Survey of Khor Al-Zubair and Umm Qasr Mudflat Birds: Effect of Tidal Cycle and Seasonal Variations on Their Assemblages and Abundance, Basrah, Iraq

Survey of Khor Al-Zubair and Umm Qasr Mudflat Birds: Effect of Tidal Cycle and Seasonal Variations on Their Assemblages and Abundance, Basrah, Iraq

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Abstract. Ornithological surveys were conducted at tidal mudflats that nationally represents one of the marine key biodiversity (KBA) areas at Khor Al-Zubair (KBZ) and Umm Qasr south-east of Basrah City, Iraq. On the basis of hourly counting for 7h monitoring period at day time and covering an area of 7.5 km^2 of the intertidal zone, a 7 surveys were conducted from March 2019 until January 2020. A total of 7658 individual birds belongs to 54 species have been recorded. The highest numbers of birds per a day were recorded in Autumn and Winter 4869, 1999 respectively, which coincided with the migration seasons. The lowest numbers were recorded during the Summer season just where only 61 birds have been observed. The birds assemblages and their abundance during the high tide times and during the low tide times were compared statistically and the results weren't different ($t < 0.05$). Additional observations of different surveys targeted different sites of the KAZ mudflat over the period 2005-2020 have resulted in a final list consists of 102 bird species, a result reflecting the importance of this habitat to various migratory and resident birds.

Key words: Intertidal zone, Birds, Khor Al-Zubair, Um Qasr, mudflat.

1. Introduction

The intertidal mudflat and the large marshland area of Mesopotamia, Southern Iraq provides and supports significant populations of large numbers of resident and intercontinental migratory bird species [1]. [2] in an ornithological survey conducted from 2005-2008 in the marshes of Southern Iraq, they recorded 159 species among them eight species are globally threatened. The freshwater Mesopotamian marshlands represent the majority wetlands area of Iraq, 15000-20000 km^2 [1] and

were attentive to many researchers and instituditional's investigations that are related to the diversity and migration of birds [3][4]. However, less attention was given to the role of the bird species at the intertidal mudflat habitat which was nationally designated as Key Biodiversity Area (KBA) [2], and as Important Bird Area IBA [5]. As part of the total mudflat areas of Iraqi coast, Khor Al-Zubair KAZ and Umm Qser's UQ intertidal zones extended along about 40 km navigation channel, and the southern shores of Fao (Fig 1). The area is rich of sediment of fluviatile origin transported by Shatt Al-Arab River [6]. Recently [7] reported a big loss of macrobenthic invertebrates in this ecosystem during the past five decades, simultaneously, the area was found inhabited by high population density of two mudskipper species mixed with at least six crab species and the ecosystem was appeared very productive.

Globally, the tidal flats assigned as a very productive habitat and of great importance to the shorebirds [8][9][10]. This article shed light on the shorebirds assemblages and their status in one of the most important coastal/marine KBA of Iraq.

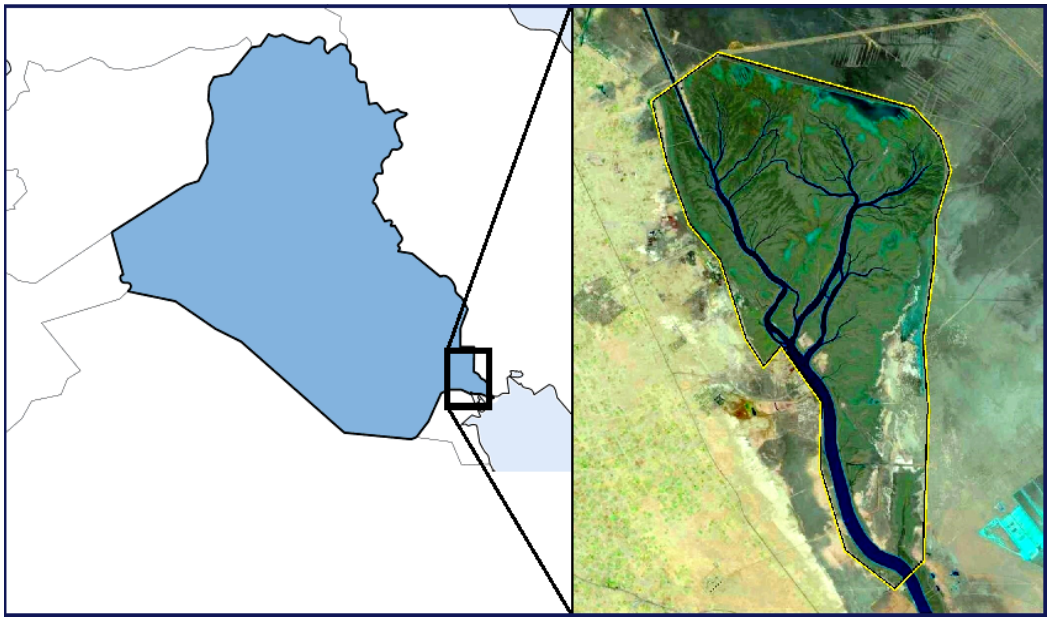

Figure 1. map of the study area, Khor Al-Zubair and Umm Qasr, Basrah, Iraq

2. Materials and Methods

2.1. Study Area

The present study was done in a tidal mudflat area located at Khor Al-Zubair (KAZ) and Umm-Qasr (UQ) which situated in the south-west of Basrah city, Iraq (Fig. 1). Two sites (A & B) were chose as a

vantage point for birds monitoring which they located at the east bank of KAZ water channel (A 30° 13′ 62” N ; 47° 91’ 88” E); (B 30° 15’ 13” N; 47° 90’ 88” E). the site (A) was located just near a dump area, recently established by the General Company for ports of Iraq, and the site (B)was 5 km along the coast northern the site (A). The sediments of KAZ comprise mainly silt and clays of fluviatile origin [11][6].

Figure 2. Photos show the general landscape of the study area. (Photos by Hanaa H. Mohammed).

2.2. Study Period

The data of the study were collected during the period between 21th February 2019 and 29 January 2020. In addition to the pre-survey visit of 21th February 2019 in which a vantage points were identified, seven visits were undertaken in the following dates: In the Spring season at March 7th and, March 14th in Summer at July 15th (2019) , in Autumn at September 18th 2019 and in Winter season at December 8th , December 24th (2019) and January 29th 2020.

The two sites were surveyed in one day for 7 hours, starting from the morning. The tidal cycles were obtained from public record (Fishing forcast https://tides4fishing.com/as/iraq/umm-qasr). The results of different surveys that have targeted Khor Al-Zubair have also been included in this study. These surveyed were conducted in different years over the period 2005-2020, and have covered all the four seasons.

2.3. Birds Counts

Birds were counted on hourly bases for 7 hours per day periods. Birds were identified and counted with aid of high-resolution zoom cameras (Nekon 700D, Nekon 84X optical zoom and Canon Power shot D 10), and by binocular (7 x 50 mm). And birds photographs were taken for further confirmation of bird species. The main taxonomic references used were [12], and [13]. The total birds count, at each site (A & B) were done to cover a study area of nearly 7.5 km length x 1 km width. Since the areas were open intertidal zone with only little plant *Salicornia perennans* there was clear good visibility of birds. A walk-over survey on the intertidal zone were undertaken during the visits for closer search for bird nests, however, the soft mud has restricted the free movement of the survey team in some areas. All bird species were photographed with the cameras for confirming the bird species and their number counts.

3. Results

3.1. Abundance

A total of 7658 individual birds representing 54 species where recorded from the two sites of the mudflat (Table 1). The highest mean number of birds per one day visit was recorded during Autumn season 4869 ind./7h./7.5 km^2. Relatively very low density was observed during Summer 61 ind./7h./7.5 km. (Fig. 2). Birds were observed at all tidal levels but mostly they were found at the area between the low tidal level and the mid tidal level.

3.2. Birds Assemblage

Gulls were the dominant bird group that have been observed during all seasons.

Four *Larus* species were identified, the Slender Billed Gill *Larus genei* was the most abundant 1229 (Table 1). Herons, mainly *Egretta gularis* and *Ardea cinerea* were a common group present in all seasons 172 and 93 total number respectively. Terns particularly Gull-billed *Gelochelidon nilotica* were also observed in large numbers 582 total number during most seasons. However, the following birds were the abundant species: the cormorant *Phalacrocorax carbo,* the Common Curlew *Numenius arquata,* and the Kentish Plover *Charadrius alexandrines*. Some other groups, the genus *Tringa* and the genus *Oenanthe*, although they were relatively less abundant but they were represented by 4 and 3 species in the bird assemblage. However, the list consist very rare species, they even were observed one time during the entire investigation period, for example, the Hoopoe *Upupa epops*.

Table 1. Numbers of the Birds species in the mudflat, Khor Al-Zubair/ Umm Qasr, during 2018-2020, in addition to other bird species observed during different periods at the same area.

	Scientific Name	**Common Name**	**Autumn season abundance birds /7h./7.5 km^2..**	**Summer season abundance birds /7h./7.5 km^2.**	**Spring season abundance birds /7h./7.5 km^2.**	**Winter season abundance birds/7h./7.5 km^2.**	**Total no.**	**IUCN**
1	*Tadorna tadorna* *	Common Shelduck	42	-	-	37	79	LC
2	*Anas clypeata*	Shoveler	-	-	-	150	150	LC
3	*Phoenicopterus ruber*	Greater Flamingo	30	-	-	50	80	LC
4	*Ciconia ciconia*	White Stork	-	-	-	1	1	LC
5	*Platalea leucorodia*	Spoonbill	-	-	1	-	1	LC
6	*Ardea purpurea*	Purple Heron	-	-	17	-	17	LC
7	Ardeola ralloides	Squoacco Heron	-	-	4	-	4	LC
8	*Ardea cinerea* **	Gry Heron	42	6	12	33	93	LC
9	*Ardea alba*	Great White Egret	6	-	5	-	11	LC
10	*Egretta garzetta* *	Little Egret	7	-	5	2	14	LC
11	*Egretta gularis* **	Western reef Heron	61	-	45	66	172	LC
12	*Phalacrocorax carbo* **	Cormorant	26	2	8	18	54	LC
13	*Circus aeruginosus*	Western Marsh Harrier	-	-	1	1	2	LC
14	*Bueto rufinus*	Long-legged Buzzard	-	-	1	-	1	LC
15	*Falco tinnunculus*	Common Kestrel	-	-	-	1	1	LC
16	*Dromas ardeola* *	Crab Plover	5	2	5	-	12	LC
17	*Phalaropus lobatus*	Red-necked Phalarope	-	-	12	-	12	LC
18	*Himantopus himantopus* *	Black-winged Stilt	352	-	-	17	369	LC

19	*Ricurvirostra avosetta* *	Avocet	219	-	-	256	475	LC
20	*Pluvialis fulva*	Pacific Golden Plover	-	-	-	7	7	LC
21	*Charadrius hiaticula*	Common Ringed Plover	560	-	-	-	560	LC
22	*Charadrius alexandrines* **	Kentish Plover	105	**5**	11	94	215	LC
23	*Charadrius leschenaultii*	Greater Sand Plover	-	-	-	5	5	LC
24	*Limosa limosa*	Black-tailed Godwit	-	-	-	31	31	NT
25	*Numenius arquata* **	Common Curlew	48	1	32	16	97	NT
26	*Tringa erythropus* *	Spotted Redshank	-	-	11	195	206	LC
27	*Tringa nebularia*	Greenshank	21	-	-	7	28	LC
28	*Tringa totanus*	Redshank	27	-	-	-	27	LC
29	*Tringa stagnatilis*	Marsh Sandpiper	28	-	-	4	32	LC
30	*Xenus cienereus*	Terek Sandpiper	3	1	-	-	4	LC
31	*Calidris minuta* *	Little Stint	2226	-	6	-	2232	LC
32	*Calidris alpina* *	Dunlin	277	-	1	-	278	LC
33	*Larus genei* **	Slender Billed Gull	410	30	126	663	1229	LC
34	*Larus ridibundus* **	Black-headed Gull	8	-	95	5	108	LC
35	*Larus fuscus* *	Lesser Black-backedGull	2	-	42	35	79	LC
36	*Larus armenicus* **	Armenian Gull	45	-	6	116	167	NT
37	*Gelochelidon nilotica* **	Gull-billed Tern	291	-	137	154	582	LC
38	*Sterna caspia*	Caspian Tern	2	-	1	3	6	LC
39	*Chlidonia leucopterus*	White-winged Tern	2	1	19	-	22	LC
40	*Streptopelia docaocto*	Collared Dove	-	7	3	-	10	LC
41	*Upupa epops*	Hoopoe	-	-	-	1	1	LC
42	*Lanius collurio*	Red-backed Shrike	-	-	4	-	4	LC

43	*Galerida cristata* *	Crested Lark	3	2	3	4	12	LC
44	*Hirundo rustica*	Barn Swallow	2	-	94	-	96	LC
45	*Hippolais pallida*	Olivacious Warbler	-	-	4	-	4	LC
46	*Phylloscopus trochilus*	Willow Warbler	-	-	2	-	2	LC
47	*Muscicapa striata*	Spotted Flycatcher	-	-	1	-	1	LC
48	*Oenanthe oenanthe*	Northern Wheatear	-	-	-	2	2	LC
49	*Oenanthe* deserti *	Desert Wheatear	6	-	5	5	16	LC
50	*Oenanthe finschii*	Finsch's Wheatear	-	-	-	1	1	LC
51	*Passer domesticus* *	House Sparrow	5	4	10	16	35	LC
52	*Motacilla flava*	Yalow Wagtail	8	-	-	-	8	LC
53	*Motacilla alba*	White Wagtail	-	-	-	1	1	LC
54	*Anthus campestris*	Tawny Pipit	-	-	-	2	2	LC
	Total No.		**4869**	**61**	**729**	**1999**		**7658**
	Mean no. of Bird counts		**4869**	**61**	**364.5**	**666.3**		

* = …. ** = ….

3.3. Tidal Variation

The bird assemblages and their abundance during the high tidal (HT) and the low tidal (LT) periods were compared statistically (Table 2). The calculated means of the number of the bird species observed during HT periods 8.9 no./ 7.5 km^2 and LT periods 9.0 no./7.5 km^2 weren't different $t < t$ 0.05 (2), 18, $P > 0.05$, also the means of the total birds counted during the HT periods and the LT periods 182 and 133.5 respectively, were compared and the results was statistically insignificant, $t < t$ 0.05 (2), 18 , $P > 0.05$.

Table 2. Tidal variation of bird assemblages and the total number of birds (density) during the periods of high tide (HT) and low tide (LT) at the KAZ, Basrah, Iraq mudflat area.

Mean no. of bird species/ 7.5 km^2 X		Mean total no. of Birds/ 7.5 km^2 X	
HT	LT	HT	LT
Mean X= 8.9 no./ 7.5 km^2	X = 9.0	T N = 182	13.5
N = 10	N = 10	N = 10	10
S = 2.28	S = 1-33	S = 149.6	53.6
t = 0.286, P > 0.05 i.s.		t = 0.354, P > 0.05 i.s.	
i.s. insignificant			

3.4. Seasonal Abundance

Figure 3. shows the results of the quantitative study conducted on 2018-2020 (7 daily surveys). In Autumn and Winter birds appear most abundant 4869 and 666.3 birds/7h./7.5 km^2 respectively, whereas in Summer they were very few 61 birds./7h./7.5 km^2. .

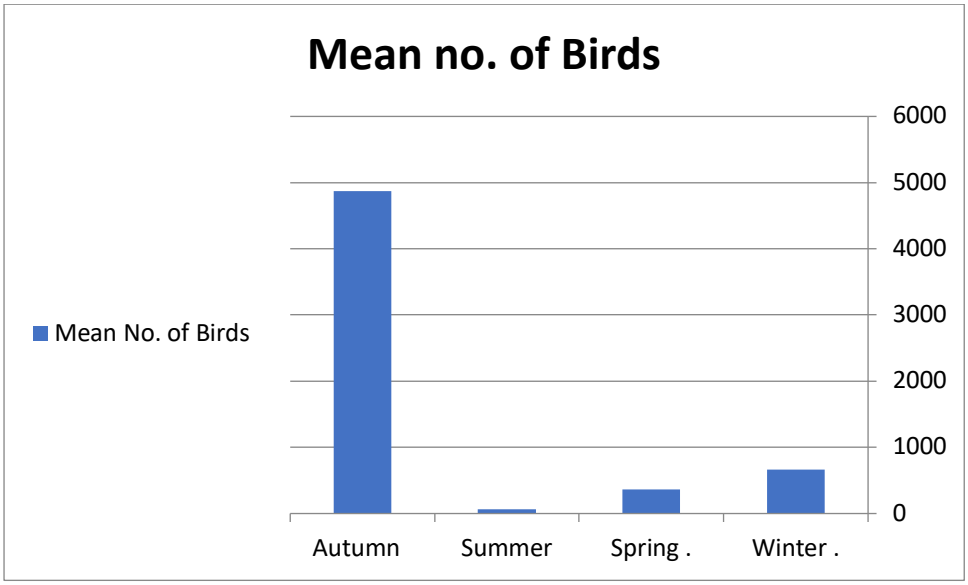

Figure 3. Mean birds density (No./7h./ 7.5 km^2) recorded in the 7 (daily surveys) during four seasons in the periods 2018-2020, KAZ, Basrah, Iraq.

3.5. Additional list of birds species

Through the period 2005-2019 many visits were done by M. Salim in various sites of KAZ's KBA where further birds species have been recorded (Table 3).

Table 3. Birds observed in the study area (By M. Salim) (2005-2019).

	Scientific Name	Common Name	IUCN Status
1	*Anas crecca*	Eurasian Teal	LC
2	*Anas strepera*	Gadwall	VU
3	*Marmaronetta angustirostris*	Marbled Duck	VU
4	*Tachybaptus ruficollis*	Little Grebe	LC
5	*Ciconia ciconia*	White Stork	LC
6	*Plegadis falcinellus*	Glossy Ibis	LC
7	*Nycticorax nycticorax*	Black-crowned Night Heron	LC
8	*Milvus migrans*	Black Kite	LC
9	*Circus pygargus*	Montagu's Harrier	LC
10	*Buteo buteo vulpinus*	Steppe Buzzard	LC
11	*Aquila nipalensis*	Steppe Eagle	EN
12	*Gallinula chloropus*	Common Moorhen	LC
13	*Recurvirostra avosetta*	Pied Avocet	LC
14	*Vanellus spinosus*	Spur-winged Lapwing	LC
15	*Vanellus indicus*	Red-wattled Lapwing	LC
16	*Vanellus leucurus*	White-tailed Lapwing	LC
17	*Pluvialis squatarola*	Grey Plover	LC
18	*Charadrius dubius*	Little Ringed Plover	LC
19	*Gallinago gallinago*	Common Snipe	LC
20	*Tringa totanus*	Common Redshank	LC
21	*Tringa ochropus*	Green Sandpiper	LC
22	*Tringa glareola*	Wood Sandpiper	LC
23	*Actitis hypoleucos*	Common Sandpiper	LC
24	*Arenaria interpres*	Ruddy Turnstone	LC
25	*Calidris alba*	Sanderling	LC
26	*Calidris temminckii*	Temminck's Stint	LC
27	*Calidris ferruginea*	Curlew Sandpiper	NT
28	*Philomachus pugnax*	Ruff	LC
29	*Larus michahellis*	Yellow-legged Gull	LC
30	*Larus cachinnans*	Caspian Gull	LC
31	*Sternula albifrons*	Little Tern	LC
32	*Sterna hirundo*	Common Tern	LC
33	*Chlidonias hybrida*	Whiskered Tern	LC
34	*Columba livia*	Rock Dove	LC
35	*Streptopelia senegalenesis*	Laughing Dove	LC
36	*Ceryle rudis*	Pied Kingfisher	LC
37	*Merops persicus*	Blue-cheeked Bee-eater	LC
38	*Merops apiaster*	European Bee-eater	LC
39	*Lanius isabellinus*	Daurian Isabelline Shrike	LC
40	*Lanius meridionalis*	Southern Grey Shrike	VU
41	*Riparia riparia*	Sand Martin	LC
42	*Phylloscopus collybita*	Common Chiffchaff	LC
43	*Prinia gracilis*	Graceful Prinia	LC
44	*Turdoides huttoni*	Afghan Babbler	LC
45	*Sturnus vulgaris*	Common Starling	LC

46	*Cercotrichas galactotes*	Rufous-tailed Scrub Robin	LC
47	*Saxicola maurus*	Siberian Stonechat	LC
48	*Anthus spinoletta*	Water Pipit	LC

4. Discussion

The lists of birds species of the present study consists 102 different migrated and resident species, this number formed nearly 2/3rd of the total national list (320) of the bird species noted in KBA surveys conducted in 2005 to 2008 [2]. However, in a more recent study [14] reported 168 bird species in the Bahr Al-Najaf area and they mentioning that this number represent more than 40% of the national check list of birds in Iraq [15]. Despite to some species included in the list were rare but such high species diversity heighten the importance in the KAZ mudflat ecosystem as a resting and feeding site of the migratory shorebirds. Also it is remarkable to mention that we expected a higher values of diversity and abundance can be recorded if surveys were conducted more frequently, a longer time in each day of monitoring (> 7h/ day) and covering a wider areas, especially during the migratory season..

The peak of birds density was observed in Autumn season 4869 bird/7h./7.5 km^2. In Winter the density was also relatively high 666.3 bird/7h./7.5 km^2 (Fig. 2). Obviously, Its coincided with the migratory seasons of birds in Iraq which represented one of the key Inter-continental migratory flyways of birds in the world [1][14].

The effects of tidal cycle on the bird's density and their assemblage were examined, and the results reveals no significant differences are there between the HT and LT periods indicating that birds have the same habitat use whether the mudflat area is exposed or flooded. This is also might be due to the vast mudflats areas where the birds can find alternative foraging areas. As far as we studied the area no evidence was found that the recorded birds have used the tidal area for breeding activity i.e. eggs or nests. Hence, it seems that the utilization of mudflat area by these bird species and populations is restricted to feeding and resting. Recently [7] were investigated the benthic community of KAZ/ UQ intertidal mudflats and demonstrating that a high densities of a mixed populations of at least 6 species of crabs: Uca sindensis, Macrophthalmus dentipes, Leptochryseus kuwaitensis, Parasesarma, plicatum, Eurycarcinus orientalis and Nasima dotiliformis, and two species of mudskippers Periophthalmus waltoni and Boleophthalmus dissumieri were actively living in this low diversity but high productive habitat. However, many regional and global reports on mudflat habitats have had noticed the predation of shorebirds on the macrobenthos [16][10]. As a conclusion this habitat is rich with benthic crabs and mudskippers and these preys were available in large number and in different sizes almost the year around as well as during the low and high tide conditions. However, catching

such burrowing preys is not easy due to the relatively complex burrows structure they made and their active hidden behavior .

Figure 4. Western reef heron *Egretta gularis* catching mudskipper fish from KAS mudflat area, Basrah (Photo by Hanaa H. Mohammed).

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