

Population dynamics of whiskered velvet Shrimp (*Metapenaeopsis barbata*) in Samboja Waters, Kuala Kutai Kartanegara Regency

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ABSTRACT

Samboja Kuala has a very wide sea and has a very abundant ecosystem and natural resources. The most dominant community work in Samboja Kuala is fishermen, the fishermen's catches include fish, shrimp, seaweed, and others. Brown Spot Shrimp (*Metapenaeopsis barbata*) is one of the catches in Samboja Kuala waters. Brown spot shrimp catches operate during the day as well as at night. This study was conducted in November-December 2022. Sampling using trawl fishing gear. The purpose of this study was to calculate sex ratio, age estimation, age group, mortality, and growth pattern. The sex ratio has 200 males and 300 shrimp females have a ratio of 0.66: 1.50. Age estimation of males and females, with growth rate (K) of male brown spot shrimp of 1,400 and females of 1.1 00, while asymbiotic length value (L_{∞}) in males of 95.90 and females of 94.44. The age group of males ranges from 48.2 7 mm – 87.32 mm , females range from 47.2 2 mm – 84.45 mm,. The total coefficient mortality (Z) of males and females was 3.25 per year and 2.79 per year. The natural mortality coefficient (M) of males and females was 1.63370 per year and 1.40121 per year. The mortality coefficient due to capture of (F) males and females was 1.62 per year and 1.39 per year. The male and female utilization rates are 0.50 and 0.50. On the growth pattern has the results of the analysis of males, a new addition occurred in June amounting to 28.6.5,%. in females a new addition occurred in July of 15.05,%.

INTRODUCTION

Samboja is a district in the coastal area of Kutai Kartanegara Regency. Samboja Kuala Village has extensive marine waters and abundant natural resources. Samboja is located between several districts within Kutai Kartanegara Regency. The district of Samboja is situated between 116°50' E - 117°14' E and 0°52' S - 1°08' S, covering an area of approximately 1,046 km² (BPS Kutai Kartanegara Regency, 2011). The livelihood of the people in Samboja Kuala includes fishing among other activities.

Kutai Kartanegara is a regency in East Kalimantan known for its significant fisheries production, amounting to 43,676.20 tons per year (BPS, 2022). Among the districts in Kutai Kartanegara Regency, Kuala Samboja District has the highest fisheries production at 10,246.50 tons per year in 2021.

Brown Spotted Shrimp (*Metapenaeopsis barbata*) are abundant in these waters, commonly known locally as "udang kroso". Brown spotted shrimp come in various sizes and types. In the Samboja area, brown spotted shrimp are relatively inexpensive, priced at 20,000 IDR per kilogram due to their small size.

They are widely distributed in the Western Indo-Pacific waters from the Bay of Bengal to Japan and are popular among Indonesian consumers (Chiang et al., 2012). These shrimp can be found at depths of 20-70 meters, typically above rocky, sandy, and muddy substrates.

METHODOLOGY

A. Research Location and Time

This research was conducted from November to December 2022 in the Coastal Waters of Samboja Kuala, Samboja District, Kutai Kartanegara Regency, involving shrimp trawling activities during nighttime. Data collection locations during the study were in the Northern Zone of Coastal Waters of Samboja Kuala.

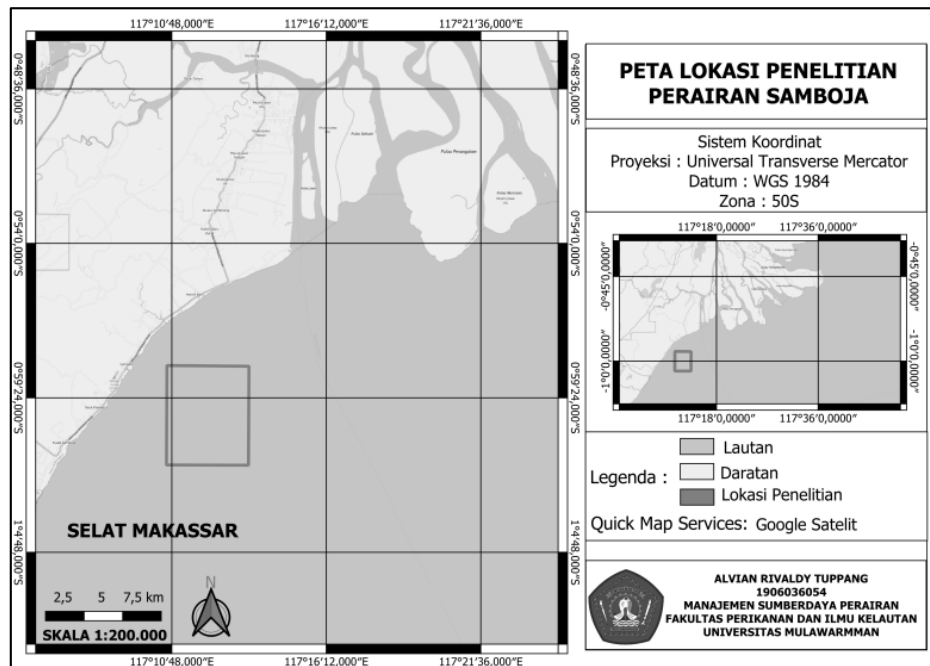


Figure 1. Study location map

B. Research Procedure

Sampling for this research was conducted from fishermen's catches of shrimp using trawling nets during nighttime. Samples were collected once a week to facilitate sample measurement and prevent sample damage. Subsequently, shrimp body parts were measured at the Conservation Laboratory of the Faculty of Fisheries and Marine Sciences, Mulawarman University.

C. Data Analysis

Data obtained were analyzed using the following analytical methods:

1. Sex Ratio

Sex ratio of shrimp was calculated using the equation:

$$X = M : F$$

where:

- X = sex ratio

- M = number of male shrimp (individuals)
- F = number of female shrimp (individuals)

2. Age Estimation

Age estimation was performed using the Von Bertalanffy growth formula (Sparre et al., 1999):

$$L_t = L_{\infty} (1 - e^{-K(t-t_0)})$$

where:

- L_t = length of shrimp at age t (mm)
- L_{∞} = asymptotic length of shrimp (mm)
- K = growth coefficient
- t_0 = theoretical age of shrimp when length equals zero (months)
- t = age (months)

The parameter t_0 was determined using the Pauly formula (1980):

$$\text{Log}(-t_0) = -0.3922 - 0.2752 (\text{Log } L_{\infty}) - 1.038 (\text{Log } K)$$

3. Mortality

Natural mortality estimation was calculated using the empirical Pauly formula (1980):

$$\text{Log } M = -0.0066 - 0.279 \text{Log } L_{\infty} + 0.543 \text{Log } K + 0.4634 \text{Log } T$$

where:

- L_{∞} = asymptotic length of shrimp (mm)
- K = growth coefficient
- T = average surface water temperature ($^{\circ}\text{C}$)

Total mortality was estimated using the equation proposed by Beverton and Holt (1956) in Sparre et al. (1992):

Fishing mortality was estimated using the equation:

$$Z = F + M$$

where:

- F = fishing mortality
- Z = total mortality

Exploitation rate (E) was obtained using the Beverton and Holt formula:

$$E = F / Z$$

4. Recruitment Pattern

Recruitment pattern data were analyzed using the FiSAT II software's recruitment pattern sub-program, aiming to determine the temporal construction of length frequency recruitment peaks per year. The data were transformed into lfq format (grouped frequencies) and input with previously calculated values of L_{∞} and K, resulting in recruitment pattern histograms.

This research was conducted from November to December 2022 in the waters of Kuala Samboja, Samboja District, Kutai Kartanegara Regency. This location was chosen as the initial area of fishermen's catches. Fishing gear used included Gillnets, Purse seines, Trammel nets, and Trawls, with fishing activities conducted both during daytime and nighttime.

RESULT AND DISCUSSION

A. Research Location

This research was conducted from November to December 2022 in the waters of Kuala Samboja, Samboja District, Kutai Kartanegara Regency. This location was chosen as the primary area for fishermen's catches. Fishing gear used included Gillnets, Purse seines, Trammel nets, and Trawls, with fishing activities conducted during both daytime and nighttime.

B. Sex Ratio

The sex ratio values of brown spot shrimp (*Metapenaeopsis barbata*) males and females during the study are presented in Table 1.

Table 1. Sex ratio

Month	Number of Individual		Ratio	
	Male	Female	Male	Female
November-Desember	200	300	0,66	1,50

Based on Table 1. Sex ratio of brown spot shrimp (*Metapenaeopsis barbata*) males and females, the number of female shrimp is greater than male shrimp with a ratio of 0.66 : 1.50. Based on the sex ratio calculation, the ratio of male to female *Metapenaeopsis barbata* shrimp is 1 : 2.12. This ratio indicates that the number of female shrimp is twice that of male shrimp. This demonstrates that the number of female brown spot shrimp is still greater than male shrimp, Saputra et al. (2009). If the population has a balanced or female-biased sex ratio, it can be considered that the population is still in an ideal condition for maintaining its sustainability.

C. Growth Rate

The growth rate analysis was conducted using the Length Frequency Analysis (ELEFAN-1) program, and the growth values for males and females were obtained. Based on the total length frequency data of brown spot shrimp males and females, the growth rate (K) and the asymptotic length (L_{∞}) values are presented in Table 2.

Table 2. Estimated Growth Parameters of Brown Spot Shrimp (*Metapenaeopsis barbata*)

Parameter	Jantan	Betina
L_{∞}	94,84	94,44
K	1,40	1,10
t_0	0,081	0,105

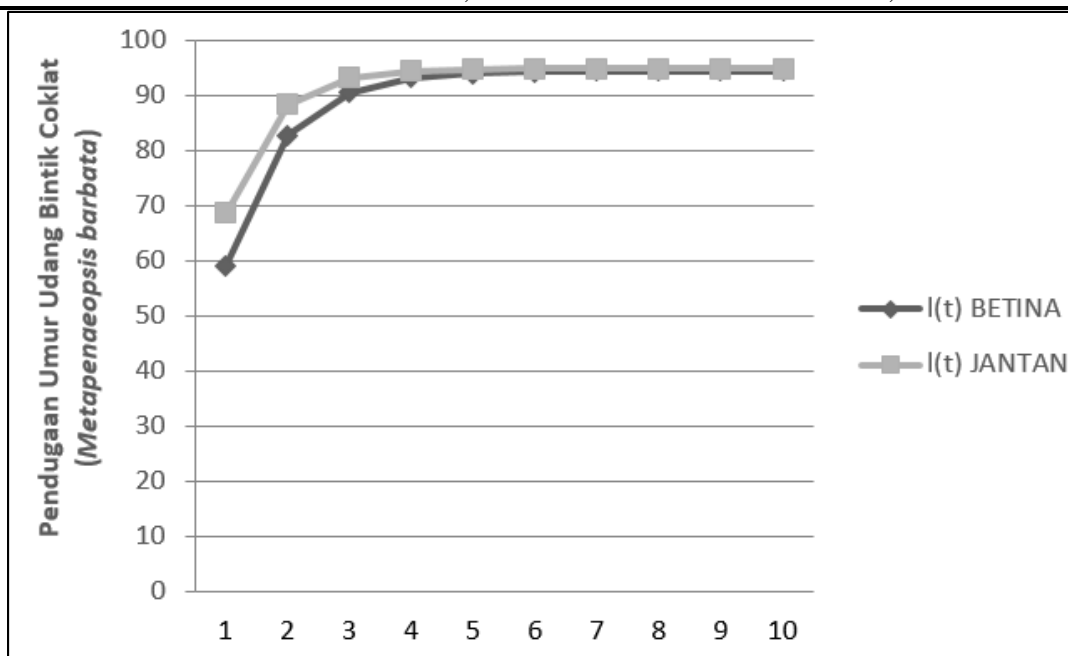


Figure 2. Age estimation of brown spot shrimp (*Metapenaeopsis barbata*)

Based on the growth graph in Figure 1, it shows that the growth of male and female brown spot shrimp (*Metapenaeopsis barbata*) differs, with the growth rate of female brown spot shrimp being faster compared to male brown spot shrimp. Rapid growth in the length of male and female shrimp occurs at a young age, while the growth rate slows as they age until they reach their asymptotic length.

D. Age Groups

Based on the measurement of total length frequency of male and female brown spot shrimp during the study, the results are presented in Figures 2 and 3. According to the figures, the mapping results between frequency values and class midpoints show that the age groups of male and female shrimp are not significantly different. The age group of male brown spot shrimp ranges from 45.32 mm to 89.53 mm, while the age group of female brown spot shrimp ranges from 35.94 mm to 95.06 mm.

E. Mortality

Based on the values of the length parameters of brown spot shrimp, calculations were performed to provide input for estimating catch results, processed using the FiSAT II software program, as shown below:

Table 3. Mortality

Parameter	Estimation value	
	Male	Female

Natural mortality (M)	1,63878	1,40121
Total mortality (Z)	2,92	2,79
Catch mortality (F)	1,28	1,39
Exploitation rate (E)	0.44	0,50

Based on the table above, the maximum length and growth rate are presented, with the water temperature being 29°C, which is a normal temperature for the waters. The total mortality coefficient (Z) for male and female brown spot shrimp is 2.92 per year and 2.79 per year, respectively. The natural mortality coefficient (M) for male and female brown spot shrimp is 1.63878 per year and 1.40121 per year, respectively. The fishing mortality coefficient (F) for male and female brown spot shrimp is 1.28 per year and 1.39 per year, respectively. The exploitation rate of brown spot shrimp for males and females is 0.44 and 0.50, respectively.

F. New Growth Pattern (Recruitment)

Based on the monthly percentage of new additions or the new growth pattern of brown spot shrimp (*Metapenaeopsis barbata*) males and females, the results are presented in Figure 3.

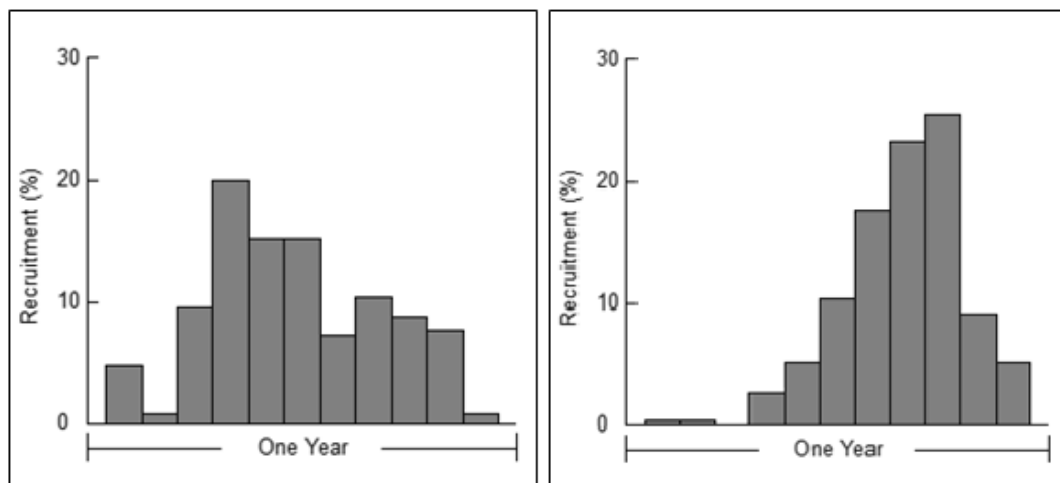


Figure 3. Graph of the growth pattern of brown spot shrimp (*Metapenaeopsis barbata*) female (left side) and male (right side)

The new growth pattern of brown spot shrimp males and females in Kuala Samboja waters. Based on the length frequency data obtained through the ELEFAN I program, the analysis shows that new additions for male brown spot shrimp occurred in September, amounting to 25.58%. For female brown spot shrimp, new additions occurred in April, amounting to 20.11%. According to Naami (1984) cited in Nurdin and Kembaren (2015), rainfall levels are related to the peak spawning season of shrimp, which typically occurs at the beginning and end of the rainy season. Therefore, it is recommended to reduce or refrain from fishing efforts during these periods.

CONCLUSION

1. Brown spot shrimp (*Metapenaeopsis barbata*) caught at night exhibit faster growth rates in females compared to males.
2. Brown spot shrimp (*Metapenaeopsis barbata*) display different growth patterns, mortality rates, and recruitment patterns between males and females.
3. Brown spot shrimp (*Metapenaeopsis barbata*) show varying mortality outcomes, determining values for Natural Mortality (M), Total Mortality (Z), Fishing Mortality (F), and Exploitation Rate (E).

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