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# THE EFFECT OF DIFFERENT SUBMERGED CAGE (VIETNAMESE STYLE) DEPTH ON THE GROWTH OF GREEN LOBSTER (Panulirus homarus) IN THE EAST COAST OF PANGANDARAN DISTRICT

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**ABSTRACT**

The purpose of this study was to determine the effect of submerged cage depth on the growth of green lobsters (*Panulirus homarus*) in Vietnamese-style cultivation on the East Coast of Pangandaran. The submerged cage was intended so that the lobsters are not disturbed by the situation/water quality in the upper layer of the water. The research method used a completely randomized design using 3 submerge cage depth treatments and 4 repetitions with different ones, A (2 meters); B (3.5 meters); and C (5 meters). Lobster maintenance was carried out for 40 days using a submerged cage with a diameter of 80 cm and a height of 90 cm. Each cage contains 10 lobster seeds measuring 40 g. Frequency of feeding 2 times a day. The amount of test feed given was 20% of the lobster weight each day. Measurement of water quality as supporting data was carried out at the beginning and end of the research. Sampling was done every 10 days and the observed parameters were growth rate, feed conversion ratio (FCR), and feed efficiency (FE). Lobster growth performance showed that treatment C (placement of cages at a depth of 5 meters) was the best among the others, as well as the daily growth rate (LPH) of 1.35%, feed conversion ratio (FCR) of 12.8, and feed efficiency ( EP) of 8.6%. The water quality in the submerged cage with a depth of 5 meters was DO 5.22 mg/L, the water temperature was 28 Celsius, pH was 7 and salinity was 34 ppt.

***Keywords:*** *submerged cage, depth, lobster, growth, water quality*



## INTRODUCTION

One commodity that has not been widely cultivated in Indonesia is lobster (Panulirus sp.), which started in 2000 in West Nusa Tenggara. Lobster cultivation in Indonesia is also carried out in Nanggroe Aceh Darussalam, East Nusa Tenggara, and South Sulawesi. However, the development of lobster cultivation is still relatively slow. Especially for growing lobster cultivation, it has begun to develop in several areas, including Lombok, Pelabuhan Ratu, and Aceh. Opportunities from the domestic lobster cultivation business are very open due to the lack of seawater cultivation activities, including the cultivation of lobsters.

The green lobster (*Panulirus homarus*) is the dominant species and its population is 3 to 9 times larger than the Mutiara lobster (*Panulirus ornatus*) (Anissah et al., 2015). Green lobster is a type of lobster that can be found in Indonesian waters, especially in the waters of the Indian Ocean. These lobsters are classified as spiny lobsters which in Indonesia are known as crayfish/barong shrimp because they are generally found in coral waters. The most common crayfish or lobsters found in Indonesian waters belong to the Palinuridae family and the Panulirus genera (Kembaren et al., 2015).

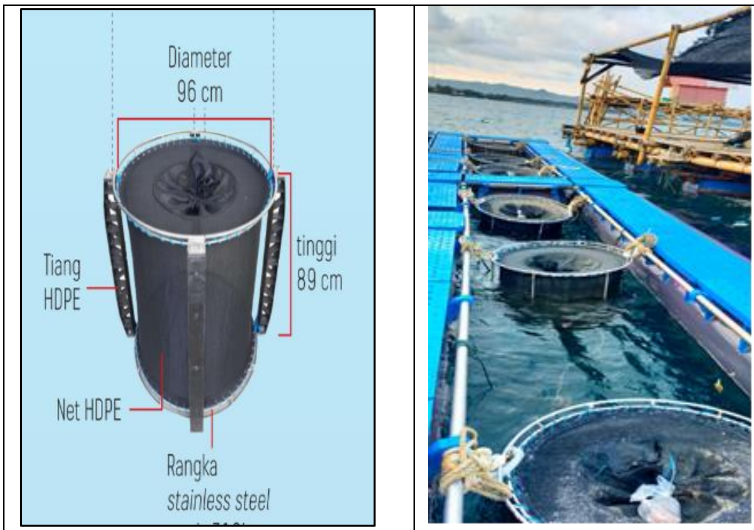
Commercial and experimental scale lobster farming activities have been initiated by several countries including New Zealand, Japan, Australia, India, and Vietnam. Some of them use a submersible cage system with various materials and designs. Vietnam is developing a sea cage submerge system. However, the lobster rearing system in Indonesia still uses floating net cages (KJA) made from bamboo and wood.

The maintenance of lobsters in floating net cages (KJA) still has weaknesses, namely the low survival rate (40-50%) (Suhana, 2018). The use of KJA for the enlargement of lobsters is also considered not optimal because lobsters only inhabit the bottom of the water column. The use of marine cages with surface nets also has disadvantages where the quality of the waters can easily change due to weather changes. On the other hand, lobsters are sensitive to environmental changes.

Based on this situation, innovation is needed for better lobster enlargement. Therefore the use of floating net cages using the Vietnamese submersible cage method is considered to be a solution for lobster farming in Indonesia (Anissah et al., 2015). The use of submersible cages is also supported because in a location below the surface of the water (water depth 5-7 m) the wind speed is not too strong and the waves are not too high, the temperature is more stable, the natural food is abundant (Zhai et al., 2022).

## METHOD

This research was conducted in floating net cages on the East Coast, Pangandaran Regency for 40 days from August 2022-September 2022. The research was conducted using a completely randomized design (CRD) method which consisted of 3 treatments with 4 replicates for each treatment. Each treatment had a different depth, namely: 1) Treatment A: cage depth 2 m from the water surface, 2) Treatment B: cage depth 3.5 m from the water surface, and 3) Treatment C: cage depth 5 m from the water surface. The submerged cages used are shown in Figure 1. The materials used in this study were test animals in the form of 40-gram lobster seeds (Figure 2) which were obtained from 156 Garut fishermen. The feed given is a natural mix of anchovies and rebon originating from Pangandaran waters (Figure 3).




| A | B |
| --- | --- |

Figure 1. A. The submerged cage used has a diameter of 96 cm and a height of 89 cm (Production by PT Aquatec)
B. Unsinkable Submerged Cage

Figure 2. Test animals in the form of 40-gram lobster fry

Figure 3. Natural Feed Mixed Minced Fish and Shrimp Minced

**Observation parameters:**

***Survival Rate***

The survival Rate is calculated using the formula (Effendi 2002 in Mulqan et al., 2017):

$$SR = \frac{\text{Nt}}{N0} x\ 10\%$$

Description: SR = Survival (%)
Nt = Number of fish on day t (heads)
N0 = Number of fish on day 0 (heads)

***Absolute Weight Measure***

Absolute weight growth is calculated by the formula (Effendi 1997 in Mulqan et al., 2017):

$$Wm = Wt - Wo$$

Description: Wm = Growth in absolute weight (grams)
Wt = Weight of biomass at the end of the study (grams)
Wo = Weight of biomass at the beginning of the study (grams)

### *Feed Efficiency*

Absolute length gain is the difference between the length of the fish between the head and tail ends of the body at the end of the study and the body length at the beginning of the study ((Mulqan et al., 2017) Calculation of feed utilization efficiency uses the formula (Tacon 1993 in Amalia 2013):

$$EPP = \frac{Wt - W0}{F} \times 100\%$$

Description: EPP = Efficiency of Feeding (%)
F = Amount of feed given during the study (g)
Wt = Average seed weight at the end of the study (g)
Wo = Average seed weight at the start of the study (g)

### *Daily Growth Rate*

Growth parameters will be calculated using the daily growth rate formula ((Mikdarullah & Nugraha, 2021):

$$G = \frac{Wt - Wo}{t}$$

Description: G = Daily growth rate (%)
Wt = average seed weight at the end of the study (g)
Wo = Average weight of seeds at the start of the study (g)
t = Fish rearing time (days)

### *Food Convention Ratio (FCR)*

Feed conversion is calculated using the formula (Fahrizal & Nasir, 2017), namely:

$$= \frac{F}{(Wt + D) - W0}$$

Description: FCR = Feed conversion ratio/feed conversion ratio.
F = Amount of feed given (g).
Wt = Weight of test fish at the end of the research (g).
D = Weight of dead fish (g).
Wo = Weight of test fish at the beginning of the research (g).

### *Water Quality*

Observation of water quality was used as a supporting parameter during the research. Water quality parameters measured during the study were temperature, degree of acidity (pH), dissolved oxygen, and water salinity.

The data analysis used in this study was an analysis of variance (ANOVA) with the F test at a 95% confidence interval. Used to determine whether the treatment has a significant effect on the survival rate, absolute weight growth, absolute length, and daily growth rate. If the treatment has a significant effect, then a further test is carried out with the Duncan test, while the water quality data is analyzed descriptively.

## RESULTS AND DISCUSSION

### Survival (Survival rate)

Survival (SR) is the ratio of the number of fish that live from the beginning to the end of the study.

Table 1. Average Survival Rate of Lobsters During the Study

| Treatment | Depth | Average |
|---|---|---|
| A | 2 m | 95±5,00 |
| B | 3,5 m | 87±8,29 |
| C | 5 m | 90±7,07 |

Based on Table 1, the survival rate of lobsters was not significantly different for each treatment with the best treatment in treatment A. The data obtained showed that the treatment given had no significant effect on the survival rate of the lobster itself. Because each treatment given has results that are not significantly different. This is presumably because the quality of the water in the research location is still good for aquaculture activities. As stated ((Arif Prasetya & La Ode Abdul Fajar Hasidu, 2021) the optimal salinity for lobster growth ranges from 29-34 ppt.

### Growth

#### *Absolute Weight Growth*

According to (Zulpikar et al., 2018) growth in absolute weight is the result of fish weight at the end of the study minus the weight of the fish at the beginning of the study, previously the weight of the fish at the end of the study was added first to the weight of dead fish during the study. (Ilhamdi & Harahap, 2020) states that the growth rate is the difference in absolute growth which is measured based on the time sequence. Absolute growth is the average total size for each age.

Table 2 Average Lobster Absolute Weight Growth Rate

| Treatment | Depth | Absolute Weight Growth Average |
|---|---|---|
| A | 2 m | 0,295±0,065 |
| B | 3,5 m | 0,395±0,060 |
| C | 5 m | 0,555±0,117 |

Treatment C (cages placed at a depth of 5 m) had the largest absolute growth per sampling, followed by treatment B (cages placed at a depth of 3.5 m) and the smallest absolute growth value was treatment A (cages placed at a depth of 2 m). The results of Duncan's test with an error level of 5% also show that each treatment is significantly different. This is presumably because the temperature has an important role in the process of growing lobsters, high-temperature increases can result in slow lobster growth, and lobsters can grow well in the temperature range of 24°C - 32°C ((Damis et al., 2015). The temperature in treatment A (placement of cages at a depth of 2 m) can change at any time because the depth of 2 m is the depth closest to the water surface.

### *Daily Growth Rate*

Daily growth serves to calculate the percentage of fish weight growth per day (Jaya et al., 2013). Daily growth is the percentage increase in growth over time.

Table 3 Average Rate Growth Lobsters Daily

| Treatment | Depth | Average Rate Growth Lobster Daily (%) |
|---|---|---|
| A | 2m | 0.695 ± 0.065 |
| B | 3.5m | 0.7475 ± 0.060 |
| C | 5m | 1.357 ± 0.117 |

Rate lobster growth during activity research showing mark highest in treatment C (placement cage at a depth of 5 m) with a value of 1.35%, then followed by treatment B (placement cage at a depth of 3.5 m) with a value of 0.75% and treatment Lowest found in treatment A (placement cage at a depth of 2 m) with value of 0.69%. Enhancement of fish growth is seen from the rate of growth daily (Nugroho 2016). Duncan test results with a level error of 5%, shows that the C treatment is different real with treatment A and B. And the best treatment is treatment C, p This is suspected There is a relationship between the depth with the closest temperature to the lobster habitat in nature that is, at the base waters.

(Kemp & Britz, 2008) state that the daily growth rate (LPH) own significant differences in each different temperature. The rate of growth daily highest occurred at 24 ° and 28°. Whereas at 21 ° it has a rate of growth daily lowest. Rate growth daily at 21 ° has a significant difference from temperatures 24° and 28°. However No There is a difference in rate growth significant daily from temperature 19°.

### *Feed Conversion Ratio (FCR)*

A comparison of the total amount of feed given with an increase in the resulting weight is a ratio conversion gift feed (Riani et al., 2012).

Table 4 Average - Average Ratio Conversion Feed Growth Weight Absolute Lobsters

| Treatment | Depth | Average Ratio Conversion Lobster Feed |
|---|---|---|
| A | 2m | 29.75±5.13 |
| B | 3.5m | 27.11±5.52 |
| C | 5m | 12.8±3.96 |

On the chart results research conducted, found the best FCR value in treatment C as big 12, 8 then in treatment B, namely 2 7.12, and treatment A has mark lowest 2 9, 75. Duncan test results with a level 5% error show that C treatment is different real with treatments B and A will but treatment B does not different real with treatment A. Increasingly low the FCR value than the better the feed is given. Best FCR value found in treatment C (placement cage at a depth of 5 m ) of 12,8. this means for yields 1 g of meat is needed to feed as much as 12.8 g. (Zainuddin et al., 2014) mention that n value conversion feed (FCR) indicates how much big shrimp can utilize the feed given For form 1 kg of meat. Increasing FCR value small to show the quality of more feed well whose level of digestibility feeds the more high.

this is in line with what was said (Kemp & Britz, 2008)in which group temperature tall own consumption of more food big with the exception at 30 °C where happen decline in consumption feed associated with pressure temperature. Got ratio conversion more feed higher at 28 °C and above from 30% where taller than treatment at 24°C.

### *Efficiency Feed*

efficiency use feed showing mark feed that can change become increase fish weight. Efficiency feed can be seen from several factors where one is ratio conversion feed (Lestari et al., 2013). efficiency value feed can be obtained through results comparison between growth weight fish with the amount of feed consumed by fish during the rearing period.

Table 5 Average Efficiency Lobster Feed

| Treatment | Depth | Average Efficiency Lobster Feed (%) |
|---|---|---|
| A | 2m | 3.48 ± 0.007 |
| B | 3.5m | 3.88 ± 0.0095 |
| C | 5m | 8.60 ± 0.025 |

Based on research conducted efficiency highest feed was found in treatment C with a mark of 8.60%, then followed by treatment B with a mark of 3.88%, and the smallest at 3.48 % in treatment A. Duncan's test results with a level 5% error show treatment A no different real from treatment B. However C treatment is different real with B and C. Increasingly big mark efficiency feed, means the more fish efficiently utilize feed consumed For growth (Iskandar & Elrifadah, 2015). efficiency lobster feed and height efficiency feed in treatment C is suspected Because the feed given is more used by lobsters, p This is caused because feed spread in a manner distributed by the current underwater or not be in one point so that no happen competition between lobsters. Besides that, rate constant salinity No changed change influence metabolism lobster for growth, so lobster more utilize feed given. By the statement (Kusumaningtyas et al., 2014), Water quality holds a role important in field fishery, especially for activity cultivation as well as in productivity animal aquatic. efficiency value feed is also comparable straight with the FCR value on the rearing medium.

### *Water Quality*

One influential factor in fish growth is water quality. (Aquarista et al., 2012) put forward the importance of management of water quality for necessity cultivation Because water is a living medium for organism aquaculture. Water quality holds a role important in field fishery, especially for activity cultivation as well as in productivity animal aquatic.

Table 6 Average Water Quality Parameters

| No. | Treatment | A (2.5m) | B (3.5m) | C (5m) | | References |
|---|---|---|---|---|---|---|
| 1. | DO (mg/L) | 6,5 | 5.55 | 5,22 | >3 | Kartina, 2005 |
| 2. | Temperature (° C) | 28 | 28 | 28 | 23-32 | Wickins and Lee, 2002 |
| 3. | pH | 8 | 8 | 7 | 7-9 | Kordi and Tancung, 2005 |
| 4. | Salinity (ppt) | 33 | 34 | 34 | 25-40 | Tong et al., 2000 |

**Salinity**

Measurement results salinity showing that in treatment A (placement cage at a depth of 2.5 m) has mark salinity 33 ppt. Whereas treatments B (placement cage at a depth of 3.5 m) and C (placement cage at a depth of 5 m) have a mark salinity of 34ppt, according to Tong et al., 2000, p this is still by the standard.

**Temperature**

Temperature waters are one very factor important for life organisms in the waters. Temperature is one factor easiest external for researched and determined. Activity metabolism as well as deployment of many aquatic organisms affected by water (Hamuna et al., 2018). Measurement results carried out temperature seven days very during the maintenance period No own big difference between treatments, that is a range of 27-30°C and obtained the average of each treatment i.e. 28°C.

**Oxygen Dissolved (DO)**

Oxygen dissolved is very useful for the continuity of marine life. Oxygen dissolved can be formed from incident displacement substance with concentration tall to low or diffusion, in case This air will do displacement to in water, besides That oxygen dissolved too formed Because the process of photosynthesis plants found in the ocean ((Mubarak et al., 2010). Based on test results on activities research shows that in treatment A (placement cage at a depth of 2.5 m) was obtained DO value of 6.5mg/l. Whereas treatment B (placement cage at a depth of 3.5 m) and C (placement cage at a depth of 5 m) was obtained do values of 5.55mg/l and 5.22mg/l.

**Degrees Acidity (pH)**

Degrees acidity something water is one of the sufficient chemical parameters important in monitoring the stability of water. Variation in the pH value of the water greatly affects the biota in an area of water. Besides that, the height pH value is very decisive domination affecting phytoplankton level primary productivity waters Where the existence of phytoplankton is supported by the availability of nutrients in the waters sea (Hamuna et al., 2018). pH measurements are carried out every week on a difference that is not significant. In treatment, A (placement cage at a depth of 2.5 m) and B (placement cage at a depth of 3.5 m) obtained a pH level of 8. Whereas in treatment C (placement cage at a depth of 5 m) was obtained pH value of 7.

## CONCLUSION

Lobster growth from sampling results every ten days very showing that treatment C (placement cage at a depth of 5 meters) is best, with mark rate growth daily (LPH) of 1.35%, ratio conversion feed (FCR) of 12.8, and efficiency feed (EP) of 8.6 %. And obtained an average survival rate of 90% in treatment C (placement cage at a depth of 5 meters). On treatment C (placement cage at a depth of 5 meters) DO 5.22 mg/L, temperature 28 °C. pH 7, salinity 34 ppt.

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