Doi: 10.31276/VJSTE.60(4).39-44

Species composition and distribution of brachyuran crabs in Duyen Hai town, Tra Vinh province

Van Tho Le[1*], Van Tu Nguyen[1], Ngoc Diem My Tran[2], Damin Lee[3], Won Kim[3], Van Son Dang[1], Doan Dang Phan[1], Duc Thien Luong[1]

[1]Institute of Tropical Biology, Vietnam Academy of Science and Technology, Vietnam
[2]University of Science, Vietnam National University Ho Chi Minh city, Vietnam
[3]School of Biological Sciences, Seoul National University, Republic of Korea

Received 2 August 2018; accepted 22 November 2018

Abstract:

Brachyuran crabs are the most diverse group of crustaceans. They are found in most marine habitats such as coral reefs, sandy beaches, rocky beaches, mangroves, and seagrass meadows. In this study, we investigated the species composition of brachyuran crabs at 10 sampling locations belonging to three habitats (mangrove forest, artificial dykes, sandy beaches) at Duyen Hai town on August (rainy season) and December (dry season) in 2017. We found that there were 22 species belonging to 10 genera of six families present in the research area. The Ocypodidae family is the most abundant, with 45.5% of the species, following by the Grapsidae (22.7%), Sesarmidae (13.6%), Portunidae (9.1%), Matutidae (4.5%), and Xanthidae (4.5%). The densities of brachyuran crabs ranged from 2.0±1.1 (inds/m^2) to 17.2±4.3 (inds/m^2). The mangrove forest habitat showed a greater diversity of species than the sandy beach and artificial dyke habitat. The rainy season supported greater diversity than the dry season.

Keywords: **brachyuran crabs, Duyen Hai town, mangrove forest, species composition.**

Classification number: **3.4**

Introduction

Crabs are a common group of the crustaceans. They have diverse species composition and widespread distribution. Currently there are about 7,000 species of crabs belonging to 98 families in maritime, freshwater, and terrestrial environments [1]. Brachyuran crabs are the dominant group of the macrobenthic communities in mangrove ecosystems [2]. They exist in greater species numbers, are more abundant, and have greater biomass than many other animals in most mangrove habitats [3]. Brachyuran crabs depend directly on mangrove areas for survival [4]. Their food resources in mangrove forests include benthic microalgae, phytoplankton, and sediment organic matter [5]. They are also the most important group for the mangrove ecosystem as they make 80% of faunal biomass [6] and are key engineers of the ecosystem [3]. The species composition and distribution of brachyuran crabs depend on their habitats and the environmental conditions. Researches on crab communities often are studies of their composition, number of species, and abundance [7]. In Vietnam, brachyuran crabs have been investigated by a number of researchers, such as Nhuong (2003) [8], Nhuong and Khac (2004, 2006) [9, 10], My, et al. (2012) [11], Chertoprud, et al. (2012) [12], and Tong, et al. (2016) [13]. However, these studies generated only preliminary data on brachyuran crabs in northern and central Vietnam and in the Can Gio district of Ho Chi Minh city. Brachyuran crabs in the Mekong river delta and Duyen Hai town of Tra Vinh province have not previously been studied. The present study was conducted to provide the information on their species composition, density, and distribution in Duyen Hai town in Tra Vinh province.

*Corresponding author: Email: tho1010@gmail.com

Materials and methods

Study area

This study was conducted in Duyen Hai town, Tra Vinh province. This is located in the north-west of the Vietnamese Mekong delta and is between the Co Chien and Hau rivers [13]. It has monsoon climate with two seasons (dry and wet). The investigations were undertaken in August (wet season) and December (dry season) in 2017. For the study, samples were collected at 10 sampling sites in three different habitats: artificial dykes (DH1, DH4, DH7), mangrove forests (DH2, DH8, DH9, DH10), and sandy beaches (DH3, DH5, DH6) (Fig. 1).

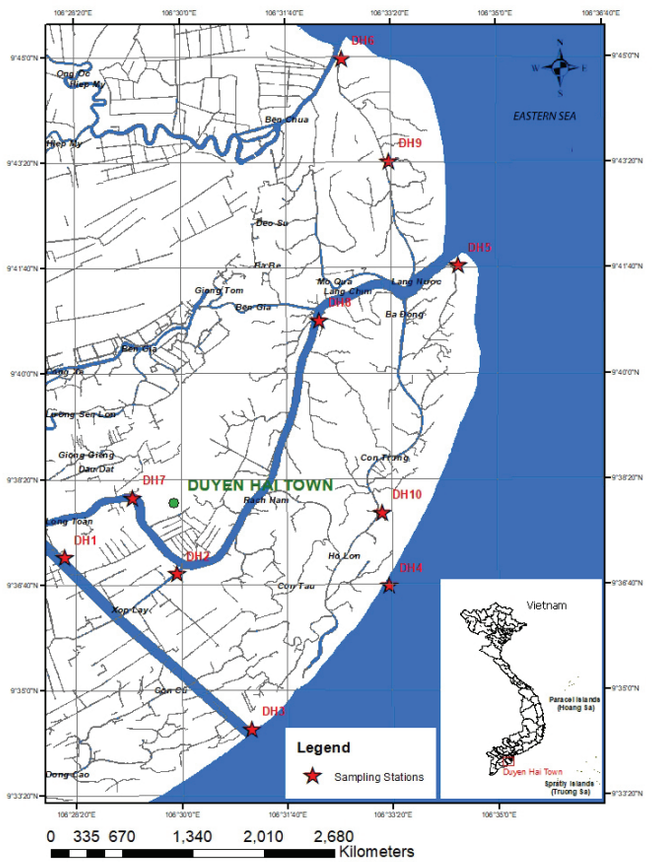

Fig. 1. Sampling stations for brachyura crabs in the study area.

Field sampling

The specimens of brachyuran crabs were collected using the method of Trivedi, et al. (2012) [14]. The qualitative samplings were recorded along a transect 50 metres in length. The quantitative samplings were collected in a quadrate area of 1 square metre [9]. The crabs were collected by hand, digging, or by the pumping out of holes and were photographed for noteworthy characteristics in the field. The samples were then washed in water and placed in jars. The specimens were conveyed to the laboratory in an icebox and preserved in 90% alcohol.

Laboratory analysis

In the laboratory, the crab specimens were identified using a Olympus SZ-ST (Olympus, Tokyo, Japan) dissecting microscope and by making use of the following literature: Crane (1975) [15], FAO (1998) [16], Ng, et al. (2001) [17], Ng and Davie (2002) [18], Ng, et al. (2008) [19], Shih, et al. (2010) [20], and Davie (2012) [21]. The samples of brachyuran crabs are kept at Marine Joint Laboratory of Vietnam - Korea at the Institute of Tropical Biology.

Data analysis

The data on the number of species and abundance of brachyuran crabs were checked to ascertain whether they fulfilled the assumptions of homogeneity of Levene's test. One-way analysis of variance was applied to examine the significance of the differences based on the habitats and the seasons. The analysis was completed using Tukey's HSD test. All statistical analyses was performed using SPSS v.20.0 (IBM Corp., Armonk, NY, USA). The degree of similarity of the crab communites across habitats was calculated using the Bray-Curtis similarity coefficient in the PRIMER VI analytical package developed by Plymouth Marine Laboratory, UK.

Results

A total of 22 species of brachyuran crabs were recorded in Duyen Hai town. They belonged to 10 genera and six families. The six families of brachyuran crabs were the Ocypodidae, Grapsidae, Sesarmidae, Portunidae, Matutidae, and Xanthidae. Of these, the Ocypodidae had the highest number of species, 10 (45.5% of total), followed by the Grapsidae (5 species, 22.7%). The Sesarmidae were present as three species (13.6%). Two species (9.1%) belonged to the Portunidae while the Matutidae and Xanthidae were present as only one species each (4.5%) (Fig. 2). The genus Uca had the highest number of species while the rest of the genera had 1-2 species/genus each.

Metopograpsus latifrons (Grapsidae) was the most dominant brachyuran crab species and was recorded at seven different sampling sites. In contrast, *Grapsus albolineatus* (Grapsidae) occurred only at site DH4. The highest number of species were detected at DH8 site (14 species) followed by sites DH2 and DH9 (12 species), DH10 (11 species), and DH1 (four species). Sites DH3, DH4, DH5, and DH6 had three species each, while site DH7 had the lowest number, with only two species.

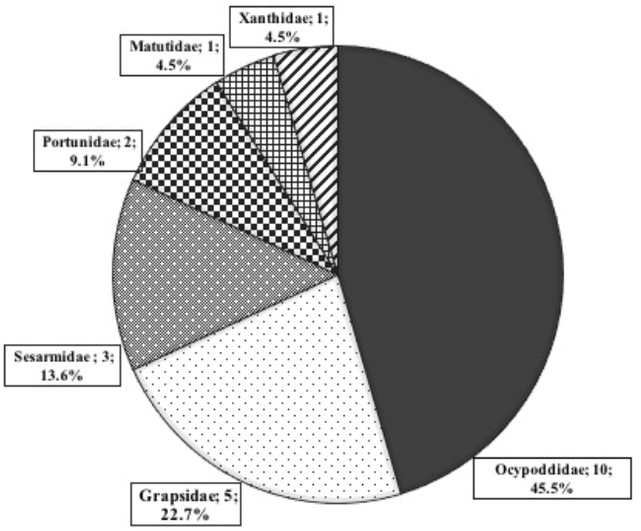

Fig. 2. Relative contribution by family of crabs in Duyen Hai town, Tra Vinh province.

The sampling stations fell into three habitat types: artificial dykes at three sampling sites (DH1, DH4, DH7), mangrove forests at four sampling sites (DH2, DH8, DH9, DH10), and sandy beaches at three sampling sites (DH3, DH5, DH6). The habitat assignment of the brachyuran crabs was based on the location where each species was found most frequently. Fig. 3 shows that the brachyuran crabs at the sampling stations in Duyen Hai town belonged to three groups equivalent to the three habitat types.

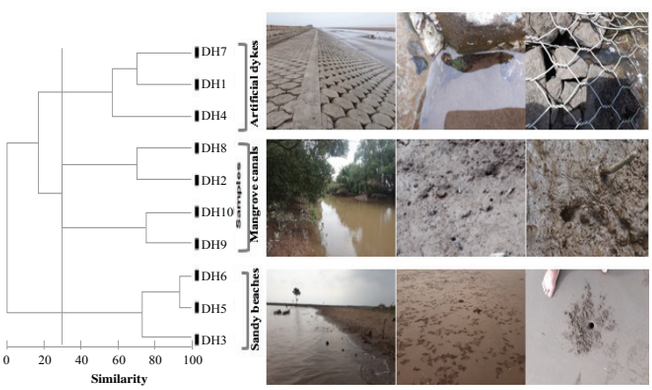

Fig. 3. Dendrogram of brachyuran crabs recorded at the stations and their habitat types.

Of the three habitats, the mangrove forest had the highest number of species, 17, while at the artificial dykes and sandy beaches only three species were recorded for each habitat (Table 1). The species of the families Grapsidae and Ocypoddidae were the most dominant in the study area. While *Metopograpsus latifrons* (Grapsidae) was dominant at the artificial dykes, *Dotilla wichmanni* (Ocypoddidae) was the dominant species on the sandy beaches, and *Parasesarma plicatum* (Grapsidae), *Uca crassipes*, and *Uca annulipes* (Ocypoddidae) were dominant in the mangrove forest.

Table 1. The species composition of brachyuran crabs in the three habitat types in Duyen Hai town.

No.	Species and Families	Habitat types		
		Artificial dykes	*Mangrove forest*	*Sandy beaches*
	Family Grapsidae			
1	*Metopograpsus latifrons* (White, 1847)	X	X	
2	*Metopograpsus* sp.	X		
3	*Grapsus albolineatus* (Lamarck, 1818)	X		
4	*Parasesarma plicatum* (Latreille, 1806)		X	
5	*Parasesarma ungulatum* (H. Milne Edwards, 1853)		X	
	Family Matutidae			
6	*Ashtoret lunaris* (Forskål, 1775)			X
	Family Ocypodidae			
7	*Ocypode cerathophthalmus* (Pallas, 1772)			X
8	*Dotilla wichmanni* De Man, 1892			X
9	*Uca annulipes* (H. Milne-Edwards, 1837)		X	
10	*Uca crassipes* (White, 1847)		X	
11	*Uca* sp.1		X	
12	*Uca (Gelasimus) borealis* Crane, 1975		X	
13	*Uca lactea* (De Haan, 1835)		X	
14	*Uca dussumieri* (Milne Edwards, 1852)		X	
15	*Uca flammula* (Crane, 1975)		X	
16	*Uca paradussumieri* Bott, 1973		X	
	Family Portunidae			
17	*Scylla serrata* (Forskål, 1775)		X	
18	*Scylla paramamosain* (Estampador, 1949)		X	
	Family Sesarmidae			
19	*Episesarma versicolor* (Tweedie, 1940)		X	
20	*Episesarma singaporense* (Tweedie, 1936)		X	
21	*Perisesarma eumolpe* (De Man, 1895)		X	
	Family Xanthidae			
22	*Platypodia granulosa* (Ruppell, 1830)		X	
Total species		**3**	**17**	**3**

Figure 4 shows the density of brachyuran crabs at the sampling stations and in the different habitats. There was a distinct seasonal variation in the abundance of crabs ($p=0.004<0.05$), with a high density in the rainy season and low values in the dry season. The greatest abundance of brachyuran crabs (17.2±4.3 inds/m^2 at site DH3) was observed in the rainy season while the lowest (2.0±1.1

inds/m^2 at site DH4) was found in dry season. There was a clear, significant ($p<0.05$) difference in crab abundance. The highest density occurred on the sandy beaches (ranging from 7.6±1.3 inds/m^2 to 17.2±4.3 inds/m^2), followed by the mangrove forests (ranging from 7.0±1.1 inds/m^2 to 15.8±1.9 inds/m^2), while the lowest densities occurred in the artificial dykes (ranging from 2.0±1.1 inds/m^2 to 5.4±1.0 inds/m^2) (Fig. 4).

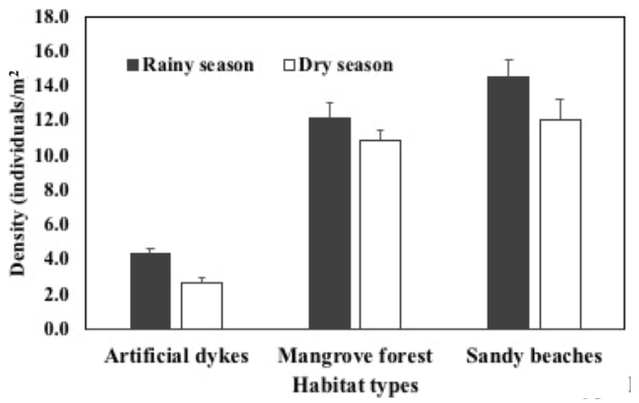

Fig. 4. Densities (mean±SD) of brachuyran crabs in the habitats studied.

Cluster analysis illustrated that the species composition of crab in the study area was divided into three groups (Fig. 5). Group 1 exclusively comprised climber crab assemblages present in the artificial dyke habitat. Group 2 comprised mangrove crabs found in the mangrove forest habitat. Group 3 comprised only sandy assemblages distributed in the sandy beach habitat.

At the artificial dykes, three species, *Metopograpsus latifrons, Grapsus albolineatus*, and *Metopograpsus* sp., belonging to family Grapsidae were recorded. *Grapsus albolineatus* and *Metopograpsus* sp. were exclusively present at the dykes (as group 1 in Fig. 5.), while *Metopograpsus latifrons* was found at both the dykes and in the mangrove forests. Species such as *Metopograpsus latifrons* and *Metopograpsus* sp. dominated and were detected at all the sampling stations in the artificial dyke habitat, while *Grapsus albolineatus* was present only at the sea dyke (DH4).

In the mangrove forest habitats, there were 17 species of brachyuran crabs in seven genera and five families. *Metopograpsus latifrons, Uca annulipes, Uca crassipes, Parasesarma plicatum* were dominant and were recorded at all the sampling stations, while *Parasesarma plicatum* and *Parasesarma ungulatum* only appeared in small mangrove

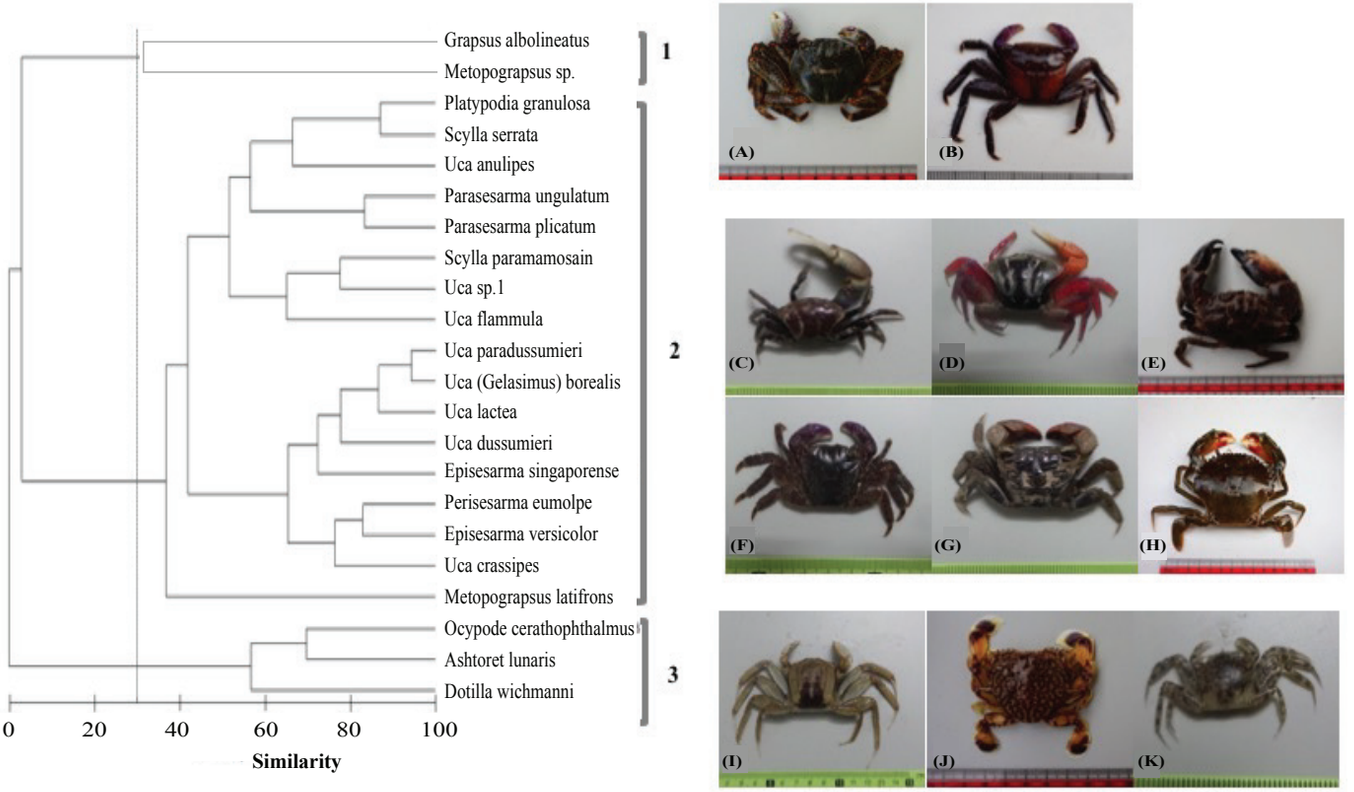

Fig. 5. Species clusters of brachyuran crabs in the habitat types, and some species. (A) *Grapsus albolineatus*; (**B**) *Metopograpsus* sp.; (**C**) *Uca paradussumieri*; **(D)** *Uca anulipes*; (**E**) *Platypodia granulosa*; (**F**) *Metopograpsus latifrons*; (**G**) *Parasesarma plicatum*; (**H**) *Scylla serrata*; (**I**) *Ocypode cerathophthalmus*; (**J**) *Ashtoret lunaris*; (**K**) *Dotilla wichmanni.*

canals (DH9 and DH10), and *Episesarma versicolor, Episesarma singaporense,* and *Perisesarma eumolpe* occurred exclusively in large mangrove canals (DH2 and DH8). The families Sesarmidae (three species), Portunidae (three species), Xanthidae (one species) and almost all Ocypodidae species were exclusively distributed in the mangrove forest habitats (as group 2 in Fig. 5).

On the sandy beaches, three species belonging to the families Matutidae (one species) and Ocypoddidae (one species) were found. *Ocypode cerathophthalmus* and *Dotilla wichmanni* were the dominant species and were recorded at all the sampling sites in the sandy beach habitat, while *Ashtoret lunaris* was detected only at site DH3 (as group 3 in Fig. 5).

Discussion

Mangrove forests have been well-studied for brachyuran crab diversity [22]. More than 100 species of brachyuran crabs in mangrove forests have been reported in Malaysia and Singapore [23]. Brachyuran crabs are a prominent faunal component and play important ecological roles in mangrove forests [24]. Twenty-two species of brachyuran crabs were found in three different habitats in Duyen Hai. Seventeen species were recorded in mangrove forest habitats, while three species were found at artificial dykes and on sandy beaches. The number of species of brachyuran crabs is dependent on the mangrove vegetation and hydrobiological factors [15]. Mangrove forests with vegetation, low temperatures, and a wet surface are a suitable habitat for brachyuran crabs; hence, they had high species richness [25].

The species composition of brachyuran crabs in Duyen Hai included grapsids, ocypodids, sesarmids, and porturnids. These species are commonly distributed in the coastal areas [10] and mangrove forests [3] in Vietnam. Portunid crabs belonging to the genus Scylla are of high value and are an important source of income for local fishers [26]. Ten ocypodid species were recorded in Duyen Hai; these comprise the preliminary data on them in Tra Vinh province. As in other areas in Vietnam, the most abundant species in the study area belong to the Ocypodidae and Grapsidae families [8]. The genus *Uca* are a group of crabs common to most tropical and subtropical coastal areas [27]. They are largely diurnal, active at low tide, often sympatric, and always gregarious [15]. They are distributed on substrates ranging from mud to sand with a minimum of silt, and in mangroves, such as mangrove forest habitat in Duyen Hai, or in other forms of vegetation [15]. Hence, they had the highest number of species in the study area.

The distribution features of brachyuran crabs are dependent on the characteristics of different biotopes, vegetation structures, food availability, and on the nature of the substrate [9, 28]. In the sandy beach habitat (DH3, HH5, and DH6) sand bubbler crabs (Dotilla) and sand crabs (*Ocypode cerathophthalmus*) were also found [9]. The hard surfaces of the dyke habitat (DH1, HH4, and DH7) are suitable for purple climber crabs (Metopograpsus) and sally lightfoot crabs (*Grapsus albolineatus*) [25]. In the mangrove forest habitat (DH2, DH8, DH9, DH10), mangrove crabs such as sesarmids, grapsids, ocypodids, ucidids, and porturnids were also found. These families occur across the mid- and low-intertidal zones in the mangroves [24]. The Grapsidae family is also found in the interior of the mangrove forest, while the genus Uca dominates the perimeter of mangrove forest, and the genus Sesarma is prevalent on the mangrove ground [9]. Water salinity varied significantly across sampling sites, which also accounts for the varied distribution of crabs [28]. Some species, such as *Ocypode cerathophthalmus*, *Ashtoret lunaris*, and *Dotilla wichmanni* were recorded in coastal areas where the water salinity is high, as with sites DH3, DH4, DH5, and DH6. In contrast, the grapsids and sesarmids were found in mangrove forests where the water salinity is low, as with sites DH2, DH8, DH9, and DH10.

Conclusions

The present study provides the first data on the composition, density, and distribution of brachyuran crabs in Duyen Hai town. In three habitats, 22 species belonging to 10 genera and six families were recorded. The number of species was highest for the Ocypodidae family and lowest for the Matutidae and Xanthidae families. The species of the Grapsidae and Ocypoddidae families were the most dominant species. Of the three habitats, the mangrove forest habitat had the highest number of species, while the sandy beaches and artificial dykes had the lowest. The density of brachyuran crabs ranged from 2.0±1.1 (inds/m^2) to 17.2±4.3 (inds/m^2). The density was highest on the sandy beaches and lowest at the artificial dykes. The density was higher in the rainy season than in the dry season.

The authors declare that there is no conflict of interest regarding the publication of this article.

REFERENCES

[1] L.M. Tsang, C.D. Schubart, S.T. Ahyong, J.C. Lai, E.Y. Au, T.Y. Chan, P.K. Ng, K.H. Chu (2014), "Evolutionary history of true crabs (Crustacea: Decapoda: Brachyura) and the origin of freshwater crabs", *Molecular Biology and Evolution*, **31(5)**, pp.1173-1187.

[2] D. Roy (2008), "Annotated checklist of mangrove and coral reef inhabiting Brachyuran crabs of India", *Zoological Survey of India*.

[3] K. Diele, D.T. Ngoc, S.J. Geist, F.W. Meyer, Q.H. Pham, U. Saint-Paul, T. Tran, U. Berger (2013), "Impact of typhoon disturbance on the diversity of key ecosystem engineers in a monoculture mangrove forest plantation, Can Gio Biosphere Reserve, Vietnam", *Global and Planetary Change*, **110**, pp.236-248.

[4] W.S. Fredrick, S. Ravichandran (2013), "Diversity of brachyuran crabs in the mangrove environment of Tamil Nadu", *World Jour. Fish and Mar. Sci.*, **5(4)**, pp.441-444.

[5] N.T. Tue, H. Hamaoka, A. Sogabe, T.D. Quy, M.T. Nhuan, K. Omori (2012), "Food sources of macro-invertebrates in an important mangrove ecosystem of Vietnam determined by dual stable isotope signatures", *Journal of Sea Research*, **72**, pp.14-21.

[6] F. Golley, H.T. Odum, R.F. Wilson (1962), "The structure and metabolism of a Puerto Rican red mangrove forest in May", *Ecology*, **43(1)**, pp.9-19.

[7] S. Kawaida, K. Nanjo, T. Kanai, H. Kohno, M. Sano (2017), "Microhabitat differences in crab assemblage structures in a subtropical mangrove estuary on Iriomote Island, southern Japan", *Fisheries Science*, **83(6)**, pp.1007-1017.

[8] D.V. Nhuong (2003), "Preliminary data on Brachyura in the Can Gio mangrove area, Ho Chi Minh city", *Journal of Biology*, **25(4)**, pp.6-10.

[9] D.V. Nhuong, H.N. Khac (2004), "Preliminary data of Brachyura in the mangrove of the estuarine zone of the Red river", *Journal of Biology*, **24(4)**, pp.13-19.

[10] D.V. Nhuong, H.N. Khac (2006), "Preliminary data on Brachyura (Crustacea) in coastal mangrove forests from Tinh Gia (Thanh Hoa province) to Hoi An (Quang Nam province)", *Journal of Biology*, **28(1)**, pp.35-39.

[11] T.N.D. My, K. Diele, T. Triet (2012), "Biodiversity and role of brachyuran crabs in leaf litter decomposition on typhoon destroyed areas at Can Gio mangrove, Ho Chi Minh city", *Science and Technology Development*, **14(3T)**, pp.46-53.

[12] E.S. Chertoprud, V.A. Spiridonov, I.N. Marin, V.O. Mokievsky (2012), "Brachyuran crabs (Crustacea Decapoda Brachyura) of the mangrove intertidal zone of southern Vietnam", *Benthic Fauna of the Bay of Nhatrang, Southern Vietnam*, **2**, Moscow: KMK Scien., p.235.

[13] H.Q. Tong, R.H. Bosma, H.T. Tran, A. Ligtenberg, T.P. Van, A.K. Bregt (2016), "Aquaculture and forestry activities in Duyen Hai district, Tra Vinh province, Vietnam", *IUCN*.

[14] J.N. Trivedi, M.K. Gadhavi, K.D. Vachhrajani (2012), "Diversity and habitat preference of brachyuran crabs in Gulf of Kutch, Gujarat, India", *Arthropods*, **1(1)**, pp.13-23.

[15] J. Crane (1975), *Fiddler crabs of the world: Ocypodidae: genus UCA,* Princeton University Pres.

[16] FAO (1998), *The living Marine Resources of the Western Central Pacific*, Volume 2, Rome, Italy, pp.1045-1156.

[17] P.K. Ng, C.H. Wang, P.H. Ho, H.T. Shih (2001), *An annotated checklist of brachyuran crabs from Taiwan (Crustacea: Decapoda),* **(11)**, National Taiwan Museum Special Publication Series.

[18] P.K. Ng, P.J. Davie (2002), "A checklist of the brachyuran crabs of Phuket and western Thailand", *Phuket Marine Biological Center Special Publication*, **23(2)**, pp.369-384.

[19] P.K. Ng, D. Guinot, P.J. Davie (2008), "Systema Brachyurorum: Part I. An annotated checklist of extant brachyuran crabs of the world", *The Raffles Bulletin of Zoology*, **17(1)**, pp.1-286.

[20] H.T. Shih, P.K. Ng, S.H. Fang, B.K. Chan, K.J. Wong (2010), "Diversity and distribution of fiddler crabs (Brachyura: Ocypodidae: Uca) from China, with new records from Hainan Island in the South China Sea", *Zootaxa*, pp.1-19.

[21] P.J. Davie (2012), "A revision of Neosesarma (Crustacea: Brachyura: Sesarmidae) with the description of a new species", *Memoirs of the Queensland Museum*, **56(1)**, pp.221-233.

[22] M.L. Shukla, B.K. Patel, J.N. Trivedi, K.D. Vachhrajani (2013), "Brachyuran crabs diversity of Mahi and Dhadhar estuaries, Gujarat, India", *Research Journal of Marine Sciences,* **1(2)**, pp.8-11.

[23] C.G. Tan, P.K. Ng (1994), "An annotated checklist of mangrove brachyuran crabs from Malaysia and Singapore", *Hydrobiologia*, **285(1-3)**, pp.75-84.

[24] K. Diele, V. Koch, F.A. Abrunhosa, J. de Farias Lima, D.D.J. de Brito Simith (2010), "The brachyuran crab community of the Caeté Estuary, North Brazil: species richness, zonation and abundance", *Mangrove Dynamics and Management in North Brazil*, pp. 251-263.

[25] K. Kon, H. Kurokura, P. Tongnunui (2010), "Effects of the physical structure of mangrove vegetation on a benthic faunal community", *Journal of Experimental Marine Biology and Ecology*, **383(2)**, pp.171-180.

[26] C.P. Keenan (1999), "Aquaculture of the mud crab, genus Scylla-past, present and future", *Aciar Proceedings*, **78**, pp.9-13.

[27] H.T. Shih, P.K. Ng, M.Y. Liu (2013), "Systematics of the Indo-West Pacific broad-fronted fiddler crabs (Crustacea: Ocypodidae: genus Uca)", *Raffles Bulletin of Zoology*, **61(2)**, pp.641-649.

[28] A. Aschenbroich, E. Michaud, T. Stieglitz, F. Fromard, A. Gardel, M. Tavares, G. Thouzeau (2016), "Brachyuran crab community structure and associated sediment reworking activities in pioneer and young mangroves of French Guiana, South America", *Estuarine, Coastal and Shelf Science*, **182**, pp.60-71.