JPPIPA 10(10) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Reproductive Aspects of Blue Swimming Crab *(Portunus pelagicus)* Landed on the South End Coast of East Lombok

Lisnawati[1*], Karnan[1], Abdul Syukur[1]

[1] University of Mataram (Biology Education Study Program), Faculty Of Teacher Training and Education, Mataram, West Nusa Tenggara, Indonesia.

Received: August 9, 2024
Revised: September 16, 2024
Accepted: October 27, 2024
Published: October 31, 2024

Corresponding Author:
Lisnawati
yccygow@gmail.com

DOI: 10.29303/jppipa.v10i10.9097

Abstract: This study aims to describe aspects of the reproductive biology of a blue swimming crab *(Portunus pelagicus*) that landed at the southern end of the coast of East Lombok during the period November 2023 to April 2024. The study used a descriptive design with a quantitative approach to measure and analyze data through direct observation. Data included carapace width, body weight, gonad maturity stages, and gonad somatic index (GSI) of *P.pelagicus*. The results showed that the male *P.pelagicus* population was more dominant than females every month. *P.pelagicus* body weight varied, with significant increases in certain months caused by spawning. Analysis of the relationship between carapace width and body weight showed positive allometric growth, with b values of 3.17 for males and 3.10 for females, indicating that body weight gain was faster than carapace width. The maturity stages of the *P.pelagicus* gonads were mostly at stages I and II, with a few reaching stages III and IV. The average gonad maturity stages increased from 2.42% in November to a peak of 5,83 % in February, then decreased in the following months. The primary spawning time occurs from December to February, characterized by changes in gonad color and a decrease in the body weight of the *P. pelagicus* after spawning. Hopefully, this study's results can positively contribute to the sustainable management of crabs *(P. pelagicus)*.

Keywords: Gonad somatic index; Portunus pelagicus; Sex ratio; Sustainable fisheries

Introduction

Portunus pelagicus, also known as blue swimming crab (BSC), is a member of the phylum Crustacea and the Portunidae family. This species generally inhabits the bottom of tropical waters, especially in Southeast and East Asia, as well as the eastern Indian Ocean and western Pacific Ocean. *P.pelagicus* can be found from the intertidal zone to waters with a depth of 50 meters, especially in shallow waters with sandy substrates (Radifa et al., 2020). Blue swimming crabs are often found on sandy bottom substrates, sand beds, and muddy sand. Adult kingfishers migrate to the open sea or either side of the estuary mouth to spawn after reaching gonadal maturity (Kurnia & Boer, 2014; Webley et al., 2009).

Male blue swimming crabs *(P. pelagicus)* prefer waters with low salinity, so they are distributed around relatively shallow coastal waters. In contrast, female blue swimming crabs prefer high salinity, especially for spawning, so they are distributed in deeper waters (Kamrani et al., 2010). Blue swimming crabs *(P. pelagicus)* live by burying themselves in the sand in muddy coastal areas, mangrove forests, and around coral reefs. The blue swimming crab *(P. pelagicus)* has four spines in the eye and three spines on the upper arm. The abdomen is triangular (tapering in males and widening in females), reduced, and folded to the ventral side of the carapace (Anggoro et al., 2022; Baswantara et al., 2021).

Blue swimming crab (*P. pelagicus)* is a vital fishery product and Indonesia's mainstay commodity because market demand continues to increase yearly. In 2022, Indonesia's fisheries potential reached 1.22 million tons with a value of US$6.23 billion, an increase of 9.15% compared to 2021, which amounted to US$5.72 million. 29,177 tons of blue swimming crab were exported at US$484.23 million (KKP, 2022). The high economic value

How to Cite:
Lisnawati, L., Karnan, K., & Syukur, A. (2024). Reproductive Aspects of Blue Swimming Crab (Portunus pelagicus) Landed on the South End Coast of East Lombok. *Jurnal Penelitian Pendidikan IPA*, *10*(10), 7775–7783. https://doi.org/10.29303/jppipa.v10i10.9097

of blue swimming crab has led to increased harvesting, leading to overfishing. Intensive and less selective exploitation can disrupt the balance of the blue swimming crab population and reduce the potential stock of blue swimming crab resources in nature (Edi et al., 2018).

The Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia issued a policy and rules for catching blue swimming crabs stipulated in the Minister of Maritime Affairs and Fisheries Regulation Number 16/Permen-KP/2022. This regulation applies to all blue swimming crab catch areas in Indonesia. The regulation stipulates that the capture and release of *P. pelagicus* in the territory of the Republic of Indonesia can only be carried out provided that it is not in the condition of laying eggs visible on the outer abdomen, carapace width size above 10 cm and weight above 60 grams/individual (KKP, 2022).

East Lombok Regency has a water area of 1,074.33 km² and a coastal length of 220 km, which produces high fisheries potential. In 2018, fisheries production in East Lombok reached 21,840 tons (Dinas Kelautan dan Perikanan NTB, 2019). Ujung Bay in Jerowaru Sub-district is known to have significant fisheries potential, with almost the entire community of Ujung Hamlet working as fishermen. One of the main catches is *P. pelagicus*, with the possibility in WPP 573 to reach 659 tons/year (Dinas Kelautan dan Perikanan NTB, 2019). Continuous exploitation of blue swimming crabs without good management can lead to a decline in their population, affecting their availability in nature and the sustainability of future fishing(Hamid, 2015).

To preserve and sustain the management of blue swimming crabs, it is essential to understand aspects of their reproductive biology, especially the stage of gonad maturity. Knowledge of gonad maturity allows for proper timing of fishing so that blue swimming crabs can carry out the egg-hatching process and maintain their population. Information on sex ratio, gonadal maturity stage, gonadal somatic index, and spawning season is needed to sustain blue swimming crabs. Therefore, in-depth research on the biological aspects of blue swimming crab populations is required to support more rational management (Hamid, 2015). This study aims to describe aspects of the reproductive biology of a blue swimming crab *(P. pelagicus)* that landed at the southern end of the coast of East Lombok during the period November 2023 to April 2024.

Method

This research was conducted from November 2023 to April 2024 at Pantai Ujung, East Lombok, the largest blue-swimming crab landing center on the island of Lombok. The map of the research location is presented in Figure 1. The research used in this study was quantitative descriptive.

Figure 1. Sampling Location Map

The study population consisted of all blue swimming crabs *(P. pelagicus*) landed by fishermen on the coast of the southern tip of East Lombok. The sample in this study is a blue swimming crab *(P. pelagicus)*

landed by fishermen on the coast of the southern tip of East Lombok. Research variables included sex, body weight, carapace width, gonad maturity stage, and gonad weight.

Sampling is carried out once every month for six months using the purposive sampling method, where samples are taken randomly from fishermen's baskets by determining specific criteria such as the completeness of the limbs of the blue swimming crab *(P. pelagicus)*. Data was collected by weighing the body weight and gonads of blue swimming crabs, measuring carapace width, and observing gonad morphology to determine the gonad maturity stage. The gonadal somatic index of blue swimming crabs was determined based on the body weight and gonad weight of male and female blue swimming crabs. GSI is calculated based on the ratio of gonad weight to the total body weight of the blue swimming crab multiplied by one hundred (Hamid, 2015). With the Formula 1.

$$GSI\ (\%) = \frac{Wg\ (gr)}{W\ (gr)} \text{X}100 \quad (1)$$

Where:
GSI : Gonad Somatic Index
Wg : Gonad weight
W : Total body weight

The analysis of the relationship between carapace width and body weight aims to understand the growth pattern of blue swimming crabs *(P. pelagicus)* landed on the coast of Ujung East Lombok. The relationship between carapace width and body weight was analyzed using simple linear regression, using the following formula (Rosmawati, 2011).

$$W = a.L^b \quad (2)$$

Where:
W : Body Weight
L : Width of the Carapace
a and b : Constant

If the value of b = 3, the growth is isometric, that is, the increase in carapace width is balanced with the increase in body weight. If the value of b ≠ 3 indicates allometric growth, where the increase in carapace width is not balanced with the increase in body weight. Allometric growth is divided into two, namely positive allometric and negative allometric. If the value of b > 3, then the growth is positive allometric, which means that the increase in body weight is faster than the increase in carapace width, otherwise if the value of b < 3 is called negative allometric growth, meaning that the increase in carapace width is faster than the increase in body weight. In addition to the b value, the regression coefficient (R^2) is an important parameter. An R^2 value ≥ 0.80 indicates good regression, meaning the relationship between the two measured variables is very close (Hajjej et al., 2016).

Result and Discussion

Result

Data from research results on blue swimming crab samples *(P. pelagicus)* conducted from November 2023 to April 2024 on the coast of the southern tip of East Lombok show dynamic growth. Tables 1 and 2 present data on the number of samples, the average width of the carapace, and the body weight of the blue swimming crab *(P. pelagicus)* by gender.

Table 1. The Population of male blue swimming crabs landed on the South End Coast of East Lombok

No	Month	Males (Ind)	Carapace Width (mm/ind)	St. Dev	Body Weight (gr/ind)	St. Dev
1.	Nov	39	117.6	6.96	98.7 gr	30.0
2.	Dec	41	106.0	9.09	78.1 gr	35.9
3.	Jan	34	104.9	12.08	60.5 gr	17.5
4.	Feb	37	120.9	10.82	95.7 gr	20.5
5.	March	37	111.5	10.12	85.7 gr	34.3
6.	April	42	111.1	13.31	85.6 gr	25.6
Total		230				

Table 2. The population of female blue swimming crabs landed on the South End Coast of East Lombok

No	Month	Females (Ind)	Carapace Width (mm/ind)	St. Dev	Body Weight (gr/ind)	St. Dev
1.	Nov	37 Ind	112.89	6.96	72.08	18.48
2.	Dec	32 Ind	112.50	9.09	73.94	15.58
3.	Jan	40 Ind	108.80	12.08	62.95	23.06
4.	Feb	34 Ind	116.03	10.82	87.62	23.18
5.	March	33 Ind	115.76	10.12	86.73	26.27
6.	April	35 Ind	114.57	13.31	85.31	29.44
Total		211 Ind				

Observations in Table 1 show that the average carapace width of male blue swimming crabs was highest in February (120.9 mm) and lowest in January (104.9 mm), while the body weight of males was highest in February (95.7 gr) and lowest in January (60.5 gr). In Table 2, for female crabs, the highest carapace width occurred in February (116.03 mm) and the lowest in January (108.8 mm), while the highest body weight was in February (87.62 gr) and the lowest in January (62.95 gr).

The Relationship between the Width of the Carapace and the Body Weight of the Crab (P. pelagicus)

Figures 2 and 3 present the relationship between carapace width and body weight of male and female blue swimming crabs in statistical tests using linear regression.

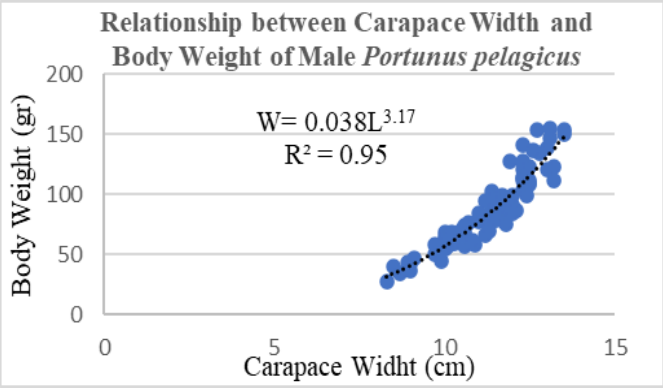

Figure 2. Graphic relationship between Carapace Width and Body Weight of Male Portunus pelagicus

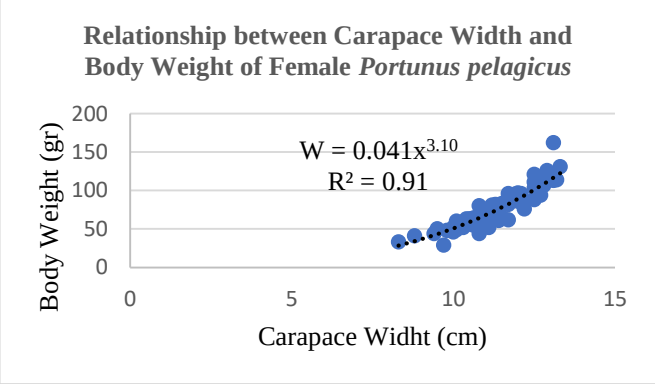

Figure 3. Graphic relationship between Carapace Width and Body Weight of Female Portunus pelagicus

Based on the analysis results, the male blue swimming crab (*P. pelagicus)* had a b value of 3.17, and the female had a b> value of 3.10, so it can be said that the growth of blue swimming crabs *(P. pelagicus)* landed on the tip coast is allometrically positive because the b value is greater than 3.

Maturity Stage of Crab Gonads (P. pelagicus)

They reported blue swimming crab stock in terms of sex ratio by observing the morphology of blue swimming crabs and gonad maturity stages, which white males and reddish-yellow females mark. Based on the results obtained, male and female blue swimming crabs are declared unbalanced. The sex ratio of blue swimming crabs landed on the coast of the southern tip of East Lombok, especially in phases 1 to IV, is presented in Figures Figures 4.1 to 4.4.

Figure 4.1.a. Phase I female

Figure 4.1.b. Phase I Male

Figure 4.2.a. Phase II Female

Figure 4.2.b. Phase II Male

Figure 4.3.a. Phase III Female

Figure 4.3.b. Phase III Male

Figure 4.4. Phase IV Female

The stage of maturity of blue swimming crabs gonads obtained, among others, consists of phase I with an average of 14, phase II with an average of 11,83, phase III with an average of 10,67, and phase IV with an average of 0.58. Then, the level of gonad maturity in phase I was one hundred and sixty specimens, seventy-nine males and eighty-five females. Gonad maturity level two phase II has as many as one hundred and forty-two specimens of eighty-seven and fifty-five females. Phase III one hundred and twenty-eight specimens comprised sixty-four males and sixty-four females. Phase IV consisted of seven specimens: three females and no males. The frequency of male and female blue

swimming crab's gonad maturity stages at each stage can be seen in Tables 3 and 4.

Table 3. Gonadal maturity stage and gonadal somatic index of male blue swimming crabs from November 2023 to April 2024

Male Gonadal Maturity Stage							
Month	Sex	Stage I	Stage II	Stage III	Stage IV	GSI	Total
Nov	J	6	9	4	0	0.19	
Des	J	8	7	6	0	0.23	
Jan	J	7	4	3	0	1.54	
Feb	J	5	5	7	0	1.28	
March	J	7	5	5	0	0.28	
April	J	5	11	6	0	0.26	
Total		38	41	31	0		110

Table 4. Gonadal maturity stage and gonadal somatic index of female blue swimming crabs from November 2023 to April 2024

Female Gonadal Maturity Stage							
Month	Sex	Stage I	Stage II	Stage III	Stage IV	GSI	Total
Nov	B	9	4	4	0	2.26	
Des	B	2	6	4	0	2.57	
Jan	B	13	2	4	1	2.75	
Feb	B	2	4	7	1	4.68	
March	B	3	4	5	1	2.46	
April	B	10	3	2	0	0.05	
Total		39	23	26	3		91

Gonadal Somatic Index Blue Swimming Crab

The results of data analysis of the gonad somatic index (GSI) in blue swimming crabs show that female blue swimming crabs are higher than the gonad somatic index of male blue swimming crabs. The highest average gonad somatic index occurs in February, which has a total of 5,83 %, and the lowest occurs in April, which is 0,27 %, while in November, 2,42%, in December, 2,81%, in January, 3,85%, and in March, 2,78%. From November to February, the blue swimming crabs experienced an increase in the gonadal somatic index; from February to April, the blue swimming crabs experienced a decrease in the gonadal somatic index. The male gonadal somatic index based on time to time can be seen in Figures 5 and 6.

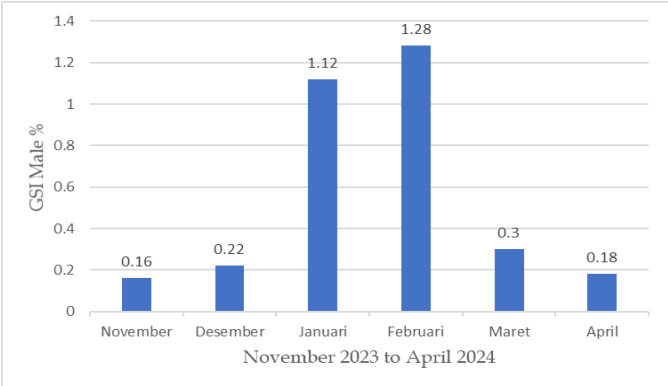

Figure 5. Graphic Male Gonadal Somatic Index from November 2023 to April 2024.

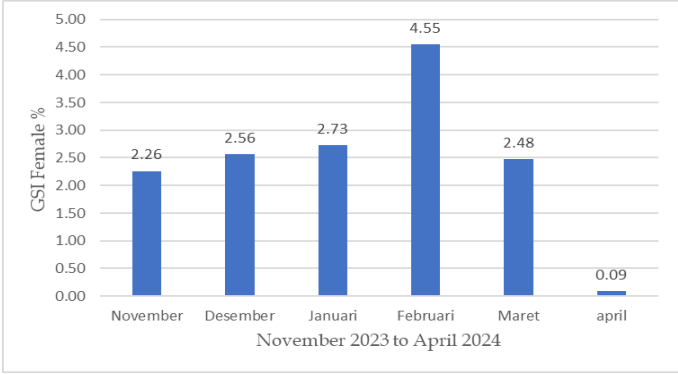

Figure 6. Graphic Gonad somatic index of females from November 2023 to April 2024.

Based on data analysis conducted for six months, the highest gonadal somatic index (GSI) of males and females is found in February or can be found in the same month. The average index of gonadal somatic based on sex of blue swimming crabs in November consisted of 0,16% males and 2,26% females, in December consisted of 0,25% males and 2,56% females, in January consisted of 1,12 % males and 2,73 % females, in February consisted of 1,28 % males and 4,55 % females, in March consisted of 0,30 % males and 2,48 % females, and in April consisted of 0,09 % males and 0,27 % females. The evidence in graphs of the male and female can be seen from the GSI observed in Figures 5 and 6.

Discussion

Sex Ratio of Blue Swimming Crab

Based on data analysis from November 2023 to April 2024, the male blue swimming crab population outnumbered females every month. Research by Ernawati et al., (2014) and Maylandia et al., (2021) showed that female blue swimming crabs often migrate to deeper waters for spawning, so the male population is more dominant. Xiao & Kumar, (2004) also found that male and female blue swimming crab habitats differ, with adult females preferring habitats with high salinity and deeper waters. Temperature and salinity influence blue swimming crabs' distribution, activity, and movement. These two environmental parameters are essential in determining a suitable habitat for blue swimming crabs and influence adaptation and movement patterns (Santoso et al., 2016).

Blue Swimming ***Crab Weight Difference***

Blue swimming crab weights varied every month, with an increase in weight in November (87.23 grams), a decrease in December and January (61-73 grams), and an increase again in February (88.06-93.05 grams). This was due to the females' spawning process. The increase in weight is due to the growth of blue swimming crabs, which, based on research, shows that weight growth is faster than the growth of grouper. The same study conducted by Iksanti et al., (2022) showed that crabs experienced positive allometric growth where the increase in body weight was faster than the width of the grouper. In addition, weight growth also becomes more significant due to the spawning process, where the blue swimming crab will return nutrients and energy spent during the spawning process. Husin, (2022) explains a significant increase in weight after the spawning process by blue swimming crabs. The increase in blue swimming crab weight peaked in February due to the gonadal maturity or maturation process before molting or changing the old shell with a new shell. Salsabilla et al., (2024) also reported that in February, there was an increase in the process of changing shells carried out by blue swimming crabs.

Relationship between Carapace Width and Body Weight of ***Blue Swimming*** *Crab*

The results show a difference in the relationship between the width and weight of blue swimming crabs in males and females. This is due to differences in life patterns between males and females. The growth rate of males is generally faster than that of females. The causes include differences in morality, competition, and recruitment. Research conducted by Mughni et al., (2022) showed differences between the growth rates of males and females based on the relationship between width and weight.

In addition, the difference between width and weight between males and females is also influenced by the way of life between males and females. Male blue swimming crabs move more than female blue swimming crabs, causing differences in growth rates. In addition, a lifestyle that often moves or moves allows male blue swimming crabs to obtain more food sources. Research conducted by Sugilar et al., (2012) also showed that the lifestyle of the blue swimming crab itself also influences the growth rates between males and females.

In addition, water conditions and salinity or temperature also affect the growth rate of male and female blue swimming crabs. Females are generally found in deeper waters than males. In Figures 2 and 3, the graph shows the equation W = 0.038L3.17 with the coefficient of determination R2 = 0.95. These results indicate that the widening of the grouper causes 95% of male blue swimming crab growth, while only 5% is caused by other factors such as the environment and food availability. Meanwhile, the female blue swimming crab showed the equation W = 0041x3.10 with the coefficient of determination R2 = 0.91. These results indicate that the widening of the grouper causes 91% of female blue swimming crab growth, while only 9% is caused by other factors, such as the environment and food availability.

Gonad Maturity Stage of Blue Swimming Crab

The stage of maturity of blue swimming crab gonadals is measured based on color, shape, gonad weight, and egg development Alam, (2021). The research results were conducted for 6 months, and the gonad maturity stage results varied. Most of the blue swimming crab gonadal landed at the southern end of East Lombok's coast are undeveloped. This is due to the level of gonad maturity, which, on average, is at levels one and two, while only a few are found at levels three and four.

In addition, based on the gonad somatic index (GSI), the average gonad maturity value was 2.45% in November. In December, it increased to 2.80%; from January to February, it was 3.92% to 6.03%. Whereas from March to April, there was a decrease in the gonad somatic index (GSI) from 2.74% to 0.31%. This shows that from January to February, the blue swimming crabs have spawned, so in the following months, the maturity of the gonadals decreased due to the spawning of both male and female blue swimming crabs.

Fadilla, (2020) reported that the maturity of the gonads of the blue swimming crab *(P. pelagicus)* that landed in the Kuala Seputih hamlet, Tulang Bawang Lampung, peaked in December to February. Then the development of the gonads decreased in the following months due to the spawning process. The level or indicator of gonadal maturity is then the benchmark in

the capture that occurs in crab *(P. pelagicus)*. The gonad maturity level of the blue swimming crab *(P. pelagicus*) that landed at the end of the south coast of East Lombok, shows that the crab still needs gonad development.

Overfishing will affect the continuity of the development and population of blue swimming crabs in nature. So, there needs to be socialization among fishermen to find out whether or not it is feasible for blue swimming crabs to be caught, especially socialization about what months the spawning process on blue swimming crabs will take place. This then affects the population of blue swimming crabs in nature. In certain months, such as November to February, there needs to be a decrease in catching blue swimming crabs because, in that month, the spawning process occurs in blue swimming crabs in maintaining the population and ecosystem.

Spawning Time

Spawning usually occurs when the male approaches and attaches himself to the female's body and then spends some time swimming. The process takes a while and usually results in a shrimp-like larva called the zoea stage. Furthermore, the blue swimming crab will continue to develop up to several zoea stages. This stage is usually the size of the blue swimming crab larvae, which are still as small as plankton and live by relying on ocean currents before entering the megalopa stage (Gumohung et al., 2024).

Spawning time is usually carried out in December to February. This is evidenced by the increased level of gonad maturity obtained from the study results in these months. This research is evidenced by Kembaren et al., (2012), which shows that the blue swimming crab spawning occurs from September to December. The same research conducted by Hira et al., (2024) also revealed that the spawning of blue swimming crabs occurred from December to February.

Conclusion

Based on the results of research and discussion, it can be concluded that the population of blue swimming crab *(P. pelagicus*) landed at the southern end of the coast of East Lombok, with more males than females for each month during the period November 2023 to April 2024, with 230 males and 211 females. This difference was caused by female migration to deeper waters for spawning and habitat differences between males and females. Body weight increased from November to December, decreased from December to January due to spawning, and increased again from February to April. The relationship between grouper width and body weight of crab *(P. pelagicus)* was positive allometric with a linear regression value of b > 3 for both males and females.

The blue swimming crab's gonad maturity stage varied from stage I to stage IV, with stage I dominating. The Gonadal Somatic Index (GSI) increased from November to February and decreased from March to April. Spawning occurs from December to February and is characterized by increased gonad maturity. The spawning process is characterized by changes in gonad color and a decrease in body weight of the blue swimming crab.

Acknowledgments

A big thank you to the supervisors, especially Dr. Drs. Karnan, M.Si., and Prof. Dr. Drs. Abdul Syukur, M.Si., for their invaluable support and guidance in completing this research. Thank you to the heads of Ujung Hamlet, Mr. Ahyar Rosidi and Mr. Sulaeman, for helping collect crabs from fishermen in Ujung Hamlet.

Last but not least, I sincerely thank my fellow research team members for their cooperation and encouragement and my family, who always provided moral support during the research process. All this help and support means a lot to the success of this research. Hopefully, this research results can positively contribute to the sustainable management of fisheries resources and benefit science and the wider community.

Author Contributions

All authors have made significant contributions to completing this manuscript.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

References

Alam, N. (2021). Aplikasi Ekstrak Daun Karamunting (Melastoma Malabathricum. L) Terhadap Pertumbuhan, Kematangan Gonad Dan Pemijahan Kepiting Rajungan (Portunus Pelagicus). In *Universitas Hasanuddin*. Http://Journal.Unilak.Ac.Id/Index.Php/Jieb/Article/View/3845%0ahttp://Dspace.Uc.Ac.Id/Handle/123456789/1288

Anggoro, A., Hanami, C. C., & Mahfudz, A. A. (2022). Identifikasi Jenis Dan Daerah Penangkapan Rajungan Pulau Baai Kota Bengkulu. *Seminar Nasional Hasil Penelitian Kelautan Dan Perikanan*, 48–68.

Baswantara, A., Firdaus, A. N., & Astiyani, W. P. (2021). Karakteristik Hambur Balik Akustik Rajungan (Portunus Pelagicus) Pada Kondisi Terkontrol. *Journal Of Science And Applicative Technology*, *5*(1),

194–197. Https://Doi.Org/10.35472/Jsat.V5i1.311

Dinas Kelautan Dan Perikanan Ntb. (2019). *Buku Profil Dinas Kelautan Dan Perikanan Provinsi Ntb Tahun 2019*.

Edi, H. S. W., Djunaedi, A., & Redjeki, S. (2018). Beberapa Aspek Biologi Reproduksi Rajungan (Portunus Pelagicus) Di Perairan Betahwalang Demak. *Jurnal Kelautan Tropis*, *21*(1), 55–60. Https://Doi.Org/10.14710/Jkt.V21i1.2409

Ernawati, T., Boer, M., & Yonvitner. (2014). Biologi Populasi Rajungan (Portunus Pelagicus)Di Perairan Sekitar Wilayah Pati, Jawatengah. *Bawal*, *6*(1), 31–40.

Fadilla, A. R. (2020). *Distribusi Ukuran Dan Parameter Pertumbuhan Rajungan (Portunus Pelagicus, Linnaeus 1758) Yang Didaratkan Di Dusun Kuala Seputih, Tulang Bawang, Lampung*. 0–0.

Gumohung, S. A., Koniyo, Y., & Lamandi, A. (2024). Pengaruh Pemberian Artemia Sp. Yang Diperkaya Minyak Cumi Dengan Dosis Berbeda Dalam Meningkatkan Kelangsungan Hidup Larva Udang Vaname (Litopenaeus Vannamei). *Jurnal Ilmiah Multidisiplin*, *3*(1), 55–65. Https://Doi.Org/10.1016/J.Ienj.2009.05.001

Hajjej, G., Sley, A., & Jarboui, O. (2016). Morphometrics And Length-Weight Relationship In The Blue Swimming Crab, Portunus Segnis (Decapoda, Brachyura) From The Gulf Of Gabes, Tunisia. *International Journal Of Engineering And Applied Sciences*, *3*(12), 257544.

Hamid, A. (2015). *Habitat, Biologi Reproduksi Dan Dinamika Populasi Rajungan (Portunus Pelagicus Linnaeus 1758) Sebagai Dasar Pengelolaan Di Teluk Lasongko, Sulawesi Tenggara*. Institut Pertanian Bogor.

Hira, K. Y., Pratikto, I., & Riniatsih, I. (2024). Kajian Morfometri Rajungan (Portunus Pelagicus) Di Perairan Kabupaten Pemalang Jawa Tengah. *Journal Of Marine Research*, *13*(1), 73–82. Https://Doi.Org/10.14710/Jmr.V13i1.37986

Husin, A. (2022). Penentuan Kadar Logam Timbal (Pb) Dan Tembaga (Cu) (Ssa), Pada Ikan Belanak Dan Kepiting Rajungan Di Perairan Benoa Kabupaten Badung Secara Spektroskopi Serapan Atom. In *Universitas Islam Negeri Maulana Malik Ibrahim Malang*. Universitas Islam Negeri Maulana Malik Ibrahim Malang.

Iksanti, R. M., Redjeki, S., & Taufiq-Spj, N. (2022). Aspek Biologi Rajungan (Portunus Pelagicus) Linnaeus, 1758 (Malacostraca : Portunidae) Ditinjau Dari Morfometri Dan Tingkat Kematangan Gonad Di Tpi Bulu, Jepara. *Journal Of Marine Research*, *11*(3), 495–505. Https://Doi.Org/10.14710/Jmr.V11i3.31258

Kamrani, E., Yahyavi, M., & Nabi, A. (2010). Stock Assessment And Reproductive Biology Of The Blue Swimming Crab, Portunus Pelagicus In Bandar Abbas Coastal Waters, Northern Persian Gulf. *Journal Of The Persian Gulf (Marine Science)*, *1*(2), 11–22. Https://Www.Researchgate.Net/Publication/268200107

Kembaren, D. D., Ernawati, T., Suprapto, D., Penelitan, B., & Laut-Jakarta, P. (2012). Biologi Dan Parameter Populasi Rajungan (Portunus Pelagicus) Di Perairan Bone Dan Sekitarnya Biology And Population Parameters Of Blue Swimming Crab (Portunus Pelagicus) In The Bone Bay And Adjacent Waters. *J.Lit.Perikan.Ind*, *18*(4), 273–281.

Kkp. (2022). *Laporan Kinerja Kementrian Kelautan Dan Perikanan Tahun 2022*.

Kurnia, R., & Boer, M. (2014). Biologi Populasi Rajungan (Portunus Pelagicus) Dan Karakteristik Lingkungan Habitat Esensialnya Sebagai Upaya Awal Perlindungan Di Lampung Timur. *Jurnal Ilmu Pertanian Indonesia (Jipi)*, *19*(1), 22–28.

Maylandia, C., Matondang, D., Ilhami, S., Parapat, A., & Bakhtiar, D. (2021). Kajian Ukuran Rajungan (Portunus Pelagicus) Menurut Jeniskelamin, Tingkat Kematangan Gonad, Dan Faktor Kondisi Diperairan Pulau Baai Bengkulu. *Journal Of Biology And Applied Biology*, *4*(2), 115–124.

Mughni, F. M., Susiana, S., & Muzammil, W. (2022). Biomorfometrik Rajungan (Portunus Pelagicus) Di Perairan Senggarang. *Journal Of Marine Research*, *11*(2), 114–127. Https://Doi.Org/10.14710/Jmr.V11i2.33085

Radifa, M., Wardiatno, Y., Simanjuntak, C. P. H., & Zairion, Z. (2020). Preferensi Habitat Dan Distribusi Spasial Yuwana Rajungan (Portunus Pelagicus)Di Perairan Pesisir Lampung Timur, Provinsi Lampung. *Jurnal Pengelolaan Sumberdaya Alam Dan Lingkungan*, *10*(2), 183–197. Https://Doi.Org/10.29244/Jpsl.10.2.183-197

Rosmawati. (2011). *Ekologi Perairan* (M. Karman (Ed.)). Hilliana Press.

Salsabilla, A., Hakim, M. F., Putra, A., & Fatin, A. (2024). Pengaruh Variasi Konsentrasi Koh Dan Waktu Pengadukan Terhadap Nilai Derajat Deasetilasi Dan Karakteristik Kitosan Dari Cangkang Rajungan. *Innovative: Journal Of Social Science Research*, *4*(7949), 6786–6800.

Santoso, D., Karnan, Japa, L., & Raksun. (2016). Karakteristik Bioekologi Rajungan (Portunus Pelagicus)Di Perairan Dusun Ujung Lombok Timur. *Jurnal Biologi Tropis*, *16*(2), 94–105.

Sugilar, H., Park, Y.-C., Lee, N.-H., Han, D.-W., & Han, K.-N. (2012). Population Dynamics Of The Swimming Crab Portunus Trituberculatus (Miers, 1876) (Brachyura, Portunidae) From The West Sea

Of Korea. In *International Journal Of Oceanography And Marine Ecological System* (Vol. 1, Issue 2, Pp. 36–49). Https://Doi.Org/10.3923/Ijomes.2012.36.49

Webley, J. A. C., Connolly, R. M., & Young, R. A. (2009). Habitat Selectivity Of Megalopae And Juvenile Mud Crabs (Scylla Serrata): Implications For Recruitment Mechanism. *Marine Biology*, *156*(5), 891–899. Https://Doi.Org/10.1007/S00227-009-1134-0

Xiao, Y., & Kumar, M. (2004). Sex Ratio, And Probability Of Sexual Maturity Of Females At Size, Of The Blue Swimmer Crab, Portunus Pelagicus Linneaus, Off Southern Australia. *Fisheries Research*, *68*(1–3), 271–282. Https://Doi.Org/10.1016/J.Fishres.2003.11.012