The effect of limb-removing and placement-depth on the growth rate of mud crab juvenile, *Scylla tranquebarica*

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Abstracts. Mud crabs, *Scylla tranquebarica* cultured in brackishwater ponds need three to four months to achieve marketable size. However, rapid movement and cannibalism seemed to be responsible for causing low survival rate of mud crabs. Therefore, a rearing system that can control movement and cannibalism in the crab's grow-out system is needed. The purpose of the study was to evaluate the growth performance of mud crabs with limb-removing and non-limb-removing were grown in plastic boxes and placed in the different water depths. Two factors were tested namely, first factor is mud crabs with limb-removing, which consists of two levels, A1). All limbs were not removed and A2). All limbs were removed except for swimming legs. The second factor is placement-depths for the crabs growth in brackishwater ponds which have three levels, namely, B1). 0 cm, B2). 35 cm and B3). 70 cm under surface of pond waters. The crabs with mean weight 88.99±5.895 g were tested in each treatment with three replications. The crabs were fed with chopped trasfish at 5% of total weight day⁻¹. The experiment lasted after 42 days. The molt crabs were observed daily and the crab growth was monitored every week by measuring their weight. The final weight, weight gain, and specific growth rate were compared among treatments tested. The water quality in the pond, (temperature, salinity, dissolved oxygen, and pH) were also observed. The results showed that 100% of crabs with removed their limb (A2) were molting, while crabs with unremoved their limb (A1) 44.44% were molt. The highest weight gain obtained in A1B3 (61.61 g/ind.) from crabs unremove their limb and placed at a depth of 70 cm under water surface and showed a significant difference (P<0.05) with A1B1 (the crab unremoved their limb and placed on the water surface with weight gain is 9.6g/ind. However, limb-removing and the interaction between limb-removing and placement-depths were not significantly different (P> 0.05). The range of water quality such as salinity (17-25 ppt), dissolved oxygen (2.71-8.51 mg/L), water temperature (28.5-31.5°C), and pH (7.5-8.5) in this study are still within the tolerance limit for crab juvenile growth. The unremoved limb crabs and growth at 70 cm as the better alternative to eliminates violation of animal ethics by removing the limb crab.

Keywords: limb-removing, placement-depth, growth, juvenile, rearing, *Scylla tranquebarica*

1. Introduction

High economic value of mud crab, *Scylla* spp. in the Asia-Pacific region, has led its high exploitation in the wild [1-5]. Otherwise, mud crab grow-out in brackishwater pond has been developed in some...
areas, such as in brackishwater pond near Cenranae mouth river, Bone Regency, South Sulawesi Province and in brackishwater ponds of Kuala Lupak, Barito Kuala Regency, South Kalimantan Province, Indonesia. In that both ponds area, the wild seed each size approximately 50-150 g/ind. were stocked in brackishwater pond. The crab reared in ponds without feeding and also the ponds without fencing to prevent of mud crab escape from the pond. However, after two to three months of culture, the mud crab size was attained to 200-400 g/ind. and selected to harvest mainly for the fatten and matured gonad crabs.

Stocking density, crab size, pond size and feed availability in ponds were influences to the mud crab growth in brackishwater ponds. High cannibalism, molting failure, and escape from the pond are most factors that affected to the crab survival rate. Gunarto and Rusdi [6] reported that crab stocking density in brackishwater was 1 ind./m² where the pond with bamboo fencing. After three months was obtained 80% of crab's survival rate. Other factors such as size equality, male and female ratio also suitable water quality for crab growth are influences to the mud crab survival rate. The increasing salinity to 45 ppt after three months cultured in ponds was affected to the decreasing of crab survival rate to 15-30% [7]. The suitable salinity for the growth of mud crab juvenile is 15-25 ppt [8]. Futhemore, Wijaya et al [9] reported that the crab growth in the plastic box and placed in the depth of 40 cm under surface water resulted the significantly higher compared to the crab growth in the box and placed in the water's surface.

High cannibalism and mobility are influences to the crab survival rate when the crab cultured in brackishwater pond. Furthermore, limb removing is the way to minimizing cannibalism and also to accelerate the molting process. However, the limb removed on the mud crab Scylla serrata is not significant affect to the growth rate. Smith [10] stated that loss of appendage could affect to the slow growth rate, hinder foraging ability, reducing defensive capability. Removing cheliped is not significant influences to the crab growth rate, but effective in reducing cannibalism [11]. Meanwhile, limb removing has been widely applied by mud crab soft shell company in Indonesia to stimulated mud crab fast molting. Therefore, it will shorten the rearing period for soft shell crab production and able to increasing mud crab soft shell production. However, limb removal is opposite to ethic animal welfare. Hence, it needed another technique to accelerate mud crab molting and growth without the opposite of ethic animal welfare. The objectives of the research is to evaluate the effect of limb removing and non-limb removing on the growth and survival rate of mud crab S. tranquebarica juvenile reared at the different depth of brackishwater pond.

2. Material and methods
The research was carried out at the Maranak experimental pond Station, Research Institute for Coastal Aquaculture and Fisheries Extension for 42 days from 1 May 2016 to 12 June 2016. The juvenile mud crabs with mean weight at 89.0±5.9g and carapace width 79.92±2.63 mm were prepared for growth test. Plastic boxes perforated each size of 20x30x10 cm were used for individual mud crab culture. These plastic boxes were placed in a raft that made from one-inch polyvinyl chloride (PVC) pipe and bamboo split for coartment space that plastic box with mud crab inside was placed. Then these rafts containing crabs in a plastic box were placed at various depths of the pond water of a 500 m² pond size.

A two-factor was tested in this experiment to determined the effects of limb removing (factor A) and the depth of water level for individual crab culture (factor B) on the growth rate of mud crab, S. tranquebarica juvenile. Two-level of factor A, i.e. A1) All limb (claws, walking and swimming leg) of the crab were not removed and A2) All limb (claws, walking leg) were removed except for swimming legs were intact.

Factor B had three levels of water depth for crab culture, i.e. B1). Surface of pond water. B2). A depth of 35 cm under surface of pond water. B3). A depth of 70 cm under surface of pond water. To remove all the claws and walking legs was done by cutting a part of the legs and claws, then the crab will automatically release the legs and claws from their body. Each plastic box contained one crab representing one replicate unit in each treatment.

The crabs were fed chopped fresh fish at a dose of 5% of the total crab weight-day was given to the crab in a plastic box in the morning at 8.00-9.00. and in the afternoon at 16.00-17.00. Pond waters
were exchanged at high tide by opening the intake and outlet pipe. Pond water level was maintained at a depth of 80-100 cm throughout the experiment. Crab growth was monitored by measuring crab weight in all treatments was conducted every week until the sixth week to obtained final weight. A digital scale balance with has an accuracy of 0.1g was used for measuring those crab weight. Weight gain during cultured is expressed with the formula: Weight gain (g) = L1 – L0. Where L1 = Crab weight at the end of the study, L0 = Crab weight when it stocked.

The molt crabs were monitored in each treatment at every day. When obtained the molting crab, the old carapace throughout of the plastic box, then the new molt crab measured the carapace width and weight. Specific growth rate (SGR) was also calculate follow the formula from Quinitio and Estepa [11] as follows: Specific Growth Rate (% / day) = (ln L2 - ln L1) x 100 / (T2 - T1), where ln = natural logarithm, L2 = final weight (g), L1 = initial weight (g), T2 - T1 = length of cultured (42 days).

Water quality parameters consisting of salinity, pH, water temperature and dissolved oxygen were measured using a YSI Professional Plus Multy DO meter. The final weight, weight gain and specific growth rate of unremoved limb crab and removed limb crabs were compared and the significant differences determined by one-way ANOVA using the IBM-SPSS-Statistics-24 package followed by Tukey’s post hoc (multiple comparisons) tests (α=0.05) while the water quality data were analyzed descriptively to see the relationship with the growth of crabs cultured.

3. Results and discussion

3.1. The number of crabs molt
The fastest molt crabs were obtained in the second week from the removed limb crabs and grown at the water surface (A2B1) and also at a depth of 35 cm below the water surface (A2B2). In the third week found one crab was molt from unremoved limb crabs placed at depth 35 cm (A1B2). Whereas in the removed limb crabs found five individual crabs were molting, namely one crab from water surface (A2B1) and two crabs from the depth of 35 cm (A2B2) and 70 cm (A2B3) respectively. In the fourth week, there was no crab molt in A1(unremoved limb crabs) treatment. Whereas, in removed limb crabs (A2), two crabs molted from the crab in the water surface (A2B1), and a depth of 70 cm (A2B3). In the fifth, to the sixth weeks, the molting crab was only found in unremoved limb crabs, namely one individual crab from the depth of 35 cm (A1B2) and two individual crabs from the depth of 70 cm (A1B3). Unfortunately, no molting crab from unremoved limb crabs grew on the water surface (A1B1) during 42 days (Table 1).

During 42 days crabs cultured in different depths of brackishwater pond, the total crabs molt from unremoved limb crabs was found four individual (44.44%), i.e. two individual from the crab at a depth of 35 cm (A1B2) and 70 cm (A1B3) respectively. Whereas from removed limb crabs was found nine individual molt crabs (100%), i.e. three individuals each from the crabs kept on the water surface (A2B1), 35 cm (A2B2) and 70 cm below the water surface (A2B3). The result of this research was proven that limb removal was affected by the molting acceleration and intensity of mud crab, *S. transquebarica*. Fujaya *et al* [12] reported that vitomolt supplementation in feed affected significantly to the molting acceleration and intensity of mud crab *S. olivacea*. The other researcher, Djunaedi [13] reported that eye ablation was the highest stimulated molt in mud crab, *S. serrata*, compared to limb removing, ovaprim hormonal application and control without any application.
Table 1. Numbers of molt crabs during reared at the different depth of pond waters

| treatments                  | Different dept of pond waters (cm) | Sampling Weekly | Total |
|-----------------------------|------------------------------------|-----------------|-------|
|                             |                                    | 1   | 2   | 3   | 4   | 5   | 6   |
| A1 (unremoved limb)         | 0                                  | -   | -   | -   | -   | -   | 0   |
|                             | 35                                 | -   | -   | 1   | 1   | -   | 2   |
|                             | 70                                 | -   | -   | -   | 2   | -   | -   |
| A2 (removed limb)           | 0                                  | -   | 1   | 1   | 1   | -   | -   |
|                             | 35                                 | -   | 1   | 2   | -   | -   | -   |
|                             | 70                                 | -   | -   | 2   | 1   | -   | -   |

Molt in the crustacea is a consequence for their tissue growth inside the crab body and old carapace is not able to cover and protect tissue growth, furthermore, it need to replaced old carapace with the new carapace. When the crab molt, their body is soft, then automatically the crab will absorb the water enter the crab body. Its activity will impact the increasing crab size. This research was proven that the limb removing on crab, will impact to the growth tissue concentrated in the crab body and an effort to build the new limb. When body tissue has been growth maximum, it stimulated the crabs to molt. In this activity, ecdysteroid hormon have an important role in manage the molt crabs process and tissue growth.

The speed of molt crabs is also influenced by the size of the crab. The larger crab size, the time required to the next molt, is longer, especially if the crab is kept in a limited place such as in a plastic box. The removed limb crabs were grown on the water surface began to molt in the second week until the fourth week and had reached nine individual crabs molt during 42 days rearing. Whereas in the unremoved limb crabs go until the third week has only one individual crab molt and goes to the fifth week only has four individual molts. Thereby, removed limb crab in this study has accelerated the crab molt, even though, the crab was cultured on the water surface and below the water surface. According to Quinitio and Estepa [11] the molting interval will be longer in crabs that have autotomy in the intermolt or premolt stage than in crabs that are deliberately removed their limb (trimmed) or normal. In this study, the limb was accidentally released (trimmed), thus causing the process of an accelerating the crab molts.

3.2. The relationship between the moon cycle (dark moon, full moon) with the number of crabs molt
The number of molting crabs in relation to the moon cycle was illustrated in Figure 1. It appears that in both the dark and bright moon conditions, the crabs are molted, although the numbers of molt crabs are different. In the bright moon (Date 6-17 of the lunar calendar) the total number of molt crabs is higher compared to in the dark moon (date 18-5 of the lunar calendar). The molt crabs were found started around the 6th of the lunar calendar and the peak is on the 9-12th with six crab molted in that period. The crab molted extended until the 16th to 17th of the lunar calendar, but the number is decreased. Only one by one individual crab is molt.

The relation between mud crab molt cycle and moon rhythms was reported by many researchers. Fujaya et al. [14] reported that molts peak is not occurred when the peak of ecdysteroid, but it occurred when ecdysteroid hormon started to decrease, specifically at the crescent moon or waxing gibbous moon.

3.3. Mud crab growth
Weekly growth data of crabs unremoved and removed their limb grown at the different depths of pond waters are shown in Figure 2. The highest of final weight, weight gain and specific growth rate (151.82±3.50 g; 61.605±2.326 g; 0.526%/day) are found in unremoved limbs crabs that are grown at a depth of 70 cm below the water surface and show significant differences (P <0.05) with final weight,
weight gain and specific growth rate of unremoved limb crabs that are grown on the water surface (0.113%/day), but not significantly different (P> 0.05) with final weight, weight gain and specific growth rate of unremoved limb crabs that are grown at a depth of 35 cm below the water surface (0.259%/day). It was also not significantly different (P>0.05) with the removed limb crabs that are grown at water surface, a depth of 35 cm and 70 cm under water surface. The SGR of the removed limb crabs and grown at the depth 70 cm (0.298%/day) under water surface were significantly different (P<0.05) with the SGR of unremoved limb crabs and grown at the water surface (0.113%/day), but not significantly different (P>0.05) with the SGR of unremoved limb crabs and grown at a depth of 35 cm and 70 cm under water surface. The survival rate of mud crabs is on average 100%, except for unremoved limb crabs and grown at a depth of 70 cm. The survival rate is only 66.6% the death of crab caused by a failure of molting.

Figure 1. Bar chart showing relationship between the number of crab molts and lunar calendar during crab reared at the different depth of pond waters (small number at the top of the figure are the dates of the lunar calendar)

Figure 2. Growth of juvenile mud crab Scylla tranquebarica at the different depth of pond waters during 42 days rearing (Note: A1B1: Crab limb are not removed and crab grown at surface pond waters. A1B2: Crab limb are not removed and crab grown at 35 cm under surface pond waters. A1B3: Crab limb are not removed and the crab grown at 70 cm under surface pond waters. A2B1: Crab limb are removed and the crab grown at surface pond waters. A2B2: Crab limb are removed and the crab grown at 35 cm under surface pond waters. A2B3: Crab limb are removed and the crab grown at 70 cm under surface pond waters).
3.4. Mud crab’s specific growth rate (%/day)

Specific growth rate (SGR) of crabs unremoved and removed their limb grown at the different depth of pond waters is shown in Table 2. The highest weight gain and specific growth rate (0.526%/day) are found in unremoved the limb crabs that are grown at a depth of 70 cm below the water surface and show significant differences (P <0.05) with weight gain and specific growth rate of crabs that are grown on the surface of the water (0.113%/day), but not significantly different (P> 0.05) with weight gain and specific growth rate of the crabs that are grown at a depth of 35 cm below the surface of the water (0.259%/day). Remove the limb crabs that are grown at water surface, a depth of 35 cm and 70 cm under water surface with weight gain and specific growth rate are not significantly different (P> 0.05) with weight gain and specific growth rates of unremoved the limb crabs that are grown at the water surface, a depth of 35 cm and 70 cm under surface water (Table 2). The removing of crab limb and the interaction between the removing of crab limb with the different depth of crab grown did not have a significant effect (P> 0.05) on weight gain and the specific growth rate of mud crab cultured. The survival rate of mud crabs is on average 100%, except for crabs that are not removing the limb and grown at a depth of 70 cm the survival rate is only 66.6%. Death of crab caused by failure of molting.

Table 2. Initial weight, final weight, weight gain, specific growth rate of mud crab during reared at the different depth of pond waters

| No. | Code   | Initial weight (g) | Initial weight (g), A2 after removed limbs | Final weight (g) | Weight gain (g) | Specific Growth Rate (%/day) |
|-----|--------|--------------------|--------------------------------------------|-----------------|----------------|-----------------------------|
| 1   | A1B1   | 87.35±8.39         | 87.35±8.39                                 | 96.96±10.34     | 9.61±3.97      | 0.113a                      |
| 2   | A1B2   | 92.51±3.63         | 92.51±3.63                                 | 118.8±25.45     | 26.27±26.21    | 0.259ab                     |
| 3   | A1B3   | 91.01±1.60         | 91.01±1.60                                 | 151.82±3.50     | 61.60±2.33     | 0.526b                      |
| 4   | A2B1   | 87.37±5.49         | 65.55±2.79                                 | 108.14±8.18     | 20.77±2.73     | 0.214ab                     |
| 5   | A2B2   | 86.53±1.27         | 65.96±3.65                                 | 109.03±8.22     | 22.5±7.21      | 0.238ab                     |
| 6   | A2B3   | 89.17±12.36        | 66.70±10.1                                 | 118.84±10.8     | 29.67±5.70     | 0.298b                      |

Note: A1B1: Crab limbs are not removed and crab grown at surface pond waters. A1B2: Crab limbs are not removed and crab grew at 35 cm under surface pond waters. A1B3: Crab limbs are not removed and the crab grew at 70 cm under surface pond waters. A2B1: Crab limbs are removed and the crab grown at surface pond waters. A2B2: Crab limbs are removed and the crab grew at 35 cm under surface pond waters. A2B3: Crab limbs are removed and the crab grown at 70 cm under surface pond waters.

The highest specific growth rate of crab was obtained at the crab grown at a depth 70 cm under water surface. It may be caused by the suitable salinity (range of 17-25 ppt) and temperature (range of 28.4-31.1°C with mean 29.47±0.757°C) for mud crab growth. Mya and Shah [15] reported that increase of salinity gradually from 5 to 25 ppt resulted from highest survival and growth rate of Scylla serrata juvenile size carapace width 2.06±0.29 cm and body weight 1.67±0.75 g. Furthermore, Sandeep and Ramudu [16] reported that constant high survival rate and growth for mud crab Scylla tranquebarica when the crabs reared at the salinity 15-25 ppt. Another researcher stated that growth rate of male and female mud crab, Scylla serrata at confinement plastic box at salinity 30-31 ppt during 30 days culture is not significantly different [17].

Mud crabs are nocturnal animal, they are active in the dark [18]. In this study that crabs are grown at a certain water depth (35 and 70 cm, then the environmental conditions are darker than on the water surface). Hence, at a depth of > 35 cm, crabs become more active feeding and finally, the crabs grow faster and significantly different (P <0.05) with the crabs grown at the water surface (0 cm). However, Morales and Roberto [18] reported that the crabs reared at differences water depth of 10, 20 and 30 cm had no significant effect (P> 0.05 ) to increase the growth rate. Presumably, the depth difference between treatments is only 10 cm, so that the environmental conditions are likely to be almost similar. Therefore, there was no significant effect on the difference in growth rate of crabs.
According to Xiaowu et al. [19] that lighting intensity does not significantly affect the speed of molting capability but has a significant effect on increasing the weight of molting crabs, especially for the crabs that are kept in lighting intensity 0 or dark condition. Another factor that increases the survival rate of mud crabs is the use of shelters [20]. Sand shelter placed at the bottom of the tank rearing significantly affects the survival of mud crab juveniles.

The crabs show bigger after molting. The best growth (tissue growth and molt frequency) and the best feed efficiency was obtained in crabs fed on the diet 40% crude protein [21]. In this study, mud crabs were given trash fish as their feed which containing 57% protein, 13.65% fat, 0.17% crude fiber and 7.69% moisture content.

3.5 Water quality

3.5.1 Salinity

Mud crab can live in a fairly wide range of salinity in estuary areas and mangrove ecosystems, from low salinity in the rainy season to high salinity in the dry season. At the pond, salinity of 40 ppt mud crab starts to death [7]. Sandeep and Ramudu [16] reported that decreasing salinity from 29.6 ppt to 10.4 ppt caused decreasing significant survival rate from 87% to 45%. At the beginning of the research, the salinity was 17-20 ppt, then had increased to 25 ppt at the end of the research (Figure 3). Therefore, that salinity was still in optimal conditions for the growth of mud crabs Scylla tranquebarica.

One of the abiotic factors that influence the crab growth and survival is pH. The optimum pH value will have the maximum impact on mud crabs osmoregulation process. Maintenance of water pH will affect the enzymes that work on the gills, for example, ATPase, carbonic anhydrase, Na-K ATPase, and enzyme activity on the gills related to respiration rate, osmoregulation, and excretion. In waters that have muddy substrates tend to have acidic pH, whereas in sandy substrates tend to contain alkaline pH. In this study, water pH was in the range of 7-8. Shelley and Lovatelli [22] established water quality standards for the mud crabs culture, with an optimum DO range of >5 ppm, temperature of 25 - 35 °C, water pH of 7.0 to 9.0; TAN <3 ppm, alkalinity >80 ppm, and turbidity > 30 mg / L.

Figure 3. Salinity (upper) and pH (lower) fluctuation in pond for mud crab rearing in the different depth of pond waters during 42 days.

3.5.2 Dissolved oxygen

Some water quality parameters are very important to support mud crab growth in brackishwater ponds. DO plays a role in the process of oxidation and reduction of organic and inorganic materials, DO is needed by all living bodies for breathing, metabolic processes or exchange of substances which then produce energy for growth and breeding. The main source of oxygen in aquatic systems comes from a process of diffusion from free air and photosynthesis of organisms that live in the waters. The speed of
oxygen diffusion from the air is influenced by several factors, such as water turbidity, temperature, salinity, water and air mass movements such as currents, waves and tides. The waters with higher temperature and salinity will have a low DO value, and vice versa the DO value will be high if the waters have low temperature and salinity. The DO concentration at 70 cm below the water surface was 5.044±1.39 mg/L is always lower than the DO concentration of at a depth of 35 cm (5.721±0.944 mg/L) and water surface (6.141±1.2 mg/L). Mud crab weight gain when it grew at the different depth of pond waters namely at 29.67±5.70 g to 61.605±2.326 g (depth 70 cm), 22.5±7.21 g to 26.27±26.21 g ( depth 35 cm) and 9.61±3.97 g to 20.77±2.730 g (waters surface). It appears that the possible effects of oxygen enrichment from phytoplankton on the surface of the water are very clear compared to the depths of 35 cm and 70 cm (Figure 4). The DO concentration in all water levels still good to support crab growth in brackishwater pond. Sandeep and Ramudu [16] stated during grow out mud crab *S. tranquebarica* for 90 days with DO concentration at the range 5.5 mg/L to 6.0 mg/L resulted average daily growth rate (ADGR) 1.25 g day⁻¹ to 2.68 g day⁻¹. Statistical analysis for the DO concentration in this research showed that DO concentration in waters surface was not significantly different (P>0.05) with DO concentration in the depth of 35 cm and 70 cm under water surface.

![Figure 4. Line chat showing the dissolved oxygen fluctuation in the different depth of brackishwater pond.](Image)

**3.5.3 Water temperature**

Temperature is the most important factor in the growth and development of mud crabs in their habitat. Water temperature can affect the growth rate, activity and appetite of mud crabs. At low temperatures, it can cause drastic activity and appetite for mud crabs decreases dramatically. At that time growth will be hampered even though the mud crabs will still be alive. Temperature affects metabolic activity and growth of mud crabs. Maximum weight-specific growth rate was 16% day⁻¹ obtained at 30°C and salinity 10 – 20 ppt [23]. Temperature also influences to the molting interval. Gong *et al* [24] reported that at temperature of 32 °C induced an increasing of ecdysone receptor (Ecr) gene and reduced molting interval in the Crab D-1, while at 39°C the expression of Ecr gene decreased and finally the crabs died without molt. In this study, based on data from the monitoring of water temperatures in ponds that water temperatures appear to fluctuate. The highest water temperature is at the water surface in the range of 29.5-31.5°C (mean 30.37±0.59°C) and it was significantly different (P<0.05) with the water temperature at a depth of 70 cm, in the range of 28.4-31.1°C (mean 29.47±0.76°C) and not significantly different (P>0.05) with the water temperature at a depth of 35 cm, is 28.2-31.4°C (Figure 5). Based on these results it appears that the best water temperature for the growth of mud crabs in brackishwater pond is in the range of 28.4-31.1°C (mean 29.95±0.806°C), because at a depth of 70 cm the mud crabs experience the highest biomass growth compared to the crabs that are cultured at water surface and 35 cm under water surface.
Figure 5. Temperature fluctuation in different depth of brackishwater ponds

4 Conclusion
The highest weight-gain (61.605±2.326 g/ind.) was obtained in removed limb crabs placed at a depth of 70 cm below water surface. Limb-removing and the interaction between limb-removing and placement-depths were not significantly different (P> 0.05) on the growth of the mud crab. By this finding was proved that still another technique to accelerate molting crab without removing their limb, exactly by placed in the depth of 70 cm under surface water, the crab will grow fast.

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