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AVIAN COMMUNITY STRUCTURE AT KESHOPUR WETLAND- A RAMSAR SITE IN NORTH INDIA

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ABSTRACT

The present study was performed to record the avian diversity of birds at Keshopur Chhamb Community Reserve; district Gurdaspur in the state of Punjab, India from June 2018 to May 2019. A total of 121 species of birds belonging to 19 orders and 47 families were observed during the study period. The maximum number (38) of the species in the area belonged to order Passeriformes. 27 winter migratory, 3 summer migratory and 91 resident species of birds were observed during study. One vulnerable (*Aythya ferina*) and six near threatened species were observed (i.e. *Aythya nyroca, Anhinga melanogaster, Mycteria leucocephala, Sterna aurantia, Psittacula eupatria, Threskiornis melanocephalus*) as per IUCN red list. A particular pattern of arrival and departure of migratory birds was observed. The winter migrants started to appear in October when the temperature started decreasing. The abundance of birds varied significantly during different seasons. Major variation was found in abundance of few species at three different sites of the same wetland. This study revealed that Keshopur Chhamb Community Reserve acts as a refuge site for many water birds including wader, waterfowl and many migratory and threatened species.

Keywords: Wetland, Diversity, Passeriformes, Migratory birds, Community reserve, Ramsar site

INTRODUCTION

Birds belong to a group of warm blooded vertebrates characterized by feathers, toothless beaked jaws, the hard shelled egg laying, high metabolic rate, a heart with four chambers and a strong yet light weight skeleton. About 10,000 species of birds are present on this tiny planet of Universe called Earth. Wetlands are areas of land that are permanently or temporarily covered with water. A large number of wetlands such as swamps, marshes, peatlands etc are present in India. Wetlands are counted among most distinctive and high yielding ecosystems (Rajasekar, Sharma &Yogalakshmi, 2008). These can be characterized as a halfway world between aquatic and terrestrial ecosystems as they exhibit characters of both ecosystems (Wagner, 2004). A wide diversity of aves depends upon wetlands during their migrant and procreation phase (Kuruvilla & Maria, 2016). Waterbirds and wetlands are inseparable components. They support an affluent arrangement of waterbird communities (Grimmett & Inskipp, 2007). They also serve as feeding and breeding grounds for a large number of economically important aquatic species other than birds such as crustaceans and fish (Gardner et al., 2016). About 10% of the bird species globally rely entirely on wetlands, while approximately the same number again utilizing them at some phase in their life span. This indicates that globally 20% (approximate) of the avian species utilize wetlands directly or indirectly for foraging, resting, breeding and overwintering (Rannestad et al., 2015). The population of birds dependent on wetlands is going through drastic decrease globally. These noticeable decreases are particularly due to immense loss of wetlands and conversion to land (Saunders et al., 2019).

In a survey conducted by Wildlife Institute of India, it was found that wetlands are dissipating every year at a rate of 2% to 3% (Bal&Dua, 2010). In wetlands, the diversity and abundance of bird species is directly associated with the developing vegetation and compounding (Kaminski & Prince 1981;Murkin, Kaminski & Titman, 1982). Wetlands provide food to birds in the form of plants, vertebrates and invertebrates. The aquatic birds are fairly receptive to the variations in wetlands (Odewumi et al., 2017). Their population size is directly affected by the food availability (Jagruti & Geeta, 2017). With the changes in wetlands, the aquatic birdlife is entirely affected which is an indication for us to understand whether the region is environmentally sound or getting contaminated (Odewumi, Okosodo & Talabi, 2017).

In Punjab, six wetlands are of international significance and Keshopur wetland is one such important wet land which has recently been declared as Ramsar site on 26 September, 2019. This wetland was the first declared community reserve of India (Mehta, 2014). The economy of rural areas surrounding it is intensely affected and the contribution from the local community has been recognized as a key factor for its protection. The reserve has many fresh water marshes

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(natural wetlands) extending to an area of 850 acres and is the main site for migratory birds during the winter season. Due to its conversion into productive agricultural land and fish farms in the past by drainage department of the government, the wetland area has been reduced to its present size which was once spread to many thousand acres. The ecosystem is now on the edge of extinction and is highly threatened. The disturbance caused by humans directly or indirectly in wetland bird habitats led to decrease in strength of various populations of wetland birds. It is necessary to understand the causes for the decrease in the populations of various water birds and to find the effects of interference of humans. The inestimable information can be obtained on the standing and fitness of wetland by monitoring the birds of wetland. Only by knowing the structure of any region, the significance of local scenery for the conservation of birds can be understood (Harisha, 2016). Wetlands in India cope with enormous anthropogenic pressures as elsewhere, due to which the structure of bird community is strongly influenced (Kler, 2002; Verma et al.,2004; Reginald et al., 2007). Anthropogenic actions are known to cause disruptions to aquatic birds in their natural surroundings including recreation (Aikins, Gbogbo & Owusu, 2018). Invasive floral species also menace wetlands globally and are particularly troublesome for basins with immense nutrient inputs and transformed hydrology (Anderson et al., 2019). Even though these sites are adequately transformed by human actions, still providing suitable environment for many bird species (Bal & Dua 2010) therefore, the present study was planned to study community structure of birds at Keshopur wetland, a ramsar site.

MATERIALS AND METHODS

Study area

The Keshopur wetland is a freshwater ecosystem situated between the Latitude 32˚05' 16.3" N and Longitude 75˚24' 24.2" E at an altitude of 245 m having an area of approximately 344 hectares adjacent to the town of Gurdaspur, District Gurdaspur, Punjab. It allures thousands of migratory birds every year from Siberia and Central Asia in winters. The average annual temperature in Gurdaspur is 23.5°C. In a year, the average rainfall is 959 mm. This region was announced as community reserve under Section 36 C of Wildlife protection Act 1972 ensuing a Punjab Government Notification Number 34/13/2007/Ft-V/6133 dated June 25, 2007. Main sources of water at Keshopur wetland are rainfall and ground water. The total area covered by wetland is about 344 hectares comprised of fresh water marshes owned by Panchayats of five villages which is categorized into two parts. Miani (162 hectares), Dalla (62 hectares), Keshopur (55 hectares), Matwa (20 hectares) form the significant one conterminous block and Magarmudian (45 hectares) is a separate patch. Major area of the wetland is under human activities in the form of fish ponds and lotus cultivation. The wetland consists of diverse amount of vegetation.

The study area was divided into three sites for taking observations:

1. Site I
2. Site II
3. Site III

• Site I consisted of trees, shrubs, herbs, grasses, aquatic plants and climbers. It supports high vegetation of lotus. The site was located near the road and surrounded by agricultural fields.

• Site II was mainly consisted of small vegetation including herbs, shrubs, climbers, grasses, aquatic plants and some trees. Fish ponds were present at the site which was surrounded by agricultural fields.

• Site III which was a separate patch consisted of large number of aquatic plants and bamboo trees. Herbs, shrubs and grasses were also present. Watchtower was present at all the three sites to see the birds from a distance.

Bird surveys

Study of avifaunal diversity of Keshopur Chhamb Community Reserve was carried out between June 2018 and May 2019. Point count method and total count method were used to study and record the diversity of birds at different sites. In point count method, all the viewable birds were counted by choosing an appropriate vantage point. Approximately 10-15 minutes were spent at each point to avoid repeated counting of same bird individual. The other method total count was used where so ever possible, from specific points or walking around the wetland. Identification of birds residing and visiting selected sites was done on the basis of visual observations on their morphological features like shape, size, color of beak, feathers, wings, eyes, feet, legs and other parts of body by using binocular and comparing them with those described by (Ali, 2002). At different sites, observations of birds were recorded weekly for one and a half hour between 6:00-9:00 a.m. in the morning and 4:00-7:00 p.m. in the evening using binoculars of 10×50. Weekly observations were made throughout the study but they were clubbed into a single monthly observation. Status of species was classified into resident (R), winter migrant (WM) and summer migrant (SM).

Data analysis

The data of four point counts recorded in one month was merged together. The community features such as Species richness, diversity, evenness and abundance were calculated to determine the bird's community at selected sites. Species richness describes the total number of species of birds in a given area. Relative abundance of birds (%) was calculated using the formula

$ni/N \times 100$.

In this equation, ni represents the number of i^{th} species and N represents the total number of birds seen.

Species diversity was calculated using Shannon-Weiner index as explained by (Spellerberg & Fedor,2003) using formula:

H= -∑Pi log Pi,

In this formula, Pi depicts the proportion of i^{th} species of birds

'H' is referred as 'Shannon's index'

Species evenness also called as equitability and written as E was determined by the equation:

J= H/H'max,

Where,

H is the observed species diversity and H' max is the log of total number of species richness (Krebs, 1985). The value of E ranges from 0-1.

Annual abundance of avifauna was tabulated and analyzed using two way analysis of variance CPCS1 software was used to compare the number of species at each selected site. SPSS1 software (Kruskal-Wallis test) was used to compare the seasonal variation between the three sites.

RESULTS AND DISCUSSION

Total 121 species of birds belonging to 19 orders and 47 families were observed during the study period (Table 1). The maximum number of the species i.e. 38 found in study area were belonging to order Passeriformes also observed that order Passeriformes form the most predominant group in India with about 54% composition. Anatidae was the most abundant family having 11 species at our study site where as (Rawat & Rao, 2020) noticed Anatidae as least abundant family in Sheopur city of Madhya Pradesh. Muscicapidae family has the highest number of birds in India (Manakadan & Pittie, 2001) however six families showed more number of species than muscicapidae in present study. Total 107 species of birds were found at Site I. Eurasian Coot, Common Moorhen and Northern Shoveler were recorded to be the predominant bird species having annual abundance 14.10%, 13.36% and 10.93% respectively at this site. Total 103 species of birds were found at Site II in which Common Moorhen and Eurasian Coot were recorded as equally abundant species having annual abundance 16.4 and 15.40% respectively. Total 113 species of birds were found at Site III where Eurasian Coot, Common Moorhen and Northern Pintail were the predominant avian species having annual abundance 15.38%, 13.83% and 10.40% respectively.

Table 1: Bird species observed at Keshopur wetland along with their resident status, IUCN status and annual abundance.

S. No	Name of species	Scientific name	Order	Resident status	IUCN Status	Annual abundance		
						Site I	Site II	Site III
	Accipitridae							
1	Black Kite	*Milvus migrans*	Accipitriformes	R	LC	0.47	0.42	0.56
2	Lesser Spotted Eagle	*Clanga pomarina*	Accipitriformes	R	LC	0.35	0.27	0.34
3	Oriental honey Buzzard	*Pernis ptilorhynchus*	Accipitriformes	R	LC	0.05	0.05	0.06
4	Western Marsh Harrier	*Circus aeruginosus*	Accipitriformes	WM	LC	0.11	0.08	0.15
	Alaudidae							
5	Ashy-crowned sparrow Lark	*Eremopterix griseus*	Passeriformes	R	LC	0.22	0.08	0.41
6	Crested Lark	*Galerida cristata*	Passeriformes	R	LC	0.11	-	0.20
	Alcedinidae							
7	Lesser Pied Kingfisher	*Ceryl erudis*	Coraciiformes	R	LC	0.01	0.12	0.04
8	White-throated Kingfisher	*Halcyon smyrnensis*	Coraciiformes	R	LC	0.05	0.72	0.17
	Anatidae							
9	Bar-headed Goose	*Anser indicus*	Anseriformes	WM	LC	1.18	-	0.68
10	Common Pochard	*Aythya ferina*	Anseriformes	WM	VU	1.27	0.88	1.35
11	Eurasian Wigeon	*Mareca penelope*	Anseriformes	WM	LC	7.02	5.57	7.92
12	Ferruginous Duck	*Aythya nyroca*	Anseriformes	WM	NT	1.03	-	0.91
13	Gadwall	*Anas strepera*	Anseriformes	WM	LC	7.54	5.95	8.01
14	Greylag Goose	*Anser anser*	Anseriformes	WM	LC	1.55	1.15	1.59
15	Indian Spot billed Duck	*Anas poecilorhyncha*	Anseriformes	R	LC	3.73	0.19	3.35
16	Lesser Whistling Duck	*Dendrocygna javanica*	Anseriformes	SM	LC	0.48	0.22	0.52
17	Mallard	*Anas platyrhynchos*	Anseriformes	WM	LC	5.68	5.56	6.15
18	Northern Pintail	*Anas acuta*	Anseriformes	WM	LC	10.06	7.88	10.40
19	Northern Shoveler	*Spatula clypeata*	Anseriformes	WM	LC	10.93	11.36	-
	Anhingidae							
20	Oriental Darter	*Anhinga melanogaster*	Suliformes	R	NT	0.43	0.20	0.23
	Apodidae							
21	Little Swift	*Apus affinis*	Apodiformes	R	LC	0.60	0.62	0.49

	Ardeidae							
22	Black crowned Night Heron	*Nycticorax nycticorax*	Pelecaniformes	R	LC	-	0.09	-
23	Cattle Egret	*Bulbulcus ibis*	Pelecaniformes	R	LC	0.49	0.93	0.35
24	Eurasian Bittern	*Botaurus stellaris*	Pelecaniformes	R	LC	-	0.02	0.13
25	Great Egret	*Ardea alba*	Pelecaniformes	R	LC	0.34	0.55	0.29
26	Grey Heron	*Ardea cinerea*	Pelecaniformes	R	LC	0.12	1.10	0.02
27	Indian Pond Heron	*Ardeola grayii*	Pelecaniformes	R	LC	0.47	0.37	0.34
28	Intermediate Egret	*Ardea intermedia*	Pelecaniformes	R	LC	0.19	0.48	0.16
29	Little Egret	*Egretta garzetta*	Pelecaniformes	R	LC	0.06	0.11	0.08
30	Purple Heron	*Ardea purpurea*	Pelecaniformes	R	LC	0.08	0.61	0.04
31	Yellow Bittern	*Ixobrychus sinensis*	Pelecaniformes	R	LC	0.30	0.24	0.43
	Bucerotidae							
32	Indian Grey Hornbill	*Ocyceros birostris*	Bucerotiformes	R	LC	0.07	0.02	0.02
	Campephagidae							
33	White-bellied Minivet	*Pericrocotus erythropygius*	Passeriformes	R	LC	0.06	0.07	0.13
	Capitonidae							
34	Blue throated Barbet	*Psilopogon asiaticus*	Piciformes	R	LC	0.04	0.03	0.07
35	Brown headed Barbet	*Psilopogon zeylanicus*	Piciformes	R	LC	0.03	0.04	0.06
36	Coppersmith Barbet	*Psilopogon haemacephalus*	Piciformes	R	LC	0.06	0.05	0.08
	Charadriidae							
37	Little Ringed Plover	*Charadrius dubius*	Charadriiformes	WM	LC	-	-	0.38
38	Pacific Golden Plover	*Pluvialis fulva*	Charadriiformes	WM	LC	-	-	0.08
39	Red-wattled Lapwing	*Vanellus indicus*	Charadriiformes	R	LC	1.13	0.82	1.51
40	White tailed Lapwing	*Vanellus leucurus*	Charadriiformes	WM	LC	-	0.01	0.32
41	Yellow-wattled Lapwing	*Vanellus malabaricus*	Charadriiformes	R	LC	0.03	-	0.16
	Ciconiidae							
42	Asian Openbill	*Anastomus oscitans*	Ciconiiformes	WM	LC	0.06	0.18	0.04
43	Painted Stork	*Mycteria leucocephala*	Ciconiiformes	R	NT	0.03	0.02	0.01
	Cisticolodae							
44	Yellow-bellied Prinia	*Prinia flaviventris*	Passeriformes	R	LC	0.07	0.06	0.14
	Columbidae							
45	Indian Ring Dove (Eurasian collared Dove)	*Streptopelia decaocto*	Columbiformes	R	LC	0.52	0.44	0.58
46	Laughing Dove	*Spilopelia senegalensis*	Columbiformes	R	LC	0.17	0.11	0.17
47	Oriental Turtle Dove	*Streptopelia orientalis*	Columbiformes	R	LC	0.06	-	0.02
48	Red Colared Dove (Red Turtle Dove)	*Streptopelia tranquebarica*	Columbiformes	R	LC	0.09	0.06	0.13
49	Rock Pigeon	*Columba livia*	Columbiformes	R	LC	0.46	0.54	0.65
50	Spotted Dove	*Spilopelia chinensis*	Columbiformes	R	LC	0.21	0.15	0.16
51	Yellow-footed Green Pigeon	*Treron phoenicoptera*	Columbiformes	R	LC	0.13	0.08	0.09
	Coraciidae							
52	Indian Roller	*Coracias benghalensis*	Coraciiformes	R	LC	0.15	0.07	0.11
	Corvidae							
53	Common Raven	*Corvus corax*	Passeriformes	R	LC	0.48	0.34	0.57
54	House Crow	*Corvus splendens*	Passeriformes	R	LC	0.91	0.84	1.10
55	Indian Jungle Crow	*Corvus culminatus*	Passeriformes	R	LC	0.58	0.46	0.68
56	Rufous tree Pie (Indian treepie)	*Dendrocitta vagabunda*	Passeriformes	R	LC	0.16	0.03	0.10
	Cuculidae							
57	Asian Koel	*Eudynamys scolopaceus*	Cuculiformes	R	LC	0.11	0.13	0.15
58	Greater Coucal	*Centropus sinensis*	Cuculiformes	R	LC	0.50	0.27	0.58

	Dicruridae							
59	Ashy Drongo	*Dicrurus leucophaeus*	Passeriformes	R	LC	0.09	0.06	0.09
60	Black Drongo	*Dicrurus macrocercus*	Passeriformes	R	LC	0.17	0.14	0.25
	Estrildidae							
61	Scaly breasted Munia	*Lonchura punculata*	Passeriformes	R	LC	0.22	0.13	0.24
62	TricolouredMunia	*Lonchura malacca*	Passeriformes	R	LC	0.03	0.01	0.02
	Falconidae							
63	Peregrine Falcon (Shaheen)	*Falco peregrinus*	Falconiformes	R	LC	0.07	0.05	0.06
	Jacanidae							
64	Pheasant tailed Jacana	*Hydrophasianus chirurgus*	Charadriiformes	R	LC	0.17	0.22	-
	Laniidae							
65	Long tailed Shrike	*Lanius schach*	Passeriformes	R	LC	-	-	0.58
	Laridae							
66	Brown headed Gull	*Chroicocephalus brunnicephalus*	Charadriiformes	WM	LC	-	-	0.28
67	Black headed Gull	*Chroicocephalus ridibundus*	Charadriiformes	WM	LC	-	-	0.29
68	River Tern	*Sterna aurantia*	Charadriiformes	WM	NT	-	-	0.35
	Meropidae							
69	Green Bee eater	*Merops orientalis*	Coraciiformes	R	LC	0.05	0.05	0.08
70	Blue tailed Bee eater	*Merops philippinus*	Coraciiformes	SM	LC	0.02	-	0.03
	Monarchidae							
71	Asian Paradise Flycatcher	*Terpsiphone paradisi*	Passeriformes	SM	LC	0.05	0.05	0.03
	Motacillidae							
72	Western Yellow Wagtail	*Motacilla flava*	Passeriformes	WM	LC	0.02	0.03	0.29
73	Grey Wagtail	*Motacilla cinerea*	Passeriformes	WM	LC	0.02	0.04	0.19
74	Citrine Wagtail	*Motacilla citreola*	Passeriformes	WM	LC	0.02	0.02	0.12
75	White browed Wagtail (Large pied)	*Motacilla maderaspatensis*	Passeriformes	R	LC	0.07	0.07	0.17
76	Paddyfield Pipit	*Anthus rufulus*	Passeriformes	R	LC	0.13	0.14	0.24
77	Long billed Pipit (Brown rock)	*Anthus similis*	Passeriformes	WM	LC	0.04	0.06	0.09
78	Oriental Magpie Robin	*Copsychus saularis*	Passeriformes	R	LC	0.12	0.05	0.12
79	Indian Black Robin	*Copsychus fulicatus*	Passeriformes	R	LC	0.14	0.15	0.24
80	Bluethroat	*Luscinia svecica*	Passeriformes	R	LC	0.03	0.03	0.07
	Nectariniidae							
81	Purple Sunbird	*Cinnyris asiaticus*	Passeriformes	R	LC	0.08	0.04	0.06
	Passeridae							
82	House Sparrow	*Passer domesticus*	Passeriformes	R	LC	0.25	0.30	0.36
	Phalacrocoracidae							
83	Indian Cormorant	*Phalacrocorax fuscicollis*	Suliformes	R	LC	0.17	1.54	-
84	Great Cormorant	*Phalacrocorax carbo*	Suliformes	R	LC	0.33	1.98	-
85	Little Cormorant	*Microcarbo niger*	Suliformes	R	LC	0.13	3.44	-
	Phasianidae							
86	Black Francolin	*Francolinus francolinus*	Galliformes	R	LC	0.07	0.04	0.12
	Picidae							
87	Black rumpedFlameback	*Dinopium benghalense*	Piciformes	R	LC	0.07	0.05	0.03
	Ploceidae							
88	Baya Weaver	*Ploceus philippinus*	Passeriformes	R	LC	0.09	0.06	0.19
89	Streaked Weaver	*Ploceus manyar*	Passeriformes	R	LC	0.13	0.10	0.22
90	Black breasted Weaver	*Ploceus benghalensis*	Passeriformes	R	LC	0.10	0.07	0.17

	Podicipedidae							
91	Little Grebe	*Tachybaptus ruficollis*	Podicipediformes	R	LC	1.18	-	0.67
92	Black necked Grebe	*Podiceps nigricollis*	Podicipediformes	WM	LC	0.91	0.26	0.10
	Psittaculidae							
93	Slaty headed Parakeet	*Psittacula himalayana*	Psittaciformes	R	LC	0.17	0.11	0.15
94	Plum headed Parakeet	*Psittacula cyanocephala*	Psittaciformes	R	LC	0.13	0.24	0.16
95	Rose ringed Parakeet	*Psittacula krameri*	Psittaciformes	R	LC	0.81	0.68	0.77
96	Alexandrine Parakeet	*Psittacula eupatria*	Psittaciformes	R	NT	0.29	0.15	0.16
	Pycnonotidae							
97	Red vented Bulbul	*Pycnonotuscafer*	Passeriformes	R	LC	0.39	0.32	0.40
98	White eared Bulbul	*Pycnonotusleucotis*	Passeriformes	R	LC	0.14	0.06	0.10
	Rallidae							
99	White breasted Waterhen	*Amaurornis phoenicurus*	Gruiformes	R	LC	0.36	0.22	1.22
100	Purple Swamphen	*Porphyrio porphyrio*	Gruiformes	R	LC	1.47	2.93	1.22
101	Common Moorhen	*Gallinula chloropus*	Gruiformes	R	LC	13.36	16.45	13.83
102	Eurasian Coot	*Fulica atra*	Gruiformes	WM	LC	14.10	15.40	15.38
	Recurvirostridae							
103	Black winged Stilt	*Himantopus himantopus*	Charadriiformes	R	LC	-	-	0.96
	Rhipiduridae							
104	White throated Fantail	*Rhipidura albicollis*	Passeriformes	R	LC	0.02	0.01	0.02
105	Common Greenshank	*Tringa nebularia*	Charadriiformes	WM	LC	-	-	0.55
106	Common Sandpiper	*Actitis hypoleucos*	Charadriiformes	WM	LC	-	-	0.52
107	Marsh Sandpiper	*Tringa stagnatilis*	Charadriiformes	WM	LC	-	-	0.44
108	Spotted Redshank	*Tringa erythropus*	Charadriiformes	WM	LC	-	-	0.50
	Strigidae							
109	Indian Eagle Owl	*Bubo bengalensis*	Strigiformes	R	LC	0.01	0.01	-
110	Spotted Owl	*Strix occidentalis*	Strigiformes	R	LC	0.01	0.01	-
	Sturnidae							
111	Asian Pied Starling	*Gracupica contra*	Passeriformes	R	LC	0.12	0.06	0.15
112	Bank Myna	*Acridotheres ginginianus*	Passeriformes	R	LC	0.36	0.29	0.54
113	Common Myna	*Acridotheres tristis*	Passeriformes	R	LC	0.73	0.80	0.88
	Sylviidae							
114	Common Tailor Bird	*Orthotomus sutorius*	Passeriformes	R	LC	0.06	0.05	0.12
	Threskiornithidae							
115	Glossy Ibis	*Plegadis falcinellus*	Pelecaniformes	R	LC	0.09	0.91	0.97
116	Indian Black Ibis (Red-naped Ibis)	*Pseudibis papillosa*	Pelecaniformes	R	LC	0.16	0.50	0.49
117	Black headed ibis	*Threskiornis melanocephalus*	Pelecaniformes	R	NT	0.04	0.09	0.03
	Timaliidae							
118	Common Babbler	*Argya caudata*	Passeriformes	R	LC	0.19	0.12	0.20
119	Jungle Babbler	*Argya striata*	Passeriformes	R	LC	0.54	0.51	0.60
	Upupidae							
120	Common Hoopoe	*Upupa epops*	Bucerotiformes	R	LC	0.40	0.28	0.34
	Zosteropidae							
121	Oriental White eye (Indian white eye)	*Zosterops palpebrosus*	Passeriformes	R	LC	0.06	0.01	0.05
Status: R- Resident; WM- Winter migratory; SM- Summer migrant IUCN status: V- Vulnerable; NT- Near threatened; LC- Least concern								

As per IUCN red list (IUCN, 2020) 27 winter migratory, 3 summer migratory and 91 resident birds were observed during study, of those one species is vulnerable (*Aythya ferina*) and six near threatened species were observed (i.e. Aythya nyroca, Anhinga melanogaster, *Mycteria leucocephala*, Sterna aurantia, Psittacula eupatria, *Threskiornis melanocephalus*). (Suryakant, 2017) also reported *Mycteria leucocephala* and *Threskiornis melanocephalus* as near threatened species at Urban Wetlands of Kolhapur, Maharashtra, India. The endangered species can be conserved by studying and conserving their habitat. Most conservation plans for endangered species build on the conservation of habitats (Maleki, Baghdadi & Rahdari, 2019). There was no seasonal variation seen in the resident bird species as they were observed throughout the year at the study site, but there was a particular pattern of arrival and departure of migratory birds. The winter migrants started to appear in October when the temperature starts decreasing, elevating the diversity in winter season. Similar results were recorded by (Mukhopadhyay & Mazumdar, 2017) in Bongaon, West Bengal, India. Major variation was found in some species abundance at three different sites of the same wetland. Most of the migratory species recorded were winter visitors only following a particular pattern of arrival and departure. The maximum abundance was recorded in month of January. (Harisha & Hosetti, 2017) observed similar results at Dyamannana Lake, Karnataka, India. Maximum species richness was reported in the month of January and minimum in June at all the sites. Highest species diversity was found in the month of May and lowest in the month of October. Species Evenness was calculated highest in months May - July and lowest in October (Table 2). Several studies have shown that species richness and abundance of water birds inflates with the emerging vegetation cover in wetlands, especially during breeding periods when water birds are less mobile and more vulnerable to disturbance (VanRees-Siewert & Dinsmore, 1996; Froneman et al., 2001).

It was found that the Keshopur wetland having great vegetation diversity and is a major habitat site for waterfowl population especially during winters when winter migratory birds reside there (Table 3). However, it appears that vegetation development affects the composition of the waterfowl breeding population at any wetland (Kristin, Siewert & Dinsmore,1996). Apart from providing food for herbivorous water birds such as seeds, leaves, tubers, and rhizomes, vegetation is a crucial habitat element and significantly influences water bird habitat usage. The Keshopur wetland provides a great diversity of vegetation for fauna. Emerging plants often provide protection and decrease human interference, which occurs very often at roosting and breeding sites in artificial wetlands (Hattori & Mae, 2001). Dense vegetation often supports invertebrate habitat and food requirements, and increases the viability of eggs or diapausing invertebrates, ultimately increasing their abundance, biomass, and diversity which increases food for water birds (Anderson & Smith, 2000).

The species were not uniformly distributed at the three sites under study area as the majority of winter migratory birds were observed in flocks preferring the ponds away from the road. It was because of more dense aquatic vegetation which protects the birds from severe climatic conditions and predators. (Brandolin & Blendinger, 2015) also showed in their study that more vegetated ponds provide better shelter to avifauna for their survival. The Eurasian coot was most abundant species found at this site. An important pond variable for the habitat selection by coots was emerging vegetation, probably because it contributed in protection against aerial predators. The luxury of emerging vegetation can also diminish competition with fishes. The adverse effects of fish on waterfowl may be mitigated to some degree by the high potency of ponds and lakes (Nieoczym & Kloskowski, 2018). As the Northern Shoveler was one of the most abundant species at the Keshopur a freshwater wetland, the best supporting evidence is from the study of

Table 2: Bird community characters Richness, Diversity and Evenness at three sites of Keshopur wetland

Month	Site I			Site II			Site III		
	Richness	Diversity	Evenness	Richness	Diversity	Evenness	Richness	Diversity	Evenness
Jun-18	43.00	3.34	0.89	40.00	3.29	0.89	41	3.29	0.89
Jul-18	59.00	3.45	0.85	55.00	3.59	0.89	60	3.72	0.91
Sep-18	78.00	3.42	0.78	78.00	3.4	0.78	69	3.42	0.81
Oct-18	85.00	2.34	0.53	86.00	2.29	0.51	84	2.36	0.53
Nov-18	89.00	2.79	0.62	81.00	2.62	0.59	95	2.97	0.65
Dec-18	90.00	2.87	0.64	87.00	2.77	0.62	91	3.07	0.68
Jan-19	96.00	2.99	0.65	95.00	3.01	0.66	101	3.15	0.68
Feb-19	91.00	2.94	0.65	90.00	2.98	0.66	99	3.18	0.69
Mar-19	87.00	3.00	0.67	90.00	3.1	0.69	97	3.18	0.69
Apr-19	74.00	3.40	0.79	70.00	3.07	0.72	77	3.52	0.81
May-19	84.00	3.87	0.87	73.00	3.67	0.85	80	3.92	0.89
The data for the August month was not taken due to rainfall and excessive water logging at the study area.									

Table 3: Vegetation recorded at different sites of Keshopur Wetland

Common name	Scientific name	Site I	Site II	Site III
Trees				
Bamboo	*Bambusa bambos*	+	+	+
Banana	*Musa spp*	+	+	_
Ber	*Zizyphus jujuba*	+	_	+
Guava	*Psidium guajava*	+	+	_
Jamun	*Syzygium cumini*	+	_	+
Kher	*Acacia catechu*	+	+	+
Lebbek tree	*Albizia lebbeck*	+	_	+
Indian rosewood	*Dalbergia sisso*	+	_	+
Mulberry	*Morus alba*	+	+	+
Curry tree	*Murraya koenigii*	+	_	_
Poplar	*Populus tremula*	+	+	_
Safeda	*Eucalyptus sp.*	+	+	+
Herbs				
Red chickweed	*Anagallis arvensis*	+	+	+
Asthma plant	*Euphorbia hirta*	+	+	+
Indian shot	*Canna indica*	+	_	+
Marijuana	*Cannabis sativa*	+	+	_
Black nightshade	*Solanum nigrum*	+	+	+
Coffee senna	*Senna occidentalis*	+	+	+
False daisy	*Eclipta alba*	+	+	+
Goatweed	*Ageratum conyzoides*	+	+	+
Hairy fleabane	*Erigeron bonariensis*	+	+	+
Mustard	*Brassica nigra*	+	+	+
Onionweed	*Asphodelus tenuifolius*	+	+	+
Prickly chaff flower	*Achyranthes aspera*	+	+	+
Prickly Sow Thistle	*Sonchus asper*	+	+	+
Punarnava	*Boerhavia diffusa*	+	+	+
Sage weed	*Salvia plebeia*	+	+	+
Japanese morning glory	*Ipomoea nil*	+	+	+
Morning Glory	*Ipomoea aquatica*	_	+	_
Shrubs				
Country mallow	*Sida cordifolia*	+	+	+
White Jute	*Chorchorus capsularis*	_	+	_
Hopbush	*Dodonaea viscosa*	+	+	+
Pink morning glory	*Ipomoea carnea*	+	+	+
Rubber tree	*Calotropis procera*	+	+	+
West Indian lantana	*Lantana camara*	+	+	+
Aquatic plants				
Mexican primrose willow	*Ludwigia octovalvis*	+	_	
Hornwort	*Ceratophyllum demersum*	+	+	+
Duckweed	*Lemna major*	+	+	+
Lesser duckweed	*Lemna minor*	+	+	+
Lotus	*Nelumbo nucifera*	+	+	+
Pondweed	*Potamogeton spp*	+	+	+
Water hyacinth	*Eichhornia crassipes*	+	+	+
Water chestnut	*Trapa bispinosa*	+	+	_
Water thyme	*Hydrilla verticillata*	+	+	+
Climbers				
Rosary pea	*Abrus precatorius*	+	+	+
Tick weed	*Cleome viscosa*	+	+	+
Grasses				
Elephant grass	*Typha elephantina*	+	+	+
Munja	*Saccharum munja*	+	+	+
Nut grass	*Cyperus rotundus*	+	+	+
Scutch grass	*Cynodon dactylon*	+	+	+
Sugarcane	*Saccharum officinarum*	+	_	+
Rice	*Oryza sativa*	_	+	_
Giant Reed	*Arundo donax*	_	+	_
Chari	*Sorghum*	+	_	_
Guria Grass	*Chrysopogon fulvus*	_	_	+

(Tietje &Teer, 2015) who observed that freshwater wetlands are of higher quality than saltwater wetlands for wintering Shovelers. The flocks of Cormorants were very frequently seen in one pond only near the poplar trees residing on the vegetation protruding from the water. They were also seen utilizing poplar trees for perching in groupsand may be for nesting sites also. Previous studies concluded that the higher the nest tree height, the higher the success rate for the breeding (Park et al., 2011). Therefore, the great cormorants may have migrated to areas with higher nesting trees (Lee, Yi & Sung, 2019). Ardeids prefer places where wide areas of wetlands or long banks are located (Boisteau & Marion, 2007).The number of Pheasant tailed Jacana was noticed significantly more in lotus vegetation. Pheasant-tailed jacana is always found in reservoirs where the coverage of aquatic vegetation with wide floating leaves is comparatively high (Gunaratne, 2013).The muddy reservoir beds deliver better foraging grounds for most migratory waders, such as Plovers and Sandpipers. Such small migratory wading birds are efficiently adapted for feeding on small insects, mollusks, worms, etc. (Harrison & Worfolk, 2011; Henkanaththegedara & Amarasinghe, 2015). Black-winged Stilts use a wide range of shallow water wetlands, both for breeding and forage (Pigniczki et al., 2019). They were mostly seen in muddy areas near ponds and shallow water ponds. Northern Pintail were found more abundant at this site as compared to the other two sites. (Yamaguchi et al., 2012) observed in their study that Northern Pintails migratory stop-over sites contained more freshwater wetlands, freshwater lakes and rivers, and other agricultural lands. Shorebirds favoured small mudflats and large bulrush areas over environments with a limited area of high vegetation (Zhenming et al., 2006).

Birds use wetlands as a source of feeding, drinking water, roosting, breeding and social interactions. The richness of avifauna found in present study at Keshopur Chhamb Community Reserve is the magnificent indicator of ecological health. The current condition of its conservation has shown that Keshopur wetland reduced to about 300 acres of the thousands of acres of land at one point has been restored to about 850 acres by the efforts of forest officials Unfortunately, because of the retrieving of land for construction and cultivation, silting, grazing in wetland catchments and the growing of weeds, wetlands are steadily decreasing with less than 1% of the land remaining under them in the Punjab state, compared to an average of 6% worldwide. That needs urgent action and community engagement to protect our natural heritage (Mehta, 2014).

CONCLUSION

In summary, the habitation of various resident and migratory birds recorded in our study shows that Keshopur wetland is an important habitat for wild birds, which could use it as a feeding, breeding, stopover and wintering site. It acts as a refuge site for many water birds including wader, waterfowl and many migratory and threatened species.

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AUTHOR CONTRIBUTION STATEMENT

Both the authors made substantial contributions to the conception or design of the work. The problem was designed by Dr Nisha Vashishat. Data was taken and analyzed by Ms Shifali Jangral. Manuscript was designed by both the authors.

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