# INFLUENCE OF ADDITION OF MURBEI (*Morus alba* L.) FLOWERS TO FOOD FOR FATHERING MANGROVECRABS(*Scylla serrata*) APARTMENT SYSTEMS


**ABSTRAK**

Mangrove crab (Scylla serrata) is one of the important fishery commodities that has high economic value. In Indonesia, crab cultivation has developed a lot, this can be seen from the cultivation media used, namely using vertical crab houses (apartments) with the RAS system. In addition, one of the problems in mangrove crab cultivation is fattening efforts because the caught crabs have a small body size and little meat, so they are less in demand by consumers and result in a decrease in economic value. This is suspected to be due to the lack of protein obtained by crabs, so alternative feed in the form of pellet feed added with mulberry leaf flour is needed to stimulate crab growth. Therefore, this study aims to determine the optimal dose of mulberry leaf flour for mangrove crab feed in stimulating growth. This study uses an experimental method conducted using a Complete Random Design (RAL) consisting of 5 treatments and 3 replicates. The treatments in this study include: A (Control), B (7,5%), C (15%), D (22,5%) and E (30%). The results showed that the administration of mulberry leaf flour with different doses in mangrove crab feed had a real effect ($P<0.05$) on the growth of absolute weight (W), absolute length (P), specific growth rate (SGR), feed conversion ratio (FCR) and feed utilization efficiency (EPP) and had no real effect ($P>0.05$) on the Survival Rate (SR). Treatment C (15%) is the best dose of mulberry leaf flour that can support the growth and survival of mangrove crabs. the highest values were W (14.6±2.6 d), P (0.6±0.3 b), SGR (0.34±0.06 s), FCR (18.39±3.50 a) and EPP (48.51±2.80 c).



*Keywords: Mangrove Crab (Scylla serrata), Mulberry Leaf Flour (Morus alba L.), Apartment System.*




## 1. INTRODUCTION

Mangrove crab (*Scylla serrata*) is an important fishery commodity that has high economic value. This can be seen from the demand for crab export markets which continues to increase from 25,942.9 tons in 2019 to 32,183.3 tons in 2021[1](. In Indonesia, crab cultivation has developed a lot, it can be seen from the cultivation media used, namely using *vertical crab houses* (apartments) with the RAS system. In addition, one of the problems in mangrove crab cultivation is fattening efforts because the crabs that are traded are caught by fishermen. The captured crabs have a small body size and little meat, making them less attractive to consumers and resulting in decreased economic value. This is thought to be the lack of protein obtained by the crab, so it needs alternative feed in the form of pellet feed to meet the protein needs of mangrove crabs that can stimulate their growth [2]. One of the ingredients that can be added in stimulating the growth of mangrove crabs is mulberry leaves.

Based on the results of several studies conducted, it is known that the addition of mulberry leaves in feed can stimulate its growth[3]. Have conducted research on mulberry

leaf flour in feed and the results obtained show that mulberry leaf flour has no significant effect and lack of feed digestibility. This is due to the dose used in the feed is not optimal. Therefore, further research is needed regarding the optimal dose of mulberry leaf flour to stimulate the growth of mangrove crabs.

## 2. METHODOLOGY

### 2.1 Time and Place

This research was conducted for 43 days from April to June 2024 at Empol Preparatory Village, Sekotong District, West Lombok Regency.

### 2.2 Research Methods

This research used an experimental method conducted using a completely randomized design (CRD) consisting of 5 treatments and 3 replications., namely:

A = Addition of 0% Mulberry Leaf Flour
B = Addition of 7.5% Mulberry Leaf Flour
C = Addition of 15% Mulberry Leaf Flour
D = Addition of 22.5% Mulberry Leaf Flour
E = Addition of 30% Mulberry Leaf Flour

The five treatments were repeated 3 times, resulting in 15 experimental units. Each experimental unit was then put into a crab apartment unit. The construction of the research layout design can be seen in Figure 1.

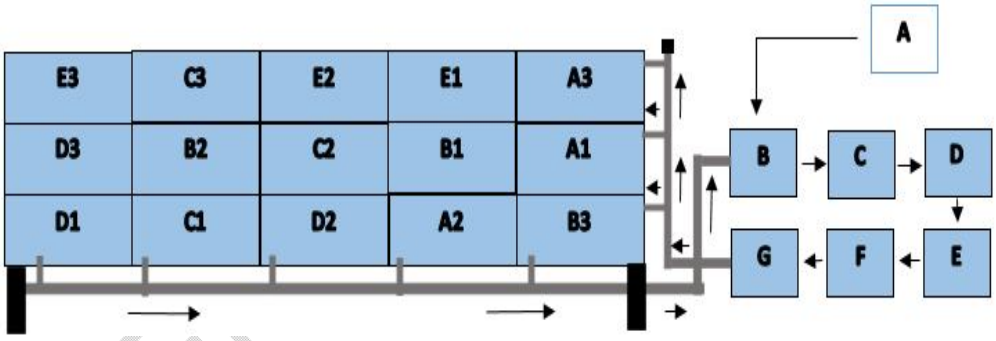


Figure 1. Experimental design

### 2.3 Research Procedure

The rearing container used is a jerry can container in the form of a tiered apartment. The containers were first cleaned using soap and rinsed thoroughly using fresh water. The container is then dried for 24 hours, which is then flowed with brackish water with a circulation system using a water pump before the crabs are inserted. The crabs used are crabs caught by fishermen in Empol Village, which are then selected with the criteria that there are no black spots on the body, complete limbs and the weight used ranges between 60-70 grams. Crabs that have been sorted will be acclimatized for 2-3 days in an apartment container before being given the treatment.

The next stage is feed preparation, where the feed used is repelletized shrimp feed, then added mulberry leaf flour as much as 0%, 7.5%, 15%, 22.5% and 30% according to the treatment dose. The feed that has become a dough is then oven at 60°C for 24 hours. The feed was then given to the crabs once a day in the afternoon (16.00-17.00 WITA). Feeding was carried out in Ad satiation.

During the maintenance period, the water quality parameters observed in this study were temperature, salinity, pH, and DO (*Dissolved oxygen*). Temperature, salinity, and pH

measurements were carried out once a week in the afternoon while DO (*Dissolved oxygen*) measurements were carried out at the beginning and end of maintenance.

## 2.4 Research parameters

The main parameters tested in this study were growth parameters (weight and length growth and *specific growth rate*) *feed conversion ratio,* feed utilization efficiency*, survival rate, and* hemocytes.

Absolute weight growth was measured using the [4]formula: Wm = Wt - Wo. Wm = Absolute weight growth (gr); Wt = Final average weight (gr); Wo = Initial average weight (gr).

Absolute length measurement using the [5]formula: P = Pt - Po. P = Absolute length growth, Pt = Average length on day t (cm), Po = Average length on day 0 (cm).

*Specific growth rate* is calculated based on the [6]formula: SGR = Daily growth rate (%/day), Wt = Test animal weight at the end of the study (g), Wo = Test animal weight at the beginning of the study (g), T = Duration of the study (days).

The calculation of *food conversion ratio* refers to the[2] formula: FCR = feed conversion ratio, F = Amount of feed consumed (g), Wt = Weight of test animals at the end of the study (g), Wo = Weight of test animals at the beginning of the study (g).

The feed utilization efficiency value can be calculated by the [7]formula: EPP = Feed utilization efficiency (%), Wt = Fish biomass weight at the end of the study, Wo = Fish biomass weight at the beginning of the study, F = Amount of fish feed consumed during the study (gr).

Calculation of the amount of THC using the [8]formula:$THC = N \times 10^4 \times FP$. N = Number of cells, FP = Dilution factor.

The DHC test can be calculated using the [8]formula: Percentage of Hemocyte Cell Types = Number of Each Hemocyte Cell / Total Hemocytes x 100%

## 2.5 Data Analysis

Data used for the effect of the optimal dose of mulberry leaf meal on feed were analyzed using anova with a 95% confidence level. If the results are significantly different, it will be tested further with the duncan test.

## 3. RESULTS AND DISCUSSION

### 3.1 Absolute Weight

The results of research conducted for 43 days in Sekotong District, West Lombok by giving mulberry leaf flour to feed mangrove crabs (*Scylla serrata*) showed that the average absolute weight growth of mangrove crabs obtained ranged from 5.0-14.6 g as can be seen in Figure 2.

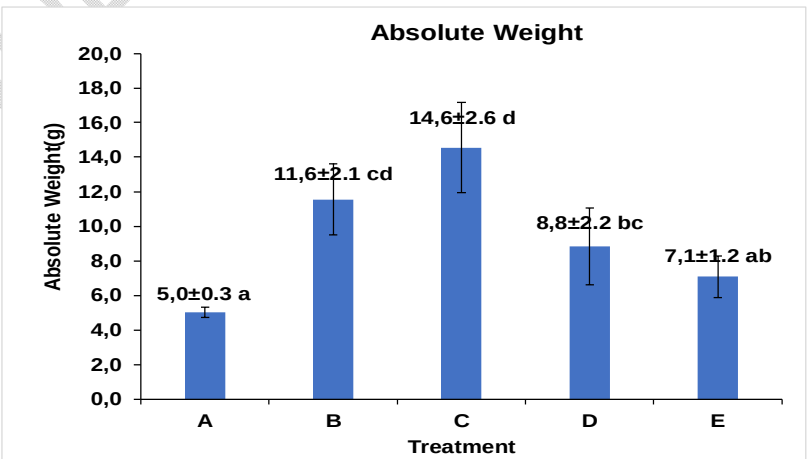


Figure 2. Absolute Weight Chart

Based on the results of the analysis that has been done that the provision of mulberry leaf flour in crab feed with
different doses gives a statistically significantly different effect on absolute weight growth, the results obtained in the highest absolute growth obtained in treatment C which amounted to (14.6 ± 2.6 d) and the lowest growth value in treatment A which amounted to (5.0 ± 0.3 a). Mangrove crabs will only grow when the crabs molt. According to [9], the amount of growth in crabs depends on the increase in weight and width of the crab when molting, where the frequency of molting varies which is influenced by the size and stadia of the crab. In addition, the level of molting in crabs is influenced by the content of *ecdysterone* in mulberry leaf powder. According to [10]*ecdysteron* is the main *streoid*hormone in arthropods (including crustaceans) which has the main function as a moulting hormone (skin replacement) and controls the formation of a new carapace to replace the old carapace, besides that, it also regulates physiological functions, such as growth, metamorphosis, and reproduction. According to [3] that the use of mulberry leaf flour in feed can increase the growth of mangrove crabs. The article stated that the nutritional content and bioactive compounds in mulberry leaves contribute to increased growth.

### 3.2Absolute Length

The results of the analysis showed that the average absolute length growth of mangrove crabs obtained ranged from 0.0-0.6 cm, as shown in Figure 3.

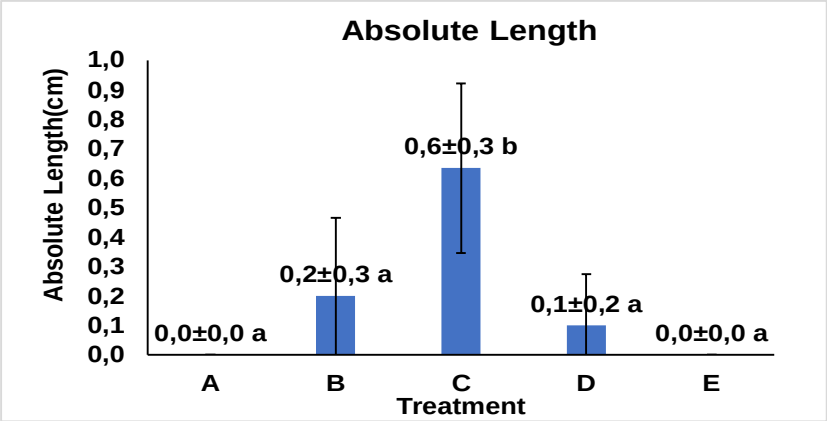


Figure 3. Absolute Length

The results of absolute length growth are directly proportional to the results of absolute weight. The higher mangrove crab growth in treatment C is (0.6 ± 0.3 b) and the lowest in treatment E is (0.0 ± 0.0 a), and treatment A is (0.0 ± 0.0 a). The results obtained are still within the normal range of absolute length growth of mud crabs. In line with the research of [11]who obtained the absolute length of mangrove crabs which ranged from 0.4-1.2 cm. Mangrove crab growth is characterized by molting because the crab has a hard outer shell that cannot grow. Therefore, in order for the crab to grow, the old carapace must be replaced with a new and larger one. Molting in crabs is influenced by several factors, one of which is the addition of active ingredients in feed that can stimulate growth, namely mulberry leaf flour. Mulberry leaf flour contains active compounds. According to [10] mulberry contains chemical compounds that are proven to accelerate molting, these chemical compounds are *ecdysterone, inocosterone, lupeol, β-sitosterol, rutin, moracetin, scopoletin, benzaldehyde, eugenol, linalol, benzyl alcohol, butylamine, acetone, kholine, and quercetin*.

### 3.3 Spesific Growth Rate

The results of the analysis showed that the average specific growth rate of mangrove crabs obtained ranged from 0.12-0.34%/day as can be seen in Figure 4.

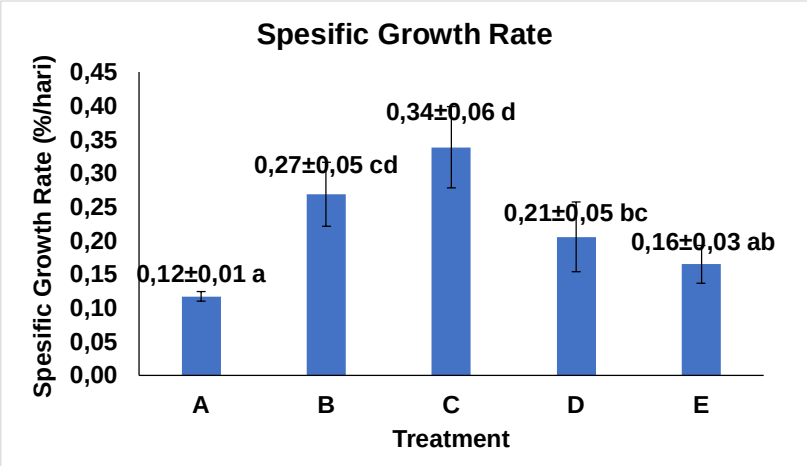


Figure 4. Specific Growth Rate (SGR) Chart

The highest *specific growth rate of* mud crab (*Scylla serrata*) was obtained in treatment C which amounted to (0.34 ± 0.06 d) and the lowest in treatment A which amounted to (0.12 ± 0.01 a). The SGR value is still within normal limits for mangrove crab growth based on research by [7]the average value of SGR is 0.09-0.50 %/day. Molting is one of the important factors in mangrove crab cultivation because it is related to growth and production. The addition of mulberry leaf powder to the feed gives significant results for the growth of mud crabs. The content of *ecdysteroids* in mangrove crabs can accelerate molting in crabs. However, the use of mulberry leaf powder in feed has an optimum limit. According to [12]naturally in crabs there is already the hormone *ecdysteron*, so the provision of excess hormones will not be utilized properly.

### 3.4 *Feed convertion ratio*

The results of the analysis showed that the average *feed conversion ratio of* mud crabs obtained ranged from 18.39 - 41.81 gas can be seen in Figure 5.

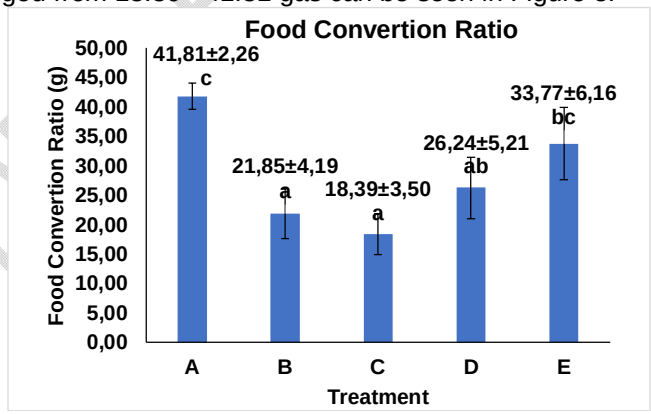


Figure 5. Graph Of Feed Conversion Ratio (FCR)

The effect of mulberry leaf flour addition on *Feed conversion ratio of* mangrove crab (Scylla sp.) gave significantly different results. The highest*feed conversion ratio* was in treatment A which amounted to (41.81 ± 2.26 c) and the lowest in treatment C amounted to (18.39 ± 3.50 a). The results obtained are still within the normal range of mangrove crab FCR. In line with the research of [13]which obtained the results of mangrove crab *FCR* which ranged from 9.63-62.61g. So from these results it can be concluded that the best *Feed conversion ratio* is in treatment C because the smaller the value obtained, the better the FCR value. According

to [14]stated that the FCR value is related to the quality of the feed and the quality of the feed given. Therefore, the lower the FCR value, the better the quality of the feed and the more efficient the feed is used for the growth of mangrove crabs. In addition, the addition of mulberry leaves to the feed can affect the FCR value because the addition of mulberry leaves makes the feed easy to digest and is a source of energy for mangrove crabs. According to [15]feed that has good nutritional intake can support crab growth which is through the addition of *ecdysteroid* hormones which are a source of energy, steroids, and sterols that can help the metamorphosis process and crab growth.

### 3.5 Feed Utilization Efficiency

The results of the analysis showed that the average feed utilization efficiency of mud crabs obtained ranged from 35.85 to 48.51% as can be seen in Figure 6.

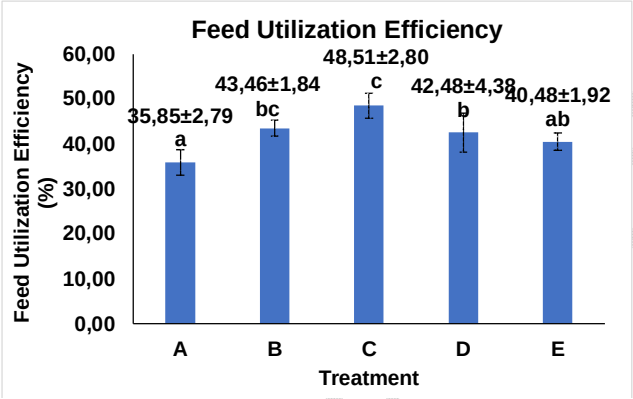


Figure 6. Graph of Feed Utilization Efficiency

The efficiency of feed utilization obtained during the maintenance of mangrove crabs (*Scylla serrata*) gave significantly different results where the highest value was obtained in treatment C (48.51 ± 2.80 c) and the lowest in treatment A (35.85 ± 2.79 a). The results obtained are still within the normal range of mangrove crab EPP. In line with the research of [16]which obtained the results of mangrove crab EPP ranging from 22.05-63.49%. This proves that treatment C is the best treatment because the higher the protein efficiency value of a feed means the more efficient the use of feed protein in supporting growth. According to [17]that the high value of feed utilization efficiency is also influenced by the quality of protein in the feed, and the quality of feed protein is influenced by its source of origin and by its amino acid content. In addition, mulberry leaf flour in feed can affect the level of digestibility of the feed given. According to [5]feed added with horman*ekdisteroid* is highly preferred by crabs so that it can increase their appetite and can accelerate their growth and can increase the efficiency of crab feed utilization.

### 3.6 Survival Rate

` The results of the analysis show that the survival rate of mangrove crabs obtained is 100% as can be seen in Figure 7.

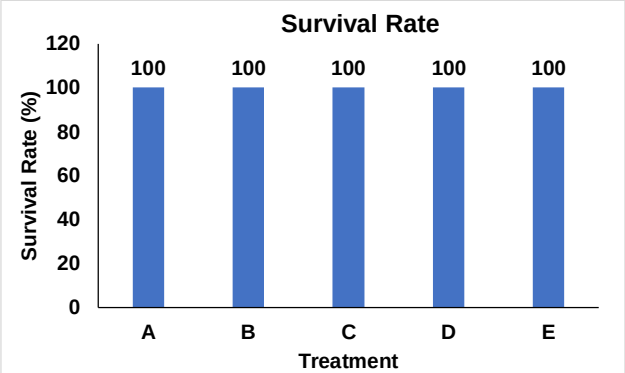

Figure 7. Survival rate graph (SR)

*Survival rate* is an important parameter in mangrove crab (*Scylla serrata*) cultivation. Based on the results of the research conducted, it shows that the addition of mulberry leaf flour can increase the survival rate of mangrove crabs,wherethe survival rate obtained is very good, namely 100% in all treatments. This high survival rate is in line with the research of [18]explaining that maintenance with a single system can increase crab survival to 100% because crabs are protected from cannibalism and the maintenance system used is an apartment system with the use of recirculation or RAS which also contributes to the high survival rate.

**3.7 Hemocytes**

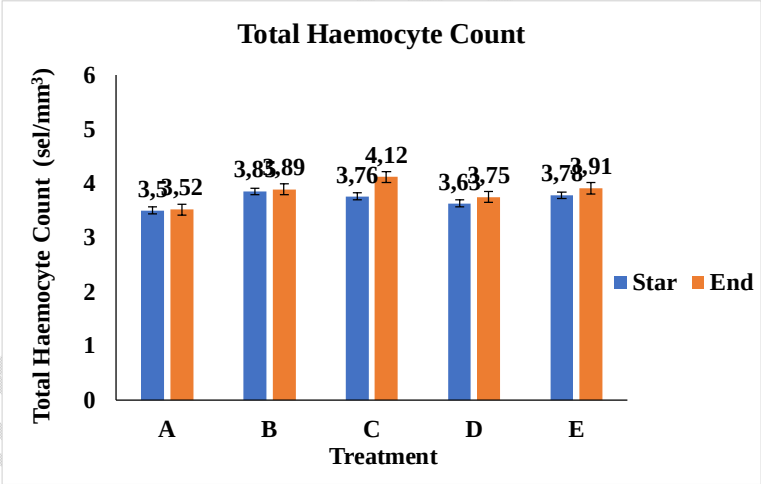

Figure 8. Total Haemocyte Count

Table 1. Diferential Haemocyte Count

| Treatment | Diferential Haemocyte Count (%) | | | | | |
|---|---|---|---|---|---|---|
| | Star | | | End | | |
| | Hialin | Granulosit | Semi granulosit | Hialin | Granulosit | Semi granulosit |
| A | 35 | 36 | 29 | 34 | 39 | 27 |
| B | 46 | 34 | 20 | 38 | 42 | 20 |
| C | 37 | 37 | 26 | 41 | 37 | 30 |
| D | 47 | 30 | 23 | 48 | 31 | 21 |
| E | 37 | 38 | 25 | 43 | 35 | 22 |

It can be concluded that the value is still within the normal range of crab THC. In line with the research of Hastuti et al. (2019), which obtained the results of *total haemocyte count of* mangrove crabs, which ranged from $3.48\times10^6$- $6.35\times10^6$ cells/$mm^3$. And in Table 1. the *differential haemocyte count* value obtained at the beginning of maintenance is hyaline ranging from 35-47%, granulocytes ranging from 30-38%, and semi granulocytes 20-29% and at the end of maintenance is hyaline ranging from 38-48%, granulocytes ranging from 31-48%, and semi granulocytes 20-30%. This haemocyte observation is very important to do to determine the level of crab resistance to disease attack and as one of the parameters of stress response. Wherestress is an adaptation to physiological changes resulting from various environmental stresses. Mulberry leaves have an important role in reducing stress in crabs. Mulberry leaves contain *ecdysteroids* that can minimize stress levels due to their ability as *adaptogens*. According to [12] mulberry leaves are *adaptogenic*, *antimutagenic*, *hypocholesterolemic*, immunostimulating, nutritional, and stamina enhancers. In this case mulberry leaves play an important role in maintaining immunostimulants and adaptogens can increase the body's resistance to stress and can prevent fatigue and increase energy.

### 3.8 Water Quality

The water quality obtained during the rearing period of mangrove crabs (*Scylla serrata*) is in the normal range that can support the survival rate and growth of mangrove crabs.

Table 2. Water Quality

| Parameters | Obtained Range | Ideal Range | Reference |
|---|---|---|---|
| DO | 5,2-63 | >5 | [19] |
| pH | 7,02-7,04 | 7,0-9,0 | [19] |
| Salinity | 22-25 | 10-25 | [19] |
| Temperature | 27,4-28,8 | 25-35 | [19] |

Water is a living medium for aquatic organisms, when viewed from a physical perspective, water is a living space that provides space for biota. Water quality is a crucial factor in mangrove crab (*Scylla serrata*) aquaculture, affecting growth, survival, and molting. Water quality parameters that support the growth of mangrove crabs include dissolved oxygen, temperature, salinity, and pH. Water quality measured during the study, such as temperature (27.4-28.8°C), salinity (22-25 ppt), and pH (7.02-7.04) and DO (5.2-6.3 ppm) values are still within the appropriate range for the growth and survival of mangrove crabs. This is in accordance with the findings of that the [19]optimum range of values for salinity is 10-25 ppt, optimum DO > 5 ppm, temperature 25-35 °C, pH 7.0-9.0. Optimal salinity can help the growth and osmoregulation process in crabs.

## 4. Conclusion

The conclusion of the research that has been done is the addition of mulberry leaf flour to mangrove crab feed, namely the best dose obtained in treatment C, namely 15% and has a significant effect on growth (absolute weight, absolute length, and *specific growth rate*) and survival rate of mangrove crabs.

**CONSENT**

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal

**ETHICAL APPROVAL**

Principles of laboratory animal care" (SNI 9057-3:2023) were followed, as well as specific national laws where applicable. All experiments have been examined and approved by the appropriate ethics committee.

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