International Journal of Applied Environmental Sciences
ISSN 0973-6077 Volume 14, Number 5 (2019), pp. 523-539

http://www.ripublication.com

Coastal Sediment and Benthic Crustacean *Emerita emeritus, Albunea symmysta, Hippa adactyla* of South Coast Central Java Indonesia

Agus Hartoko[1]*, Max R Muskananfola[2], Nurul Latifah[3], Bambang Sulardiono[4], Djoko Suprapto[5],Siti Rudiyanti[6]

[1,2,3,4,5,6]. Dept of Fisheries. Fac of Fisheries and Marine Science. Diponegoro University.

Jalan Prof. Sudarto.SH. Kampus Undip Tembalang. Semarang - Indonesia

**Corresponding author*

Abstract

South Java coastal zone was the least studied on coastal sediment type and benthic Crustacean. Character of south Java coastal area had two type of coastal sediments. First is a blackish volcanic sand type originated from the Merapi mountain through its waterways southward. Second is whitish organic calcareous sediment with vertical limestone hills originated from geological up-lifted of formerly underwater coral-reef materials. Aim of study is to reveal occurence of benthic mole crab Crustacean in the intertidal coastal sediment at Parangtritis, Parangkusumo, Glagah and Depok coast south Java. Dominant grain size of 0.25 - 0.50 mm at Depok is 52.92%, 51.66% at Glagah, 56.08% at Parangkusumo and fery fine sand of 0.063 – 0.125 mm only at Parangtritis (82.06 %). Slope range from 14.50 – 21.80 at Depok, Glagah, Parangkusumo and very gentle slope of 4.57 – 16.80 only at Parangtritis coast. Three main benthic Crustacean found at the four coast were *Albunea symmysta, Hippa adactyla, Emerita emeritus* were closely associated the blackish sediment. Dominant species of four locations was *E. emeritus* from 9 plots at each locations. Samples at Glagah 453 abundance : 31-96 ind/m^2, 78 samples at Depok abundance : 24-46 ind/m^2, 286 at Parangkusumo abundance : 22-37 ind/m^2 and 32 samples and 20 of juveniles were only at Parangtritis. Carapace length to weight equation at Parangtritis : $W = 0.1797e1^{.3292(L)}$, $R^2 = 0.9$ for *H. Adactyla*; $W = 0.1695e1.8168^{(L)}$, $R^2 = 0.8$ for *A.symmysta*; $W = 0.703e^{0.8088(L)}$, $R^2 = 0.6$ for *E. emeritus*; Parangkusumo : $W = 1.0143e^{0.672(L)}$, $R^2 = 0.6$ for *E. emeritus*; Glagah : $W = 0.7066e^{0.7419(L)}$, $R^2 = 0.5$ for *E. emeritus* and Depok : $W = 0.7171e^{0.7509(L)}$, $R^2 = 0.7$ for *A.symmysta*; $W = 1.1199e^{0.4983(L)}$, $R^2 = 0.8$ for *H. adactyla* and

$W = 0.4702e^{0.7004(L)}$, $R^2 = 0.7$ for *E. emeritus*). *E. emeritus* is the most abundance at the four locations.

Keywords : *coastal, sediment, south-Java, benthic, crustacean*

INTRODUCTION

It was unfortunate that south Java coastal zone was the least studied from the point of view of coastal sediment type and its benthic community. Intertidal zone known as the area of from highest to the lowest tide of seawater in coastal area [1,2,3,4,5]. More detail the intertidal zone can be devided into three sub-zones as supralittoral or supratidal zone or backshore, littoral or intertidal zone and sublittoral or subtidal zone. Where as horizontally [1,3] devided into four sub-zone as splash zone or high tide zone, high intertidal or lowest high tide, mid-intertidal or middle tide zone and low intertidal or lowest low tide. In general, major activity of south Java coastal community was inshore one-day fishing opration or shrimp pond culture and beach related tourism. The south coast of Java were consist of two main type of sediment. That are blackish volcanic and whitish organic calcareous type of sediments. In general the common question are there any preference of benthic community to black volcanic and white calcareous type of south Java intertidal zone coastal sediment. The study mainly aimed to study the endemic and dominant benthic organism mainly mole-crab Crustacean associated with the blackish coastal sediment.

METHODOLOGY

Fundamentally, a field explorative survey method was used in the study. Coastal sediment and benthic mole crav Crustacean samples were collected as representative of the blackish volcanic coastal sediment from Parangtritis, Parangkusumo, Glagah and Depok coast. Sediment grain size analysis and organic content was done at Laboratory of Fishery and Marine Science and Fac of Animal Husbandary and Agriculture, Diponegoro University. Sediment grain size analysis was done with one hundred grams of dried sediment in 100 ^{0}C temperature and then sifted with series of sieves based on Wentworth scale of 2.00 mm, 1.00 mm, 0.5 mm (500 μm), 0.25 mm (250μm), 0.125mm (125μm) and 0.063 mm (63μm) mesh and then sieve shaker for 15 minutes [1]. Organic content of sediment analysis using of 20 gram sediment sample dried oven at 60^0 C for 24 hours, gentely ground with porcelain grinder. A portion of 0.5 gram put into a crucible porcelain then furnace at 550 ^{0}C for 24 hours [1].

$$\text{Total organic in sediment} = ((Wt - C) - (Wa - C) / Wt-C)) \times 100\%$$

Where :

Wt = total weight (*cruscible* + sampel) before furnace

C = weight of *cruscible*

Wa = total weight (*cruscible* + sampel) after furnace

Numerical equation of mole crab Crustacean is weight and length based on a cubical correlation rule analysis, with assumtion that any length increase will affect to increase of weigth. The weight-length correlation analysis aimed to assess the weight or length growth of the organism, possible feeding behaviour and environment condition factor [6]. Weight-length correlation formula as follows [7] :

$$W = a\, L^b$$

Where as :

W = weight (gram)

L = carapace length (cm)

a = intersept constant

b = exponential value or slope

Followed with a logaritmic transformation of the equation, in order to get the value of slope (b). According to Muzammil (2015), when exponential value (b) = 3 indicates an isometric growth, if value (b) ≠ 3, indicates as allometric growth. If (b) > 3, known as positive allometric growth and weight gain is more dominant. If (b) < 3, negative allometric growth where length groth is more dominant. To test the value of b=3 or b≠3 using T-test (Partial-test) with hyphotesis:

Ho: b=3, length-weight correlation is isometric;

H1: b≠3, length-weight is allometric, positif allometrik when b>3 and negatif alometric when b<3, with rule of decission making based on t_{count} value :

$$t_{count} = \left| \frac{3-b}{Sd} \right|$$

where,

b = slope;

Sd = standard deviation

If : $t_{count} \leq t_{\alpha/2\ ;\ (n-2)}$, accept hyptothesis Ho and $t_{count} \geq t_{\alpha/2\ ;\ (n-2)}$, reject Ho and accept H1 [8,9].

The value of (b) could be different for sample taken at different location or at different sampling time. The differences of (b) value was refer to the effect of ecological factors such as seasons, water quality, water temperature, pH, salinity or biological factors such as gonad phase developments or maturity, feeding behaviour, or sex that are male or female [10]. Steps for analysis on the 50 percent of mole crab catch ($L_{50\%}$), start with list from minimum to maximum length, count of frequency of each length, count of percent frequency as follows [11,12] :

a. Percent frequency = (frequency of length/ sum of total frequency)*100
b. Percent cumulative frequency = percent frequency + following percent

frequency of (n)

c. $L_{50\%}$ is the length at X-axis correlates to graphic plot percent cumulative length at Y-axis
d. L_{max} is maximum length
e. $L\infty = L_{max} / 0{,}95$

RESULT AND DISCUSSIONS

South coast of Java in general characterized with mostly vertical rocky coastal hills and high Indian oceanic waves. Tidal type of mixed tide predominatly semi diurnal. Field survey had found that south central Java coast have two specific type of coastal sediment (Figure 1). Start at the segregation point at Parangtritis to eastward of south Java coast was characterized with whitish organic calcareous coastal sediment such as at Krakal and Indrayanti coast. Which is originated from the up-lifted of formerly ancient underwater coral-reef ecosystem to become calcareous hills. The segregation hill of Parangtritis (A, in Figure 1) to the west of south Java coast characterized with blackish volcanic type of sediment. Type of andesit laharic originated from the Merapi mountain lava flows through south Jogya Progo riverine watershed onto south westward Java coastal area as in Figure 1. The south east part of Java with whitish coastal sediment was originated from the south Java mountains called as "*Gunung Sewu*" (thousands mountain) of limestone with about 200 – 800 m thickness undergone uplift, tilting and block faulting during the Midle Pleistocene as Karst phenomena [13]. The current study was focussed only on the blackish coastal sediment.

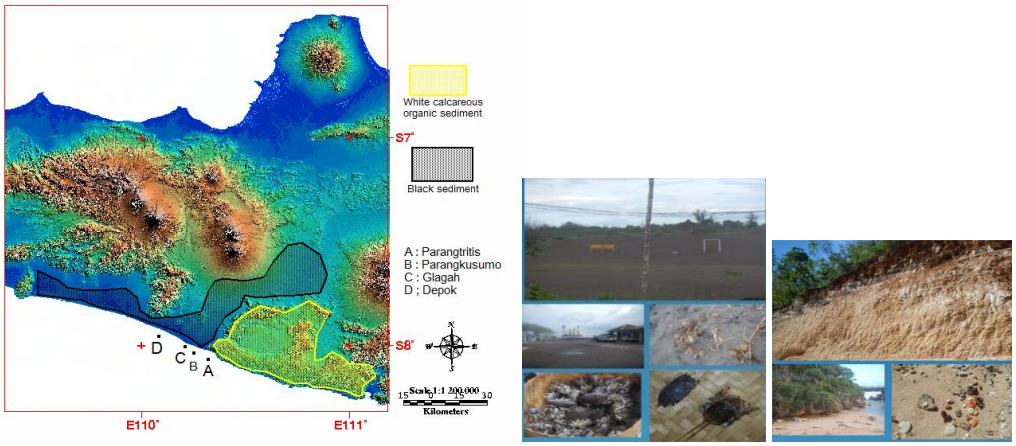


Figure 1. Sampling locations A: Parangtritis, B: Parangkusumo, C: Glagah, D: Depok and two types of coastal sediment at south Central Java coastal area

The dominant diameter of grain size at three blackish coastal sediment was surprisingly dominated by a class of very fine sand with diameter range of 0.063 – 0.125 mm at Parangtritis (82.06 %). Dominant grain size at the other three coast were class of sand with diameter range of 0.25 - 0.50 mm at Depok coast 52.92%,

Parangkusumo 56.08 %, Glagah 51.66 % as in Table 1. Highest organic content in sediment was found at Parangtritis coast with 0.49-2.04 (%), Parangkusumo : 0.77-1.58 (%), Depok : 0.01-0.64 (%), Glagah : 0.01-0.33 (%) as the lowest. Parangtritis coast was found as the most different among the four coast with the most gentle slope, dominant of very fine sand or grain size and highest of organic content in the sediment (Table.1). Slope (in degree) at black volcanic sediment coast at Parangtritis range from 4.57 – 16.80 found as the most gentle slope. While at Parangkusumo : 15.85 – 17.12, Depok : 14.50 – 15.50, Glagah : 16.38 – 21.80 in front of sandy creeks and hills. According to [14] found at North Carolina in the range of 4.0 – 9.0 degree. Differential rates of migration caused by a decrease in the beach slope angle [15].

Table 1. Grain size analysis and organic content of coastal sediment South Central Java

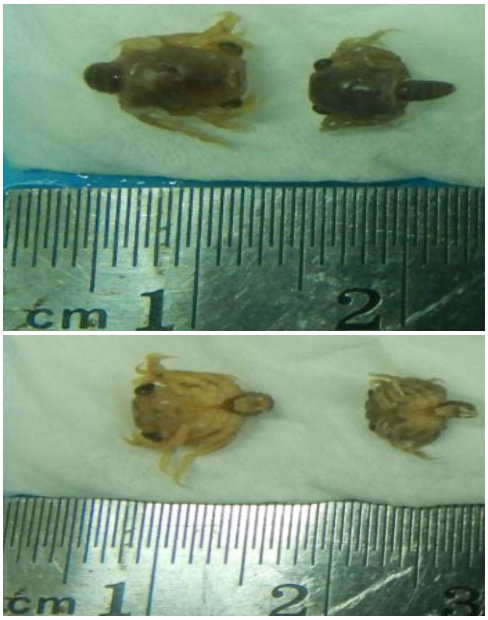
Grain size (mm)	Glagah	Depok	Parang kusumo	Parangtritis
1.00 – 2.00 Very coarse sand	0.45	0.65	0	0
0.50 – 1.00 Coarse sand	6.0	4.0	0.3	0.02
0.25 – 0.50 Sand	**51.66***	**52.92***	**56.08***	0.18
0.125 – 0.25 Fine sand	36.80	40.72	25.45	7.48
0.063 – 0.125 Very fine sand	5.03	1.68	6.78	**82.06***
0.032 – 0.063 Silt	0.06	0.04	11.34	10.2
0.020 – 0.032 Clay	0	0	0.05	0.07
Organic content (%)	0.01-0.33	0.01-0.64	0.77-1.58	**0.49-2.04***
Coastal Slope (degree)	16.38 – 21.80	14.50 – 15.50	15.85 – 17.12	**4.57 – 16.80**

Three main dominant benthic Crustacea found were *Emerita emeritus, Albunea symmysta, Hippa adactyla* (Figure 2) were exhibit a closely associated with coastal sediment along the swash intertidal zone of blackish volcanic coastal sediment at Depok, Glagah, Parangkusumo and Parangtritis coast. Parangkusumo, Depok and Glagah coast were exclusively dominated by *E. emeritus.* This was assumed that only *E. emeritus* which has the most adaptive capability to the south Java Indian ocean wave and sand dominant coastal sediment. As well as possible variation of sea surface temperature due coastal upwelling of the Indian ocean that spread along west of Sumatra and south Java [1]. Earlier study [16,17] describe that the phylogenetic tree and morphological characteristics had confirmed that the populations of *E.emeritus* and *H. adactyla* mainly inhabited the west coast of Sumatra and south coast of Java which likely spread to the Sundaland region. Whereas group of *H. marmorata*, *H. admirabilis*, *H. ovalis*, and *H. celaeno* were found only at east of Indonesia such as Bali, Lombok, Sulawesi (Celebes) and Mollucas. Systematic of *Hippa adactyla* collected from Parangtritis, Parangkusumo, Depok and Glagah coast in the study was refered [18,19] with infraorder of Anomura, Macleay. 1838; Family Hippidae Stimpson, 1858; Genus Hippa, Fabricius, 1787; synonim to *Remipes denticulatifrons,* White, 1847 junior synonym *Remipes testudinarius,* Latreille, 1806 junior synonym *Remipes testudinarius var. denticulatifrons,* Miers. 1878 junior synonym *Hippa adactyla,* Fabricius. 1787 [20,21]. The morphological characteristics of the specimens collected in this study were also consistent with those of the *Hippa* species collected from Pelabuhanratu [20,22], Taiwan [23] and *H. adactyla* [24]. *H. adactyla* is a species in the family Hippidae and has been reported also in Taiwan and Australia [25,26]. The current study revealed that most of these three dominant benthic Crustacean *E. emeritus, H. adactyla, A. symmysta* inhabits the intertidal swash zones and engages in sand digging ranges from 10 – 25 cm. Which is also had been found along the west coast of Padang Sumatera and from the south coast of Pelabuhan Ratu west Java, Bali and specimen at Banggai Island Sulawesi or Celebes [27]. *H. adactyla* specimens from the above coast in general, exhibit the same characteristics and colours. The species is also morphologically identical to *H. ovalis*, which is found in Sulawesi [24,20,27]. The specimens found on the west coast of Sumatera had an average length and width of 2 to 3 cm. These specimens differed from those on the south coast of Java and Bali-Lombok because the latter had an average length and width of 3 to 4 cm. Based on the distribution of this species in Taiwan [24], it is likely that its distribution might be affected by sea currents and several biological factors. The textures of the substratum of the west coast of Sumatera and the south coast of Java are nearly identical, such as rough sand. The colour of the crabs carapace was influenced by the colour of the sand in their particular habitat [17]. Total 450 specimens of *E. emeritus,* 2 specimens of *A. symmysta*, one specimen of *H. adactyla* were collected from Glagah coast. Depok coast collect 48 specimens of *E. emeritus*, 16 specimens of *A. symmysta,* 14 specimens of *H. adactyla*. Total 279 specimens of *E. emeritus,* 3 specimens of *A. symmysta,* 4 specimens of *H. adactyla* and 4 specimens of Bivalvia were found at Parangkusumo coast.

Albunea symmysta

Emerita emeritus

Hippa adactyla



Juvenile of *Hippa adactyla*

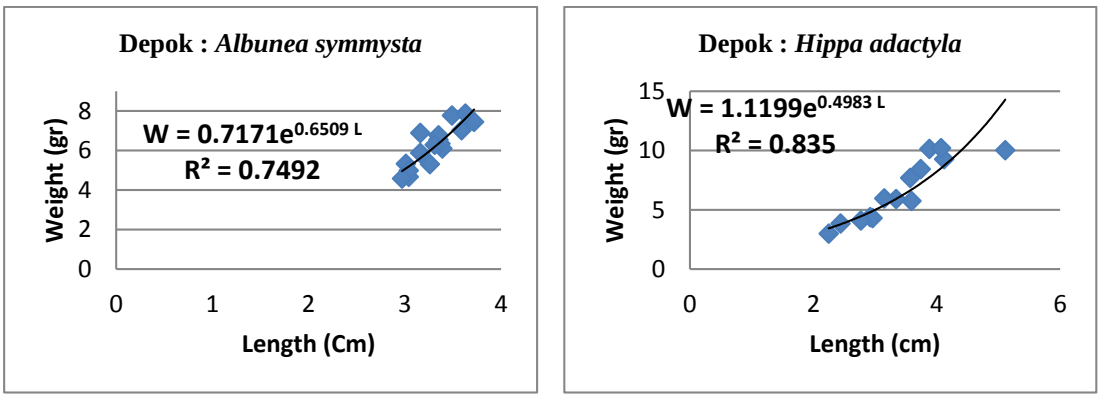
Figure 2. Dorsal and abdominal photograph of *A.symmysta, H.adactyla* and *E.emeritus* from Parangtritis, Parangkusumo, Glagah and Depok south coast of Central Java

Table 2. Total specimen per location, male-female ratio, length, weight and abundance (individu/m^2) of the three mole crab Crustacean at south coast of Java

Species :	**Glagah**	**Depok**	**Parangkusumo**	**Parangtritis**
Emerita emeritus	450 M : F = 1 : 3	48 M : F = 1 : 3	279 M : F = 1 : 3	22 M : F = 1 : 3
Carapace Length (cm)	1.75 – 3.18	2.88 - 4.48	2.44 - 3.37	2.61 – 3.43
Weight (gr)	1.62 – 8.14	3.44 -12.11	1.67 - 11.41	5.24 -11.13
Albunea symmysta	2	16 M : F = 1 : 7	3	10 M : F = 1 : 3
Carapace Length (cm)	1.22 – 1.27	2.97 -3.72	1.21- 1.74	1.31 – 1.85
Weight (gr)	1.72 - 2.62	4.58 – 7.87	2.35 - 3.15	1.15 – 10.21
Hippa adactyla	1	14 M : F = 1 : 3	4 M : F = 1 : 3	6 + (20 juvenile)
Carapace Length (cm)	2.48	2.25 – 4.12	2.61 – 2.94	2.32 – 3.11
Weight (gr)	4.24	3.0 – 10.21	8.17 – 8.21	2.67- 11.13
Abundance (Ind/m^2)	31 – 96*	24 - 46	22 - 37	2 - 10
Total sample	453	78	286	32 + 20

Total 22 specimens of *E. emeritus,* 10 specimens of *A. symmysta,* 6 specimens of *H. adactyla* and 4 specimens of Bivalvia were found at Parangtritis coast. Important discovery in the study was that 20 juveniles of *H. adactyla* were found only at Parangtritis coast (Table 2). This was assumed corelated with the dominant sediment size of 0.063 – 0.125 mm as very fine sand category, mean smaller or weaker wave at Parangtritis coast. This coast as the most different among the four coast as the

most gentle slope, dominant of very fine sand and highest of organic content in the sediment. More female specimens than male specimens were found in the study or ovigerous female specimens were dominant. The phenomenon indicates to the regeneration and survival effort of the species [28]. Glagah coast : *E. emeritus* carapace length 1.75 – 3.18 cm, weight 1.62 – 8.14 gr,; *A. symmysta* carapace length 1.22 – 1.27 cm, weght 1.72 - 2.62 gr ; *H. adactyla* carapace length 2.48 cm, weight 4.24 gr; three species abundance 31 – 96 individu/m^2. Depok coast : *E. emeritus* carapace length 2.88-4.48 cm, weight 3.44 - 12.11 gr; *A. symmysta* carapace length 2.97 – 3.72 cm, weght 4.58 -7.87 gr ; *H. adactyla* carapace length 2.25 cm, weight 3.0 – 10.21 gr; three species abundance 24 - 46 individu/m^2. Parangkusumo : *E. emeritus* carapace length 2.44 – 3.37 cm, weight 1.67 – 11.41 gr; *A. symmysta* carapace length 1.21 – 1.74 cm, weight 2.35 – 3.15 gr ; *H. adactyla* carapace length 2.61 – 2.94 cm, weight 8.17 – 8.21 gr; three species abundance 22 – 37 individu/m^2. Parangtritis : *E. emeritus* carapace length 2.61 – 3.43cm, weight 5.24 -11.13 gr; *A. symmysta* carapace length 1.31 – 1.85 cm, weight 1.15 – 10.21 gr ; *H. adactyla* carapace length 2.32 – 3.11 cm, weight 2.67 – 11.13 gr. Overall three species abundance range at Glagah, Depok and Parangkusumo 22 – 96 invidu/m2 but only 2 - 10 individu/m^2 at Parangtritis (Table 2). Further detail analysis based on the ecological point of view, the study had explore the correlation of carapace length (cm) and body weight (grams) of the three benthic Crustacean of *E. emeritus, H. adactyla* and *A. symmysta*. Correlation of total abundance of benthic Crustacea (individu/m^2) and weight (grams) to organic content of sediment (%). This is in trying to reveale whether variable of organic content assumed as the source of food in the sediment will affects to total abundance or to body weght. Three benthic mole crabs Crustacean found at south coast of Java *E. emeritus, H. adactyla, A. symmysta* were closely associated with the black volcanic sediment type. Carapace length - weight equation of the three benthic crustaceans at Parangtritis : $W = 0.1797e1^{.3292(L)}$, $R^2 = 0.9$ for *H. Adactyla*; $W = 0.1695e1.8168^{(L)}$, $R^2 = 0.8$ for *A.symmysta*; $W = 0.703e^{0.8088(L)}$, $R^2 = 0.6$ for *E. emeritus*; Parangkusumo : $W = 1.0143e^{0.672(L)}$, $R^2 = 0.6$ for *E. emeritus*; Glagah : $W = 0.7066e^{0.7419(L)}$, $R^2 = 0.5$ for *E. emeritus*; Depok coast : $W = 0.7171e^{0.7509(L)}$, $R^2 = 0.7$ for *A.symmysta*; $W = 1.1199e^{0.4983(L)}$, $R^2 = 0.8$ for *H. adactyla* and $W = 0.4702e^{0.7004(L)}$, $R^2 = 0.7$ for *E. emeritus* (Figure 3).



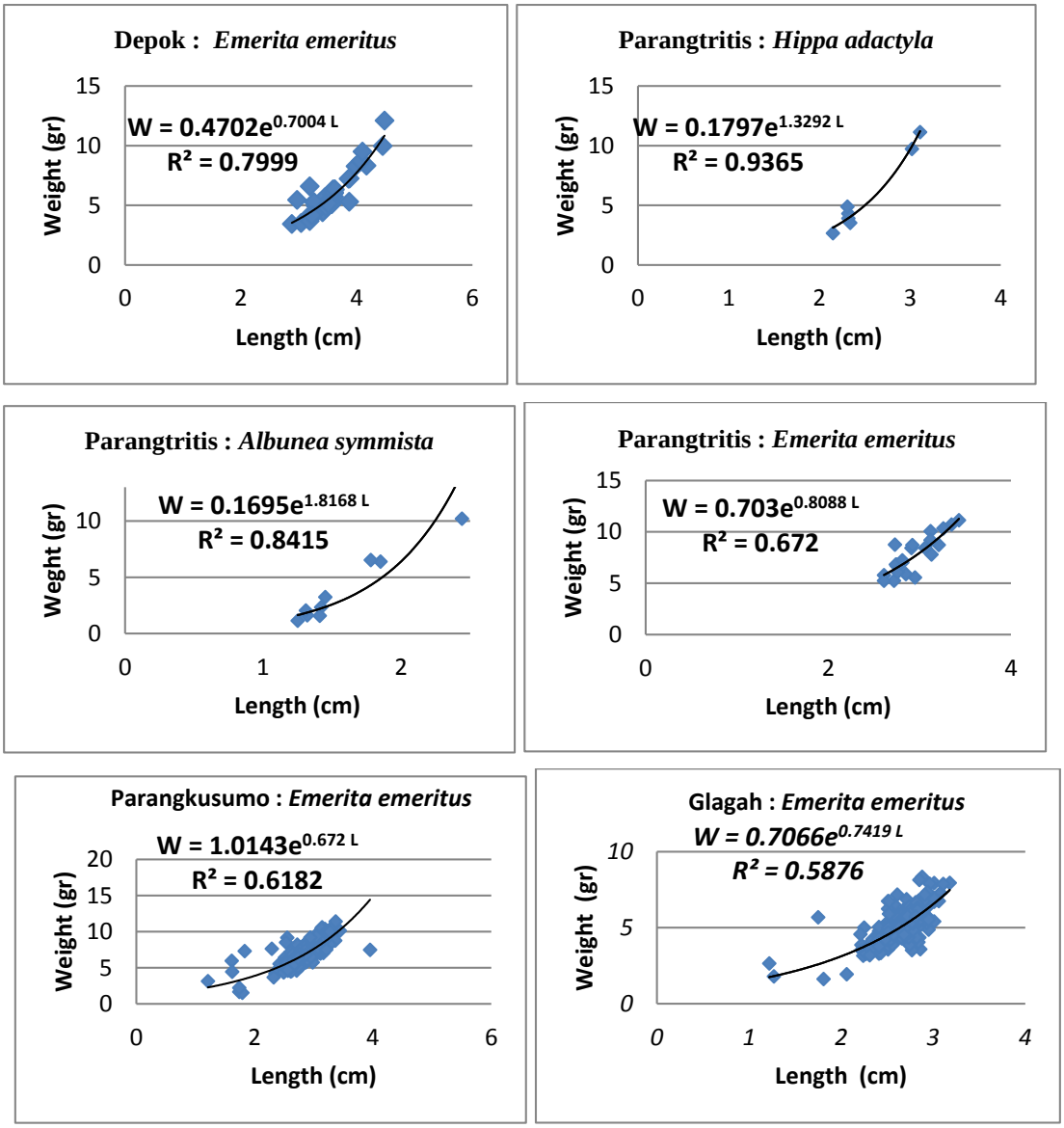


Figure 3. Length – weight correlations of the three benthic Crustacean at Depok, Glagah, Parangtritis and Parangkusumo south coast of Java

Further analysis of growth pattern found that at Depok for *E. emeritus* log W = 2.5273 (log L) - 0.6336, R^2 = 0.7868; *H. adactyla* log W = 1.7508 (log L) - 0.1286, R^2 = 0.8809 and for *A. symmysta;* log W = 2.1689(log L) - 0.334; R^2 = 0.7577. Since value of slope (b) < 3 for the three species at Depok coast, means as a negative allometric growth where length growth is more dominant. Analysis of the most dominant species *E. emeritus* at Parangkusumo value of maximum length L_{max} = 4.0 cm, length of invinity $L\infty$ = 4.2 cm and length of 50-percent catch $L_{50\%}$ = 2.75 cm and ½ $L\infty$ = 2.1 cm; Parangtritis : L_{max} = 3.4 cm, $L\infty$ = 3.6 cm and ½ $L\infty$ = 1.8 cm, $L_{50\%}$ = 2.85 cm. Glagah : L_{max} = 3.2 cm, $L\infty$ = 3.4 cm and ½ $L\infty$ = 1.7 cm and

$L_{50\%}$ = 2.6 cm as in Figure . If value of $L_{50\%} \geq ½ L\infty$ means that length of cath is in suitable length size and vice-versa $L_{50\%} \leq ½ L\infty$ mean that the catch is too small and will cause of overfishing. Based on samples of mole crab Crustacean catch at Parangkusumo with the value of $L_{50\%}$ (2.75 cm) $\geq ½ L\infty$ (2.1 cm); at Parangtritis : value of $L_{50\%}$ (2.85 cm) $\geq ½ L\infty$ (1.8 cm) and at Glagah the value of $L_{50\%}$ (2.6 cm) $\geq ½ L\infty$ (1.7 cm) thus none of the three species at the three locations were in an overfishing condition.

As in Figure 4, that 50% catch frequency of the most abundance *E.emeritus* at Parangkusumo with carapace length of 2.6 cm, Parangtritis with carapace length of 2.8 cm and Glagah coast with carapace length of 2.6 cm.

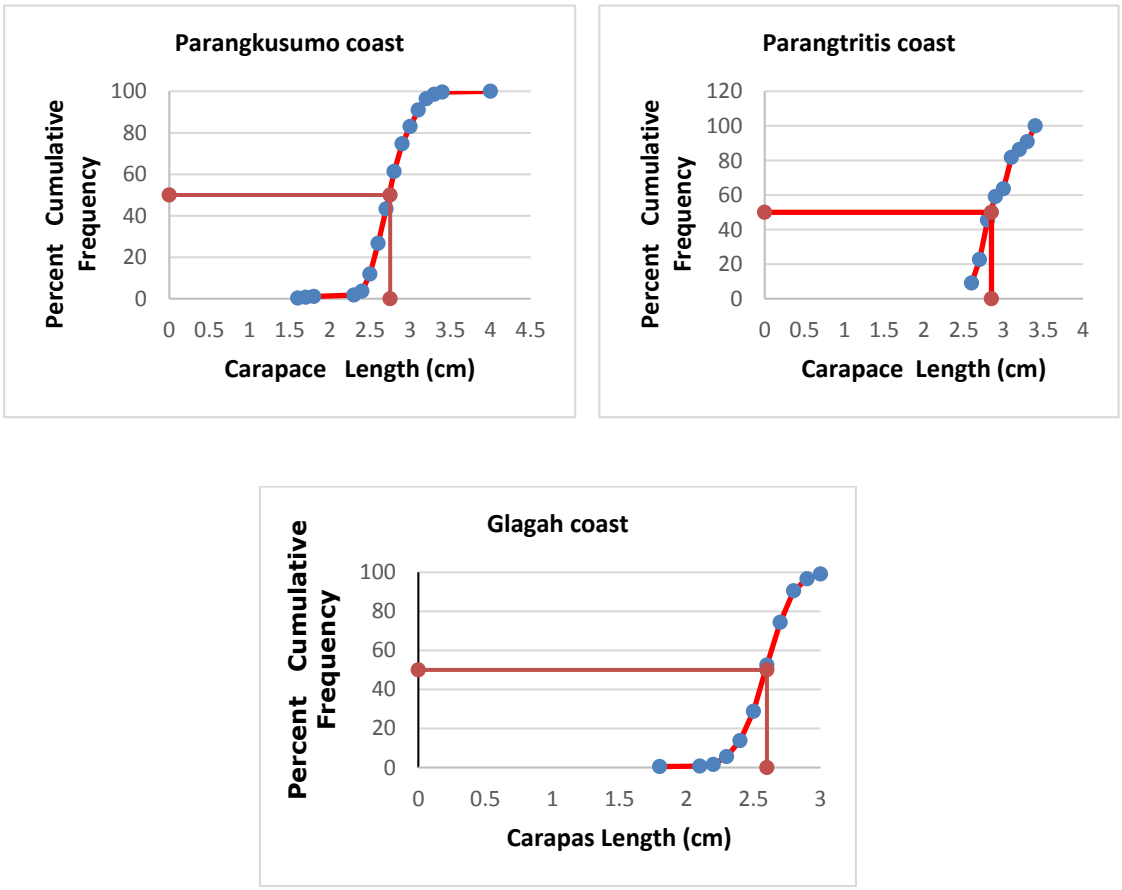


Figure 4. Length-maximum (L_{max}), Length-invinity ($L\infty$) and Length of 50 percent catch ($L_{50\%}$) of *E. emeritus* at Parangtritis, Parangkusumo and Glagah coast.

Correlation of organic sediment content (%) to individual abundance (indv/m^2) of total three species of mole crabs was found higher determination value (R^2) than weigth to organic content (Figure 5 and 6)

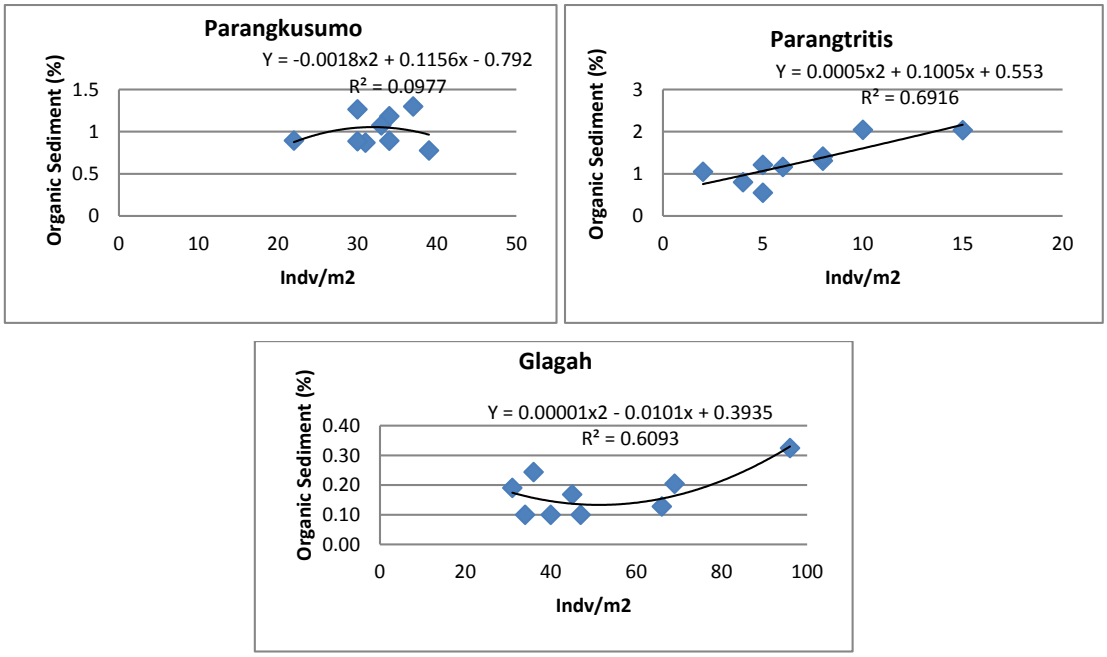


Figure 5. Correlation of individu/m^2 to organic sediment content (%) of three species of benthic Crustacean at Parangtritis, Parangkusumo and Glagah coast south Central Java

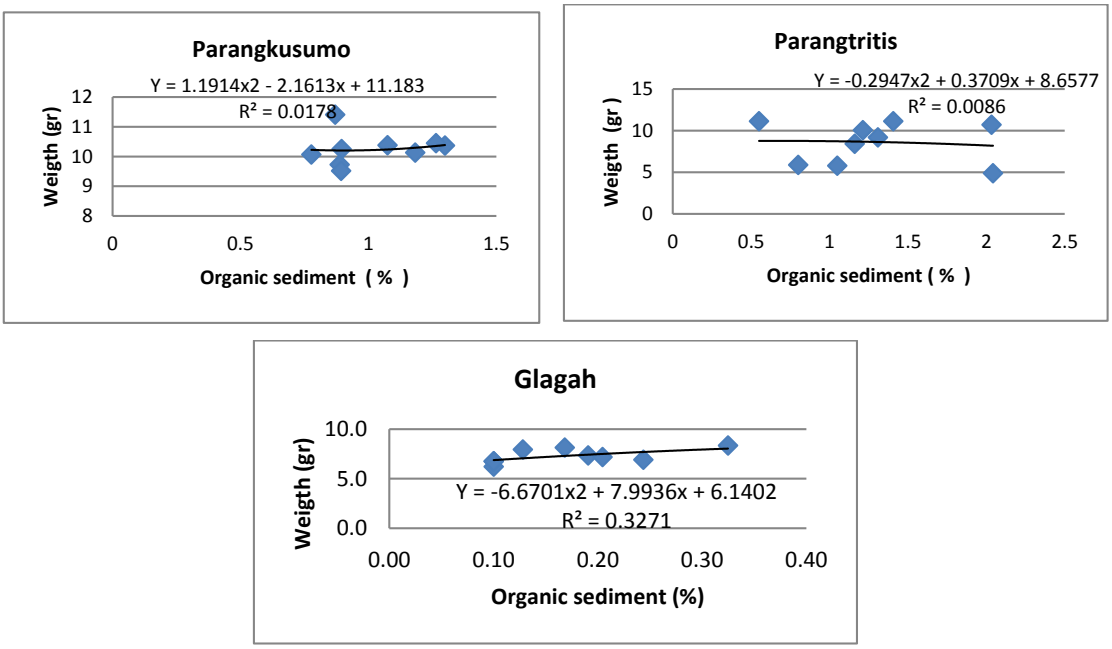


Figure 6. Correlation of weigth (gr) to organic sediment content (%) of three species of benthic Crustacean at Parangtritis, Parangkusumo and Glagah coast south Central Java

The abundance of mole crab Crustacean were closely associate with dominant sediment size of 0.125 – 0.500 mm (coarse sand) at Parangtritis, Depok, Glagah. Interestingly the study discover that only at Parangtritis coast have fine sand domination 0.063 – 0.125 mm (82.06 %), which has the smallest wave comparred to the other coast. In general of four sampling locations that mostly dominated by female mole crab Crustacean. Another discovery was that only at Parangtritis found more female and juvenile of mole crabs Crustacean which assumed because of smaller wave or more calm water because of vertical coastal cliff protection. Which would be important environmental condition needed for reproduction [29]. As study of [30] at Pagak, Purworejo coast found that mole crabs inhibits sediment size dominant of 0.25 – 1.00 mm. As stated by [31], found in the range of 0.50 – 1.00 mm dominant sediment size. According to [1] stated that sandy sediment will low organic content, this was due to more poreous, easy to evaporates and oxidation. While clay and silt type of sediment will bears more organic content and very slowly evaporations. Mentioned by [28], that mole crabs Crustacean tends to move vertically due to tide variation and very active after 1 – 2 hour after high tide, which is assumed in voraging of food in the tide water.

As earlier study at Pagak-Purworejo south Java coast [30], discover two species of mole crab *E. emeritus* and *H. ovalis*. Overall abundance was 684 individu/50 m^2 or about 14 individu/ m^2 and Relative Abundance (RA,%) of *E. emeritus* was 605 individu (88.45%) and for *H. ovalis* was 79 individu (11.55%). Domination Index at this coast found that *E. emeritus* was 0.782 as the most dominant species as also stated by [31] and for *H. ovalis* was 0.205 and 0.013 for *A. symmysta* as the least dominant species. The domination of *E. emeritus* inhabit the most upper layer of the sandy beach ecosystem, comparred to the other two species. Study of [32]) at Samas-Bantul coast found that abundance of mole crab *E. emeritus* and *H. ovalis* in the range of 9 – 13 individu/m^2. Rather different result by [33] at Kebumen found the three species of mole crabs *E. emeritus, H. ovalis,* and *A. symmysta.* Furthermore, [31]) stated that *E. emeritus* tends to inhibit the upper layer of coastal sediment with range of 0 - 15 cm. Vertical sediment segregation of mole crab inhabitant was assumed due to adaptation to wave and sediment. In general [34] that bottom susbtrates as the main ecological factor related to the organism abundance. In the current study at Parangtritis, Parangkusumo, Depok and Glagah coast revealed that in most stations mole crabs were collected in 5 – 25 cm of sediment at the swash zone, according to the tide water period. Study of [30] at Pagak-Purworejo coast found in range 5 – 10 cm in coastal water swash zone 5 – 64 cm depth. Discussed by [35] that type and depth of sediment will vary with the occurence of macrozoobenthos or benhic organisms, as well also vary to soft or hard sediment types, that mole crabs lenght less than 8 cm mostly found at intertidal zone, and size of 8 – 15 cm found at the midle of swash zone and bigger size than 15 cm found at the lowest part of swash zone. Ecological and biological factors plays an important biotic determinant of animal population dynamics and community structure. Reduction in the number of larger, reproductive age females in populations of the Pacific sand crab, *Emerita rathbunae* (Decapoda, Hippidae), was observed in study [36].

SUMMARY.

Three main mole crab Crustacean *E.emeritus, H. adactyla,* and *A. symmysta* and only *E.emeritus* as the most dominant species in blackish volcanic coastal sediment south coast of Java. Dominant of three mole-crab Crustacean *E. emeritus, H.adactyla,* and *A.symmysta* were female. Carapace length of *E.emeritus* range from 1.75 – 3.18 cm; *H. adactyla* range from 2.25 – 4.12 cm; *A. symmysta* range from 1.21 -3.72 cm. Weight of *E.emeritus* range 1.62 – 12.11 grams; *A. symmysta* range 1.15 – 10.21 grams; ; *H. adactyla* range 2.67 – 11.13 grams. Length – weight shows equation and value exhibit a negative allometric growth pattern for the three mole-crab Crustacean. Mole-crab Crustacean abundance (indv/m2) correlates more to organic sediment than weigth to organic sediment (%).

ACKNOWLEDGEMENT

The authors would like very much to thanks to the Faculty of Fisheries and Marine Science. Diponegoro University for the Research Grant No. 01/UN7.5.10/PP/ 2019, 11 March 2019 and No. 79/UN7.5.10/HK/2019, March 6th 2019. Also special thanks to Irzani Hamzah and Intan Nirmala for their help of field sample collection and laboratory length-weight measurements and grain size analysis.

REFERENCES

[1] Hartoko, A. 2010. Oseanography, Fisheries and Marine Resources of Indonesia (in Indonesian). UNDIP Press. Semarang. ISBN : 978-979-704-892-1.

[2] Wally, D.A. 2011. Benthic Organism Adaptation at Intertidal Zone. *Bimafika*. 3: 244-249

[3] Nugroho S.H. 2012. Coastal Morphology Pantai, Zonation and Adaptation of Intertidal Organisms (in Indonesian). *Oseana*. XXXVII (3) : 11-21.

[4] Yulianda F., M.S. Yusuf, W. Prayogo. 2013. Zonation and Community Abundance at the Intertidal at Batu Hijau Coast, Sumbawa Island (in Indonesian). J.of Tropical Marine Technology. Vol.5 (2): 409-416.

[5] Supratman, O, A.M. Farhaby, and J. Ferizal. 2018. Abundance and Diversity of Gastropods at Intertidal Zone of East Bangka Beach (in Indonesian). Jurnal Enggano, Vol.3(1): 10-21.

[6] Muzammil, W. 2015. Population Analysis of Mole Crab *Hippa adactyla* Fabricius, 1787 (Crustasea: Hippidae) Based on Morphometric and Genetic at Cilacap and Kebumen Coast. Institut Pertanian Bogor. Bogor. 42 pp

[7] Effendie, M. I. 2002. Fisheries Biology (in Indonesian). Yayasan Pustaka Nusatama. Yogjakarta

[8] Azizah, I. R., S. Rudiyanti and A. Ghofar. 2015. Catch Composition of

Cantrang and Biological Aspect of fish *Upeneus sulphureus* Landed at Bajomulyo Fishing Port, Jepara (in Indonesian). Diponegoro Journal of Maquares. 4(4): 33-41

[9] Sugiyono. 2013. Statistics for Research (in Indonesian). Alfabeta. Bandung, 390 pp

[10] Hargiyatno, I. T., F. Satria, A. P. Prasetyo and M. Fauzi. 2013. Length-Weigth Correlation and Condition Factor of Sand Lobster (*Panulirus homarus*) at Yogjakarta and Pacitan.Bawal. 5(1): 41-48

[11] Pauly, D. 1984. Fish Population Dynamics in Tropical Waters: A Manual for Use with Programmable Calculators. ICLARM Studies and Reviews 8. 325 p

[12] Wahyuni, I. I. 2017. Biological Aspect of White Shrimp (*Penaeus indicus*) at North Brebes and Tegal, Central Java (in Indonesian). Faculty of Fisheries and Marine Science. Universitas Diponegoro,49 pp

[13] Van Bemmelen. R.W.1949. The Geology of Indonesia. Vol. I A. General geology of Indonesia and Adjacent Archipelagoes. Government Printing Office. The Hague. pp: 556-558

[14] Bowman, M. and R. Dolan. 1984. The Relationship of *Emerita talpoida* to Beach Characteristics. Journal of Coastal Research 1: 151-163.

[15] Perry. Diane M. 1980. Factors Influencing Aggregation Patterns in the Sand Crab *Emerita analoga* (Crustacea: Hippidae). Oecologia. Vol.45. 379-384.

[16] Yusli Wardiatno, Puji U. Ardika, Achmad Farajallah, Nurlisa A. Butet, Ali Mashar, Mohammad A. Sarong. 2015. Biodiversity of Indonesian Sand Crabs (Crustacea, Anomura, Hippidae) and Assessment of Their Phylogenetic Relationships. AACL Bioflux. Volume 8, Issue 2. pp: 224 - 235. http://www.bioflux.com.ro/aacl).

[17] Mahapatro, D., S. K. Karna., S. K. Mohanty., B. Mohanty., P. R. Muduli., A. K. Pattnaik, and S. Nanda. 2018. First Record of a Burrowing Mole Crab *Emerita emeritus* (Decapoda:Anomura: Hippidae) from Chilika Lake, East Coast of India. Indian Journal of Geo Marine Sciences. 47(1):109 - 113

[18] Boyko C B. 1999. Crustacea Decapoda: Albuneidae and Hippidae of the tropical Indo-West Pacific region. In A Crosnier (ed.). Résultats des Campagnes MUSORSTOM, vol. 20. Mémoires du Muséum National d'Histoire Naturelle 180: 379–406.

[19] Boyko C B and Harvey A W. 2002. Case 3106. *Remipes pacificus* Dana, 1852 (currently *Hippa pacifica*; Crustacea, Anomura): Proposed precedence over *Remipes marmoratus* Jacquinot, 1846. The Bulletin of Zoological Nomenclature 59(1): 12–16

[20] Puji Utari Ardika, Achmad Farajallah and Yusli Wardiatno. 2015. First Record of *Hippa adactyla* (Fabricius, 1787; Crustacea, Anomura, Hippidae) from Indonesian Waters. Tropical Life Sciences Research. 26(2), 105–110

[21] Mashar A., Y. Wardiatno, M. Boer, N. A. Butet, A. Farajallah, dan P. U. Ardika. 2015. First Record of *Albunea symmsyta* (Crustasea: Decapoda: Albuneidae) from Sumatera and Java, Indonesia. *AACL Bioflux*. 8(4): 611-615

[22] Mashar, A., Y. Wardiatno, M. Boer, N. A. Butet, dan A. Farajallah. 2014. Diversity and Abundance of Sandy Crabs at South Coast of Central Java. J. Ilmu Kelautan. 19(4): 226-232

[23] Fabricius J. 1787. Mantissa insectorum sisten eorum species nuper detectan: Ajectis karakteribus genericis, diferencis, specifis, emedationibus, observanibus. http://crus.biota.biodiv.tw/node/232 (accessed on 12 December 2013).

[24] Osawa M, Boyko C B and Chan T Y. 2010. Part I Hiipoidea (Mole Crabs). In T Y Chan (ed.). Crustacean Fauna of Taiwan: Crab-like Anomurans (Hippoidea, Lithodoidea and Porcellanidae). Keelung, Taiwan: National Taiwan University.pp: 1–40.

[25] Haig J. 1970. The status of *Remipes testudinarius* Latreille, and the designation of a neotype for *Hippa adactyla* J. C. Fabricius (Decapoda, Hippidae). Crustaceana 19(3): 288–296.

[26] Haig J.1974. A review of the Australian crabs of the family Hippidae (Crustacea, Decapoda, Anomura). Memoirs of the Queensland Museum 71(1): 175–189.

[27] Mashar, A dan Y. Wardiatno. 2013. Growth Factors of Mole Crabs *Emerita emeritus* at Sandy Beach Kebumen. Jurnal Biologi Tropis. 13(1): 29-38

[28] Forward, R., H. Diaz and J. Cohen. 2005. The Tidal Rhythm in Activity of the Mole Crab *Emerita talpoida*. Journal of the Marine Biological Association of the United Kingdom. 85: 895-901.

[29] Kusumawardani, D. A. 2013. Reproductive Biology of Mole Crab *Emerita emeritus* at Buluspesantren - Kebumen, Central Java (in Indonesian). Departement of Aquatic Resources Management. Faculty of Fisheries and Marine Science. Institut Pertanian Bogor. Bogor, 31 pp

[30] Darusman.Viki, Max Rudolf Muskananfola, Ruswahyuni. 2015. The Abundance of Mole Crab (Hippidae) and Sediment Distribution in the Pagak Beach Subdistrict of Ngombol, Purworejo, Central Java. Diponegoro University. Journal Management of Aquatic Resources (MAQUARES). Volume 4, No.1, pp: 9-18. http://ejournal-s1.undip.ac.id/index.php/maquares

[31] Boonruang, P and B. Phasuk. 1975. Species Composition and Abundance Distribution of Anomuran Sand Crabs and Population Bionomic of *Emerita emeritus* (L) along The Indian Ocean Coast of Thailand. Research Bulletin.No.8 : 1 - 20 .

[32] Hadisusanto, S. 1988. Ecological Study of Mole-crab *Emerita emeritus* at Samas Beach, Bantul, DIY. Faculty of Biology. Universitas Gadjah Mada.

Yogyakarta.

[33] Nuraisah, R. 2012. Estimation of Secondary Productivity of *Emerita emeritus* and *Hippa ovalis* on March to May 2012 at Sandy Coast at Kebumen, Central Java (in Indonesian). Departement of Aquatic Resources Manajement. FPIK. Institut Pertanian Bogor. Bogor.

[34] Nybakken, J. W. 1992. Marine Biology : An Ecological Approach (in Indonesian). PT Gramedia Pustaka Utama. Jakarta.

[35] Ziegler, T. A. and R. B. Forward Jr. 2005. Larva Release Rhythm of the Mole Crab *Emerita talpoida*. Marine Biological Laboratory. North Carolina.

[36] Violante-González. Juan, Scott Monks, Guadalupe Quiterio-Rendon, Sergio García-Ibáñez, Edvino Larumbe-Morán, Agustín A. Rojas-Herrera. 2016. Life on the beach for a sand crab (*Emerita rathbunae*) (Decapoda, Hippidae): parasite-induced mortality of females in populations of the Pacific sand crab caused by *Microphallus nicolli* (Microphallidae). Zoosyst. Evol. 92 (2) 2016, 153–161. DOI 10.3897/zse.92.8256