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Variations in Morphometric Characteristics of *Nerita* Sp. in Ambon Bay Waters, Moluccas Indonesia

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ABSTRACT

In Ambon, *Nerita sp*. is most commonly known as *bia.* The people who live on Ambon Island consume *bia* as an alternative to fish products. *Nerita sp*. belongs to one of the gastropod mollusks that have numerous convex spires, short curved body whorls, and small dextral (right-handed) shells. The morphological characters of the shell at the family level include general forms and color patterns that can be used for identification. In simple terms, shell characters can be used for identification down to the species level. This study was conducted from May 2019 to 21 September 2019 in *Latuhalat*, *Hutumuri,* and *Suli,* three villages on Ambon Island. A purposive sampling technique was employed. The identification of *Nerita sp.* morphometric characters was performed using the Image Raster Viewer software version 3.0 at the Basic Laboratory of the Department of Biology Education, Universitas Pattimura, Ambon. The analysis showed morphometric variations of *Nerita sp.* in shell length (SL), shell width (SW), aperture length (AL), and aperture width (AW). The average shell length (SL) found was 23.44 mm, while the average shell width (SW) found was 19.51 mm. The average length and average width of aperture reported were 10.55 mm and 4.48 mm, respectively. The average widths and lengths of the shell and aperture were observed from the seven species of *Nerita sp.* collected from Ambon bay waters.

INTRODUCTION:

Ambon Island has abundant marine products, such as *Nerita sp.* that belong to the Neritidea family. *Nerita sp*. or most commonly known by the local people as *bia,* is consumed as an alternative to fish. These gastropod mollusks have numerous convex spires, short curved body whorls, and small dextral (right-handed) shells. The aperture is oval and the siphonal canal is tubular. The shell is brown with black stripes on each spiral line, the outer lip is white and the columella is yellow. The shell length varies between 3.88-1.51 cm and the shell width ranges between 2.97-1.31 cm. *Nerita sp*. also has gills and an operculum. **[1]**.

The shell morphology of the gastropod family includes general forms and color patterns that can be used for identification. **[2]**. To simply put, the shell characters can be used to identify the species of the mollusks. **[2, 3]**. Identification can be done by adjusting the specimen with the gastropod image displayed in the identification book.

Some research has been conducted to determine the morphological structure of *Nerita* sp. For instance, studied the morphological structure of *Nerita albicila* from the deep bay of Ambon and analyzed gastropods from the *Nerita* genus found in Lombok Island. **[5, 11]**. However, among past studies, there has not been any study conducted to analyze the morphometric characters of *Nerita* sp. from *Latuhalat*, *Hutumuri,* and *Suli* villages in Ambon.

Gastropods are widely scattered in the coastal waters of Ambon Island, especially in the rocky areas. This is proven by the abundance of *Nerita sp.* located around that place. However, there is little information about the morphological characters of *Nerita* sp. found in the Latuhalat, Hutumuri, and Suli villages. As a result, variations in the morphometric characters of *Nerita* sp. in Ambon bay waters have not been completely identified. Therefore, this study was conducted to reveal variations in the morphometric characters of *Nerita* sp. in Ambon bay waters. **[4].**

MATERIALS AND METHODS:

This study was conducted from May 2019 until 21 September 2019, in the coastal areas of *Latuhalat*, *Hutumuri*, and *Suli* villages, Ambon. A purposive sampling technique was employed in this study (**Figure 1**).

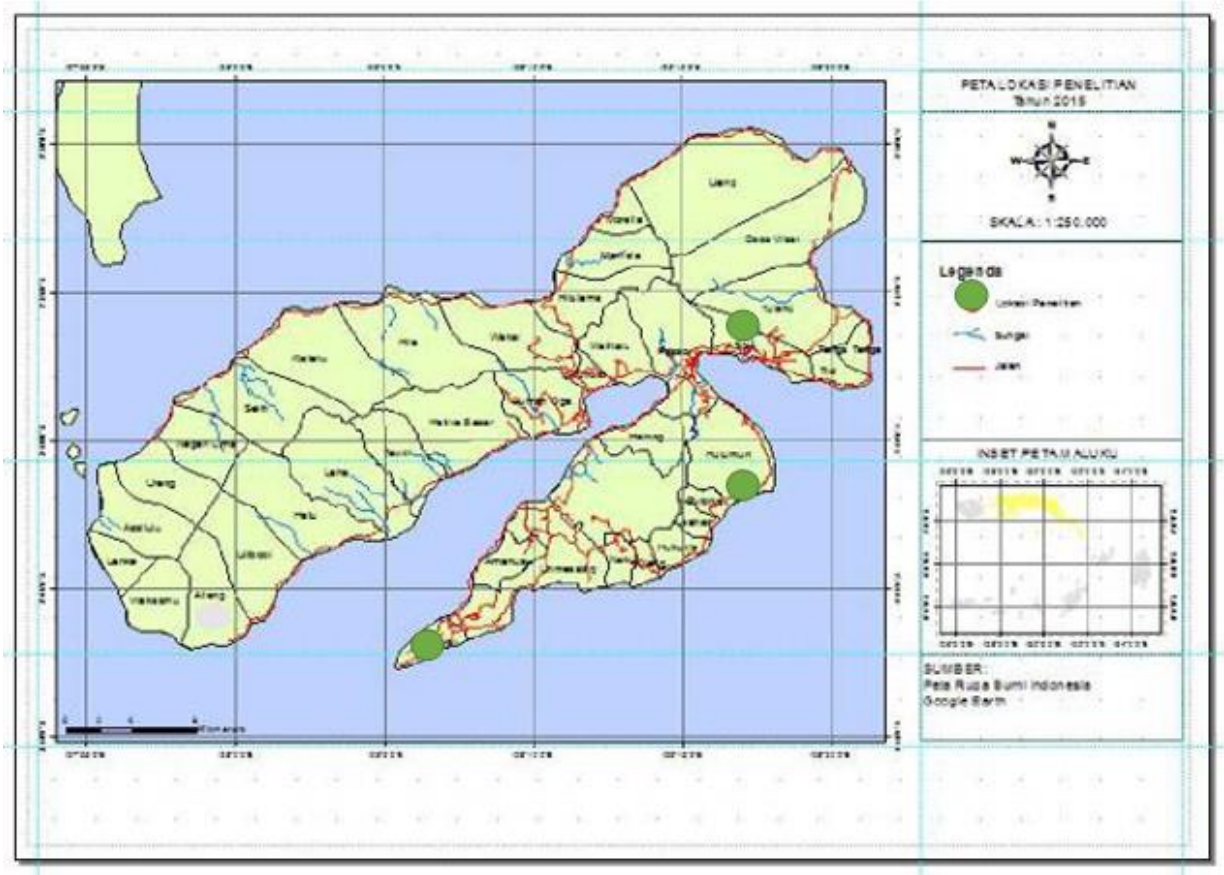

Figure No. 1: The map of Ambon Island, Indonesia

The equipment used for morphological observation and morphometric analysis consisted of a field book to record the characterization results, a Samsung 100 SSCAM digital camera for documentation, and Image Raster Viewer 3.0 software for morphometric analysis. The current study was carried out by the following procedure. The *Nerita sp.* The sample was taken, cleaned, and observed for morphological identification. The snail content and shell were separated. The shell and operculum were photographed with a Samsung 100 SSCAM digital camera. Then, the morphometric analysis of the shell and operculum was performed using Image Raster Viewer 3.0 software.

Variations in the sample's morphometric characteristics (Figure 2) were analyzed based on four parameters, namely shell length (SL), shell width (SW), aperture length (AL), and aperture width (AW). The result of the morphological analysis was presented in visual data showing the representative shells and operculum. (**Figure 2**)

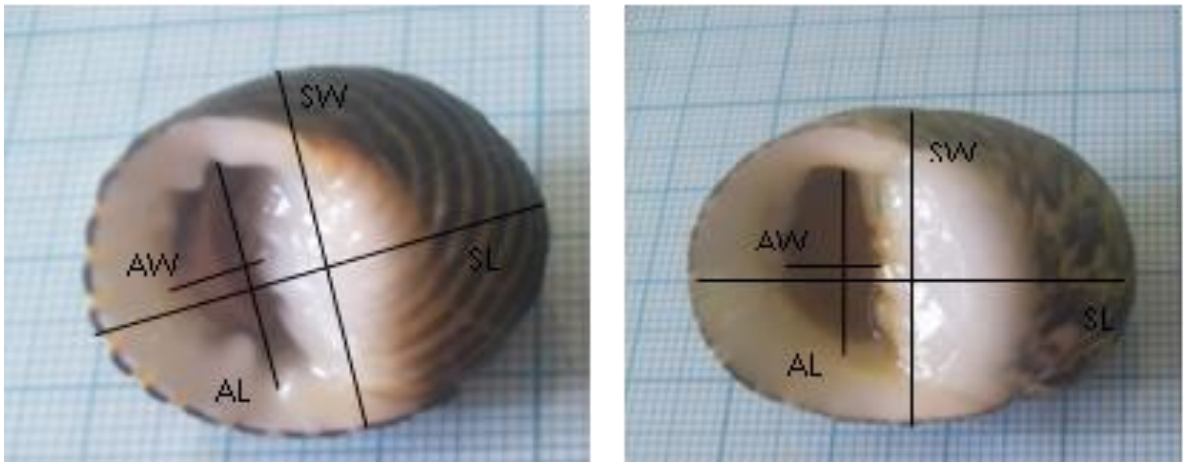

Figure No. 2: The Morphological Characteristics of *Nerita sp*.

Notes:

SW: Shell Width

SL: Shell Length

AL: Aperture Length

AW: Aperture Width

RESULTS AND DISCUSSION:

RESULTS:

***Nerita sp*. Species in Ambon Bay Waters**

The identification of the *Nerita sp.* species collected from Ambon bay waters was based on the morphological characteristics of the shell and operculum. Seven species of *Nerita sp.* were successfully identified; they are *Nerita maxima*, *Nerita costata*, *Nerita plicata*, *Nerita spengleriana*, *Nerita gossa*, *Nerita albicilla*, and *Nerita chamaeleon*. The shell morphology of each species is presented in **Figure No. 3**.

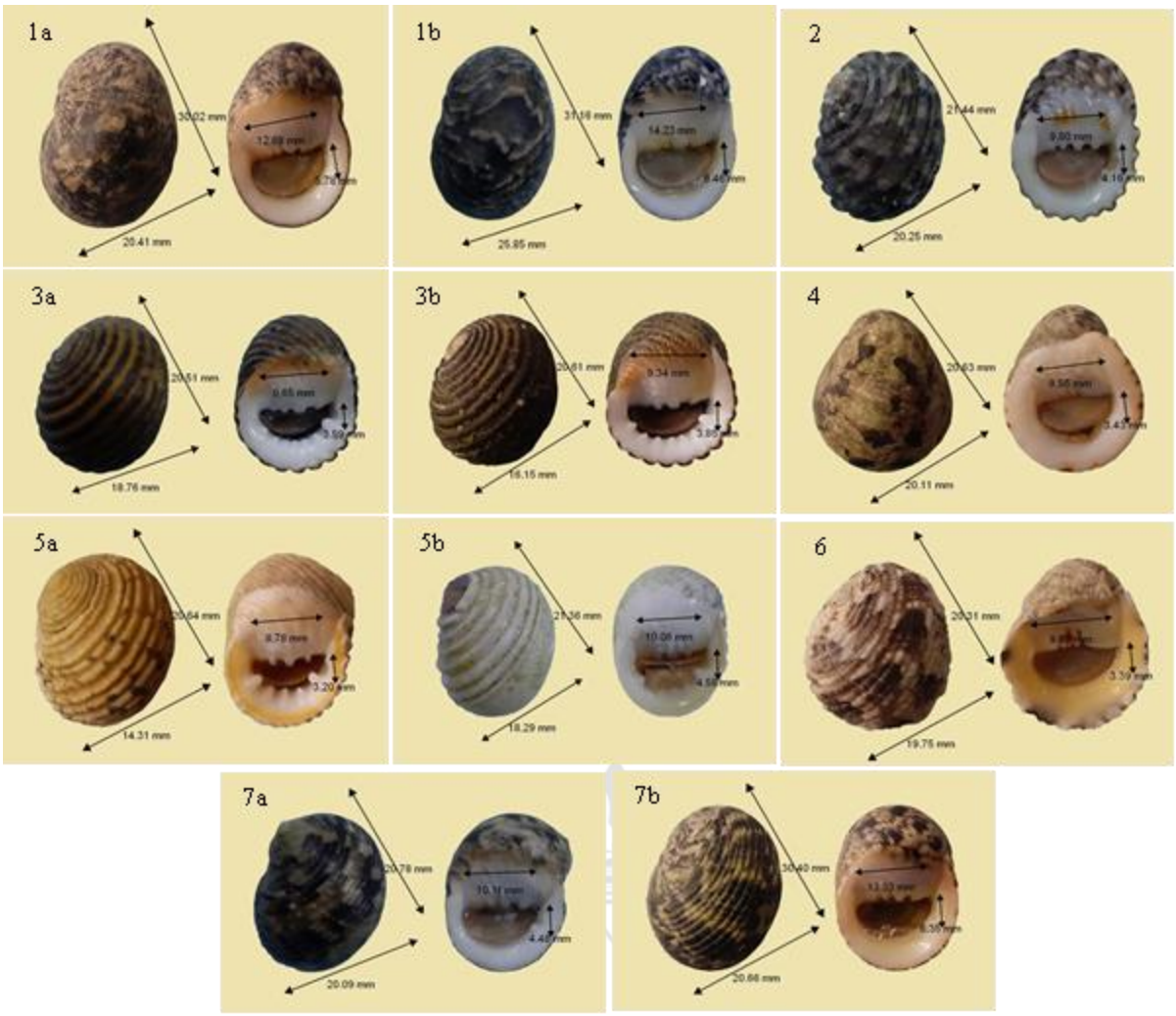

Figure No. 3: The Shell Morphology of *Nerita sp*., (1a) *Nerita maxima* Gmelin, 1791; (1b) *Nerita maxima* Gmelin, 1791; (2) *Nerita grossa* Linnaeus, 1758; (3a) *Nerita costata* Gmelin 1791; (3b) *Nerita costata* Gmelin 1791; (4) *Nerita albicilla* Linnaeus, 1758; (5a) *Nerita plicata* Linnaeus, 1758; (5b) *Nerita plicata* Linnaeus, 1758; (6) *Nerita chamaeleon* Linnaeus, 1758; (7a) *Nerita spengleriana* Récluz, 1843; (7b) *Nerita spengleriana* Récluz, 1843.

The morphology of the inner side (D) and the outer side (L) of the operculum is shown in **Figure No. 4**:

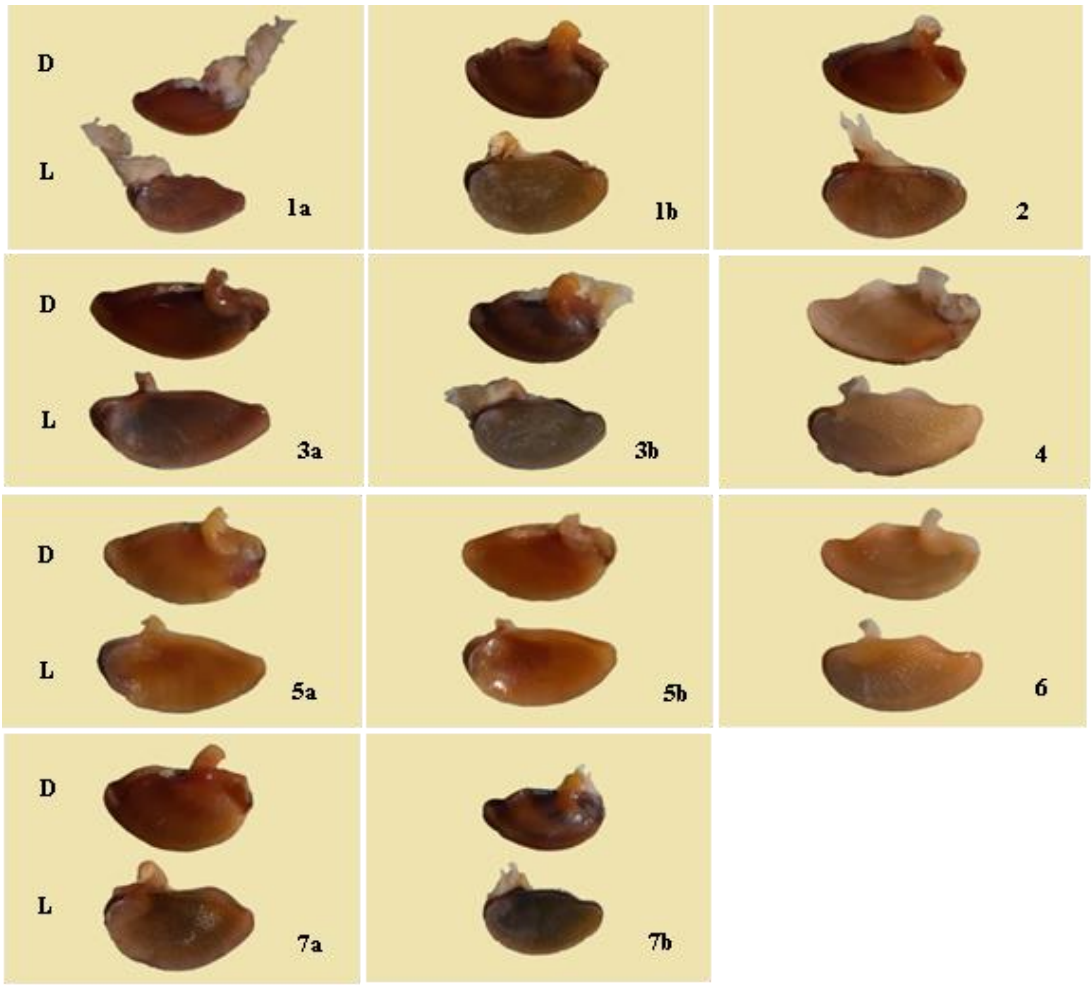

Figure No. 4: *Nerita sp. Operculum*, (1a) *Nerita maxima* Gmelin, 1791; (1b) *Nerita maxima* Gmelin, 1791; (2) *Nerita grossa* Linnaeus, 1758; (3a) *Nerita costata* Gmelin 1791; (3b) *Nerita costata* Gmelin 1791; (4) *Nerita albicilla* Linnaeus, 1758; (5a) *Nerita plicata* Linnaeus, 1758; (5b) *Nerita plicata* Linnaeus, 1758; (6) *Nerita chamaeleon* Linnaeus, 1758; (7a) *Nerita spengleriana* Récluz, 1843; (7b) *Nerita spengleriana* Récluz, 1843.

Variations in *Nerita sp*. Shell Morphometric Characteristics

The analysis of the shell morphometric characteristics (Table 1) was based on the following parameters: shell length (SL), shell width (SW), aperture length (AL), and aperture width (AW).

Table No. 1: The Shell Morphometric Characteristics of *Nerita sp*. in Ambon Bay Waters

Parameter Species	Shell Length-SL	Shell Width-SW	Aperture Length-AL	Aperture-Width-AW
N. maxima (1a)	30.02 mm	20.41 mm	12.68 mm	5.78 mm
N. maxima (1b)	31.16 mm	25.85 mm	14.23 mm	6.46 mm
N. gossa (2)	21.44 mm	20.25 mm	9.80 mm	4.16 mm
N. costata (3a)	20.51 mm	18.76 mm	9.65 mm	3.59 mm
N. costata (3b)	20.61 mm	16.15 mm	9.34 mm	3.85 mm
N. albicilla (4)	20.63 mm	20.11 mm	8.55 mm	3.43 mm
N. plicata (5a)	20.64 mm	14.31 mm	8.78 mm	3.20 mm
N. plicata (5b)	21.36 mm	18.29 mm	10.06 mm	4.58 mm
N. chamaeleon (6)	20.31 mm	19.75 mm	9.50 mm	3.39 mm
N. spengleriana (7a)	20.78 mm	20.09 mm	10.11 mm	4.48 mm
N. spengleriana (7b)	30.40 mm	20.66 mm	13.33 mm	6.35 mm

DISCUSSION:

The seven (7) species of Nerita identified in this study live predominantly in the coastal waters of Ambon Island, where the life of this species is supported by the substrate of the place. *N. albicilla, N. chameleon,* and *N. polita* have been founded in the intertidal zones of Latulahat village in Ambon. **[6]**. Besides that, ten species of Nerita also have been founded in the intertidal zones of Oma village in Central Maluku; these species include *N. albicilla*, *N. undata*, *N. chamaeleon, N. costata, N. exuvia*, *N. maxima*, *N. polita*, *N. patula*, *N. signat*a, and *N. plicata*. **[7].**

Nerita maxima have a brown shell with a colorful *batik* pattern; the pattern can be black, white, or light brown. The surface of the shell is serrated smooth and the top of the shell is small and pressed. The operculum is brown to dark brown and the outer surface of the operculum is nodular. Shell length and width differ from one individual to another; the longest and widest shells are 31.16 mm and 25.85 mm, respectively. The length and width of the aperture also vary between individuals; the longest and widest aperture is 14.23mm and 6.46mm, respectively. These species live by attaching to the surface of a dead coral.

The shell color of *N. maxima* varies widely. Most of the specimens are dark brown and gray and some are brightly colored. The operculum is flat and the pustulosa is gray-green. **[8]**. *N. maxima* have a grayish-black shell, accompanied by gray and white color, white porcellaneous callus, white aperture, and mottled outer lip. **[9]**. The operculum is pale gray with many rashes on the outer surface. The internal surface is smooth. The flesh is bright red with two broader gray bands parallel to the outer margin. The apophysis is well developed and pale orange, while the anterior end is flat and pale yellow. The shell of *N. maxima* has an average length of 40 mm and an average width of 29 mm. The average length of the aperture is 32 mm and the average width of the aperture is 16 mm. *N. maxima* has an operculum with an average length of 18 mm and an average width of 6 mm.

N. maxima are distributed in India, the Andaman and Nicobar Islands, Mannar Bay, Pamban, and Shingles Islands, as well as in the Indo-Pacific region. **[9]**. *N. maxima* can generally be found around the Andaman and Nicobar Islands, but not on land. **[10]**. After being tracked carefully, the distribution of this species now also extends to the mainland. *N. maxima* inhabit rocky substrate surfaces, rocky shorelines in the upper intertidal area and can be found in the south of Carbyn Bay. The distribution of this species is also identical to that of other rocky coasts, such as in the Port Blair area, on the west side of the central Pacific, Fiji to Guam, and Australia. **[8].**

Nerita grossa has a light brown shell with random black and white patches. The surface of the shell is roughly serrated with spiral stripes. The apex is protruding and high and there are serrations on the outer lip of the shell. The operculum is brown and the outer surface of the operculum is nodular. This species has an average shell length of 21.44 mm, an average shell width of 20.25 mm, an average aperture length of 9.80 mm, and an average aperture width of 4.16 mm. They survive by sticking to the surface of a dead coral.

The *Cymostyla* sub-genus was more varied with the addition of *Nerita grossa* Linnaeus in 1758. This species has a raised apex with a shell surface resembling a slightly rough spiral line. The columellar edge has 3-4 denticles which are large and square at the top. There is a transverse wrinkle on the parietal callus and there are more than 10 fine denticles inside the outer lip. The operculum is dense with a flat outer surface and a rough rash. **[12]**.

Nerita costata has a black shell and a rough serrated shell surface with spiral lines. The apex sticks out and there are serrations on the outer lip of the shell. The operculum is dark brown and the outer surface of the operculum is nodular. The length of the shells varies between individuals and the longest is 20.61 mm. Each individual has a different shell width; the widest shell measures 18.76 mm. The length and width of the aperture differ from one individual to another; the longest and widest apertures were 9.65mm and 3.85mm, respectively. This species is attached to the surface of a dead coral.

The entire surface of the *N. costata* shell is covered with spiral lines, the apex of the shell is protruding and high, there are less than 15 serrations on the outer lip of the large shell. The outer surface of the operculum is rotted and the callus is crimped transversely. **[13, 14, 15]** *Nerita costata* individuals live in coastal ecosystems, usually attached to dead rocks or corals. **[16]**. *N. costata* and *N. ocellata* can be found in the rocky coastal ecosystem. *N.costata* shell width varies between 13-37 mm. **[1]**

The morphological characters of *Nerita albicilla* include light brown shells with random patches of dark brown and black. The surface of the shell is fine serrated, the apex sticks out, the operculum is pale brown and the outer surface of the operculum is rotted. The shell has an average length of 20.63 mm and an average width of 20.11 mm, while the aperture has an average length of 8.55 mm and an average width of 3.43 mm. Mollusks of this species live by sticking to dead coral surfaces.

N. albicilla has a nodule operculum, a shell surface with spiral lines, rash callus, many small serrations on the outer lip of the shell, and a slightly protruding shell apex. *N. albicilla* shell length varies between 24.74 mm ± 3.40, longer than that of other *Nerita* sp. individuals that can be found in the rocky intertidal zones of Oma village. **[7]**. *N. albicilla* can reach a maximum shell length of 2.5 cm to 3.5 cm. **[17]**. On the other hand, variations in the *N. albicilla* shell length are fewer than those of other species. *N. albicilla* shell length varies between 19 mm and 32 mm and the shell width varies between 15 mm and 24 mm. **[1]**

Nerita plicata has a yellowish-white shell with black spots and a rough serrated shell surface with spiral lines. The apex of the shell sticks out high and there are serrations on the outer lip of the shell. The operculum is light brown and the outer surface of the operculum is nodular. The

length and width of the shell vary widely from individual to individual; the maximum length and width of the shell are 21.36 mm and 18.29 mm, respectively. The length and width of the aperture vary between individuals; the longest and widest aperture measured is 10.06 mm and 4.58 mm, respectively. These species live by attaching themselves to the surface of a dead coral. The entire outer surface of the *N. plicata* operculum is rotted. The surface of the shell is covered with spiral lines and the part of the callus is crimped crosswise. There are less than 15 large serrations on the outer lip of the shell with a high, protruding shell apex. **[13, 14, 15]**

The morphological characteristics of *Nerita chamaeleon* include a light brown shell with random dark brown, black, and white patches. The surface of the serrated shell is rough with spiral lines, the shell apex is raised and high and there are serrations on the outer lip of the shell. The operculum is light brown and dark brown with a rash and sunken outer surface. The average shell length and width are 20.31 and 19.75 mm, while the average length and width of the aperture are 9.50 mm and 3.39 mm, respectively. These gastropods live on a sandy substrate with a mixture of small rocks (dead corals) around the mangrove roots where they stick. **[18].** The outer surface of the *N. chamaeleon* operculum is concave and nodule, there are spiral lines on the surface of the shell, the callus is nodular, there are more than 15 large serrations on the outer lip of the shell. The shell apex sticks out a little. **[13, 14, 15]**

Nerita spengleriana has a brown shell with random black and white patches. The shell surface has rough serrations and spiral lines. The apex is protruding and high and there are serrations on the outer lip of the shell. The operculum is brown to dark brown and the outer surface of the operculum is nodular. The length and width of the shells vary from one individual to another with the highest values of 30.40 mm and 20.66 mm, respectively. The length and width of the aperture also vary between individuals; the highest measurement results were 13.33 mm and 6.35 mm, respectively. The species individuals live by attaching themselves to dead coral surfaces.

Cymostyla has a high shell apex. The last circle forms a very small angle. There are fine spiral lines on the surface of the shell. The surface of the septum is flat to convex with an irregular engraving on the back that is oriented from the anterior to the posterior. The margins of the septum have one or two varied denticular centers and an outer lip that is thickened internally. On the left side of the outer lip, there is a protrusion characterized by fine denticles that are largely adaptive to the environment. The apical part is sometimes enlarged slightly. The outer surface of

the operculum is usually concave and granular. All Cymostyla species living in the Western Pacific Ocean and India collectively stretch from the Red Sea and East Africa to the east to Fiji, Tonga, and the Marshall Islands, but not to Polynesia. **[14].** The fossils of the species are thought to be from the European Miocene period. **[19]**

CONCLUSION:

Based on the morphometric characteristics of the shell and operculum, seven Nerita species were identified in Ambon bay waters. These species include *Nerita maxima*, *Nerita grossa*, *Nerita costata*, *Nerita albicilla*, *Nerita plicata*, *Nerita chamaeleon*, and *Nerita spengleriana.* Each of the species demonstrates distinguished morphometric characteristics.

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