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S Haumahu

Department of Marine Science,
Faculty of Fisheries and Marine
Science, Pattimura University,
Ambon, Indonesia

Prulley A Uneputty

Department of Aquatic
Resources Management, Faculty
of Fisheries and Marine Science,
Pattimura University, Ambon,
Indonesia

YA Lewerissa

Department of Aquatic
Resources Management, Faculty
of Fisheries and Marine Science,
Pattimura University, Ambon,
Indonesia

Growth and potential reproductive of gastropod *Strombus luhuanus* Linnaeus, 1758 inhabit OMA coastal waters, central Maluku, Indonesia

S Haumahu, Prulley A Uneputty and YA Lewerissa

Abstract

Strombus luhuanus (strawberry conch) is one of the marine gastropods belongs to Strombidae family. *S. luhuanus* is a consumed species by Maluku communities and usually is collected in adult size. The research was conducted in Oma intertidal zone, Central Maluku, Eastern Indonesia with the objectives were to analyse the growth of *S. luhuanus* and its potential reproductive. Sampling was done randomly from January to June 2019. Shell length of *S. luhuanus* was measured using digital vernier calliper to the nearest 0.05 mm and was determined its sex. Growth of *S. luhuanus* was analysed by using FISAT II software. A total of 1151 individuals of *S. luhuanus* were found in this study. The value of asimthotic length (L_{∞}) was 63.25 cm, growth coefficient (K) was 1.60, and two cohorts were found in this study. Generally, sex ratio of female and male of *S. luhuanus* was 56.58: 43.42% or 1.27: 1.00.

Keywords: *Strombus luhuanus*, growth, sex ratio, age group

1. Introduction

Strombus luhuanus or strawberry conch is one of marine gastropods belongs to Strombidae family. Strombidae is widely distributed along tropical and subtropical waters and it is known as tropicopolitan marine gastropods. This family usually inhabits various substrates which is sandy, sandy muddy, and seagrass bed ^[1]. In addition, there were 38 species of Strombidae found in Indo-Pacific which 266 species found in Philippine and 5 species found in Johar Strait ^[1]. In Maluku coastal area, this Strombidae is found abundantly. Haumahu (2011) ^[2]. Reported that there were nine species of Strombidae around Lease coastal waters, Central Maluku, consisting of two genera: *Strombus* and *Lambis*. *S. luhuanus*, is one species of *Strombus* also abundantly dominant in Maluku coastal area especially in intertidal zone which is consisted of coral rubble and seagrass ^[2].

S. luhuanus is usually consumed by local community in Maluku province. People usually collect this species during low tide specifically for adult size. The continuing collecting activity can cause overexploitation which will decrease *S. luhuanus* population. One of the important aspects to maintain *S. luhuanus* population is eco-biological aspect, including abundance, size structure, growth and its reproduction. Studies on biological aspects of Strombidae family were also studied ^[3-5]. The study aimed to analyzed growth and potential reproductive of *S. luhuanus*. This study will provide data based on biological aspects of *S. luhuanus* in order to manage its population.

2. Materials and Methods

2.1. Field work

Sampling was conducted in Oma coastal waters Central Maluku, Eastern Indonesia (Fig. 1) from Januari 2019 to June 2019. Geographically, Oma village is situated on 3°37'50"S-3°37'25"S and 128°25'50"E-128°23'30"E. The substrates in this intertidal zone consist of boulder, pebble, dead coral, coral rubble, and coarse sand

Corresponding Author:

Prulley A Uneputty

Department of Aquatic
Resources Management, Faculty
of Fisheries and Marine Science,
Pattimura University, Ambon,
Indonesia

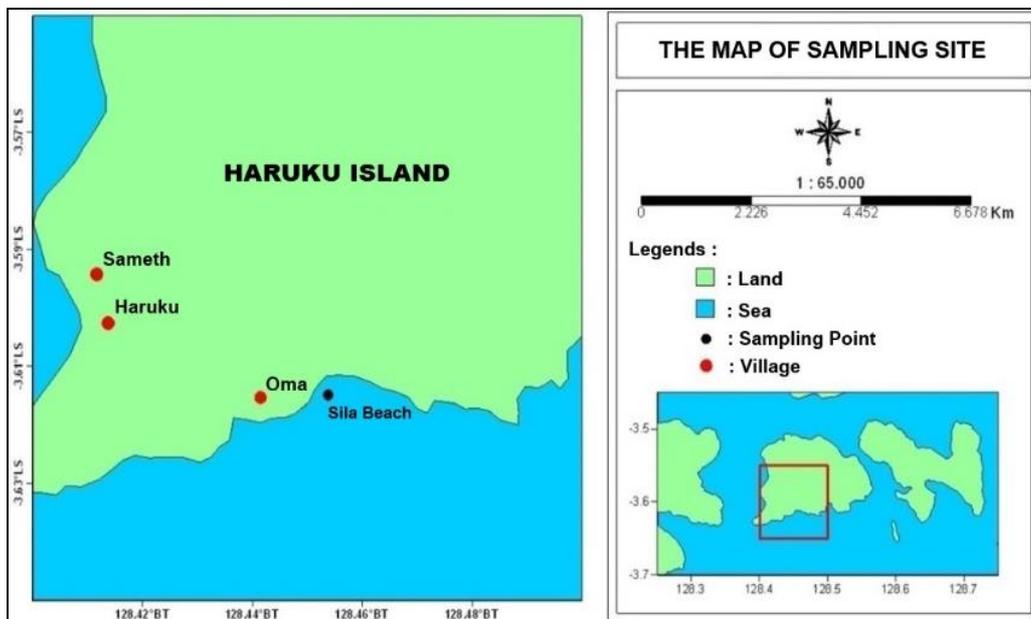


Fig 1: Map of Sampling Site [6].

Specimen of *S. luhuanus* was collected randomly without replacement during low tide (Khouw, 2016) [7]. Specimen of *S. luhuanus* was measured its shell length using digital vernier caliper to the nearest 0.05 mm. Sex determination of *S. luhuanus* was based on the presence of the penis in the male

by macroscopic observation (Fig 2). The male specimen has an *open-groove sde*-like penis which is brownish black on the right dorsal side of the foot. Whilst the female has genital groove running across the foot into the pedal groove at the base of the anterior end of the foot [8].

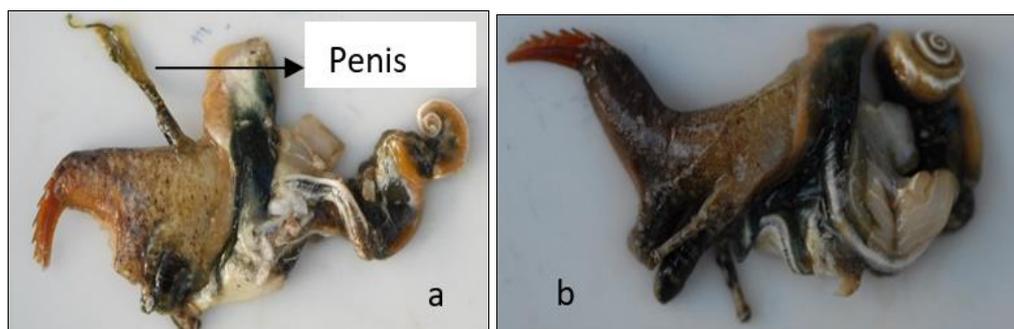


Fig 2: The differences between male and female of *S. luhuanus*

2.2. Data analysis

The asymptotic length (*L*) and growth coefficient (*K*), of the von Bertalanffy growth function (VBGF) were estimated by means of ELEFAN-1 incorporated in the FISAT software package. The *L* value was estimated using modified Powell-Wetherall plot, which was then used as seed value in ELEFAN-I analysis to assess a reliable estimate of the growth parameter *K*.

Sex ratio was carried on which consisted in dividing the total collected females by total number of males, the result was expressed as female are to males (F:M) of *S. luhuanus*. Chi-square test was used to analyse sex ratio equity test with the formula [9] as follows:

$$X^2 = \sum \frac{(f_{ij} - f'_{ij})^2}{f'_{ij}}$$

Where

X² = chi-square

f_{ij} = the frequency expected of male and female *S. luhuanus*

3. Results and Discussion

3.1. Abundance: A total of 1151 individual of *S. luhuanus* were found in this study, from which 645 females and 506 males. The abundance was varied from sampling periods as well as its sex (Figure 3). This figure also showed that the highest abundance of *S. luhuanus* found on May 2019 (257 individuals), while the lowest abundance was on Februari 2019 (102 individuals). This difference is due to the continuing collecting activities by local people. This would caused decreasing of the target species. Based on sex, Figure 3b showed that females of *S. luhuanus* dominated this population compared to the males. The highest number of males individual of *S. luhuanus* was found on May, 2019, whereas the females were on April 2019. The size frequency distribution showed that average shell length of *S. luhuanus* ranged from 29.64-55.88 mm and was dominated by 42.80 mm length both for females and males of *S. luhuanus* (Figure 4). Uneputti *et al.* (2019) [10] found the average shell length of *S. luhuanus* in the same area varied from 30.27 to 56.00 mm. The results of our study indicated that the minimum shell length found in our study was slightly lower than the previous study, but the maximum shell length was similar.

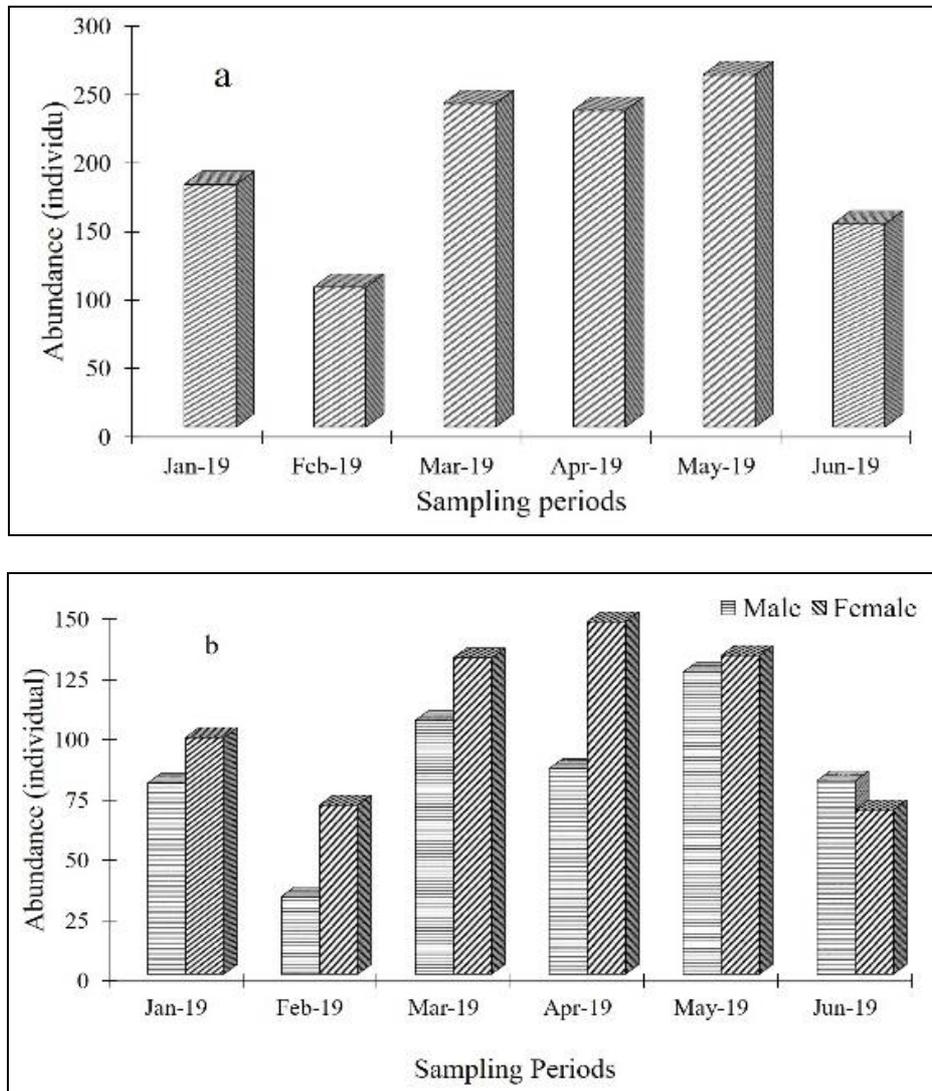


Fig 3: The abundance of *S. luhuanus* (a-total individual; b-abundance based on sex) found in coastal waters of Oma

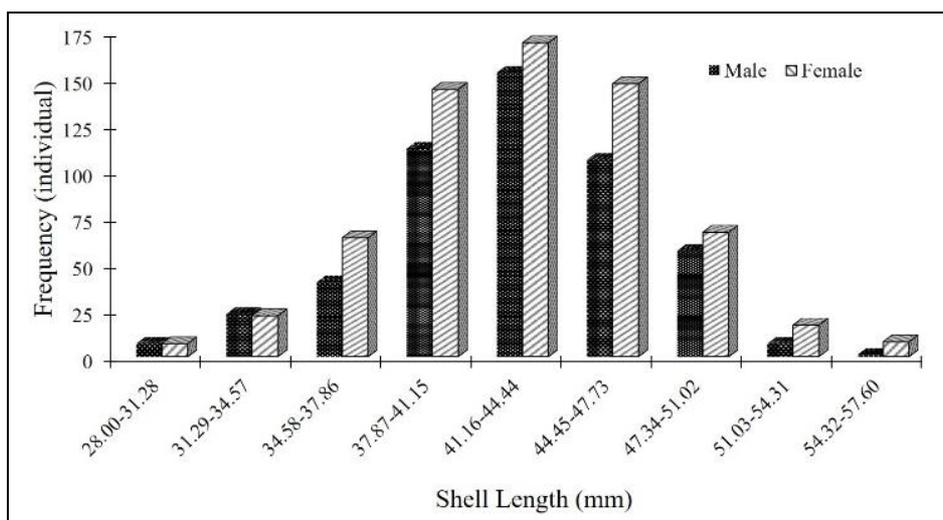


Fig 4: Size frequency distribution of female and male of *S. luhuanus* found in coastal waters of Oma

Poutier (1998) ^[11] stated that maximum shell length of *S. luhuanus* is 80 mm, but commonly it was 50 mm. According to Wada *et al.* (1983) ^[3], shell length of *S. luhuanus* between 20-30 mm, indicated the age of 1⁺ year, while shell length between 35-45 mm indicated the age of 2⁺ year. The dominant size of *S. luhuanus* found in our study indicated that *S. luhuanus* was in an adult populations (2⁺ year), whereas some

individuals were in young size.

3.2. Growth

The growth of an organism can be measured by increment in length and weight. Growth of organisms can be analysed by length frequency distribution, so their age classes could be estimated ^[12].

A total of 1151 individual of *S. luhuanus* found from Januari-June 2019. Statistical analysis using FISAT I software package showed that there were two cohorts of *S. luhuanus*

found in this study (Figure 5). The first cohort was found in *S. luhuanus* less than 40 mm length, while the second cohort has shell length more than 40 mm.

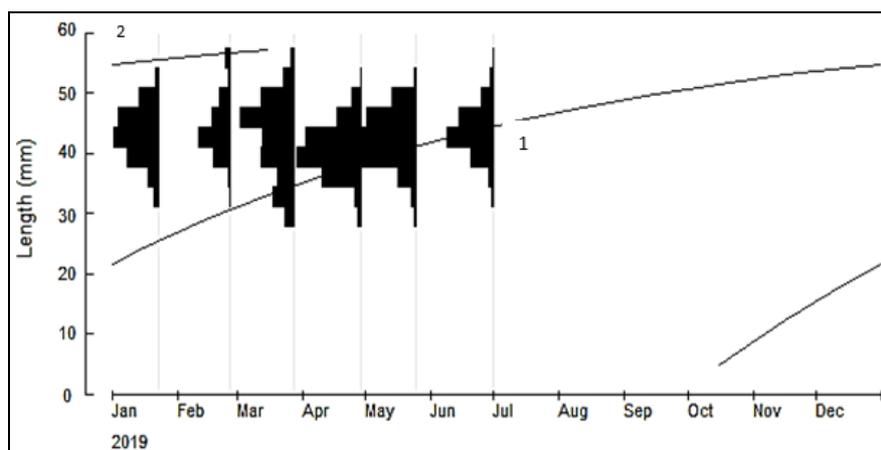


Fig 5: Age classes (cohort) of *S. luhuanus* found in coastal waters of Oma

The asymptotic length (L_{∞}) of VBGF was 63.25 mm, and the growth coefficient (K) was 1.60 year⁻¹. The computed growth curve using these parameters is also shown in Figure 5. The observed maximum length was 55.96 mm, while the predicted maximum length was 63.25 mm. As previously described, *S. luhuanus* can reach 80 mm in shell length, but usually grow at 50 mm. Growth of an organisms can be caused by some factors such as food, substrate, and physico-chemical factors [7]. Wada *et al.* (1983) [3] stated that *S. luhuanus* could reach the age of 3⁺ year when it was growing with maximum shell length more than 58.1 mm.

3.3. Sex ratio

Sex ratio in bio-ecological field is an important aspect because it could determine proportion of females and males individuals of an organism in one population. Sex ratio is related to probability of a population to produce new generation. In nature, the proportion of males and females population is 1:1.

A total of 1151 individuals of *S. luhuanus* collected in this research in which 506 individual were males population and 654 individual were females. Sex ratio of *S. luhuanus* could be shown in Table 1. Sex ratio of total of examined snail was 1.27 females per males.

Table 1: Abundance and sex ratio of *S. luhuanus* based on sampling periods

Sampling Periods	Number of individuals		Sex ratio	
	Male	Female	Male	Female
January 2019	79	98	1,00	1,24
February 2019	32	70	1,00	2,19
March 2019	105	131	1,00	1,25
April 2019	85	146	1,00	1,72
May 2019	125	132	1,00	1,06
June 2019	80	68	1,18	1,00
Total	506	645	1,00	1,27

Statistical analysis showed that sex ratio of males and females *S. luhuanus* was not 1:1 ($\chi^2_{\text{computed}} = 18,166$; $\alpha = 0,01$; $db = 6$; $\chi^2_{\text{table}} = 16,812$). It means that statistically significant differences between males and females conch found in this study. In other words, there was not an equal proportion of females to males. The results also indicated that the females were dominated *S. luhuanus* population. This was probably

caused by the differences on growth pattern and migration of this conch. Wada *et al.*, (1983) [3] stated that the larger and adult populations and spawning conchs will migrate to deep waters. Some larger conchs migrate from inshore area or from offshore rock flat to the offshore sand and sand-pebble areas.

4. Conclusion

1. A total of 1151 individuals of *S. luhuanus* found in this study, from which 645 resulted females and 506 males. The abundances varried monthly and its sex.
2. Average shell length of this conch varried from 29.64-55.96 mm which was dominated by 42.80 mm length. Asimtoth length (L_{∞}) was 63.25 mm dan growth coefficient (K) was 1.60 year⁻¹. There were two cohorts found in this study.
3. The sex ratio of this strawberry conch was 1.27 females to males.

5. Acknowledgement

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