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Identification of crabs in intertidal zone (coastal field of the Persian Gulf). Case study of Bushehr County

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Abstract. This study was carried out in order to identify the crabs of intertidal zone of coastal field in Bushehr County in nine stations during both warm and cold seasons (September and January 2014). Sampling was randomly collected using quadrates of 25×25 cm. 98 crabs were totally taken, and 5 species identified (*Petrolisthes armatus*, *Petrolisthes rufescence*, *Neoepisesarma sp.*, *Actaea sp.*, *Portunus plagicus)* from 4 families (Porcellanidae, Grapsidae, Xanthidae, Portunidae) were. Identification was carried out using valid identification keys according to the appearance of the crabs' bodies. In all species morphological features was found to be in accordance with other previous researches. In order to identify new species and to perform assessment of the coastline biodiversity of these species, it would be desirable to conduct annual studies on these invertebrates.
Key Words: Invertebrates, marine biology, Porcellanidae, Grapsidae, Xanthidae, Portunidae.

Introduction. Intertidal zone is a bed habitat that is alternately exposed to air being situated between the maximum flood tide and the minimum ebb tide. Intertidal communities are very large in average latitude. South Pole is lack of intertidal zone due to permanent ice cover. In North Pole intertidal range is less than a meter since winter ice is frozen to 2 m depth and intertidal zone is often frozen during the year. That is why intertidal fauna and flora is limited in North Pole. Intertidal range is usually less than a meter in the tropics. Thus intertidal communities are not very large in these regions. In average latitudes high tides are along with average environmental conditions and have large biological communities. Fauna and flora of the intertidal zone are exposed to the changes of the environmental factors with a larger range in comparison with open oceans (Webber & Thurman 1995).

Crustaceans are considered as one of the most frequent groups of invertebrates with having universal dispersal being found in all depths and fresh, saline and brackish aquatic ecosystems. Crustaceans have the most frequencies among the aquatic animals and show a lot of diversities in terms of shape, behavior, and type of habitat (Hendrickx 2005). So far various studies have been carried out concerning crabs' diversity in the coastline of the Persian Gulf and Oman Sea (Stephensen 1945; Sharafi & Shajiee 2009; Ghotbeddin et al 2012). So annual study in the regions and find the species include crabs, can help to appointment of situation of coastline in biodiversity, pollution and other important subjects.

The Persian Gulf is the advancement of the Indian Ocean water in the south area of the Iranian Plateau over the rim of the Indian Ocean that lies in northwest of the Oman Sea. Since 70 % of the world cities lie in coastal regions and include 90% of the world fishing (Webber & Thurman 1995), better identification of these regions and their creatures in order to protect their health is vital. Thus this study aims to identify the crabs of intertidal zone of the coastal field of the Persian Gulf (Bushehr County).

Material and Method

Study aria. Bushehr city lies in the southwest of Iran and at longitude 28º 48' 54" to 29º 00' 01" east and latitude 50º 48' 19" to 50º 55' 07" north. Bushehr area is 1308.3 km^2. Annual mean temperature of the region is 25.7°C, its relative humidity is between 75-85% and annual rainfall is 220 mm.

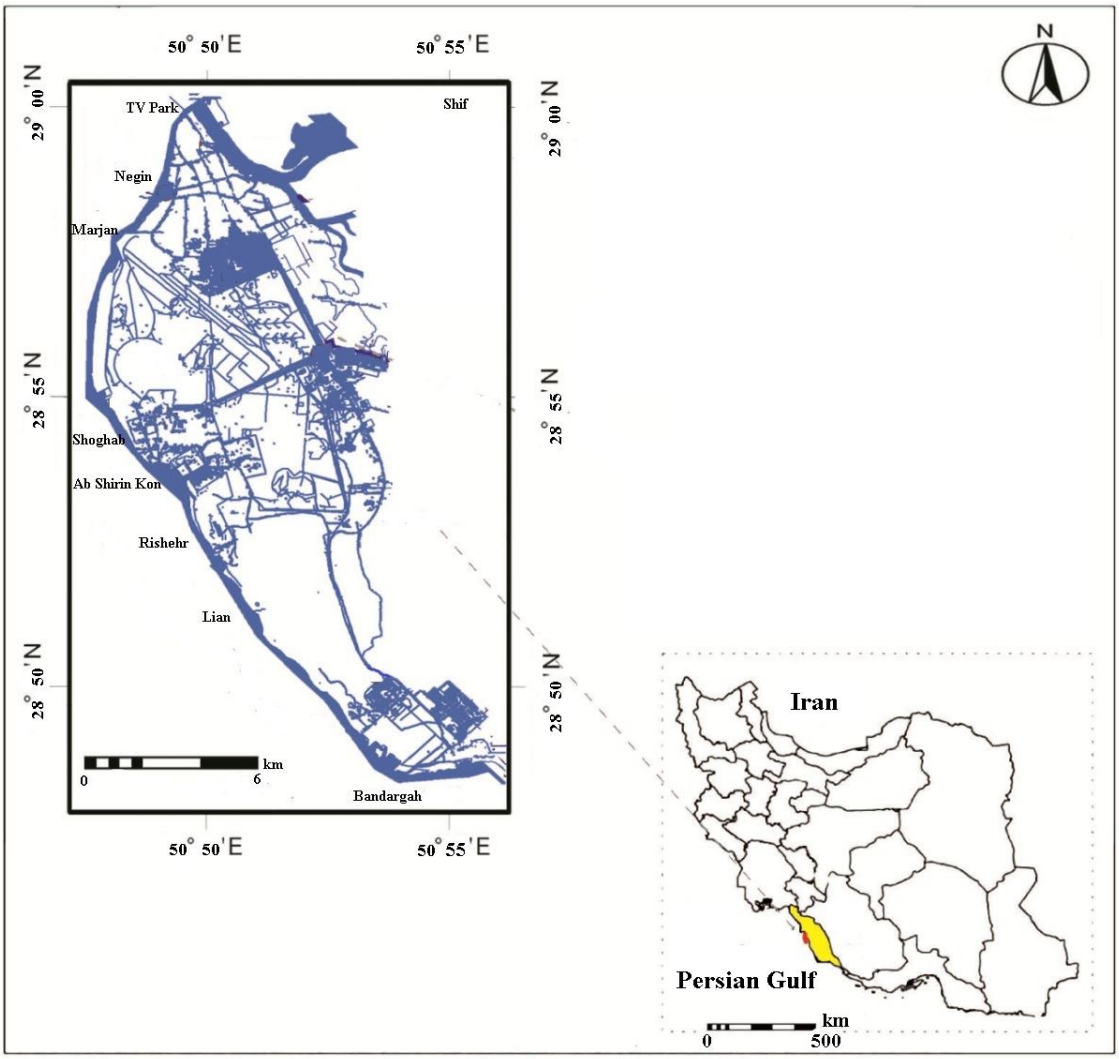

Figure 1. Location of the study stations (original drawing).

Research method. In order to identify the crabs of intertidal zone of the coastal field of Bushehr County, the best sampling time having the most tide range was chosen using tide tables. Sampling was carried out using quadrates of 25×25 cm from 9 stations (Figure 1) at complete ebb tide and during both warm and cold seasons (September and January 2014).

After collecting samples and preserving them using 4% formalin, the samples were transported to the laboratory for biometry studies. Identification of the samples was done using physical features of the body, carapace surface texture, lateral carapace margins, number of body surface thread, the form of eyes, existence and non-existence of eye/ocular base, telson shape, antenna, foot shape, and identification of sexes.

Identification of the species was carried out using valid identification keys (Apel & Spiridonov 1998; Apel 2001).

Results

In this study 5 species belonging to 4 families were totally identified that their features are mentioned in the followings.

Family of Porcellanidae

Order: Decapoda
Suborder: Pleocyemata
Infraorder: Anomura
Superfamily: Galatheoidea
Family: Porcellanidae (*Chinese crabs*) (Haworth 1825)
Crabs of this family are usually called Chinese or fragile crab. Their body purtenance is very fragile. These crabs belonging to Anomura infraorder are different from the other real Brachyura crabs. Carapace is pressed from abdominal-dorsal area and has long antennae in its frontier part. Clipped are long and extended and carapace is longer and more extended than merous and in all species one curvature is almost observed in carpus and merous muscles. In some species length and width of carapace are equal and in some others its length has been reported more than its width. But so far no species are reported that its carapace width is more than its length. Color diversity in this family seems a lot. This family have three pairs of feet similar to the other crabs but the forth pair is very short and weak and it usually places on carapace. Abdominal part includes 7 joints that returned below the pectoral part and at the end have telson with 5 to 7 joints. Males having one pair of pleopod feet in the second abdominal joint are recognizable from females having 3 to 4 pleopod feet in 3, 4 and 5 joints. Their main habitat is amid the clefts of the rocks and under the big rocks in intertidal zones (Osawa & Komai 2007).

Petrolisthes armatus. Species of this genus have round carapace but in frontier parts carapace is in the form of sharp-pointed triangle in such a manner that from the peak toward the middle part of carapace one deep groove is created. This feature caused carapace to be seen triangular and angular from the front scene. Length and width of carapace are equal. In this species telson has 7 joints and their color is different from red to bright brown and their egg color is red (Lewinsohn 1976).

Figure 2. *Petrolisthes armatus* (original).

Petrolisthes rufescence. The feature of this species is similar to the other species but it also has some special features separating it from the other species. In this species carapace and merous are longer than in other species. On the other hand on the edge of carapace 3-5 teeth and spine are seen instead of on tooth (Lewinsohn 1979). The color of carapace is usually black and also has black eggs kept in the abdominal part of the females.

Figure 3. *Petrolisthes rufescence* (original).

Family of Grapsidae

Order: Decapoda
Suborder: Pleocyemata
Infraorder: Brachyura
Superfamily: Grapsoidea
Family: Grapsidae

These crabs belonging to Brachyura infraorder (real crabs) and are rapid crabs walking nimbly in rock and breakwater beds of in intertidal zones. Carapace appears in different forms of triangle or square. There are lines or grooves on carapace which are observed more in frontier part where the eyes are placed. Carapace is wider in front than the back part and eyes are placed with a distance from each other. The distance between two eyes is almost equal to the width of carapace. A lot of spines are seen on the feet. Clippeds are shorter but stronger in comparison to feet. Clipped fingers are sharp and leave a deep scratch when it touches human's hand. Abdomen is thin in males and one pair pleopod in the second abdominal joint has been left in order for mating. The eggs of this family are red which are kept in abdomen part by female pleopods (Schubart 2011).

Neoepisesarma sp. The shape of carapace in this species is trapezoid with this difference that in front part it has a deeper curvature in the distance between two eyes. Eyes are placed in two extreme ends of carapace in front part of the body and on the base. There are more grooves on carapace in comparison with the previous species.

Figure 4. *Neoepisesarma sp.* (original).

This species has a fragile carapace so that it will crack and break with a little pressure by a forceps. In this species just like the previous species clipped fingers is red and have teeth in clefts between fingers (Crosnier 2001).

Family of Xanthidae (black fork crabs)

Order: Decapoda
Suborder: Pleocyemata
Infraorder: Brachyura
Superfamily: Xanthoidea
Family: Xanthidae (MacLeay 1838)
Crabs of this family are well-known as black-fork crabs or coral crabs and have various genders. Members of this family have short feet and slow movement. Carapace is elliptic and dorsal surface has a lot of protuberances. Clippeds are huge and thick and almost unequal in most species. Antenna and antennules are short in these species and eyes are placed in front in a hole. They don't have specific rostrum and tiny teeth are seen on the lateral edges of carapace. There is a lot of color diversity in this species. Abdomen is thinner in males than in females and there are no sexual holes on sternum. These crabs are abundantly found in rocky shores in intertidal zones (Marin & Spirodonov 2007).

Actaea sp. Carapace is elliptic in this crab and has more width than length and a lot of protuberances are observed on the body. Carapace is wide in frontier part and orange spots with a lot of decoration are observable. Sometimes these spots lay scattered over carapace and sometimes they are concentrated in one point. These spots are also seen over clipped in orange or violet color. Clipped fingers are black and have slow movements but they are closed quickly when they strike an obstacle and stop the obstacle. are orange colored, carried by pleopods on the abdomen part (Ng & Clark 2003; Marin & Spirodonov 2007).

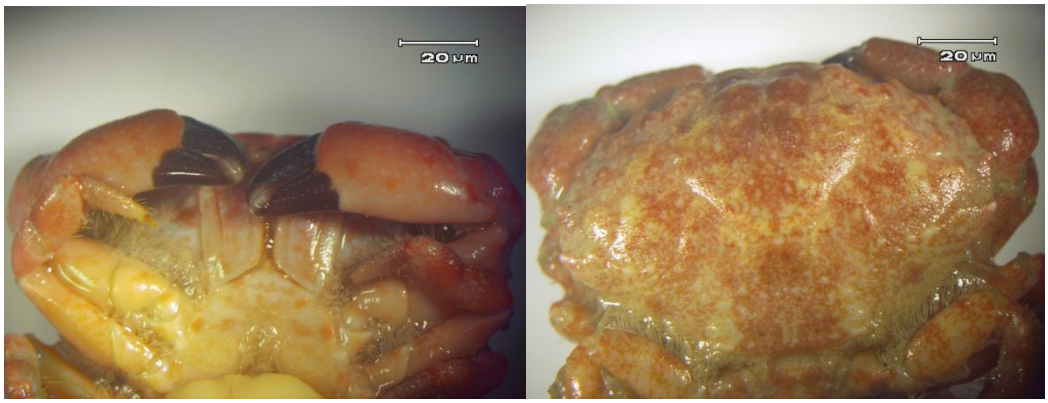

Figure 5. *Actaea sp.* (original).

Family of Portunidae

Order: Decapoda
Suborder: Pleocyemata
Infraorder: Brachyura
Superfamily: Portunoidea
Family: Portunoidea (Rafinesque 1815)
This family is called swimmer crabs. Members of this family swim in water by the last foot which is wide and paddle shape. These crabs are very active and are found in all coastal water and estuaries in India and west Pacific Oceans and are considered as the most important food and economical kinds in waters of the Persian Gulf and Oman Sea (Apel & Spiridonov 1998). General shape of carapace is the same in different species but the numbers and the shape of bones of carapace edge are different in various sexes which is the most important factor in species identification of this group. These crabs can do progressive, reverse or turndown and on side movements in their quick swimming. But

these crabs are benthic anyway and do swimming alternatively when the sea water rises during the flood tide in intertidal zones (Titgen 2003). In recent study one species of this family was identified.

Portunus plagicus. At the end of each side of the wide carapace of this crab one long spine is seen. In lower part of carapace in each side of the body 9 bones and there are 4 bones in forehead part. The width of carapace (the distance between the two lateral spines) reaches 20 cm. Carapace is covered with colorful spots which are bright and shiny in males and dull and dark in females. The back part of carapace is wide in both sexes. Forks are very strong and firm and are larger in males than females. There are some spines on carpus and merous. This species is found in muddy and rocky shores and to the depth of 50 m. Of course in depths more than 20 m their numbers decrease. This species is omnivorous and its feeding activity starts at sunset. They feed on planktons, the Annelids, crabs and shrimps (Lay et al 2010).

Figure 6. *Portunus plagicus* (original).

Discussion. Crabs choose different environments to live according to their morphological and physiological capabilities and access to the food resources. This choice is to have access to the habitat facilities (food, shelter, mate and suitable conditions for growth and survival) (Nybakken 1997). Bed conditions affect species diversity according to its type and quality. Frequency of these species in different shores is a sign of their adaptation to the conditions dominating on these zones. Climate, season changes and physical factors of the aria affect their dispersal.

The most frequency of the species was observed in summer. The Danish research team carried out a wide sampling in the Persian Gulf waters during 1937 and 1938 and the samples of collected crabs of this wide sampling were studied by Stephensen (1945). Although he just presented a list of crabs in his studies and no complete explanation concerning them was stated, brief explanations along with morphological features have been mentioned. Oliveira & Masunari (1995) in rocky shores of Brazil introduced the concentration of Petrolisthes sp. species from Porcellanidae family 350 individuals in square meter. This concentration was the highest amount of population of Chinese crabs in that region. The above instances show that this kind of bed as a suitable habitat causes an increase in combination of this recent species by increasing ecological niche.

8 species of Brachyura crabs and 3 species of Anomura crabs were identified on rocky beds in Brazil. Petrolisthes gender was dominant combination of epi-fauna of this kind of bed and due to food diet type in external bed surface in order for more access to nutrients were observed (Alves et al 2006). Abele & Kim (1986) stated that these two species are among halophilic species. Thus there are not a lot of fluctuations in their frequencies with an increase in salinity in summer. In the present study the most frequency of Petrolisthes gender was also observed in summer.

E'temadi Deylami (2011) who investigated dispersal and taxonomy of real crabs (Decapoda: Brachyuran) in intertidal zones of Oman Sea and their role in development of coastal ecotourism industry of the region and Sharafi & Shajiee (2009) who identified broad crab species belonging to (Xanthidae) family of intertidal zones of the east of Hormozgan identified and observed the species belonging to this family. These crabs' meat is poisonous and its consumption is dangerous. These crabs are abundantly found in rocky shores in intertidal zones. In present study one gender from this family was also observed.

In all species morphological features was found to be in accordance with other previous researches and we could find the keys by those and identify the species by those reports, the features of Porcellanidae family was in accordance with the results of Osawa & Komai (2007) and Lewinsohn (1976, 1979), features of Grapsidae family was same as presented by Schubart (2011) and Crosnier (2001). We could find the features of Xanthidae family that was same as our results in the studies conducted by Ng & Clark (2003) and Marin & Spirodonov (2007). Also the result of Portunidae family was same as reported by Apel & Spiridonov (1998), Titgen (2003) and Lay et al (2010).

It would be desirable to conduct annual studies on invertebrates such as crabs, in order to help identifying new species and to perform assessment of the coastline biodiversity of these species.

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