



Morphometric Relations of Gastropod Species: *Nerita albicilla* and *Patella nigra*

Roldan T. Echem

Department of Biology and Natural Science, College of Science and Mathematics,
Western Mindanao State University, Normal Road, Baliwasan, Zamboanga City 7000, Philippines

E-mail address: roldanechem@gmail.com

ABSTRACT

This study aims to compare the morphometric characteristics of *Nerita albicilla* and *Patella nigra* and to determine the allometric relationships between the shell weight, shell length, fresh weight, dry weight, tissue weight and shell weight. A total of 200 of *Nerita albicilla* and *Patella nigra* were collected along the coasts of Zamboanga City Bay, Western Mindanao, Philippines. *Nerita albicilla* has the highest mean \pm SD in width (1.59 ± 0.19 mm), fresh weight (2.59 ± 0.15 g), tissue weight (1.26 ± 0.83 g), dry weight (2.38 ± 0.55 g) and shell weight (2.19 ± 0.11 g). The fresh weight of *Nerita albicilla* was strongly related with the shell length. The shell width of *Patella nigra* was slightly correlated with shell weight. There was slight correlation between the shell width and shell weight and these can be attributed to the developmental, environmental and abiotic factors that highly contribute to the morphology of the gastropods. The calcium carbonate content suspended in the environment has major effect in the shell composition and is directly related with the shell weight. Nutrition is also a major contributory factor in the weight of the shells.

Keywords: Mollusca, gastropods, univalve, morphometric relationship, shell length, tissue weight

1. INTRODUCTION

Gastropods are the largest group in the phylum Mollusca and have been known for many years as a major source of proteins consumed by humans and other macroorganisms. The class consists of snails by which possessing outer shells into which the animal can

generally withdraw. Gastropods are found and were able to successfully thrive to different habitats such as ocean, fresh water and land performing specific roles in keeping ecological balance intact. Gastropods, being highly diverse group as compared from other groups within the Phylum Mollusca are commercially beneficial for human. The other species were used as ornaments, serves as predators, herbivores and scavengers. Other gastropod species serves as internal or external parasites to other species.

Gastropods are distributed in a wide array performing various ecological functions particularly at maintaining the balance in the environment as well as to provide food and livelihood for humans. There had been numerous methods used by researchers to further understand these organisms. Studying the morphometric relations has been widely known as a jumpstart for every comparative type of study and as well to correlate changes in the physiology of the gastropods. Extensive studies of gastropods to determine the environmental impact to the growth and development of these organisms.

Nerita albicilla and *Patella nigra* are the gastropods that are found to be highly abundant in Zamboanga City Bay. *Nerita albicilla* are commonly known for their depressed spire, sculptured with bread, low spiral ribs and their outer lip with one or two strong teeth posteriorly and sometimes one anteriorly located. *N. albicilla* commonly range from 24 mm in height and widely distributed. *Patella nigra* which is considerably known to be rare and physically, possess common spot located posteriorly. Patellidae are also known as limpets that are found in algae rich locations on most rocky shores. They support the conservation of algae because of their slime supporting plant growth.

Since gastropods vary widely in sizes and range and there are ways that biologists and ecologist study them for academic purpose or for correlating such characteristics to abiotic factors. Allometric characteristics are used in determining relationships between species size from different habitats. In order to determine how outside factors affect growth and development if an environment is too disturbed to even support their full growth or how one species is related to another species. Allometric is often known to be common in nature. Generally, it is used in comparing the same animals of different sizes or two different animals of different sizes.

A comparative study of morphometry in shell-bearing molluscs was conducted. Twenty-nine (29) species shell bearing molluscs species were identified from the intertidal stony shore in Japan. The relationships between shell size and total weight and between shell size and flesh weight are highly significant. A separate study was conducted in Thailand on the morphometric relationship of weight and size of cultured freshwater *Hyriopsis myersiana* under laboratory conditions.

Measurements were taken of the length-height and the total body weight-size (shell length, shell height and shell width). It was noted that the length-height in each period of culture showed a linear relationship and that the shell height increases as the shell length increases along with the same linear relationship. Other than that, there are only few literature had been found concerning correlating other physical parameters of the gastropods aside from the length, width and weight.

The aim of this present study is to compare the morphometric characteristics of the 2 species. The relationships between the shell weight, shell length, fresh weight, dry weight, tissue weight and shell weight were determined.

2. METHODOLOGY

Map of the study site



Figure 1. Map of Zamboanga City, Western Mindanao showing the study sites.

Samples were collected in Zamboanga City Bay namely; Sinunuc, Ebenezer and Golf. Sinunuc is approximately located at $6^{\circ}56'01.6''N$, $122^{\circ}00'03.8''E$. Ebenezer is located at $6^{\circ}55'22.3''N$, $122^{\circ}01'18.5''E$ and Golf Club Beach Resort is located at $6^{\circ}55'22.3''N$, $122^{\circ}01'18.5''E$. The 3 sites are slightly disturbed due to local visitors, destination for tourists and venue for outdoor activities.

Sample Processing

A total of 200 *Nerita albicilla* and *Patella nigra* were collected along the coasts of the sampling sites. Fresh samples were transported immediately to the College of Science and Mathematics Laboratory, Western Mindanao State University for proper identification. The morphometric characteristics of the gastropods species were measured and recorded. The shell length (SL) and shell width (SW) in millimetre was measured using calliper. The fresh weights (FW), tissue weight (TW) and shell weight (SW) in milligram were measured using analytical balance. In determining the tissue weight (TW), a pin was used to remove the tissues inside the shell, wrapped in a foil paper and dry it in the oven at $30^{\circ}C$ for 5 hours. The length (L) and width (W) were measured using a calliper.

Data analysis

Results were recorded and subjected to One-way ANOVA to determine significant difference between samples. Data were also subjected to Correlation Analysis to determine the relationships of the different variables.

3. RESULTS

Table 1 revealed the mean \pm SD of the length, width, fresh weight, tissue weight and shell weight of *Nerita albicilla* and *Patella nigra*. The length of the *P. nigra* has the highest mean \pm SD (2.16 ± 0.66). *N. albicilla* has the highest mean \pm SD in width (1.59 ± 0.19), fresh weight (2.59 ± 0.15 g), tissue weight (1.26 ± 0.83 g), dry weight (2.38 ± 0.55 g) and shell weight (2.19 ± 0.11 g).

Table 1. Mean \pm SD on the observed parameters of *Nerita albicilla* and *Patella nigra*.

Species	Shell Length (mm)	Width (mm)	Fresh Weight (g)	Tissue weight (g)	Dry Weight (g)	Shell weight (g)
<i>N. albicilla</i>	2.02 ± 0.25	1.59 ± 0.19	2.59 ± 0.15	1.26 ± 0.83	2.38 ± 0.55	2.19 ± 0.11
<i>P. nigra</i>	2.16 ± 0.66	1.43 ± 0.33	1.4 ± 0.53	0.94 ± 0.33	1.2 ± 0.15	1.0 ± 0.75

Table 2 revealed that the shell length of *Nerita albicilla* is highly related to shell weight ($P = 0.00$), shell width ($P = 0.01$), dry weight ($P = 0.00$) and shell weight ($P = 0.00$). The fresh weight is highly related to dry weight ($P = 0.00$) and shell weight ($P = 0.00$). The tissue weight is related to shell weight ($P = 0.03$). Dry weight is highly related to shell weight ($P = 0.00$). Shell weight is highly related to fresh weight ($P = 0.00$) and dry weight ($P = 0.00$).

Table 2. Pearson Correlation Analysis of parameters of *Nerita albicilla*.

Variables		P- Value
Shell length	Shell weight	0.00***
Shell width	Shell length	0.01**
Fresh weight	Dry weight	0.00***
	Shell weight	0.00***
Tissue weight	Shell weight	0.03**

Dry weight	Shell length	0.00***
	Fresh weight	0.00***
	Shell weight	0.00***
Shell weight	Shell length	0.00***
	Fresh weight	0.00***
	Dry weight	0.00***

*. Correlation is significant at the 0.05 level (1-tailed).

Table 3 revealed that the shell length of *Patella nigra* is highly related to fresh weight ($P = 0.00$) and tissue weight ($P = 0.00$). The shell width is highly related fresh weight ($P = 0.00$), tissue weight ($P = 0.00$) and dry weight ($P = 0.00$). Fresh weight is highly related to dry weight ($P = 0.00$) and shell weight ($P = 0.00$). The tissue weight is highly related to shell weight ($P = 0.00$).

Table 3. Pearson Correlation Analysis of parameters of *Patella nigra*.

Variables		P-Value
Shell length	Fresh weight	0.00***
	Tissue weight	0.00***
Shell width	Fresh weight	0.00***
	Tissue weight	0.00***
	Dry weight	0.00***
Fresh weight	Shell length	0.00***
	Dry weight	0.00***
	Shell weight	0.00***
Tissue weight	Shell length	0.00***
	Fresh weight	0.00***
	Dry weight	0.00***
Shell weight	Shell weight	0.00***
	Fresh weight	0.00***
	Dry weight	0.00***

*. Correlation is significant at the 0.05 level (1-tailed).

4. DISCUSSION

In this study, the fresh weight showed high correlation with the shell length. However, *Nerita albicilla* collected from the sampling sites varies in terms of the length, width, fresh weight, tissue weight and shell weight. The *Patella nigra* collected from the sampling sites showed statistically larger. The shell length and tissue width were significantly higher than the fresh weight and shell weight. These findings can be contributed to the age of the collected shells, the method of extraction of the tissue and also abiotic factors. The calcium carbonate content suspended in the environment has a major effect in the shell composition and directly related with the shell weight. Nutrition is also a major contributory factor in the weight of the shells. According shell mass is a relevant factor as it is known that the mechanical strength of the shell is closely related to its mass. Thus, shell mass increases with proportion with the body size, the larger the gastropods individuals the larger the body size. The location of the samples is also an indicator how a gastropod is fit enough for the level of extreme environment they are exposed with. The gastropods species can either make larger in shells early in the life cycle and gradually reduce the proportional contribution as the individual grows or make a limited shell investment at first and then increases its magnitude as they grow. It was stated that there are a variety of environmental factors that are known to influence shell morphology and the relative proportions of many gastropod species. Examples of the abiotic factors are water quality, water depth, currents, water turbulence and wave exposure.

5. CONCLUSION

The results from this study leads to insights that fresh weight statistically showed strong relationship with the shell length collected in the sampling sites. However, shell width did not statistically exhibited strong relationship with the shell length. Difference in the morphology of the gastropods are likely contributed by the difference in the physico-chemical and biotic factors in the environment.

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