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Morphometric and Length–Weight Relationships of Three Penaeid Shrimp Species in the Waters of Jaloh Island, Batam City

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Abstract

Background: *Understanding the relationship between body length and weight in commercially essential shrimp species is crucial for assessing growth patterns and estimating biomass. This study aims to evaluate the relationship between body length and weight in three species of shrimp, namely the whiteleg shrimp (Penaeus merguensis), whiteleg shrimp (Litopenaeus vannamei), and tiger shrimp (Penaeus monodon), as a basis for fisheries management in the waters of Jaloh Island, Batam City.* **Methodology:** *The samples were collected randomly from the results, catching fishermen at three stations during a day of data collection. Morphometric measurements were conducted on 180 individual, namely whiteleg shrimp (P. merguensis), White shrimp (L. vannamei), and Tiger shrimp (P. monodon). The length-weight relationship has been analyzed for a long time using simple regression using Excel software. The connection between character morphometrics and total length was analyzed with ANCOVA using SPSS 27 software.* **Findings:** *The results showed the determinant coefficient of three species shrimp in this study indicates a very close relationship between the growth of length and weight of shrimp. In the P. monodon species, it is known that approximately 78 % of the weight gain is attributed to the increase in shrimp length, while 22 % is attributed to other factors. Characters that influence the total length of the three species are generally overall, where P. merguensis is more influenced by the tail and weight, L. vannamei by the front, back, and body mass, while P. monodon involves almost all parts of the body.* **Contribution:** *This approach helps estimate biomass, identify morphological variations between species, and provides a scientific basis in supporting efforts to manage shrimp resources sustainably.*

Keywords: *Growth Pattern; Morphology; Penaeid; Shrimp*

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INTRODUCTION

Shrimp is one of the commodities featured in the subsector of fisheries that contributes about 60% of the total value of Indonesian fisheries (Suhana et al., 2023). Production of shrimp nationally reaches ± 600,000 tons per year, with the main contribution originating from cultivation and fisheries catch (BPS, 2021). Based on data from the Ministry of Maritime Affairs and Fisheries (KKP, 2023), fish production of Indonesian shrimp in 2022 reached around 1.19 million tonnes, with 22.5% coming from fishery catch. In Q4–2022, production catch shrimp recorded at 87,135 tons, an increase of 31.3% compared to the same period of the previous year (KKP, 2022; Sosek, 2022). These figures highlight the critical role of shrimp in supporting the national fisheries sector, both economically and ecologically.

Islands (Kepri), including Batam and the islands small around it like Jaloh, have a potential source of strategic power fisheries because of their vast coastal area as well as their location, which borders directly with Singapore, Malaysia, and Vietnam (Muharni et al., 2025; Febriandini et al., 2023). Jaloh Island is a small island located on the coast of Batam City, geographically adjacent to Singapore (Sunargo et al., 2022). The island plays an important ecological and biogeographic role because it provides natural habitats for various marine species such as shrimp and reef fish. Jaloh also possesses a distinctive coastal ecosystem, including mangrove forests, coral reefs, and muddy to sandy seabeds, which support diverse marine biota. Condition ecological. This makes Jaloh Island one of the main fishing grounds for locals, especially for shrimp, with a market economy.

Besides the value economy, shrimp is also ecologically important. Shrimp are members of the subphylum *Crustacea* with a segmented body protected by a thick chitinous exoskeleton. The cephalotorax contributes about 36 – 49 % of the total body weight, meat 24 – 41 %, and shell 17 – 23 % (Febrianti et al., 2022). Shrimp act as decomposers of organic waste in aquatic ecosystems, helping to regulate nutrient cycles and maintain ecosystem stability (Tasya et al., 2024). Thus, shrimp are recognized as both an economically valuable and ecologically essential fishery commodity (Farkan et al., 2023).

Morphometric studies on shrimp length–weight relationships are crucial in fisheries biology. Studies in Indonesia show the existence of variation between species and location. In *P. merguiensis*, growth tends to be allometric and influenced by coastal habitats (Putra et al, 2018). On the other hand, *L. vannamei* under aquaculture conditions shows a relatively stable length–weight relationship, although sensitive to stocking density and water quality (Hafizi et al., 2022). Meanwhile, *P. monodon* exhibits a wider morphometric range strongly influenced by growth phases and moulting cycles (Muryanto et al., 2020). However, the majority of studies are still local, species-specific, and more are performed on the system cultivation or certain areas such as Aceh and North Sumatra. Until now, there has been limited comparative research across multiple shrimp species in natural coastal ecosystems such as the Riau Islands.

Climate change and fluctuations in capture fisheries further complicate the availability and consistency of morphometric data. Changes in fishing seasonality and variability of fishermen's catches in Jaloh waters may affect the validity of length–

weight relationship analyses (Kasri et al., 2024). These challenges highlight the need for site-specific studies that can generate reliable and representative data for fisheries management.

Based on this gap, the goal is to study this is evaluate the connection between the length body and weight in three species of shrimp, namely shrimp jerbung (*Penaeus merguiensis*), shrimp white (*Litopenaeus vannamei*), and shrimp tiger (*Penaeus monodon*), which are caught by fishermen in the waters of Jaloh Island, Batam City. The findings of this study are expected to provide a better understanding of growth patterns and biological conditions of shrimp populations, as well as baseline data for sustainable shrimp resource management and conservation in the Riau Islands region.

METHOD

Time and Research Location

This research was conducted April 2025 in the waters of Jaloh Island, Batam City, Riau Islands Province. This coastal area has a coastline of ± 15 km. It is an essential habitat for various species of economic shrimp, including the curbing shrimp *P. merguensis*, whiteleg shrimp *L. vannamei*, and tiger shrimp *P. monodon*. Jaloh Island is also one of the active shrimp fishing areas, mainly by local traditional fishermen. Sampling was conducted directly for three days based on the fishermen's catch at night. Shrimp fishing activities occur in two periods, namely 02.00 – 06.00 AM and 18.30 –21.00 PM. The fishing gear fishermen use includes shrimp traps when the water begins to recede and nets when the water is high.

Observation locations were determined purposively with the aim of representing three main habitat species around Jaloh Island. Station 1 is located in the Sudip area (00°57'44" N; 103°51'16" E), characterized by a muddy substrate. Its morphogenic conditions are influenced by open ocean currents and waves, with generally high and stable salinity levels. Station 2 is located in Ujung Busung (00°57'37" N; 103°51'01" E), having a sandy substrate mixed with mud and relatively sparse coastal vegetation. This area experiences sedimentation from tidal currents, so its morphology is more dynamic, while its salinity can change with the seasons. Station 3 is located in the mangrove ecosystem (00°57'36" N; 103°50'50" E). Morphogenic activity at this location is largely influenced by the accumulation of fine sediment due to current damping by mangrove roots, while salinity levels tend to be lower and fluctuate due to tides and runoff from the mainland. The three stations can be seen in Figure 1.

A B C

Figure 1. Sampling locations at different points. A Station 1 (Sudip), B station 2 (Ujung Busung), C station 3 (Mangrove)

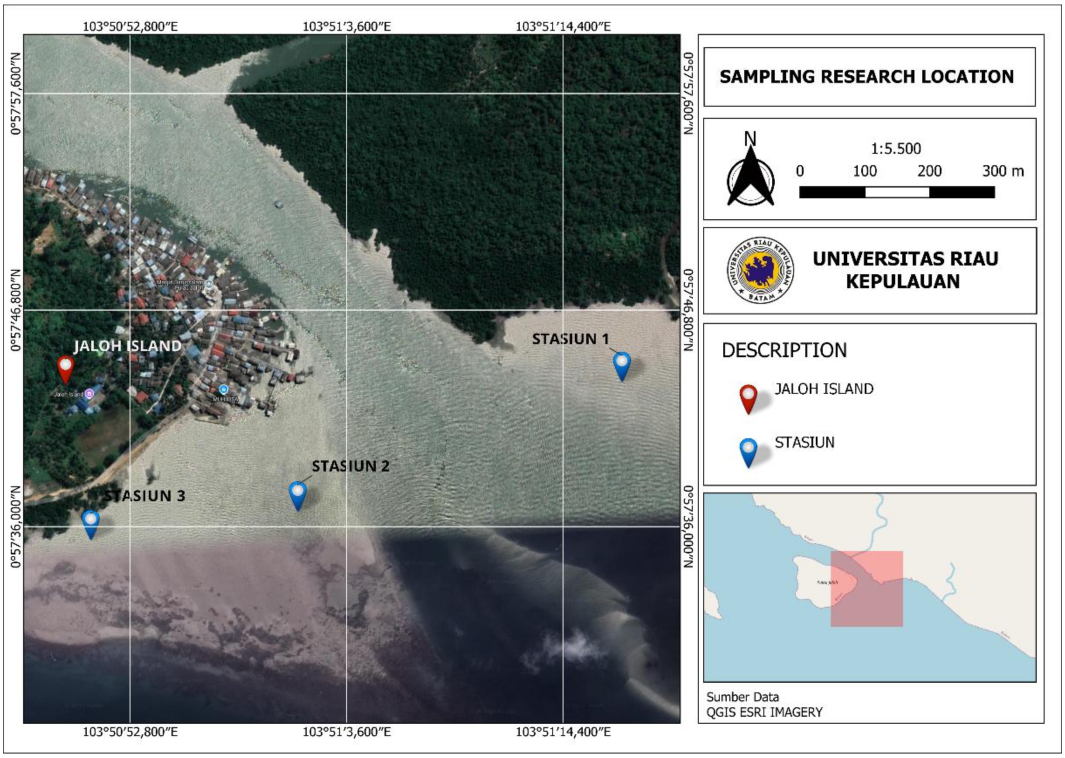

Figure 2. Map of research locations

Tools and Materials
The tools and materials used to conduct this research are,

Table 1 . Tools and materials study

No	Tools	Function
1	Vernier caliper 0.01 mm	A tool for measuring the length of shrimp
2	Digital scales 0.01 g	To weigh the shrimp
3	Stationery	Record the data obtained
4	Smartphone 64 MP camera	To document

Shrimp Sampling

The sample in this study consists of three species of shrimp, namely jerbung shrimp *P. merguensis*, vaname shrimp *L. vannamei*, and shrimp Windu *P. monodon*, which were obtained from the results of catch fishermen in the waters of Jaloh Island, Batam City. A total of specimens were analyzed , as many as 180 individual, or around 30% of the total catch. On the first day, taking samples at Station 1 consisted of over 12 individual of *L. vannamei* and 82 fish *P. merguiensis*; Station 2, 7 individuals of *L. vannamei* and 6 individual *P. monodon*; and Station 3, as many as 61 individual *P. merguiensis*. On the second day, at Station 1, 57 individuals were obtained. *P. merguiensis* and 6 individual *P. monodon*; Station 2, 36 individuals *L. vannamei*, 2 fish *P. monodon*, and 2 individual *P. merguiensis*; whereas Station 3 consists of over 39 individual *P. merguiensis*. On the third day, Station 1 produced 61 individual of *L. vannamei*, Station 2, 49 individuals of *L. vannamei*, and Station 3, as many as 51 individuals of *P. merguiensis*. In total, the number of samples per station was 218 individuals at Station 1, 107 individuals at Station 2, and 151 individuals at Station 3. Based on its species, 165 individual were obtained from *P. merguiensis*, 165 individuals from *L. vannamei*, and 14 fish from *P. monodon*.

A sample was selected randomly from the results of catching fishermen at three stations and observation during three days of data collection. Specimens used were chosen based on condition, whole body, no experienced physical damage, and considered representative of each population. Samples were then used to analyze morphometrics refers to Sari et al., (2023) to observe the connection between length and weight-body shrimp from the three species.

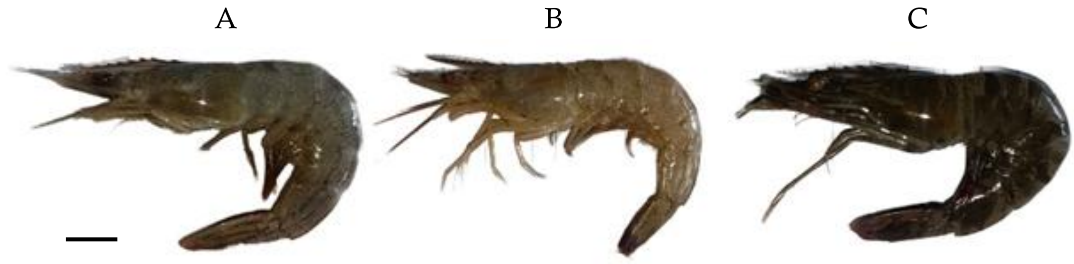

Figure 3. Sample image three. Species shrimp, (A) jerbung shrimp *P. merguensis*, (B) white shrimp *L. vannamei*, (C) tiger shrimp *P. monodon*.

Measurement of the morphometrics of shrimp

Three species of shrimp, jerbung shrimp *P. merguensis*, vaname shrimp *L. vannamei*, and tiger shrimp *P. monodon*, were measured using a tool measuring term push with an accuracy of 0.1 mm. Weight shrimp were measured using digital scales with 0.1 g accuracy. Measurement carried out on Jaloh Island, Pantai Gelam Subdistrict, District Bulang.

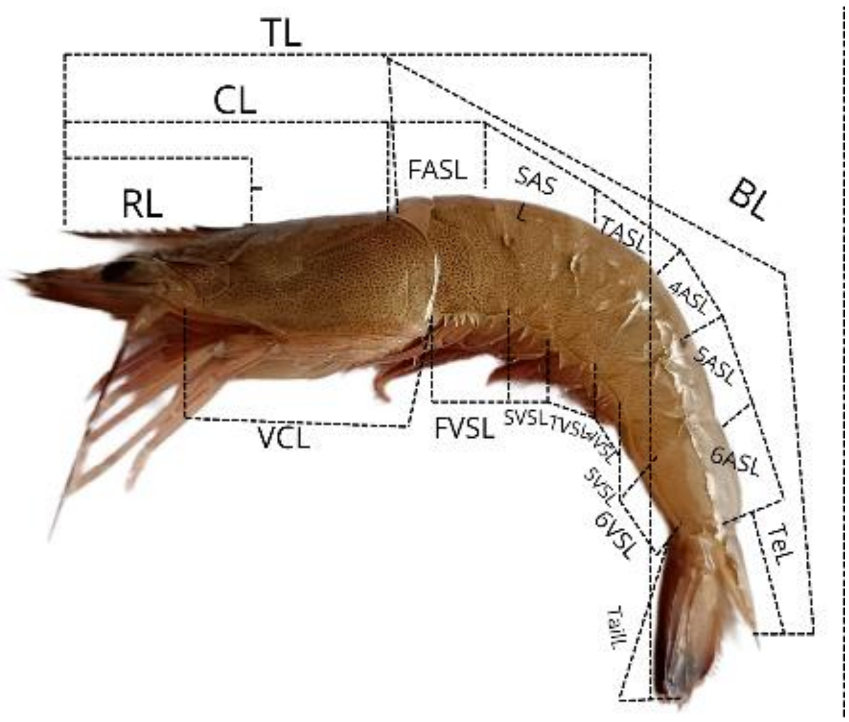

Figure 4 . Morphometrics of Shrimp

Shrimp morphometric measurements were carried out by referring to the method used by Zahrah et al., (2023) in the study of pink shrimp. In (figure 4) is done by measuring total length (TL), Rostrum length (RL), cephalotorax length (CL), First Abdominal length (FASL), second abdominal length (SASL), third abdominal length (TASL), fourth abdominal length (4ASL), fifth abdominal length (5ASL), sixth abdominal length (6ASL), telson length (TEL), body length (BL), Lower cephalotorax length (VCL), First ventral segment length (FVSL), Second ventral segment length (SVSL), third ventral segment length (TVSL), fourth ventral segment length (4VSL), fifth ventral segment length (5VSL), sixth ventral segment length (6VSL), tail length (Tail), weight.

Data analysis

The data from the morphometric and body weight character measurements of three species of shrimp, namely *P. merguensis*, *L. vannamei*, and *P. monodon*, were analyzed using descriptive and inferential statistical approaches. Growth patterns of each species were evaluated through an analysis of the connection length – weight using regression models, exponential $y = ae^{bx}$. The creation of morphometric tables and graphs of the relationship between length and weight was done using Microsoft Excel software. To test the differences in characteristics between species and to determine the morphometric variables that contribute to total length, an analysis of covariance (ANCOVA) was carried out using SPSS version 27 software. This analysis aims to evaluate the effect of each body character on total length and compare growth patterns between the three shrimp species observed refers to Safitri et al., (2022). With a hypothesis, namely: H0: No influence of morphometrics on the total length (PT); H1: There is an influence of morphometrics on the total length (PT). Testing criteria: If Sig > 0.05 then H0 is accepted, H1 is rejected; If Sig < 0.05 then H0 is rejected, H1 is accepted.

RESULT AND DISCUSSION

Morphometric Characteristics of Three Penaeid Shrimp

Morphometric analysis was conducted to compare the morphological characteristics of the three observed shrimp species (Minarseh et al., 2021). Twenty parameters were measured, including length and proportional body ratio aspects that can reflect ecological adaptation and taxonomic differences between species. The data are presented as mm interval values (minimum-maximum) and average ± standard deviation. The following table summarizes the results of morphometric measurements of the three shrimp species (*P. merguensis, L. vannamei,* and *P. monodon*) as a basis for further interpretation.

Based on the size of each morphometric character, differences that are not too large between the shrimp species *P. merguensis*, *L. vannamei*, and *P. monodon* (Table 2). The species *P. merguensis and L. vannamei* have morphometrics with similar sizes, especially cephalotorax length 15.21 – 36.49 mm; 25.66 ± 4.90 and 23.41 – 48.84 mm; 35.53 ± 6.77, first segment length 3.64 – 10.21 mm; 6.52 ± 0.98 and 3.41 – 11.68 mm; 6.57 ± 1.16, second segment length 5.53 – 12.98 mm; 8.92 ± 1.04 and 5.31 – 14.91 mm; 8.79 ± 1.39, fourth lower segment length 3.99 – 9.98 mm;

5.90 ± 1.22 and 5.41 – 9.91 mm; 7.12 ± 1.10, and tail length 4.51 – 13.94 mm; 8.53 ± 1.59 and 4.93 – 13.87 mm; 8.58 ± 1.63). When compared, the morphometrics of *L. vannamei* and *P. monodon* also have similarities in size, namely the third abdominal segment 3.45 – 12.73 mm; 7.44 ± 1.89 and 3.51 – 11.79 mm; 7.36 ± 1.30, the fourth abdominal segment 4.10 – 10.35 mm; 7.56 ± 1.52 and 5.41 – 9.91 mm; 7.12 ± 1.10, the sixth abdominal segment 5.23 – 12.91 mm; 8.26 ± 1.63 and 5.32 – 12.81 mm; 8.28 ± 1.62, the first lower segment 3.15 – 13.75 mm; 7.83 ± 1.92 and 3.51 – 11.81 mm; 7.48 ± 1.40, the sixth lower segment 2.94 – 12.45 mm; 7.04 ± 1.86 and 3.30 – 12.48 mm; 7.21 ± 1.94, and weight 2 – 20 g; 8.52 ± 4.30 and 3 – 22 g; 8.57 ± 6.20.

The morphometric similarities between the three species are in the length of the sixth segment and the length of the sixth lower segment, with a size range of *P. merguiensis* 3.99 – 9.98 mm (6.71 ± 1.17), *L. vannamei* 5.23 – 12.91 mm (8.26 ± 1.63), and *P. monodon* 5.32 – 12.81 mm (8.28 ± 1.62). Similarly, in the length of the sixth ventral segment, P. *merguiensis* has a size of 2.31 – 9.98 mm (5.67 ± 1.48), *L. vannamei* 2.94 – 12.45 mm (7.04 ± 1.86), and *P. monodon* 3.30 – 12.48 mm (7.21 ± 1.94). Thus, based on the measurement results, the species with the most morphometric similarities is *P. merguensis* and *P. monodon*.

The differences in morphometric character variations in *P. merguensis, L. vannamei,* and *P. monodon* shrimp are thought to be caused by ecological adaptation, according to Nugroho et al., (2025) some species can adapt morphometrically for certain survival strategies. For example, differences in physical conditions such as substrate, salinity, temperature, and water current will affect certain body parts as an ecological form. According to Pandit (2022), species that live on the substrate allow for a flatter body posture to facilitate camouflage. The results of morphometric measurements in the Table showing the similarities in characters in *P. merguensis* and *P. monodon* can also be caused by genetic factors, as the two shrimp species are still included in the same genus. According to Indarjo et al., (2021) and Sala et al., (2021) there is a possibility of similarities in morphometric characters in the same genus, namely Penaeus, which means they share closer evolutionary ancestors than species from different genera.

The assumption of ecological adaptation related to the morphometric characteristics of the three shrimp species in this study is correlated with the habitat of each species, which differed based on the sampling location. *P. merguensis* tended to be more commonly found in Location 3, which is mangrove vegetation with muddy and sandy substrates.

In addition, this species was also found in Location 2 (Ujung Busung) with the same type of substrate. The *P. monodon species* was also found in Location 2, primarily in seagrass habitats. According to Wagiyo et al., (2021), the *P. merguensis species* is generally found in shallow coastal waters, such as river mouths and estuaries (mangrove habitats). They like muddy or sandy waters and often live with varying salinity. Meanwhile, according to Sachio (2023), the *P. monodon* species prefers deeper sea waters and higher salinity. When compared with the results of water quality measurements at each location, the salinity at locations 2 and 3 tends to be the same.

Table 2. Morphometric Characteristics of Three Penaeid Shrimp

No.	Morphometric Characteristic	*P. merguiensis*		*L. vannamei*		*P. monodon*	
		Hose mm (Min - Max)	**Average ± SD**	**Hose mm (Min - Max)**	**Average ± SD**	**Hose mm (Min - Max)**	**Average ± SD**
1	Total Length (TL)	67,74 - 135,49	96,17 ± 16,88	70,03 - 140,12	98,39 ± 14,02	71,11 - 146,62	98,61 ± 22,32
2	Rostrum Length (RL)	3,51 - 44,5	29,55 ± 6,40	17,76 - 39,94	28,97 ± 4,67	23,41 - 48,84	32,67 ± 7,57
3	Cephalotorax Lenght (CL)	20,1 - 83,1	34,7 ± 9,96	23,34 - 46,68	33,69 ± 5,27	24,48 - 50,03	34,54 ± 7,55
4	First Abdominal Sigment (FASL)	2,6 - 11,16	6,25 ± 0,98	3,33 - 55,55	7,82 ± 5,70	3,41 - 8,56	6,18 ± 1,62
5	Second Abdominal Sigment (SASL)	3,43 - 13,82	7,02 ± 1,84	3,42 - 10,7	6,65 ± 1,51	4,49 - 11,16	7,38 ± 2,03
6	Third Abdominal Sigment (TASL)	5,53 - 19,96	7,96 ± 2,29	2,12 - 13,84	8,65 ± 1,85	5,57 - 11,21	8.59 ± 1,79
7	Fourth Abdominal Sigment (4ASL)	3,39 - 9,98	5 ± 1,22	4,71 - 10,05	7,56 ± 1,52	5,41 - 9,92	7,17 ± 1,56
8	Fifth Abdominal Sigment (5ASL)	2,31 - 9,95	3,41 ± 1,17	3,35 - 12,29	6.18 ± 1,63	3,42 - 13,77	5,89 ± 2,88
9	Sixth Abdominal Sigment (6ASL)	7,8 - 18,86	11,62 ± 2,43	2,1 - 15,57	11,09 ± 2,24	8,87 - 17,73	11,66 ± 2,64
10	Telson Lenght (TeL)	7,44 - 15,53	10,44 ± 1,75	8,85 - 67,89	13,19 ± 8,10	9,88 - 19-96	12,6 ± 3,23
11	Body Lenght (BL)	6,65 - 83,4	58,65 ± 12,75	6,84 - 81,15	60,51 ± 11,94	44,42 - 83,3	62,19 ± 14,30
12	Ventral Cephalothorax Lenght (VCL)	11,15 - 28,85	19,72 ± 3,54	11,7 - 86,67	22,54 ± 7,92	10,5 - 34,47	20,24 ± 7,18
13	First Ventral Segment (FVSL)	3,41 - 12,74	7,61 ± 1,63	3,7 - 15,3	8,58 ± 1,93	5,51 - 11,21	8,1 ± 1,99
14	Second Ventral Segment (SVSL)	3,36 - 7,77	5,16 ± 1,04	4,43 - 12,72	6,3 ± 1,36	3,41 - 7,8	5,85 ± 1,42
15	Third Ventral Segment(TVSL)	2,32 - 7,73	4,81 ± 0,93	3,35 - 41,44	6,32 ± 3,96	3,4 - 7,75	5,17 ± 1,40
16	Fourth Ventral Segment(4VSL)	2,32 - 9,46	5,21 ± 1,21	3,42 - 8,83	6,09 ± 1,14	3,39 - 7,4	5,14 ± 1.13
17	Fifth Ventral Segment (5VSL)	2,61 - 10.08	5,61 ± 1,26	3,4 - 9,96	6,35 ± 1,26	3,39 - 9,48	3,36 ± 1,78
18	Sixth Ventral Segment (6VSL)	4,92 - 13,36	9,38 ± 1,74	6,68 - 12,24	9,25 ± 1,24	6,65 - 12,3	9,21 ± 1,84
19	Tail Lenght (TaiL)	7,71 - 29,45	16,67 ± 4,08	9,5 - 21,14	15,97 ± 2,97	8,84 - 26,7	16,57 ± 4,76
20	Weight	2 - 15	5,52 ± 2,95	2 - 20	8,52 ± 4,30	3 - 22	8,57 ± 6,20

Length-Weight Relationship

The length and weight correlation graph in three shrimp species, *P. merguensis*, *L. vannamei*, and *P. monodon*, visualizes the growth pattern, indicating isometric and allometric tendencies. This graph makes the differences in growth characteristics of each species in response to aquatic environmental conditions appear transparent. This pattern can be interpreted as a form of biological response to habitat conditions in the waters of Jaloh Island.

Table 3. Relationship Parameters Length-Weight of Penaeid Species Shrimp

No	Shrimp Species	Length-Weight Equation	b Value	R^2
1	Jerbung (*P. merguensis*)	$y = 0.4392e^{0.0252}$	0.0252	0.8224
2	Vaname (*L.vannamei*)	$y = 0.4109e^{0.0286}$	0.0286	0.861
3	Tiger prawn (*P. monodon*)	$y = 0.4109e^{0.0286}$	0.0286	0.861

Growth isometric shows that the proportion of length and weight of the body of shrimp increases in a balanced manner, which usually indicates sufficient food availability, the quality of the habitat is supportive, and the level of competition is relatively low. On the other hand, the pattern allometric (good positive and negative) reflects existing factors that influence the distribution of energy for growth, for example, population pressure, variation in natural feed type, or substrate base waters.

On Jaloh Island, the differences in habitat characteristics such as availability of detritus, presence of phytoplankton and zooplankton, as well as complex vegetation coast (for example, seagrass or mangrove) are very influential to the pattern growth third species. The shrimp that live in areas with abundant food tend to show allometric growth, positive because more energy Lots allocated to increase body mass. On the other hand, at the location with dense population, tall or source Power limited, growth tends to be allometric negative, because energy is more focused on maintaining metabolism compared to increasing body weight.

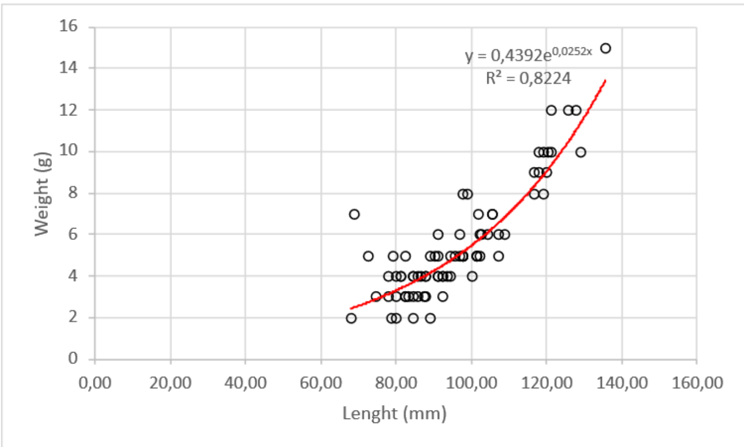

Figure 5. Length-Weight Shrimp Relationship of Jerbung Shrimp (*P. merguensis*)

Thus, variation pattern growth indicated by the third species shrimp not only reflects differences in genetics and morphology, but also a close relation with the local aquatic environment, especially factors such as food availability, population density, and habitat quality in the waters of Jaloh Island.

The b-value obtained in the equation for determining the length-weight relationship graph shows whether or not the length growth of the *P. merguensis* species is significant (Aminin et al., 2022). The analysis results show ab = 0.0252 value <3 (negative allometric), indicating that length growth is more important than weight. The R^2 value on the graph describes the percentage of the cause of the increase in weight of *P. merguensis,* so that it can be seen that R^2 = 0.8224 means around 82% of the weight increase *is* caused by length, while other factors cause 18%. Compared with the research of Sala et al., (2021), with the same species from the waters around Bakoi, South Sorong, R^2 = 0.69 was obtained, so 69% of the weight gain was caused by length, while other factors caused 31%.

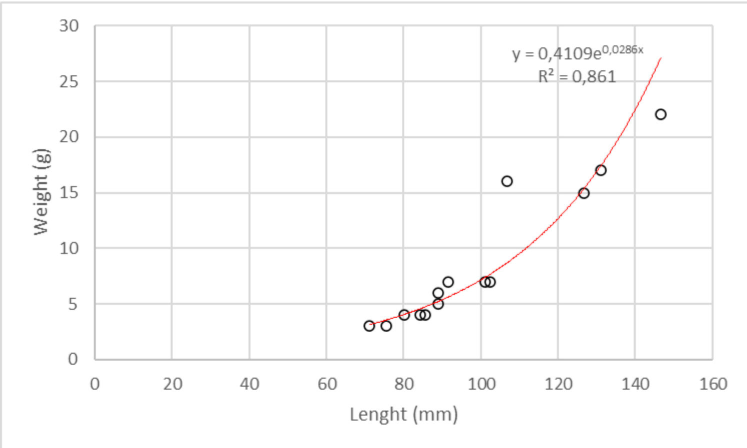

Figure 6. Length-Weight Shrimp Relationship of Vannamei (*L. vannamei*)

The figure of the relationship between the length and weight of whiteleg shrimp (*Litopenaeus vannamei*) shows a proportional relationship between length and weight, meaning that the longer the shrimp, the more its weight increases. The significance of length growth can be seen based on the b value presented in the graph with the equation. (b = 0.0286), ab value <3 It is called negative allometry. Length growth is more significant (faster) than weight; this result is the same as the graph of the length-weight relationship of the *P. merguensis* species. This result is from the research of Afara et al., (2023) In white-leg shrimp, the b value < 3 Shows negative allometric growth, where the increase in length is more dominant than weight.

Based on the determinant coefficient obtained in the Graph of the relationship between the length and weight of white leg shrimp, R^2 = 0.861 means that around 86 % of weight growth is caused by the length of the shrimp, and 14% is caused by other factors. This result, when compared with the determinant coefficient of *P. merguensis shrimp*, shows that the effect of length on the weight of *L. vannamei* is higher by around 4%. This result is comparable to the research of Maria et al., (2024); in giant prawns, there is a difference in the determinant coefficient of around 10% in the influence of length and weight. The R^2 value approaching 1 indicates a close relationship between length growth and weight.

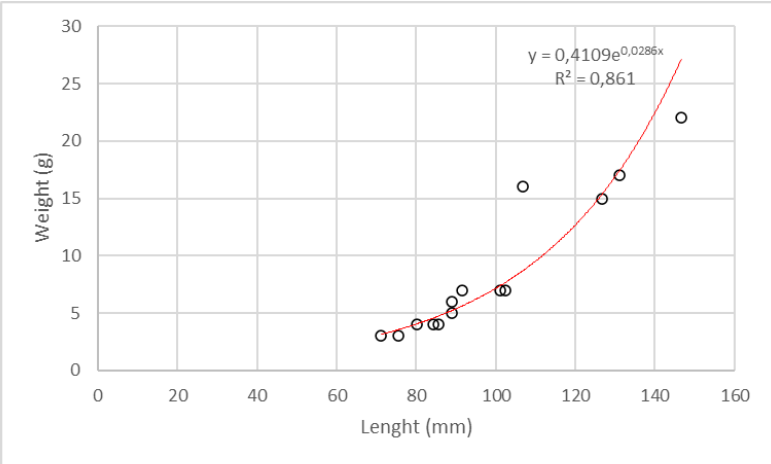

Figure 7. Length-Weight Shrimp Relationship of Tiger Prawn (*P. monodon*)

The figure of the relationship between the length and weight of the tiger prawn *P. monodon* shows a proportional growth between the length and weight of the shrimp, meaning that the lengther the shrimp size, the more its weight increases. Based on the equation obtained, namely $y = 0.4109e^{0.0286}$, it is known that b = 0.0286 <3 indicates a negative allometric growth pattern. The growth pattern of *P. monodon* is the same as that of the *P. merguensis* and *L. vannamei* species, namely that the growth in length is more significant (faster) than the weight. This result is comparable to Alnanda et al., (2023), in the jerbung shrimp, b <3 Negative allometric growth.

The determinant coefficient in the relationship between the length and weight of tiger prawns shows a very close relationship between the growth of length and weight of shrimp. According to Zulfakar et al., (2023), if the determinant coefficient is 0.26-0.50, it is categorized as quite close, 0.51 - 0.75 as close, and 0.76 - 1.00 as very close. So the results of the determinant coefficient of the three species of shrimp in this study show a very close relationship between the growth of length and weight of shrimp. In the *P. monodon* species, it is known that around 78 % of weight gain is caused by the development of shrimp length, and other factors cause 22 %. Compared with the research of Sucipto et al., (2023), in tiger prawns with a determination coefficient > 80 %, a significant relationship was obtained with shrimp weight and length.

An cova analysis (*Analysis of Covariance*)

The number of specimens obtained shows variation interspecifically, with *L. vannamei* (87 individuals) more dominant compared to *P. merguensis* (79 individuals) and *P. monodon* (14 individuals). This indicates different ability adaptation, where *L. vannamei is* more tolerant of the conditions of Jaloh Island; meanwhile, a low amount of *P. monodon* is allegedly related to habitat limitations and pressure arrest.

Analysis of covariance univariate shows a different contribution of character morphometrics to total length (PTO). Growth *P.merguensis* tends to influence the posterior part and body weight, *L. vannamei's* own growth pattern is more proportional, whereas *P. monodon* shows involvement almost all over the body. This pattern reflects the growth strategy unique to each species and describes the condition of the waters of Jaloh Island, which supports certain dominant species. To see the results of the comparison of the three shrimp, see Table 4.

Table 4. The ANCOVA Result of Penaeid Species Shrimp

Category	Characteristic	*P. merguiensis*	*L. vannamei*	*P. monodon*
		Sig	Sig	Sig
Cephalothorax	Rostrum length (RL)	0.072	0.321	0.076
	Cephalothorax Length (CL)	0.154	0.000**	0.002**
Abdomen	Ventral Cephalothorax Length (VCL)	0.465	0.053	0.010*
	First Abdominal Sigma (FASL)	0.912	0.662	0.006**
	Second Abdominal Sigma (SASL)	0.452	0.763	0.095
	Third Abdominal Sigma (TASL)	0.526	0.164	0.013*
	Fourth Abdominal Sigma (4ASL)	0.160	0.277	0.005**
	Fifth Abdominal Sigma (5ASL)	0.889	0.649	0.011*
	Sixth Abdominal Sigma (6ASL)	0.113	0.051	0.030*
	First Ventral Segment (FVSL)	0.908	0.273	0.088
	Second Ventral Segment (SVSL)	0.453	0.091	0.067
	Third Ventral Segment (TVSL)	0.231	0.678	0.086
	Fourth Ventral Segment (4VSL)	0.635	0.192	0.076
	Fifth Ventral Segment (5VSL)	0.084	0.119	0.022*
	Sixth Ventral Segment (6VSL)	0.008**	0.018*	0.097
Telson	Telson Length (TeL)	0.335	0.835	0.033*
	Tail Length (TaiL)	0.004**	0.035*	0.081
Other	Body Length (BL)	0.216	0.903	0.025*
	Weight	0.038*	0.000**	0.044*

In Table 4 above, the analysis results of the connection between character morphometrics and total length on all three shrimp species show that each species has its own pattern of different significance to component morphology. In shrimp, jerbung *P. merguensis*, only several proven characters have a significant connection to total length, namely the length section lower sixth (p = 0.008), the length tail (p = 0.004), as well as the weight body (p = 0.038). This indicates that an increase in total length in species is more influenced by the back part of the body, especially the tail segment and the end of the abdomen.

Different from that, white shrimp *L. vannamei* show relatedness significantly to total length at more Lots characters, such as length cephalotorax (p = 0.000), length lower sixth section (p = 0.018), length tail (p = 0.035), and weight body (p = 0.000). This is to signify that the Good parts, front and behind the body, and the mass of the body, play a role in influencing total length growth in this species.

Temporary, tiger shrimp *P. monodon* own amount of character significantly contributes the most to total length, including length cephalotorax (p = 0.002), fourth section length ($p < 0.05$), telson length ($p = 0.033$), without cephalotorax ($p = 0.025$), and weight body ($p = 0.044$). Condition: This reflects that almost all parts of the body of the tiger prawn, starting from the cephalotorax, body parts, and the tail, are influential to the total length, indicating a more comprehensive body.

Shrimp *P. monodon* shows the most morphometric significant, followed by *L. vannamei*, and least in *P. merguiensis*. The difference indicates the existence of diversity patterns, growth, and body structure interspecifically. These results are in line with findings previously, where the morphometrics of *P. monodon* were reported to be influenced by environment and population distribution factors (Okon et al., 2024). Analysis of combination morphology and genetics also supports the existence of intra-population differentiation in *P. monodon* (Kumara et al., 2017). In *L. vannamei*, variation morphometrics has been proven to be influenced by different culture conditions (Rao et al., 2023), while in *F. merguiensis*, the association genetics to character morphometrics has been confirmed through analysis of heritability (Vu et al., 2014). Thus, diversity morphometrics in the three species. This possibility is a big result of the interaction between genetics and ecological adaptation.

CONCLUSION

The length-weight relationship of penaeid shrimp from 3 species *P. merguensis*, *L. vannamei*, and *P. monodon* shows the same growth pattern, which is negative allometric, meaning that the lengther the shrimp size, the more its weight increases. Growth patterns can be influenced by environmental conditions such as food scarcity, which can cause stress in shrimp, or the early phase of shrimp growth can also cause it. The characters that influence the total length in the jerbung shrimp (*P. merguensis*) are the length of the sixth lower segment, tail length, and body weight. In the whiteleg shrimp (*L. vanammei*), the characters that influence the total length are the cephalotorax length, the length of the lower sixth section, telson length, and body weight. Windu shrimp (*P. monodon*) showed the widest range of influences, including cephalotorax length, fourth segment length, telson, rostrum length, and body weight. Whole Windu shrimp shows the most significant amount of character morphometrics, followed by vaname, and the least seen in jerbung, which reflects the overall growth pattern of the body. Findings. This contributes to the management of fishery capture and cultivation, especially as base election species featured as well as the development of appropriate habitat and food management strategies for supporting optimal growth and sustainability of Power shrimp.

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