Density of Mollusks Community from a Rocky Intertidal Zone in Karang Papak Coastal, West Java, Indonesia

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Abstract. Mollusks are soft boned animals that are included in invertebrate phyla. The Karang Papak coastal is located in Cikelet, Garut Regency, West Java, Indonesia. The study was carried out in an intertidal zone in Karang Papak, West Java Indonesia at October 2018-February 2019 which the intertidal zone was divided into three observation stations using four times sampling based on the four moon phases (Quarter one, dark moon, quarter two, full moon). The objectives of this research were to study abundance and density of mollusks based on moon phase. The results showed that Seventy-one mollusk species were found to be represented, corresponding to 36 genera, 23 families, 11 orders from class of Gastropoda and Bivalvia. The density values ranging from 3.22-4.17 ind/m². The highest value obtained in the dark moon phase was 4.17 ind/m² while the lowest value was found in the moon phase Q-2 amounted to 3.22 ind/m². The moon phase can affect the density of mollusks because the main contain light from the moon that can affect the regulation of the mollusks’ body such as for physiological processes. This data can be used as basic data on mollusks' diversity and determine the time to catch mollusks.

Keywords: Abundance, density, intertidal zone, Karang Papak, mollusks

1. Introduction

Indonesia is an archipelago that is dominated by water (sea), so that Indonesia has a high diversity of marine life, one of those is mollusk. According to a research by Dingle H in 2014 and Cahyadi A in 2017, the ocean is one of the places to gather a large variety of organisms and a variety of habitats such as mangrove and intertidal zone [1,2].

The intertidal zone is referred to as a tidal zone that starts at the seashore, when the tide is flooded and at low tides like land. The intertidal zone is one of the marine animal habitats and almost all organisms that live in these intertidal waters are from marine organisms [3]. Mollusk is one of the animals that live in the intertidal zone with several characteristics such as soft body, bilateral symmetry form, the body closed coat, has a hard shell and has ventral legs [4].

The existence of animal communities in the intertidal zone is influenced by several factors such as the influence of moonlight. Reported by [5] that moonlight can determine several aspects of biology in animals, including mollusks. Also, based on a direct survey at several locations in the coastal of Cianjur, West Java, the phenomena of this moon phase are the main reference for the community in the exploitation of natural resources around the coast. The same result was reported by [6] which
stated that the exploitation of natural resources such as mollusks and crustaceans was directed to the lunar cycle phenomena.

The existence of a mollusk community in Indonesia that is associated with the influence of moonlight is still rarely reported. As for several reports examining some of the biological aspects of the mollusks community in East Sumatera by [7]. Furthermore, [8] reported the composition of mollusks in the estuary waters of Barru, South Sulawesi, but not based on differences in the moon phase. In locations around Karang Papak Coastal, namely Bojonglarang-Jayanti Nature Reserve, West Java, reported by [9], the structure of macroinvertebrate communities based on tides. Information about the density of the mollusk community associated with different phases of the moon has never been reported. Therefore, this study aims to determine the abundance and density of the mollusks community, Karang Papak coastal, Garut, West Java, which is related to the phases of the lunar phases that occur during one lunar cycle.

2. Methods
Karang Papak is one of the coastal with most popular of the crowded beach located south of West Java Beach near tourist zone of Santolo beach. In the intertidal zone of Karang Papak, we can find higher abundance of Macroalga which growth at rocky zone.

2.1 Time and Places
This research was conducted in October 2018-February 2019. The sample was taken from Intertidal Zone, Karang Papak Coastal, Garut. The identification process of morphological characteristics was conducted at the Laboratory of Aquatic Ecology, Universitas Islam Negeri Sunan Gunung Djati Bandung and Lembaga Ilmu Pengetahuan Indonesia (LIPI) Cibinong. The sample was taken with four replication based on the lunar phase at one month (November-December). Therefore, the sampling site can be seen in Figure 1.
2.2 Tools and materials
The tools used during this study were buckets, gloves, masks, roll gauges, plastic, 5-10 cm jars, digital cameras, tweezers, ropes, wooden stakes, stationery, identification books, rulers, trays, magnifiers, savers small dip net, and bucket. The materials used during this study included alcohol with a concentration of 70% and Aquades. While the tool to capture the moon during the perfect moon phase using a digital camera cannon type shot A2300 HD, 16.0 megapixels, 5x optical zoom lens, 5.0-25 mm 1: 2.8 -6.9.

2.3 Procedure
The preliminary study aims to determine the location to be observed. Preliminary field survey to determine the location of the study and the size of the sample area taken in the study determine the location to be observed and date based on the moon phase. Sampling is done at the lowest ebb tide using quadrant transects. Samples obtained from the field were then observed and identified at the Aquatic Ecology Laboratory of UIN SGD Bandung using the help of a good library of books from [10], journals or mollusks bases, and then verified to LIPI Cibinong. The procedure of this research can be seen at Figure 2.

2.4 Data Analysis
Abundance was calculated using the number of mollusks individual collected every moon phase. Density was evaluated in organism/m². To know the values of mollusks density using the formula from [11] and the formula can be seen as follows.

\[ K = \frac{n_i}{A} \]

With \( K \) is Individual density \( i \), \( n_i \) is an individual number of \( i \) and \( A \) is area scale of \( i \).

3. Results and Discussion
3.1 The abundance of mollusks
The abundance of mollusks discovered during the study was 71 species, 36 genera, 23 families, 11 orders and 2 classes with a total of 10,700 individuals. The highest number of individuals in the dark moon phase and the fewest individuals are in the phase of Q-2 (Figure 3).

Mollusks that are found in Karang Papak Coastal are derived from the family Cypraidae, Conidae, and Murcidae. Whereas the lowest value is found in the Neritidae, Costelaridae and Cancelaridae families. High and low abundance of mollusks on the coastal seen from the large number of individuals that can be found during the sampling process. The greatest amount of individual abundance comes from the class of gastropods because gastropods are one of the organisms which are widespread in various habitats. According to [12], states that gastropod class of mollusks are one of component in marine ecosystems with high species diversity spreading in various marine animals. Also, [4] stated that among the mollusks classes the most common was the gastropod class.

In Karang Papak Coastal, mollusks are found attached to marine plants such as algae, immersing themselves in the sand, and occupying the reefs in that place. On the intertidal zone, the mollusks eat of algae and sargassum algae, mollusks also eat the phytoplankton, while for Bivalvia eat small worms in the sand and around corals. In the research of [12] states that groups of soft-bodied animals can be found starting from the coast to the deep sea with food sources that encircle of intertidal zones with the availability of food such as algae, phytoplankton, zooplankton and small worms used as mollusks food for their survival and space can be the main cause of the distribution of mollusks.

![Figure 3. Individual Number of Mollusks from Karang Papak Coastal Based on Moon Phase](image)

3.2 Density of mollusks

A species that has the highest density shows that this organism can occupy a wider space so that the opportunity to develop more. The density of mollusks based on the lunar phase on Karang Papak Coastal is presented in Figure 4.
The results of the calculation of the value of mollusks density in Karang Papak Coastal, West Java ranged from 3.22 to 4.17 ind/m². The highest value obtained in the dark moon phase was 4.17 ind/m² while the lowest value was found in the moon phase Q-2 amounted to 3.22 ind/m². The highest density value indicates a large number of organisms. This indicates that the habitat can be occupied by the mollusk.

The density and distribution of gastropods or bivalves can be influenced by several factors, such as environmental conditions, availability of food sources, predation and competition [13]. Also, the habitat of Intertidal Zone in Karang Papak has a high abundance of macroalgae as food resources and houses for the mollusks community. Furthermore, environmental stresses and changes such as metal pollution can influence the number and type of structures of soft-bottom mollusks and reported by [14-20] that metal pollution can affect the community structure of mollusks in the intertidal areas of Dar as Salaam Coast Tanzania.

4. Conclusion
There are 71 species, 36 genera, 23 families, 11 orders and 2 classes of mollusk found from four times the sampling based on the moon phase. The highest density in the dark moon phase is 4.17 ind/m² and the lower density in the quarter-2 phase (3.22 ind/m²).

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