

PRELIMINARY STUDY ON CORAL REEF AND ITS ASSOCIATED BIOTA IN QATARI WATERS, ARABIAN GULF

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دراسة أولية للشعاب المرجانية والكائنات المصاحبة لها

في المياه القطرية ، الخليج العربي

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تم تعريف الشعاب المرجانية والكائنات المصاحبة لها في أربع مناطق تعتبر هامة للتكاوين المرجانية في المياه القطرية . جمع العينات وتصوير الشعاب تم بواسطة الغطس تحت الماء . وقد وصفت المناطق المختارة للدراسة والشعاب السائدة في كل منها حيث سجل ١٧ نوعاً من المرجان السائدة ، وفيما يتعلق بأنواع الكائنات المصاحبة فقد تم تعريف ٢٣ نوعاً من الطحالب ، ٥ أنواع من المساميات ، ٤ أنواع من الأشنات ، ١٧ نوعاً من الديدان الشوكية ، ٢١ نوعاً من شوكتيات الجلد ، ١٠٢ من الرخويات ، ٤ من الحبيليات و ١٥ نوعاً من القشريات . تمثل شعبة الرخويات أهم الشعب السائد في جميع مناطق الدراسة ، إذ تشكل وفرة عالية مقارنة بالأنواع الأخرى تصل إلى حوالي ٤٢ - ٥٢ % .

تدل النتائج الأولية للدراسة في مناطق الشعاب المرجانية المختارة على تميزها بالحيوية والتنوع البيولوجي الوفي مما يكسبها ديناميكية هامة للتوازن في البيئة البحرية الأمر الذي يتطلب إجراء دراسات تفصيلية في المستقبل .

ABSTRACT

Coral reef grounds and their associated biota in Qatari waters were investigated by Scuba diving. Four selected reef-sites were studied. Coral was presented by 17 species. Descriptive notes of each site and an initial list of associated fauna and flora were presented. The associated biota composed mainly of Algae 23 sp, Porifera 5 sp, Bryozoa 4 sp, Polychaeta 17 sp, Echinodermata 21 sp, Mollusca 102 sp, Chordata 4 sp, and Crustacea 15 sp. Mollusca was the predominant group in all visited sites forming between 43 and 52% Abundance and distribution of species were compared to other studies along the Gulf.

INTRODUCTION :

Coral reefs are the most diverse and productive habitats in the Gulf marine environment. It supports diverse assemblages of fauna and flora. Basson *et al* [1] reported a total of 543 species associated with its biotope. Fish associated with patch reefs have been studied by McCain *et al* [2]. A total of 106 species were recorded, with physical characteristics of the reef and seasonal variations controlling fish assemblage McCain *et al* [2]. Along the Gulf coasts coral reef habitats receive very little attention and information on taxonomy and species distribution are scarce [3] and [4]. Sheppard [5] reported approximately 57 species of reef corals from 31 genera, mostly from fringing reefs of the offshore Saudi Arabian coral Islands. He divided the Arabian Gulf reef coral around Bahrain into five main assemblages. Recently, Mohammed and Al-Sadah [6] and Mohammed [7] have studied the coral reef grounds and its associated biota in the western side of Arabian Gulf.

In view of the lack of detailed information on Qatar coral reefs, the present study took place to illustrate the type and diversity of Qatar coral reefs, the biota associated with coral reefs and major benthic components of the reef community.

MATERIALS AND METHODS

Quantitative surveys for four different coral reef sites were carried out from April to September 1998 using the R/V «Mukhtabar AL-Bihar» belonging to University of Qatar (Fig. 1). Using SCUBA diving, quantitative macrobenthos samples

were obtained from coral reef sites along the eastern coast of Qatar. Benthos were taken from each site using self-constructed plastic cores. Samples were sieved using 0.1 mm mesh sieve and preserved in 5% buffered formalin in sea water solution. In the laboratory, the macrofauna and flora were sorted and identified to the level of higher taxa. On each site, video and close-up photographs were taken for coral reefs and their associated living organisms. Coral genera were identified from video records and magnifications of field photographs. The percentage cover of dominant coral genera was estimated for each site.

RESULTS

Site 1. Halul

a. Location : N 25°38'53.8" E051°25'34.4" and N25°40'16.0" E051°25'19.0" The length of the Island is about 4.8 km while the maximum width is about 3.2 km. It lies about 52 nautical miles north-east of Doha. Halul is fringed by a reef, which extends about three miles offshore. Shoals extend about four miles north-east and northwest from the Island, and depth are up to 10 meters in the Southern-most part of the Island. Around Halul exists a highly productive fishing ground.

b. Corals :

Eleven species were observed in this area (Table 1). The dominant community was Family : Acroporidae presented by 2 species i.e. *Acropora clathrata* and *Acropora* sp.; Family : Partitidae represented by 3 species i.e. *Porites compressa*, *Goniopora lobata* and *Alveopora* sp.; Family : Faviidae presented by 2 species i.e. *Favites* sp.

and *Platygyra daedalea* and Family : Dendrophylliidae presented by 2 species i.e. *Dendrophyllia* sp. and *Tubastraea* sp., while sub family : Montastreinae was presented by 1 specie i.e. *Echinopora* sp. The most abundant species *Acropora* sp. and *Platygyra daedalea* cover an area of 60% along the south-western part of Halul Island reef flats and at depths ranging from 3-10 m, while in the north side of the Island *Acropora* sp. were less abundant due to the prevailing north wind (Al-Shamal).

c. Associated fauna and flora :

Organisms identified from Halul biotope are presented in Table 2. The sample showed a total of 110 species. The percentage frequency of the different taxa is shown in Fig. 2. Algae contributed 15.5% of the total biota, while Porifera and Hydrozoa presented 2.7% and Bryozoa presented a very low percentage i.e. 1.82%. Other taxa like Annelida presented by 5.45%; Echinodermata by 12.73% and Crustacea presented 10%. Molluscs contributed 49.09 % of the biota and considered as the predominant taxon. Most of its species were found in crevices for example, *Turritella* sp., *Cronia konkanesis* and *Diplodonta* sp., or settled on rocks and dead corals and coral rubbles for example. *Thais* sp., *Cypraea* sp., *Pinctada radiata*, *Chlamys* sp., or on the bottom of lagoons such as *Cerithium* sp., *Miterella blanda* and *Strombus* spp.

2. Umm Aladam

a. Location : N 25°18'59.4" E 051°08'58.0"
Um Aldam lies about 19.6 nautical miles east of Doha at a depth of 18 meters.

b. Corals :

Nine species were found in this area dominated by *Acropora* sp., *Montipora capricornis*, *Porites compressa*, *Favites* sp., *Favites pentagona*, *Platygyra daedalea*, *Turbinaria peltata*, *Dendrophyllia* sp and *Cirrhopathidae anguina*. The coral reefs covers 30% of the area.

c. Associated fauna and flora :

The overall percentage distribution of different biota collected from this site (Fig. 2), indicates that molluscs were highly abundant represented by >43%. Annelida and Chordata show very little occurrence and are represented only by >5%, while algae and crustacea were represented by 23.8% each. Table 2 shows the most important species observed at this site. Phaeophyta was represented by 5 species *Sargassum angustifolium*, *Sargassum binderi*, *Padina tetrastrumatica*, *Colpomenia sinuosa* and *Hormophysa triquetra*. Crustacea was also represented by 5 species *Balanus tintinnabulum*, *Portunus pelagicus*, *Epixanthus* sp., *Pilumnus longicornis* and *Pilumnus vespertilio*; while annelida was represented only by 1 specie (*Nereis* sp.)

3. Hadeed

a. Location : N 24°53'01.4" E 051°47'02.0"
Fasht Al-Hadeed is about 12 nautical miles southeast from Umm Said in shallow coral reef area.

b. Corals :

Nine species were observed in this area dominated by *Stylophora pistillata*, *Acropora clathrata*, *Acropora* sp., *Porites* sp., *Favites* sp., *Goniastrea* sp., *Platygyra* sp., *Turbinaria* sp. and *Echinopora* sp. The

most abundant species was *Acropora* sp. covering about 30% of the flats and at depths ranging from 3-6m.

c. Associated fauna and flora :

The most abundant classes of fauna collected from this site are gastropods and bivalves forming >52% of biota. Hydrozoa is the lowest and their occurrence from >2% followed by Porifera (>3%) and Bryozoa >3%. Crustacea were presented by 6.45%, Chordata (3.23%) and Annelida (>16%). Algae constitute 10% and is represented by 3 species of Chlorophyta, 5 species of Phaeophyta and 1 species of Rhodophyta (*Gracilaria foliifera*) (Table 2)

4. Halut Al-Asere

a. Location : N 25°08'42.2" E 051°57'01.22"
Halut Al-Asere lies about 26 nautical miles at east south of Doha. The water depth ranges between 0.5 to 5.7 meters. This area is used as a storm shelter for fishermen when strong northerly winds blow up.

b. Corals :

Also, 9 species were found in this area and dominated by the same species found at Hadeed site. The most abundant species is *Acropora* sp. which cover an area about 60% of the flats and at depths ranging from 3 to 6m.

c. Associated fauna and flora :

The percentage of biota collected from this site are illustrated in Fig. 2 Molluscs are the most common at this site, presented by >52%, followed by Annelida (>16%) and algae (10%). Other taxa represented be-

tween 2% and 9%. A total number of 88 species were found at this site (Table 2).

DISCUSSION

In Qatari waters, Shinn [8] reported 8 coral species from north and east coast of Qatar and found that *Acropora*, *Platygyra* were the most common with the appearance of *Porites* sp. Mohammed and Al-Sadah [6] reported that the dominant coral genera consist mainly from *Acropora* sp., *Platygyra daedalea*, *Turbinaria* sp. and *Porites compressa* covering more than 50% of the flat reefs. The same authors also reported that on the eastern and southeastern coasts of Bahrain *Acropora* sp. and *Porites* sp. were the most common while *Turbinaria* sp., *Milliopora* sp., and *Pavoria* sp., were frequently reported. Baratt and Ormand [9] and Sheppard [5] recorded 12 coral species in distinct areas along the east coast of Bahrain (Fasht Adham) and observed that these species cover over 50%. Along Saudi Arabia coasts (north Arabian Gulf) a total of 21 reef corals species were recorded [10], while a combination of several studies [1] and [5] mentioned that approximately 57 species of reef corals from 31 genera have been recorded for the Gulf, mostly from fringing reefs of the offshore Saudi Arabian Coral Islands. Recently, Sheppard and Sheppard [11] reported that 60 species of hard corals are known from the Arabian Gulf area compared to 200 species in the Red Sea and perhaps twice that number in the Indian Ocean.

The dominant Coral species recorded in the present investigated sites consist from

17 species *Stylophora pistillata*, *Acropora clathrata*, *Acropora* sp., *Montipora copricornis*, *Porites compressa*, *Goniopora lobata*, *Alvepora* sp., *Favia* sp., *Favites pentagona*, *Goniastrea* sp. *Platygyra daedalea* *Turnbinaria peltata*, *Dendrophyllia* sp. *Tubastraea*, *Echinopora* sp., *Echinophyllia* sp. and *Cirrhopathidae anguina*.

Concerning the diversity of associated biota in the investigated sites (Fig. 1), it is obvious that site of Halul sustained the highest diversity recording with 110 species, while Umm Al-Adam showed 21 species, Hadeed 93 species and Halut Al-Asere 88 species. Molluscs form the main component, and most of its species were found in crevices, settled on dead corals or on the ground of corals reef area. Mollusca are particularly well represented in the coral area. Many of the large spectacular types of shells, familiar form coral reefs in the tropical Pacific, have not yet been recorded in the Arabian Gulf, but a fair number of interesting species occur. Yamaguchi [12] reported that the coral reef habitat is favored by cowries especially where thin layer of sand overlays a hard substrate. These cowries especially where thin layer of sand overlays a hard substrate. These cowries : *Cypraea caneola*, *C. caurica*, *C. felina*, *C. fabula* and *C. garcilis* were recorded in the Gulf and the Red Sea coasts, where over 180 species of molluscs have been observed, including a number of endemic cowries (Cypraeidae) and Strombids (Strombidae) [4]. Annelida was represented by 14 species at Hadeed and Halat Al-Asere sites, while it was represented by lowest number of species at other sites.

Mohammed and Al-Sadah [6] listed 1 porifera, 16 coelentrata, 6 annelida, 10 crustacean, 12 echinodermata and 52 mollusca from coral reef grounds and its associated biota in the Western side of the Arabian Gulf. On the other hand, Al-Khayat [13] reported that the mollusca community of Qatari waters is represented by 246 species including 115 gastropods, 124 bivalves, 4 scaphopods and 3 polyplacophors. However Briggs, [14] listed 97 gastropods, 83 bivalves and 4 scaphopoda from all habitats in United Arab Emirates; while Vousden [15] reported from all habitats around Bahrain Island 1 amphineura, 3 scaphopoda and 187 molluscs (100 of them are gastropods).

Sub-tidal macroalgae bed (e.g. *Sargassum*, *Hormpopysa*) play an important role in the life cycles of a number of species such as the post larval stage of shrimp (*P. semiselcatus*), and spat of pearl oyster (*Pinctada* spp.) [16]. During the present survey, around 23 species were identified from different sites where *Sargasum* spp. form the main component of marcolage.

The present study is based on few samples collected during autumn 1997 and summer 1998, it represents a basic study of coral reefs and its associated biota in Qatari Waters. It provides a background for future long-term studies. More detailed studies of coral reefs and their associated biota are required before any conclusions can be made.

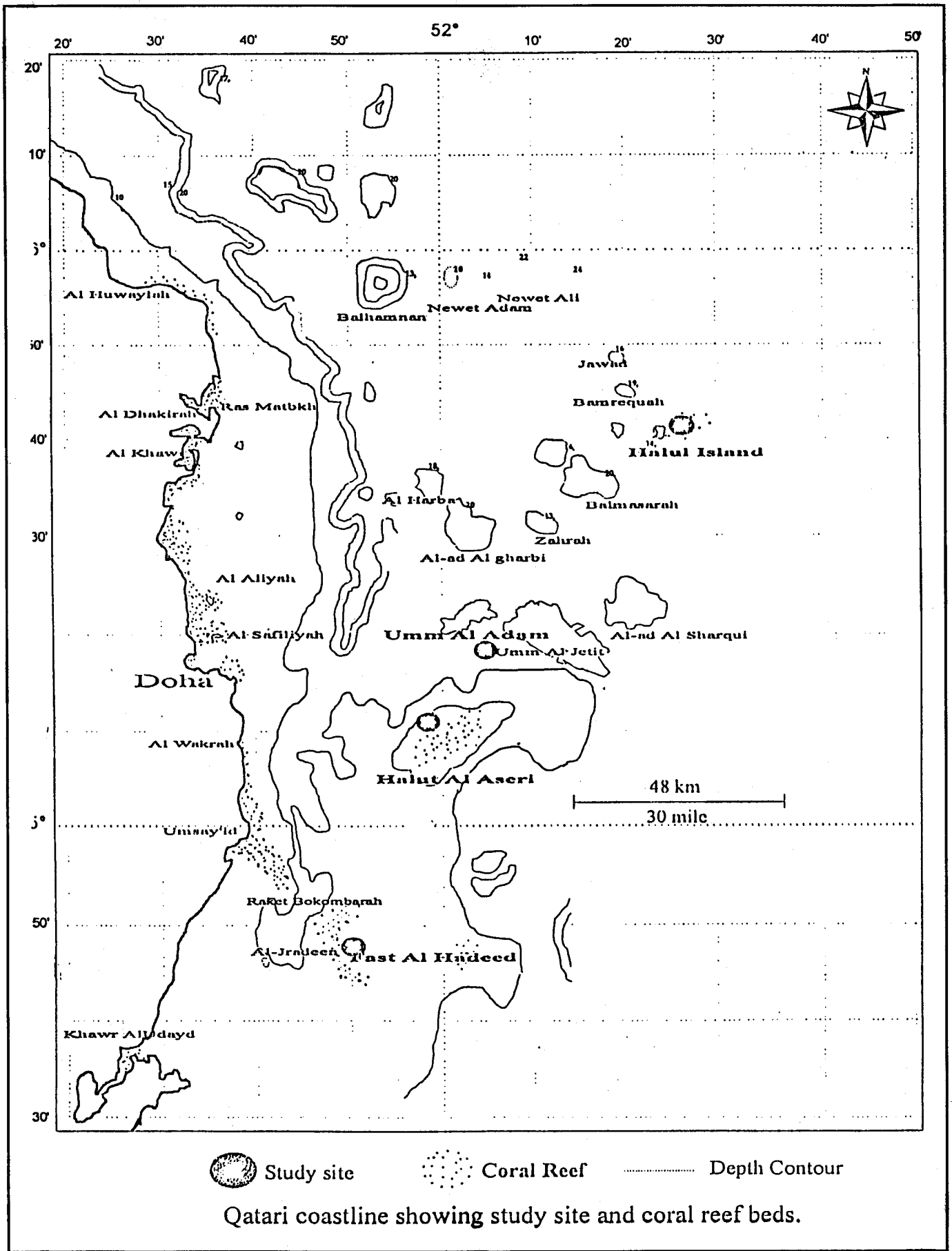
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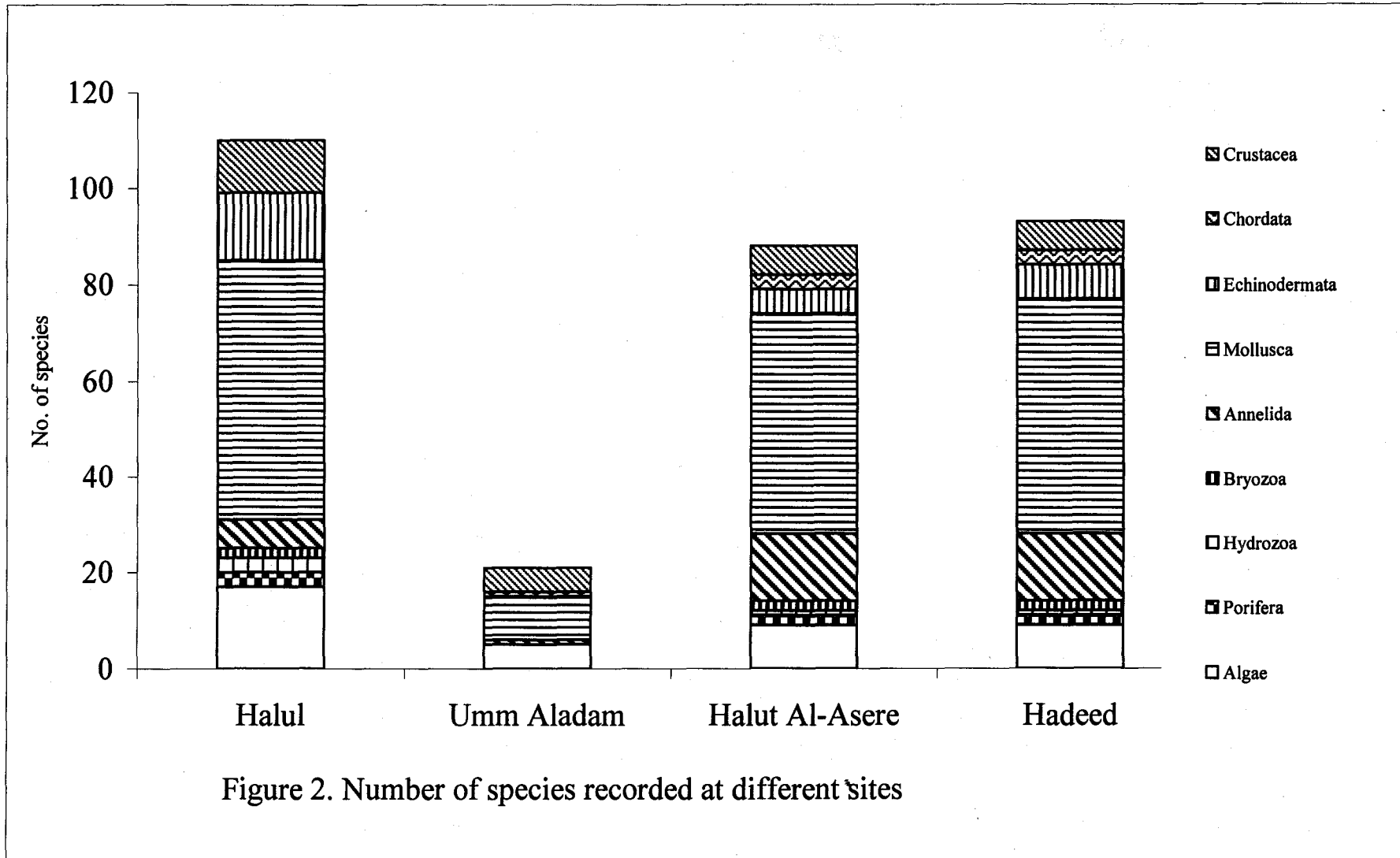
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(Fig. 1)



(Fig. 2)



Platygyra daedalea



Porites sp.



Turbinaria sp.



Juncella sp.



Acropora clathrata



Fish associated with coral reef

(Fig. 3)

Species	H	U	S	D
<i>Syllis</i> sp	*		*	*
<i>Nereis</i> sp	*	*	*	*
<i>Perinereis</i> sp			*	*
<i>Nephtys</i> sp			*	*
<i>Eunice</i> sp	*			
<i>Onuphis emerita</i>	*		*	*
<i>Onuphis</i> sp			*	*
<i>Cirriformia</i> sp			*	*
<i>Phyllodoceidae</i> sp			*	*
<i>Owenia fusiformis</i>			*	*
<i>Melinna</i> sp			*	*
<i>Sebella</i> sp			*	*
<i>Janua (fauveldora) kayi</i>			*	*
<i>Pomatoleios terricola</i>			*	*
<i>Hydroidea elegans</i>	*			
<i>Hydroidea</i> sp	*			
Phylum: MOLLUSCA				
Class: Gasropoda				
<i>Diodora rueppellii</i>			*	*
<i>Diodora</i> sp	*			
<i>Turcica erithreus</i>	*		*	*
<i>Trochus</i> sp	*			
<i>Priotrochus obscurus</i>			*	*
<i>Umbonium vestiarium</i>	*			
<i>Umbonium</i> sp			*	*
<i>Turbo radiatus</i>		*		
<i>Turbo bruneus</i>	*		*	*
<i>Nerita albicilla</i>			*	*
<i>Cerithium scabridum</i>	*			
<i>Cerithidea cingulata</i>	*			
<i>Cerithidea</i> sp	*			
<i>Chiocoreus ramosus</i>	*			
<i>Rhinoclavis sordidula</i>			*	*
<i>Rhinoclavis (Proclava) kochi</i>	*			
<i>Clypeomorus bigasciata</i>		*		
<i>Clypeomorus</i> sp			*	*
<i>Pirinella</i> sp			*	*
<i>Turritella cochlea</i>	*		*	*
<i>Turritella</i> sp.	*			
<i>Terebellum terebellum</i>			*	*
<i>Strombus</i> sp			*	*
<i>Hexaplex kuesterianus</i>	*			
<i>Hexaplex</i> sp			*	*
<i>Murex scoloplax</i>	*			
<i>Cronia konkanensis</i>			*	*
<i>Cypraea cribrarias</i>		*		
<i>Cypraea chinensis</i>			*	*
<i>Cypraea</i> sp	*			
<i>Natica</i> sp	*			
<i>Xenophora corrugata</i>			*	*
<i>Natica vitellus</i>			*	*
<i>Natica</i> sp.	*			
<i>Thais tissoti</i>	*			
<i>Thais</i> sp	*			

Species	H	U	S	D
<i>Gari maculosa</i>	*			
<i>Gari</i> sp.	*			
<i>Lioconcha ornata</i>	*			
<i>Circe scripta</i>	*			
<i>Circe</i> sp			*	*
<i>Circenita callipyga</i>			*	
<i>Gafrarium pectinatum</i>			*	*
<i>Callista multiradiata</i>			*	*
<i>Callista</i> sp	*			
<i>Sunetta effossa</i>	*			
<i>Dosinia alta</i>			*	
<i>Dosinia</i> sp.	*			
<i>Paphia</i> sp	*			
Phylum: ECHINODERMATA				
Class: Crinoidea				
<i>Heterometra savignii</i>	*			
Class: Echinoidea				
<i>Echinometra mathaei</i>	*			
<i>Clypeaster humilis</i>	*			
<i>Echinodiscus auritus</i>			*	
<i>Diadema setosum</i>			*	*
<i>Tripneustes</i> sp	*			
<i>Lagunum depressum</i>	*			
Class: Stellerioidea				
<i>Asterina burtoni</i>	*			
<i>Astropecten indicus</i>			*	*
<i>Astropecten polyacanthus polyacanthus</i>	*			
<i>Astropecten</i> sp			*	*
Subclass: Asteroidea				
<i>Linckia multiflora</i>	*			
<i>Pentaceraster mammillatus</i>	*			
Subclass: Ophiuroidea				
<i>Ophiothela danae</i>	*			
<i>Ophiothela venusta</i>	*			
<i>Ophiothrix savignyi</i>	*			
<i>Ophionereis dubia</i>			*	*
<i>Ophiura kinbergi</i>	*			
<i>Paracrocnida persica</i>			*	
Class: Holothurioidae				
<i>Holothuria atra</i>			*	*
<i>Holothuria</i> sp	*			
Phylum: CHORDATA			*	*
<i>Stichopus</i> sp				
Class: Ascidiacea				
<i>Polyclinum</i> sp			*	*
<i>Didemnum</i> sp			*	*
<i>Phallusia</i> sp		*	*	*
Phylum: ARTHROPODA				
Class: Crustacea				
<i>Balanus tintinnabulum</i>	*	*	*	*
<i>Gonodactylus</i> sp	*			
<i>Rhopalophthalmus</i> sp			*	*
<i>Cymodoce</i> sp			*	*
<i>Sphaeroma</i> sp			*	*

Species	H	U	S	D
<i>Mitrella blanda</i>			*	*
<i>Pyrene</i> sp			*	*
<i>Cantharus spiralis</i>			*	*
<i>Nassarius (Nassarius) arcularia plicatus</i>	*		*	*
<i>Nassarius(Niotha) albescens gemmuliferus</i>			*	*
<i>Nassarius</i> sp	*			
<i>Vexillum</i> sp			*	*
<i>Fusinus townsendi</i>	*			
<i>Fusinus</i> sp			*	*
<i>Conus rattus</i>		*		
<i>Conus terebra thomasi</i>		*		
<i>Conus vexillum sumatrensis</i>		*		
<i>Conus</i> sp	*	*	*	*
<i>Inquisitor griffithi</i>			*	*
<i>Atys</i> sp			*	*
<i>Siphonaria</i> sp			*	*
Class: Bivalvia				
<i>Arca ventricosa</i>	*		*	*
<i>Barbatia obliquata</i>			*	*
<i>Barbatia helblingi</i>	*			
<i>Acar plicata</i>	*		*	*
<i>Anadara ehrenbergi</i>	*			
<i>Anadara</i> sp			*	*
<i>Cucullaea labiata</i>	*			
<i>Glycymeris livida</i>	*			
<i>Glycymeris maskatensis</i>	*			
<i>Glycymeris</i> sp			*	*
<i>Brachidontes variabilis</i>			*	*
<i>Brachidontes</i> sp	*			
<i>Amygdalum</i> sp			*	*
<i>Pteria macroptera</i>	*			
<i>Lithophaga</i> sp			*	*
<i>Pinctada margaritifera</i>	*	*	*	*
<i>Pinctada radiata</i>	*	*	*	*
<i>Pinctada</i> sp			*	
<i>Malleus</i> sp				*
<i>Trachicardium</i> sp	*			
<i>Isognomon</i> sp.	*			
<i>Crassostrea cf. margaritacea</i>			*	
<i>Diplodonta</i> sp	*			
<i>Laevicardium</i> sp			*	
<i>Pinna</i> sp.	*			
<i>Pecten</i> sp				*
<i>Chlamys</i> sp			*	*
<i>Decatopecten plica</i>	*			
<i>Spondylus exilis</i>	*			
<i>Anomia</i> sp	*			
<i>Cardita bicolor</i>	*			
<i>Cardita</i> sp	*			
<i>Chama</i> sp	*			
<i>Siliqua</i> sp.	*			
<i>Tellinia</i> sp.			*	*
<i>Donax scalpellum</i>	*			
<i>Donax</i> sp.			*	*

Species	H	U	S	D
<i>Dardanus</i> sp	*			
<i>Menaethius</i> sp	*			
<i>Lambrus prensor</i>	*			
<i>Portunus pelagicus</i>	*	*	*	*
<i>Portunus</i> sp	*			
<i>Medaesus granulatus</i>			*	
<i>Epixanthus</i> sp	*	*		*
<i>Pilumnus longicornis</i>	*	*		
<i>Pilumnus vespertilio</i>	*	*		
<i>Pilumnus</i> sp	*			

Table 2. List of biota collected from the coral reef grounds on the eastern coast of Qatar (H=Halul, U=Umm Aladam, S=Halut Al-Asere & D=Hadeed).

Species	H	U	S	D
PLANTAE				
Division: CHLOROPHYTA				
<i>Cladophora</i> sp	*		*	*
<i>Chaetomorpha</i> sp	*		*	*
<i>Dictyosphaeria cavernosa</i>	*		*	*
Division: PHAEOPHYTA				
<i>Ectocarpus</i> sp	*			
<i>Dictyota</i> sp	*			
<i>Sargassum binderi</i>	*	*	*	*
<i>Sargassum angustifolium</i>		*		
<i>Sargassum boveanum</i>	*		*	*
<i>Sargassum</i> sp	*		*	*
<i>Padina boryana</i>		*		
<i>Padina tetrastrumatica</i>	*			
<i>Padina</i> sp			*	*
<i>Colpomenia sinusa</i>	*	*		
<i>Cystoseira</i> sp			*	*
<i>Hormophysa triquetra</i>		*		
Division: RHODOPHYTA				
<i>Chroodactylum</i> sp	*			
<i>Gracilaria foliifera</i>			*	*
<i>Hypnea</i> sp	*			
<i>Lithothamnium</i> sp	*			
<i>Centroceras</i> sp	*			
<i>Ceramium</i> sp	*			
<i>Laurencia</i> sp	*			
<i>Polysiphonia</i> sp	*			
ANIMALIA				
Phylum: PORIFERA				
Class: Demospongiae				
<i>Halichondria</i> cf. <i>glabrata</i>			*	*
<i>Tethya</i> cf. <i>aurantium</i>			*	*
<i>Tethya</i> sp	*			
<i>Tedania</i> sp	*			
Class: Calcarea				
<i>Clathrina</i> sp	*			
Phylum: CNIDARIA				
Class: Hydrozoa				
<i>Obelia geniculata</i>			*	*
<i>Obelia dichotoma</i>	*			
<i>Obelia</i> sp	*			
<i>Clytia linearis</i>	*			
Phylum: BRYOZOA				
Class: Gymnolaemata				
<i>Zoobotryon</i> sp	*			
<i>Bugula</i> sp			*	*
<i>Schizoporella errata</i>	*			
<i>Watersipora subovidea</i>			*	*

Species	H	U	S	D
Phylum: ANNELIDA				
Class: Polychaeta				
<i>Lepidonotus</i> sp			*	*
<i>Syllis</i> sp	*		*	*
<i>Nereis</i> sp	*	*	*	*
<i>Perinereis</i> sp			*	*
<i>Nephtys</i> sp			*	*
<i>Eunice</i> sp	*			
<i>Onuphis emerita</i>	*		*	*
<i>Onuphis</i> sp			*	*
<i>Cirriformia</i> sp			*	*
<i>Phyllodoceidae</i> sp			*	*
<i>Owenia fusiformis</i>			*	*
<i>Melinna</i> sp			*	*
<i>Sebella</i> sp			*	*
<i>Janua (fauveldora) kayi</i>			*	*
<i>Pomatoleios terricola</i>			*	*
<i>Hydroidea elegans</i>	*			
<i>Hydroidea</i> sp	*			
Phylum: MOLLUSCA				
Class: Gasropoda				
<i>Diodora rueppellii</i>			*	*
<i>Diodora</i> sp	*			
<i>Turcica erithreus</i>	*		*	*
<i>Trochus</i> sp	*			
<i>Priotrochus obscurus</i>			*	*
<i>Umbonium vestiarium</i>	*			
<i>Umbonium</i> sp			*	*
<i>Turbo radiatus</i>		*		
<i>Turbo bruneus</i>	*		*	*
<i>Nerita albicilla</i>			*	*
<i>Cerithium scabridum</i>	*			
<i>Cerithidea cingulata</i>	*			
<i>Cerithidea</i> sp	*			
<i>Chiocoreus ramosus</i>	*			
<i>Rhinoclavis sordidula</i>			*	*
<i>Rhinoclavis (Proclava) kochi</i>	*			
<i>Clypeomorus bigasciata</i>		*		
<i>Clypeomorus</i> sp			*	*
<i>Pirinella</i> sp			*	*
<i>Turritella cochlea</i>	*		*	*
<i>Turritella</i> sp.	*			
<i>Terebellum terebellum</i>			*	*
<i>Strombus</i> sp			*	*
<i>Hexaplex kuesterianus</i>	*			
<i>Hexaplex</i> sp			*	*
<i>Murex scoloplax</i>	*			
<i>Cronia konkanensis</i>			*	*
<i>Cypraea cribrarias</i>		*		
<i>Cypraea chinensis</i>			*	*
<i>Cypraea</i> sp	*			
<i>Natica</i> sp	*			
<i>Xenophora corrugata</i>			*	*

Species	H	U	S	D
<i>Natica vitellus</i>			*	*
<i>Natica</i> sp.	*			
<i>Thais tissoti</i>	*			
<i>Thais</i> sp	*			
<i>Mitrella blanda</i>			*	*
<i>Pyrene</i> sp			*	*
<i>Cantharus spiralis</i>			*	*
<i>Nassarius (Nassarius) arcularia plicatus</i>	*		*	*
<i>Nassarius (Niotha) albescens gemmuliferus</i>			*	*
<i>Nassarius</i> sp	*			
<i>Vexillum</i> sp			*	*
<i>Fusinus townsendi</i>	*			
<i>Fusinus</i> sp			*	*
<i>Conus rattus</i>		*		
<i>Conus terebra thomasi</i>		*		
<i>Conus vexillum sumatrensis</i>		*		
<i>Conus</i> sp	*	*	*	*
<i>Inquisitor griffithi</i>			*	*
<i>Atys</i> sp			*	*
<i>Siphonaria</i> sp			*	*
Class: Bivalvia				
<i>Arca ventricosa</i>	*		*	*
<i>Barbatia obliquata</i>			*	*
<i>Barbatia helblingi</i>	*			
<i>Acar plicata</i>	*		*	*
<i>Anadara ehrenbergi</i>	*			
<i>Anadara</i> sp			*	*
<i>Cucullaea labiata</i>	*			
<i>Glycymeris livida</i>	*			
<i>Glycymeris maskatensis</i>	*			
<i>Glycymeris</i> sp			*	*
<i>Brachidontes variabilis</i>			*	*
<i>Brachidontes</i> sp	*			
<i>Amygdalum</i> sp			*	*
<i>Pteria macroptera</i>	*			
<i>Lithophaga</i> sp			*	*
<i>Pinctada margaritifera</i>	*	*	*	*
<i>Pinctada radiata</i>	*	*	*	*
<i>Pinctada</i> sp			*	
<i>Malleus</i> sp				*
<i>Trachicardium</i> sp	*			
<i>Isognomon</i> sp.	*			
<i>Crassostrea cf. margaritacea</i>			*	
<i>Diplodonta</i> sp	*			
<i>Laevicardium</i> sp			*	
<i>Pinna</i> sp.	*			
<i>Pecten</i> sp				*
<i>Chlamys</i> sp			*	*
<i>Decatopecten plica</i>	*			
<i>Spondylus exilis</i>	*			
<i>Anomia</i> sp	*			
<i>Cardita bicolor</i>	*			
<i>Cardita</i> sp	*			

Species	H	U	S	D
<i>Chama</i> sp	*			
<i>Siliqua</i> sp.	*			
<i>Tellinia</i> sp.			*	*
<i>Donax scalpellum</i>	*			
<i>Donax</i> sp.			*	*
<i>Gari maculosa</i>	*			
<i>Gari</i> sp.	*			
<i>Lioconcha ornata</i>	*			
<i>Circe scripta</i>	*			
<i>Circe</i> sp			*	*
<i>Circenita callipyga</i>			*	
<i>Gafrarium pectinatum</i>			*	*
<i>Callista multiradiata</i>			*	*
<i>Callista</i> sp	*			
<i>Sunetta effossa</i>	*			
<i>Dosinia alta</i>			*	
<i>Dosinia</i> sp.	*			
<i>Paphia</i> sp	*			
Phylum: ECHINODERMATA				
Class: Crinoidea				
<i>Heterometra savignii</i>	*			
Class: Echinoidea				
<i>Echinometra mathaei</i>	*			
<i>Clypeaster humilis</i>	*			
<i>Echinodiscus auritus</i>			*	
<i>Diadema setosum</i>			*	*
<i>Tripneustes</i> sp	*			
<i>Lagunum depressum</i>	*			
Class: Stellerioidea				
<i>Asterina burtoni</i>	*			
<i>Astropecten indicus</i>			*	*
<i>Astropecten polyacanthus polyacanthus</i>	*			
<i>Astropecten</i> sp			*	*
Subclass: Asteroidea				
<i>Linckia multiflora</i>	*			
<i>Pentaceraster mammillatus</i>	*			
Subclass: Ophiuroidea				
<i>Ophiothela danae</i>	*			
<i>Ophiothela venusta</i>	*			
<i>Ophiothrix savignyi</i>	*			
<i>Ophionereis dubia</i>			*	*
<i>Ophiura kinbergi</i>	*			
<i>Paracrocnida persica</i>			*	
Class: Holothurioidae				
<i>Holothuria atra</i>			*	*
<i>Holothuria</i> sp	*			
Phylum: CHORDATA			*	*
<i>Stichopus</i> sp				
Class: Ascidiacea				
<i>Polyclinum</i> sp			*	*
<i>Didemnum</i> sp			*	*
<i>Phallusia</i> sp		*	*	*

Species	H	U	S	D
Phylum: ARTHROPODA				
Class: Crustacea				
<i>Balanus tintinnabulum</i>	*	*	*	*
<i>Gonodactylus</i> sp	*			
<i>Rhopalophthalmus</i> sp			*	*
<i>Cymodoce</i> sp			*	*
<i>Sphaeroma</i> sp			*	*
<i>Dardanus</i> sp	*			
<i>Menaethius</i> sp	*			
<i>Lambrus prensor</i>	*			
<i>Portunus pelagicus</i>	*	*	*	*
<i>Portunus</i> sp	*			
<i>Medaeus granulatus</i>			*	
<i>Epixanthus</i> sp	*	*		*
<i>Pilumnus longicornis</i>	*	*		
<i>Pilumnus vespertilio</i>	*	*		
<i>Pilumnus</i> sp	*			