield pipit	*Anthus rufulus*	Motacillidae	Passeriformes	WB	R	LC	LC	1.26
140	Olive-backed pipit	*Anthus hodgsoni*	Motacillidae	Passeriformes	WB	W	LC	LC	0.35
141	Rosy pipit	*Anthus roseatus*	Motacillidae	Passeriformes	WB	W	LC	LC	0.15
142	Velvet-fronted nuthatch	*Sitta frontalis*	Sittidae	Passeriformes	TB	R	LC	LC	0.02
143	Crimson sunbird	*Aethopyga sipraja*	Nectariniidae	Passeriformes	TB	R	LC	LC	0.11
144	House sparrow	*Passer domesticus*	Passeridae	Passeriformes	TB	R	LC	LC	2.14
145	Eurasian tree sparrow	*Passer montanus*	Passeridae	Passeriformes	TB	R	LC	LC	1.17
146	White-rumped Munia	*Lonchura striata*	Estrildidae	Passeriformes	TB	R	LC	LC	0.06
147	Orange-bellied leafbird	*Chloropsis hardwickii*	Irenidae	Passeriformes	TB	R	LC	LC	0.04
148	Yellow breasted bunting	*Emberiza aureola*	Emberizidae	Passeriformes	WB	W	CR	CR	0.48