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Abundance and Distribution Patterns of Mussel (*Corbicula javanica*) in Wonggeduku District Konawe Regency - Southeast Sulawesi

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Abstract

This research was conducted in November 2018 to February 2019 in the sub-watershed of Lahombuti River, Lahotutu Village, Konawe Regency. The aim of the study was to determine the population abundance and distribution pattern of mussel (*C. javanica*) in the sub watershed of Lahombuti tributary, Lahotutu Village, Wonggedu Sub-District, Konawe District.

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Sampling site was determined with purposive random sampling method. Sampling of mussel (*C. javanica*) was carried out in a location with the greatest abundance of mussel, that was insub watershed of Lahombuti tributary, Lahotutu Village, on the main rice field irrigation channel (width: ± 1.75 m, Length: ± 4500 m (4.5 km), Depth: ± 110 cm). Sampling of mussel was carried out at the same station with different sampling spot. Three quadratic transects sizing 1x1 m^2 each were randomly assigned in the plots. The results showed that the highest abundance of mussel (*C. javanica*) was recorded in November with a value of 65.33 ind/m^2 and the lowest population abundance was in February with a valueof 12.67 ind/m^2.In other words, the abundance of mussel in the sub watershed of Lahombuti tributaries range from 12.67 ind/m^2-65.33 ind/m^2. In general, the results of population abundance analysis showed that the level of abundance was very high. The results of Morishita index analysis generally showed that distribution pattern of mussel (*C. javanica*) in the sub watershed of Lahombuti tributaries was classified as uniform pattern (Id <1). The results of this study indicate the potential availability of mussel resources (*C. javanica*) based on abundance data and distribution patterns in the Lahombuti River, Wonggeduku District, Konawe Regency.

Keywords: Abundance; Distribution Pattern; Corbicula Javanica; Konawe Regency.

1. Introduction

Konawe Regency is one of 18 regencies/cities within the Southeast Sulawesi Province with a large potential of inland fisheries (Konawe Regency land area ± 80%). Unaaha District (± 73 km from Kendari, the Capital of Southeast Sulawesi Province) as the regency capital and the center of community economic activity plays a vital role in stimulating regional economic growth. The geographical location of Konawe Regency is 2^{o}.45 '- 4^{O}.15' SL and 121.15 '- 123.30' EL. The imaginary lines (SL and EL) illustrate in detail that land and inland waters (Natural and Artificial) such as rivers, swamps, lake dams, and situ dominate the geographical area of Konawe Regency [1,2]. Konawe Regency has several large rivers and swamps with great potential for the development of agriculture, plantations, inland fisheries, irrigation and power generation, such as Konaweeha River, Lahumbuti River and Rawa Aopa National Park. These three natural waters has great potential for economically important inland fisheries resources such as fish, bivalves and gastropods. Lahombuti River had large potential for the availability of freshwater biodiversity, especially mollusk (Pelecypoda) [2]. Classification of the catchment area in Lahumbuti River was administratively divided into 3 clusters, namely (1) Upstream of Lahumbuti in Abuki and Tongauna Districts, (2) Middle Lahumbuti in Unaaha, Konawe, Wawotobi, Anggaberi and Meluhu Districts, and (3) downstream of Lahumbuti in Woggeduku, Pondidaha and Amonggedo districts. The village of Lahotutu, Wonggeduku district, was included in the downstream area of the Lahumbuti River, where the waters of Lahumbuti River had a variety of freshwater mollusk resources and one of them was corbiculidae mussel (*Corbicula javanica*). Indonesian people usually call it “Remis”. Remis is freshwater bivalves that immerse themselves in sand or mud in the riverbed (depth: ± 45 cm) with the local name of Boiboina. Mussels are sedentary animals regardless no changes in water quality. The typical behavior of *C. Javanica* includes inhabiting a wide range of habitats with various conditions of water quality and long life spans (depending on the species, it can be one to two years), making it possible to use them to record the quality of surrounding environment [3]. Due to its relatively sessile nature and filter feeding behavior, *C. javanica* is one of good bio indicator organism in monitoring fresh water pollution. Bivalvia commodities like mussel (*C.*

javanica) consist of several types that physiologically respond differently to changes in water quality and relatively more easily to identify and collect, making it used more frequently as water quality indicator. Aside from being bioindicator of water pollution, *C. javanica* was also popular food source especially for the people in the village of Lahotutu, Konawe Regency. To date, environmental change was a crucial problem for biotic component of freshwater ecosystems. The main factor causing environmental change was land conversion, which caused environmental degradation. Majority of environmental stresses in Lahombuti watersheds were caused by demographic factors and land conversion. Dense community settlements along the rivers and sediment input from land conversion and agricultural waste were assumed the cause of ecosystem pollution. Water pollution that occurred massively and continuously had implications for the decrease in water quality due to the components of pollutants that continued to grow, bringing about the imbalance of ecological aspects of the waters that eventually affected the abundance of populations and distribution patterns of mussels (*C. javanica*).Therefore, it was necessary to conduct research on population abundance and distribution patterns of *C. javanica* in the sub watershed of Lahombuti tributary. The purpose of this study was to determine population abundance and distribution patterns of mussel (*C. javanica*) in the sub watershed of Lahombuti tributary, Lahotutu Village, Wonggedu District, Konawe Regency.

2. Materials and Methods

2.1. Location

This research was conducted in November 2018 to February 2019 in the village of Lahotutu, Wonggeduku District, Konawe Regency, Southeast Sulawesi Province.

2.2. Research Tools

The tools and materials used in this research were pH indicator, mercury thermometer, soil tester, GPS Garmin 60, scale sticks, PVC pipes, digital cameras, shovels, calipers (mm), label paper, sample plastics, quadratic transects, plastic buckets of 30 cm diameter, mussel (*C. javanica*) as research objects as well as several tools and chemicals needed for laboratory analysis.

2.3. Data Collection

Preliminary study was conducted prior to studying main variables. The preliminary study was a deep constructive observation carried out for 2 months (once per week) using survey methods and interviews with relevant informants, aimed to find out locations with abundant supply of *C. javanica* in the village of Lahotutu, Konawe Regency, Southeast Sulawesi. Result of preliminary study showed that the most abundant mussels in Lahombuti tributary watershed was found in main rice field irrigation channels ($\pm$ 1.75 m width, 4.5 km length, $\pm$ 1.1 m depth). Based on this result, the channels was determined as sampling location that then divided into several sampling spots. Sampling of mussels was done following purposive random sampling method [4], using as much as three 1x1 m^2 transects thatwere randomly assigned to the plots. Water quality measurements were performed simultaneously with the sampling of *C. javanica* in each transect.

2.4. Data Analysis

Temperature, brightness, depth, water pH, substrate pH and substrate were analyzed. Sampling of the substrate (sediment) was to analyze sediment texture fraction. Measurements and observations were performed directly in the field, followed by laboratory analysis. Population abundance of mussel (*C. javanica*) was measured following formula of K = N/A, where "K" is Abundance per m^2, "N" is Average number of individuals obtained and "A": Area of plot area. Distribution pattern was determined according Morisita index with three criteria, such as uniform (Id <1), random (Id = 1) and clustered (Id> 1) [16].

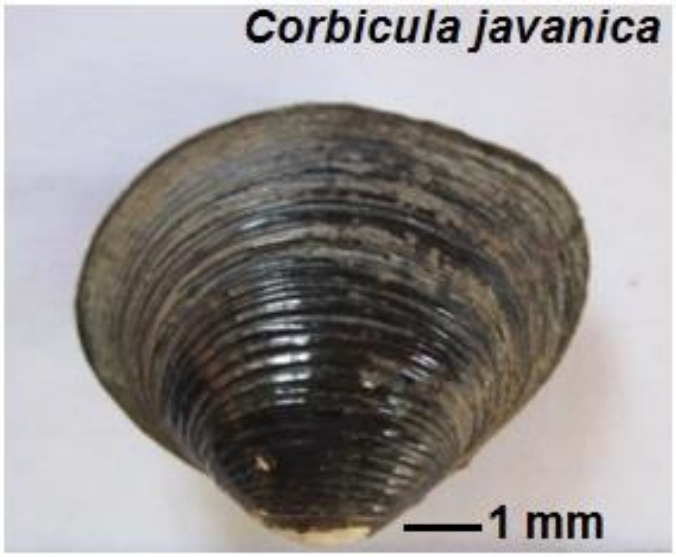

Figure 1: Remis (*C. javanica*)

3. Result and Discussion

3.1. Overview of Research Locations

Konawe Regency covers an area of 16,480 km² with population of 443,911. Administratively, Konawe Regency has 30 subdistricts and 405 villages with a land area of 666,652 Ha or 17.48 percent of total land of Southeast Sulawesi province,while sea area (including the waters of South Konawe Regency) is ± 11,960 km² or 10.87 percent of Southeast Sulawesi waters. Terrestrial topographic types in Konawe Regency are mountain and hill landscapes flanked by lowlands. Rainfall reached 2,851 mm in 205 rainy days or higher than previous year with rainfall of 1,556 mm in 132 rainy days. Overall, it is a tropical climate. According to data obtained from Halu Oleo Kendari airbase, the maximum and minimum air temperature was 34°C and 15°C respectively, with an average of 20°C. In average, air pressure was 1,010.5 millibars with humidity of 87.7 percent. Wind speed is generally normal, which was around 12.75 m/sec [1]. One of the villagesin Konawe with potential inland fisheries was Lahotutu Village. Geographically, Lahotutu village is the existing territory of watershedsof Konaweha and Lahombuti. These two major rivers supported the availability of economically important freshwater resources in Lahotutu village, especially in the sub-district of Wonggeduku and Konawe in general. Administratively, Lahotutu village is located in Wonggeduku District, Konawe Regency, Southeast Sulawesi

provice. The territory of the village of Lahotutu was dominated by lowlands that are traversed by one of major rivers in Konawe Regency, namely Lahombuti River, making its rice field area, which covered ± 70% of the area get to have adequate irrigation systems. The majority of Lahotutu Village residents worked as farmers who relied on agriculture and plantation sectors as their main source of income. The village of Lahotutu shared borders with several villages in Wonggeduku Subdistrict: Lakomuni village in the north, Duriasi in the south, Lalohao village in the east and Lambangi village in the west. Inland water areas (rivers and swamps) in Lahotutu village was potential to be developed as center for aquaculture of economically important freshwater commodity (fish and non-fish). In addition, freshwater biodiversity was also very diverse and abundant, such as fish, snails (gastropods) and freshwater shellfish (bivalve), which were very popular as fresh food source for daily consumption. One of the commodities wasmussel (*C. javanica*), which called boiboina by the locals.

3.2. Population Abundance of C. Javanica

Population abundance was found the highest inperiod of November, as many as 65.33 ind/m², followed by periods of December and January, as many as 56.67 ind/m² and 43 ind/m², respectively (Table 1). Meanwhile, period of February gave the lowest abundant, such as 12.67 ind/m² (Table 1). Population abundance was classified as very high, considering very small transect of 1x1 m².

Table 1: Data Tabulation of Abundance of Mussels (*C. javanica*) Population in sub watershed of Lahotutu tributary

Period	Number of Individual (N)			Average	Plot Size (m^2)	Abundance (Ind/m^2)
	Plot 1	Plot 2	Plot 3			
November	79	53	64	65,33	1	65,33
December	71	48	51	56,67	1	56,67
January	15	89	25	43	1	43
February	12	9	17	12,67	1	12,67

The population abundance of *C. javanica* in the Lahombuti watershed, Lahotutu Village, Wonggeduku District, Konawe District, during the study period (November - February) is presented in Figure 1 below :

Fig. 1 showed that population abundance was classified as very high. However, the trend of abundance decreased during study period. The decline in the population in the sub watersheds of Lahombuti River during study period wasbrought about by frequent catching activity by the locals. As mentioned before, *C. javanica*wascommodity that was favored by the people of Konawe Regency, be it for daily consumption orfor sale. The phenomenon of mortality that was showed by the number of shell remains found around transectwas one aspect that explained the decrease in mussels abundanceduring study period.It was presumed that mortality was caused by environmental parameter of waters in the sub watershed of Lahombuti tributary. During November period, temperature was 29-30^{o}C, while during December to February it went between 32-34^{o}C. Therefore, December period gave optimal range of temperature for the life of *C.*

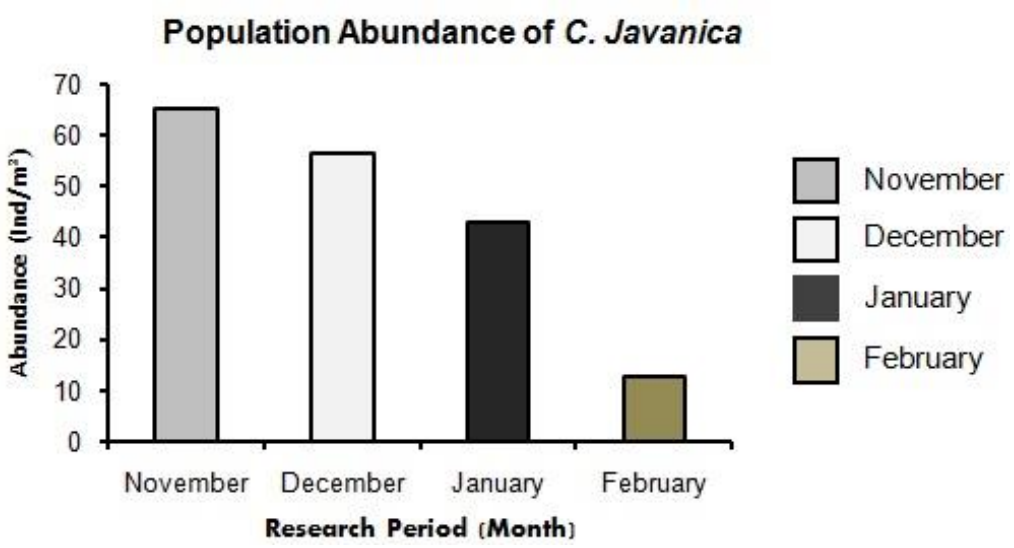

Figure 2: Population abundance of remis (*C. javanica*)

Javanica while during period of December to February the temperature was considered too high. In addition,shallow water depth (low tide) (± 37 cm) and narrow width (± 1.75 cm) made water temperature increase. Physiologically, 1^{o}C rise in temperature above standard tolerance would cause disruption of metabolic system or protein dysfunctionin aquatic organism. In this case, instead for growth, energy from protein would be allocated more for adapting to changes in the aquatic environment as aquatic organisms are poikilothermic (cold blooded) that constantly follow the temperature of its surrounding. The same case was recorded in *Corbicula* sp. in the river of Borang, Banyuasin Regency whose population was decreased due to high temperature [3]. Furthermore the abundance of macroinvertebrates in the waters of Tukad, Bali was highly dependent on the quality of the aquatic environment or the physico-chemical parameters of the waters [5]. The existence of bivalve and gastropod commodities in the coastal waters of Makassar City was strongly affected by anthropogenic activities, both the capture of macrozoobenthos routinely by the local community and the supply of pollutants from household waste [6]. Were also stated that water quality parameters especially temperature and other physico-chemical parameters were key factors for the presence or abundance of macrozoobenthos in waters [7,8,9,10,11,12].

3.2. Distribution Pattern of C. javanica

Based on Morishita index, distribution pattern of *C. javanica* in the sub watershed of Lahombotu tributary was less than one (Id<1) during the entire study period (November 2018 to February 2019) (Table 2). This value was the basis for determining the status or category of the distribution pattern of *C. javanica* at the study site. As its value was less than one, distribution pattern of *C. javanica* in the sub watershed of Lahombuti was categorized as uniform species distribution. The uniform pattern of the distribution of *C. javanica* in the sub watershed of the Lahombuti tributary was presumed because sampling was carried out during low tide (depth: ± 37 cm) and the river was relatively narrow (± 1.75 m). In other words, narrow widthwas directly proportional to the surface area of the water that was small or narrow. The uniform distribution pattern of *C. javanica* was also caused by competition in space and food.

Table 2: Data tabulation for distribution pattern (morishita index) of *C. javanica* in sub watershed of Lahombuti tributary

Research Period	Morisita Index (Id)	Criteria	Distribution Pattern
November	0,33	Id < 1	Uniform
December	0,33	Id < 1	Uniform
January	0,51	Id < 1	Uniform
February	0,28	Id < 1	Uniform

The relatively narrow ecological space and niches in the Lahombuti River watershed were implications of the narrow river diameter. This condition naturally triggered intraspecific and interspecific competition. The phenomenon of interspecific competition in the Lahombuti watershed involved two species of clams such as *C. javanica* and *Anodonta woodiana*. The relatively large size of *A. woodiana* made *C. javanica* increasingly depressed in space and food competition [2,15]. Above description was in line with the study by [3] which stated that the uniform distribution pattern was because sampling was done during low tide, so that the surface area of the water was smaller and the river area was narrows. Furthermore, signified that uniform distribution pattern was result of negative interactions between individuals, e.g. competition over food and space [13]. The main cause of the distribution pattern of mussels has a uniform category is the narrow surface area of water and shallow water which is the habitat of mussels, this can be seen in the distribution pattern of mussels in the area of rice fields in the village of Air Satan, Musi Rawas Regency [14].

4. Conclusion

The abundance of mussel (*C. javanica*) population in the sub-watershed of the Lahombuti tributary from November 2018 to February 2019 ranged from 12.67 ind/m^2 - 65.33 ind/m^2. The results of the abundance data analysis showed a very high category due to the small size of the sampling transect of 1 m^2. Distribution pattern of mussel (*C. javanica*) in the Sub watershed of Lahombuti tributary based on Morishita index formulation all showed uniform categories (Id <1). This research recommendation focuses on the sustainability of *C. javanica* population in the waters of the Lahombuti river by reducing and even eliminating pollution around the watershed.

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