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Echinodermata, Species Diversity and Distribution in Hormuz Island (The Persian Gulf), Iran

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Abstract: Echinoderms are one of the oldest and most important groups of marine organisms which play an important role in the marine ecology especially in the coral reefs. During February to August 2010, five stations were selected in intertidal zone of Hormuz Island according to sea bottom. At each station the Echinoderms species of the selected area were counted in 100 m^2 with 5 replications. This study was made in three seasons namely winter, spring and summer. According to the result, distribution of Echinoderms has direct correlation with bottom type. In this respect we can find every species in definite bottom. Jaccard index and cluster analyses showed that stations 3 and 5 with the same bottom type have high similarity in species abundance and diversity and also stations 1 and 2 have minimum diversity and abundance.

Key words: Echinoderms · Ecological Distribution · Intertidal · Hormuz Island · The Persian Gulf

INTRODUCTION

Echinodermata are most familiar invertebrates exclusively marine and are largely bottom dwellers [1, 2]. Echinoderms are globally distributed in almost all depths, latitudes and environments in the ocean [2]. Echinoderms provide a key of ecological role in ecosystems [3, 4]. The borrowing of sea cucumber and sand dollar recycle the nutrients, the grazing of sea urchins reduce the rate of colonization of bare rock [4, 5]. In the Chinese, Japanese and Koreans, sea cucumbers are one of a sea food sources [6] and the toxins of sea cucumber have antiviral, antitumoral, anticancerous. Their antifertility properties are use in the pharmaceutical industries [7].

The present study was carried out in Strait of Hormuz region because of lace of data regarding to Echinodermata species diversity and distribution.

MATERIALS AND METHODS

During February to August 2010 the diversity, density and distribution of Echinodermata species were studied in 5 stations in intertidal zone of Hormuz Island according to substratum type (Fig. 1, Table 1). This present study was carried out in three seasons namely winter, Spring and Summer. At each station, the abundance of echinoderms (appendix 1, Table 5) was counted using 20 m^2 quadrat with five replicates in 100 m^2.

For comparing similarity and species diversity between stations, Jaccard similarity coefficient (Cs) was used. It considers the present or absent.

The fallowing formula describe Jaccard index:

$$Cs = c/(a+b-c)\times 100$$

a: Number of taxa in station A
b: Number of taxa in station B
c: Number of species common to both stations

This index values has changed between 0 and 100. Tendency to 100 shows that 2 stations have the same species and drift to zero shows that 2 stations are different. Jaccard similarity coefficient index is used for diversity between stations and it is not related to species abundance.

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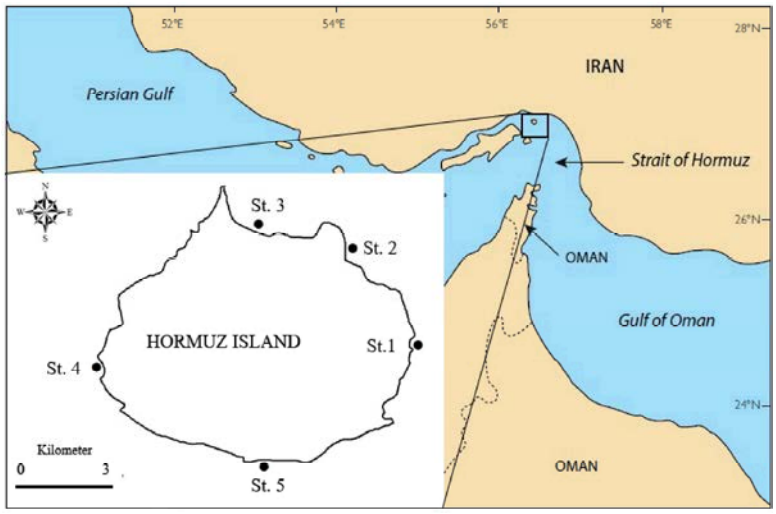

Fig 1: Map of Hormuz Island in the Persian Gulf, showing the sampling sites

Table 1: Position and type of substrata in site sampling

Station	*Sea bed*	*Lat.*	*Long.*
St 1	Sea anemone with Mud	27 03 21,7N	56 30 06,7E
St 2	Sandy	27 05 24,3N	56 29 09,3E
St 3	Mud with Gravel	27 05 24,3N	56 27 43,0E
St 4	Gravel	27 03 26,9N	56 25 19,0E
St 5	Rock with Mud and Gravel	27 04 25,0N	56 04 25.0E

Cluster Analyses (CA) for comparing density of echinoderms between stations was used. This index survey similarity and differences between stations and hence put the similar stations in to the same group. Total mean values were measured for 3 seasons for each station.

RESULTS

The results of Jaccard index shows that station 2 had the most difference with other stations. The most similarity was between station 3 and station 5 with 50% (Cs). During spring season echinoderms species were absent in station 2. Jaccard index showed maximum similarity between stations 3 and station 5 with 66.6% (Cs) and the minimum similarity was found between station 1 and station 3 with 25% (Cs). In summer minimum similarity was between station 2 with other stations and maximum similarity was between station 3 and 5 with values of 0 and 53.84% respectively (Tables 2, 3 and 4).

Cluster Analyses: Cluster Analyses result shows 2 main groups between stations. First group includes stations 1 and 2 and the second group includes stations 3, 4 and 5.

DISCUSSION

Identification of animal distribution and species diversity can help to preserve of species and also it act as basic information for ecological studies [8].

The measurement of Jaccard index showed that there is a different between station 2 and other studied stations. This means that echinoderms species existence in

Table 2: Result of jaccared index for winter

Stations	St. 1	St. 2	St. 3	St. 4	St. 5
St. 1	100%				
St. 2	0	100%			
St. 3	25%	0	100%		
St. 4	33.33%	0	40%	100%	
St. 5	22%	0	50%	40%	100%

Table 3: Result of Jaccard index for spring

Stations	St. 1	St. 2	St. 3	St. 4	St. 5
St. 1	100%				
St. 2	-	100%			
St. 3	25%	-	100%		
St. 4	50%	-	30%	100%	
St. 5	37.5%	-	66.6%	55.5%	100%

Table 4: Result of Jaccard index for summer

Stations	St. 1	St. 2	St. 3	St. 4	St. 5
St. 1	100%				
St. 2	0	100%			
St. 3	27.27%	5.88%	100%		
St. 4	51.14%	0	41.66%	100%	
St. 5	33.33%	0	53.84%	33.33%	100%

Table 5: Echinoderm fauna list for Hormuz Island

	Station				
species	St. 5	St. 4	St. 3	St. 2	St. 1
Holothuria atra	•		•		
Holothuria leucospilota	•	•			•
Holothuria arenicola	•		•		
Holothuria scabra			•	•	
Holothuria cornusalba	•				
Holothuria bacilla	•	•	•		•
Holothuria parva	•	•	•		•
Holothuria pardalis	•		•		
Astropecten monoacanthus				•	
Astropecten polyacanthus polyacanthus			•	•	
Astropecten polyacanthus pheragmorus				•	
Luidia hardwicki				•	
Aquilon astrairanica	•	•	•		•
Macrophiotrix elongate			•		
Ophiocoma scalopendarina	•				
Echinometra mathaei	•	•			
Echinodiscus auritus				•	
Echinodiscus bisperforatus				•	

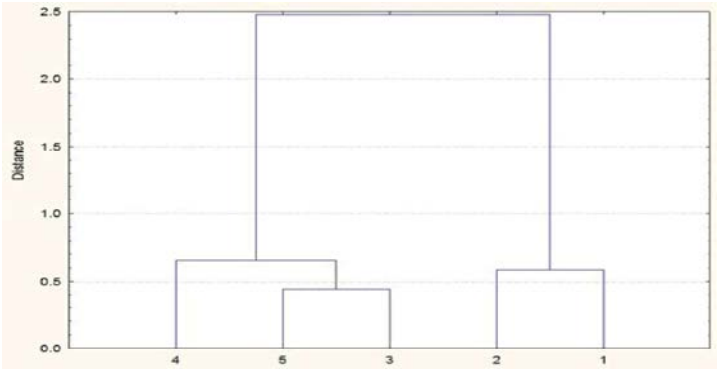

Fig 2: cluster analyses based on total mean of echinoderms abundance at each station

station 2 are quite differences comparing with other stations. This can be related to substrata types in the study area. Maximum similarity was found between station 3 and station 5 that it seems because of similarity between substrates and ensue this similarity between species.

Cluster analyses explain similarity between station 3 and station 5. Whereas these two stations have the same substrate, in conclusion there is a similarity in diversity and abundance of species.

Station 1 and station 2 are relatively equal abundance. This is maybe has two reasons. The first one, these two stations are located in east of Hormuz Island, therefore these two stations expose to entrance water current to the Persian Gulf. Mucha and Costa [9] showed that hydrodynamism appears to be a stabilizing factor for macrobenthic assemblages. Strong hydrodynamism leads to decrease in nutrient load and fostered less reducing condition, finally result in decrease in species number, biomass and diversity [10]. The second reason backs to condition of sea bed, based on larvae settling. Settlement is the initial processes determining the structure of population [11]. Sea bed in station 1 is covered by sea anemone. It seems during larva settlement time, the most of settling larvae is eaten by sea anemone and hence diversity and abundance in station 1 is low.

Sea bed in station 2 is sandy. Physical characters of substrate such as contouring can help to success larvae settlement [11] and maybe sandy substrate does not supply optimum condition for larvae settling. Study on distribution pattern of dominant sea cucumber in the northwest Australia coral reef shown that *Holothuria atra* doesn't have any regular pattern.

And also study on selective substrata with temperate sea cucumber from Aspidochirotida shown that member of family Holothuria as *Holothuria atra* have rare tendency or without tendency for nutrient source select and so select specific substrata [12, 13]. However, Bellchambers *et. al*. explained that *Holothuria atra* was primarily found in sand-dominated habitats. Hydrodynamic factors can have most important effective on sea cucumber distribution [14].

In conclusion, diversity and abundance of echinoderms are directly related to substrate.

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