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# Study of the Utilization of Broiler Chicken Waste on the Molting Speed of Mud Crabs (*Scylla* spp.)

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## ABSTRACT

One strategy to increase diversity and add value in mangrove crab cultivation is the production of soft shell crabs. Feed plays a crucial role, serving as a source of energy and supporting body maintenance, growth, and reproduction. This study aims to examine the effect of broiler chicken waste on the molting speed of mud crabs (*Scylla* spp.). The research was conducted at the Aquaculture Laboratory, Faculty of Fisheries and Marine Sciences, Indonesian Muslim University, from August to September 2023. The experiment was designed as a completely randomized design (CRD) with three treatments, each consisting of four replications: Treatment A (chicken head), Treatment B (chicken intestines), and Treatment C (chicken skin), all administered at 9% of the crab's body weight. The results showed that broiler chicken waste had no effect on survival but significantly influenced growth and the number of molting crabs, with chicken intestinal waste producing the highest number of molting crabs. Therefore, it is recommended that farmers use chicken intestines as supplemental feed at approximately 9% of the crab's body weight to accelerate molting and increase production value, without negatively affecting survival.

## INTRODUCTION

Mangrove crab (*Scylla* spp.) is one of the important fishery commodities in Indonesia since the early 1980s **(Wijaya *et al.*, 2010)**. In 2008, mangrove crab production reached 26,628 tons and increased by 7.32% in 2012 with a volume reaching 33,910 tons **(KKP, 2012)**. The deliciousness and high nutritional value, place mangrove crab as an exclusive type of seafood with a fairly expensive price **(Syahrulla, 2013)**. This has implications for the urgent demand for the development of intensive mangrove crab cultivation **(Adha, 2015)**. One alternative to increase diversity and added value for mangrove crab cultivation is cultivation by producing mangrove crabs with soft carapaces (Soft shell crabs). External factors that affect molting include water quality and the type of feed consumed **(Adha, 2015)**. These factors will affect the brain and stimulate the Yorgan to produce Ecdysteroid or molting hormone **(Fujaya, 2011)**. Feed is one of the requirements that must be met to achieve maximum production in mangrove crab cultivation. The feed must be handled seriously, both in terms of its provision, processing, nutritional content, and consideration of whether or not it is in accordance with the eating habits of mangrove crabs **(Fujaya, 2012)**. This study uses chicken heads, chicken intestines, and chicken skin as feed for mangrove crab cultivation because these materials are relatively inexpensive and less competitive with human consumption. The aim of the study is to determine the effect of chicken waste on the molting speed of mangrove crabs (*Scylla* spp.). The novelty of this research lies in its focus on waste-based feed, whereas previous studies have primarily explored trash fish, shellfish, or commercial feeds. This approach offers an innovative strategy to support soft-shell crab production, which has not yet been widely optimized in mangrove crab cultivation practices.

## MATERIALS AND METHODS

This research was conducted from August to November 2023 at the Tambak Faculty of Fisheries and Marine Sciences, Muslim University of Indonesia. The test animals used were mangrove crabs (*Scylla* spp.) with an average weight of 100g. Each cage was stocked with 1 crab. The feed used was chicken head waste, chicken intestines and chicken skin with a dose of 9% of the crab's body weight which is given twice a day, namely at 06.00 and 18.00. The container used was a plastic basket with a top diameter of 24cm, a base diameter of 16cm and height 26cm totaling 60 units. The study was designed in a completely randomized design (CRD) with 3 treatments and each treatment consisted of 4 replications, namely treatment A (Chicken head), B (Chicken intestine), C (Chicken skin) with a dose of 9% of body weight. Since the objective of the study was to determine whether the type of chicken waste affected molting, an analysis of variance (ANOVA) was used to test for differences in effects between treatments.

### Observed variables

### 1. Survival

Survival was calculated using the formula of **Manuputty (2014)** as follows:

$$SR = Nt / No \times 100$$

SR = Survival of mangrove crabs (%)
Nt = Number of crabs at the end of the study (ind)
No = Number of crabs at the beginning of the study (ind)

### 2. Carapace Width Growth

Carapace width growth was calculated according to the formula of **Manuputty (2014)** as follows:

$$LK = LKt – LKo$$

$\Delta LK$ = Increase in carapace width (cm)
LKt = Average carapace width at the end of the study (cm)
LKo = Average carapace width at the beginning of the study (cm)

### 3. Absolute weight growth

Absolute body weight growth was calculated using the formula of **Manuputty (2014)** as follows:

$$\Delta BW = BWt - BWo$$

$\Delta BW$ = Absolute body weight growth (g)
BWt = Average body weight growth at the end of the study (g)
BWo = Average body weight growth at the beginning of the study (g)

### 4. Specific weight growth rate

Daily specific weight growth (SGR) was calculated using the formula of **Manuputty (2014)** as follows:

$$SGR = (\ln wt – \ln wo / t) \times 100\%$$

SGR = Daily specific weight growth rate (%/day)
wt = Average weight of crabs at the end of the study (g)
wo = Average weight of crabs at the beginning of the study (g)
t = Maintenance period (days)

### 5. Molting percentage

The percentage of molting mangrove crabs during maintenance is calculated using the formula of **Fujaya (2012)** as follows:

$$Mt/Mo \times 100\%$$

M = Molting percentage (%)
Mt = Number of molting mangrove crabs (ind)
Mo = Total number of mangrove crabs (ind)

### 6. Water quality measurement

During the study, several physical and chemical parameters of water were measured including temperature, salinity, pH and dissolved oxygen.

# RESULTS

## Survival

The survival of mangrove crabs (*Scylla* spp.) fed with broiler chicken waste is presented in Fig. (1).

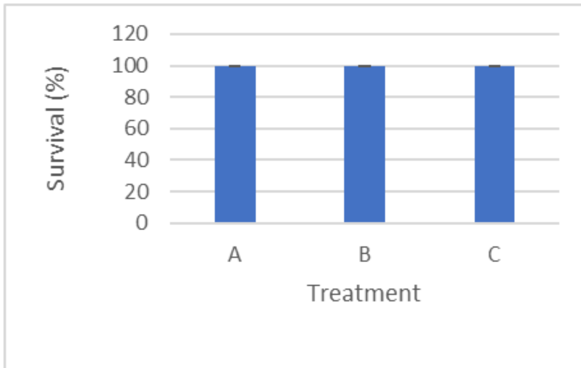


**Fig. 1.** Survival of mangrove crabs (*Scylla* spp.) in various treatments

## Carapace width growth

The growth of carapace width of mangrove crabs (*Scylla* spp.) fed chicken waste is presented in Fig. (2).

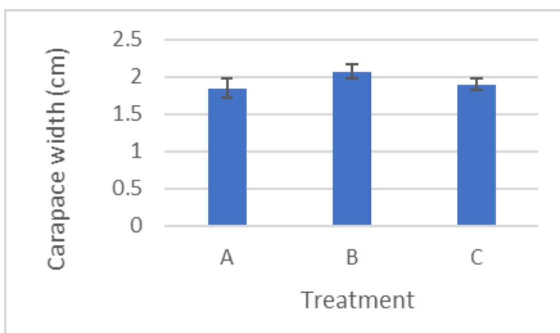


**Fig. 2.** Growth of mangrove crab *(Scylla* spp.) carapace width in various treatments

## Absolute weight growth

The absolute weight growth of mangrove crabs (*Scylla* spp.) fed with chicken waste is presented in Fig. (3).

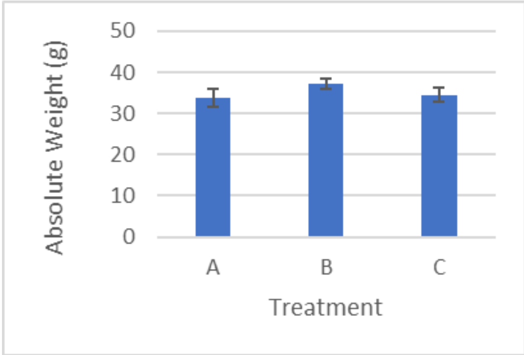


**Fig. 3.** Absolute weight growth of mangrove crab (*Scilla* spp.) in various treatments

**Specific weight growth rate**

The specific weight growth of mangrove crab (*Scylla* spp.) fed with chicken waste is presented in Fig. (4).

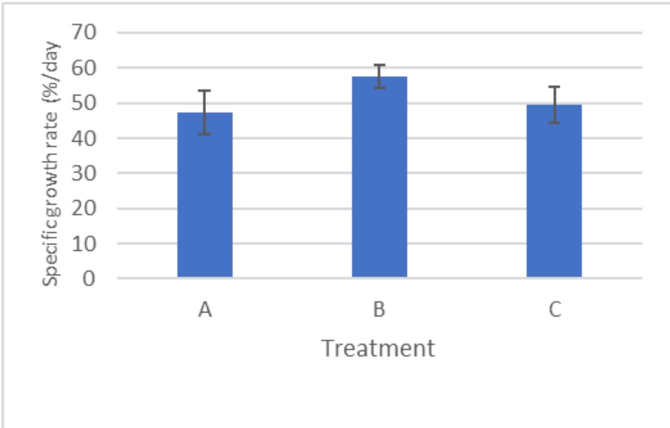


**Fig. 4.** Specific growth rate in various treatments

**Moulting**

The absolute weight growth of mangrove crabs (*Scylla* spp.) fed with chicken waste is presented in Fig. (5).

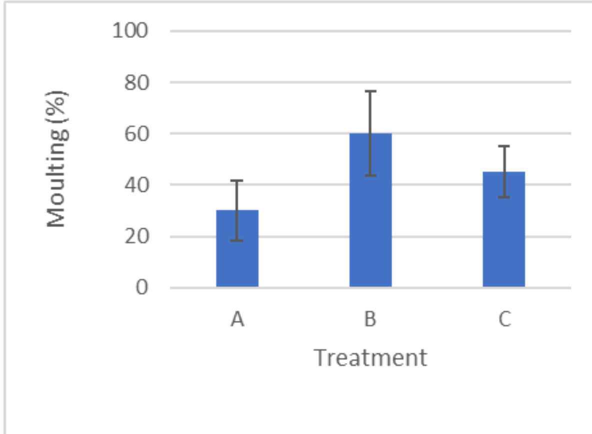


**Fig. 5.** Molting in various treatments

## Water quality

The molting growth of mangrove crabs is greatly influenced by water quality. Water quality is one of the important parameters in this study that affects the growth and survival of mangrove crabs, thus in this study water quality measurements were carried out every day. The parameters measured were salinity, temperature, pH and dissolved oxygen content (Table 1).

**Table 1.** Results of measuring water quality parameters for mangrove crab maintenance media

| Week | Water quality parameters | Range unit | Optimal |
|---|---|---|---|
| I | | | |
| Temperature | 25-30°C | 26-32°C | (Kumlu & Kir, 2005) |
| Salinity | 26-28 ppt | 16-34 ppt | (Karim, 2013) |
| pH | 7-8 | 7,2-7,8 | (Fujaya *et al.*, 2012) |
| DO | 5-6 ppm | 5-6 ppm | (Gunarto *et al.*, 2015) |
| II | | | |
| Temperature | 29-33°C | 26-32°C | (Kumlu & Kir, 2005) |
| Salinity | 25-30 ppt | 16-34 ppt | (Karim, 2013) |
| pH | 7-8 | 7,2-7,8 | (Fujaya *et al.*, 2012) |
| DO | 5-6 ppm | 5-6 ppm | (Gunarto *et al.*, 2015) |

| | | | |
|---|---|---|---|
| III | | | |
| Temperature | 28-35$^o$C | 26-32$^o$C | (Kumlu & Kir, 2005) |
| Salinity | 25-28 ppt | 16-34 ppt | (Karim, 2013) |
| pH | 7-8 | 7,2-7,8 | (Fujaya *et al.*, 2012) |
| DO | 5-6 ppm | 5-6 ppm | (Gunarto *et al.*, 2015) |

## DISCUSSION

Based on Fig. (1), the survival rate in all treatments reached 100%. This indicates that the three types of chicken waste provided nutritional content in accordance with the requirements of mangrove crabs. Additional contributing factors include prior acclimatization, the absence of cannibalism, good water quality, and feed provided according to the daily needs of the crabs. This is consistent with **Susanto *et al.* (2012)**, who reported that high survival rates result from adequate feed, suitable water quality, and the crabs' ability to utilize available space. **Fujaya *et al.* (2012)** also noted that crab survival is influenced by cannibalism, competition, and environmental factors such as water and soil quality. A recent study by **Arifin *et al.* (2025)** in the Egyptian Journal of Aquatic Biology and Fisheries found that battery-cage (individual housing) systems for mud crabs (*Scylla* spp.) achieved survival rates of up to 100% across all treatments, as individual housing significantly reduces competition and cannibalism. Comprehensive reviews indicate that water quality parameters and adequate feeding are key determinants of crab growth, health, and survival.

Analysis of variance (ANOVA) showed that chicken waste significantly affected the width of the mangrove crab carapace ($P < 0.05$). Duncan's test indicated that Treatment B (chicken intestines) produced a significantly greater increase in carapace width (2.075cm) compared to Treatments A (chicken heads, 1.85cm) and C (chicken skin, 1.90cm), which were not significantly different from each other. Chicken intestines contain higher protein levels (53.1%) than chicken heads (14.52%) and skin (17.14%), along with easily digestible nutrients, moderate fat content for energy during molting, and minerals essential for carapace hardening and tissue formation. Consequently, crabs fed chicken intestines exhibited more optimal molting and carapace development. Growth in mangrove crabs is influenced by feed quality and quantity, feeding method and frequency, initial weight, density, disease, genetics, and water quality **(Cholik *et al.*, 2005; Hamka *et al.*, 2005; Affandi *et al.*, 2009)**. The highest absolute weight gain was observed in Treatment B (37.25 g, 57.50% specific growth rate), followed by Treatment C (34.50 g, 49.50%), and the lowest in Treatment A (33.75 g, 47.25%). High-protein feeds support growth, tissue repair, enzyme and hormone formation, and energy for molting, whereas insufficient energy can lead to protein being catabolized for energy, reducing growth **(Buwono, 2000; Fujaya, 2011)**.

Chicken waste also significantly affected the molting rate of mangrove crabs. Treatment B achieved the highest molting percentage at 60%, followed by Treatment C at 45% and Treatment A at 35%. This is consistent with the protein content of chicken intestines meeting the crabs' requirements (34–54%) for initiating molting **(Anderson *et al.*, 2004)**. Molting is influenced by internal factors such as age, sex, and nutritional status, as well as external factors including salinity and temperature **(Koo *et al.*, 2005; Karim, 2007)**. The observed results indicate that under optimal environmental conditions, feed nutrition was the most critical factor determining molting success.

The relationship between molting and growth is well-established. During molting, crabs absorb water, expanding their body size before the new carapace hardens, which contributes to growth **(Hudita *et al.*, 2020)**. Thus, the higher frequency of molting in Treatment B explains its superior growth performance.

Water quality parameters measured during the study were temperature, pH, salinity, dissolved oxygen (DO), and ammonia (Table 1). Temperature ranged between 25–35°C, within the optimal range of 23–32°C for mangrove crab growth **(Rusmiyati, 2011)**. Salinity was 25– 30ppt, suitable for crab cultivation **(Karim, 2013)**, with variations influenced by water circulation, evaporation, rainfall, and river flow **(Sagala *et al.*, 2013)**. pH ranged from 7–8, consistent with the optimal 7.2–7.8 **(Fujaya *et al.*, 2012)**, supporting biochemical reactions and chitin synthesis. DO ranged from 5– 6mg/ L, within the 4– 7mg/ L recommended for crabs **(Nurdin, 2010; Gunarto *et al.*, 2015)**.

Each water quality parameter directly correlates with molting and growth. Optimal temperature maintains metabolic and enzyme activity, including ecdysteroid hormone function, while extreme temperatures reduce molting rate and increase mortality risk. Salinity affects osmoregulation, where optimal levels minimize energy expenditure and allow more energy to support molting and growth. Stable pH ensures efficient nutrient absorption, while sufficient DO provides energy for the energy-intensive molting process, supporting tissue development and preventing hypoxia.

## CONCLUSION

Provision of chicken waste did not affect survival but significantly influenced growth and the number of molting mangrove crabs, with chicken intestine waste producing the highest number of molts.

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## REFERENCES

**Adha, M**. (2015). Analysis of Abundance of Mangrove Crabs (*Scylla* spp.) in the Mangrove Area of Dukuh Senik, Bedono Village, Sayung District, Demak Regency. Thesis. Walisongo State Islamic University. Semarang.

**Affandi, R.; Sjafei, D.S.; Rahardjo, M.F and Sulistiono**. (2009). Fish Physiology: Digestion and Food Absorption. IPB Press. Bogor. 240 pp.

**Anderson, A.; Mather, P. and Richardson.** (2004). Nutrition of the mud Crab *Scylla serrata* (forskal). in Proceeding of Crab Aquaculture in Australia and Southeast Asia. Alla and D. Fielder (editors):57.

**Arifin, M.Z.; Widodo, C.; Pramono, A.I.N.; Sudiarsa, Z.; Usman, P. N.; Rizky*, D. A.; Fatahillah, M.L. and Vana.** (2025). Sustainable Mud Crab Aquaculture Using Individual Battery Cage Systems in Silvofishery Ponds. *Egyptian Journal of Aquatic Biology & Fisheries.* Zoology Department, Faculty of Science, Ain Shams University, Cairo, Egypt. ISSN 1110 – 6131 Vol. 29(3): 2721 – 2737 (2025)

**Buwono, I.** (2000). Essential Amino Acid Requirements in Fish Rations. Kanisius.Yogyakarta. 52 pp.

**Catacutan, M. R.** (2002). Growth and body composition of mud crab (*Scylla serrata*) fed formulated diet and fresh *trash fish*. *Asian Fisheries Science*, 15, 191–200.

**Cholik, F.** (2005). Review of Mud Crab Culture Research in Indonesia, Central Research Institute for Fisheries, PO Box 6650 Slipi, Jakarta, Indonesia, 310CRA.

**Fujaya, Y.** (2011). Growth and Molting Of Mud Crabs Given Vitomolt With Different Doses. Indonesian Aquaculture Journal, Fisheries Department, Faculty of Marine Sciences and Fisheries, Hasanuddin University Makassar 10(1): 24-28.

**Fujaya, Y.; Aslamiyah, S. and Alam, N.** (2012). Soft Crab Cultivation and Business, Brilliant International, Surabaya, 114 pages.

**Gunarto, G.; Herlina, H. and Parenrengi, A.** (2015). Technical Instructions for Mangrove Crab Seeding (*Scylla* sp). Ministry of Marine Affairs and Fisheries BPPBAP Maros.

**Hamka.; Kusumawati, D.S.; Bahri, S. and Ibrahim.** (2005). Use of commercial shrimp feed in the nursery of tiger brittle seeds (*Epinephelus fuscoguttatus*). Collection of papers from the meeting of cross-UPT brackish and marine. Directorate General of Culture. Jakarta.

**Holme, M. H.; Southgate, P. C. and Stroud, G. J. (2009).** Growth and survival of mud crab (*Scylla serrata*) megalopa fed natural *shellfish* diets versus commercial feeds. *Aquaculture Research*, 40(11), 1256–1264.

**Hudita, K.; Agustono, A. and Lokapirnasari, W.P.** (2020). Addition of Crude Fish Oil (CFO) to Feed on Growth and Feed Conversion Ratio of Mutilated and Unmutilated Mutilated Mangrove Crabs.

**Kamal, D. and Mustapha, S. (2018).** Utilization of animal by-product diets for the growth performance of mud crab (*Scylla olivacea*). *International Journal of Fisheries and Aquatic Studies*, 6(2), 128–133.

**Karim, M.Y.** (2007). Molting Phenomenon of Mutilated and Unmutilated Mutilated Mangrove Crabs, Torani, Journal of Marine and Fisheries Science, Hasanuddian University, Makassar.

**Karim, M.Y.** (2013). Growth Performance of Female Mutilated Crabs (*Scylla serrata*) in Various Media Salinities and Their Evaluation at Optimum Salinity with Different Feed Protein Contents [Dissertation], Postgraduate School, Bogor Agricultural University.

**Ministry of Marine Affairs and Fisheries.** (2012). Marine and Fisheries Statistics Book. Data, Statistics and Information Center, Secretariat General of the Ministry of Marine Affairs and Fisheries, Jakarta. 319 pages.

**Koo, J.G.; Kim, S.G.; Jee, J.J.; Kim, J.M.; Bai, S.C. and Kang, J.C.** (2005). Effect of ammonia and nitrite on survival, growth, and molting in juveniles tiger crab, *Orithyia sinica* (Linnaeus). Aqua. Res. 36: 79-85.

**Kumlu, M.; Kir, M**. (2005). Food consumption, molting and survival of *Penaeus semiculatus* during overwintering. Aqua Res 36: 137-143

**Manuputty, G.D.** (2014). Proximate of artificial feed and *Sardinella* sp. for fattening mangrove crab *Scylla serrata*. Chimica et Natura Acta. 2(3): 173-179.

**Nurdin, M. and Armando, R.** (2010). Fast way to harvest soft shell crab and egg crab. Jakarta: Penebar Swadaya.

**Paital, B. and Chainy, G. B. N. (2013).** Effects of temperature on oxidative stress and metabolic rate in crustaceans. *Journal of Thermal Biology*, 38, 24–31

**Rangka, N.A.** (2010). Status of mangrove crab business reviewed from the aspect of opportunities and prospects. Journal of Neptunus, 14(1): 90-100.

**Romano, N. and Zeng, C. (2012).** Osmoregulation in decapod crustaceans: implications to aquaculture productivity. *Reviews in Aquaculture*, 4, 1–24

**Rosa, R. and Nunes, M. L. (2004).** Nutritional quality of red shrimp (*Aristeus antennatus*) supplemented diets and its effect on growth and metabolism. *Aquaculture Nutrition*, 10, 223–230.

**Rusmiyati, S.** (2011). Successful Cultivation of Soka Crab and Egg Crab. Pustaka Baru Press, Yogyakarta. 136 pp.

**Sagala, L.S.S.; Idris, M. and Ibrahim, M.N.** (2013). Comparison of Growth of Male and Female Mangrove Crab (*Scylla serrata*) in the Basic Confinement Method. J. Mina Laut Indonesia. 3(12):46-54.

**Suprayudi, M.A. *et al.* (2012).** Evaluation of commercial feeds for juvenile mud crab (*Scylla paramamosain*). *Jurnal Akuakultur Indonesia*, 11(1), 50–58.

**Susanto, A. and Irnawati, R.** (2012). Use of Escape Gap in Folding Mangrove Crab Traps (Laboratory Scale). Journal of Fisheries and Marine. Department of Fisheries, Faculty of Agriculture, Sultan Ageng Tirtayasa University. Banten. Vol 2 (2): 71-78

**Syahrulla, L**. (2013). Morphological Structure of Mangrove Crab *(Scylla* sp). Triton Journal 5(1): 11-21.

**Tuan, V. A. and Ngoc, N. B. (2010).** Effects of different feeds on growth and survival of mud crab (*Scylla paramamosain*) in nursery rearing. *Journal of Science and Development*, 8(3), 371–376.

**Verberk, W. C. E. P. (2011).** Oxygen supply in aquatic ectotherms: effects of temperature and oxygen availability on metabolic performance. *Philosophical Transactions of the Royal Society B*, 366, 1966–1979

**Wijaya, N.I.; Yulianda, F.; Boer, M. and Juwana, S.** (2010). Population Biology of Mud Crab *(Scylla serrata*) in Mangrove Habitat of Kutai National Park, East Kutai Regency. Indonesian Journal of Oceanology and Limnology 36(3): 443-461.

**Williams, M. J. (2007).** *Penaeid shrimp nutrition*. In: D'Abramo, L. R. *et al.* (Eds.), *Crustacean Nutrition*. World Aquaculture Society