Biosaintifika 11 (1) (2019) 100-107

Biosaintifika

Journal of Biology & Biology Education

http://journal.unnes.ac.id/nju/index.php/biosaintifika

Biodiversity and Potential Use of Macro Algae in Pesisir Barat Lampung

✉**Triana Asih[1], M. Khayuridlo[2], Rasuane Noor[1], Muhfahroyin[1]**

DOI: http://dx.doi.org/10.15294/biosaintifika.v11i1.16532

[1]Biology Education Study Program, Teacher Training and Education Faculty, Universitas Muhammadiyah Metro, Indonesia
[2]Primary Shcool Teacher Education, Teacher Training and Education Faculty, Universitas Nahdlatul Ulama Lampung, Indonesia

History Article

Received 24 November 2018
Approved 19 February 2019
Published 30 April 2019

Keywords

Classification of macro algae; Pesisir Barat Regency; Potential use of macro algae

Abstract

Pesisir Barat Regency in Lampung has abundant marine biological wealth that has not been widely known and utilized by the community, one of them is macro algae. The objectives of the research were to identify the types of macro algae and to explains the potential use of macro algae in the Pesisir Barat Lampung Region. The study used cruise method. The findings were identified by experts to validate the results of classification, morphology, and qualitative studies regarding the potential use and benefits of macro algae. From the results of this study, 15 species of macro algae were found on Tanjung Setia Beach included; 3 species of green algae (Chlorophyta) consist of *Halimeda opuntia* L., *Caulerpa racemosa* F., *Ulva lactuca* L .; 7 species of brown algae (Phaeophyta) consist of *Padina pavonica* L., *Padina australis* H., *Sargassum vulgare* C.A., *Sargassum polycystum* C.A., *Turbinaria ornata* J.A., *Turbinaria ornata* J.A., *Fucus vesiculosus* L.; and 5 species of red algae (Rhodophyta), consist of *Corallina officinalis* L., *Gigartina pistilla* S., *Gigartina disticha* S., *Gracilaria verrucosa*, H., *Rhodymenia pseudopalmat* J.V.L.The benefits of this research for society to provide insight into the potential use of macro algae which can be utilized in many fields. For students, provide information on the biodiversity of macro algae in the sea.

How to Cite

Asih, T., Khayuridlo, M., Noor, R., & Muhfahroyin. (2019). Biodiversity and Potential Use of Macro Algae in Pesisir Barat Lampung. *Biosaintifika: Journal of Biology & Biology Education*, 11(1), 100-107.

✉ Correspondence Author:
E-mail: asih.triana@yahoo.com

p-ISSN 2085-191X
e-ISSN 2338-7610

INTRODUCTION

Pesisir Barat Regency, Lampung has abundant biodiversity, especially biodiversity in the beach and the sea. The area of the Pesisir Barat sea water stretches from Bengkunat Belimbing to Lemong district along the coast about 210 km. Most of the food potential has not been optimally regulated and still relies on traditional fishermen (BPS Kabupaten Pesisir Barat, 2014).

There are many learning sources, which are able to empower students to understand science cognitively and psychomotorically, one of which is an environment that has biodiversity (Muhfahroyin & Oka, 2017). One of the area in Pesisir Barat is Tanjung Setia Village. In this area, there is a beach namely Tanjung Setia Beach is known by the local community as Pantai Karang Nyimbor (Seli & Christanto, 2015).

Tanjung Setia has abundant marine biodiversity. According to Noor (2014) Tanjung Setia Beach also has a wide expansion of seagrass beds. This area can be used by visitors to see marine animals, as well as green, brown, and red algae. The potential of marine biological resources, for marine aquaculture, consisting of the potential of fish, shrimp, mollusks (shellfish, pearls, sea cucumbers); and seaweed (Lasabuda, 2013).

Tanjung Setia Beach is located along the west coast, Lampung, which is close to south Bukit Barisan National Park, located around 273 km or about 6-8 hours from Bandar Lampung. This beach is in the great flow of the Indian Ocean which makes has relatively constant waves, also provides a natural environment that is still awake in its natural state(BPS Kabupaten Pesisir Barat, 2014).

The result of interview around Tanjung Setia beach, 70% of society still don't know the types and the benefits of macro algae in the coastal area. Biology Education Students Muhammadiyah University of Metro Lampung were also still having trouble identifying the type of macro algae in the sea.

The research by Tampubolon et al. (2013) showed the classification and general description of macro algae found in Pasige Island, Tagulandang district, Sitaro regency with the results of identification including: 9 types of green algae *Halimeda macroloba, H. opuntia, H.discoidea*, *H. incrassata, Caulerpa lentillifera, C. racemosa, Boergesenia forbesii*, *Dictyospheria cavernosa, Boodlea coacta*; 10 types of red algae, *Gracilaria blodgetti, G. edulis*, *G. verucosa, Laurencia papilosa, Amphiroa fragilisima, Gelidiopsis intricata, Acanthopeltis* sp, *Hypnea* sp, *Amansia glomerata, Euchema* denticulatum; and 2 brown algae *Padina minor*, *Turbinaria ornata.*

The objectives of the research were to identify the types of macro algae and to explains the potential use of macro algae in the Pesisir Barat Lampung Region. The benefits of this research for society to provide insight into the potential use of macro algae which can be utilized in many fields. For students, provide information on the biodiversity of macro algae in the sea.

METHODS

This research was conducted onTanjung Setia beach, Pesisir Barat Lampung. Sampling and identification process were carried out for 2 months.

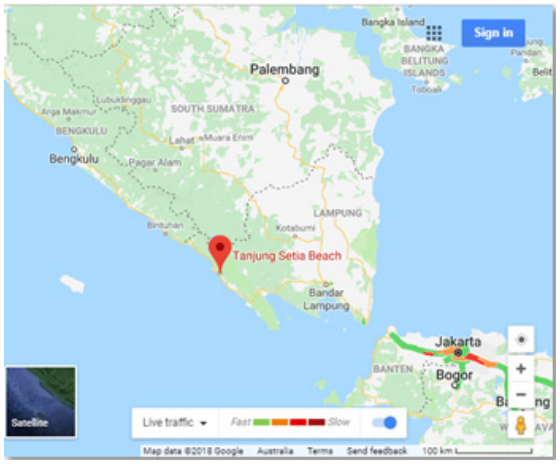

Figure 1. Research Location

Sampling was carried out by using the Cruise Method. Samples found were documented to make the ir original color visible, then made wet with 70% alcohol immersion. After that, the identification process was carried out by experts to validate the results of classification, morphology, and qualitative studies for the potential and benefits of the macro algae.

RESULTS AND DISCUSSION

Pesisir Barat Regency Lampung has abundant marine biodiversity, one of them is macro algae, Tanjung Setia Beachis a location with macro algae diversity. There were 14 species macro algae found in Tanjung Setia Beach 3 species of green algae (Chlorophyta), 7 species of brown algae (Phaeophyta), and 4 species of red algae (Rhodophyta) Details of algae classification can be seen in Table 1.

Table 1. Classification of Macro Algae on Tanjung Setia Beach

Divisio	Classis	Ordo	Familia	Genus	Spesies
Chlo-rophyta	Ulvophyceae	Bryopsidales	Hamiledaceae	Halimeda	*Halimeda opuntia* L.
	Ulvophyceae	Bryopsidales	Caulerpaceae	Caulerpa	*Caulerpa racemosa* F.
	Ulvophyceae	Ulvales	Ulvaceae	Ulva	*Ulva lactuca* L.
	Phaeophyceae	Dictyotales	Dictyotaceae	Padina	*Padina pavonica* L.
	Phaeophyceae	Dictyotales	Dictyotaceae	Padina	*Padina australis* H.
	Phaeophyceae	Fucales	Sargassaceae	Sargassum	*Sargassum vulgare* C.A.
Pha-eophyta	Phaeophyceae	Fucales	Sargassaceae	Sargassum	*Sargassum polycystum* C.A.
	Phaeophyceae	Fucales	Sargassaceae	Turbinaria	*Turbinaria ornata* J.A.
	Phaeophyceae	Fucales	Sargassaceae	Turbinaria	*Turbinaria ornata* J.A.
	Phaeophyceae	Fucales	Fucaceae	Fucus	*Fucus vesiculosus* L.
	Florideophyceae	Corallinales	Corallinaceae	Corallina	*Corallina officinalis* L.
Rod-hophyta	Florideophyceae	Gigartinales	Gigartinaceae	Gigartina	*Gigartina pistilla* S.
	Florideophyceae	Gigartinales	Gigartinaceae	Gigartina	*Gigartina disticha* S.
	Florideophyceae	Gracilariales	Gracilariaceae	Gracilaria	*Gracilaria verrucosa* H.
	Florideophyceae	Rhodymeniales	Rhodymeniaceae	Rhodymenia	*Rhodymenia pseudopal-mata* J.V.L.

14 macro algae found on Tanjung Setia, 11 were known to have some potential use. The details of morphology and potential uses of are as follows.

Figure 2. *Halimeda opuntia* L.

Halimeda opuntia L.has the characteristics of coenocytic thallus (the cell has many nuclei), this genus grows very well on hard substrate coral reefs. Thallus off *H. opuntia* L. are segmented, contains a lot of lime and forms colonies (in groups) it also has an adhesive device in the form of rhizoid (Tampubolon et al., 2013). *H. opuntia* L. thalus characteristics are: lush, erect, flattened and overlapping, with trichotomous branching. In this type of algae, a filament is used as an attachment device with characteristis of, calcareous blade, stiff, and green color. Habitat of *H. opuntia* L. in sandy areas.

H .opuntia. contains high amounts of extracellular aragonite calcium, making it the largest calcium carbonate contributor in the ocean. The presence of calcium makes *H. Opuntia*. Has the potential as a natural source of calcium that can be used for fortification. Ilincreasing the calcium intake through the food ingredients are safer than using supplements, because in digestion system, high calcium concentrations will actually suppress the bone *remodeling*. In addition, *H. opuntia* protein / amino acids, fats / fatty acids, phenolic compounds, and others that make thisese biota have antioxidant bioactivity (Novoa et al., 2011).

The research conducted by Subagiyo (2012) found that the intake of *Halimeda* sp.is able to modulate a non-specific defense system in white shrimp (*Litopenaeus vannamei*). The secondary metabolites content with pharmacological bioactivity has also been identified in *Halimeda* sp. Therefore, . *opuntia* is a potential raw material for nutraceutical products.

Figure 3. *Caulerpa racemosa* F.

Caulerpa racemosa F. is an algae that has a lot of water content. It cannot stand in dry conditions, found in sand, substrate of coral and dead coral fragments. This species can only grow at the lowest ebb which is still inundated. A common feature of this genus are: the main thalus grows creeper, the main stem segment is overgrown with roots, various branch forms such as leaves such as single, round leaves, such as coconut leaves and cassava. The thimbles grow horizontally with stoles. The blade is upright with, round shape to form rather flat spheres, amounted to 8-16 ramuli, with a diameter of 2.92 mm. The distance between the branches is 5 mm. *C. racemosa* F has yellowish dark green color and grows rather rare (Tampubolon: 2013).

The *Caulerpa* genus is rich for antioxidants, folic acid, thymine and ascorbic acid. Optimal Caulerpa breeding, can be planted on the surface of the media compared to cultivation in the media column so that the reception of sunlight is more effective for photosynthesis. (Sunaryo, 2015)

Figure 4. *Ulva lactuca* L.

Ulva lactuca L. also called as sea lettuce has a length of up to 100 cm and bright apple green color. It also, has a strap-shaped blades with a smooth but wavy edge. The middle part of each strand is often pale and color getting darker to wards the edge. Sea lettuce habitat is in sea water of tropics area. It is usually found in shallow water upper intertidal zone to a depth of 10 meters. An appropriate substrate of thisalgae is often, associated with high nutrient areas such as mangroves or near freshwater sources.

Morphology of sea lettuce is thin and flattened like a swordthallus consisting of 2 layers of cells. There is no tissue differentiation and all cell identical form, except for the basal cells that experience elongation to form the rhizoid for attachment. Each cell in this species consists of a nucleus, with cup-shaped chloroplasts, and a pyreneoid (Guiry, 2007).

Ethanol extract of *U. lactuca* L. contains antioxidant melatonin a type of hormone which is a powerful antioxidant. Melatonin is able to overcome free radicals (antioxidants) to prevent acute myocardial infarction (by reducing lipid peroxide levels in vivo). The ideal dose to reduce lipid peroxide levels is 200 mg / kgBW. Myocardial infarction is the death of heart muscle cells due to lack or even cessation of oxygen supply. This occurs after the heart muscle that is experiencing insubstantial ischemia is overcome and other causes due to free radicals. (Mahmud et al: 2014)

Figure 5. *Padina pavonica* L.

Padina is a genus of seaweed that comes from the Phaeophyta class (brown seaweed). It is abundant during the seasons around a pool of water on the beach reefs in the tropics. *Padina pavonica* L. has a morphology of thallus shape like a 3-4 cm diameter fan that grows in concentric circles.

P. pavonica L. has potential as a natural

antioxidant and has several active compounds as (flavonoids, alkaloids, tannins, triterpenoids, saponins and, phenolics) and pigments (chlorophyll a, chlorophyll c, carotenoids, fucoxanthin, fucoxantol and β-carotene). (Sari et al., 2016).

Based on the result of research by Tuney et al. (2006), *P. pavonica* L. extract with ethanol extract showed a weak antimicrobial activity against Candida, *Enterococcus faecalis, Pseudomonas aeruginosa, and Escherichia coli*. According to Kandhasamy & Arunachalam (2008), *Padina tetrastromica* methanol extract can inhibit the growth of *Klebsiella pneumoniae, Enterobacter aerogenes, Micrococcus luteus, Enterococcus faecalis, Staphylococcus aureus, Pseudomonas aeruginosa, and Bacillus subtilis*, but cannot inhibit the growth of *Escherichia coli* and *Streptococcus faecalis*.

Figure 6. *Sargassum polycystum* C.A.

Morphology of *Sargassum polycystum* C.A. is not much different from the general characteristics of Phaeophyta. Small spiked cylindrical thallus docked, the holdfast forms small discs withlush roots on top of which expanded in all directions. This type of algae also has a short stem with the main branch growing thick and bladder which is generally solitair, reaches 7 meters in length, the color of the thallus is generally (Anggadiredja, 2009).

The mostly found chemical compounds in brown seaweed is alginate. In small amounts there are laminaran, fucoidan, cellulose, mannitol, and other bioactive compounds S. polycystum contains alginate, vitamin C, vitamin E (α-tocopherol), minerals, carotenoids, chlorophyll, fluorotin, polysaccharides sulfate, fatty acids, and amino acids. This algae has the potential to cure bladder disease, mumps, cholesterol as well as, used as cosmetics, alginate sources, and antioxidants (Matanjun et al., 2009).

Sargassum sp. (seaweed), which is often cultivated in Indonesia has the potential to be a source of macro minerals for dairy cattle that are often experience mineral-deficiency.it has high mineral contentt, especially K minerals that exceed 10%. In addition to high mineral content, its solubility in physiological solutions and rumen fluids is also high so that it is expected to be available to livestock (Matanjun et al., 2009).

Figure 7. *Turbinaria ornata* T.

The thallus of *Turbinaria ornata* T. is straight and hardin which, hardest part is in the bottom. The shape of the blade is rather round, generally like a funnel and surrounded by irregular thorns. Color of thallus is dark brown and forms holdfast rhizoid. Habitat on sandy substrate.

Turbinaria sp contains fucoxanthin which is one of the bioactive carotenoid pigments that has the potential to be developed for nutraceutical materials, which have been formulated into weight-loss ingredients. Januar et al. (2011) concluded that agricultural runoff areas that contain high phosphate levels can be used as an potential area to develop fucoxsanthin for nutrasetic raw materials.

Figure 8. *Turbinaria conoides* J.A

Characteristics of *Turbinaria conoides* J.A. includes: cylindrical rods, upright and roughthallus with the, branch marks. Its holdfast is a in from of small disk with rooting that has radial expansion. Branching rotates around the main stem. Thalus is a unit consisting of dangling stems that are less long than *Turbinaria Ornata* and sheets. This species is generally found in reef flat areas, attached to rocks. *T. Conoides* J.A. is widely distributed in Indonesian waters.The bioactive content of *T. conoides* J.A. is in the form of phenols and their cosmeceutical activity as antiaging, reduce wrinkle and as, antioxidants (Januar et al., 2011).

Figure 9. *Corallina officinalis* L.

Corallina officinalis L. has a hard and calcareousthallus, rigid structure, joint-jointed sheets in one plane, branching, pinnate or irregular, *C. Officinalis* has cylindrical or flat stems with a disc-shaped root-like base structure. The color of this algae is, whitish to pinkish. They live on rocks with, varying shapes and often grow stunted.

C. officinalis L. has high ash content (77.8%), low protein (6.9%) and high calcium content (182 ppm); The application of this seaweed extract in human and fish food can increase the antioxidant value of these foods which will be able to maintain food nutrition and provide health effects for subjects who consume (Rasyid, 2004)

Gigartina pistillata S.G. lives on the reef level, especially in places that are still inundated at low tide. The thallus stiff-soft like a gel with red-brown-purplish color. The thalli forms a blade with a thick and, simple branch. On the surface of the thallus there is a cystocarp awhich is clearly visible in the from of nodules and spermatogonias gathering at the tip of the thallus branching.

Figure 10. *Gigartina pistillata* S.G.

Gigartina pistillata S.G. is one of the red algae (Rhodophyceae) which is often used as food ingredients especiially as a gelatin maker. Pudding is often made because of its high vitamin C content. Gigartina also contains carrageenan substances that are used in the manufacture of toothpaste, cosmetics, paints, leather refining, textile, beer and pharmaceutical industries. Doctors also use carrageenan to speed up the blood clotting process. (Rasyid, 2004)

Figure 11. *Gigartina disticha* S.

Gigartina disticha S. has the characteristics of soft thallus substance like a gel with a red-purplish color. Thallus is smaller forming a blade with lush branching. Aside from being gelatinous ingredients, *G. disticha* has antioxidant activity as well as, anticoagulants and immunostimulant activities in vitro as antiviral, anti-allergic, anticancer drugs (Barahona et. al., 2014).

G. disticha S. is the most important raw material for carrageenan production. Carrageenan is

often used in the pharmaceutical industry as an emulsifier (for example in liver oil emulsions), as a granulation solution and binder (for example in tablets, eleixier, syrup, in medicines, etc.). It is stated that high depolymerization of ijota-carrageenan is used as a drug in purulent gastric therapy, whithout any side effects. Carrageenan is also used this compound in the cosmetics industry as a stabilizer, suspension, and solvent. Cosmetic products that often use are ointment, cream, lotion, toothpaste, hair tonic, soap stabilizer, sun protection oil, and others. Carrageenan is also used in the leather, paper, textile and other industries (Suparmi & Sahri, 2009)

Figure 12. *Rhodymenia pseudopalmata* J.V.L.

Rhodymenia pseudopalmata J.V.L. has shape of a sheet and has a dichotomy branch. The thallus texture is soft and slightly transparent. It has red to bronze pigments because it contains chlorophyll-a carotenoids and fikoeritrin. This algae live attached to stone substrate in the reef flat, *R. pseudopalmata* J.V.L. is one of the algae that produces gelatinous ingredients.

R. pseudopalmata J.V.L. contains carotenoid compounds that can prevent cancer because they can inhibit the formation of free radicals, which react directly with oxygen. A antimutagenic â-carotene at 7,12-dimethylbenz induced in mice has an effect on the growth of rat tumors, tumors found in rat lungs are inhibited. Based on the Kruskal-Wallis analysis carried out on pulmonary histology data for the treatment group sample, it was confirmed that there were significant differences in carbohydrate treatment, which meant that carotene isolates could inhibit cancer (Astutiningsih, et al., 2010).

This reserch was the first study to identify biodiversity of macro algae on the Pesisir Barat of Lampung and their potential use. The benefits of this research for society to provide insight into the potential use of macro algae which can be utilized in many fields. For students, provide information on the biodiversity of macro algae in the sea.

CONCLUSION

There were 15 species macro algae that were found in Tanjung Setia beach that consist of. 3 species of green algae (Chlorophyta), 7 species of brown algae (Phaeophyta), and 5 species of red algae (Rhodophyta). Off 15 speciesfound 11 species have potential use that can be utilized. The potential use of the algae found are. Gigartina and Gracilaria as the source of vitamin C and high antioxidants. Halimeda as the source of natural calcium (calcium aragonite) for fortification ingredient. Ulva as a source of melatonin antioxidant to prevent acute myocardial and turbinaria as a source of phenol for antiaging.

ACKNOWLEDGMENT

This research was funded by the "Penelitian Dosen Pemula" (PDP) in 2018. The authors would like to thank the DRPM, the Directorate General of Strengthening Research and Development of the Ministry of Research Technology and Higher Education.

REFERENCES

Anggadiredja, J.T. (2009). *Seaweed, Cultivation, Processing & Marketing of Potential Fisheries Commodities*. Depok: Penebar Swadaya.

Astutiningsih, Christina., Limantara, Leenawaty., Radjasa & Ocky K. 2010. Uji Mutagenik β-Karoten Alga Merah Rhodymenia Pseudopalmata terhadap Mencit Jantan Galur Balb/C yang Diinduksi 7,12-Dimetilbenzen (A)Antrasen (DMBA). *Biosaintifika: Journal of Biology & Biology Education*, 2(1), 133-151.

Badan Pusat Statistik. 2014. Pesisir Barat Dalam Angka. Bandar Lampung: BPS.

Barahona, T., Encinas, M.V., Imarai, M., Mansilla, A., Matsuhiro, B, Torres, R., Valenzuela, B., 2014. Bioactive polysaccharides from marine algae. *J. Bioact Carbohydr and Diettary Fibre.* 4: 125–138.

Guiry. 2007. *Algaebase*. National University of Ireland Galway: Ireland.

Herliatika A1, Permana IG, Despal. 2017. Potential of Various Seaweed Species as a Mineral Source for Dairy Cattle.*Buletin Makanan Ternak*, 104 (3): 21-30.

Januar, Hedi Indra., And Wikanta, Thamrin. 2011. Correlation of Fukosanthine Content from Turbinaria sp. Against Sea Nutrients on Binuangeun and Krakal Beaches. *Squalen,* 6(1), 18-

25.

Kandhasamy, M. and Arunachalam, K.D., 2008. Evaluation of in vitro antibacterial property of seaweeds of southeast coast of India. *African Journal of Biotechnology*, 7 (12), 1958-1961.

Lasabuda. 2013. Development of Coastal and Oceanic Areas in the Perspective of the Republic of Indonesia. *Platax Scientific Journal*. 1(2), 92-101.

Lestari, Imas Laili., Mita, Soraya Ratnawulan. 2017. Potential of Marine Algae and Biological Compounds as Raw Cosmic Materials. *Farmaka*.14 (1). 114-126.

Mahmud, Iwan., Pertiwi, Reza., Aziz, Nova R., and Reviana, Desi N. 2014. *Utilization of Green Algae Potential (Ulva lactuca) as Natural Antioxidants in Prevention of Acute Myocardial Infarction*. Faculty of Pharmacy, Ahmad Dahlan University.

Matanjun P, Mohamed S, Mustapha NM, Muhammad K. 2009. Nutreint content of tropical edible seaweeds, Eucheuma cottonii, Caulerpa lentillifera and *Sargassum polycystum*. *Apples Phycol*. 21 (1), 75-80.

Muhfahroyin & Oka, A. A. (2017). Improving Postgraduate Students Learning Activities through Lesson Study in Learning Forest-Prototype. *Biosaintifika: Journal of Biology & Biology Education*, 9(2), 311-316.

Nawaly, Hermanus., Susanto, A.B., and Uktolseja, Jacob L.A. 2016. Application of Antioxidants from Seaweed Conference: *Prosiding Seminar Nasional X Pendidikan Biologi.* 10(1), 7-14.

Novoa, A. V., Andrade-Wartha, E. R., Linares, A. F., Genovese, M. I., González, A. E. B., Vuorela, P., Costa, A. & Mancini-Filho, J., (2011). Antioxidant activity and possible bioactive components in hydrophilic and lipophilic fractions from the seaweed Halimeda incrassata. *Revista Brasileira de Farmacognosia*, 21 (1), 53-57.

Rasyid, Abdullah. 2004. *Various Benefits of Algae*. Oseana, 29 (3), 9-15.

Sari, D.P., D.H.C. Pangemanan dan Juliatri. 2016. Uji Daya Hambat Ekstrak Alga Coklat (Padina australis Hauck) terhadap Pertumbuhan Bakteri Porphyromonas Gingivalis Secara In Vitro. *Jurnal e-GiGi*., 4(2): 140-144.

Seli, Tria F., & Christanto, Joko. 2015. Identification of the Coastal Tourism with Community-Based Preference in Pesisir Barat Regency Of Lampung Province. *Jurnal Bumi Indonesia,* 4(3), 342-351.

Subagiyo, S. (2012). Test of Halimeda sp. Seaweed utilization as a functional food source to modulate a non-specific defense system in white shrimp (Litopenaeus vannamei). *Indonesian Journal of Marine Sciences*, 14 (3), 142- 149.

Sunaryo, 2015. Study of the Differences in Cultivation Methods for Caulerpa Seaweed Growth. *Tropical Marine Journal*, 18(1), 13-19.

Suparmi., & Sahri, Achmad. 2009. Know the Potential of Seaweed: Study of Utilization of Seaweed Resources from Industrial and Health Aspects.. *Sultan Agung*, 44(118), 95-116.

Tampubolon, Agrialin., Grevo., Gerung., And Wagey, Billy. 2013. Macro Algae Biodiversity in Lagun Pasige Island, Tagulandang District, Sitaro Regency. *Journal of Coastal and Tropical Seas*. 2(1). 35-43

Tuney, I., Cadirci, B.H., Unal, D., Sukatar, A., 2006. Antimicrobial activities of the extracts of marine algae from the Coast of Urla (zmir, Turkey). Tour. *J. Biol*. 30(1), 171-175.

Wanenoor. 2014. *Exotic Tanjung Setia Beach in the west*. (http://wanenoor.blogspot.com). Quoted April 05 2017.

World of Tourism. 2014. *Enchantment of Tanjung Setia Tourism*. (www.wisatatiga.com). Quoted April 05 2017.