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NOTE

Length-weight relationship of mangrove clam (*Pegophysema philippiana*) in different sites within the Baganga, Davao Oriental Province, Philippines

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ABSTRACT. Mangrove clam *Pegophysema philippiana* Reeve, 1850, is common to mangroves muddy substrate in Baganga, Davao Oriental, particularly in barangay Kinablangan, Lucod, Salingcomot and Bobonao. Sampling was done on May 2-7, 2022, during high tide. Mangrove clam length-weight relationship was calculated using the exponential equation $W = aL^b$. A total of 769 mangrove clams were collected during sampling. The biggest (4.4 ± 0.81cm) and heaviest (43.4 ± 25.3 g) clams were recorded at Bobonao, the smallest was measured at Lucod (3.7 ± 0.65 cm), and the lightest clam was found at Kinablangan (26.8 ± 16.28 g). ANOVA detected significant differences ($p < 0.05$) in length and weight of mangrove clams between sites. Length-weight relationship of mangrove clam exhibited a strong positive relationship between length and weight; however, different values of slopes were noted. This is very common in bivalves because they are very sensitive to environmental changes. In general, the length-weight relationship of mangrove clam in Baganga, Davao Oriental, revealed allometric growth pattern.

Key words: Davao, exploitation, gleaning, invertebrates, mangrove ecosystem.

Relación longitud-peso de la almeja de manglar (*Pegophysema philippiana*) en diferentes sitios dentro de Baganga, Provincia Oriental de Davao, Filipinas

RESUMEN. La almeja de manglar *Pegophysema philippiana* Reeve, 1850, es común en los sustratos fangosos de los manglares en Baganga, Davao Oriental, particularmente en los barangays de Kinablangan, Lucod, Salingcomot y Bobonao. El muestreo se realizó del 2 al 7 de mayo de 2022, durante la marea alta. La relación longitud-peso de las almejas de manglar se calculó mediante la ecuación exponencial $W = aL^b$. Se recolectaron un total de 769 almejas de manglar durante el muestreo. Las almejas más grandes (4,4 ± 0,81 cm) y más pesadas (43,4 ± 25,3 g) se registraron en Bobonao, las más pequeñas se midieron en Lucod (3,7 ± 0,65 cm), y las almejas más ligeras se encontraron en Kinablangan (26,8 ± 16,28 g). El ANOVA detectó diferencias significativas ($p < 0,05$) en la longitud y el peso de las almejas de manglar entre los distintos sitios. La relación longitud-peso de la almeja de manglar exhibió una fuerte relación positiva entre la longitud y el peso; sin embargo, se observaron diferentes valores de pendientes. Esto es muy común en los bivalvos porque son muy sensibles a los cambios ambientales. En general, la relación longitud-peso de la almeja de manglar en Baganga, Davao Oriental, reveló un patrón de crecimiento alométrico.

Palabras clave: Explotación, espigueo, invertebrados, ecosistema de manglar.

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Mangrove clam *Pegophysema philippiana* Reeve, 1850, is a highly sought bivalve species in the Philippines because of its flavor and size, and is con-

sidered as a local seafood delicacy in the region (Primavera et al. 2002). Mangrove clam is a burrowing bivalve and one of the most valued invertebrate species in the Davao Region. It is considered as the main source of proteins, vitamins and minerals for the poorest social communities living on the coast since most of them rely on artisanal fishery catch (Dejarme et al. 2015). Due to the large population of the Philippines, growing coastal settlement drives increasing fishing pressure on certain commodities, and the mangrove clam is not exempted from this problem since it is very susceptible for exploitation (Araneta 2016). A study in biology, ecology, genetics, and early life stages of *P. philippiana* was already conducted (Adan 2000; Primavera et al. 2002; Araneta 2016); however, the study of its morphometric measurement was limited (Sajol-Degamon and Fernandez-Gamalinda 2021). Hence, only taxonomic investigation was conducted in the Davao Region and no morphometric relationship study was carried out (Lumogdang et al. 2022).

Morphometric measurements of the association between length and weight were computed in the current investigation. In fisheries biology and population dynamics, the length-weight relationship (LWR) is crucial and many stock assessment models suggested the use of LWR parameters (Jamabo et al. 2009). LWR is basic for evaluating the growth of any edible and economically significant invertebrate species since it may directly represent the organism's general health by providing an evaluation of its weight in relation to its length (Aban et al. 2017).

Mangrove clam was reported to be depleted in Baganga, Davao Oriental according to the Municipal Agriculturist and observation of gleaners during the pre-sampling visit (Bacaltos et al. 2010). Although mangrove clams could still be harvested in the mangrove areas of Baganga, Davao Oriental, a need for scientific data is essential and this paper aims to fill in this gap. This paper focuses only on the morphometric relationship (LWR) of *P. philippiana* in different barangay[1] of Baganga, Davao Oriental, as this municipality is one of the major exporters of mangrove clams in Davao City (Bangkerohan and Agdao Public Markets) with reported 1,000 to 3,000 kg of mangrove clam sold every day (Bacaltos et al. 2010). Thus, the data generated from the current study provides a first reference for the study of mangrove clam fishery management and ecological monitoring in the area.

Mangrove clam (*P. philippiana*) was collected in barangay Kinablangan, Lucod, Salingcomot and Bobonao, within the Baganga, Davao Oriental province (Figure 1). Field sampling was done during daytime on May 2-7, 2022, with the assistance of three hired gleaners. Within the mangrove forest, gleaning was done during high tide as preferred by the gleaners to facilitate easy maneuver in the mud at 1 m depth. Using their toes, they locate the mangrove clam by doing rhythmic movement, which is termed locally as *hinol-hinol*. Shell length was measured using a Vernier caliper (± 0.1 mm), while weight was obtained using a digital weighing scale (± 0.2 g) *in situ*. Collected clams were partially drained before weighing in order to minimize the influence of water.

Analysis of Variance (ANOVA) was used to establish the significant difference in length and weight of mangrove clams ($p = 0.05$). Further, Tukey test was used to identify significant difference between study sites. The relationship between length and weight was also calculated using the exponential equation $W = aL^b$, where W stands for weight, a stands for the intercept, which represents the initial growth coefficient, L stands for length, and b stands for the slope, which represents the relative growth rates of the variables and provides growth information (Aban et al. 2017). The value of the slope was analyzed using the t-test to determine the growth exhibited by the

[1]Barangay is the lowest territorial and political boundary in the Philippines.

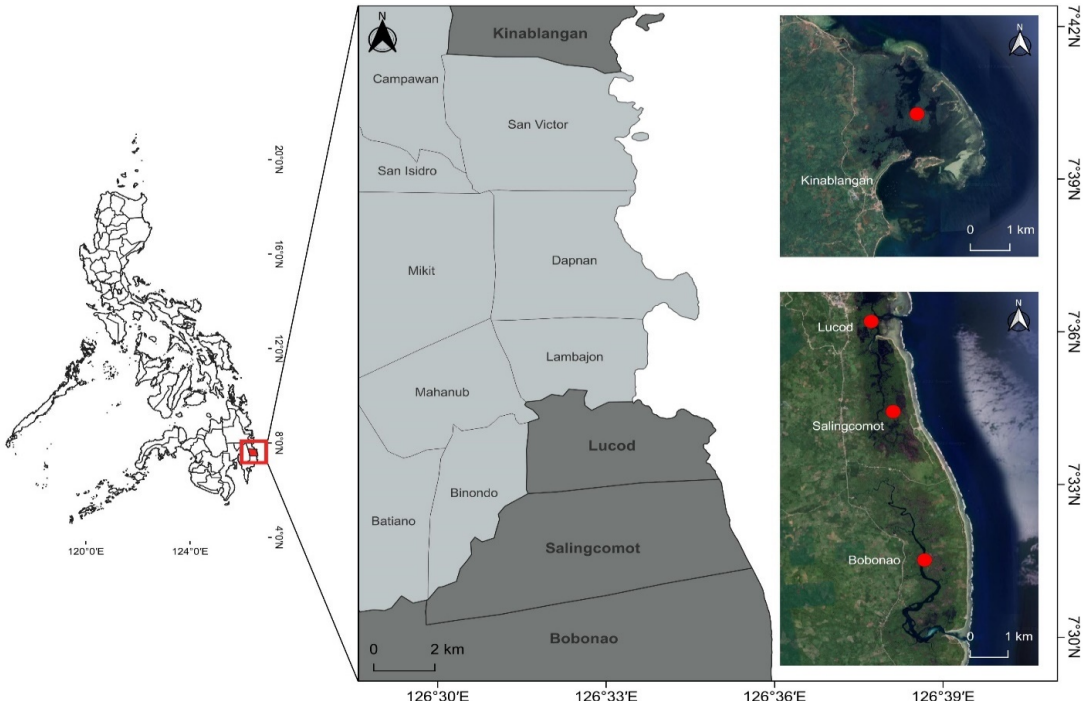

Figure 1. Collection sites (red spots) of mangrove clam in Baganga, Davao Oriental province, Philippines.

mangrove clam (López-Rocha et al. 2018). Growth is isometric when b = 3, allometric when b substantially differs from 3 (positive if b > 3 and negative if b < 3) (Sajol-Degamon and Fernandez-Gamalinda 2021). The analysis was carried out through SPSS 20 and Microsoft Excel 365.

A total of 769 mangrove clam *P. philippiana* specimens were collected in Baganga, Davao Oriental. Results indicated that Bobonao had biggest clams with a mean length of 4.4 ± 0.81 cm (n = 176) followed by Salingcomot with 4.1 ± 0.71 cm (n = 120), Kinablangan with 3.8 ± 0.67 cm (n = 251), and lastly Lucod with 3.7 ± 0.7 cm (n = 222). In terms of mean weight, the heaviest individual was found in Bobonao (43.4 ± 25.3 g), followed by Salingcomot (37 ± 20.57 g), Lucod (29.8 ± 17.77 g) and Kinablangan (26.8 ± 16.28 g). The Tukey test found that mangrove clams from Kinablangan and Lucod showed no significant difference ($p > 0.05$) in length and weight, while significant differences were observed when comparing Bobonao and Salingcomot ($p < 0.05$). One factor that might affect the size differentiation (length and weight) of clams between study sites is the magnitude of harvest of the resource (Elvira and Jumawan 2017). Moreover, comparable results from barangay Lucod and Kinablangan might be due to the accessibility of both areas in which no gleaning restrictions were instituted and as a result gleaners could harvest clams freely and gleaning pressure increased. In addition, according to the office of Municipal Agriculture, the majority of the gleaners were from Lucod, so it is safe to assume that the harvest in Kinablangan and Lucod was comparable compared to other study site (Sadino 2022 pers. comm.). High exploitation pressure on resources in mangrove wetlands of Butuan (Philippines) may be found in Elvira and Jumawan (2017), where they found out that exploitation due to gleaning of mud clam *Polymesoda erosa* was a contributing factor of its size variability. So, different sizes observed in

mangrove clam in the current study might also be influenced by the gleaning activity in different barangays. In addition, mangrove clam has high market value in Baganga, Davao Oriental, with reported values of 2.2-2.7 U$ kg^{-1} (Sunstar 2018), which may drive an increase in gleaning pressure on some study sites considering there is no gleaning restrictions to increase their income (Table 1).

Mangrove clams in this study ranged from 3.7-4.4 cm shell length and 26.8-43.4 g weight, indicating that mangrove clam population was in good condition based on its size structure. Clams reached first sexual maturity at 3 cm shell length before being harvested (Primavera et al. 2002; Araneta 2016). Therefore, growth exploitation was not observed since bigger clams were gleaned in the area (> 3 cm shell length). In consonance, recruitment exploitation was also not observed since mangrove clam collected across study sites were smaller compared to the ideal brood stock size of 5.7-7.3 cm and weights of 60-125 g since recruitment exploitation only existed when the brood stock of a certain fishery were heavily harvested (Adan 2000). Moreover, results from the present study are comparable to those of Kilatong and Bruckner (2010) in which mean length of mangrove clams collected outside the protected area of Oikull, Airai Strair, Republic of Paluau, ranged from 4.45-4.75 cm. However, bigger mangrove clam also collected in an unprotected area in Panay, Philippines by Adan (2000) reported 4.3-5.1 cm mean length and 21-170 g weights.

Mangrove clam is a commercially important bivalve collected for consumption and sold to local markets and restaurants by the local gleaners (Yahya et al. 2020). Due to their size, taste, and supposed aphrodisiac powers, mangrove clams are sold in other regions to generate more income to support daily needs of families (Primavera et al. 2002). Given its economic value and dependence of gleaners to mangrove clam to sustain their regular necessities, fishing pressure might increase as competition among gleaners arouse during harvest which could influence a decline in mangrove clam size and stocks.

The result from morphometric analysis showed that shell length and total weight of mangrove clam *P. philippiana* in all study sites had strong positive relationship, since all values of correlation coefficients (r^2) were close to 1.0 (Table 2). Thus, shell length and total weight of mangrove clam *P. philippiana* were closely related to each other and could be used to estimate total weight based on shell length. Values of the slope from different study sites varied and no isometric growth was observed. In Kinablangan, a positive allometric growth pattern (b = 3.052) was observed indicating that the weight of mangrove clam increases superiorly compared to its shell length. This growth pattern could be influenced by the existing aquaculture pond in the area which increased organic materials beneficial to clams nourishment (Lebata 2001; Sarà et al. 2009). On the other side, negative allometric growth patterns were observed in Lucod (b = 2.811), Salingcomot (b = 2.749) and Bobonao (b = 2.913) suggesting that the rate of shell length increase was higher compared to weight increase. This negative growth

Table 1. Mean (± SD) length (cm) and weight (g) of mangrove clams (*Pegophysema philippiana*) collected in different areas of Baganga, Davao Oriental. Different superscript denotes significant different using ANOVA ($p < 0.05$).

	Kinablangan (n = 251)	Lucod (n = 222)	Salingcomot (n = 120)	Bobonao (n = 176)
Mean length	3.8 ± 0.65^{b}	3.7 ± 0.7^{b}	4.1 ± 0.71^{ab}	4.4 ± 0.81^{a}
Mean weight	26.8 ± 16.28^{b}	29.8 ± 17.77^{b}	37.0 ± 20.57^{ab}	43.4 ± 25.3^{a}

Table 2. Summary of the relationship between shell length and weight and growth patterns of mangrove clam *Pegophysema philippiana* in Baganga, Davao Oriental.

Sampling sites	n	r^2	Intercept (a)	Regression coefficient (b)	t-test	Growth pattern
Kinablangan	251	0.929	0.401	3.052	$P < 0.05$	Allometric (+)
Lucod	222	0.963	0.675	2.811	$P < 0.05$	Allometric (–)
Salingcomot	120	0.886	0.685	2.749	$P < 0.05$	Allometric (–)
Bobonao	176	0.932	0.525	2.913	$P < 0.05$	Allometric (–)

Note: n = sample size, r^2 = coefficient of determination, $b > 3$ = positive allometry, $b < 3$ = negative allometry.

pattern may be driven by multiple factors such as fluctuating environmental parameters and the consequent mangrove clam physiology (Thomas 2013; Singh 2017). The analysis of the slope was also done to establish significant difference between the b values and isometric values (3) using t-test and the result showed significant difference in all study sites ($p < 0.05$).

The result of the analysis conforms to the study of Aban et al. (2017) in which the growth of organisms proceeds with different factor differing from the measurement of the length. It was also noted that the slopes of the paired morphometric parameters were greater or lesser than 3.0, meaning that the increase in shell length was not proportional to the weight gained of mangrove clam *P. philippiana*. Different findings for length and weight relationship in the selected study sites maybe influence by ecological or physiological factors (Ramesha et al. 2009; Malathi and Thippeswamy 2011) though it was a limitation in the study. As clams were particularly sensitive to environmental changes, further studies comparing its state and heterogeneity in different locations will be needed.

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