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Diversity and Distribution of Intertidal Benthic Fauna at Ras Al Khor Wildlife Sanctuary of Dubai

Karuppaiyan Murugesan*[1], Aisha Almurr Almuhery[2] and Shadab Alam Khan[1]
[1]Coastal Zone Waterways and Management Section, Environment Department, Dubai Municipality, Dubai
[2]Natural Resources Conservation Section, Dubai Municipality, Dubai
kmurugesan@dm.gov.ae

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Abstract

This research reports the diversity and population of intertidal benthic fauna from Ras Al Khor Wildlife Sanctuary a RAMSAR site of Dubai during January (winter season), 2015. The study was conducted at Ras Al Khor Wildlife Sanctuary (RAKWS) to assess the present status of the intertidal benthic fauna. Thirty one benthic fauna species belonging to 3 phylum representing 6 classes were recorded. Collections were made from 14 stations. The stations were divided into four (4) sectors, as results showed that major Polycheates were dominant at sector 1 and 4 in general, particularly at JSIB1, JSIB2, RSIB1 and RSIB2. However, (molluscan) gastropods and bivalves (to certain extent) were dominant at sector-2 followed by sector-4, 3 and 1. The results indicate that in RAKWS the dominance of inter-tidal benthic fauna is relatively high while the level of diversity is low.

Keywords: Diversity, Population, Inter-tidal benthic fauna, Ras Al Khor Wildlife Sanctuary.

Introduction

Intertidal area of any ecologically rich area is considered as the most productive with the greatest diversity of flora and fauna. Because of its accessibility, the intertidal area remain highly explored than any other area[1]. Sesarmid crabs are known to have a high impact on leaf litter dynamics as they can remove a large amount of leaf litter from the sediment surface and carry it into their burrows[2,3]. Mangrove crab such as *Uca* spp. have been considered as either bacteria feeders[4,5] or microalgal bacteria like cyanobacteria feeders[6,7] and even less is known about the feeding habits of mangrove-dwelling gastropods which are often referred to as 'deposit-feeders[8], with little information on their selectivity for mangrove detritus or algal food sources[6,9]. The publication of a monograph on the polychaeta of southern Africa[10]. A total of 476 species of macrozoobenthos and representatives of higher taxonomic groups belonging to 12 phyla were recorded and identified from Kuwait waters[11].

Ras Al Khor Wildlife Sanctuary (RAKWS) is located at the end of the 14 km long Dubai creek and lying at the interface between the Arabian Gulf and Al Awir Desert, it is a coastal wetland of global importance. Covering a 6.2 km^2 area, 450 species of fauna and 47 species of flora is presence in the sanctuary and it is one of the best managed arid zone wetlands in the region. The Ras Al Khor Wildlife Sanctuary is the first wetland ecosystem in the gulf region to be recognized as a RAMSAR site.

Although, no previous and published benthic data is not available on the Ras Al Khor Wildlife Sancutary. In this paper deals with distribution, diversity and population of mangrove intertidal benthic fauna at Ras Al Khor Wildlife Sanctuary of Dubai.

Materials and Methods

The benthic samples were collected at 14 locations during January, 2015 along the Ras Al Khor Wildlife Sanctuary (Stations: JSIB1 – Jadaff side -1; JSIB2 – Jadaff side - 2; JSIB3– Jadaff side - 3; FH-1- Flamingo hide -1; FH-2-Flamingo hide - 2; FH-3-Flamingo hide - 3; MH-1-Mangrove hide -1; MH-2-Mangrove hide - 2; MH-3-Mangrove hide - 3; RSIB1- Ras Al Khor side - 1; RSIB2 - Ras Al Khor side - 2; RSIB3- Ras Al Khor side – 3; RSIB4 - Ras Al Khor side – 4; RSIB5- Ras Al Khor side - 5) their co-ordinates recorded using a hand-held GPS as shown in Table-1.

The intertidal benthos sampling location was fixed at a number of places for collecting the animals to know the distribution pattern and density of the organisms in each station. Then at in each sampling stations, a square wooden frame of 25cm sides and count the burrows of the animals living as epifauna in each quadrat and the total numbers per square meter[12].

The benthic organisms were separated by sieving through 500 micron mesh and preserved using 10% buffer formaldehyde with Rose Bengal. In the laboratory, benthic fauna were sorted and identified to species/genus level using Leica stereo zoom microscope. At intertidal stations large organisms were additionally collected and identified.

Results and Discussion

Intertidal benthic population studies from Ras Al Khor Sanctuary were conducted during the monthly of January, 2015. Sample collections were made from 14 stations as given Table-2, and Figure-1.

Table-1
Inter-tidal benthic sampling locations at Ras Al Khor Wildlife Sanctuary of Dubai

Locations	UTM-Zone-40R-WGS-1984	
	Easting-X(m)	Northing-Y(m)
JSIB1	331315	2788393
JSIB2	330909	2788175
JSIB3	330530	2787908
RSIB1	332433	2787508
RSIB2	332105	2787294
RSIB3	331838	2787123
RSIB4	331798	2786741
RSIB5	331606	2786711
MH1	330464	2786822
MH2	330356	2786707
MH3	330228	2786541
FH1	330469	2787420
FH2	330627	2787620
FH3	330322	2787724

The stations were divided into four (4) sectors, which are as below.
Sector-1- (Three stations-Jadaff side) comprising stations: JSIB1, JSIB2 and JSIB3.
Sector-2- (Three stations- Flamingo side) comprising stations: FH1, FH2 and FH3.
Sector-3- (Three stations- mangrove side) comprising stations: MH1, MH2 and MH3.
Sector-4- (Five stations- Ras Al Khor side) comprising RSIB1, RSIB2, RSIB3, RSIB4 and RSIB5.

Sector-1 (Jadaff side): The total number of intertidal benthic organisms recorded from this sector was 16,054 nos./m^2. The population recorded from this sector was about 38.2% of the total population recorded from all the 14 stations. This was slightly lower than the population recorded from sector-4 (Ras Al Khor side) which was about 39.5% within this sector-1, JSIB1 station recorded the highest number of organisms (10880 nos./m^2) which is about 67.8% followed by JSIB2 (3446 nos./m^2 – 21.5 %) and JSIB3 (1728 nos./m^2 – 10.8%). Polychaete worms were the dominant organisms recorded within this sector forming about 94.6%and this was about 36.2% of the total population from all the 14 stations. At JSIB1 station, the polychaetes formed about 70.2% of the population followed by JSIB2 (20.6%) and JSIB3 (9.2%) respectively at this sector.

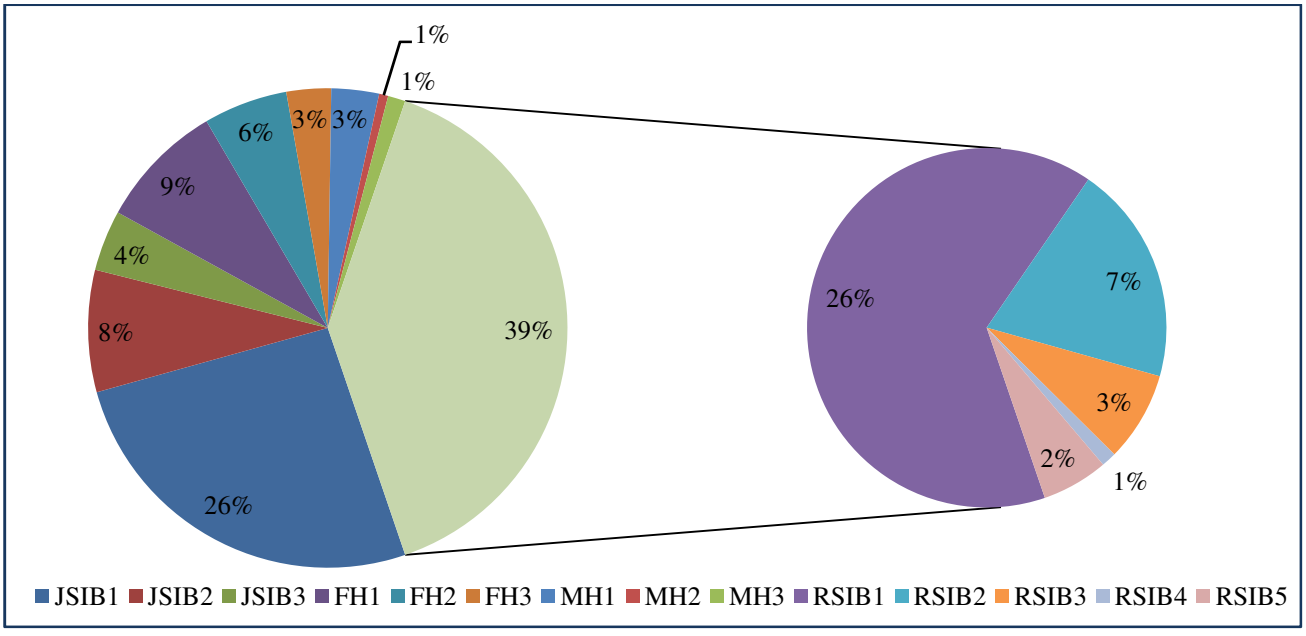

Figure-1
Percentage wise distribution on inter-tidal benthic fauna at Ras Al Khor Wildlife Sanctuary

Table-2
Inter - tidal benthic fauna distribution and population at Ras Al Khor Wildlife Sanctuary of Dubai

Groups	Inter - tidal benthos (nos./m^2)													
	Stations													
	IB1	**IB2**	**IB3**	**IB4**	**IB5**	**IB6**	**IB7**	**IB8**	**IB9**	**IB10**	**IB11**	**IB12**	**IB13**	**IB14**
Phylum: Annelida, Class: Polychaeta, Group: Errantia														
Family: Nereidae *Perineris* sp.	8368	1920	896	512	112	448	96	32	32	2480	900	320	80	0
Leonnates sp.	0	0	0	16	16	48	16	32	0	0	0	0	0	0
Family: Onuphidae *Onuphis* sp.	272	310	96	112	16	0	0	0	0	48	32	16	0	0
Family: Eunicidae *Marphysa graveli*	0	0	16	336	128	192	32	0	0	0	0	0	0	0
Eunice sp.	512	608	192	240	224	96	192	32	0	0	16	64	0	0
Family: Nephtyidae *Nephytes* sp.	0	0	0	16	16	96	32	0	0	96	0	0	0	0
Family: Alciopidae *Alciopina* sp.	0	0	0	0	0	0	16	32	16	0	0	0	0	0
Family: Phyllodocidae *Phyllodoce* sp.	0	0	0	0	0	0	0	0	0	32	80	0	16	0
Family: Syllidae *Syllis* sp.	0	0	0	0	0	0	0	0	0	4240	0	0	0	0
Group: Sedentaria														
Family: Cossuridae *Cossura* sp.	1120	0	64	0	0	0	160	0	0	2800	992	128	0	0
Family: Orbiniidae *Serpula* sp.	0	0	0	0	0	0	0	0	0	400	224	0	0	0
Family: Terebellida *Terebellides* sp.	112	96	48	0	0	0	0	0	0	0	0	48	0	0
Family: Ampharetidae *Amphicteis* sp.	0	0	0	0	0	0	0	0	0	0	0	32	0	0

Groups	Inter - tidal benthos (nos./m^2)													
	Stations													
	IB1	**IB2**	**IB3**	**IB4**	**IB5**	**IB6**	**IB7**	**IB8**	**IB9**	**IB10**	**IB11**	**IB12**	**IB13**	**IB14**
Family: Paraonidae *Paraonis* sp.	0	0	0	0	0	0	0	0	0	304	144	0	0	0
Family: Opheliidae *Ophelina* sp.	0	16	48	16	16	0	0	0	0	0	0	336	0	0
Unidentified Polychaete	288	192	80	176	192	48	32	32	16	32	528	192	16	16
Phylum: Arthropoda, Class: Crustacea, Order: Amphipoda														
Family: Ampeliscidae *Ampelisca* sp.	0	0	0	0	0	0	0	0	0	32	96	0	0	0
Order: Decapoda														
Metopograpsus messor	0	0	0	16	0	0	0	0	0	16	32	0	0	0
Phylum: Mollusca, Class: Gastropoda														
Family: Cerithidae *Cerithidea cingulata*	32	32	96	1264	1392	80	688	64	400	64	64	96	64	464
Cerithium sp.	48	16	16	0	0	0	0	0	0	32	16	64	0	0
Family: Columbellidae *Mitrella blanda*	16	16	32	224	48	16	48	32	32	16	32	0	16	0
Family: Littorinidae *Echinolittorina* sp.	48	112	96	64	16	0	0	0	0	144	96	0	0	0
Family: Trochidae *Trochus* sp.	0	16	0	0	0	0	16	0	0	0	0	0	0	0
Family: Pyramidellidae *Pyramidellidae* sp.	0	0	0	0	0	0	0	0	0	16	32	0	32	512
Family: Naticidae *Natica* sp.	0	0	0	0	48	16	0	0	0	0	0	0	0	0
Family: Nassriidae *Nassarius perisus*	0	0	0	16	0	0	0	0	0	0	0	16	0	0

Groups	Inter - tidal benthos (nos./m^2)													
	Stations													
	IB1	**IB2**	**IB3**	**IB4**	**IB5**	**IB6**	**IB7**	**IB8**	**IB9**	**IB10**	**IB11**	**IB12**	**IB13**	**IB14**
Family: Bullidae *Bulla ampulla*	0	0	0	16	0	0	0	0	0	0	0	0	0	0
Family: Turritellidae *Turritella* sp.	16	32	16	0	0	0	0	0	0	0	0	0	0	0
Family: Haminoeidae *Atyes* sp.	32	16	16	0	0	0	0	0	0	0	0	0	0	0
Class: Bivalvia														
Family: Tellinidae *Tellina methoria*	0	0	0	48	128	48	0	0	0	0	0	0	0	0
Family: Veneridae *Dosinia* sp.	0	16	0	512	32	176	16	0	0	0	0	32	0	0
Class: Scaphopoda														
Family: Dentallida *Dentalium* sp.	16	48	16	0	0	0	0	0	0	0	0	0	0	0
Total (nos./m^2)	**10880**	**3446**	**1728**	**3584**	**2384**	**1264**	**1344**	**256**	**496**	**10752**	**3284**	**1344**	**224**	**992**

IB1-JSIB1; IB2-JSIB2; IB3-JSIB3; IB4-FH-1; IB5-FH-2; IB6-FH-3; IB7-MH1; IB8-MH2; IB9-MH3; IB10-RSIB1; IB11-RSIB2; IB12-RSIB3; IB13-RSIB4; IB14-RSIB5.

Perineris sp. was the dominant polychaete species with 78.4% followed by *Cossura* sp. (10.5%) and *Eunice* sp. (4.8%). The percentage of polychaete within this sector-1, compared to the total population of this sector was 98%, 90.7 and 80.5% for JSIB1, JSIB2 and JSIB3 respectively. In addition, *Ophelina* sp. were also recorded from stns. JSIB2 and JSIB3. Gastropods were the next dominant group of organisms found in this sector 1. Here, JSIB1 accounted for 27.3% followed by JSIB2 (34.1%) and JSIB3 (38.6%) among the gastropod population. However, compared to the total population with in this sector, they were only 1.8%, 7.0% and 15.7% at stns. JSIB, JSIB2 and JSIB3. The dominant gastropod species found at this sector were *Cerithidea cingulata* and *Echinolittorina* sp. some numbers of *Dosinia* sp. belonging to the bivalvia group was recorded from JSIB2 only. Apart from this, few specimens of *Dentalium* sp. representing scaphopoda was observed at this sector 1 at all the 3 stations. Incidentally, this was recorded only from this sector and was found absent from all other sectors.

Sector-2 (Flamingo side): The total number of benthic organisms recorded for all the 3 stations at this sector was 232 nos./m^2 which is about 17.2% of the total population recorded from all the 14 stations. With in this sector, station FH1 recorded the maximum number of organisms (3584 nos./m^2) followed by FH2 and FH3 with 2384 and 1264 nos./m^2 respectively. Gastropods were found to be marginally more in this sector-2 (3200 nos. /m^2) compared to polychaetes (3040 nos./m^2). Together they contributed about 86.3 % of the total population in this sector. Bivalves were the third dominant group of organisms here with 13.1%. Gastropods represented by *Cerithidea cingulata* were observed in large numbers at this sector especially in stations FH1 and FH2. *Mitrella blanda*, *Echinolittorina* sp. and *Natica* sp were also found in small numbers. The dominant polychaete species found at this sector 2 were *Perineris* sp., *Marphysa graveli* and *Eunice* sp. However, *Leonnatus* sp. which was totally absent at sector-1 stations, showed their presence here. *Onuphis* sp. and *Nephytes* sp. were also recorded in this sector in few numbers. Among the bivalves, *Dosinia* sp. was dominant at this sector-2 followed by *Tellina methoria*.

Sector-3 (Mangrove side): The intertidal benthic population at this sector (Mangrove side) was very poor compared to the other three sectors. Total number of organisms recorded from all the 3

stations here were only 2096 nos./m^2 which forms about 5 % of the total population recorded from all the 14 stations. Gastropods contributed 61.1% and polychaetes about 38.2% in this sector. Among Gastropods, the percentage share of 3 stations were 58.7 (MH-1), 7.5% (MH-2) and 33.8 % (MH-3). For polychaetes, the percentage contributions were 72% (MH-1), 20% (MH-2) and 8% (MH-3). Few numbers of bivalves, *Dosinia* sp. was recorded from MH-1 station. The dominant polychaetes were *Eunice* sp., *Perineris* sp., *Cossura* sp. and *Alciopina* sp. in this sector. A large numbers of Gastropods represented by *Cerithidea cingulata* were recorded in this sector -3 *Mitrella blanda* was also found in small numbers at all the 3 stations. Few *Trochus* sp. were recorded from stn. MH.1.

Sector-4 (Ras Al Khor side): As stated earlier, this sector recorded the highest number of intertidal benthic organisms compared to the other 3 sectors. The total number of organisms encountered at this sector was 16,596 nos./m^2, which is about 39.5% of the total population recorded from all sector. RSIB1 recorded the highest benthic population at this sector 4 accounting to 64.8% there was a gradual decrease in the population from RSIB1 to RSIB4 and improved slightly at RSIB5 station. The population percentage recorded at this sector from RSIB1 to RSIB5 were 64.8, 19.8, 8.1, 1.3 and 6.0% respectively. Polychaete worms formed the bulk of the benthic population in this sector with 86% and formed 34.0% of the overall benthic population comprising all 14 stations. There was a sudden decline in the Polychaete population from RSIB1 to RSIB2 and then on a gradual decrease from RSIB2 to RSIB5. Recorded percentage of polychaetes at this sector from RSIB1 to RSIB5 were 73.1, 20.4, 5.6, 0.78 and 0.11% respectively. *Perineris* sp. was dominant at his sector and showed a declining trend from stn. RSIB1 to RSIB4 and was completely absent at st. RSIB5. *Syllis* sp. was found in large numbers only at stn. RSIB1 and was completely absent from rest of all other 13 stations in this sanctuary. *Cossura* sp. was also recorded at fairly good numbers at RSIB3 and was completely absent at RSIB4 and RSIB5. Interestingly, a large number (336 nos./m^2) of *Ophelina* sp. were also recorded only from stn. RSIB3 at this sector 4.

After polychaetes, Gastropods molluscs were the next abundant benthic organisms found in the intertidal area of their sector, with 10.7% of the total population. Ampelisca sp. were recorded in low numbers only at his sector 4 at stn. RSIB1 and RSIB2. Likewise, few decapods (*Metopograpsus messor*) were recorded only from this sector at st. RSIB1 and RSIB2, besides at stn. FH1 of sector 2. Few specimens (32 nos./m^2) of *Dosinia* sp. belonging to the bivalvia group was recorded only at RSIB3 in this sector. Intertidal benthic population studies have been conducted from Ras Al Khor wildlife sanctuary during the month of February 2015. Based on collection sites, the 14 stations were divided into 4 sectors as discussed earlier in sector "Results". The total intertidal benthic population recorded from all the 14 stations in this Ras Al Khor wildlife sanctuary was 41,978 nos./m^2. Sector wise, the recorded faunal population were 15,054, 7,232, 2,096 and 16,596 nos./m^2 from sector 1,2,3 and 4 respectively. It is observed that the intertidal benthic population were rich at sector 4 (Rs Al Khor side) followed by sector-1 (Jadaff side), sector- 2 (Flamingo side) and sector - 3 (Mangrove side) respectively. The recorded population percentage for each sectors were 39.5% at sector 4, 38.2% at sector-1, 17.2 at sector – 2 and 5.0% at sector -3. Station wise, JSIB1 in sector- 1 recorded the maximum number of organisms (10,880 nos./m^2) and the minimum number of organisms (224 nos./m^2) were recorded from RSIB4 in sector-4. In general, sector 1 and 4 are equally more productive as the difference between them is very meager. Sector-2 is moderately productive and sector-3 is less productive. Polychaetes were the dominant organisms in sector – 1 and 4 with 36.2% and 34% of the total population in this sanctuary. However, Polychaete population at sector 2 and 3 were only 7.2% and 1.9% respectively. The population of polychaetes combining all the 4 sectors in this sanctuary works out to be 79.3% of the total population followed by gastropods with 16.6%. Together they formed about 96.9% of the population at this sanctuary. After polychaetes and gastropods which formed about 96.9% of the total population in the sanctuary, the remaining balance of 4.1% of the population comprised bivalves (2.4%), *Ampelisca* sp. (0.3%), decapods (0.2%) and Scaphopods (0.2%). The percentage populations of gastropods at various sectors in respect of the total populations were 1.7% (sector-1), 7.6% (sector-2), 3.0% (sector-3) and 4.2 (sector-4). Bivalve molluscs were the third dominant group of organisms found at this sanctuary. Like gastropods, this group was also found abundant at sector-2. This confirms the preference of molluscan organisms for the sediment/soil characteristics. *Tellina methorina* was found only at sector-2 at all the 3 station and were completely absent in rest of the stations. Another bivalve species, *Dosinia* sp. was found in large numbers at all the 3 stations at sector -2 and in less numbers at sector -1 (JSIB2), sector-3 (MH1) and sector 4 (RSIB3). *Certhidea cingulata* (gastropods) were the only organisms recorded from all the 14 stations, particularly sector-2 (FH-1 and FH-2). *Mitrella blanda* another gastropods was also recorded in almost all the stations except at RSIB3 and RSIB5. The total gastropod population was recorded more at sector-2 (3,200 nos./m^2) followed by sector-4 (1,776 nos./m^2), sector-3 (1,280 nos./m^2) and sector-1 (704 nos./m^2).

Discussion: Ras Al Khor Wildlife Sanctuary mangrove system support nursery habitat for invertebrates, vertebrate species and thus contribute to sustaining the local abundance of fishes and shellfish populations. In general, mangrove ecosystem appears to be retiring in both abundances and species diversity compared to other estuarine habitats. At Sindh wildlife mangroves forest of comprises of the following as birds, fishes, polychaetes, molluscan and crustaceans[13]. Recording of a higher faunal diversity of polychaetes, molluscan, arthropod and crustaceans at Ras Al Khor Wildlife Sanctuary mangrove area.

The mangrove habitats had fascinated a wide group of benthic faunal species. Higher diversity of benthic fauna could be due to the habitat's pristine condition, complex vegetation structure and composition[14]. The species availability and richness of food resources such as fish, polychaetes, molluscan, crabs and crustaceans[15] and low predation risk[16]. The benthic fauna species distribution and diversity of animals directly or indirectly due to vegetation structure and composition, occurrence of mudflat and richness of food resources are the major driving factors that influence the faunal distribution. Mangrove and other vegetation heterogeneity plenty of food resources and habitat diversity may increase avian richness and diversity[17,18]. It may be that the Ras Al Khor Wildlife Sanctuary mangrove areas are rich in invertebrate assemblages such as polychaete worms (nereidae, eunicidae, onuphidae, tube worms, cossuridae, and syllidae), crustaceans (amphipods, crabs, prawns and shrimps), molluscs (cerithidae, columbellidae, littorinidae, turritellidae, haminoeidae, tellinidae, veneridae and oysters) and scaphopoda. In addition, the extensive root systems of mangroves create habitat heterogeneity and complexity, offering suitable foraging sites for juvenile fishes and protecting them from predators by reducing their visibility[19,20]. Major factor that influences fauna diversity and distribution due to habitat heterogeneity and complexity[21-24]. Mangrove vegetation is healthy respond to, and moderates the environmental conditions prevailing in different intertidal zones and habitats[25]. The presence of the high diversity of benthic faunal composition could also be due to the availability of sheltered beaches and tidal mudflats, which are rich in organic matter. Mangrove aquatic invertebrates are a major dietary component of birds, fishes and even other invertebrates. As result shows that Ras Al Khor Wildlife Sanctuary mangrove forest is potentially very important habitat for a wide array of avian species.

Conclusion

Based the results of this study, RAKWS the dominance of inter-tidal benthic fauna is relatively high while the level of diversity is low. Benthic faunal populations are environment dependent and mainly on the nature and the organic matter content of the substratum. This is clearly evident in the distribution of intertidal benthic organisms at Ras Al Khor wildlife sanctuary. Polycheates were dominant at sector 1 and 4 in general, particularly at JSIB1, JSIB2, RSIB1 and RSIB2. However, (molluscan) gastropods and bivalves (to certain extent) were dominant at sector-2 followed by sector-4, 3 and 1. It is concluded that at Ras Al Khor Wildlife Sanctuary mangrove system, Dubai, UAE must be protected in a sustainable way in order to protect its diverse aquatic and terrestrial fauna species for future generations.

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