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The Type and Distribution of Violin Crab (*Uca*) at Mangrove Forest of Kahyapu, Enggano Island and The Gulf of Muaro, Labu Nawi, Bengkulu City

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ABSTRACT

Violin Crab (Uca) is type of crab living in mangrove habitat as a detrivore. In Bengkulu, the mangrove forest zone locates in many areas, including Kahyapu, Enggano Island and Gulf of Muaro Labu Nawi, Pulau Baai, Bengkulu City. The objective of this experiment was to investigate the pattern of Violin Crab distribution at mangrove forest in Kahyapu and Gulf of Muaro. The methodology used in this experiment, carried out from 2017 to 2018, was a survey done by random sampling. The samples were taken from 2 stations at 10 plots, whose size was1m x 1m each. The variable measured included the crab pattern of distribution and abiotic factor which might affect the growth of the crabs, such as water pH, temperature, and salinity Muaro Labu Nawi. However, the total Biola crab in these two habitats was 11, including Uca *annulipes, Uca boninensis,Uca coarcata, Uca crassipes, Uca dussemiert, Uca forcipata, Uca perplexa, Uca rosea, Uca tetragon, Uca triangularis,* and *Uca vacans.* The violin crab inhabitating Kahyapu showed random pattern of distribution while those in the Gulf of Muaro Labu Nawi had clustered and random distribution. Moreover, Kahyapu habitat had water temperature of 27–30 ºC, solution pH of 6.4–6.7, and salinity level of 26–28%. On the other hand, the Gulf of Muaro Labu Nawi had water temperature of 27–31 ºC, pH of 6.5–6.9, and 26–31% of salinity level.

Keywords: *Violin crab, distribution pattern, random sampling, Enggano Island, Bengkulu City*

1. INTRODUCTION

Violin crab (Uca) is one of the most populair Crustacea, living as a detrivor by making a pit at the base of mangrove trees [1], and screening the microrganisms from the surface of sedimenct ant then disgesting them [2]. The number of violin crab (Uca) types across the globe reaches 97 types.

Violin crabs have a unique characteristic, called a sexual dimorphism in which one of the claws (chela) may reach twice as big as the chepalothorax, to lure the female crab and scare their opponents. In fact, the name of violin crab is given from the way the male crabs pick their foods, in which the small claw moves back and forth from the substrate to the mouth picking up food. This move just like the move of a violin being played [5]. Volin crab is a mangrove dependent Crustacea, searching for food in mangrove habitat when the sea recedes, by acting as a detritus. In addition, violin crab also uses the mangrove as a place to breed, producing offsrpings for continuing their life cycles [6].

Mangrove forest locates at the tidal area across the sea shore and small islands rich in natural resources and food supplay to support the violin crab. Unfortunately, people have been cutting down the mangrove trees in Bengkulu and used the trees for construction materials or traditional fuels, in addition to using the land for housing. These lead to the destruction of the violin crab habitat at Kahyapu village, Engano Island and at Muaro Labu Nawi, Bengkulu City, a home for many types of violin crabs. Beacause of these a research to study type of violin crab and their distribution pattern of violin crab at these areas need to carried out. The objective of

this research was to study the type of violin crabs and their distribution pattern at the mangrove forest at Kahyapu Village, Enggano Islan and at the gulf of Muaro Labu Nawi, Bengkulu City.

2. MATERIALS AND METHODS

2.1. Time and Place

The research was conducted from 2017 to 2018 at the mangrove forest area of Kahyapu village, Enggano Island and at the guld of Muaro Labu Nawi, Bengkulu City

2.2. Equipment and Supplies

Equipment used in this research were plastic bucket, netted sach, ice box, shovell, gloves, bottles, wooden stick, pH meter, refractometer, calipers, GPS (Garmin), and digital camera. Supplies needed for this experiment included formalin 4%, alcohol 70%, and ice block

2.3. Description of Reseach Area

Kahyapu village, Enggano Island Kahyapu village locates in Enggano Island, having area of 8563 hectare in which about 250 hectar is mangroe forest. Along with the incrase in Kahyapu population, the area of Kahyapu mangrove reduces accordingly, due to the need for housing, leading to the destruction of violin crab habitat.

Gulf of Muaro Labu Nawi, Bengkulu City.The gulf of Muaro Labu Nawi locates in Sumber Jaya village, sub-district of Kampung Melayu, Bengkulu City. This location is one of the favorite tourist destinations in Bengkulu Province, locating next to the natural tourism destination of Pantai Panjang and Pulau Baii, where tourist may enjoy fishing and sight-seeing of the beautiful panoramic beach.

2.4. Research Station

Two locations were used in this study, which were Kahyapu Village, Enggano, defined as Location I (L-1) and the gulf of Muaro Labu Nawi, Bengkulu City, defined as Location II (L-1). At each location we put two research stations (RS). At L-1, research station one (RS-1) was a mangrove forest away from the settlement while research station two (RS-2) was a mangrove forest closed by the settlement. At L-2, RS-1 was undisturbed mangrove forest while RS-2 was disturbed mangrove forest.

2.5. Sampling Method

At each RS, violin crab (Uca) was observed by taking sample of the crab from their habitats by employing Random sampling, done by arranging 10 plots of 1m x 1m taken randomly. Uca was observed when the water sea level receded, by digging the pit to take all the crabs and substrates from the 1m x 1m plot. The crab and substrates were put in the netted sach and submerged underwater to separate them.

2.6. Water Quality

Water quality were observed chemically by measuring the salinity level (by refarctometer) and pH level (by pH meter) and physically by mearuring the temperature (by thermometer). The measurement was conducted *in sit* at each RS.

2.7. Data Analysis

Data analysis was done to determine the Uca crab identification and their distribution pattern.

2.6.1. Uca Crab Identification.

Crab identification was done based on a Manual for Violin Crab (Uca) Identification, as described in the book of Identification of Uca [3].

2.6.2. Crab Distribution Pattern

Crab distribution pattern was determinated based on the following formula [7]

$$\mathrm{Id} = n\frac{(\sum x2) - N}{N(N-1)} \quad (1)$$

Where:
Id = Morisita dipersion index;
N = total number of individuals of a given organism within the plot;
$\sum X^2$ = total number of individuals within plot
n = number of plots being observed

Based on [7], there were 3 categories of ditribution pattern, where:

Id < 1: even distribution
Id = 1: random distribution
Id > 1: group distribution

To determine whether the id values were significant (either >1 or <1), one must do chi-square test, by using the following formula:

$$X^2 = \frac{n \sum X^2 - N}{N} \quad (2)$$

where:

X^2 = statistical test of the distribution pattern by chi-square;
N = total number of individuals on a given organism within plot;
$\sum X^2$ = total number of individuals within plot;
n = number of sample unit.

If calculated $X^2 <$ table X^2, it means a random distribution; however, if calculated $X^2 >$ table X^2, it means a non-random distribution.

3. RESULTS AND DISCUSSIONS

We found 11 species of violin crab (Uca) from these two locations (L), where 9 of them found at Kahyapu (L-1) while 7 of them found at the Gulf of Muaro Labu Nawi (L-2), as presented in Table 1.

Table 1. Species of violin crab (Uca) found in Kahyapu (L-1) and gulf of Muaro Labu Nawi (L-2).

No	Name of Species	Kahyapu Enggano (L-1)		Gulf of Muaro Labu Nawi (L-2)	
		St1	St2	St1	St2
1	*Uca annulipes*		√	√	√
2	*Uca boninensis*		√		
3	*Uca coarciata*			√	
4	*Uca crassipes*	√			
5	*Uca dussumeiri*	√		√	
6	*Uca forcipata*	√			
7	*Uca perplexa*	√	√	√	√
8	*Uca rosea*			√	
9	*Uca tetragonon*	√			
10	*Uca triangularis*	√		√	√
11	*Uca vocans*		√		√

It seemed that the condition of the mangrove forest affected the number of Uca species found in each research station (RS). For example, at Kahyapu (L-1) we found 6 species of violin at RS-1 and 44 species at RS-2. In fact, the mangrove forest at RS-1 was still undisturbed while at RS-2 the mangrove forest had been disturbed. Similarly, at the Gulf of Muaro (L-2) we found more species of violin crab at RS-1 (6 species) than those at RS-2 (4 species). In fact, the mangrove forest at RS-1 was undisturbed, more populated, and rich in substrate to support the violin crab life, compared to those at RS-2.

Some violin crabs (Uca) like certain substrate for making a pit and searching for food. For example, *Uca perplexa* was found in every research station both in Kahyapu (L-1) and Gulf of Muaro (L-2). On the other hand, *Uca annulipes* and *Uca triangularis* were found in every station at Gulf of Muaro (L-2), but only in one station at Kahyapu (L-1). Apparetnly, these findings were related to the Uca behavior, in which *Uca perplexa* was the type of Uca like making a pit within the sandy substrates and sandy mud at somewhat open area while *Uca triangularis* and *Uca annulipes* like makin a pit at the mangrove area [8-9]. These findings confirmed previous research done by [2], reporting that Uca tirangularis is usually found at the mangorve area having fine muddy substrate with high water content

Three distribution patterns of the violin crabs were found in this study: a random, an even, and a group distribution. All violin crabs at R-1 of L-1 and most of them at R-1 of L-2 were randomly distributed (Table 2). On the other hand, all violin crabs found at R-2 of L-2 showed a group distribution. We believed that these distribution patterns were affected by the nature of the mangrove forest. When the forest was undisturbed, the mangrove trees grew well and occupied all over the places, because of the forest produced lots of litter and spreaded out all over the area. As the source of food available everywhere, there was no competition between the violin crab living at that location. So, the crab could live everywhere, resulting in a random distribution pattern. These were the case for RS-1 at every location (Kahyapu and Gulf of Muaro).

In contrast to above mentioned, when the mangrove forest was disturbed, either for fire wood or settlement, the mangrove trees sparsely distributed at the area, causing uneven distribution of litter as the source of food for the crab. Some places might have lots of litters while other places might not have any, causing a high competition for food among the violin crab. In response to those environmental condition, the violin crab lived in a group where the source of food was availble. As a result, the violin crab formed an even or a group distribution pattern, mainly for two resason: to be easily access the food and to protect themselves from any predator [10]

Table 2. Distribution pattern of violin car (Uca) at Kahyapu (LT-1) and Gulf of Muaro Labu Nawi (LT-2)

No.	Species	Kahyapu, Enggano (L-1)				Gulf of Muaro Labu Nawi (L-2)			
		RS 1		RS 2		RS 1		RS 2	
		Id*	Pattern	Id*	Pattern	Id*	Pattern	Id*	Pattern
1	*Uca annulipes*	-	-	-		5	G	-	-
2	*Uca boninensis*	-	-	0.95	R	-	-	-	-
3	*Uca coarciata*	-	-	-	-	-	-	-	-
4	*Uca crassipes*	1.33	R	-	-	-	-	-	-
5	*Uca dussumeiri*	1.03	R	-	-	-	-	-	-
6	*Uca forcipata*	1.11	R	-	-	-	-	-	-
7	*Uca perplexa*	1.23	R	0.60	E	1.65	R	1.74	G
8	*Uca rosea*					1.51	R		
9	*Uca tetragonon*	1.14	R						
10	*Uca triangularis*	-	-			1.70	R	2.85	G
11	*Uca vocans*			0.44	E			4	G

Note: R = random; E = even; G = group

We also found that one species of violin crab formed different distribution pattern at different research stations, such as *Uca perpelexa* and *Uca triangularis* having a random and group distribution pattern at different research station (Table 2). Two main factors were proposed as the cause of this differences: internal and external factors. Food availability and the presence of predator were two external factors, causing the violin crab to live as a group, forming a group distribution pattern, or as an individual, forming a random distribution pattern [11]. In addition, the crab might live together in a group during the mating season, especially in April through August, forming a group distribution pattern [11]. These external and internal factors explained why one species of violin crab might form a group distribution pattern or a random distribution pattern.

All research stations (RS) at two locations (L) showed water temperature of 27–30 ºC and water pH of 6.5–6.9 (Table 3), indicating that these two locations were ideal places for the Violin Crab (Uca). Previous study showed that to ideally support the life of Crustacea, including violin crab, mangrove forest must have water temperature of 25–30 ºC and water pH of 6.5–6.9 [2]. In addition, the water salinity of these location was 26–31%, suggesting that the salinity level is an ideal for supporting the life of violin crab, as the ideal level of water salinity for violin crab is 25–29 ppt [11].

Table 3. Abiotic factors measured at mangrove forest of Kahyapu (LT-1) and Gulf of Muaro Labu Nawi (LT-2) during the experiment

No	AbiotIc Factors Criteria	Kahyapu, Enggano (L-1)		Gulf of Muaro Labu Nawi (LT-2)	
		RS 1	RS 2	RS 1	RS 2
1	Water temperature (°C)	27-29	29-30	27-29	28-30
2	Water pH	6.5-6.7	6.5-6.6	6.7-6.9	6.8-6.9
3	Water salinity level (%)	26–28	26–27	26–29	29–31

4. CONCLUSION

We found that there were 11 species of violin crabs from these research venues. Among them, 9 species liven in Kahyapu, Enggano, including *Uca annulipes, Uca boninensis, Uca crassipes, Uca dussumeiri, Uca forcipata, Uca perplexa, Uca tetragonon, Uca triangularis,* and *Uca vocan and* 7 species inhabited at the gulf of Muaro Labu Nawi, Bengkulu City, *like Uca annulipes, Uca coarciata, Uca dussumeiri, Uca perplexa, Uca rosea, Uca triangularis* dan *Uca vocans.*

We also found that the distribution pattern of violin crab at Kayapu, Enggano, was an evenly randomized distribution while that at the Gulf of Mauaro Labu Nabi was a group distribution. The distribution pattern of the Violin Crab (Uca) might be attibuted by the availabiliy of food source, the presence of predator threat, and/or the mating season.

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