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Abundance of green algae in the intertidal zone of Karang Papak Coastal, West Java, Indonesia

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Abstract. Green algae (Chlorophyta) is the one of macroalgae who have much function such as ecologically and economically that living in the intertidal zone. Several genera of Chlorophyta have been used by local society around coastal area of Karang Papak Coastal, West Java as local product, but the research about abundance of Chlorophyta in Karang Papak coastal was not yet understood. This research aims to study of abundance of green algae in the intertidal zone, Karang Papak Coastal, West Java, Indonesia. This study was conducted on November 2018 and collecting data were collected using ransect method and held in every week (following moon phase). The website of algaebase.org and macroalgae identification books was used to green algae identification and then the results was verified by professional researchers from Lembaga Ilmu Pengetahuan Indonesia (LIPI). Data analysis was performed by calculating the total individual of each type green algae. The results showed that green algae were found consist of 15 species and 6 genus. The highest abundance of green alga species is *Ulva lactuta* and the lowest one is *Codium tomentosum*. Its can be caused by environmental factors such as nutrition, temperate, seasonal and tides of seawater. This data can be used for complete data about Indonesian macroalgae and as suggestion for management and monitoring of macroalgae by government and local people to maintain the sustainability of Chlorophyta.

1. Introduction

Green algae (chlorophyta) in the intertidal zone, Karang Papak coastal is the one of macroalgae group that distributed in the Indonesian water. Interaction between sea, land and atmosphere accure at this region, and this region is one of the most interesting divisions of marine ecosystem, as it is daily covered and uncovered by flooding and ebbing tides. The intertidal zone is an environment that rich in oxygen, this area also gets enough sunlight, so it is suitable for several types of organisms to breed [1]. The type of intertidal zone substrate consists of sand, mud and coral. Another thing that is characteristic of this zone is the presence of tides and the organism component. The diversity of environmental factors can be seen from the gradient of environmental factors that physically influence the formation of types or characteristics of community and their habitat [2]. The one of organism that is living in the intertidal zone is macroalgae (especially, green algae-based on dominant pigment division) [3].

Green algae is the one of ecosystems component along coral reef which has ecological and economic benefits [4,5]. Ecologically, green algae is a primary producer in the food chain, a habitat for small marine organisms (crustaceans, molluscs and ecinoderms), and a food source for marine organisms [6].



In addition, green algae have a role as a provider of carbonate and reinforcement of basic substrates so that it is beneficial for the stability and continuation of the coral reefs existence [7,8]. Green algae has a variety of shapes, sizes and colors that are used as a basis for grouping. Green algae also has a variety of living areas including coral debris, muddy corals, dead corals, muddy sand, mangroves [9,10]. One location that has these characteristics is on the coast of Karang Papak, Garut, West Java, Indonesia.

The Karang Papak is the one of coastal which located in the Southern part of Java Island. This area can be utilized and developed so as to bring benefits to the surrounding community. Karang Papak coastal is an area that supports to biodiversity. South coastal is famous for its large and fast-flowing waves and has the characteristics of coastal with very abundant of coral types which can support to macroalgae growth, especially green algae as a place of its life.

Preliminary research about species composition in green algae is needed for data support about plant diversity in indonesia. The study aims to study of abundance (species and individual composition) in Karang Papak Garut, West Java using methods of transect quadrat.

2. Material and methods

2.1. Time and place

This research is a descriptive exploratory study, which describes the abundance of green algae. The location of this research was conducted at Karang Papak Coastal, Garut Regency, West Java, Indonesia. The study was conducted in June 2018 until February 2019.

2.2. Data collection

Sampling is carried out in four lunar phases which lasts for 40 days which refers to the moon phase differentiation [11,12]. Based on observations, the moon phase $\frac{3}{4}$ (quarter-1) takes place on 28th-30th, the dark phase (9-11th), the moon phase $\frac{1}{4}$ (quarter-2) (16-18th), and Full moon (23-25th). The quadrant transect method was used in this data sampling. Sampling was carried out at three stations, each station consisting of three transects with a transect length of 100 meters. Each transect consists of five observation plots measuring 1x1 m². The transect line is placed perpendicular to the sea from the coastline to the outer area. Sampling is carried out at the lowest low tide. All types of seaweed in the quadrant are counted and sampled and put into plastic bags and labeled to be identified. Samples found were preserved using 70% alcohol to maintain freshness.

2.3. Identification

Identification of the morphological characteristics of green algae was carried out at the Laboratory of Aquatic Ecology, UIN Sunan Gunung Djati, Bandung. Samples found during the study were identified to determine the abundance of the species. And then the green alga is made of wet herbarium (preserved in 70% alcohol). Green algae identification uses algaebase.org and Macroalgae identification books and is verified by professional researchers in the algae field (LIPI).

2.4. Data analysis

Abundance value of green algae from data collection was tabulated and counting used Microsoft Excel for knowing composition species and individual.

3. Result and Discussion

The Karang Papak Coastal, West Java, Indonesia have 15 species from 6 genus with genus of *Ulva* has highest abundance than other genus (figure 1). Based on species, *Ulva lactuta* is the species that have higher abundance if compared with other species. Moreover, *Codium tomentosum* is the species that have smallest abundance in the Karang Papak, West Java (table 1).

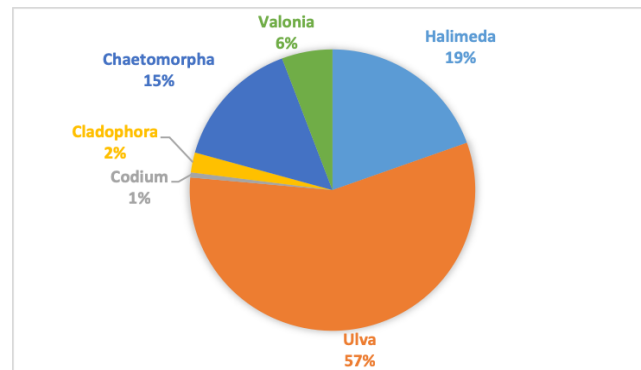


Figure 1. The abundance of Chlorophyta Genera, Karang Papak, West Java, Indonesia.

Table 1. Amount of individual from green algae in the Karang Papak, West Java.

No	Species	Total of individual
1	<i>Halimeda sp.</i>	6778
2	<i>Halimeda tuna</i>	5369
3	<i>Halimeda discoidea</i>	4586
4	<i>Halimeda gracilis</i>	3677
5	<i>Halimeda simulans</i>	13658
6	<i>Ulva lactuca</i>	36764
7	<i>Ulva reticulata</i>	16829
8	<i>Ulva fasciata</i>	18196
9	<i>Ulva intestinalis</i>	27335
10	<i>Codium tomentosum</i>	427
11	<i>Codium fragilis</i>	606
12	<i>Cladophora glomerata</i>	4587
13	<i>Chaetomorpha crassa</i>	9536
14	<i>Chaetomorpha antennina</i>	16736
15	<i>Valonia aegagropila</i>	10757



Figure 2. Species of *Ulva lactuca* in the intertidal zone, Karang Papak, West Java, Indonesia

This results suggest that in the intertidal zone of Karang Papak Coastal, the distribution and abundance of macroalgae are influenced by the substrates and exposure condition. Substrates are important components that play role in the growth and presence of macroalgae [13]. Genus of *Ulva* have higher abundance than other genus in the intertidal zone, Karang Papak Garut, West Java. Genus of *Ulva* had filamentous thalus that can withstand environmental stress. This genus is also known to be able to live on saltwater or freshwater, has a high salinity tolerance and high reproductive capability. And the otherhand, *Ulva* can use for food resource and non food resourch like energy and bioactive compound [14].

Based on species, *Ulva lactuta* (Figure 2) more abundance than other species. This alga is used as a biofilter in fish farming wastewater treatment [15]. In the tropical region, this plant usually live in the upper of intertidal zone until deeply 10 meters. In the right substrates, usually associate with region that have higher nutrient (like mangrove) or near resourch of freshwater [16].

Codium tomentosum is the species with widly abundance. This species is the one of invasif species from Europe (first reported in 1990) and may be can not adapt yet in Indonesia water region. Intertidal zone as the one of zone that direct effected by tides seawater and has an important role in the abundance of species, including the green algae group. The use of this moon phase condition is related to seed distribution of plant, variation diameter of tree, root growth [17], and relate with anticipate upcoming daily and annual environmental changes in habitat of plant and to adjust biochemical and physiological [18]. Moreover, plant growth can be influenced by electric fields and weak magnetic, perhaps by the ion cyclotron resonance mechanism, affecting the Ca^{2+} messenger function [19], while a slow magnetic field could hold up growth during early germination stages [20].

4. Conclusion

Based on this research, six genera of Chlorophyta were inventored in Karang Papak Coastal, West Java, Indonesia: they are *Ulva*, *Halimeda*, *Chaetomorpha*, *Velonia*, *Cladophora* and *Codium*. Among the six genera, *Ulva* has the highest abundance as much as 57% and *Codium* has the lowest abundance as much as 1%.

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