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MACROFAUNA ABUNDANCE IN SEAGRASS OF QATARI WATERS, ARABIAN GULF

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ABSTRACT

The present investigation deals with a preliminary study for the Macroinvertebrates of seagrass community in seven sites of the Qatari waters. The associated macrofauna taxa comprising nine major taxonomic groups, showed significant differences in the total numbers of individuals and species. Most seagrass meadows stations showed denser and richer macrobenthic fauna in comparsion with unvegetated stations. The highest total number of species (58 spp.) was recorded at Uraydah (St. UR3) while the lowest number of species (17 & 18 spp.) was observed at Al Ruwais (RW1) and Ras Rackan (RR1) respectively. The fauna was most dominated by Mollusca (36 spp.), Polychaeta (22 spp.) and crustacean (17 spp.). The faunal diversity index ranged from 3.489 (St. UR3) to 2.131(St. RW1). The salinity ranged from 42-45‰ and the value of the pH ranged from 8.2-8.4. The concentration of chlorophyll-*a* biomass was low. The grain size of bottom sediment was composed of high percentage of fine to very fine sand.

1. INTRODUCTION

Seagrasses are flowering plants able to live permanently under water in the marine environment and are represented by 50 species within 12 genera (den Hartog 1979; Phillips and Menez, 1988 and Sheppard *et al*., 1992). There are four species of seagrasses occurring in the Arabian Gulf (Sheppard *et al.*, 1992; Jones *et al*., 2002): *Halodule uninervis*, *Halophila ovalis*, *Halophila stipulacea* and *Syringodium isoetifolium*. The latter species exists in Bahrain's deep water (Khamdan and Al-Shehabi, 1992). Out side the Arabian Gulf, Species such as *Syringodium isoetifolium* and *Cymodocea serrulata* are presented in the water of Oman (Jacob and Al-Muzaini, 1990). Seagrasses in the Arabian Gulf show complex distribution pattern, reflecting the heterogeneous nature of the seabed and fluctuating oceanographic conditions (Sheppard *et al*., 1992). In Saudi waters, well-developed stands occur within a number of shallow coastal embayments (Basson *et al*., 1977). Well-developed stands in Bahrain occur principally along the southeast coast (Sheppard *et al*., 1992). Seagrasses are also extensive in southern parts of the Arabian Gulf, off coast of Qatar and UAE, but less on the coast of Iran and Kuwait (Jones 1985, ICUN/UNEP 1985 and Sheppard *et al*., 1992).

Seagrass beds are habitats for a wide range of epiphytic algae, microflora, and sessile fauna. This total community represents a rich and highly dynamic food web sustaining resident and migrotary marine animals and birds (Phillips and McRoy 1980). Seagrasses beds are exceptionally productive areas. They provide nursing grounds for fish, shrimp, invertebrates and substantial food source for turtles and dugon. In addition, the decomposing grass leaves

from the basis of variety of food chains (Barratt, *et al*., 1990). In general, seagrass beds are among the most productive of natural ecosystem. The gross productivity of 500-3000 g/cm^2 yr been recorded (IUCN, 1987).

Seagrass communities occur through the Arabian Gulf, There are some areas of the Qatar coastline which are known to have seagrass beds especially in the shallow waters and sheltered areas (Khors and small Bay).

In the Arabian Gulf, more than 600 species of animals have been recorded among seagrass (Basson *et al*., 1977 and McCain, 1984). Later study in the Gulf revealed 834 species with seagrass and sand/silt substrata (Coles and McCain, 1990). It was indicated that the great majority of these biota belong to polychaete worms, mostly of burrowing habits, molluscs of many different adaptive type and crustaceans, such as crab sand shrimp-like forms. Most of these animals are small, being adapted to make most of the space among the grass blades and rhizomes. Jupp *et al*. (1996) studied the seagrass communities on the western side of Masirah island on the Arabian sea coast of Oman. This area is an important feeding ground for the green turtle, *Chelonia mydas*, and it is affected by upwelling of low temperature waters during the summer monsoon. They found that the depth distribution of *Halodule univeris* and *Halophila ovalis* most abundance and overlapped but were inversely related. *Halodule* dominated the intertidal zone and *Halophila* was more predominant in the deep subtidal.

The present study is designed to provide information on the macrofaunal elements.

2. MATERIALS AND METHODS

The study sites were located along the south, south east, east and north shores of Qatar. They confined to seven sites (as shown in Fig.1): Massaieed, Al Wakrah, Uraydah, Al Khor, Al Dhakira, Al Ruwais and Ras Rakan. These sites comprised of monospecific or bispecific of *Halodule uninervis*, *Halophila ovalis* and *Halophila stipulacea*. It found that most of these species interspread with sandy and sandy mud substrata.

At each site one or two stations with seagrass beds, each approximately 10m^2, were chosen for comparison with another station randomly located with no seagrass lawns, in the same site. Seagrass and non seagrass beds were interspread, at depths 0.5-1 m below mean low water (MLW) and separated from each other and from any naturally occurring seagrass by at least 10m.

Seagrass Macrofauna were collected from randomly placed quadrants (0.5 m^2) and three replicates were taken from each site. Similarly, samples were also collected from unvegetated areas close to the sea grass beds.

Macrofauna samples were sieved and preserved in 5% buffered formalin solution. Benthic samples were sorted and animals identified to species level.

Species diversity (H') at each station was calculated using the information theory indices developed by Shannon and Wiener index (Shannon and Wiener, 1963), as:

$$H' = -\sum Pi \log_2 Pi$$

where Pi is the proportion of animals of *i*th species.

Two additional measures, the evenness (E) and species richness (R), were calculated as follows:

$$E = H' / H_{max}$$

And $R = S - 1 / \ln N$

Where, $H_{max} = \log_2 S$,

S is the number of species, and N is the total number of individuals (Krebs, 1978).

Water temperature, salinity, dissolved oxygen and pH were recorded during sampling using a Grant YSI Model 3800 Water Quality Logger, Chlorophyll-*a* was determined by acetone extraction according to Strickland and Parsons, 1972.

Sediment samples were collected from each station using core (5 cm diameter) to a depth of 10 cm. Organic matter and soil particle size were determined using the sieve method (Buchanan, 1984). For organic

matter, triplicates samples (5g) were washed to remove salt and placed in preweighed crucibles, then weighed again. The replicates were ashed at 450-500°C for 30 minutes in the muffle furnace. The organic content was estimated as the loss of weight after ignition and expressed as a percentage of the dry weight prior to ashing.

Fig. (1): Map of Qatar Showing study sites.

3. RESULTS

3.1. Environmental conditions

The physico-chemical parameters of the area investigated are illustrated in Table 1. It can be pointed out that:

The temperature of sea waters ranged during sampling period from 19.1°C in winter to 31.8°C in early summer.

The salinity ranged from 42‰ - 45‰, while the values of the pH of the surface waters showed narrow limit variations, where it ranged from 8.2 to 8.4 during the period of study.

The concentration of chlorophyll-*a* biomass was low and ranged between not detected (ND) and 0.72µg/L.

The grain composed of high percentage of fine to very fine sand (Table 1). There was a large size of bottom sediment collected from most seagrass stations was contribution of silt-clay fraction at almost of the stations with seagrass beds, where it showed variation from 33.2% at Al Ruwais to 83.9% at Al Dhakhira. The exception to this pattern was found at unvegetated stations where sand fraction was higher than sand-clay fraction.

3.2 Biota composition and diversity

Species diversity at each station is given in Table (2) and the fauna identified from the biotopes samples collected from each station is presented in Table (3). The percentage frequency of the different fauna groups is presented in Figure (2).

The data given indicate that three species of seagrass were identified in the investigated sites. Benthic invertebrates were represented by a total of 3933 animals representing 131 species. Fauna and flora associated with seagrass beds in Qatari Waters were classified according to the following catigories:

Algae

About 19 algae species belonging to different groups were observed in the seagrass beds of Qatari waters. *Chondria daysyphylla* was observed at 8 different stations. *Cystosiera trinodis* and *Cystosiera* sp were observed at 6 stations. The most common species *Padina* sp was observed at 10 different stations.

Demospongia

The sponges were only represented by 5 species. The most dominant species encountered were *Haliclona* sp which appeared at 10 stations, followed by *Hyrtios* sp at 5 stations.

Polychaeta

The second highest abundant taxa were polychaetes where (22 spp) were found. The most common species were *Nereis* sp and *Eunice* sp. The former was represented at all stations, while the latter was represented at 14 stations. Both, *Nephtys* sp and *Perinereis nigropunctata* were recorded at 11 stations, followed by *Janua* sp which appeared at 10 stations. The other polychaete species occurred with 1 to 7 species between various stations.

Crustacea

Around 17 species of Crustacea were identified from seagrass beds. Most common crustacean was *Diogenes* sp and *Portunus pelagicus*, the former was represented at 14 stations and the latter was represented at 17 stations out of 18 stations. *Gammaropsis* sp and *Alpheus* sp were flourished at 8 and 9 stations respectively. The most important economically and commercially shrimps *Penaeus semisulcatus* was observed at 6 stations located in Uraydah, Al Khor and Al Dhakhira. The rest of crustacean species were observed at 1 to 7 stations.

Mollusca

Mollusca was the most abundant taxa and representative in the seagrass beds, specially gastropods and bivalves with the former represented by 36 species and the latter represented by 42 species. The gastropods

Cerithium scabridum and *Miterella blanda* dominated at 17 stations (Table 3). *Calypeomorus* sp, *Cerithium cingulata*, and *Pirinella conica* dominated at 15, 13 and 11 stations respectively. *Cronia* cf *konkanensis*, *Lunella coron*ata, *Nassarius* sp and *Thais tissoti* dominated and flourished at 8 stations. Other gastropods, were also encountered in varying quantities in the different stations. The bivalves *Ervilia* sp and *Tellina* sp dominated at 11 and 12 stations respectively, while *Brachidontes variabilis* and *Diplodonta globosa* were dominated at 9 stations. The scaphopods *Dentalium octangulatum* and *Laevedintalum longitrorsum* were observed at 1 station and 6 stations respectively.

Other taxa such as Acidia, Echinodea and Stelleroidae were represented by 1,2 and 4 species respectively. Among the brittle stars *Ophiothrix* sp was the most dominant and flourished at 11 stations.

3.3. Massaieed site (Stations MS1, MS2 and MS3) (January 2003)

Stations MS2 and MS3 both associated with seagrass species *Halodule uninervis* and *Halophila stipulatacea* in January, 2003. Around 26 species (19.85%) were recorded from unvegetated bed (St. MS1), 36 species (27.48%) at station MS2 and 32 (24.43%) was recorded from station MS3. Gastropods were represented by 12 and 8 species, while bivalves were represented by 12 and 14 at stations MS2 and MS3 respectively. Among the gastropods *Cerithium scabridum* occurring in high numbers, between 13-15 individuals /0.5m^2 at St. MS2 and St. MS3 respectively. The rest of gastropod species were represented by 1 to 8 individuals /0.5m^2 at these stations.

The Most common bivalves at St. MS2 and MS3 was *Donax* sp which was represented by 25 and 22 individuals/0.5 m^2 respectively. Other bivalve species were represented by 1 to 12 individuals/0.5 m^2. The polychaetes were represented by *Nereis* sp, *Eunice* sp, *Euclymen*e sp *Janu*a sp, and *Lingula* sp. Echinoidea was represented by 2 species at St. MS1. Crustacea was represented by 1 species *Diogenes* sp (1 individual /0.5m^2) at St. MS3, and *Portunus pelagicus* dominated at all stations. Stelleroidae *Ophiothrix* sp occurred with 11, 14 and 7 individuals /0.5 m^2 at Stations MS1 to MS3 respectively. *Ophiothrix purpurea* was represented by 4 individuals /0.5 m^2 at St. MS2.

3.4. Al Wakrah site (Stations WK1 and WK2) (January 2003)

Station WK1 located in unvegetated area, while WK2 is associated with seagrass *Halodule uninervis* in January, 2003. A total of 20 species (15.27%) was recorded at station WK1 and 26 species (19.85%) at station WK2. Gastropod was represented by 6 and 10 species, while bivalve was represented by 2 and 6 species at stations WK1 and WK2 respectively. Among the gastropods *Ancilla castanea* (27 individuals/0.5 m^2) and *Calypeomorus* sp (9 individuals/m^2) most common at station WK1. *Umbonium vestiarium* accounted for 26 individuals/0.5 m^2) and *Cerithium caeruleum* 9 individual/0.5 m^2 at station WK2. The bivalves *Donax* sp was represented by 24 and 13 individuals/0.5m^2 at stations WK1 and WK2 respectively. Other mollusc species occurred with different proportions from 1 to 3 individuals/0.5 m^2. The brittle stars were represented by 16 to 20 individuals/0.5 m^2 at stations WK1 to WK2 respectively. At station WK1, polychaetes *Ceratonereis erythraensis*, *Armandia* sp and *Glycera* sp were accounted for 24, 28, and 19 respectively. *Nereis* sp and *Eunice* sp both accounted for 3-6 individuals/0.5 m^2, while *Ceratonereis erythraensis* presented by 28 individual/ 0.5 m^2 at Station WK2. Brittle stars *Ophiothrix* sp was presented by 16 and 20 individual/0.5 m^2 at stations WK1 and WK2 respectively.

Table (1): Sediment characteristics and Hydro-chemical parameters of investigated sites in Qatari waters.

Location	Sand (%)	Silt & Clay (%)	Organic matter %	pH	Salinity (‰)	Dis. O_2 (mg/L)	Chl-a (µg/L)	Water Temp. °C	Date of collection
MS1	68.2	31.8	0.8	8.2	44	5.3	ND	20.8	Jan-2003
MS2	45.5	54.5	1.7	8.21	45	5.26	0.23	21.2	
MS3	44.7	55.3	1.9	8.21	44	5.32	0.61	21.2	
WK1	65.8	34.2	0.3	8.3	42	5.1	0.23	19.6	Jan-2003
WK2	52.1	47.9	1.2	8.39	42.6	5.3	0.30	19.1	
UR1	44.9	55.1	0.9	8.22	43.4	4.8	0.23	30.9	Apr-2003
UR2	56.1	43.9	1.21	8.26	43.8	4.6	0.72	30.3	
UR3	47.3	52.7	1.3	8.24	44.2	4.6	0.52	29.1	
KH1	50.1	49.9	0.5	8.24	43.8	4.5	ND	31.8	May-2003
KH2	49.1	50.9	1.1	8.21	43.1	4.6	0.62	31.4	
KH3	28.3	71.7	1.8	8.2	43.2	4.5	0.65	31.5	
DK1	48.6	51.4	0.73	8.23	43.2	4.1	0.34	31.8	May-2004
DK2	47.8	52.2	1.3	8.21	43.1	4.5	0.35	31.4	
DK3	16.1	83.90	1.9	8.22	43.1	4.5	0.52	31.5	
RW1	96.9	3.1	0.1	8.2	42.8	5.11	0.10	21.2	Feb-2003
RW2	66.8	33.2	0.8	8.24	42.6	5.2	0.22	21.5	
RR1	88.1	11.9	0.11	8.2	43.2	5.2	0.13	18.2	Feb-2003
RR2	52.7	47.3	0.4	8.21	43.2	5.4	0.23	18.5	

Masaieed (MS1-MS3), AlWakrah (WK1-WK2), Uraydah (U1-U3), Al Khor (KH1-KH3), Al Dhakhira (DK1-DK3), Al Ruwais (RW1-RW2), Ras Rakan (RR1-RR2).

Table (2): Species Diversity (H'), evenness (E), Richness (R) and species number (S) values of macrofauna recovered during this study (Shannon and Wiener index).

Station	Diversity index (H')	Evenness (E)	Richness (R)	No. of Species (S)
MS1	2.949	0.905	6.03	26
MS2	3.140	0.876	6.89	36
MS3	3.064	0.812	6.26	32
WK1	2.434	0.812	3.64	20
WK2	2.731	0.781	5.88	33
UR1	2.998	0.900	6.59	28
UR2	3.466	0.873	9.22	53
UR3	3.489	0.859	10.19	58
KH1	2.134	0.681	4.07	23
KH2	3.070	0.785	8.11	50
KH3	3.034	0.784	7.73	48
DK1	2.686	0.790	6.43	30
DK2	3.381	0.829	9.99	59
DK3	3.181	0.805	8.52	52
RW1	2.131	0.752	3.82	17
RW2	2.893	0.827	5.81	33
RR1	2.226	0.770	4.04	18
RR2	3.081	0.835	7.00	40

Masaieed (MS1-MS3), AlWakrah (WK1-WK2), Uraydah (U1-U3), Al Khor (KH1-KH3), Al Dhakhira (DK1-DK3), Al Ruwais (RW1-RW2), Ras Rakan (RR1-RR2).

Table (3): Species presented at different stations together with abundance /0.5m^2 (*=Presented).

Species \ Stations	MS1	MS2	MS3	WK1	WK2	UR1	UR2	UR3	KH1	KH2	KH3	DK1	DK2	DK3	RW1	RW2	RR1	RR2
Sea grass																		
Halodule uninervi		*	*		*		*	*		*	*		*	*		*		*
Halophila ovalis								*		*	*					*		
Halophila stipulacea		*	*				*						*	*				*
Algae																		
Caulerpa sertularioides											*	*		*				
Jania rubens						*	*				*			*				
Colopomenia sp							*	*			*			*				
Chondria daysyphylla				*	*					*	*		*	*		*		*
Cystosiera myrica				*	*	*		*										
Cystoseira trinodis							*			*	*		*	*		*		
Cystosiera sp								*		*	*		*	*	*			
Ceramium sp					*	*										*		*
Dictyosphaeria sp													*			*		
Digenia sp													*					*
Hormophysa sp							*											
Laurencia papillosa						*												
Laurencia sp								*										
Padina sp		*			*		*	*		*	*		*	*		*		*
Rhizoclonium sp						*												
Sargassum binderi				*	*	*												
Sargassum boveanum							*											
Sporolithon molle					*			*								*		*
Polysiphonia sp		*																
Class: Demospongia																		
Biemna sp								1										
Haliclona sp	1	1			1			1		1	1		1	1		1		1
Spongia sp								1			1		1	1				
Hyrtios sp			1					1								1	1	1

Table 3: continue

Species \ Stations	MS1	MS2	MS3	WK1	Wk2	UR1	UR2	UR3	KH1	KH2	KH3	DK1	DK2	DK3	RW1	RW2	RR1	RR2
Adocia atra	1																	
Class: Polychaeta																		
Nereis sp	1	10	8	3	6	1	25	23	9	19	33	1	25	31	3	18	10	21
Prionospio sp												1	3	4				
Ceratonereis erythraensis				24	28				32	47	50					22		20
Eunice sp	5			1	6	1	7	9	3	12	18	3	14	17		5		7
Onuphis sp					1													
Nephtys sp				1	3	1	7	4	2	6	5	2	8	13				
Euclymene sp		9	5															
Syllis sp								1		7	9		10	18				2
Armandia sp				28	5													
Owenia sp					2				21	15	20		11	13		4		3
Leocrates sp								1				1						
Melinna sp												2						
Janua sp	6	5	13		3					7	9		8	8			1	5
Marphysia sanguinea										19	12		18	16		14		12
Loimia medusa						1	2											
Perinereis nigropunctata				1	5	1	3	7	1	2	3	2	8	8				
Perinereis nuntia								1		2	2		2	1				
Lingula sp	2	5	3															
Cirratulus cirratus																13		17
Glycera sp		3	2	19	1					1	1		1	1				
Typosyllis porlifera															19		18	
Typosyllis sp																5		2
Class: Crustacea																		
Diogenes sp			1	1	1	1	1	1	1	1	2	1	2	2	1		1	
Cymodoce sp						2					1		1	2				

Table 3: continue

Species \ Stations	MS1	MS2	MS3	WK1	Wk2	UR1	UR2	UR3	KH1	KH2	KH3	DK1	DK2	DK3	RW1	RW2	RR1	RR2
Cymadusa imbroglio							5	1										
Cymadusa sp							2											
Gammaropsis sp		1		13	50			3							3	5	2	9
Leucothoella bannworthi							3											
Argathona macronema									1	2	4	1	3	2				
Alpheus sp					1		1	3		7	5		1	2		1		2
Afrogitanopsis sp												1			1	2	1	3
Dardanus sp									1	2		6	1					
Urothoe grimaldi								2										
Paranamixis sp							1											
Paratanaidae sp								1										
Petrolisthes rufescens						1	4	5		1	2		1	1				
Portunus pelagicus	1	2	3	2	2	2	1	5	1	1		1	1	1	1	1	1	1
Undescribed crab							2	8										
Penaeus semisulcatus							12	31		19	38		13	45				
Class: Gastropoda																		
Ancilla castanea				27			2					1	1					
Ancilla farsiana																		6
Ancilla sparella		1	1				1											1
Atys cylindrica	3	5	8												1			
Bulla ambulla		1		2	2	1	6					2	4	22				
Cerithium scabridum	3	13	15	1	3		34	21	4	55	40	22	36	51	8	28	10	29
Cerithum saeruleum				2	9		8	2										
Cerithidea cingulata	5	3	7			2	10	4	1	9	12	5	11	14				1
Diodora funiculata		2	2															
Diodora sp							1	1										1
Euchelus sp						2		3										
Calypeomorus sp				9	17	7	12	13	3	38	25	15	29	22	18	14	12	15

Table 3: continue

Stations / Species	MS1	MS2	MS3	WK1	Wk2	UR1	UR2	UR3	KH1	KH2	KH3	DK1	DK2	DK3	RW1	RW2	RR1	RR2
Cronia cf *konkanensis*					1	2	6	1					2	1		4		7
Hexaplex kuesterianus	3							4				1	1	2		1		
Lunella coronata						2	2	2	22	10	2		5	1				
Liltoraria glabrata		3	2							3	3		2	3				
Mitrella blanda	1	3	3		1	1	8	9	1	3	2	1	22	2	3	26	1	11
Nodilittorina subrodos					1				2									
Pirinella conica		1	1	1	1	1						1	1		1	1	1	1
Pseudominolia sp		1																
Tricollia fordiana															1			2
Tricollia iso							5	6		1	1			1		1		1
Trochus erithreus		2														2		3
Trochus sp					1		2			1	2	1	2	1				
Nassarius persicus							12			1	2		22					
Nassarius sp							1	1		1	1		2	1		8		3
Osilinus kotschyi							3	2										
Potamidea conicus		3					3											
Potamides sp												1						
Thais tissote						1	2		1	1	1	1	1	2				
Thais savignyi						2	4	3			1		1					
Thais sp										1	1	1	1	4				
Pseudominolia sp						2			1	1	1	1	1	2				
Turbo sp							4	2				1	1					
Umbonium vestiarium					26		5											
Basiodiscus sp												1	1					
Class: Scaphopoda																		
Dentalium octangutum		1																
Levedintalum longitrorsum	1	1	1	1	2			1										

Table 3: continue

Species \ Stations	MS1	MS2	MS3	WK1	Wk2	OR1	OR2	OR3	KH1	KH2	KH3	DK1	DK2	DK3	RW1	RW2	RR1	RR2
Class: Bivalvia													1					
Brachidontes variabilis							3	1	69	45	38		1	3		2		2
Brachidontes emarginatus								2	3	4			2	3				
Diplodonta holosphaera							2	3										
Diplodonta globosa						9	11	10	42	38	53	12	16	32				
Diplodonta sp		1	3	9	13		1								2	5	1	3
Donax sp		25	22	24	13											39		43
Ervilia sp			2				2	1		1	1		1	1	1	2	1	2
Fulvia fragile	1	2	2															
Fulvia australe	3	6	5												1			
Fulvia sp															1	1	1	2
Pillucina fischeriana									1	1		1	2					
Pinctada radiata						1	22	15								7		5
Pinna muricata						8	12	14	1	1			5	10				
Pinna sp							6	8		2	2		1	3				
Scintilla sp												1						
Tellina sp	2	5	2		1		1			1	1		2	1		6	1	8
Tellinides sp										1	1		1	1				
Timoclea arakana	2	1	1		1													
Wallucina erythraea							1											
Wallucina sp						1												
Acrosterigma maculosa							1											
Atrina sp								1										
Bellucian semperiana	2	12	6				1	1										
Chama asperella		6	5		1		1	2										3
Chama aspersa							1	1										
Chama reflexa	1	3	2															
Marcia optima								2		2	3		2	1				

Table 3: continue

Species / Stations	MS1	MS2	MS3	WK1	Wk2	UR1	UR2	UR3	KH1	KH2	KH3	DK1	DK2	DK3	RW1	RW2	RR1	RR2
Circenita sp						1												
Gari roseus								2		3	2		1	1				
Isognomon sp							1	3		2	1		2	2				
Modiolus ligneus								1										
Parviperna nuclus						3		5										
Placuna sp								1										
Semele sinensis							3											
Semele sp								1										
Anadara ehrenbergi	1	1	2															
Callista sp	1	2	2		2											1	1	2
Nucula consentanea			2															
Timocalea arakana			2															
Bassina calophylla		3																
Conus sp	1																	
Carditopsis majeeda	3															3	3	4
Echinoidea																		
Holothuria sp	1					1				1	1		1	1				
Echinometra sp	1									2	1		1	1				
Stelleroidae																		
Asterina sp						2	6	9		12	13		10	15				
Ophiothela sp										5	8		2	4				
Ophiothrix purpurea		4																
Ophiothrix sp	11	14	7	16	20					2	1		2	1		1		1
Ascidia																		
Ascidia sp								1		1	1		1	1	1	2		1

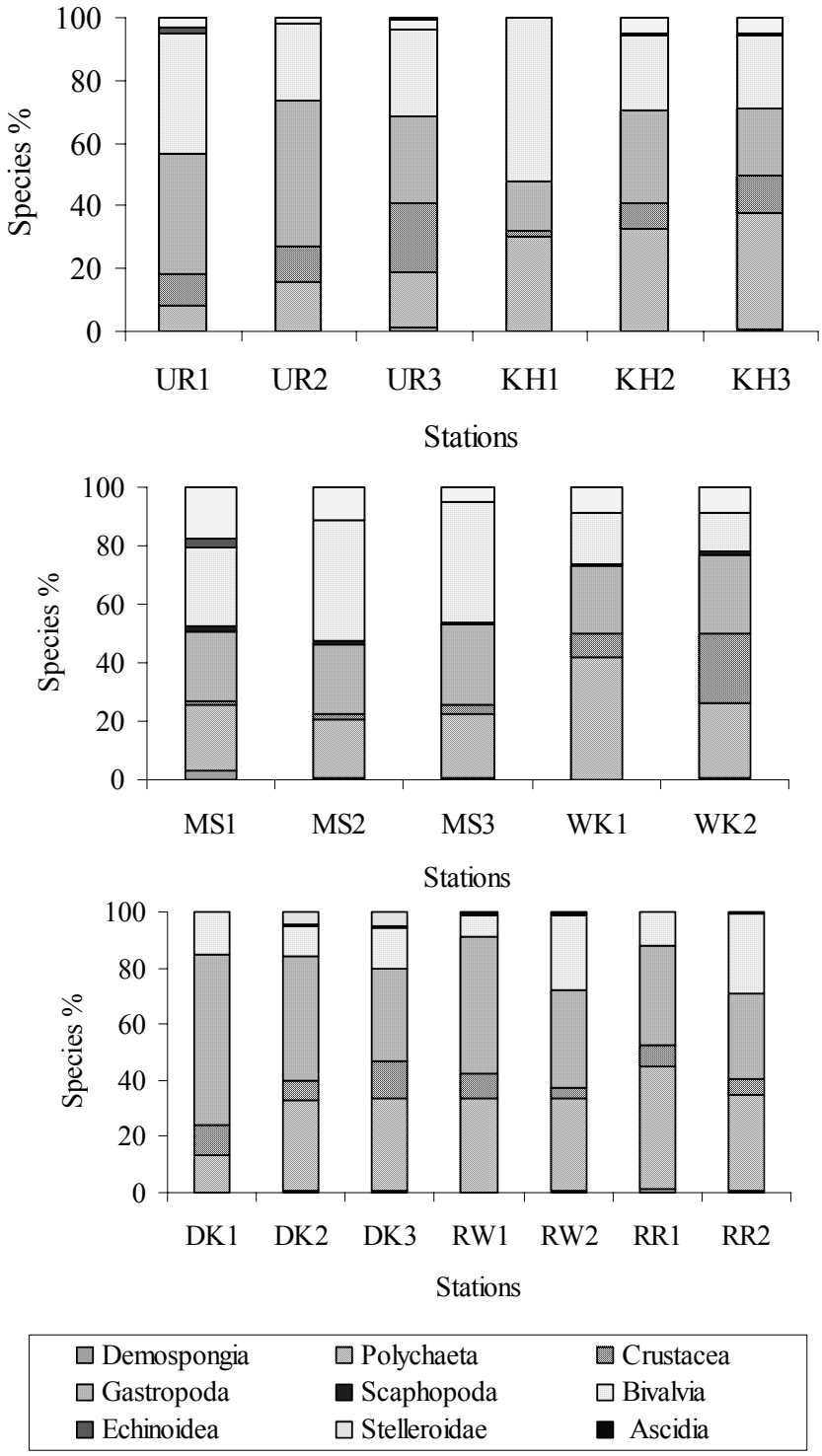

Fig. (2): Frequency percentage of different animal groups in the study stations.

3.5. Uraydah site (Stations UR1, UR2 and UR3) (April 2003)

Three stations were located at this site**,** Station UR1 without seagrass meadow, station UR2 vegetated with *Halodule uninervis* and *Halophila stipulacea*, and station UR3 vegetated with *Halodule uninervis* and *Halophila ovalis* in April, 2003.

Fauna recorded at this site belong to Mollusca, spongia, Echinoidea, Ascidia and brittle stars. The highest numbers of species were recorded at station UR3 (66 species) followed by station UR2 with 61 species and unvegetated station UR1 with 34 species.

Similarly, the fauna was most dominated by gastropods, bivalves mollusc. Among the Gastropoda *Cerithium scabridum* was represented by 34 and 21 individuals /0.5m^2 at stations UR2 and UR3 respectively. The bivalves *Pinctada radiata* occurred with 22 and 15 individual/0.5m^2 at stations UR2 and UR3 respectively. *Pinna muricata* was presented by 12 and 14 individuals/0.5m^2 at stations UR2 and UR3 respectively. Crustacean *Penaeus semisulcatus* was the most dominant and it occurred with 12 and 31 individuals /0.5 m^2 at stations UR2 and UR3 respectively. Echinoidea and Stelleroidea were represented by 1 species each.

3.6. Al Khor site (Stations KH1, KH2 and KH3) (May, 2003)

Three stations were located at this site, KH1 unvegetated and KH2-KH3 vegetated with *Halodule uninervis* and *Halophila ovalis* in May, 2003.

Fauna recorded at this site belonging to Mollusca, Polychaeta, Crustacea, Echinoidea and Stelleriodea. A total of 23, 49 and 46 species were presented at stations KH1 to KH3 respectively. The Gastropoda was represented by 13 species at station KH2 and 14 species at station KH3. The dominant gastropod species was *Cerithium scabridum* which was observed with 55-40 individuals/0.5 m^2 at stations KH2 and KH3 respectively. The second highest Gastropoda *Calypeomorus* sp was accounted for 38 and 25 individuals/0.5 m^2 at stations KH2 and KH3 respectively.

The bivalves species were represented by 12 species at station KH2 and 9 species at station KH3. The most abundant bivalve species was *Brachidontes variabilis*. It represented by 69, 45 and 38 individuals/0.5m^2 at stations KH1 to KH3 respectively. The second highest bivalve species was *Diplodonta globosa* and it was represented by 42, 38 and 53 individuals/0.5 m^2 at stations KH1 to KH3 respectively.

The polychaete species are important members of the benthic community in seagrass beds and others marine habitats. It dominated with 6 species at station KH1, while stations KH2 and KH3 each was dominated with 11 species. *Ceratonereis erythraensis* was the most abundant at this site. It occurred by 32, 47 and 50 individuals /0.5 m^2 at stations KH1 to KH3 respectively. *Nereis* sp occurred with 33 individuals /0.5 m^2 at station KH3. Crustacean species were represented by 4, 7 and 6 species at stations KH1 to KH3 respectively. Stations KH2 and KH3 were characterized by the dominance of the Crustacean *Penaeus semisulcatus* (19 to 38 individuals /0.5 m^2).

3.7 Al Dhakhira site (Stations DK1, DK2 and DK3) (May 2004)

Three stations were located at this site, station DK1 unvegetated, stations DK2 and DK3 both vegetated with *Halodule uninervis* and *Halophila stipulacea* in May, 2004.

The highest numbers of fauna (59 species) was observed at station DK2, followed by 52 species (46.56%) at station DK3 and the lowest numbers 30 species (23.66%) was recorded at station DK1. At stations DK2 and DK3 Demospongia represented by 2 species *Haliclona* sp and *Spongia* sp. The polychaete *Nereis* sp presented by 25-31 individuals /0.5

m^2 and *Syllis* sp occurred with 10-18 individuals/0.5 m^2 at stations DK2 to DK3 respectively. *Eunice* sp was represented by 14 and 17 individuals/0.5 m^2 at stations DK2 and DK3 respectively. Crustacea *Penaeus semisulcatus* was dominated by 13 and 45 individuals /0.5 m^2 at stations DK2 and DK3 respectively.

Mollusca was most dominant group at this site. Among the Gastropoda *Cerithium scabridum* was observed with 22, 36 and 51 individuals /0.5m^2 at stations DK1 to DK3 respectively. *Calypeomorus* sp occurred with 15, 29 and 22 individuals /0.5m^2 at stations DK1 to DK3 respectively. Most abundant bivalves were *Diplodonta globosa* and *Pinna muricata*. The former represented by 32 individuals /0.5 m^2 at station DK3, while the latter represented by 10 individuals /0.5m^2. The remaining taxa showed less abundance (Table 3).

3.8. Al Ruwais site (Stations RW1 and RW2) (February 2003)

Two stations were located at this site. Station RW1 without seagrass bed and station RW2 associated with seagrass species *Halodule uninervis* and *Halophila ovalis* in February, 2003.

A total of 17 species (13.74%) was recorded at station RW1 and 33 species (31.30%) at station RW2. Demospongia *Haliclona* sp and *Hyrtios* sp both were observed at station RW2. Polychaeta *Nereis* sp, *Ceratonereis erythraensis*, *Marphysia sanguinea* and *Cirratulus cirratus* were represented by 18, 22, 14 and 13 individuals/0.5 m^2 at station Rw2 respectively. *Typosyllis porlifera* was represented by 19 individuals/0.5 m^2 at station RW1. Crustacea was dominated with 4 species at stations RW1 and RW2 with 1 to 4 individuals/0.5 m^2. The gastropods were represented by 6 and 9 species, while bivalves were represented by 4-9 species at stations RW1 and RW2 respectively. Among gastropods, *Cerithium scabridum*, *Calypeomorus* sp and *Miterlla blanda* were represented by 28, 14 and 26 individuals/0.5 m^2 respectively at station RW2. The bivalves *Donax* sp was dominated by 39 individuals /0.5 m^2 at station RW2. The remaining bivalves species occurred with 1 to 7 individuals/0.5 m^2. Ascidia was represented by 1 and 2 species at RW1 and RW2 respectively, while brittle stars was represented by 1 species at RW2.

3.9. Ras Rackan site (Stations RR1 and RR2) (February, 2003)

Two stations were located at this site station RR1 unvegetated and station RR2 vegetated with *Halodule uninervis* and *Halophila stipulacea* in February, 2003.

A total of 18 species was recorded at station RR1 and 40 species at station RR2. Demospongia presented by 2 species *Haliclona* sp and *Hyrtios* sp both were observed at station RR2. The latter species also observed at station RR1. Polychaeta *Nereis* sp, *Ceratonereis erythraensis*, and *Cirratulus cirratus* were represented by 21, 20 and 17 individuals /0.5 m^2 at station RR2. *Typosyllis porlifera* was presented by 18 individuals/0.5 m^2 at station RR1. Gastropoda *Cerithium scabridum*, *Calypeomorus* sp and *Mitrella blanda* were observed with 29, 15 and 11 individuals/0.5 m^2 at station RR2. The highest proportion of bivalves *Donax* sp was represented by 43 individuals/0.5 m^2 at station RR2. The rest of bivalve species occurred with 1 to 8 individuals/0.5 m^2.

3.10. Species Diversity

Species diversity indices based on number of individuals for all the stations studied were calculated. These showed some variations between the vegetated stations and unvegetated stations (Table 2). The overall species diversity index was greater at St. UR3 (H' = 3.489), while the lowest species diversity index is recorded at St. RW1 (H' = 2.131). The overall evenness (E) based on the number of individuals was the highest at St. MS1(E = 0.905), while the lowest value

was recorded at St. RW1 (E = 0.752). There was a significant difference in species richness between vegetated and unvegetated stations. The highest richness value was observed at St. UR3 (R = 10.19), while the lowest value at St. WK1 (R = 3.64).

4. DISCUSION

This study is the first attempt to investigate macrobenthic invertebrate community that associated with seagrass beds at the coast of Qatar. Three species of seagrasses were found at the study sites, *Halophila stipulacea, Halophila ovalis* and *Halodule univeris*. The latter two species have been identified from the present survey in Al Khor, Uraydah (St. UR2) and Al Ruwais. On the other hand, *Halophila stipulacea* and *Halodule univeris* were recorded in Massaieed, Al Dhakira, Ras Rackan and Uraydah (St.UR2). In Al Wakrah (St. WK2), only one species of seagrass meadows of *Halodule univeris* was identified. Similarly, these species of seagrass have been also recorded from the Arabian Gulf. Sheppard *et al*., 1992 reported that 4 seagrass species are presented in ROPME Sea Area (RSA), compared with 11 for the Red Sea. Assemblages in the Arabian Gulf are dominated by *Halodule uninervis* and *Halophila ovalis* although mixed stands also occur (Price and Coles, 1992; Sheppard *et al*. 1992). Their productivity is often enhanced by Cyanophyta-dominated algal mats (Price *et al.,* 1993).

Further offshore, however, they appear to be patchy and less prevalent at least along the coast of Saudi Arabia and the greatest concentrations are between Safaniya and Manifa, in Musallamiyah and the south of Abu Ali, and in the Gulf of Bahrain (WCMC, 1991). In Bahrain, they are more extensive, thought they do not generally extend dee/than 8 m (Price *et al*., 1993).

In the present study, sediment of seagrass beds showed a high proportion of silt-clay comparing with those beds without vegetation. In the Arabian Gulf, seagrasses are generally associated with relatively fine grained sediments types (Sheppard *et al*., 1992). Seagrasses of the Red Sea have colonized a range of unconsolidated sediments (Price *et al*., 1988). In the Gulfs of Suez and Aqaba, fine to coarse sands are favoured, although certain species such as *Halophila stipulacea* have also colonize environments with fine grained sediments (Hulings and Kirkman, 1982).

The salinities recorded in the present study, do not appear to differ greatly between the sites and from those recorded on the other parts of the Arabian Gulf. Salinity has been suggested to be largely responsible for restricted seagrasses (4 species) in the Arabian Gulf, although seagrass biomass is not significantly correlated with salinity (Sheppard *et al*., 1992). The pH values were in the alkaline range (8.2-8.39), and dissolved oxygen values fluctuated between a minimum of 4.1 mg/L in St RR2. With respect to the elevated salinity, the water of all sites were well oxygenated due to shallowness where winds play an important role in such process. The highest levels of organic matters were found in vegetated stations. This is likely correlated with increased settlement of material derived partly from the seagrasses themselves. On the other hand, chlorophyll-*a* level was low for all stations and do not exceeding 0.8 µg/L. Therefore, the studied sites can be considered as oligotrophic area. Highest levels of chlorophyll-*a* were recorded at station UR2 (0.72 µg/L), and the lowest level was observed at Station RW1 (0.10 µg/L). Despite of sites location, levels of chlorophyll-*a* are within those of the Qatar waters.

In the seagrass meadows of Qatar waters, 131 spp. seagrass associates were recorded, approximately 61% (80 spp.) of which were molluscs. In comparison, in the western Gulf, 350 spp. seagrass associates were recorded by Basson *et al*., 1977. Thirty one percent (164 spp.) of which were molluscs. This study revealed that there are significant differences between stations with seagrass beds and those

without seagrass meadows in numbers and diversity of biota. It was very obvious from seagrass beds at stations located at these sites: Uraydah, Al Khore and Al Dhakhira (56 to 67 spp), while in unvegetated stations, the numbers of species varied between 18 to 26 spp. In the vegetated sites, also it was much higher in species richness (R between 6.26.3-10.19) and much greater abundance of fauna compared with other stations. There was quite a variety of marine organisms within stations with seagrass themselves, and those without seagrass. This might, therefore, be a result of their productivity and the complexity of the seagrasses, which provide both food sources and shelter for the faunas (Heck and Thoman, 1981; Robertson, 1984; Nelson and Bonsdroff, 1990; Boström and Mattila, 1999). Below ground, seagrasses rhizomes and roots can stabilize sediments, protecting the substrate from erosion (Williams and Heck, 2001). The diversity and abundance of animal species associated with seagrass meadows are known to increase with increasing plant biomass (Heck and Orth, 1980).

Differences in seagrass and fauna community density, colonisation period, food availability and predation cannot be ruled out. A manipulative study would be necessary to test the hypothesis of habitat preference for both seagrass and macroinvertebrates associated with it in Qatari waters.

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