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Biology and growth of Asiatic Hard Clam (*Meretrix meretrix*) population in Tanjung Balai, North Sumatera

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Abstract. Asiatic hard clam (*Meretrix meretrix*) was one of molluscs (bivalve) with economical value. However, fishing activities were presumed to cause a decline in population. This condition was strengthened by the size of the clam which became smaller nowadays. The purpose of this study was to determine spatial distribution of *M. meretrix*, length distribution, and length-weight relationship. The study was conducted at 3 stations, consisted of Station I at Asahan River estuary which was located by mangrove forest, Station II at the sea and Station III at the waters near mainland of Batu Bara Regency. Estimation growth of *M. meretrix* was examined following FISAT II method. The density of *M. meretrix* was dominant at Station I which was low in salinity and high in organic matter. The class interval of 23–34 mm at station I dominated length distribution. Length-weight relationship was found to be very strong with determinant value approaching

1. Introduction

Asiatic hard clam (*Meretrix meretrix*) is one of fisheries resources that is widely used by the locals of Tanjung Balai [1] and, according to [2] besides hairy ark cockle (*Anadara gubernaculum*) [3]. Asiatic hard clam is one of the many invertebrates found in intertidal areas. This organism also has special adaptation that allows it to survive areas with physical and chemical stress. Besides, it has an adaptability to withstand currents and waves. This clam, however, has no ability to move fast (motile), so it is very easy to catch. Asiatic hard clam is a marine commodity favoured by the people of Tanjung Balai Asahan. Its presence in nature is abundant, but the fishermen fished it in various sizes both large and small without considering its sustainability.

Along with the increasing demand for bivalves in the market both in meeting local and regional needs outside Asahan Regency and Tanjung Balai City, the exploitation of the resources tends to override the principles of natural resource sustainability. Increased human activity has brought about the pressure on the population of the clam.

For this reason, this study was aimed to see the biology population and the growth of Asiatic hard clam.



2. Materials and methods

2.1. Study site

Sampling sites were determined purposively in which there were 3 sampling sites that were the mouth of Asahan river which is located by mangrove forest (Station I), station 2 and 3 as intertidal zone. Station 3 is an intertidal zone near the mainland of the Batubara region (Figure 1).

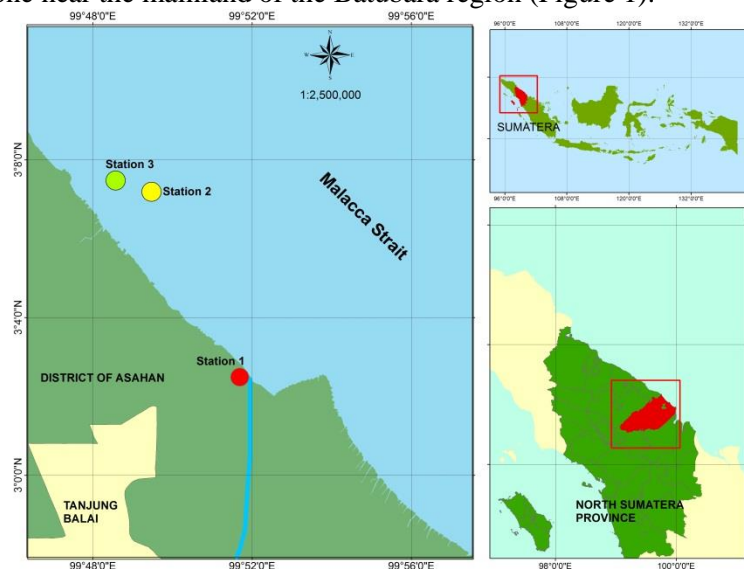


Figure 1. Sampling sites of *Meretrix meretrix* in Tanjung Balai Aquatic: Station 1 (03°01'25.47"N-99°51'44.32"E), Station 2 (03°06'55.48"N-99°49'03.86"E) and Station 3 (03°07'12.47"N-99°48'09.67"E) [2].

2.2. Procedures

Sampling was carried out 4 times from September to November 2016 using traditional fishing gear namely garuk (Figure 2), at 3 points each station. Material used consisted of preservatives (formaldehyde and alcohol). The sample of *M. meretrix* was analysed at the Integrated Laboratory of Water Resources Management Study Program, Faculty of Agriculture, USU.



Figure 2. Traditional fishing gear named Garuk [1].

The sample of *M. meretrix* was identified by referring to the book "Recent and Fossil Indonesian Shells" [4]. Length was measured from the left to the right side of the shell using the callipers. Wet weight was weighed with digital scales.

The density of *M. meretrix* in waters was expressed as the number of individuals per area [5]. Total length frequency distribution was calculated using Sturges [6]. Length-weight relationship was determined following Effendie [7], and Allegations of growth parameters was analysed using the Von Bertalanffy approach [8] through the FISAT II program.

3. Results and discussion

3.1. Biology population of Asiatic hard clam *Meretrix meretrix*

The taxonomy of the *M. meretrix* according to [4] is as follow: Phylum Mollusc class Bivalve, Ordo Veneroida; Superfamily Meretricinae; Genus *Meretrix*; Species *Meretrix meretrix*.



Figure 3. Asiatic hard clam (*Meretrix meretrix*).

Morphologically, *M. meretrix* has a thin, smooth and shiny shell. The back end has an elongated shape and some are flat. The clam has a like-egg shape, large umbo, bulged anterior cavity, slender front, smooth surface, deep pallial sinus and varies in colour with white anterior part [9].

M. meretrix is known by several local names such as milk clam, white clam, Lamis [10] and tofu clam [11]. In North Sumatra, it is called Kepah (Figure 3).

3.2. Spatial distribution

Distribution of *M. meretrix* can be viewed from several characteristics and its behaviour in the environment. In this study, the distribution of *M. meretrix* was determined from the density, and environmental conditions.

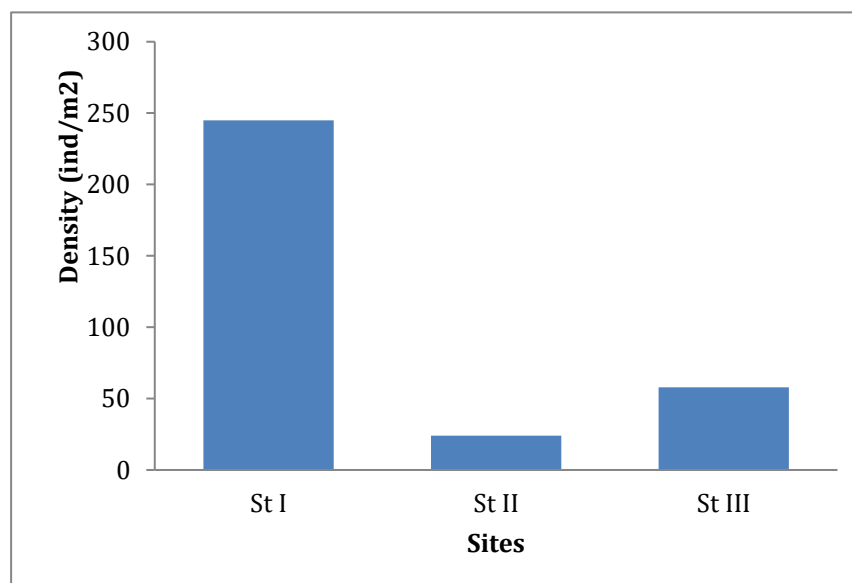


Figure 4. Density of *M. meretrix* at each station.

The density of *M. meretrix* was found to be the most dominant at Station I with 245 individual/ m² followed by Station III and Station II with 58 and 24 individuals/m², respectively [2]. Generally, *M.*

meretrix is a type of shellfish that widely spread along fine sandy beaches and is cultivated intensively in some shallow and open sea areas with sandy substrate [12]. Asiatic hard clam is able to live in intertidal areas up to subtidal regions with a depth of about 20 m. In accordance with the results of the research by [13], this clam was dominantly found at Binalatung Beach with sandy and muddy substrates.

Table 1. Spatial distribution profile of *M. meretrix* in Tanjung Balai Asahan Waters.

Water parameters	St I	St II	St III	Pattern
Salinity (%)	0.79	3.24	3.27	Up fluctuation
Transparency (m)	0.58	0.95	0.93	Up
Nitrate (mg/l)	2.99	1.29	1.87	Down fluctuation
Oragnic matter (%)	0.78	0.71	0.38	Down
Substrate	Sandy clay	Sandy clay loam	Sand	

Source : Secondary data [2]

Spatial distribution profile of *M. meretrix* exhibited the same pattern of density at each Stations. Both Salinity and transparency tended to rise. On the contrary, nitrate and organic matter content tented to fall. Salinity had a pattern opposite to the density distribution. The role of salinity greatly determined the distribution of *M. meretrix* population. Asiatic hard clam was not able to develop well at high salinity and always mixed with freshwater [10], so that the clam was generally found around the estuary area with high input of water turbidity. Water clarity level was inversely proportional to organic matter content with a strong relationship. The lower the clarity, the more the organic matter circulated. The density of Asiatic hard clam at Station I was higher than that at other stations because organic matter tended to be higher. According to Kennish [14], C-organic content in the substrate had positive correlation to species density and biomass.

3.3. Length frequency distribution of *M. meretrix*

The number of Asiatic hard clam (*M. meretrix*) observed during the study was 1.017 individuals in total with 883 individuals at Station I, 120 individuals at Station II and 206 individuals at Station III.

Composition of class interval of all samples obtained during the study ranged from 11 to 46 mm. Overall the distribution of the length of *M. meretrix* was imbalanced. Distribution based on catches obtained at each station underwent an alteration in dominance of a certain class interval. Station I, Station II and Station III were dominated by size of 20-31 mm with 357 individuals (Figure 5), 29-31 mm with 95 individuals (Figure 6) and 26-31 mm with 99 individuals (Figure 7), respectively. Class interval with the smallest number of individuals corresponded to the range of 38-46 mm at Station I, 23-25 mm and 35-43 mm at Station II and 14-19 mm and 35-40 mm at Station III.

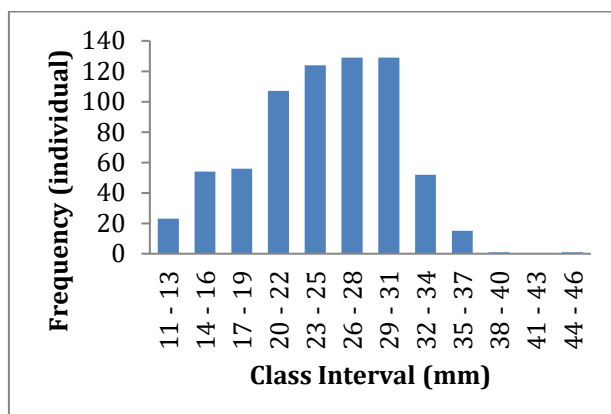


Figure 5. Distribution of class interval *M. meretrix* at stasiun I.

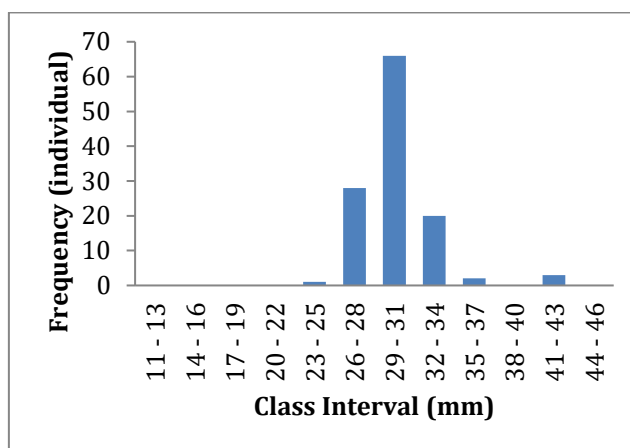


Figure 6. Distribution of class interval *M. meretrix* at stasiun II.

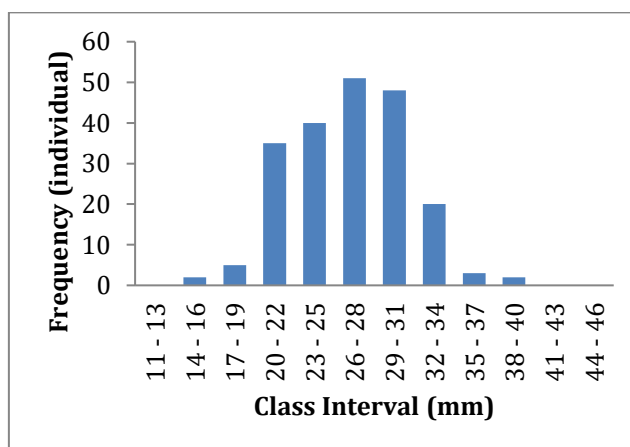


Figure 7. Distribution of class interval *M. meretrix* at stasiun III.

The highest number of individuals (883 individuals) as well as maximum length (46 mm) was obtained at Station I. This was in accordance with the potential of *M. meretrix* at Station I of Tanjung Balai Waters in North Sumatra. Macro infauna measuring 1-10 cm are organisms that are able to adapt well to sand substrate *Length-Weight Relationship*.

Determinant value (R^2) of length-weight relationship of *M. meretrix* for Station I, Station II and Station III were 0.79, 0.86 and 0.88, respectively. The determinant value of length-weight relationship

of *M. meretrix* was relatively large, which was close to 1, indicating that diversity influenced by other factors was quite insignificant and the relationship between total length and weight is very strong. This is presented in the Figure 8, Figure 9 and Figure 10.

Value of *b* was obtained from the measurement of length-weight relationship of *M. meretrix*. This value ranged between 2.5-4, but most was close to 3. The results showed that *M. meretrix* had a value of *b* (2.1-2.7) (close to 3). This meant that the growth pattern was negative Allometric. Different growth patterns seemed to be related to environmental conditions, differences in age, food supply, gonad development, disease and parasitic pressure [15].

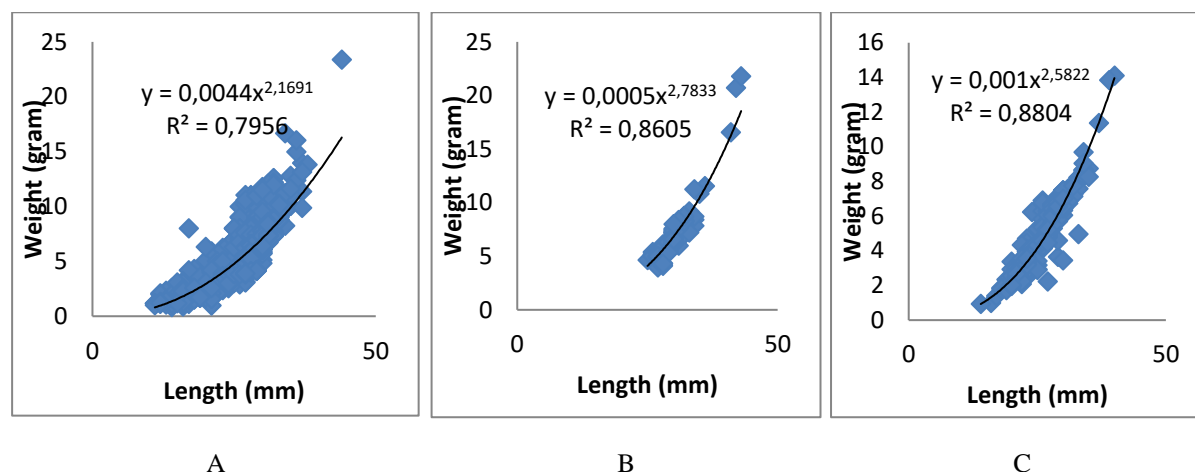


Figure 8. A) Length-weight relationship of *M. meretrix* at station I, B) Length-Weight relationship of *M. meretrix* at station II C) Length-weight relationship of *M. meretrix* at station III.

3.4. Growth analysis (*K* and *L*_∞)

The result of growth analysis by ELEFAN 1 is presented in Table 2.

Table 2. Growth analysis (*K* and *L*_∞).

Parameters	Station 1	Station 2	Station 3
<i>K</i>	0,010	0,010	0,010
<i>L</i> _∞ (mm)	36,75	45,15	39,90

The asymptotic length values for Station I, Station II and Station II were 36.75 mm, 45.15 mm, and 39.90 mm, respectively. The value of growth coefficient (*K*) was 0.010. Estimation of growth parameters asymptotic length (*L*_∞) and growth coefficient (*K*) of *M. meretrix* were able to be expected from the results of length group analysis using Von Bertalanffy growth model. The presence of asymptotic length (*L*_∞) difference at each station was influenced by internal factors (heredity, sex, age, parasites and diseases) and external factors (food and aquatic hydrology conditions) [16].

4. Conclusions

The highest density of *M. meretrix* was recorded at Station I, namely the Asahan River Estuary, in accordance with the salinity profile and organic material at the Station. The longest size of *M. meretrix* was obtained at Station I with a maximum length of 46 mm. The growth pattern of *M. meretrix* was negative allometric with a value of *b*<3. The asymptote length (*L*_∞) was different for each station.

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