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Intertidal Amphipod assemblages of two Iranian Islands of the Persian Gulf

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Abstract

In the current study, the intertidal amphipod assemblages of two Iranian Islands which includes Qeshm , as an Island near to mainland, and Abu Musa, as an Island far from the mainland. The sampling is down in eight stations in each Island from 2013 to 2016. Results show that the amphipod assemblages of Abu Musa and Qeshm islands were composed of 8 species from 8 genera and 5 families and 11 species from 11 genera and 6 families, respectively. The record of the *Glossomaera octodens* (Sivaprakasam, 1968) is new for the western part of the Indian Ocean. There were no differences in taxonomic indices between islands. However, both islands showed similar average taxonomic distance with greater variation in taxonomic distance and species richness of Qeshm compared with Abu Musa, primarily because of .greater variation in habitats in the former.. The better environmental conditions in Abu Musa caused higher abundance per species then in Qeshm. The results of the present study add two species to previous reports of the Abu Musa Island and produce first comprehensive listed record of amphipods in the Qeshm Island, including new species record.

Keywords: Amphipods; Qeshm Island; Abu Musa Island; new records; *Glossomaera octodens.*

1. Introduction

The Amphipoda, as a main part of the macrobenthos assemblage, taxonomically are problematic and prone to misidentification in ecological studies. The density and composition of amphipod assemblages are affected by environmental conditions, geography and history of distribution (Ellis *et al*. 2000; Guerra-García & GarcíaGómez 2009). In the recent years, the knowledge about amphipods in the Persian Gulf has been improved (Myers and Nithyanandan 2016; Maghsoudlou et al., 2019). In the previous studies *Ampithoe qeshmensis* Layeghi & Momtazi 2016 was described from the Qeshm Island and *Elasmopus alkhiranensis* Myers & Momtazi 2015 from sediments of Kuwait and Abu Musa Island. However, there is no general knowledge of the amphipod biodiversity of the Islands of the Persian Gulf. Recent marine biodiversity expeditions which

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were carried out by the faculty of the University of Tehran in the Abu Musa Island and Iranian National Institute for Oceanography and Atmospheric Sciences in the Qeshm Island provided the opportunity and specimens to study amphipod assemblages in above mentioned islands.

Amphipods are a diverse and important group of invertebrates contributing to the functioning of aquatic ecosystems. In spite of their variety, many species of amphipods share important biological and ecological characteristics that make them suitable test organisms for assessment of the ecological quality of estuarine and marine sediments (Podlesińska & Dąbrowska 2019). The biodiversity indices based on taxonomic (or phylogenetic) relatedness of species have been developed in recent years. Warwick and Clarke (???) introduced the concept of taxonomic distinctness (TD or Δ) into marine ecology and mentioned that they are useful in detecting degraded and polluted sites from the control site (Clarke and Warwick, 2001; Warwick and Clarke, 1995). In this investigation, we used In the other part of present 'average taxonomic distinctness' (AvTD, Δ^+) and 'variation in taxonomic distinctness' (VarTD, Λ^+) to study the ecological status of Qeshm and Abu Musa Islands.

2. Material and Methods

Sampling in Abu Musa was performed at eight stations (Fig. 1) by Tehran University during Abu Musa marine biodiversity project (ProjectNumber 92006736) over four field surveys from 2014 to 2016 and in Qeshm Island in eight stations (Fig. 1) in two surveys from 2013 to 2015 (Table 1). Specimens were collected in low tide mainly by hand and different-sized scoop nets. Collected specimens were preserved in 90% ethanol containing 1% glycerin. Dissections were made in glycerol. Illustrations were made using the methods described in Coleman (2003, 2006). The material was deposited on the Iranian National Institute for Oceanography Collection (INIOC) and Zoological Museum, University of Tehran (ZUTC). The biodiversity indices and taxonomic distances were calculated by PRIMER software (ver. 6.1.6) (Clarke and Gorley, 2006).

Table 1: Coordinates of sampling stations and habitat description

Station	Latitude	Longitude	Habitat description
Q1	N 26.92755	E 56.2528	Rocky- dead coral
Q2	N 26.8368	E 56.13275	Rocky- dead coral
Q3	N 26.771367	E 56.056108	Sandy with cobbles
Q4	N 26.716172	E 55.975490	sandy
Q5	N 26.705756	E 55.913257	Rocky
Q6	N 26.686171	E 55.714147	Sandy
Q7	N 26.656617	E 55.283317	Muddy- mangrove
Q8	N 26.699196	E 55.491215	Muddy-sandy
AB1	N 25.890983	E 55.027833	Rocky bed,
AB2	N 25.895850	E 55.044050	Rocky-cobble
AB3	N 25.889733	E 55.045467	Sandy
AB4	N 25.874050	E 55.051533	Sandy
AB5	N 25.868133	E 55.053267	Sandy
AB6	N 25.863183	E 55.026350	Sandy
AB7	N 25.869000	E 55.018450	Sandy
AB8	N 25.882800	E 55.015650	Shingle beach

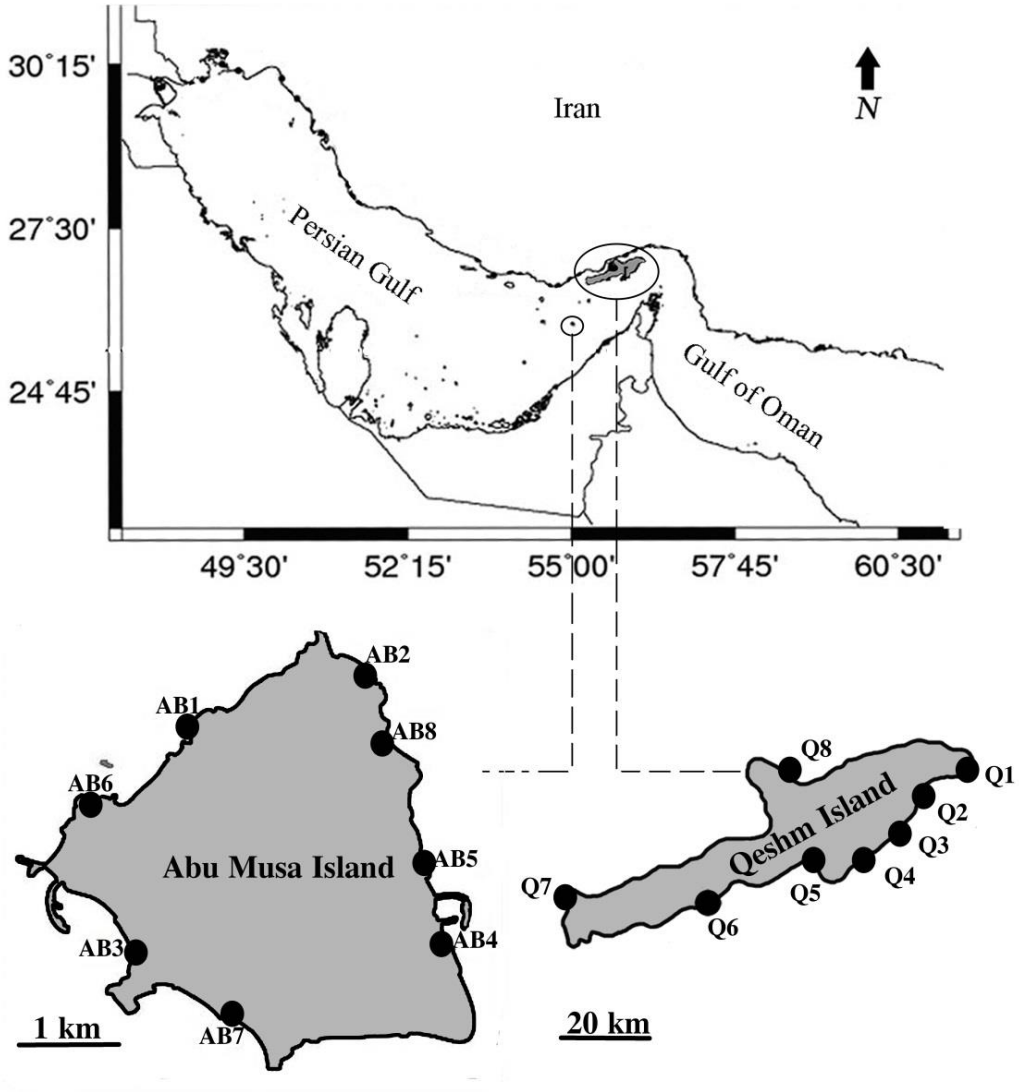

Fig. 1: Amphipoda sampling locations in Abu Musa and Qeshm Islands

3. Results and Discussion

In the present study, 13 species of amphipod were isolated 11 of which were identified to species level. Due to lack of male specimens, identification of specimens from *Tethygeneia* and *Protohyale* remained incomplete.

The amphipod assemblages of Abu Musa and Qeshm islands were composed of eight species from 8 genera and 5 families and and 11 species from 11 genera and 6 families, respectively (Table 2). There are two new records of amphipods in the Persian Gulf. The *Glossomaera octodens* (Sivaprakasam, 1968) is recorded and reported for the first time from the western part of the Indian Ocean (Fgures 2 and 3).

Glossomaera octodens was described from the Indian coast by Sivaprakasam, 1968. The Iranian specimens are completely same as Indian specimens. This species was remarked by long rami of the third uropod (Fig. 3), the shape of telson (Fig. 3) and enlarged right second gnathopod in male specimens

(Fig. 2). The records of this species were restricted to the Qeshm Island in the Persian Gulf (Maghsoudlou *et al*., 2019).

Previous studies on amphipods in the Persian Gulf were limited (Myers & Naithyanandan, 2016; Layeghi & Momtazi, 2016; Momtazi & Maghsoudlou, 2016; Myers & Momtazi, 2015; Momtazi, Sari & Maghsoudlou, 2014; Momtazi & Sari, 2013). In the present study, the distribution of *Latigammaropsis pseudojassa* and *Podocerus mamlahensis* that were described from Kuwait coasts by Myers & Naithyanandan (2016) extended to the eastern part of the Persian Gulf in Qeshm and Abu Musa islands. Also *Elasmopus alkhiranensis* that previously was described from Kuwait and Abu Musa by Myers & Momtazi, 2015 is recorded and reported from the Qeshm Island.

Table 2: The amphipod assemblages in Qeshm and Abu Musa Islands

	Family	**Species**	**Qeshm**	**Abu Musa**	**Distribution**	**Refrences**
1	Ampithoidae	*Cymadusa filosa*	+	+	endemic	Savigny, 1816
2		*Ampithoe qeshmensis*	+	+	endemic	Layeghi & Momtazi, 2016
3	Caprellidae	*Metaprotella macoranicus*	+	+	endemic	Momtazi & Sari, 2013
4		*Pseudaeginella hormozensis*	+	+	endemic	Momtazi & Sari, 2013
5	Hyalidae	*Parhyale darvishi*	+	+	endemic	Momtazi & Maghsoudlou, 2016
6		*Protohyale* sp.	+	-	endemic	Bousfield & Hendrycks, 2002
7	Maeridae	*Glossomaera octodens*	+	-	Indian ocean	Sivaprakasam, 1968
8		*Elasmopus alkhiranensis*	+	+	endemic	Myers & Momtazi, 2015
9		*Elasmopus menurte*	+	-	Indian ocean	Momtazi, Sari & Maghsoudlou, 2014
10	Melitidae	*Melita persia*	+	-	endemic	Momtazi, Sari & Maghsoudlou, 2014
11	Photidae	*Latigammaropsis pseudojassa*	+	+	Endemic	Myers & Naithyanandan, 2016
12	Podoceridae	*Podocerus mamlahensis*	-	+	endemic	Myers & Naithyanandan, 2016

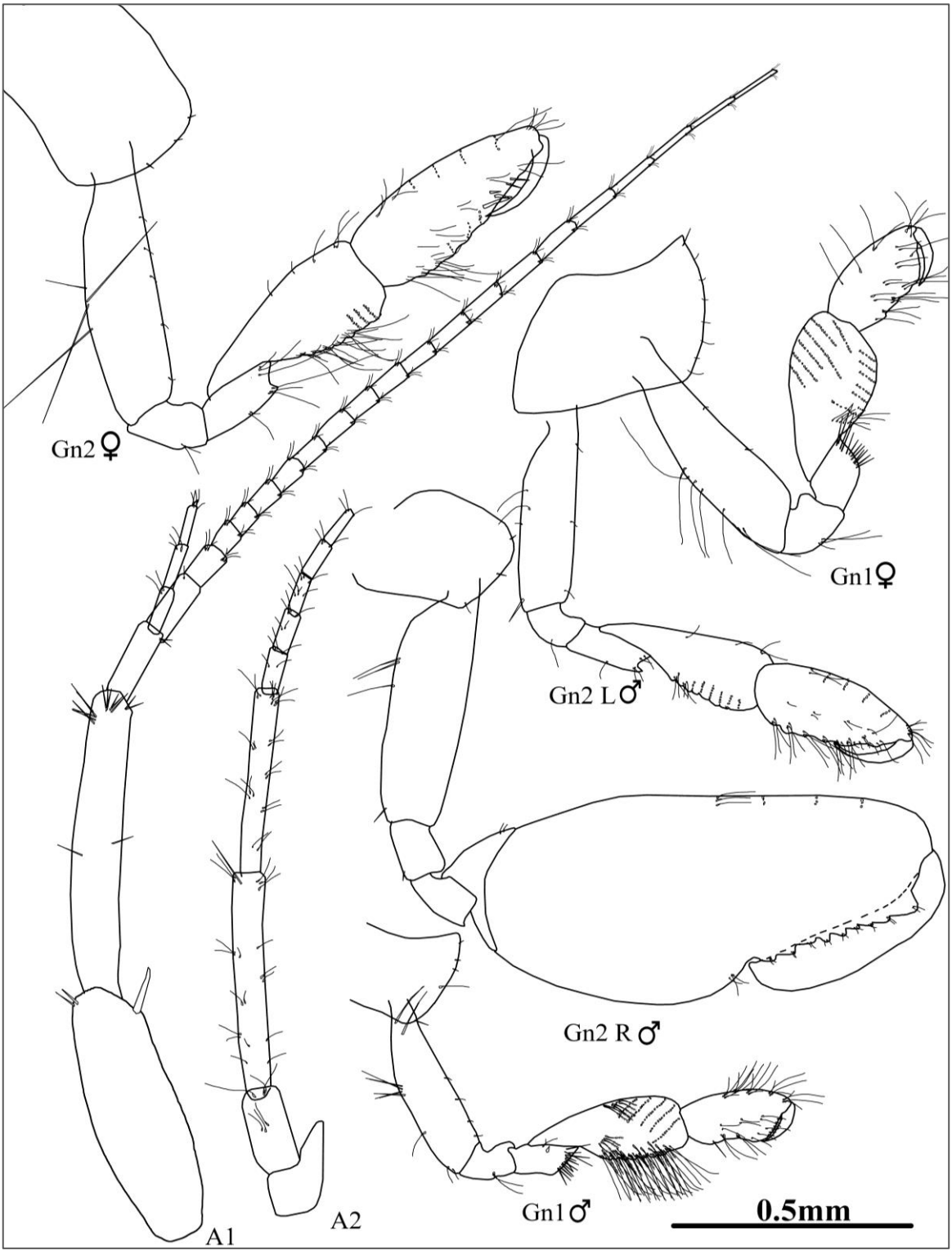

Fig. 2: Gnathopods and antennae of Glossomaera octodens (Sivaprakasam, 1968) from the Qeshm Island (Persian Gulf)

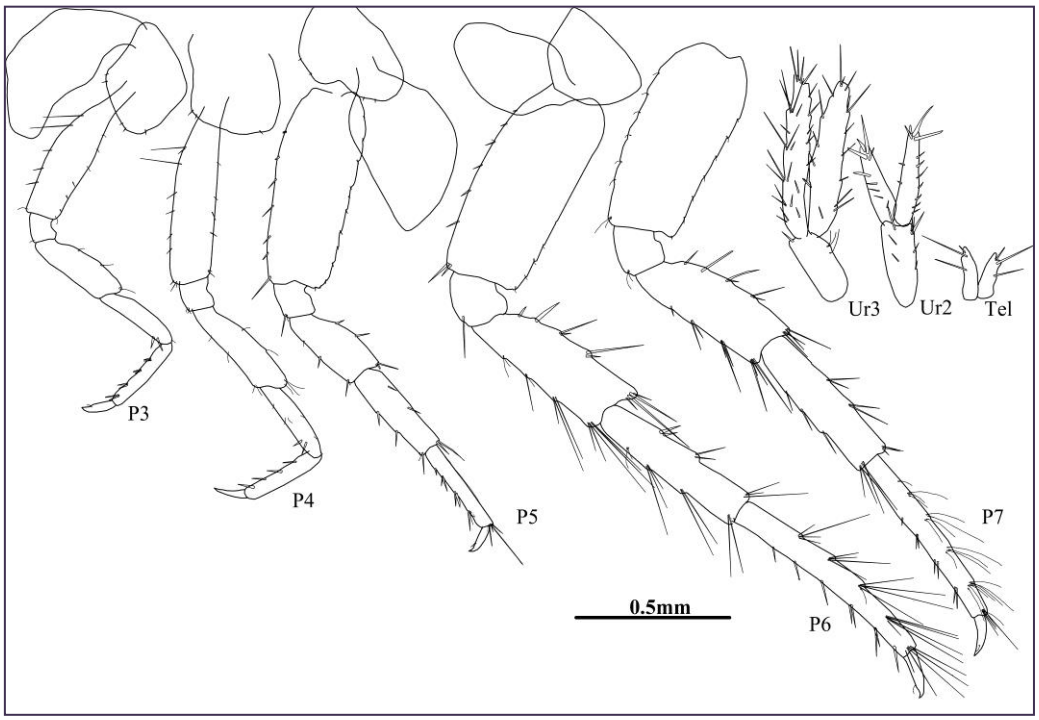

Fig. 3: Pereopods and uropods of Glossomaera octodens (Sivaprakasam, 1968) from the Qeshm Island (Persian Gulf)

The results of taxonomic indices (Table 3) showed that there is no clear difference between two Islands. The higher number of species of crustacean and Mollusca was reported from Abu Musa than Qeshm Island by Naderloo *et al.*, (2017). But, the results of this are contrary. However the number of species is higher in Qeshm Island but the abundance per species is higher in the Abu Musa Island. The species richness was higher in Qeshm Island and the Shannon and Simpson indices are the same in both Island (Table 3).

Table 3: The diversity indices in two Iranian Islands of the Persian Gulf

Diversity indices	Qeshm	Abu Musa
Taxa_S	11	8
Individuals	116	182
Dominance_D	0.3213	0.323
Simpson_1-D	0.6787	0.677
Shannon_H	1.42	1.405
Margalef	2.014	1.345

However, the results of diversity indices show similarity in both islands. However, taxonomic distance index depicts a more varying environment for the biodiversity of both islands, The average taxonomic distance that shows the horizontal variation in each location is the same in both islands, but the variation in the taxonomic distance that reflect the vertical variations in the taxonomy of amphipod assemblages was higher in the Qeshm Island (Table 4). It seems that the variation in habitat in the Qeshm Island (Naderloo *et al*., 2013; Pour *et al*., 2012) is made of several habitats suitable for different kinds of amphipods from many families. Although, Abu Musa that has only two types of coastal habitats (Naderloo *et al*., 2017), the higher species abundance in Abu Musa Island could be considered as a better environmental conditions and less prone to marine pollution because of its farther distance from mainland, in contrast to Qeshm Island which is affected by tourists and visitors (Pour *et al.*, 2012) and also by marine pollution.

Table 4: Taxonomic distance values in Qeshm and Abu Musa Islands

	J'	H'(log_e)	1-Lambda'	Delta*	Average taxonomic distance	Variation in taxonomic distance
Qeshm	1	2.484907	1	96.46465	96.46465	139.0164
Abu Musa	1	2.079442	1	97.61905	97.61905	73.69615

4. Conclusions

The amphipod assemblages in the islands of the Persian Gulf are different from amphipod assemblages of coastal communities. We reported two new records of amphipod species and more records could br revealed by conducting more investigations. Results of this study showed that use of taxonomic distance could reveal more knowledge about the health of the amphipods environment than other indices, such as the Shannon and Simpson indices.

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