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Status biologis populasi rajungan (*Portunus pelagicus*) di Perairan Aceh Timur [Biological status of blue swimming crab population (*Portunus pelagicus*) in East Aceh]

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ABSTRACT | There are many factors such as high market demand, both for local consumption and export, as well as favorable prices that encourage the exploitation of crab in East Aceh waters. Therefore, appropriate management efforts are needed in order to preserve the life of blue swimming crab. Evaluation of the biological aspects of the blue swimming crab population in East Aceh waters has a major role in drafting regulations. This study aims to determine the biology of the blue swimming crab population in the waters of East Aceh. This research was conducted in June 2024 in the waters of East Aceh. The method used was survey method. Blue swimming crab samples were taken randomly from crab fishermen as much as 10% of the catch. Sampling once a week at 2 different locations for 1 month. The results showed that the relationship between carapace width and weight of male and female blue swimming crab (*Portunus pelagicus*) had a negative allometric growth pattern because the value of b < 3, namely 1.65. The sex ratio of blue swimming crab is not 1:1 or unbalanced. Male blue swimming crab gonad maturity is mostly at level I, while females can reach gonad maturity at level II.

Key words | Blue swimming crab, biology, East Aceh

ABSTRAK | Terdapat banyak faktor seperti permintaan pasar yang tinggi, baik untuk konsumsi lokal maupun ekspor, serta harga yang menguntungkan mendorong eksploitasi rajungan di perairan Aceh Timur. Oleh karena itu, diperlukan berbagai upaya pengelolaan yang tepat agar dapat menjaga kelestarian hidup dari rajungan. Evaluasi aspek biologi populasi rajungan di perairan Aceh Timur memiliki peran utama dalam penyusunan peraturan. Penelitian ini bertujuan untuk mengetahui biologi populasi rajungan di perairan Aceh Timur. Penelitian ini dilaksanakan pada bulan Juni 2024 di perairan Aceh Timur. Metode yang digunakan adalah metode survei. Sampel rajungan diambil secara acak dari nelayan rajungan sebanyak 10% hasil tangkapan. Pengambilan sampel seminggu sekali di 2 titik lokasi berbeda selama 1 bulan. Hasil penelitian menunjukkan bahwa hubungan antara lebar karapas dan bobot rajungan (*Portunus pelagicus*) jantan dan betina memiliki pola pertumbuhan alometrik negatif karena nilai b < 3 yaitu 1,65. Rasio jenis kelamin rajungan tidak 1:1 atau tidak seimbang. Kematangan gonad kepiting jantan paling banyak pada level I, sedangkan betina dapat mencapai kematangan gonad pada level II.

Kata kunci | Rajungan, status biologi, Aceh Timur

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INTRODUCTION

Blue swimming crab (*Portunus pelagicus*) is a highly valuable fishery commodity, both as a local and export commodity (Yanti *et al*., 2023). Blue swimming crab production in Indonesia ranks third after China and the Philippines, with a production value of 16.4% or 28,000 tons of all world production (Kembaren *et al*., 2016). The high market demand makes the current blue swimming crab resources experience survival pressure that leads to overexploitation due to increased wild catch efforts (Maryani *et al*., 2025), which causes a decrease in stock availability and productivity values (Hamid, 2019).

Blue swimming crabs are classified as animals that live on the seabed and swim near the surface of the sea to find food, so they are called swimming crabs or blue swimming crabs, which means swimming crabs (Safira *et al*., 2019). Blue swimming crab can live in waters with varying temperatures and salinities. In the fry stage (yuwana), blue swimming crab inhabits waters with lower salinity levels (estuaries), while when developing into adults they switch to waters with relatively high salinity (Kembaren *et al*., 2016). According to La Sara *et al.* (2016) the main habitat of blue swimming crab is in the coastal and coastal areas and likes substrates such as sandy and muddy, thus causing crabs to be directly utilized by fishermen who are in the coastal area and in coastal areas (Safira *et al*., 2019), one of which is the coastal community in East Aceh Regency.

Geographically, East Aceh Regency is located on the eastern side of Aceh, with an area of 6,040.60 km2 or 10.53% of the total area of Aceh Province (Risfandini, 2019). To the east, East Aceh District borders the city of Langsa while to the west it borders North Aceh. East Aceh District has extensive coastal areas inhabited by true and associated mangrove vegetation, with rich fisheries potential in the form of marine and inland fisheries (Kusuma *et al*., 2016).

The increasing demand for blue swimming crab automatically causes more intensive fishing activities, which certainly threatens the sustainability of existing crab resources (Kurnia and Boer, 2014). According to export data in 2020, crabs and blue swimming crab ranked 5th in the export volume of capture fisheries products at 27,616 tons (Maryani *et al.,* 2025), but the trend in export volume from 2016 to 2020 tends to show a decrease in export volume with a declined growth of -1.08% (Nuraini *et al*., 2023). This indicates a decrease in the catch of crab in nature which leads to overfishing.

Safira *et al*. (2019) revealed that if stock utilization exceeds the existing potential, it will threaten the sustainability of the stock. Moreover, the production needs of blue swimming crab aquaculture still rely on nature. Therefore, determining the biological status of blue swimming crab in East Aceh waters is important, as an initial step of countermeasures for the sustainability of blue swimming crab.

The morphological and reproductive performance of blue swimming crab in East Aceh waters needs to be studied as part of information on the biological status of blue swimming crab. This information certainly supports the structuring of commodity capture regulations. This was also stated by Maryani *et al.* (2025) that aspects of blue swimming crab biology including sex ratio, length-weight relationship, condition factor, maturity size, fecundity, and reproductive potential information are needed to ensure the sustainability of blue swimming crab potential in a particular area.

This study aimed to determine the biological status of blue swimming crab in East Aceh waters. Some aspects studied were sex ratio, carapace length and width relationship, body weight, gonad maturation, and fecundity of blue swimming crab.

MATERIAL AND METHODS

Location and time of research

This research was conducted in June 2024 and took place in the waters of East Aceh. The research was conducted for one month. Blue swimming crab sampling was carried out every 1 week at 2 different location points. Sampling locations were at 8 location points.

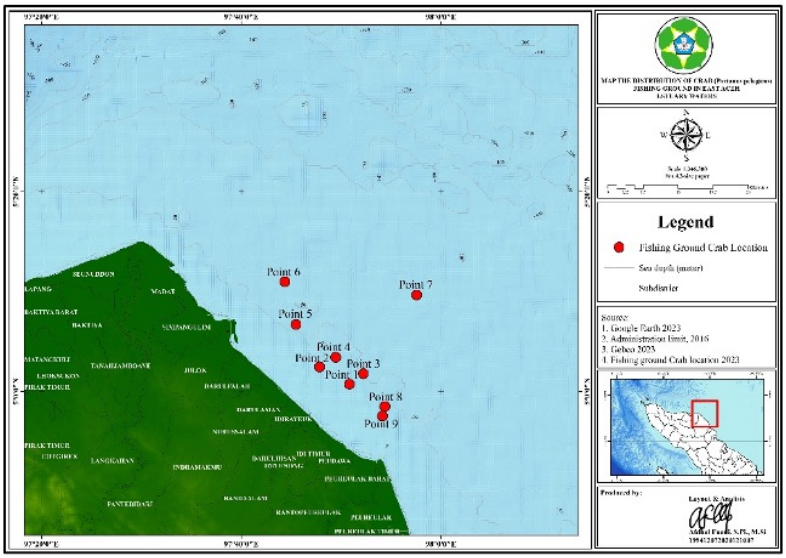

Figure 1. Sampling location points

Sampling Method

A total of 10% of the catch. Samples taken were observed, namely: sex ratio, carapace length and width, body weight, gonad maturity level, gonad maturity index, and fecundity.

Data analysis

Sex ratio

Observation of the sex ratio of blue swimming crab is done visually by looking at the morphology and secondary sex characteristics of blue swimming crab. Sexual characteristics can be seen from the color and shape of the abdomen on the crab. Then, the sex ratio was calculated by comparing the number of male and female blue swimming crab samples caught.

The sex ratio value is known by calculating the number of male and female blue swimming crab from all samples taken. Determination of the sex ratio balance is done through calculations using the X2 (Chi-squere) test as follows (Sari *et al*, 2024): $X^2=\sum$ (Oi-ei))/ei. Oi = Total frequency of males and females, ei = Expected number of males and females, k = Number of groups observed.

Carapace length and width

Carapace length and width (Figure 2) were measured using a caliper (accuracy 0.01 mm). Carapace length was measured from the anterior (eyes) to the posterior (belly) end. Carapace width was measured from the left side to the right side, i.e. from the tip of the longest lateral spine on the left side to the right side.

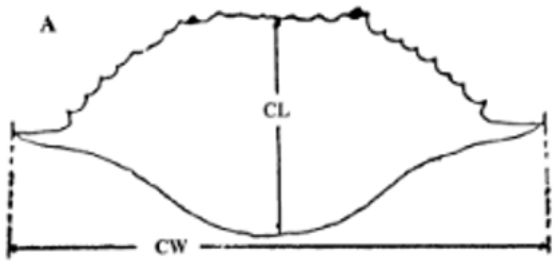

Figure 2. Measurement of length and width of crab. (Josileen, 2013)

Weight measurement

The weight of female blue swimming crab and eggs was measured using digital scales (with an accuracy of 0.01 g). The relationship between width and weight of crabs is described in two growth patterns, namely isometric and allometric. For both patterns, the equation used is (Effendi, 2002): Total weight of crab (W) = Regression constants (a) x Total width of crab (L) x Regression constants (b).

Gonad maturity level

Determination of the level of gonadal maturity in blue swimming crab is done by visual observation of the morphology of blue swimming crab gonads. Observations are made by looking at the color of male and female blue swimming crab gonads (Sari *et al*, 2024).

Gonad maturity index

The gonadal maturity index is the ratio of gonadal weight to body weight. The calculation of the gonadal maturity index uses the formula according to Effendi (2002) as follows: Index of gonadal maturity (IKG) = Weight of gonads (Bg) / Total body weight (Bt) x 100%.

Fecundity

Fecundity is the number of eggs produced by one female in one spawning period. The calculation of the fecundity value uses the following formula (Sari *et al*, 2024): F = Fecundity (F) = Number of egg samples (n) x Total egg weight (G) / Weight of egg samples.

RESULTS

Sex Ratio

Based on observations made on captured blue swimming crab, of the 52 blue swimming crabs observed among them are 30 male and 22 female blue swimming crabs. To make it easier to see the comparison of the number of male and female blue swimming crabs, a graph comparing the number of male and female blue swimming crabs (Figure 3).

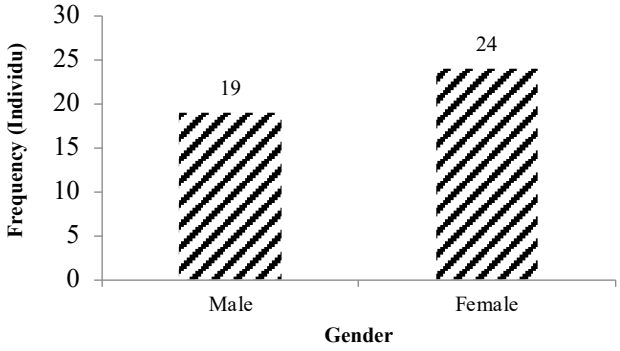

Figure 3. Number of male and Female blue swimming crab

Based on the graph of the number of male and female blue swimming crab above, it can be seen that male blue swimming crab are outnumber female blue swimming crab. Male found as many as 30 individuals with a percentage of 58% and female blue swimming crab found as many as 22 individuals with a percentage of 42% of the total 52 blue swimming crab that have been observed. Based on the results of the *Chi-Square* test obtained Xcount value of 15.523 and Xtable of 7.815. From these results indicate that Xcount > Xtable then it can be concluded that H_0 is rejected and H_1 is accepted.

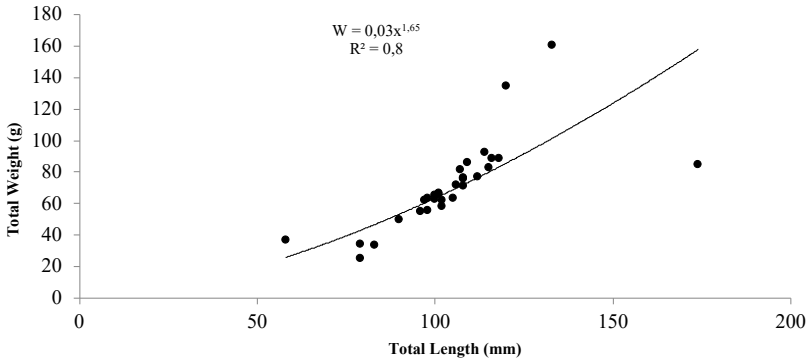

Figure 4. Correlation of carapace width and weight of male blue swimming crab

Relationship Between Carapace Width and Body Weight

The b value of the relationship between carapace width and weight of captured male blue swimming crab is 1.65, this value indicates that the value of b<3 **(**Figure 4). According to Effendi (2002), if the value of b<3, it is called a negative allometric growth pattern, where width growth is faster or dominant than weight growth. From the graphical pattern above, it can be seen that the width of the carapace and the weight of male blue swimming crab do not have a closeness with an R2 value of 0.8. This condition indicates that the increase in width value is faster than the increase in weight value.

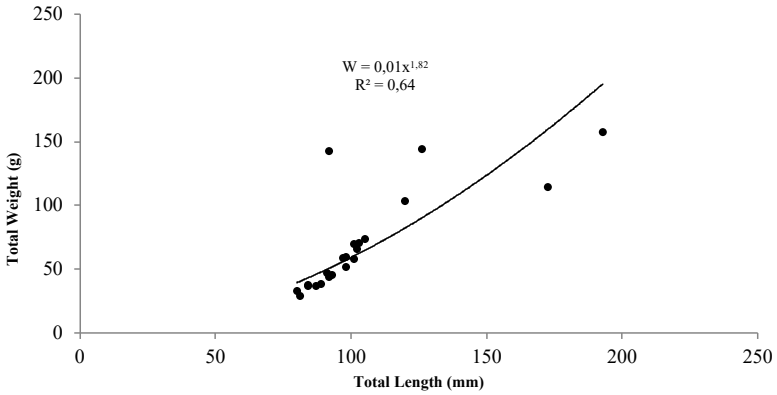

Figure 5. Relationship between carapace width and body weight of female blue swimming crab

Furthermore, the relationship between carapace width and weight of female blue swimming crab has a b value of 1.82 (Figure 5). The value of b in female blue swimming crab is higher than the value of b in male blue swimming crab. The value of b<3 indicates that the growth pattern of the female blue swimming crab population is negative allometric, where the growth of the width is faster than the weight. From the graphical pattern above, it can be seen that carapace width and weight of female blue swimming crab have no closeness with an R2 value of 0.64.

Gonad Maturity Rate (TKG)

The gonad maturity level of male blue swimming crab TKG I was 13 (43%), TKG II was 9 (30%), TKG III was 8 (27%). The level of gonad maturity that is most caught is TKG I (Figure 6).

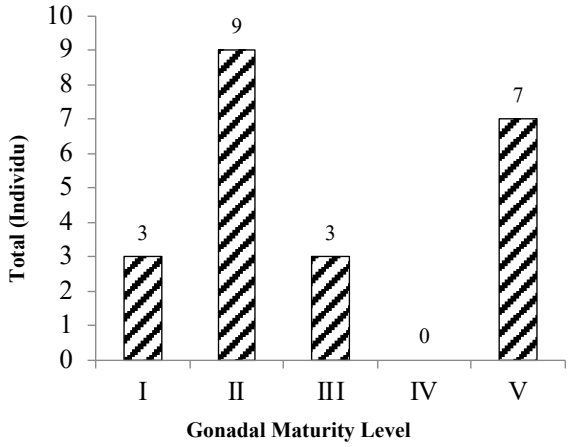

Figure 6. Male blue swimming crab gonad maturity level

The level of maturity of female blue swimming crab gonads TKG I as many as 3 individuals (14%), TKG II as many as 9 individuals (41%), TKG III as many as 3 individuals (14%), TKG V as many as 7 (32%). From the overall Gonad Maturity Level (TKG) of male and female blue swimming crabs, the results are obtained in TKG I as many as 16 individuals with a percentage of 31%, TKG II as many as 18 individuals with a percentage of 35%, TKG III as many as 11 individuals with a percentage of 21% and TKG V as many as 7 individuals with a percentage of 13% (Figure 7).

Gonad maturity index

Gonad Maturity Index (IKG) is the ratio of gonad weight to body weight. The IKG results of male and female blue swimming crabs (Table 1). The result of Gonad Maturity Index (IKG) of male blue swimming crab TKG I on 13 blue swimming crabs is 0.7242, TKG II on 9 blue swimming crabs is 1.0926%, TKG III on 8 blue swimming crabs is 0.7362%. While the results of the Gonad Maturity Index (IKG) of female blue swimming crab TKG I on 3 blue swimming crabs is 4.7241%, TKG II on 9 blue swimming crabs is 3.9201%, TKG III on 3 blue swimming crabs is 5.0312%, TKG V on 7 blue swimming crabs is 22.1909%.

Tabel 1. Male and female blue swimming crab gonad maturity indices

TKG	Male	Female
1	0,7242	4,7241
2	1,0926	3,9201
3	0,7362	5,0312
4	-	22,1909

Fecundity

Fecundity is the total number of eggs produced by an individual female in one spawning. The results of female blue swimming crab fecundity (Figure 8). The results of the fecundity of 7 female blue swimming crabs in this study with egg weights of 7.1-72.1 g, fecundity of 22,070 - 235,604 eggs, carapace width of 92-192.7 mm and body weight of 58.6-157.4 g.

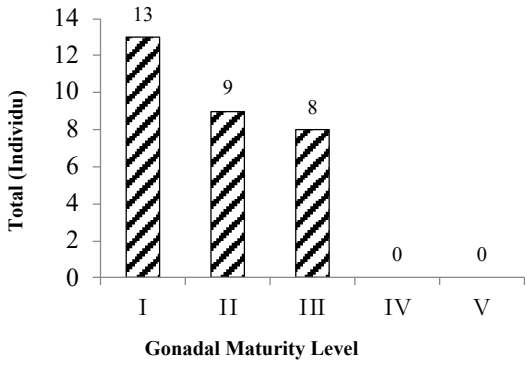

Figure 7. Female blue swimming crab gonad maturity level

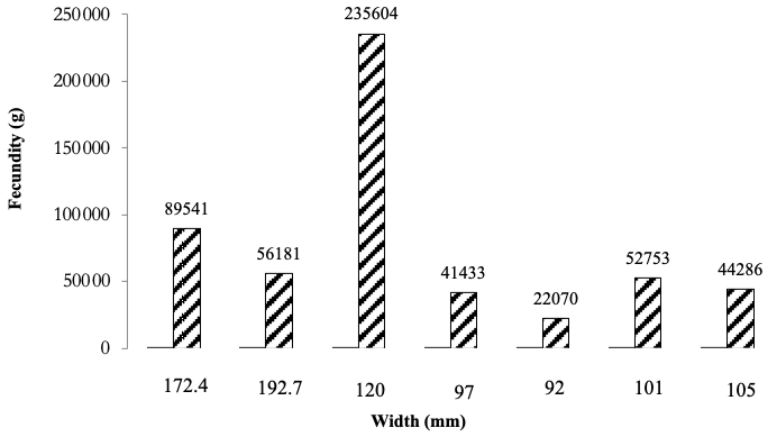

Figure 8. Female Crab Fecundity by Carapace Width

DISCUSSION

Sex ratio is the ratio of the number of male and female organisms. Observation of sex ratio is a very important factor because it can be used to obtain information related to the proportion of male and female blue swimming crabs in nature and can also determine the spawning ability of blue swimming crabs.

Based on the results of the study, the number of male and female blue swimming crabs in East Aceh waters is not balanced. More male blue swimming crabs (58%) than female blue swimming crabs (42%) were found in the waters. The difference in sex ratio between males and females can occur due to growth rate and recruitment. This is in accordance with the statement of Yanti *et al* (2023) that the factors causing differences in the ratio of males and females are biological factors such as growth rate, competition and mortality. On the other hand, Sari *et al.* (2024) mentioned that the imbalance in the proportion of sex ratio can be caused by extreme environmental conditions, such as salinity up to 50 ppt and temperatures ranging from 32-34°C in the dry season.

Male blue swimming crabs generally have a faster growth rate than females. Male blue swimming crabs that like to move to find food experience faster growth, while female blue swimming crabs when entering the spawning season are more silent (not actively moving) and save their energy for reproduction and migration to deeper waters with higher salinity (Nurdin *et al.,* 2022). The ratio between male and female blue swimming crabs caught still shows a good composition in these waters, this is because the availability of males can still fertilize more than one female blue swimming crab, and certainly supports the sustainability of the blue swimming crab population. As stated by Gumelar (2016) that the more the composition of female blue swimming crabs, the greater the level of eggs produced.

The population growth pattern of male blue swimming crabs is negative allometric, which means that the growth of carapace width is faster than body weight growth. Then, similar results are also shown by the growth pattern of male blue swimming crabs in the waters of East Aceh. According to Iksanti *et al.* (2022), the physiological situation in fish has an irreversible effect on various factors to determine the level of obesity. Then, according to Effendie (2002), if the value (b <3) or (b> 3), it is called an allometric growth pattern, where the value (b <3) is called negative allometric, which means that the growth of carapace width is greater than the growth of weight, while the value (b> 3) is called positive allometric, which indicates that weight growth is greater than carapace width, and if the value b = 3 is called an isometric growth pattern, which means carapace width growth with weight balanced.

The b parameter value for male blue swimming crab is higher than that of female blue swimming crabs. This means that male blue swimming crabs are heavier than female blue swimming crabs in these waters. According to Nurdin *et al.* (2022), the difference in b values indicates that male blue swimming crabs are larger than female blue swimming crabs. Lighter female blue swimming crabs can cause females to expend more energy for reproduction, while males use more energy for growth.

Of the overall levels of gonad maturity of male and female blue swimming crabs, the highest percentage of male blue swimming crabs is at gonad maturity level I. This is due to several factors, such as environmental conditions. According to Yanti *et al.* (2023), male blue swimming crabs prefer relatively shallow waters such as around coastal waters. While female blue swimming crabs are at gonad maturity level II. According to Romimohtarto (2005) blue swimming crabs head to deeper areas to face the spawning season which occurs throughout the year with peaks occurring in December, March, July and September.

Blue swimming crabs in the waters of East Aceh have a gonad maturity index of more than 20%, which means that the individual can lay eggs several times a year. Changes in the index value are closely related to the development stage of gamete cells and this value is also related to changes in the level of gonad maturity. Blue swimming crabs that have a gonad maturity index value of more than 20% can lay eggs several times a year (Yanti *et al*., 2023).

Another aspect of biological appearance is the fecundity of the blue swimming crab. The fecundity of 7 female blue swimming crabs with egg weights ranging from 7.1-72.1 grams, then the fecundity ranged from 22,070 - 235,604 eggs, while the carapace width varied in size from 92-192.7 mm and body weight reached 58.6-157.4 grams. Large female blue swimming crabs will produce many eggs, while small crabs will produce few eggs. Fecundity certainly has a relationship with the carapace width (L) and weight (W) of the blue swimming crab (Soundarapandian & Tamizhazhagan, 2009).

CONCLUSION

The sex ratio of blue swimming crabs in the waters of East Aceh is in an unbalanced proportion, where male blue swimming crabs are higher than females. Then, the correlation analysis of carapace width and blue swimming crab weight is classified as negative allometric. The gonad maturity of male blue swimming crabs is highest at level I, while females can reach gonad maturity at level II. Then the fecundity of female blue swimming crabs follows the size of the carapace width.

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