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The value of small dispersed wetland areas for bird; Case of study Basrah Province/ Iraq

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Abstract

Monitoring bird population and diversity are considered as a vital tool in ecological conservation practice. Most of bird monitoring and survey internationally and nationally (in Iraq) have been concentrated mainly on the great wetland areas such as marshes, coasts, lakes and rivers. However, a little or neglecting attention has been devoted for the small wetlands which are widely distributed around the world in general and Iraq in specific. Current study was designated to monitor the bird population and diversity in such areas. Thirty four species were recorded in three pre-chosen sites. Most of these species belong to the Charadriformes order 47% and Passeriformes order 26.5%. Highest diversity was found in the Al-Hartha site which is the closet site to East Al-Hammar marsh. While the lowest diversity was identified in Al-Dweeb site which is the most south site. Human activities were varied in types and frequency spatially and temporally. The highest disturbed area was Qarmatt-Ali (Basra University site). However, cars were the most frequent and effective disturbance component and it was evident in the Al-Dweeb site. These results shed the light on the importance of dispersed small wetlands which can support a valuable species number of birds and constitute a connective bridge between the local, regional and continental sites.

Keywards: small wetland, bird, diversity, population, human disturbance.

Declaration: Each author has participated equally in this work

Introduction

Monitoring the population, biodiversity and distribution of bird species have contributed considerably in conservation management practice by providing an essential data base **[1, 2, 3]**. Furthermore, monitoring birds is respected a valuable biological indicators which used as tool to detect any adverse changing on broad scale habitat changes, fluctuating in environmental conditions or/ and to identify the potential risk of changing on the abiotic parameters (physical and chemical) of site **[4, 5**]. Hence, survey and monitoring bird species at different spatial and temporal scales can highlight the value of certain locations and time for bird occurrence and diversity **[6]**, therefore, the determination whether a particular site is considered as vital location for bird or it just a visiting site during a certain temporal scale needs to be taken into account through establishing a network of monitoring programme which aim to shed the light on the ecological importance of different habitats at varied spatial scales **[7**]. Premature studies related to Iraqi birds had been performed during nineteenth and twentieth centuries, such as Ticehurst[**8**]. Allouse **[9, 10]** published books which considered in detail the Iraqi bird. Then, Al-Robaae [**11]** carried out an extensive bird survey included different ecological sites; desert, marshes, swamps, riverine and date-palm roves. Forty two bird species were recorded by the above mentioned study such as Little grebe *Podiceps ruficollis*, Grey heron *Ardea C. Cinerea*, White stork *Ciconia ciconia*, Flamingo *Phoenicopteruse ruber roseus*, Marbled duck *Anas angustirostris Menetries*, Wigeon *Anas Penelope*, Black kite *Milvus Linestus*, White tailed plover *Chettusia leucura*, Black headed gull *Larus ridibundus*, Common tern *Sterna hehirundo* and Red-crested pochard *Netta rufina*. Much of our current knowledge about Iraqi birds in particular after 2003 was derived from limited sources which have been performed recently. During the period from May 2004 to May 2005, fifty seven waterbirds species were detected in Huwayzah marsh, Suq Shuyukh and East-Hammar, the most common bird species through all sites were Pygmy cormorant (Phalacrocorax pygmeus), little egret (Egretta garzetta) and little egret (Egretta garzetta) & gulls respectively **[12]**. Salim **[13]**et al. (2009) mentioned that the Iraq Key Biodiversity Areas (KBA) project was accomplished and authorized by Nature Iraq organization. This project was a collaborating work with different national organizational bodies such as Iraq Ministry of Environment and Iraqi universities. In addition to the international organizations which applied a financial support for different wildlife projects in Iraq such as Canadian International Development Agency, the Italian Ministry of Environment, Land and Sea and Birdlife International. Bird was one of the most valuable components to define the Iraq KBA **[14]**. Salim **[13]** found that 34 bird species out of 159 species were classified under the conservation concern category, while, many of bird species were in healthy status. Further analysis was accomplished by Hussain [**15]** for Iraqi bird particularly in three of different habitat characteristics marshes south of Iraq. The authors calculated the highest diversity index during 2005-2006 in Non-tidal freshwater marsh (Huwaiza) which was 2.89, while, the lowest diversity was detected in Tidal mesosaline marsh (East Hammar), which was approximately 2.4. The above mentioned details were primarily focused on monitoring the main and large marsh areas; however, unfortunately, the ecological roles of the small wetlands and water body in receiving and providing many services for the wildlife in particular for birds are still underestimation. The ecological fact of species dispersion which considered as an ecological response followed by wildlife to avoid the undesirable conditions such as human disturbance and predators risk, or to search for food availability in the most adjacent areas **[16]**. Waterbirds perform this movement recurrently to locate the hot spot sites **[17]**. Thus, the network connectivity of long series of small water body and wetland areas contributes substantially in accommodating and conserving a feasible number of waterbirds. In Iraq, permanent and temporary small wetland areas are distributed over the wide areas. The great marshes which concentrate in the middle and south of Iraq especially between Tigers and Euphrates rivers constitute the foremost target for migrating waterbirds [**14,13,18**]. In addition, another wetland locates in the most south of Basra which resulted from the tidal effect of Al-Basra River in Khor-Alzubair which is counted one of the Important Birds Areas IBAs **[19**]. Nevertheless, numerous small wetland areas which extend alongside the rivers and inside the farmlands areas are play a major role in hosting the residential and migrating birds through the year. The water of these areas is principally provided by the precipitation, the groundwater and/or rivers. However, the ecological value of these areas for birds has not been estimated appropriately. The current study aimed to clarify the bird community structure and biodiversity in three sites of small wetland areas; two of them locate in North (Al-Hartha and Basra University location/ Qarmat Ali) and one in South of Basra governance/ Iraq.

Material and Methods

Study Areas

Three study sites were chosen to survey bird community structure and biodiversity from October 2015 to February 2016. The first site was Al-Hartha which locates to the north of Basra city N304.671 E047 34.779. This site characterises principally as farmland area, dominated by *Phoenix dactylifera*. In addition to *Ceratonia siliqua, Capparis spinosa, Alhagi graecorum, Ziziphus spina-christi, Rumex dentatus*. Some of the ponds locate alongside the Shatt Al Arab River, so, water are supplied by diurnal river tidal cycle, while, the rest small wetlands depend on rain or ground water. The second site was Qarmatt Ali/ Basra University location N30°33.512 E047°44.955. This site locates to the south of the first one and characterized by the occurrence inside of urbanization area (originally was farmland area) such as the university site constructions as well as new residential areas are in constructing. In general, Qarmatt Ali area is the point of the Tiger and Euphrates convergence. Inside the university, the urbanisation processes have destructed the farms vegetation covers. Six small ponds were surveyed in this site during the study period, three of them are covers with water around the year, whereas, the rest are temporal ponds which mainly depend on the rain and ground water. The most vegetation covers site are *Ceratophylum demersium*, *Cyperus mellecises, Potamogeton grespus, P. perfolatus, Tapha doutsis, Vasinaria sprlis, Pago boomnera*, *Arundo donax* and *Typha anguststa*. Al-Dweeb site is the third location, which locates south of Basra Province (N30°16.802 E 048°19.541. In general, this location is adjacent to the main road which connects between Basra city centre and Al-Faw city. The most common characteristic of this area is semi-arid area; however, there are many small dispersed ponds within it. These ponds is primarily provided water by rain during winter season, otherwise most of these ponds converted to the salts patches during summer. The most common vegetation covers are *Alhagi maurorum, Bienertia sinuspersici* and *Ceratonia siliqua.*

Birds survey

Bird survey was performed at the mid of each month throughout the study period in average of two visits for each site. Two bird count tactics were followed; point and transect count [20,21] that depends on the topographic features and the dens of plants which cover the area. The well-trained observers were performed the survey and they tried to be attentive to avoid inducing any disturbance for bird during spotting, identification and counting processes. Ten moments counting time was enough to cover each pond in all sites. Bird were located by using the binocular (Bresser 10*50) and then to identify bird species in field, telescope was used. Digital camera type Nikon D90 with magnification 350mp was used to take photo for birds. Bird identification was accomplished by using [**22]**.

Human Disturbance

In order to identify the impact of human activities on birds' count, 30 minutes observation at each visit for studying site were executed. Observations were done between 7:00 to 12:00 (local time). All human activities types and frequency were recorded. These activities were ascribed to one of distinct categories which were derived during the pilot phase of the project. A pair of binocular (Bresser 10*50) were used to assist with data collection far away from the observer point [**3**].

Statistical Analysis

Statistical Package for the Social Sciences Version 19 (SPSS V.19) was used to analyse the data. Due to the high data dispersion, Kruskal Wallis and Mann Whittney U tests were applied to find out the differences in disturbance components among the sites. Shannon Weaver diversity index *H′* and Shannon Equitability index *EH′* were calculated using the following equations **[23]**:

Shannon Weaver Diversity Index H' (bird species) = $- \Sigma S\, pi\, ln\, pi$ ……Equation 1

Where:

S = the total number of each species at each month

pi = the proportion of species in total individual numbers of all specie

ln = natural log of the proportion of each species

Shannon Equitability index *EH'* (bird species) = *H'/lnS*…….Equation 2

Where:

H'= Shannon diversity index

lnS = Natural log of species richness

Results

One thousand nine hundreds twenty eight bird individuals were recorded in all sites. Out of 34 species were recorded, 24 species were found in Al-Hartha site, 20 species in Qarmatt-Ali site and 7 species in Alseeba (table 1). These species belong to 8 orders. The most common orders were Charadriiformes and Passeriformes, which represented approximately 47% and 26.5% respectively (Figure1). The majority of Al-Hartha species belong to the Passeriformes (it was approximately 37.5) for examples *Hirundo rustica, Acrocephalus griseldis and Corvus monedula* which represented by 9 families such as Hirundinidae, Aludidae and Acrocephalidae (table 1). While, the majority of Qarmatt-Ali species belong to the Charadriiformes such as *Limosa limosa* and *Himantopus himantopus* which belong to 4 families for instances Scolopacidae, Charadriidae and Laridae (Figure 1). Interestingly, all of Al-Dweeb site species belong to the Charadriiformes, in exception one species *Egretta alba* which belong to Pelecaniformes. The most significant feature of these records was observing the Basra Reed Warbler in Al-Hartha site. This species is considered internationally endangered species that in according to the Birdlife International [**24a**].

Table 1: The presence (+) and absence (-) of bird species in the study sites during autumn and winter 2015/2016.

Common Name	Scientific Name	Site			Order (Family)
		Al-Hartha	Qarmatt-Ali	Al-Dweeb	
Black-tailed Godwit	*Limosa limosa*	−	+	+	Charadriiformes (Scolopacidae)
Black-winged stilt	*Himantopus himantopus*	+	+	+	Charadriiformes (Recurvirostridae)
Barn Swallow	*Hirundo rustica*	+	−	−	Passeriformes (Hirundinidae)
Bar-tailed Lark	*Ammomanes cinctura*	+	−	−	Passeriformes (Aludidae)
Basra Reed Warbler	*Acrocephalus griseldis*	+	−	−	Passeriformes (Acrocephalidae)
Eurasian Collard Dove	*Streptopelia decoacto*	+	+	−	Columbiformes (Columbidae)
Eurasian Buzzard	*Buteo buteo*	+	−	+	Accipitriformes (Accipitridae)
Common Gull	*Larus canus*	+	−	−	Charadriiformes (Laridae)
Common Kingfisher	*Alcedo atthis*	+	+	−	Coraciiformes (Alcedinidae)
Graceful prinia	*Prinia gacilis*	+	−	−	Passeriformes (Cisticolidae)
Great Crested Grebe	*Podicepes cristaus*	−	+	−	Podicipediformes (Podicipedidae)
Great white Egret	*Egretta alba*	+	+	+	Pelecaniformes (Ardeidae)
Greenshank	*Tringa nebularia*	−	+	−	Charadriiformes (Scolopacidae)
Gull-billed Tern	*Gelochelidon nilotica*	+	+	+	Charadriiformes (Laridae)
Jackdaw	*Corvus monedula*	+	−	−	Passeriformes (Corvidea)
Jack snipe	*Lymnocryptes minimus*	+	−	+	Charadriiformes (Scolopacidae)
Kentish Plover	*Charadrius alexandrines*	−	+	+	Charadriiformes (Charadriidae)
Little Grebe	*Tachbaptuse ruficollis*	+	+	−	Podicipediformes (Podicipedidae)
Marsh Sandpiper	*Tringa stagnatilis*	−	+	+	Charadriiformes (Scolopacidae)
Moorhen	*Gallinulue chlorapus*	+	−	−	Gruiformes (Rallidae)
Pied Kingfisher	*Cerysle rudi*	−	+	−	Coraciiformes (Alcedinidae)
Eurasian Reed Bunting	*Emberiza schoeniclus*	+	−	−	Passeriformes (Emberizidae)
Red-wattled Lapwing	*Vanellus indicus*	−	+	−	Charadriiformes (Charadriidae)
Ringed Plover	*Charadris hiaticula*	−	+	−	Charadriiformes (Charadriidae)
Sandwich Tern	*Sterna sandvicensis*	+	+	−	Charadriiformes (Laridae)

Spotted Redshank	*Tringa erythropus*	–	+	–	Charadriiformes (Scolopacidae)
Tree Pipit	*Anthus trivialis*	+	+	–	Passeriformes (Motacillidae)
Tree Sparrow	*Passer montanus*	+	+	–	Passeriformes (Passeridae)
Ruddy Turnstone	*Arenaria interpris*	+	–	–	Charadriiformes (Scolopacidae)
White-breasted Kingfisher	*Halcyon smyrnersis*	+	–	–	Coraciiformes (Alcedinidae)
White-cheeked Tern	*Sterna repressa*	+	–	–	Charadriiformes (Sternidae)
White Tailed lapwing	*Vanellus leucura*	–	+	–	Charadriiformes (Charadriidae)
White Wagtail	*Motocilla alba*	+	–	–	Passeriformes (Motacillidae)
Yellow-legged Gull	*Larus cachinnanse*	+	+	+	Charadriiformes (Laridae)
Total species number	34	24	20	8	1928
Total No.		579	1023	326	

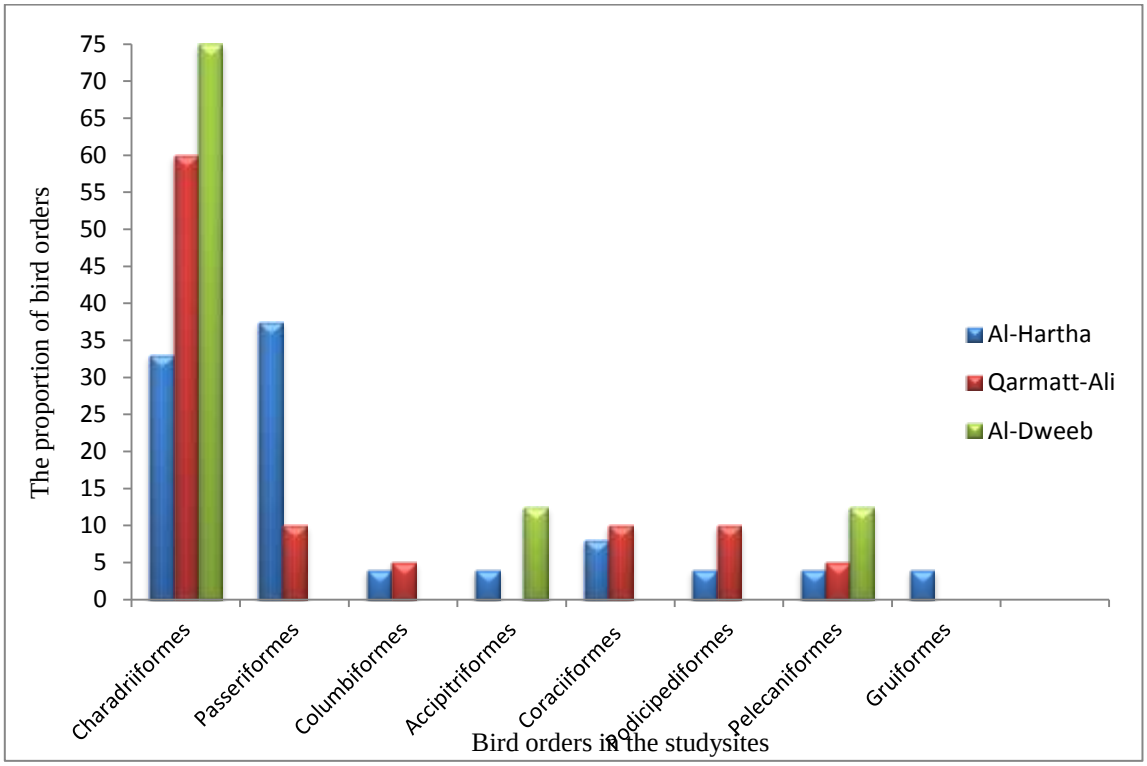

Figure (1) the distribution of bird orders in the three study sites.

Table (2) Fluctuation of Shannon diversity index through the period between October 2015 and February 2016.

Month	site					
	Qarmat-Ali		Al-Hartha		Al-Dweeb	
	H	E_H	H	E_H	H	E_H
October	0.645	0.47	1.03	0.43	0.6	0.43
November	0.7	0.3	1.09	0.45	0.62	0.45
December	0.73	0.4	1.6	0.6	0.65	0.34
January	0.8	0.6	1.75	0.97	0.6	0.4
February	0.78	0.4	1.6	0.8	0.57	0.4

Bird diversity fluctuation during the winter 2015/2016 is shown in table (2). It is explicit that the highest diversity was found in Al-Hartha site along the winter months, while the lowest index was recorded in Al-Dweeb site. It is apparent that the maximum diversity value in Al-Hartha was in January 2016 which reached roughly 1.75, whereas, the minimum value was in October 2015 was about 1.03. Similarly, the highest and lowest bird diversity indices in Qarmatt-Ali site were calculated in January and October 0.8 and 0.65 respectively. A little difference was identified in Al-Dweeb site; the highest Shannon index was 0.57 in February 2016 while, the highest value was 0.65 in December 2015. The human activities during the study period were varied among the sites (Table 3). Walkers were the most common activity in Al-Hartha site which ranging between 9-51 walkers with median 22, in addition to the farm animals look like cow (9 (3-9)) and horses (2 (1-5)). While, few number of cars were recorded in this site. In contrast to the previous figure of disturbance, both Qarmatt-Ali and Al-Dweeb were characterized by dominating of cars in particular in the most south site (Al-Dweeb) which was 30 (22-47). Walking as well was noticeable in the Qarmatt-Ali area (table 3). The disturbance activities varied significantly between the sites $H= 8.211$, $P\leq 0.016$ (Figure 3). Pair-wise comparisons using Mann Whitney U test revealed that both disturbance activities in both Al-Hartha and Qarmatt-Ali were more than Al-Dweeb site $U= 231.000$, $P \leq 0.0004$ and $U= 275.5$, $P \leq 0.028$ (Figure 3). Walking was the most frequent figure of disturbance was recorded around the study time specially in October 2015, it was 23 (2-31), this activity followed by cars which was noticeable activity during December 2015, 47 (0-63) (Table 3). In contrast to the site variation, these activities did not change considerably among the months (Figure 4).

Table (3): Human disturbance activities which were recorded during the period from October 2015/ February 2016

Disturbance Type	Site Median (minimum - maximum)			Month Median (minimum - maximum)				
	Al-Hartha	Qarmatt-Ali	Al-Dweeb	October	November	December	January	February
Bike	0 (0-5)	6 (3-18)	0 (0-1)	5 (1-6)	2 (0-18)	1 (0-5)	0 (0-3)	0 (0-6)
Cars	2 (0-5)	18 (13-63)	30 (22-47)	17 (5-38)	13 (2-29)	47 (0-63)	18 (0-22)	18 (2-30)
Cows	9 (3-9)	2 (0-4)	0 (0-0)	0 (0-7)	3 (0-9)	1 (0-9)	4 (0-9)	2 (0-3)
Horses	2 (1-5)	0 (0-1)	0 (0-2)	2 (0-5)	0 (0-4)	0 (0-2)	0 (0-2)	1 (0-1)
Tractors	1 (1-5)	0 (0-0)	0 (0-0)	0 (0-2)	0 (0-5)	0 (0-1)	0 (0-1)	0 (0-1)
Walkers	22 (9-51)	31 (7-51)	0 (0-2)	23 (2-31)	22 (0-47)	9 (0-51)	16 (1-51)	7 (0-18)

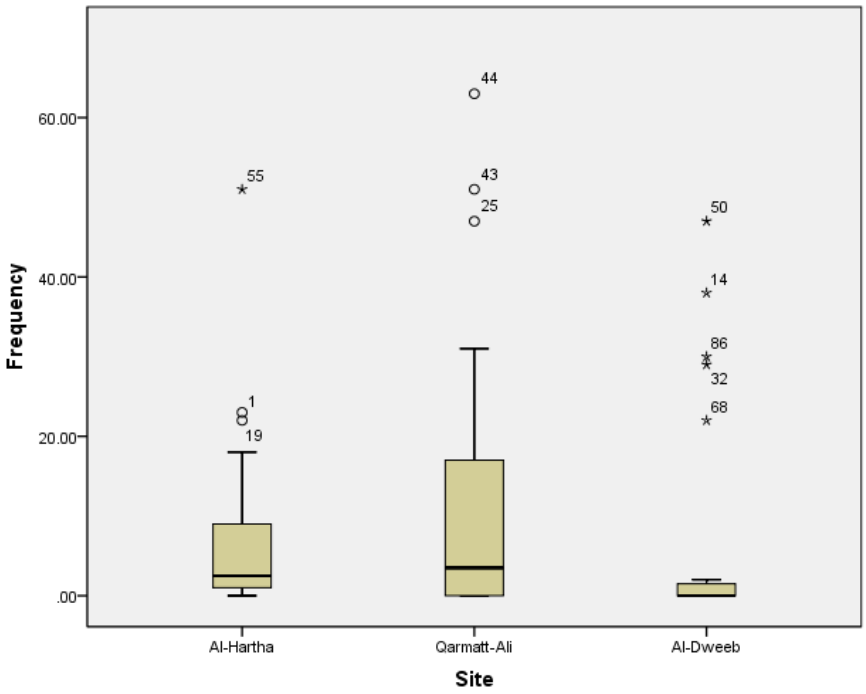

Figure (2) Disturbance activities through the studying areas

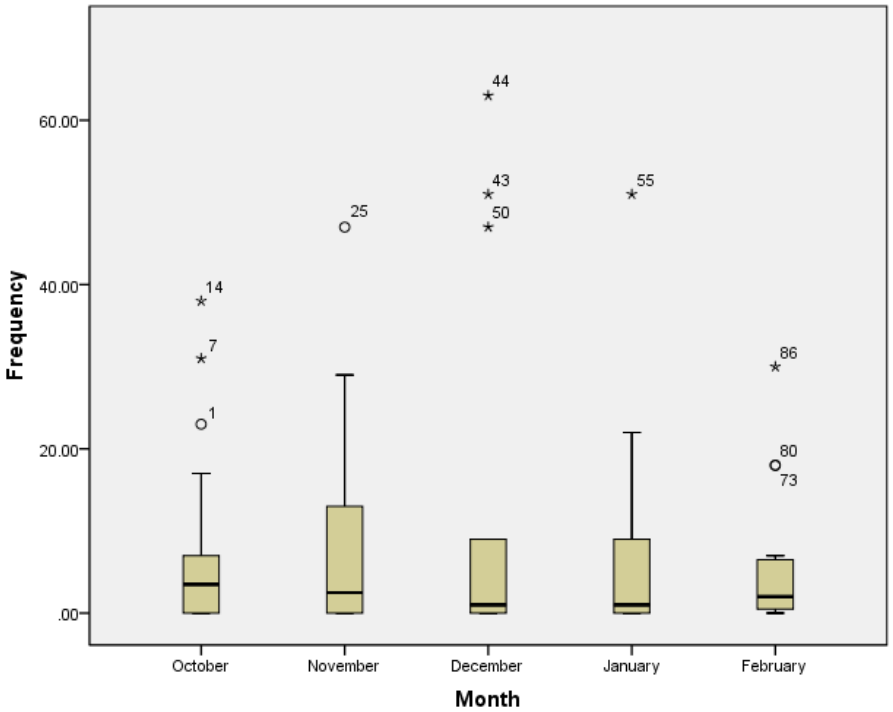

Figure (3) Disturbance activities throughout the study period from October 2015 to February 2016

Discussion

Thirty four species were recorded in three sites by monitoring small and limited wetland areas in five months. This number of species represents approximately 8% of the total documented species number in Iraq which

reached to 412 species [25]. Two of these species are listed under different protection categories such as Basra Reed Warbler which is deemed as endangered species and Black-Tailed Godwit *Limosa limosa* is categorised as globally near threatened species [**26]**. It is clear from the results that the Charadriformes order was the most frequent taxon among all sites except in the Al-Hartha site which dominated by Passeriformes order. The assume reason for this dominance form of distribution is the availability of the ecological requirements for species which are represented by the availability of water and food. Charadriformes members select ponds, lakes or any type of wetland areas which are rich with fishes and benthic invertebrates that are regarded as most desirable food for most of this order members, in addition, this kind of habitats is often abundant with some of plant species that can provide a hidden location from the predators and suitable resting spaces for bird **[27]**. While, the abundant of Passeriformes species in Al-Hartha site can be attributed to the availability of vegetation covers which afford the seeds as food resource and nesting locations [**28]**. Biodiversity indices through all sites and months indicated plainly that Al-Hartha site hosted the highest and mostly equal distribution number of individuals among the species. In contrast, the lowest bird diversity was found in Al-Dweeb site. Shannon Weaver index for Al- Hartha was 1.75 with evenness about 0.95 which is closed to the highest value of this index value, whereas, the highest value of diversity in Al-Dweeb was 0.65 and evenness roughly 0.3. That can be interpreted by the geographical location of this site. Al-Hartha locates to the south of marshes area in particular to the East Al-Hammar marshes while, Al-Dweeb is far south of marshes area and the studying areas were located alongside the main road that connects the city centre with al-Faw city. Hence, current results came in line with previous study which showed that bird diversity value was 2.43 with evenness that ranged from 0.6 to 0.8 in East Al-Hammar [**15]**. Another possible justification that Al-Hartha is farmland area which occupied by a wide range of economic vegetation cover as well as the presence of small ponds which locates alongside the Al-Hartha River and others disperse over the area which obviously provides another habitat for waterbird. This mosaic of habitats support and attract a wide extent of bird species **[29]**. One more interpretation that the level of effective human activities such as the cars which increased gradually from the north (Al-Hartha) to the south (Al-Dweeb) (table 3).

Qarmatt-Ali site was the most disturbance area among the rest of sites because this site is inside the University of Basra campus and the survey period was in concurrent with the University time table activities, however, the survey time was preferred to be during the weekend to moderate the effect of disturbance. Despite, the disturbance number in Al-Dweeb site was the fewest location variation, the location of water areas close to the main road which facilitates the adverse effect of the number of cars which passed on road that induced a great effect on bird species diversity and individual numbers. The current findings well match with previous studies about the influence of disturbance on bird distribution and diversity **[30]**. Hubbard and Dugan **[31]** and Lafferty et al., [**32]** mentioned distinctly the role of human disturbance on decreasing the bird diversity by changing bird distribution. This effect might be more evident when the limited space is available for human and wildlife, in this case interaction would increase significantly and the intensification of competition between the bird species will increase in parallel **[33**]. In this study which is considered a first effort to evaluate the importance of small wetland habitats in South of Iraq with caution should be given in extrapolating the results, however, it highlighted a vital point in habitat management and biological conservation. This point is related to the dispersion of both niches habitat and birds. Morris [**34]** underlined the correlation between the dispersal phenomena of waterbirds and the connectivity of landscapes. It is essentially to realize and understand carefully the process of this correlation **[35]**. In simple explanation, the connectivity of dispersed habitats in local, regional or even continental scale increase the opportunity of locating the appropriate habitat which provides the standard levels of ecological requirements for wildlife in general and bird in specific. In other words, the connectivity of dispersed habitat will increased the biological connectivity possibilities. Therefore, the current results raise the importance of maintain the dispersal small wetlands for both waterbirds and other bird taxa. The diversity of topics covered in this special section provides an overview of the benefits we expect to obtain from treating habitat ecology as interplay between habitat choices and consequences. This approach promises to improve our understanding of the process of habitat selection and how it affects population distribution, abundance, and dynamics. Approaching habitat ecology in this way will encourage us to identify the times of year when habitat choices are made, the information that is available to birds and used at that time, and the individual fitness and population consequences of those choices.

Conclusion

One of the most significant point to emerge from this study that, although the limited spatial scale of all included sites in this study, there were a remarkable number of species were recorded. That might draw the attention for two important ideas; first, the small wetland areas may constitute vital locations for bird as ecological niches and simultaneously, observing the connectivity among them give an adequate knowledge about the birds dispersion from the main aggregation sites in marshes area to inside the city. Second, these small sites might be alternative sites which bird can use when undergo from sever human disturbance at their mother sites.

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