

MARSH BULLETIN

**Assessment of the diversity of wading birds and shorebirds in East Hammar marsh – Basrah / Iraq**

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ABSTRACT

This study aim to evaluate wading birds and shorebirds diversity in the East Hammar marsh from November 2017 to November 2018. Twenty-seven species belonging four families for shorebirds and one family for wading birds were recorded in study area. A highest relative abundance 15.88% was recorded in November 2018, while the lowest 1.63% was recorded in July 2018. Simpson diversity index 0.79, whereas Shannon-Weiner index was 1.91. Richness index was reached 2.01, while an evenness index was 0.77. Dominance index recorded a high value in November 2018, due to dominance of *Egretta garzetta* . The assemblage of wading birds and shorebirds at East Hammar marsh was moderate, whereas showed disturbed and semi-balanced assemblage in terms of the richness and evenness respectively.

**Keywords:**

**Introduction**

Birds are highly mobile animals and spread around the world, because their morphological and structural adaptations features. Some bird species are residence in certain area during breeding period to produce generation successfully, while others migrate for long distances of thousands of miles in certain seasons then return to their original home for breeding (Newton, 2008).

It was recognized that the waterbirds are highly dependent on wetland habitat

nature (Zakaria and Rajpar, 2013). Wetlands support a high diversity of resident and migrant waterbirds (Amezaga *et al.*, 2002). They exhibit wide variation due to differences in soil, terrain, climate, water regime, water chemistry, vegetation and other factors. They include swamps, bogs, marshes and other similar areas (O' Neal, 2008).

One of the basic benefit of wetlands is providing suitable habitat for plants and animals that live primarily in these regions. For example, migratory birds are considered the main users of

wetlands for foraging, resting, and roosting sites (Zhijun *et al.*, 2010). Iraq wetlands are one of the largest wetlands in the Middle East and south- west Asia. These habitats include many permanent and seasonal marshes such as Al-Hammar marsh, Huwizeh marsh, central marshes, Al- Dulmaj marsh, Al- Auda marsh and others. The Iraqi marshlands are more significant wetland for wildlife in the Middle East and they are considered as important birds area IBA (Evans, 1994; Scott, 1995; Birdlife international, 2010; Salim and Porter, 2015).

Iraqi southern marshes are considered important area for endemic birds such as Basra Reed Warbler *Acrocephalus griseldis*, Iraqi Babbler *Turdoides altirostris* and subspecies Mesopotamian Crow *Corvus cornix capellanus* (ICBP, 1992; Salim and Porter, 2015). The marshlands of lower part Mesopotamia are one of the most important wintering areas for migratory birds in western Eurasia ( Scott, 1995 ).This importance comes from geographical location, which lies on the main migration routes from Siberia to south Africa ( Al – Robaee, 2006). Based on the criteria that established by RAMSAR convention, many wetland sites in Mesopotamia have been included in the list of wetlands of global importance as important habitats for birds ( Carp, 1980). The southern marshes of Iraq were recently considered within UNESCO world heritage list. Previous studies that recorded several birds species of wading birds and shorebirds in East Hammar marsh were limited after restoration in 2003. Abed (2007) survey the three

restored Iraqi southern marshes and recorded 26 species, fourteen of them were in East Hammar marsh. Similarly, Habeeb (2008) recorded 35 species in the same marsh. Finally, Habeeb (2014) recorded 20 species of shorebirds at the muddy littoral zone of East Hammer marsh.

One of the some weakness points of previous studies are the time limitation of sample collection, confined to certain time of the year, and mostly coincides with winter migration. Secondly, availability a proper instruments that used in observation of birds such as accurate camera, specific binocular and spot scope. Thirdly, the lack of training and finally the missing of guidance.

At the population level, there is no clear database about the size of population of birds in the marshes to monitor changes in biodiversity and population trends during previous years.

### **Aim of study**

The purpose of the study is the assessment of bird species diversity, richness, evenness, dominance and relative abundance in East Hammar marsh.

### **Materials and Methods**

#### **Study area**

Al- Hammar marsh is located in the south of Euphrates river and extend from the westward of Nasiriyah city to the outskirts of eastern of Basrah city ( Evans, 1994). The area of Al- Hammar marsh covers 2,500 km<sup>2</sup> of the permanent marshes and extends to more than 4,500 km<sup>2</sup> during the spring and temporary flooding period ( Iraq foundation, 2003). Al- Hammar marsh

is one of the largest southern marshes, with 120 km in length and approximately 25 km in width ( Scott, 1995 ). This marsh divided into two parts; western and eastern. The western part is supplied from Euphrates tributaries, while the eastern part is mainly supplemented with water from Shatt al- Arab and partly by Euphrates river. Thus, the east of Al- Hammar marsh is described as an exposed marsh to the semidiurnal tide of the Arabian Gulf through the Shatt al- Arab as a huge tidal mass water that enters to the Shatt al- Arab as well as groundwater sources ( Hussain and Taher, 2007).

The high and low tide has greatly effect on the basic characteristics of marsh water. The large water mass of the Shatt al- Arab enters to the marshes during the high tidal period leading to an increase in water level. It may spill over the side banks covering large areas of land, especially during the spring tide (Khalef, 2016).

Three stations were chosen for performing the wading birds and shorebirds survey in east- Hammar marsh (figure 1). First station was Hareer (N: 30° 35' 59"; E: 47° 41' 19"). It represents the entrance of the marsh. It is characterized by the emergence of large mudflats during the ebbing period on the eastern and western banks, which considered an area of attraction for many waterbird species. This area is under influence of many human activities mainly fishing.

The second station was Al- Salal ( N: 30° 38' 12.2" ; E: 47° 39' 35.9" ) characterized by the muddy bank during low water level, thus become an area of

attraction for the wading birds that using this bank. This area presents facilities to various human activities, especially fishing activities fodder cutting, as well as buffalo grazing.

The third station was Al- Burgah (N: 30° 41' 27.6"; E: 47° 34' 25.9"). It is an area with open water. At low tide, the area appears to be large mudflats with main waterways and other narrow channels. This region is respected as the most attractive site for bird species. In addition, it provides a valuable location for diverse human activities, such as fodder cutting, fishing activities as well as birds hunting by shotguns and buffalo grazing.

### **Birds survey**

The survey was conducted from November 2017 to November 2018. Birds survey was performed during the peak of bird activity from 7 am to 1 pm. The survey was carried out under appropriate climatic conditions, (no survey was made on rainy or windy days ) so that the birds activity was directly affected by bad climatic conditions reducing the ability of seeing or hearing birds during the counting time that may leads to lower the efficiency and reliability of collecting data ( Johannesdottir, 2013 ). Birds survey was carried out during the low tide due to the mudflats is appearance. According to Bibby *et al.*, (2000) and Sutherland *et al.*, (2004) two bird count strategies were used ; line transect and point transect ( point count ) choice one of these methods depends on focal species and habitat. The line transect was used in Hareer and Al- Salal stations, while the point transect was used in Al- Burgah station according to the nature and topographic of this area. One visit per month for all stations was accomplished. During the survey work, we used boat in

wetland area. Birds watching used binocular Opticron 8 x 42 and a professional camera Canon EOS 7D with sigma lens 50-500 mm were used for bird detection and identification. Birds were identified and classified depending on field guide (Porter *et al.*, 1996).

### Data analysis

To assess the wading birds and shorebirds assemblage, we applied relative abundance and ecological indices to analyze the composition of communities of these organisms. The relative abundance ( Ra ) refers to the percentage of one species in relation to the total number of different species in a specific community, formula [  $Ra\% = n_i / N * 100$  ], the diversity indices were calculated by using the Shannon -

Weiner index explain in formula [  $H' = - \sum p_i \ln p_i$  ] and Simpson's index formula [  $D = 1 / \sum (p_i)^2$  ] and richness were estimated by using the Margalef's index formula [  $S = S-1 / \ln N$  ] for evenness we used, the Pielou evenness index indicated in formula [  $J = H' / \ln S$  ] and dominance index (Berger and Parker index ) using formula [  $d = N_{max} / N$  ] ( Magurran, 2004 ; Krebs, 2014 ) . Diversity indices were determined by using the PAST program (Paleontological statistics software package for education and data analysis) statistical software (v. 3.22). Statistical analysis using SPSS (V.21) software was used. One - way ANOVA was applied to test whether the abundance and number of species (species richness) among the stations.

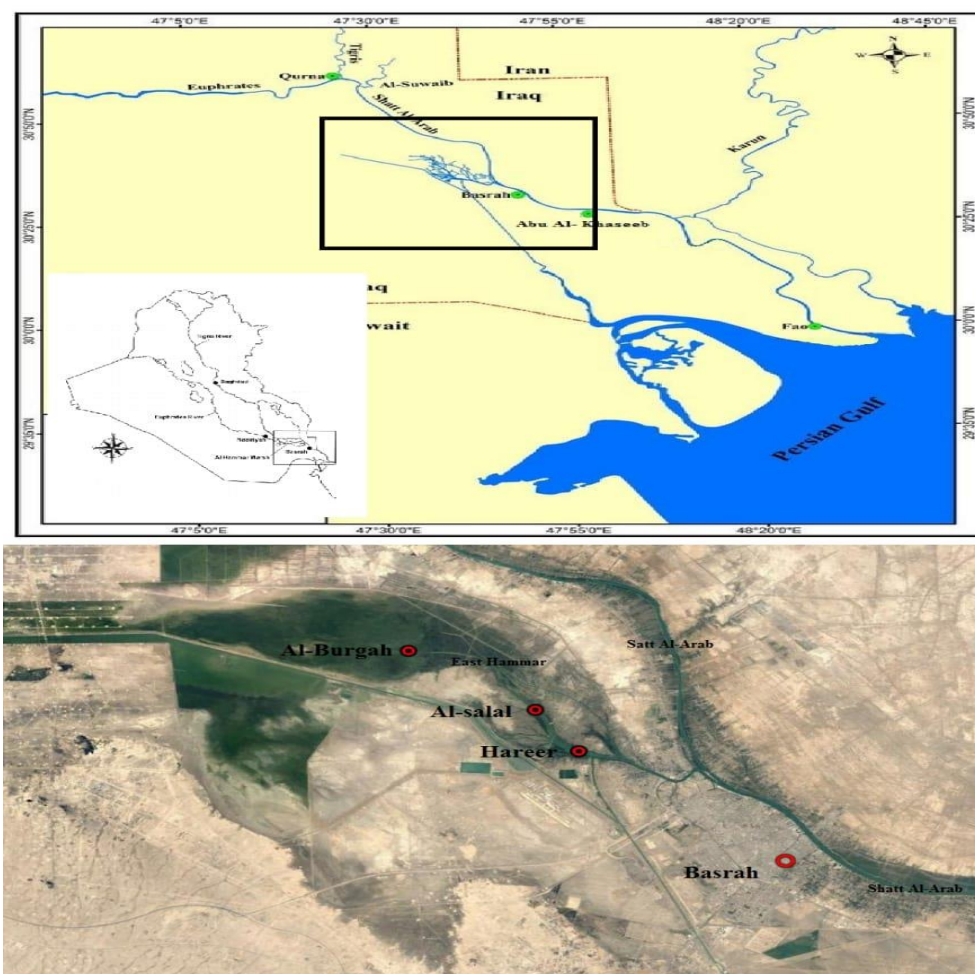


Fig. (1) Map of the study sites

## Results

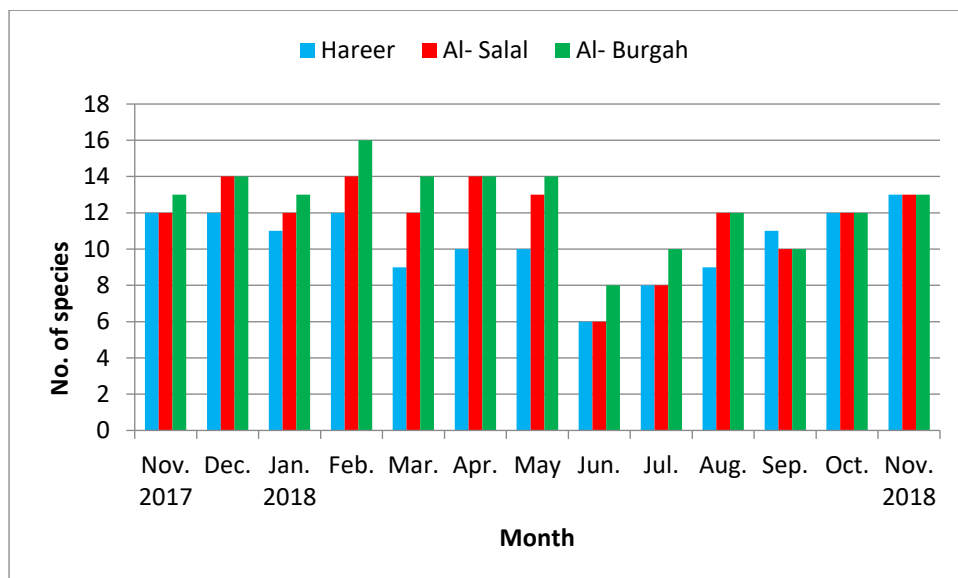
A total of 19 species of shorebirds belonging to 11 genera and four families have been recorded in East Hammar marsh and eight species under six genera within one family have been recorded in the same area, these species are to (16, 21, 24) in Hareer, Al- salal and Al-Burgah respectively ( Table 1 ).

Table ( 1 ). Occurrence of wading birds and shorebirds in East Hammar marsh sites during monitoring period.

Order	Family	Common name	Scientific name	Hareer	Salal	Al-Burgah
Charadriiformes	Charadriidae	White-tailed Lapwing	<i>Chettusia leucura</i>	+	+	+
		Red-wattled Lapwing	<i>Vanellus indicus</i>	+	+	+
		Spur-winged Lapwing	<i>V. spinosus</i>	-	+	-
		Kentish plover	<i>Charadrius alexandrinus</i>	+	+	+
		Ringed Plover	<i>C. hiaticula</i>	-	+	+
		Little Ringed Plover	<i>C. dubius</i>	+	+	+
	Scolopasidae	Common Redshank	<i>Tringa totanus</i>	+	+	+
		Common Greenshank	<i>T. nebularia</i>	+	+	+
		Marsh Sandpiper	<i>T. stagnatilis</i>	-	-	+
		Wood Sandpiper	<i>T. glareola</i>	-	-	+
		Common Sandpiper	<i>Actitis hypoleucos</i>	+	+	+
		Curlew Sandpiper	<i>Calidris ferruginea</i>	-	+	-
		Dunlin	<i>C. alpina</i>	+	+	+
		Little Stint	<i>C. minuta</i>	+	+	+
		Ruddy Turnstone	<i>Arenaria interpres</i>	-	-	+
		Common Snipe	<i>Gallinago gallinago</i>	+	+	+
		Ruff	<i>Philomachus pugnax</i>	-	+	+
	Recurvirostridae	Black-winged Stilt	<i>Himantopus himantopus</i>	+	+	+
	Glareolidae	Collared Pratincole	<i>Glareola pratincola</i>	+	+	+
Ciconiiformes	Ardeidae	Purple Heron	<i>Ardea purpurea</i>	-	+	+
		Grey Heron	<i>A. cinerea</i>	-	-	+
		Western Great Egret	<i>A. alba</i>	-	-	+
		Little Egret	<i>Egretta garzetta</i>	+	+	+
		Squacco Heron	<i>Ardeola ralloides</i>	+	+	+
		Little Bittern	<i>Ixobrychus minutus</i>	+	+	+
		Western Cattle Egret	<i>Bubulcus ibis</i>	-	+	+
		Night Heron	<i>Nycticorax nycticorax</i>	+	-	-

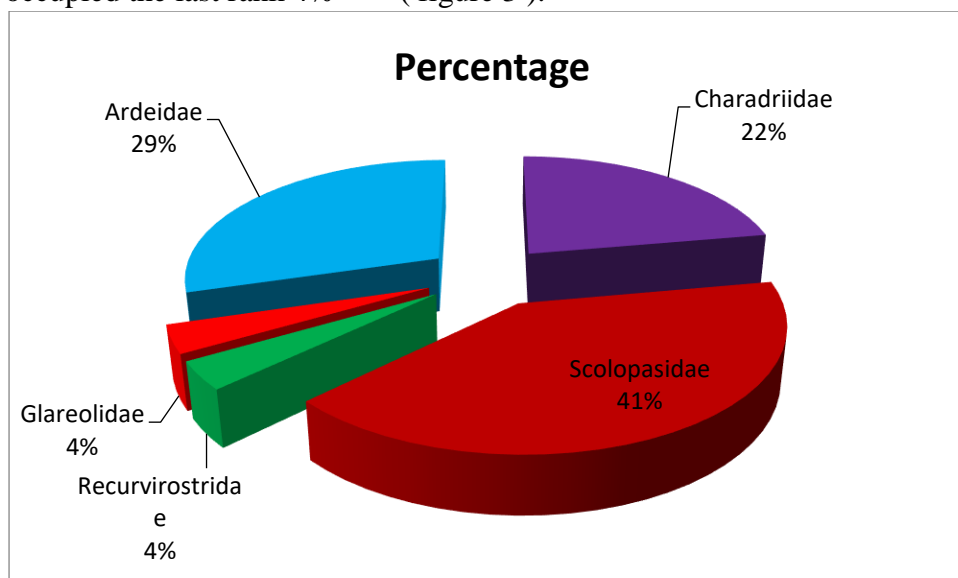
+ Recorded - Not recorded

The results of current study showed the number of species that recorded in East Hammar marsh. Interestingly, the highest number of species 16 recorded in February 2018 in Al- Burgah, whereas lowest number of species was six which recorded in June 2018 in Hareer and Al- Salal ( figure 2 ).



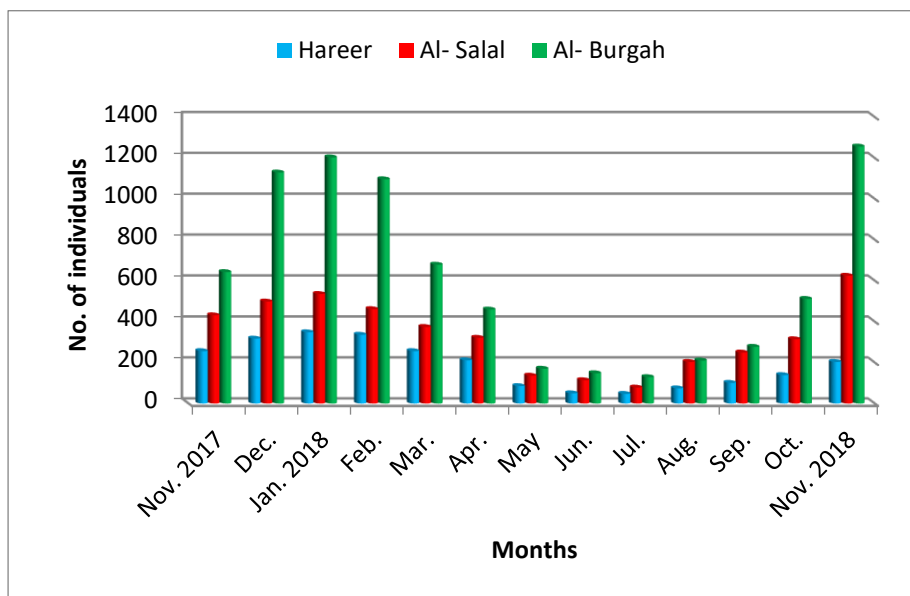
**Fig.( 2 ) : Number of species recorded in East Hammar marsh.**

A percentage of wading birds and shorebirds species in each family in East Hammar marsh, Scolopasidae family occupied first rank 41% , while Recurverostridae and Glareolidae families occupied the last rank 4% ( figure 3 ).



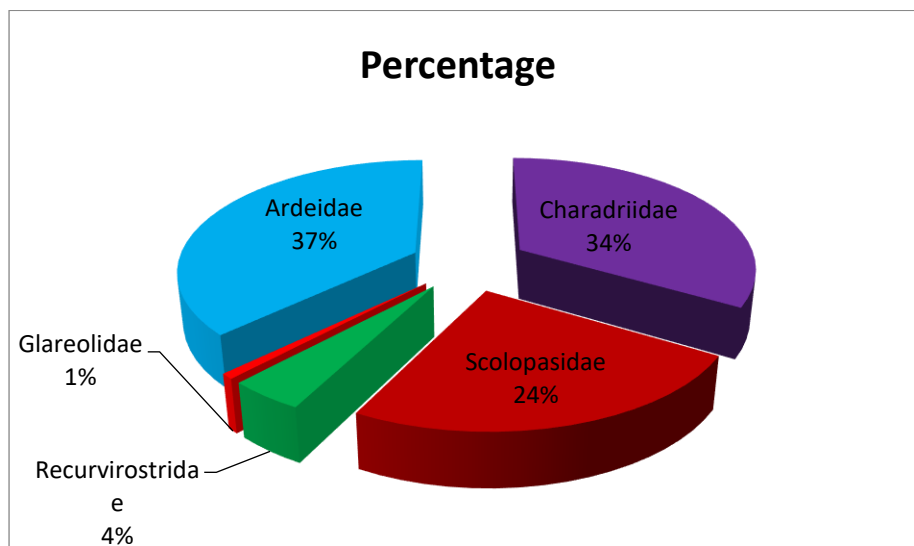
**Fig.( 3 ) : Wading birds and shorebirds as percentage of species in each family in East Hammar marsh.**

The number of individuals in present study showed the highest number 1256 of birds in November 2018 in Al- Burgah while, the lowest number 47 of birds was found in July 2018 in Hareer (Figure 4). A total number of individuals were recorded in all stations in East Hammar during the monitoring period were 14669 birds.



**Fig. ( 4 ) : Number of individuals recorded in East Hammar marsh.**

A percentage of individuals in current survey including, Ardeidae family occupied the first rank 37% while, the Glareolidae family occupied the last rank 1% (figure 5).



**Fig. ( 5 ) : Wading birds and shorebirds as percentage of individuals in each family in East Hammar marsh.**

The relative abundance percentage were recorded in each stations (Table 2). *C. alexandrinus* species recorded a highest relative abundance in Hareer that reached to 20.22%, while *C. hiaticula* species recorded a lowest relative abundance that reached to 0.12%. In Al- Salal *A. ralloides* species recorded the high relative abundance which was 30.03%, but the *V. spinosus* species recorded low relative abundance that reached to 0.02%. Finally, the highest relative abundance was for *E. garzetta* species in Al- Burgah site, which reached to 29.23%, while the *E. alba* species was found in the lowest percent of relative abundance that reached to 0.01%.

**Table ( 2 ) : Relative abundance percentage of all species recorded in monitoring period.**

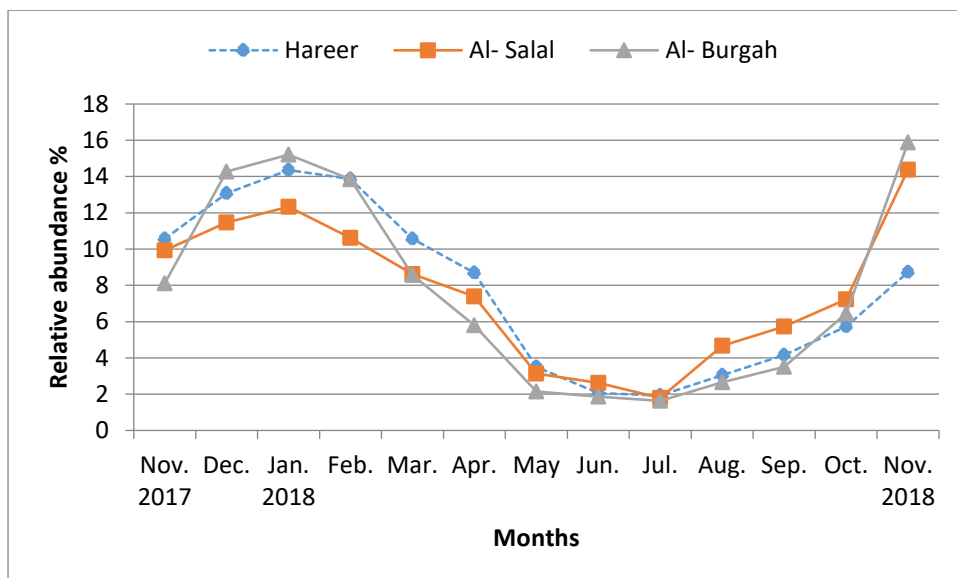
Common name	Scientific name	Hareer	Al- Salal	Al- Burgah
White-tailed Lapwing	<i>Chettusia leucura</i>	10.19 %	17.38 %	13.82 %
Red-wattled Lapwing	<i>Vanellus indicus</i>	3.79 %	2.83 %	1.27 %
Spur-winged Lapwing	<i>V. spinosus</i>	-	0.02 %*	-
Kentish plover	<i>Charadrius alexandrinus</i>	20.22 %**	12.84 %	14.37 %
Ringed Plover	<i>C. hiaticula</i>	0.12 %*	0.73 %	0.32 %
Little Ringed Plover	<i>C. dubius</i>	0.78 %	1.10 %	2.27 %
Common Redshank	<i>Tringa totanus</i>	4.08 %	3.31 %	3.14 %
Common Greenshank	<i>T. nebularia</i>	7.59 %	5.53 %	5.41 %
Marsh Sandpiper	<i>T. stagnatilis</i>	-	-	0.08 %
Wood Sandpiper	<i>T. glareola</i>	-	-	0.16 %
Common Sandpiper	<i>Actitis hypoleucos</i>	0.61 %	0.64 %	0.21 %
Curlew Sandpiper	<i>Calidris ferruginea</i>	-	0.06 %	-
Dunlin	<i>C. alpina</i>	8.37 %	4.56 %	4.75 %
Little Stint	<i>C. minuta</i>	4.58 %	3.61 %	7.15 %
Ruddy Turnstone	<i>Arenaria interpres</i>	-	-	0.11 %
Common Snipe	<i>Gallinago gallinago</i>	0.53 %	1.63 %	3.90 %
Ruff	<i>Philomachus pugnax</i>	-	0.13 %	1.40 %
Black-winged Stilt	<i>Himantopus himantopus</i>	3.79 %	6.40 %	3.43 %
Collared Pratincole	<i>Glareola praticola</i>	0.82 %	1.17 %	0.55 %
Purple Heron	<i>Ardea purpurea</i>	-	0.06 %	0.02 %
Grey Heron	<i>A. cinerea</i>	-	-	0.02 %
Western Great Egret	<i>A. alba</i>	-	-	0.01 %*
Little Egret	<i>Egretta garzetta</i>	20.18 %	30.03 %**	29.23 %**
Squacco Heron	<i>Ardeola ralloides</i>	11.72 %	7.49 %	7.58 %
Little Bittern	<i>Ixobrychus minutus</i>	0.20 %	0.27 %	0.40 %
Western Cattle Egret	<i>Bulbucus ibis</i>		0.09 %	0.21 %
Night Heron	<i>Nycticorax nycticorax</i>	2.35 %	-	-

\* Low

\*\* High

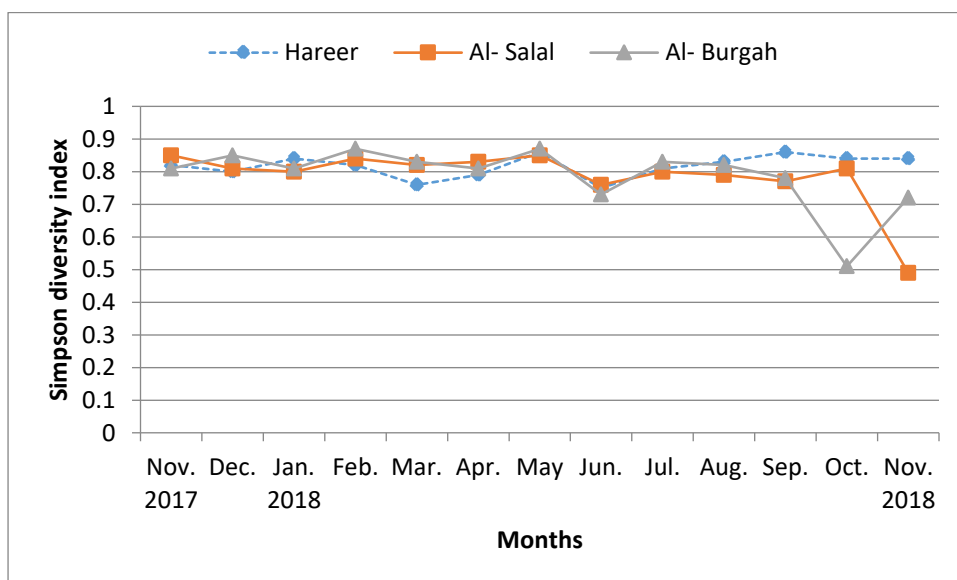


The monthly relative abundance of wading birds and shorebirds in the East Hammar marsh illustrated in figure 6. The highest relative abundance was 15.88% recorded in November 2018 in Al- Burgah station, whereas, the lowest abundance was 1.63% recorded in July 2018 in Al- Burgah station.



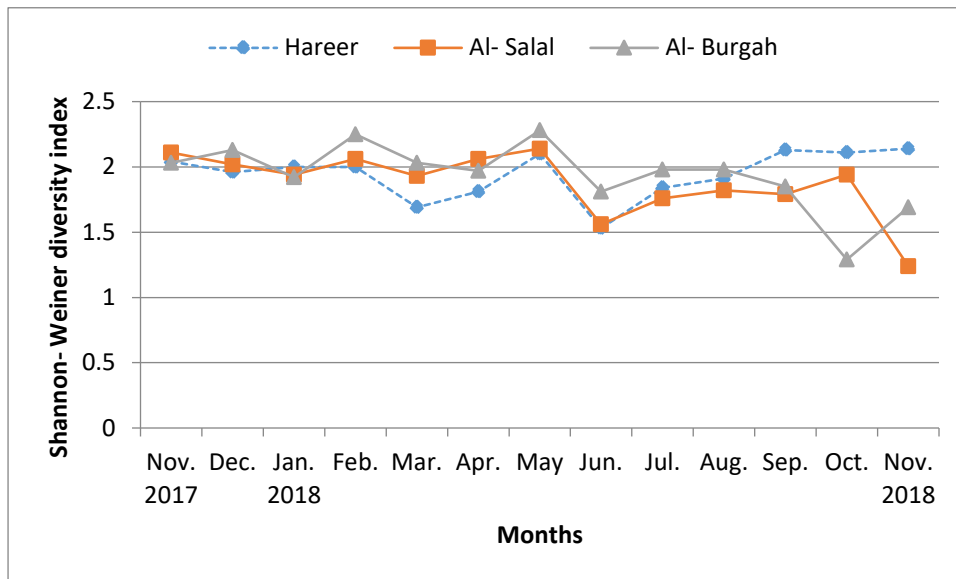
**Fig. ( 6 ) : Monthly variations in relative abundance in East Hammar marsh.**

The monthly fluctuations values in Simpson diversity index were showed in figure 7 . The peak value was 0.87 recorded in February and May 2018 in Al- Burgah, while the low value was 0.49 recorded in November 2018 in Al- Salal site.



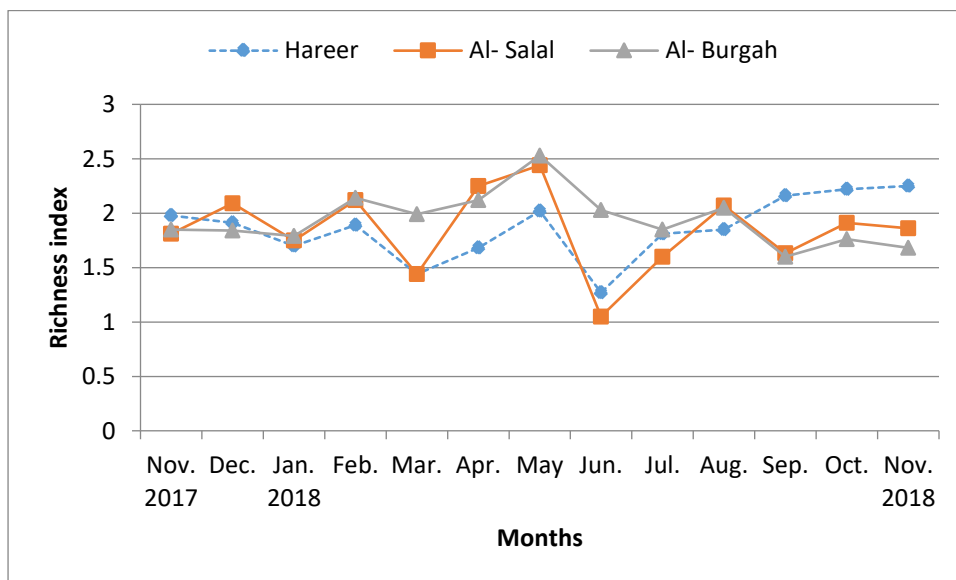
**Fig. (7): Monthly variations in Simpson diversity index in East Hammar marsh.**

The monthly variations in Shannon – Weiner diversity index values were showed in figure 8. They fluctuated between highest value 2.28 in May 2018 in Al- Burgah site, and the lowest value 1.24 in November 2018 in Al-Salal.



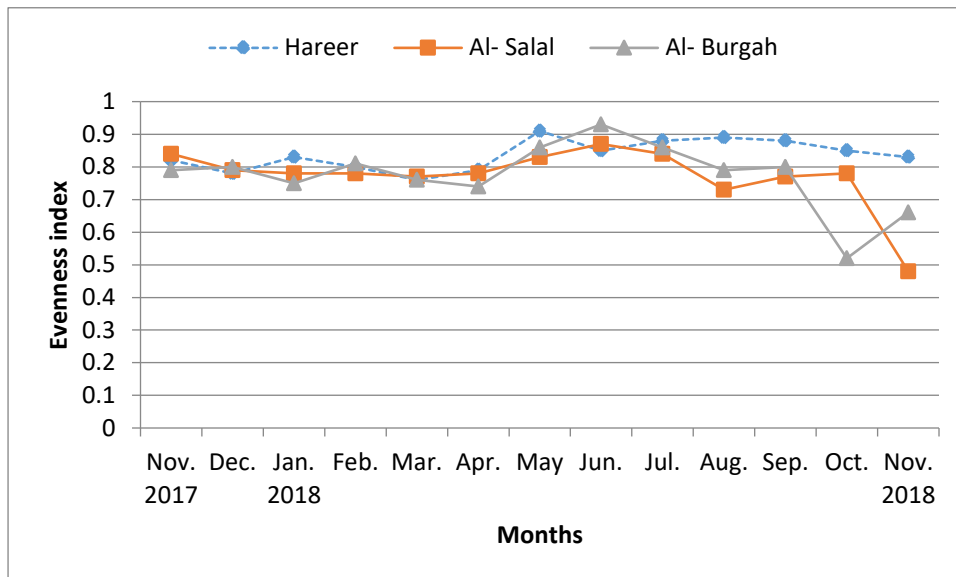
**Fig. ( 8 ) : Monthly variations in Shannon - Weiner diversity index in East Hammar marsh.**

The fluctuations values in richness index in East Hammar marsh, ranged between the highest value 2.53 in May 2018 in Al- Burgah station, and lowest 1.05 in June 2018 in Al- Salal site (figure 9).



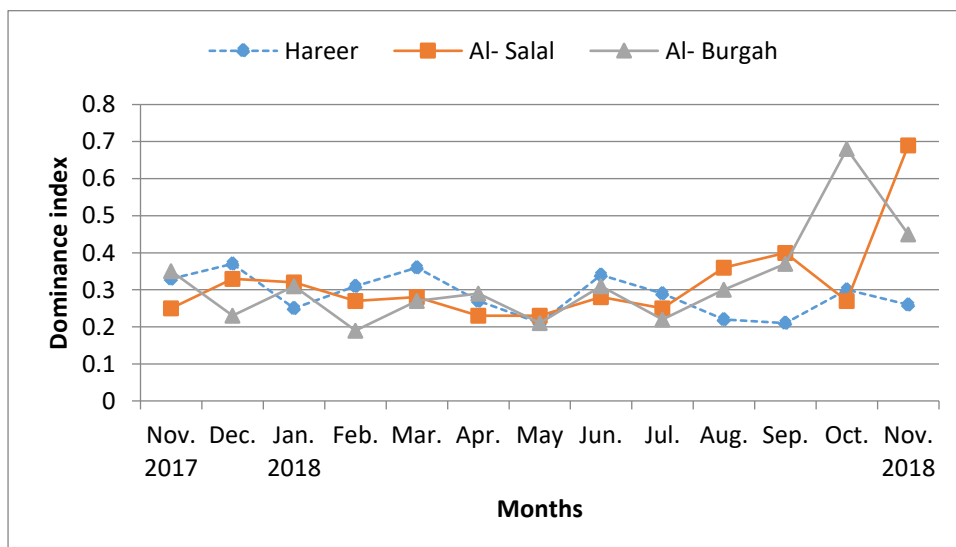
**Fig. ( 9 ) : Monthly variations in richness index in East Hammar marsh.**

The evenness index in each sites of East Hammar marsh illustrated in figure 10. The high value was 0.93 that recorded in June 2018 in Al- Burgah site, but a low value was 0.48 in November 2018 in Al- Salal site.



**Fig.( 10) : Monthly variations in evenness index in East Hammar marsh.**

The monthly variations in dominance index were explained in figure 11. The values ranged between 0.69 in November 2018 in Al- Salal station and 0.19 in February 2018 in Al- Burgah.



**Fig. 11: Monthly variations in dominance index in East Hammar marsh.**

The statistical analysis exhibited that the abundance and species richness of birds differed significantly among all stations. In case of birds abundance, there were significant differences between the sites ( $f = 24.92$ ,  $df = 2$ ,  $P < 0.05$ ), while in case of species richness, there were significant differences between stations ( $f = 5.90$ ,  $df = 2$ ,  $p < 0.05$ ).

## Discussion

The Iraqi marshland characterized by huge avifauna including large number of shorebirds and wading birds as stated by previous surveys ( Habeeb, 2014). One of the major group is the migrating birds (Scott, 1995). Several studies pointed out the importance of southern marshes habitat for the migrating birds, which prefer these marshland. Birds mostly come from western Siberia during winter season when force hard weather as well as a scarcity of food at the original homeland. Thus, many migrating species refuge to Iraqi southern marshes (Al- Robaae, 2006; Habeeb, 2014).

The present survey recorded 27 species of wading birds and shorebirds that occurred in East Hammar marsh. The total number of individuals reached to 14669 birds through the monitoring period. There is obviously an increase in the number of individuals and species in winter due to arrival of migratory species as well as residents compare with other seasons ( Habeeb, 2008 ). Al- Burgah station is considered as a more diverse compared with other stations, because it is an area with open water and subjected exposure during tide and receding water that revealed large mudflats, this leads to attraction of large numbers of wading birds and shorebirds species, because the mudflats are the main sources of feeding habitats for these birds.

The relative abundance of wading birds and shorebirds might be relevant to availability of food, habitat conditions and migration season of the species (Bibi and Ali, 2013 ). Therefore, it showed increasing in abundance of these birds in winter season. Simpson index and Shannon-Weiner index were used to assess the bird species diversity, the values of Simpson index ranged between 0 to 1, the values of Shannon- Weiner 0 to 5, but the typical values are generally between 1.5 to 3.5 and the index is rarely it surpasses 4 ( Magurran,

2004 ; Krebs, 2014 ), the values were recorded of Simpson index fluctuated between 0.4 to 0.8 in all stations during the survey, while the average annual value of this index reached to 0.79, it is depend on how individuals are distributed to the species of community. The values of Shannon-Weiner index ranged between 1.24 to 2.28 in all sites through the monitoring period, while the average annual value reached to 1.91 in East Hammar marsh. Shannon - Weiner value close 4.5 would indicate that the individuals are equally distributed among all the species (Bibi and Ali, 2013). The values over 3.0 indicate that the composition of habitat is stable and balanced; the values under 1.0 indicate the habitat is unstable where pollution and degradation occurs accordingly, in this case, the status of wading birds and shorebirds community are moderate status and the habitat of these birds is not degradation.

The values of richness index fluctuated between 1.05 to 2.53, while the average annual value was reached 2.01 during the survey. The margalef index determine the diversity relating certain richness to all individuals, the major problem when applying this index is the absent of a limit value, so it is very difficult to arises reference values ( Jorgensen *et al.*, 2005 ). Ros and Cardell (1991) pointed out the values less than 4 as typical polluted (disturbed), on the contrary, Bellan and Santini ( 1980 ) consider that it is limit when this index takes values less than 2.05. In this situation, the wading birds and shorebirds assemblage and their habitat considered disturbed.

Evenness is directly proportional to diversity. When the high value of evenness means high value of diversity. The values are ranged between 0 to 1. When the values are reaching near 1, it mean that the individuals of all species are distributed evenly, while the low value of evenness

means there is an extreme distribution of individuals, in other words there is a dominance of one species or a few on other species of community (Magurran, 2004 ; Krebs, 2014 ). The evenness values in present study fluctuated between 0.48 to 0.93, this is attributed to the low value of evenness in November 2018 that resulted from dominance of *E. garzetta* on other species, but the high value means all individuals distributed closer equally. The average annual value of evenness in the East Hammar marsh reached 0.77 from this value the community of wading birds and shorebirds in the East Hammar marsh can be described as semi-balanced ( Hussain *et al.*, 2012).

The Berger- Parker index express the proportional abundance of the dominant species ( most abundant ). In large assemblages, the dominance index ( more than 100 species ) is independent of number of species, while in smaller communities, its values will tend to reduction with increasing species richness ( Magurran, 2004 ). The values of the dominance index are inversely proportional to the values of diversity, when the Berger- Parker value increase the diversity decrease. The dominance index values in this study ranged between 0.1 to 0.69, th increasing in value attributed to the dominant of *E. garzetta* in November 2018. The values of dominance index in present survey refer to dominance of a few species on other species in birds community.

### Conclusion

The present study supports the idea that marshes are precious buffer wetlands habitat for migratory wading birds and shorebirds, plays as alternate feeding habitats and nesting area for many residents species. So for this characteristic, they attracted many birds, especially in winter season . We can conclude that , the southern marshes are rich in bird species with relative diversity.

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## تقييم تنوع الطيور الخواضة والشاطئية في هور شرق الحمار – البصرة - العراق

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### الملخص

كان الهدف من الدراسة هو تقييم تنوع مجتمع الطيور الخواضة الكبيرة والشاطئية في هور شرق الحمار للفترة من تشرين الثاني 2017 إلى تشرين الثاني 2018 . سجل ما مجموعه 27 نوعا تنتمي إلى 4 عوائل من الطيور الشاطئية و عائلة واحدة من الخواضات الكبيرة. سجلت أعلى وفرة نسبية في تشرين الثاني 2018 وبلغت 15.88% ، بينما كانت أدنى وفرة نسبية في حزيران 2018 وبلغت 1.63%. سجل مؤشر سيمبسون 0.79 في حين سجل مؤشر شانون – وينر 1.91. ووصل مؤشر الغنى ( الثراء ) إلى 2.01 في حين كانت قيمة مؤشر التكافؤ 0.77 . سجل مؤشر السيادة أعلى قيمة له في تشرين الثاني 2018 بسبب سيادة النوع *E. garzetta* . ونتيجة لذلك ، فإن مجتمع الخواضات الكبيرة والشاطئية في هور شرق الحمار في حالة متوسطة التنوع ، في حين أظهرت مؤشرات الثراء والتكافؤ أن هذا المجتمع مضطرب وشبه متوازن.