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Identification of Macro-Algae Species in Sindangkerta Beach, Tasikmalaya District: an Effort to Explore The Biodiversity of Indigenous Species

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Abstract

Sindangkerta beach has a total area of 90 ha, located in the Sindangkerta village, which is one of the natural tourism areas located on the south coast of West Java, which became one of the mainstays of Tasikmalaya regency. The tourist area is relatively unspoiled and has not maximized its potential. Aside from being a tourist area, Sindangkerta Beach is also a conservation area for sea-turtle breeding. As one of the conservation areas and a tourist spot is certainly a lot of pressure and ecological threats. Handling indigenous species diversity is very important and urgent treated as early as possible to monitor the occurrence of extinction and efforts to develop the existing potential. Data species and morphological descriptions for basic data management and enrichment of biodiversity, especially in Sindangkerta Beach Tasikmalaya. This study was conducted in June 2013 at the Sindangkerta Coastal Waters, District Cipatujah, Tasikmalaya District, West Java Province. The method used *Line Transect Square*. Sampling was carried out during low tide using *square plot*. All types of macroalgae found in the *square plot* were calculated for the number of individuals before the identification process. Macroalgae found in Sindangkerta Beach were 25 species and 17 genera of 3 divisions namely *Chlorophyta, Phaeophyta, and Rhodophyta*. The highest abundance of macroalgae is *Padinaaustralis* and *Sargassumduplicatum*,while the lowest abundance is *Halimedadiscoidea* , *Halimedamacroloba*, and *Laurencia sp*. Types of macroalgae that dominate a group Sindangkerta Beach Aquatic included as *Phaeophyta (*brown algae) categories with the highest dominance type of *Padinaautralis.*

Keyword: Identification, Macro-algae, Sindangkerta Beach, Indigenous species

Introduction

As the largest archipelagic country consist of 17,508 islands and coastline roughly 81,000 km, Indonesia has enormous potential for coastal and marine resources. Coastal and marine ecosystems provide natural resources that are very productive, either as a source of life, a source of food, mineral mining, recreational areas, or tourism (Bengen, 2000).

One part of the ecosystem that has an important role in the life of various marine life is macroalgae. Macroalgae is one of the various marine biological resources that have important economic value and have a high level of use because macroalgae can give benefit both humans and the aquatic environment.

Ecologically, the macroalgae community has a role and benefits for the surrounding environment, namely as a place of care and protection for certain fish species (nursery grounds), spawning grounds, as a place to find food for fish and herbivores (feeding grounds). From an economic perspective, macroalgae as a natural product is a very good commodity to be developed considering its chemical content. Macroalgae are widely used both in the form of raw materials for all parts of the plant and in processed form. In the form of raw materials in Indonesia, it is used as vegetables, sweets, and pickles. Utilization in the form of processed macroalgae, among others, is in the form of foodstuffs, health foods, medicines, and ingredient in various industries such as the food industry, beverage industry, biotechnology industry, textile industry, and others. The types of macroalgae that have important economic value include *Caulerpa*, *Eucheuma*, *Gracilaria*, *Hypnea*, *Sargassum*, and others (Atmadja et al, 1996). Biologically, macroalgae have a big role in increasing primary productivity, absorbing pollutants, producing organic substance, and producing oxygen for aquatic organisms in aquatic environments (Bold and Wynne, 1985).

The Sindangkerta Beach area has coastal conditions in the form of stretches of coral reefs and dead corals with fairly wide flat and sandy beaches. Remark of the environmental conditions nowadays, it is strongly possible for macroalgae to be able to live and reproduce, based on the characteristics of macroalgae which generally live on substrates in the form of sand, rubble, dead coral, and hard objects submerged in the seabed. As one of the conservation areas and tourist areas in West Java, of course, there are many ecological pressures and threats that occur on Sindangkerta Beach. The main threats to biodiversity are caused by human activities that has highly effect in habitat destruction, especially macroalgae included pollution, and the overuse of species for human interests. This condition is worrying because the diversity of macroalgae has an important role as a provider of foodstuffs, medicines that need to be maintained. To protect the diversity of germplasm, species, and ecosystems through inventory, monitoring, and calculation of the value of natural resources. Identification of local species is required for a database of diversity and their potential in a place for sustainable management efforts. The purpose of this study is to determine the diversity of macroalgae species in Sindangkerta Beach, Tasikmalaya and describe the morphological characteristics of macroalgae species obtained at Sindangkerta Beach, Tasikmalaya.

Materials and Methods

A. Research Setting

This research was conducted in June 2015 in Sindangkerta Beach Waters, Cipatujah District, Tasikmalaya Regency, West Java Province. The method used is *line transect quadrat* (English et al 1994). The observation stations are spread over three coastal areas of Sindangkerta (Figure 1). The station I is the western part of Sindangkerta Beach with coordinates 07.76036º"S - 108.05159º "E; station II is the middle part of SindangkertaBeach with coordinates 07.76410º"S - 108.05605º"E; and station III which is the eastern part of Sindangkerta Beach with coordinates 07.76692º"S - 108.06229º"E.

Figure 1. Research Location Sindangkerta Beach
(http://earthgoogle.com/Cipatujah_JawaBarat)

B. Materials and Tools

The research material was macroalgae species from Sindangkerta Beach, Tasikmalaya. Research equipment: hand refractometer, pH-meter, thermometer, 1 x 1 m2 square plot, roll meter, digital camera, tracing paper. Identification of species using identification keys from Trono (1986), Atmadja (1996), Handayani, et al (2013)

C. Procedure

Three transect lines were drawn at each observation station along 40 m with a distance between transects of ± 50 m. The transect is drawn perpendicular to the coastline. Whereas a square with a size of 1 x 1 m is placed along the transect line with a distance between squares of 10 m, which can be seen in Figure 2.

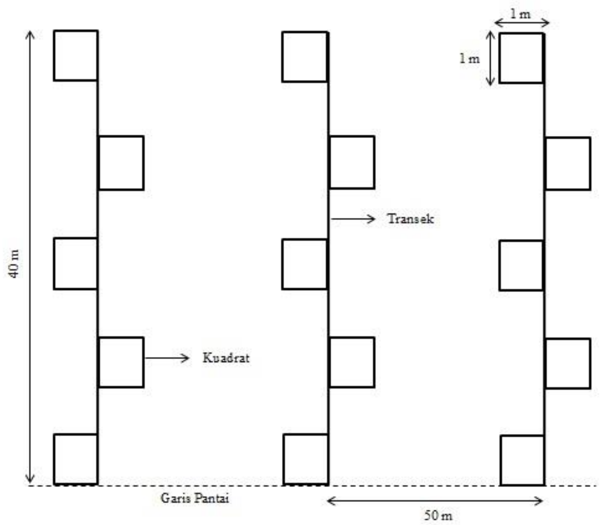

Figure 2. Line TransectQuadrat

Sampling was carried out at low tide using plot kuadrat. All species of macro-algae found in plot kuadrat were counted for the individual. For macro algae that have not been identified, put in a labeled plastic bag for further identification in the laboratory. Identification of macro-algae using identification books Trono (1986), Atmadja, et al (1996) and Handayani, et al (2013). Environmental parameters measured to support this activity are temperature, salinity, brightness, degree of acidity (pH), and the substrate. The temperature was measured using a thermometer, salinity using a refractometer, measuring the degree of acidity using a pH meter, using an organoleptic substrate.

D. Data Analysis

To determine the macro-algae community, a formula adapted by Cox (1967) was used:

$$\text{Density} = \frac{\text{Number of individuals per species}}{\text{Area (m2)}}$$

$$\text{Dominance of species} = \frac{\text{The value of closure of the area of species- i}}{\text{The plot area of the sampling area}}$$

Results and Discussion

Result

1. Composition and Species Abundance

The results showed that the macro-algae in Sindangkerta Beach were quite diverse with the discovery of 25 species and 17 genera from 3 divisions, namely *Chlorophyta*, *Phaeophyta, and Rhodophyta*. The abundance of each macro-algae division is as seen in Figure 3.

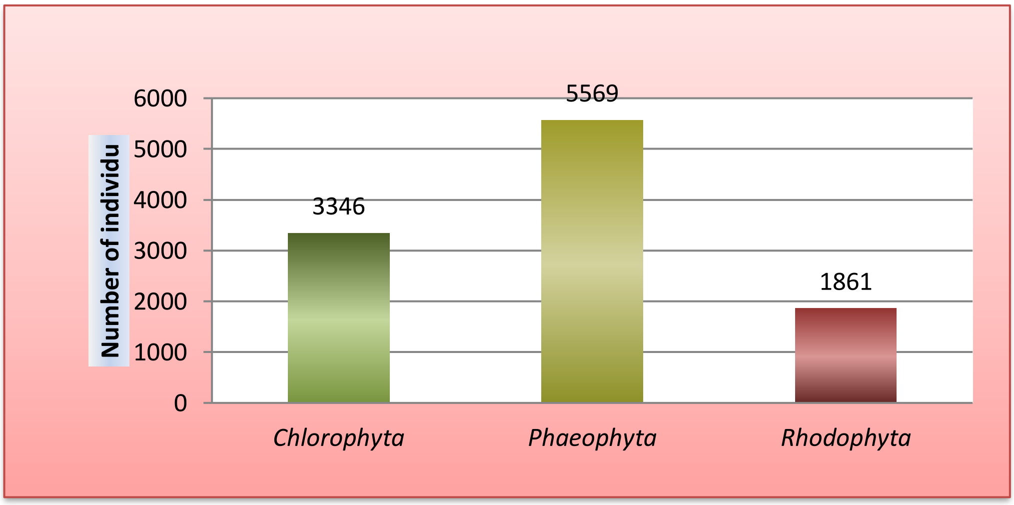

Figure 3. Composition and Abundance of Macro-algae at Sindangkerta Beach

2. Density and Dominance

Padinaaustralis had the highest density, it was 64,267 ind / m^2, while the macro-algae which had the lowest density was *Halimedadiscoidea* with a density value of 0.111 ind / m2 (Figure 4).

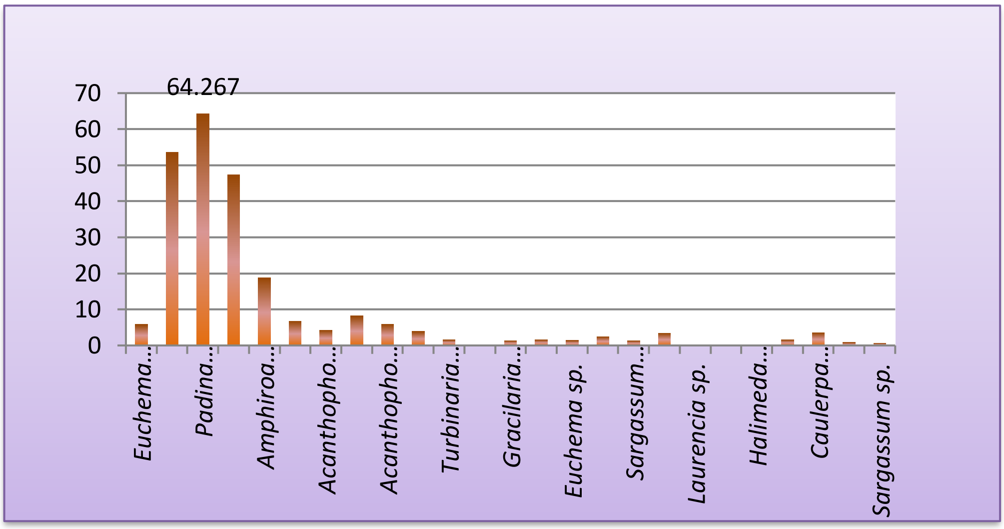

Figure 4. Individual Density (ind / m2)

The species of macro-algae that dominates the waters of Sindangkerta Beach is a group of *Phaeophyta* (brown algae) which can grow optimally in rocky and dead coral habitats by the conditions in Sindangkerta Beach Waters.

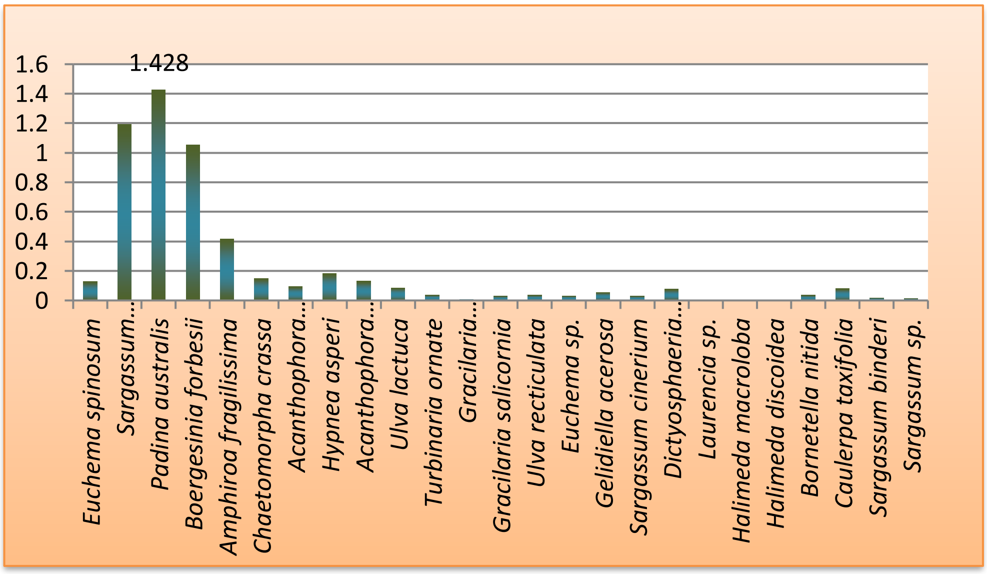

Figure 5. Macro-algae Dominance Index Value in Sindangkerta Beach

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3. Diversity of Macro-algae

Table 1. Description of the Types of Macro-algae Found in Sindangkerta Beach

No	Species name	Description
1	 *Euchemaspinosum*	The thallus is round, cylindrical, or flattened with branches. Clumps with simple and complex branches. The tip of the thallus is pointed. The surface of the skin is smooth with spines, dark brown, green-brown, green-yellow, or red-purple
2	 *Sargassumduplicatum*	Cylindrical or flattened trunk (thalli), up to about 60 cm high, branches resembling trees on the land, 'alternate' regular, opposite. Leaves oval, serrated edge, 5 cm long, 1 cm wide, pointed tip. Has air bubbles between the leaves. The color of the thallus is brown.
3	 *Padinaaustralis*	The fan-like thalli form thin sheet segments (lobes) with radial hairy lines and calcification on the leaf surface.The color is yellowish-brown or sometimes it turns white because of the calcification
4	 *Boergesiniaforbesii*	The thallus forms a cylindrical pouch filled with fluid, sleek-smooth surface, light green to dark green. The thallus forms clumps with solitary branches

5	 *Amphiroafragilissima*	The thallus forms dense clumps, cylindrical branches, internodes or knuckles, dichotomous or trichotomous regular branching. The thallus contains chalk, breaks easily at the branching, brownish-yellow to pink color.
6	 *Chaetomorphacrassa*	Talus cylindrical, resembling hair or forming tangled threads, green color, attached to other algae examples in *Sargassum.*
7	 *Achantophoraspecifera*	Cylindrical thallus, unstructured branching, straighten, short spines around the thallus as the characteristic. Brownish green, or fawn, thick clumps, in all directions.
8	 *Hypneaasperi*	The thallus is cylindrical, alternate branching has short branch spines that resemble spurs or horns. Lush clumps and expanding in various directions. The thallus has small sizeabout 0.5 mm in diameter. The color of the thallus is yellowish-green or yellow.
9	 *Acanthophoramuscoides*	The thallus is cylindrical, spines blunt like a round protrusion evenly found almost all over the surface of the thallus. Irregular branching, dreadlocks, thickened at the top of the clump. Brownish red color. Clump height 15 cm.

10	 *Ulvalactuca*	The thallus is thin as paper, bright green color, wavy edgesalmost a circular shape, the width of the talus reaches 5 cm, small holdfast, black color
11	 *Turbinaria ornate*	The thallus has leaves that are generally funnel-like with serrated edges, the edges of the leaves form a lip with the center of the leaf curving inward.
12	 *Gracilariacoronopifolia*	The thallus is cylindrical, smooth, brown-green, or brown-yellow (blonde) color, attached to the substrate with small discs. Dichotomous, repetitive branching. Generally lush at the top.
13	 *Gracilariasalicornia*	Cylindrical thallus, dichotomous to trichotomous branching. There is a bulge at the end stem. Forming dense clumps expanding in width (radial).
14		The thalli are like a green sheet with holes so that it resembles a braid of wide ribbons. It grows to form thick colonies, its attachment is difficult to observe, colonies are usually attached to a solid substrate.

	Ulvarecticulata	
15	 *Sargassum*sp	Thalli cylindrical, leaves oval to oblong with serrated edges, alternate branching.
16	 *Gelidiellaacerosa*	Cartilaginous thallus, straighten, stolons make branches upright and lying down, rhizoid is short, axial branches are cylindrical with opposite leaves
17.	 *Sargassumbinderi*	A short, cylindrical main stem about one centimeter and three millimeters in diameter, attached with a discoidal or conical holdfast. Thalli (leaves) on the branches are flat, smooth, alternating regularly
18.	 *Dictyosphaeriacavernosa*	Light green color, hollow and cup-shaped. The surface of the thallus is composed of tiny bubbles.Generally found on reef flats and shallow subtidal. Often considered a nuisance to marine macroalgae because of its ability to explode populations.

19.	 *Laurencia sp.*	The cylindrical thallus, dichotomous branching, forms lush clumps.The size of the thallus reaches 5-7 cm in length, 0.5-1 mm in diameter. The green thallus at the base combines with the red at the tip
20.	 *Halimedamacroloba*	The thallus is segmented with wavy edges, dull-whitish green color, up to 16 cm high, implantsin the substrate with tuber-like rhizoid fibers.
21.	 *Halimedadiscoidea*	The thallus is segmented, the shape of the segment is discoidal, whitish-green, upright, lush, up to about 15 cm high, the attachment tool is rhizoid fibers (holdfast) which are dense with sand and shaped like a tuber.
22.	 *Bornetellanitida*	The thallus is arranged as a hard spherical bubble. Branching at the base of the thallus. The holdfast part has fiber roots as a means of sticking to the substrate. The color of the thallus is green to brown

23.	 *Caulerpasertularoides*	The thallus has stolons, the upright thallus resembles feathers, so this macroalga is known as Caulerpa feather (feather Caulerpa)

4. Water Quality

The results of chemical physics measurements in Sindangkerta Beach waters are obtained as shown in Table 2.

Table 2. Results of Measurement of Physical Parameters - Water Chemistry

No.	Parameter	Unit	Observation Location		
			East	Central	West
1	Temperature	^{0}C	31,81	32,13	31,59
2	Salinity	($^0/_{00}$)	30,67	30,56	30,11
3	pH	-	8,34	8,30	8,19
4	DO	ppm	10,08	8,79	7,42
5	Brightness	%	95,00	93,33	76,67
6	Substrate	-	Dead coral	Dead coral	Sandy dead coral

Discussion

The highest abundance of macroalgae was *Padinaaustralis* and *Sargassumduplicatum*, while the lowest abundance was *Halimedadiscoidea*, *Halimedamacroloba*, and*Laurencia sp.* The abundance of *Padinaaustralis* and *Sargassumduplicatum*is due to the favorable habitat conditions for the growth of both species. Rocky habitats and dead coral are suitable places for the growth of these two types because they have morphological adaptations in the form of strong hold fast to reduce carried away by currents. This is following the opinion of Kadi (2005), that *Sargassum* grows in a clear coastal environment with a substrate of coral, dead coral, and massive objects at the bottom of the water. The small number of *Halimedadiscoidea* and *Halimedamacroloba* were found due to unsuitable habitat conditions. Both *Halimeda* usually grow optimally in sandy habitat conditions so that not many are found in the Sindangkerta Beach area where most of the corals are dead. This is by the opinion of Nontji (1993), the types of macroalgae such as *Halimedasp*, *Caulerpasp*, *Gracillariasp* and *Hypneasp* are mostly found in soft water substrates such as sand and mud.

The macroalgae that had the highest dominance value was *Padinaaustralis* with a dominance value of 1.428 (figure 5) compared to other macroalgae species found in the research setting. This dominance value indicates that *Padinaaustralis* was a macro -algae that dominatesSindangkerta Beach because the dominance value was > 1. This is influenced by environmental conditions that are very supportive of the growth of these types of macro-algae.

The results of temperature and salinity measurements in Sindangkerta Beach waters obtained an average temperature ranging from 31-33°C and an average salinity ranging from 30-31 ‰. The temperature of each observation location shows a value that exceeds the range of the optimum temperature for macro-algae growth. Meanwhile, the salinity of each observation location shows the optimum value for macro-algae growth. According to Luning (1990), the ideal temperature and salinity for macro-algae growth are temperatures ranging from 16-30 ° C and salinity ranging from 30-35 ‰. This temperature variation can affect the spread of macro-algae in a place (Atmadja, 1988).

According to Zatnika and Angkasa (1994), the optimum degree of acidity (pH) for macroalgae growth ranges from 7-9. Based on this range, the level of acidity at each observation location is still normal for macro-algae growth. The degree of acidity affects the processes of breaking down organic matter in water into minerals that plants can assimilate (AkhmadFarid, 2008).

Dissolved oxygen (DO) measurements at each observation location showed a range of values that exceeded the optimal value for macroalgae growth. According to Sulistijo and Atmadja (1996), the limit of the normal value of dissolved oxygen for macro-algae is 5.006 ppm. The oxygen fluctuation that is too large in this study is influenced by the presence of mixing, photosynthetic activity, and the movement of water masses. This is following the opinion of Effendi (2003) that dissolved oxygen levels also fluctuate daily and seasonally depending on the mixing and movement of water masses, photosynthetic activity, respiration, and waste that enters watermasses.

The brightness of water determines the intensity of sunlight or light that enters. Brightness is strongly determined by the color of the waters, the content of organic and inorganic materials suspended in the waters, the density of plankton, microorganisms, and detritus. The brightness at each observation location is still in good condition, ranging from 76%-94% (Table 3). This condition shows that the waters of Sindangkerta Beach are still in optimal condition for macroalgae growth. Turbidity is a description of the optical properties of water which is determined based on the number of rays (light) emitted and absorbed by the particles in the water and can affect the photosynthetic process and primary production of waters because it affects the penetration of sunlight (Boyd, 1988 in Apriyana, 2006).

In the eastern and central parts of Sindangkerta Beach, the conditions are rocky and dead corals, so the types of macroalgae found are those that have a strong holdfasttostick on the substrate firmly. The species found include *Padinaaustralis, Sargassumduplicatum, Sargassumcinerium, Boergesiniaforbesii*, etc. In the western part of Sindangkerta Beach, the conditions are dead and sandy corals. The types of macroalgae found in the area are mostly the same as those found in the eastern and central parts of Sindangkerta Beach, but several other types are not found in these two areas such as *Halimedamacroloba, Halimedadiscoidea and Caulerpataxifolia*. This is because the three types can grow optimally in sandy habitat conditions according to the conditions in the western part of Sindangkerta Beach.

Conclusion

The identification results found that there were 25 species of macro-algae consisting of 17 genera and 3 divisions. The macro-algae which had the highest density was *Phaeophyta(*Brown Algae*)* division, namely *Padinaaustralis*with a density value of 64.267 ind / m2 while the macroalgae which had the lowest density was the *Halimedadiscoidea* with a density value of 0.111. The species of macro-algae that dominated the waters of Sindangkerta Beach was*Padinaaustralis* with a dominance value of 1.428. In general, the quality of the waters at Sindangkerta Beach is still tolerable for macro-algae growth.

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