BIOEDUSCIENCE
ISSN: 2614-1558
http://journal.uhamka.ac.id/index.php/bioeduscience

Analysis of Abundance, Length-Weight Relationship, and Condition Factors of Bulleye Snails (*Turbo argyrostoma*) on the Batam Coast

Nirma Adeseprianah Hasibuan [1] , Devi Novianti [1] , Ramses [1] , Fitrah Amelia [2] and Ismarti [2*]

[1] Department of Biology Education, University of Riau Islands, Batam, Indonesia, 29438
[2] Department of Mathematics Education, University of Riau Islands, Batam, Indonesia 29438
[*] Correspondence: ismarti@fkip.unrika.ac.id

Abstract

Background: The oxeye snail (*Turbo argyrostoma*) is a marine gastropod commonly harvested by coastal communities for consumption. Intensive and unregulated harvesting may lead to population decline, raising concerns for ecosystem stability and resource sustainability. This activity directly reduces the population of *T. argyrostoma* in coastal waters. This study aims to determine the abundance and the correlation between the length-weight and condition factors of *T. argyrostoma* in the waters of Batam, Riau Islands. **Method:** This study was performed from September to October 2024. Sampling was conducted at three locations: Kajang Island, Piring Island, and Layang Island. The sampling method conducted was purposive sampling. Water quality measurements were carried out in situ. Abundance was determined based on the number of individuals per unit area. Morphometric data were collected by measuring the body dimensions of *T. argyrostoma* using digital callipers. Next, the length-weight relationship was analysed using linear regression to determine growth patterns. **Results:** The aquatic environment met the quality standards set by the Minister of Environment, as outlined in Decree No. 51/2004. The highest abundance of *T. argyrostoma* was observed at Kajang Island (1.37 ind/m^2). Morphometric measurements showed mean shell length (SL) of 39 ± 4.83 mm, weight (W) of 21.3 ± 4.58 g, and shell width (SW) of 30.3 ± 3.25 mm in Layang Island samples. A positive length–weight relationship was identified at all stations (r = 0.73, 0.45, 0.78) with allometric growth coefficient (b) values indicating growth patterns. Condition factors (K and Wr) varied across locations: 6.766 and 70.340 at Piring Island; 6.518 and 103.984 at Kajang Island; and 6.229 and 101.037 at Layang Island, respectively. **Conclusion:** A positive length–weight relationship was observed at all sites, and variation in condition factors suggests differing ecological pressures. The low Wr value at Piring Island may indicate environmental stress or higher predation pressure.

Keywords: Mollusca, Morphometrics, Oxeye Snails, *T. argyrostoma*

Check for updates

Article history
Received: 27 Dec 2024
Accepted: 26 Aug 2025
Published: 31 Aug 2025

Publisher's Note:
BIOEDUSCIENCE stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Citation: Hasibuan, N.A., Novianti, D., Ramses, Amelia, F., & Ismarti. (2025). Analysis of Abundance, Length-Weight Relationship, and Condition Factors of Bulleye Snails (*Turbo argyrostoma*) on the Batam Coast. *BIOEDUSCIENCE, 9*(2), 258-268, doi: 10.22236/jbes/17820

Introduction

The bull's-eye sea snail (*Turbo argyrostoma*) is a marine gastropod that is abundantly found in the waters of Sarang Island, Batam, and has economic value as a food source for coastal communities. Research on this species is crucial because harvesting without sustainable management has the potential to cause population decline and disrupt the balance of coastal ecosystems. Its use as a food source for coastal communities makes managing the capture of *Turbo argyrostoma* crucial to prevent population decline. Bull's-eye sea snails are reported to have potential as a source of protein and minerals that function as aphrodisiacs, such as K, Mg, Ca, Fe, Zn, and Cu (Merdekawati et al., 2017). Although the saturated fatty acid content of bull's-eye sea snail meat is reported to be relatively high, at 43.60% (Tazkia et al., 2016), this species remains essential to study due to its food value for the community and its potential as a bioindicator of water quality.

T. argyrostoma is a member of the phylum Mollusca and generally inhabits reef habitats (steep coral reef slopes) directly exposed to open ocean waves. Bull's-eye snails prefer coral reef flats overgrown with marine plants, such as Sargassum (Tazkia et al., 2016). The waters of Sarang Island and its surroundings fall within the administrative area of Sekanak Raya Village, Belakang Padang District, Batam City. This area is impacted by various anthropogenic activities, including shipping, fishing, and industries such as shipyards and seafood processing, which have the potential to degrade the quality of the aquatic environment. According to Pratiwi & Utami (2022), anthropogenic pressures, particularly overexploitation, have caused a decline in marine biota populations.

The quality of the aquatic environment will impact the life of marine biota. Changes in aquatic environmental conditions, including physical, chemical, and biological elements, can indicate damage to the aquatic ecosystem (Ismail et al., 2019). The decline in marine biota can be caused by marine pollution by hazardous and toxic materials (B3), industrial waste, transportation, and domestic waste. Pollutant sources can originate from both the sea and land. The numerous sources of pollution in the waters have the potential to contaminate the aquatic environment of Sarang Island. Waste generated from various industrial and domestic activities can contaminate aquatic biota and potentially accumulate in the food chain (Amelia et al., 2024). Some marine biota, such as fish, shellfish, and macroalgae, accumulate pollutants and can be used as bioindicators of pollution (Ismarti, 2024; Ismarti et al., 2017; Suheryanto & Ismarti, 2018). On the other hand, the harvesting of *T. argyrostoma* for consumption without regard for sustainability can lead to a decline in its wild population. This decline in the wild population is primarily due to rapid overfishing rather than the population's ability to reproduce and replace losses (Pratiwi & Utami, 2022).

Research on bulleye snails in the Riau Islands, particularly Batam Island, is still limited. To support sustainable management, up-to-date data on abundance, size, and length-weight relationships in the waters of Sarang Island are needed. Gastropod morphometry was measured based on length and weight, with the main parameters such as shell length (SL), shell width (SW), peak height (SpH), and weight (W). (Sriyanti et al. 2021). The purpose of this study's morphometric measurements was to evaluate shell morphometric variations and analyze the length-weight relationship in the *T. argyrostoma* species (Haumahu et al., 2014). Furthermore, the length-weight relationship and condition factors are essential parameters in marine biology that can be used to distinguish taxonomic units and assess the health condition of organisms (Utami et al., 2022). This study aimed to determine the abundance, length-weight relationship, and condition factors of *T. argyrostoma* in the waters of Sarang Island, Padang Belakang District, Batam City, Riau Islands Province.

Methods

Sampling Time and Location

This research was conducted from September to October 2024 in the waters surrounding Sarang Island, Sekanak Raya Village, Belakang Padang District, Batam City. The research location was determined by purposive sampling, taking into account the conditions and circumstances of the intertidal zone. The research location comprised three stations: Kajang Island, Piring Island, and Layang Island. Sampling was conducted three times at each location at weekly intervals to capture temporal variation. The coordinates of the sampling locations are shown in Figure 1. The coordinates of the sampling locations are Station I on Kajang Island (1°7'31.254"N 103°50'39.63" E), Station II on Piring Island (1°7'3.204"N 103°50'29.508"E), and Station III on Layang Island (1°7'59.772"N 103°51'0.666"E).

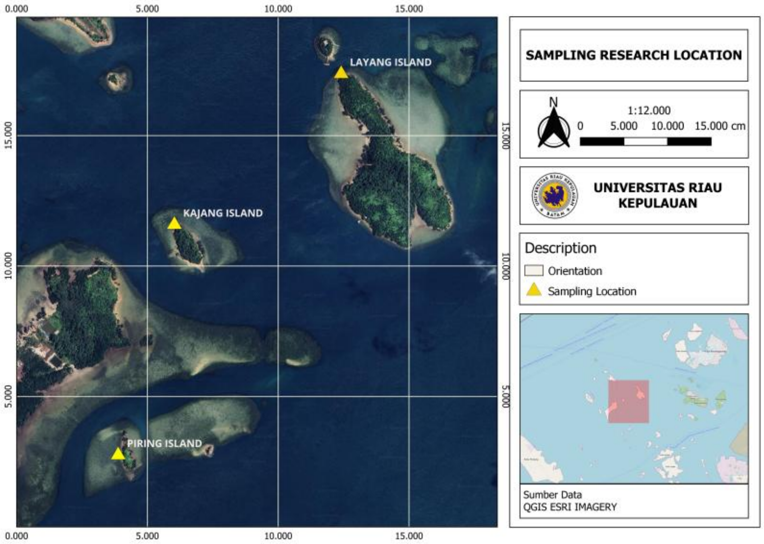

Figure 1. Sampling Location Map

Instruments

The instruments used in this study included digital calipers (with 0.01 mm accuracy), a multitester, a digital DO meter (MH01 brand, with 0.01 mm accuracy), a GPS device, a digital camera, writing instruments, and sample containers. Supporting equipment for sampling included snorkeling equipment to examine the bull's-eye snails found beneath the water.

Data Collection

Water quality parameters were measured using the equipment shown in Table 1. Water quality measurements were conducted in situ for temperature, salinity, DO, TDS, clarity, and current velocity. This was repeated three times for each sampling location.

Table 1. Water Quality Parameter Measurement Instruments

Parameters	Equipment	Unit
Ph	Ph Meter	-
Temperature	Thermometer	°C
Dissolved Oxygen	DO Meter	Mg/L
Salinity	Refractometer	Ppm
Turbidity	Multimeter	Mg/L
Brightness	Secchi Disk	M
Current Speed	Flow Meter	M/S

T. argyrostoma samples were collected using a sweeping method in the intertidal zone at each station, the extent of which varied depending on the location. Sampling was conducted in the morning during the maximum low tide to facilitate observation and comprehensive collection of individuals. Station 1 on Kajang Island covered a 10 x 15 m2 area, Station 2 on Piring Island covered a 10 x 5 m2 area, and Station 3 on Layang Island covered a 10 x 50 m2 area. All samples attached to the rock or coral substrate were collected, from smallest to largest, for morphometric and weight measurements.

Samples collected from each location were cleaned by rinsing with seawater and then allowed to drain for 5-10 minutes. Samples were then counted to determine abundance, and measurements included shell length (SL), spire height (SpH), and shell width (SW).

Procedure

Abundance of T. argyrostoma

The abundance of *T. argyrostoma* was calculated based on the number of individuals per unit area. The density of bullseye snails at each station was calculated and converted to individuals/m2 using the following formula (Ramses et al., 2018):

$$Di = \frac{Ni}{A}$$

Information:
In : Number of bullseye snails per area (individuals/m2)
Ni : Number of bullseye snails on the quadrat transect.
A : Area of the sampling quadrat transect (m2)

Morphometric measurements

Digital calipers were used to measure the morphometric characteristics of *T. argyrostoma* with an accuracy of 0.01 mm. Morphometric measurements of the sea snail, such as shell length (SL), spire height (SpH), and shell width (SW), were as described by Haumahu et al. (2014), and are shown in Figure 2.

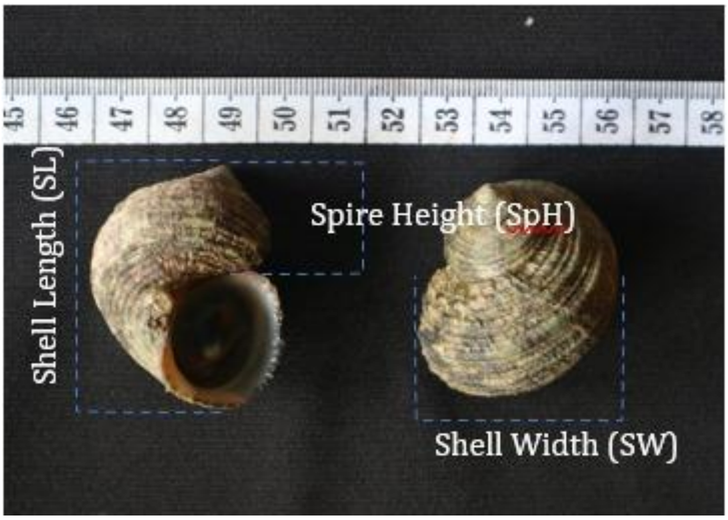

Figure 2. Morphometric measurements of *Turbo argyrostoma* L.

Length and Weight Analysis

Parameters a and b were determined using logarithmic regression analysis with the equation log W = log a + b log L, which models the length-weight relationship in an allometric manner. To predict length and weight parameters, bias correction for the average weight change was applied in logarithmic units. The following allometric equation, based on De-Robertis and William, was used (Fadhil et al., 2016; Ramses, Syamsi, et al., 2019):

$$W=aL^{b}$$

Information:
W = Snail weight (g)
L = Shell length
a, b = Constant values

Growth patterns are divided into two categories: if b is equal to 3, it is called isometric growth, meaning that weight growth is equal to length growth. Furthermore, if b is ≠ 3, it is allometric. Allometric growth is categorized into two types: positive allometry and negative allometry. With the following conditions, if the b value is above 3, then the allometric is positive, meaning weight growth is faster than length growth. Conversely, if the b value is below 3, then the allometric is negative, meaning length growth is faster than weight growth in the snail (Napisah & Machrizal, 2021).

Condition Factor Analysis

The condition factor for each snail (total n = ...) was analyzed using the Fulton coefficient (K) and the relative weight condition factor (Wr), where the Ws value was predicted from the combined length–weight regression results of all sampling locations. Relative weight (Wr) is determined based on the Rypel and Richter equation (Ramses, Ismarti, et al., 2019):

$$Wr = (W x Ws) x\ 100$$

Where Wr is the relative weight, W is the snail weight (g), and Ws is the standard weight (g) predicted from the same sample, calculated from a combined length-weight regression using the distance between species:

$$Ws = a\ Lb$$

The condition factor is an index value indicating the health condition of the snail (Ramses, Ismarti, et al., 2019). The Fulton condition factor is calculated based on the following equation (Sayyidah & Rusdi, 2021):

$$K = WL\text{-}3\ x\ 100$$

Where K is the Fulton condition factor, W is the snail weight (g), L is the length (mm), and - -3 is the length coefficient to ensure that the K value tends to unity.

Result

The research results consisted of an analysis of the abundance, morphometry, length-weight relationship, and condition factors of *Turbo argyrostoma* in the waters of Sarang Island, Batam, as a basis for developing a sustainable management strategy.

Water Quality Parameters

The results of water quality parameter measurements at three sampling locations are shown in Table 2. The results of water quality measurements at Kajang Island, Piring Island, and Layang Island. In general, the pH values at all three locations ranged from 8.5 to 8.8, which is still within the range of environmental quality standards for marine biota. The recorded DO content (8.4–9.8 mg/L) supports the respiration of aquatic organisms.

The water temperature was relatively uniform (30–31°C), suitable for tropical habitats. Salinity varied between 26 and 31 ppt, with lower values on Piring Island, likely influenced by freshwater inputs. The highest TDS was observed on Piring Island (73,400 mg/L), indicating a higher concentration of dissolved substances.

Water clarity ranged from 2 to 3 m, and current speeds varied, with the highest values at Layang Island. These differences in parameters between locations indicate varying environmental conditions that may affect the distribution, growth, and physiological state of *T. argyrostoma*.

Table 2. Water Quality at Three Sampling Locations

Locations	Parameters						
	pH	DO (mg/L)	Temperature (°C)	Salinity (PPM)	TDS (Mg/L)	Brightness (M)	Current Speed (M/S)
Kajang Island	8.5	8.4	30	31	31070	2	2.386
Piring Island	8.6	9.4	30	26	73400	3	5.419
Layang Island	8.8	9.8	31	29	42160	3	6.834

BML air laut*	7 – 8.5	>5	28-30	33-34	20	>3	-

Abundance of *T. argyrostoma*

Observations show that the abundance of *T. argyrostoma* varied across the three study sites, as shown in Table 3. The results in Table 3 indicate that the abundance of *T. argyrostoma* varied across the three study sites. Kajang Island had the highest abundance (1.37 ind/m^2), followed by Layang Island (0.96 ind/m^2) and Piring Island (0.92 ind/m^2). These differences in abundance may be influenced by habitat conditions, nutrient availability, and other environmental factors that support the existence and growth of the population. This variation is critical to consider in efforts to manage *T. argyrostoma* resources in coastal areas sustainably.

Table 3. Abundance of *T. argyrostoma* at Three Sampling Locations

Locations	Number of Individuals	Area (m^2)	Abundance (ind/m^2)
Kajang Island	206	150	1.37
Piring Island	46	50	0.92
Layang Island	240	250	0.96

Morphometric Measurements

The results of morphometric measurements of *T. argyrostoma*, including shell length, weight, shell width, and crest height, in samples from three sampling locations, are shown in Table 4. The results of morphometric measurements of *T. argyrostoma* from the three sampling locations. The average values for shell length (SL), weight (W), crest height (SpH), and shell width (SW) varied between locations. Samples from Layang Island generally showed a larger average size than the other two locations. This morphometric variation reflects differences in environmental conditions, food availability, and the potential morphological adaptation of *T. argyrostoma* to local habitats. This information is essential for understanding population dynamics and supporting sustainable management.

Table 4. Morphometrics of *T. argyrostoma* from Three Sampling Locations in Batam Waters

Locations	Measurements Parameters			
	Shell Length (SL)	Weight (W)	Crest Height (SpH)	Shell Width (SW)
Kajang Island	34.80 ± 5.52	19.40 ± 6.68	16.60 ± 3.43	25.70 ± 4.85
Piring Island	39.60 ± 3.23	29.10 ± 4.98	23.00 ± 4.98	27.00 ± 5.06
Layang Island	39.00 ± 4.83	21.30 ± 4.58	19.00 ± 2.86	30.30 ± 3.25

Length-Weight Relationship between *T. argyrostoma*

The results of the length-weight relationship analysis of *T. argyrostoma* from three sampling locations in Batam waters are shown in Figure 2. The length-weight relationship analysis shows an allometric growth pattern at all three sampling locations. The coefficient of determination (R^2) and slope (b) values varied between stations, reflecting differences in habitat conditions and food availability. A positive relationship between length and weight indicates consistent growth; however, variation between locations highlights the importance of habitat management in sustaining *T. argyrostoma* populations.

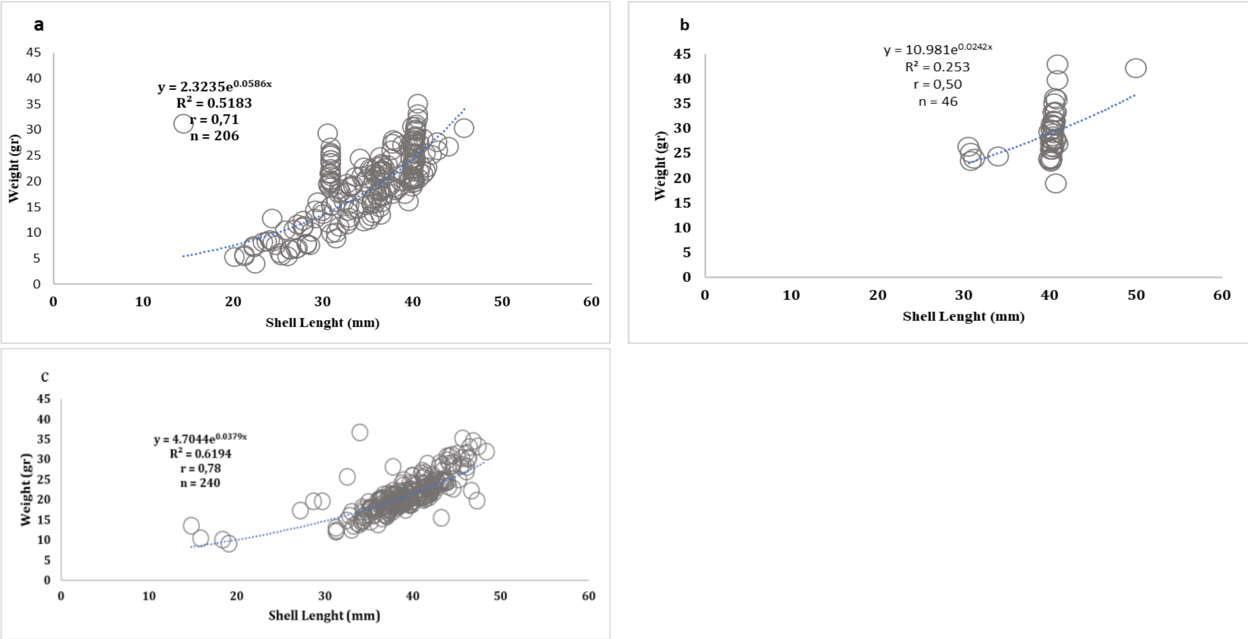

Figure 2. Length-weight relationship diagram of *T. argyrostoma* at sampling locations: (a) Kajang Island, (b) Piring Island, and (c) Layang Island

Condition Factor

The results of the condition factor analysis of *T. argyrostoma* snails from three sampling locations in Batam waters are shown in Table 5. The results of the condition factor analysis of *T. argyrostoma* at the three research locations show variations in Fulton's K and relative weight (Wr) values. Kajang Island and Layang Island had Wr values above 100, indicating good body condition and a favorable environment. Conversely, Wr values on Piring Island were lower, suggesting the potential for higher environmental stress or predation. This variation in condition factors is essential as an indicator of population health and habitat quality, supporting sustainable management strategies.

Table 5. Fulton's Condition Factor (K) and Relative Condition Factor (Wr) of *T. argyrostoma* Snails from Three Sampling Locations

	Faktor Kondisi	
Stasiun	K	Wr
Pulau Kajang	6,518	103,984
Pulau Piring	6,766	70,340
Pulau Layang	6,229	101,037

Discussion

Seawater Quality Parameters

Assessing water quality is crucial because the physical and chemical conditions of the environment directly influence the survival, growth, and distribution of *T. argyrostoma*. Several parameters measured in this study included pH, DO, temperature, salinity, TDS, clarity, and current velocity. Table 2 shows that the water conditions on Kajang Island meet the seawater quality standards for biota established by the Indonesian Ministry of Environment, specifically in terms of pH, DO, temperature, and salinity. Meanwhile, the other two locations exceeded the standards, particularly in terms of pH on Layang Island. According to Hamuna et al. (2018), the ideal pH for water is between 7 and 8.5. Waters that are too alkaline or too acidic are harmful to organisms because they disrupt metabolic and respiratory processes. pH indicates the level of acidity or alkalinity of the water. The pH values at the three stations were between 8.557 and 8.8, indicating ideal alkaline conditions for *T. argyrostoma* shell calcification. These conditions support the formation of strong shells and the overall health of snails (Sari & Wijaya, 2019).

According to Mubarak et al. (2018), dissolved oxygen is a key water quality parameter for biota. DO is a measure of the amount of oxygen dissolved in water required by aquatic organisms for respiration. Measurements at the research site showed DO values varying from 8.4 mg/L on Kajang Island to 9.8 mg/L on Layang Island. Higher DO values on Layang Island are associated with better photosynthetic activity or aeration, which helps *T. argyrostoma* undergo optimal metabolism. Pratiwi et al. (2015) reported that high DO can increase growth and metabolic activity in bulleye snails. All three stations had water temperatures of 30°C–31°C, ideal for the development and physiological activity of tropical marine mollusks, including *T. argyrostoma*.

Aquatic species require ideal salinity conditions. According to Abdullah, stable salinity helps osmoregulation and optimal growth of sea slugs. The salt concentration in seawater, known as salinity, ranges from 26 to 31 parts per million (PPM). The salinity of the waters of Kajang Island is ideal for osmoregulation and fluid balance in *T. argyrostoma*. At the other two locations, seawater salinity was lower, possibly related to the influence of freshwater from settlements.

Total Dissolved Solids (TDS) is a measure of the total amount of dissolved solids present in water. The highest TDS value was observed at the sampling location on Piring Island, indicating a higher mineral or organic matter content at that location. This location also has a muddy substrate. Malesi & Putra (2024) reported that high TDS levels can impact aquatic organisms' ability to regulate their body water and ion balance (osmoregulation), as well as water quality. Conversely, water clarity indicates the extent to which light can penetrate the water. Light plays a crucial role in photosynthesis, organism visibility, and the extent to which assimilation processes can still occur in water (Pingki & Sudarti, 2021). Variations in light penetration at the three sampling locations can affect primary productivity and the foraging activity of *T. argyrostoma* snails. Research Sari & Wijaya (2019) report that good clarity supports primary productivity and aquatic ecosystems.

Water dynamics have the potential to influence the distribution of nutrients and oxygen significantly. There was an increase in current velocity at the three sampling locations, with the highest being on Layang Island. Layang Island, situated in open waters accessible to the public, is frequently utilized for recreational activities, scientific research, and environmental conservation (Rahima & Febrianti, 2022). Research by Surya et al. (2021) states that the minimum flow velocity is 0 m/s, the maximum flow velocity is 0.7 m/s, and the overall average is 0.16 m/s. According to Firmansyah et al. (2015), moderate current speeds facilitate ideal nutrient distribution for mollusks, making snail movement and attachment more difficult. Measurements at each station showed high current speeds. Therefore, it can be concluded that all measured locations exhibited high current speeds, with Layang Island having the highest current speed among the three locations.

T. argyrostoma Abundance

Kajang Island had the highest abundance of *T. argyrostoma* at 1.37 inches/m², followed by Layang Island (0.96 inches/m²) and Piring Island (0.92 inches/m²), with an average abundance across the three locations of 1.08 inches/m². Based on the Kruskal-Wallis test ($p > 0.05$), the difference in abundance between locations was not statistically significant, suggesting that local environmental factors more influence this variation than considerable population differences. Differences in habitat characteristics, such as Kajang Island's dense mangrove forests, may influence this variation in abundance. These forests maintain water quality and harbor numerous fish and birds. Piring Island's seagrass beds harbor various types of seaweed, such as Enhalus acoroides and Thalassia hemprichii, which provide marine organisms with shelter and food. With its coral reef ecosystem, Layang Island harbors a diverse array of fish, mollusks, and invertebrates, which contribute to climate change mitigation through the absorption of carbon dioxide. These habitats are crucial for maintaining the balance of Batam City's aquatic ecosystem.

The observed variations in *T. argyrostoma* are related to environmental conditions, such as food availability, salinity, water temperature, and current velocity. Pratiwi & Utami (2022), reported a positive correlation between shell size and nutrient availability.

According to Abdullah et al. (2016), the growth and morphometric adaptation of bulleye snails are influenced by variations in salinity and nutrient availability. This finding aligns with research by Firmansyah et al. (2015), which suggests that moderate current velocity can enhance the distribution of nutrients and oxygen in the water, thereby influencing snail growth and morphometric size. Furthermore, research by Mahardika et al. (2018) reported that a stable temperature of 30–31°C supports normal physiological processes and reproduction in tropical marine mollusks, including bulleye snails. Therefore, the differences in morphometric measurements at the three observation stations demonstrate how bulleye snails adapt to various environmental conditions.

Length-Weight Relationship of *T. argyrostoma* Snails

The analysis of the length-weight relationship of *T. argyrostoma* at three stations showed an allometric growth pattern. This pattern indicates good food resource availability and favorable environmental conditions. According to Muthmainnah et al. (2023), this pattern is commonly found in gastropods in Indonesian waters. Based on data analysis at Station 1, Kajang Island, the value of W = 2.3235L^0.0586, R^2 = 0.5183, indicates a moderate correlation. This finding is consistent with research Haumahu et al. (2014), which suggests that an R^2 value greater than 0.5 indicates an adequate relationship for marine gastropods. Station 2 (W = 10.981L^0.0242, R^2 = 0.2219) had the weakest correlation. According to Handayani et al. (2022), a low R^2 can be influenced by variations in environmental parameters. Station 3 (W = 4.7044L^0.076, R^2 = 0.6331) showed the strongest correlation. Rofi'i et al. (2022), stated that optimal habitat conditions resulted in a more stable length-weight relationship.

Condition Factor

The condition factors measured in this study were the Fulton condition factor (K) and the relative weight condition factor (Wr). According to Gundo et al. (2014), the condition factor is an index value that indicates the health of the biota. Fadhil et al. (2016) added that a condition factor value approaching 100 indicates that the marine biota is in excellent condition, demonstrating a balance between prey and predators in its environment.

The condition factors obtained in this study (Table 5) indicate that the condition of snails at the three research stations remains good, with Fulton condition factors (K) ranging from 6.229 to 6.766. In contrast, the relative weight condition factor (Wr) value exceeds 100 on Kajang Island and Layang Island, specifically 103.98 and 101.03. Meanwhile, the relative weight condition factor (Wr) value on Piring Island is 70.34, indicating that predators on Piring Island have increased significantly compared to those on Kajang Island and Layang Island. This is also supported by the lowest abundance data observed on Piring Island, as in Table 3.

Conclusions

The results of the study indicate that the aquatic environment continues to meet the environmental quality standards set by Ministerial Decree No. 51 of 2004. The abundance of bulleye snails ranged from 0.92 to 1.37 ind/m2, with the highest abundance found on Kajang Island. Morphometric measurements showed that the highest shell length (SL), weight (W), and shell width (SW) were observed in samples from Layang Island, with an average SL value of 39±4.83 mm, an average W value of 21.3±4.58 mm, and an average SW value of 30.3±3.25 mm. There was a positive correlation between the length and weight of bulleye snails at all three sampling stations, with r values of 0.73, 0.45, and 0.78, respectively. Furthermore, there was variation in the condition factor across the three research locations. The lowest condition factor was observed on Piring Island, indicating low abundance due to the threat of predators at that location.

Acknowledgments

This research is part of a Regular Fundamental Research Grant funded by the Ministry of Education, Culture, and Research and Technology. The author team would like to express their gratitude for the funding provided through contract number 003/KP-PFR/LPPM/UNRIKA/VII/2024.

Declaration statement

The authors report no potential conflict of interest.

References

Amelia, F., Ramses, R., & Ismarti, I. (2024). Pengaruh Penggunaan Asam Organik untuk Menurunkan Kadar Logam Timbal (Pb) pada Daging Siput Gonggong. *Indonesian Journal of Pure and Applied Chemistry*, *7*(1), 10–16.

Fadhil, R., Muchlisin, Z., & Sari, W. (2016). Hubungan Panjang-Berat dan Morfometrik Ikan Julung-Julung (*Zenarchopterus dispar*) dari Perairan Pantai Utara Aceh. *Jurnal Ilmiah Mahasiswa Kelautan Dan Perikanan Unsyiah*, *1*(April), 146–159.

Gundo, M. T., Rahardjo, M. F., Batu, D. T. F. L., & Hadie, W. (2014). Length-Weight Relationship and Condition Factor of Eggcarrying Buntinge, *Adrianichthys oophorus* Kottelat, 1990 (Beloniformes: Andrianichthyidae) in Danau Poso Sulawesi Tengah. *Jurnal Iktiologi Indonesia*, *14(3)*(3), 225-234 [in Indonesian]. https://doi.org/10.32491/jii.v14i3.83

Hamuna, B., Tanjung, R. H. R., Suwito, S., Maury, H. K., & Alianto, A. (2018). Study of Seawater Quality and Pollution Index Based on Physical-Chemical Parameters in the Waters of the Depapre District, Jayapura. *Jurnal Ilmu Lingkungan*, *16*(1), 35–43. https://doi.org/10.14710/jil.16.135-43

Haumahu, S., Uneputty, P., & Tuapattinaja, M. . (2014). Variasi Morfometrik dan Hubungan Panjang Berat Siput Jala (*Strombus luhuanus*). *Jurnal TRITON*, *10*(2), 122–130.

Ismail, F., Akbar, N., Pembonan, R. E., Studi, P., Kelautan, I., Studi, P., & Kelautan, I. (2019). Kajian Pemanfaatan Padang Lamun sebagai Lahan Budidaya Ikan Baronang di Pulau Sembilan Kabupaten Sinjai. *Jurnal Ilmu Kelautan dan Kepulauan*, *2*(1), 48–62.

Ismarti, I. (2024). *Akumulasi dan Distribusi Logam Berat di Pesisir Barat Pulau Batam* (Suheryanto (ed.); 1st ed., Issue November). Insight Mediatama.

Ismarti, I., Ramses, R., Fitrah, A., & Suheryanto, S. (2017). Kandungan Tembaga (Cu) dan Timbal (Pb) pada Lamun Enhalus Accoroides dari Perairan Batam, Kepulauan Riau, Indonesia. *DEPIK*, *6*(1), 23–30. https://doi.org/10.13170/depik.6.1.5555

Malesi, W. A. ., & Putra, D. J. (2024). Kandungan Total Dissolved Solid (TDS) dan Salinitas Air Tanah di Distrik Merauke Total Dissolved Solid (TDS) Content and Water Salinity in District Merauke. *Sumberdaya Akuatik Indopasifik*, *8*(2), 145–152.

Merdekawati, D., Nurhayati, T., & Jacoeb, A. (2017). Kandungan Proksimat Dan Mineral dari Keong Mata Lembu (Turbo setosus Gmelin 1791). *Jurnal Mina Sains*, *3*(1), 47–53. https://doi.org/10.30997/jms.v3i1.865

Mubarak, A. Shofy, U., D. A. S., & Kusdarwati, R. (2018). Korelasi antara Konsentrasi Oksigen Terlarut pada Kepadatan yang Berbeda dengan Skoring Warna Daphnia spp. *Jurnal Ilmiah Perikanan Dan Kelautan*, *2*(1), 1–6. https://doi.org/10.20473/jipk.v2i1.11665

Napisah, S., & Machrizal, R. (2021). Hubungan Panjang Berat dan Faktor Kondisi Ikan Gulamah (*Johnius trachycephalus*) di Perairan Sungai Barumun Kabupaten Labuhanbatu. *Bioscientist : Jurnal Ilmiah Biologi*, *9*(1), 63. https://doi.org/10.33394/bjib.v9i1.3562

Pingki, T., & Sudarti, S. (2021). Analisis Kualitas Air Sungai berdasarkan Ketinggian Sungai Bladak dan Sungai Kedungrawis di Kabupaten Blitar. *Budidaya Perairan*, *9*(2), 54–63. https://doi.org/10.35800/bdp.9.2.2021.35364

Pratiwi, I., Fathul, F., & Muhtarudin. (2015). Pengaruh Penambahan berbagai Starter pada Pembuatan Silase Ransum terhadap Kadar Serat Kasar, Lemak Kasar, Kadar Air, dan Bahan Ekstrak Tanpa Nitrogen Silase. *Jurnal Ilmiah Peternakan Terpadu*, *3*(3), 116–120. https://doi.org/10.23960/jipt.v3i3.p%25p

Pratiwi, W., & Utami, R. . (2022). Perlindungan Hukum terhadap Pengelolaan Siput Lola (*Rochia nilotica*) di Pulau Enggano, Bengkulu. *Bina Hukum Lingkungan*, *6*(3), 351–361.

Ramses, R., Ismarti, I., & Syamsi, F. (2019). Length-Weight Relationships and Condition Factors of Four Dominant Fish Caught by Coral Bubu Trap on the West Coast of Batam Island, Indonesia. *Aceh Journal of Animal Science*, *5*(1), 1–10. https://doi.org/10.13170/ajas.5.1.14902

Ramses, R., Syamsi, F., & Notowinarto, N. (2018). Karakteristik Morfometrik, Pola Sebaran, Kepadatan dan Kondisi Lingkungan Siput Gongong *Strombus canarium* di Perairan Kota Batam. *Simbiosa*, *7*(2), 95. https://doi.org/10.33373/sim-bio.v7i2.1502

Ramses, R., Syamsi, F., & Notowinarto, N. (2019). Length-Weight Relationship, Growth Patterns and Sex Ratio of Dog Conch Strombus canarium Linnaeus, 1758 in the Waters of Kota Batam. *Omni-Akuatika*, *15*(1), 103–109.

Rofi'i, M., Mustakim, M., & Rafii, A. (2022). Long Relationship of Weight and Condition Factors of Belanak Fish (*Mugil cephalus*) in Sanipah Samboja Kutai Kartanegara Regency, East Kalimantan. *Tropical Aquatic Science*, *1*(1), 76–82. https://doi.org/10.30872/tas.v1i1.476

Sari, E. K., & Wijaya, O. E. (2019). Penentuan Status Mutu Air dengan Metode Indeks Pencemaran dan Strategi Pengendalian Pencemaran Sungai Ogan Kabupaten Ogan Komering Ulu. *Jurnal Ilmu Lingkungan*, *17*(3), 486. https://doi.org/10.14710/jil.17.3.486-491

Suheryanto, S., & Ismarti, I. (2018). Bio-Concentration Factors of Copper (Cu) and Lead (Pb) in Seagrass and Some Fish from Coast Batam, Riau Islands, Indonesia. *Journal of Physics: Conference Series*, *1095*(1). https://doi.org/10.1088/1742-6596/1095/1/012038

Tazkia, R., Maulana, I. T., & Purwanti, L. (2016). Prosiding Farmasi Analisis Kandungan Asam Lemak Keong Mata Lembu (*Turbo argyrostoma* L.) dan Rumput Laut Coklat (*Sargassum sp.*) dengan Metode KG-SM. *Prosiding Farmasi*, 559–565.

Utami, R. T., Ibrahim, P. S., Kusnadi, A., Kurnianto, D., Triandiza, T., & Pesillette, R. N. (2022). Hubungan Panjang Berat dan Faktor Kondisi Siput Lola (Rochia nilotica) di Perairan Maluku, Sumbawa, dan Bengkulu. *Jurnal Kelautan Tropis*, *25*(3), 320–328. https://doi.org/10.14710/jkt.v25i3.14089