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by Abdul Syukur

Seagrass Ecosystems Monitoring as Related to Coral Reef in Coastal Waters of Sekotong West Lombok, Indonesia

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PREFACE
Bismillaahirrahmaanirrahiim
Assalaamu'alaikumwarahmatullaahwabarakaatuh.
Peace be upon us.

Praise always we pray to God Almighty for giving us the abundance of grace, guidance and inayah, so that we all can meet here in the "2nd International Conference on Science and Technology (ICST) 2017". The theme of this conference is "The Emergence of Science for Human Prosperity and Health" where this conference is joint international conference between Mataram and Malaya University.

First of all, I would like to welcome you all to West Nusa Tenggara Province specially Lombok Island, "the Island of Thousand Mosques", which is famous to its many natural resource and beautiful tourism destinations where you can enjoy them while attending the conference. This conference will be held for two days, from 23rd to 24th August 2017, and took place in campus of the University of Mataram.

So far, we received one hundred fifty papers from various universities and research institutions in Indonesia and from overseas. The paper have been selected and grouped based on the similarity of the research field, which then are presented and discussed. Presentation of the papers will be held in seven parallel classes and poster presentation. The Selected papers will be published in Malaysian Journal of Science (Special Issue) which index by Scopus, and the rest will be published in the Conference Proceedings. Additionally, selected paper in aquaculture have the opportunity to be published in Jurnal Akuakultur Indonesia.

At this moment, the organizing committee would like to express our gratitude to all of you for your participation on this conference, especially to the all keynote speakers, presenters who have submitted for both oral and posters presentations and also to all participants. Our special gratitude also goes to the Rector of the University of Mataram and Vice Chancellor of Malaya University, who have been highly supporting this conference. Critics and suggestions on the implementation of this conference will be appreciated and as much as possible we will improve the next ICST. Last but not least, the organizing committee would like to thank to all of you who have supported this conference.

Have an enjoyable conference.
Wassalamu'alaikum warohmatullahi wabarakatuh.

Chairman of 2nd ICST 2017

Dr.rer.nat. Lalu Rudyat Telly Savalas, M.Si.

Proceeding of 2nd ICST 2017

OPENING SPEECH - RECTOR THE UNIVERSITY OF MATARAM
The 2nd International Conference on Science and Technology 2017
Joint International Conference on Science and Technology in The Tropic Beetwen
Mataram and Malaya Universiti

Respected Guests,
Keynote speakers,
Conference participants,
and all other participants.

On Behalf of all staffs of the University of Mataram, I welcome you all to Lombok, a beautiful island in West Nusa Tenggara Province, where the University of Mataram is located. Lombok is known for its natural and cultural diversity where you can enjoy traditional cuisines, beaches, waterfalls, mountain, traditional villages and handicraft of many ethnics including Sasak, Samawa, Mbojo, Balinese, Chinese, Arabic, and many others.

As the Rector of the University of Mataram, it is a great honour for me to address the opening of "The 2nd International Conference on Science and Technology" here at the University of Mataram, which will be held from 23rd to 24th August 2017, with a theme "The Emergence of Science for Human Prosperity and Health". The main aim of this seminar is to gather scientist from all over the world to share their ideas, knowledge and experiences and to build network for possible future collaboration. As we are aware that sharing knowledge and experiences from speakers are extremely valuable in a conference, therefore I would like to express my high appreciation, first, to the keynote speakers from overseas and from Indonesia for their willingness to come to Lombok to share their acknowledged works. Your effort and contribution to this conference are absolutely valuable. Second, my high appreciation also goes to the national speakers and all other participants, including the speakers from University of Mataram and local universities in West Nusa Tenggara Province, your participation in this conference not only will give incredible share of ideas, skills and knowledge that you have, but also will improve the academic environment that we are developing in this university. I hope this conference will be a good forum, not only for communicating and sharing ideas, knowledge and experiences, but also for building networking for future collaboration.

I would also like to take this opportunity to express my appreciation to the sponsors which have given some contribution to this conference. Last but not least, I would like to thank the organizing committee as well as all other supporters and participants, without their effort, commitment and hard work, this conference will not run well.

Finally, I wish you most successful conference, enjoy Lombok Island and hope to see you again in other forum here at the University of Mataram.

Rector of the University of Mataram

Prof. Ir. Sunarpi, Ph.D

Seagrass Ecosystems Monitoring as Related to Coral Reef in Coastal Waters of Sekotong West Lombok, Indonesia

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Abstract

Coastal waters of Sekotong West Lombok is one of the coastal waters of Indonesia that is set in monitoring the health of coral reefs. However, the sustainability of coral reefs from ecological aspects is influenced by the preservation of other ecosystems, such as seagrass ecosystems. In this case, seagrass monitoring has been conducted in 2015 and 2016. Seagrass monitoring method uses transect and quadratic methods. The results of the monitoring of the entire station was found six species are *EnhalusEnhalus* (Ea), *Thalassiahemprichii* (Th), *Cymodocearotundata* (Cr), *Halodulepinifolia* (Hp), *Halophilaovalis* (Ho), and *Syringodiumisoetifolium* (Si). Abundance of seagrasses has not changed much from 26.58% (2015) to 26.10% (2016). However, in *T. hemprichii* decreased 3.88%, while *E. acoroides* increased 3.23%. Another parameter is an indicator of the value of seagrass cover and has been a decline of seagrass cover occurs in SKTS06 and SKTS10 stations, ie 17.89% and 15.32%. The decline in abundance and covering of value*T. hemprichii* and closing of seagrass was an indicator has been damage to the seagrass. This condition can have a negative impact on the health of coral reefs in the coastal waters of West Lombok. In this case the prevention of damage to seagrass is a very important action to ensure the sustainability of coral reefs and marine life in the coastal waters of West Lombok.

Key words: Monitoring of Seagrass, Seagrass Abundance and Seagrass cover

1. Background

Seagrass is a flowering plant that has adapted to the marine environment, with indicators: (1) seagrass can live in salt water (2) able to function normally in submerged circumstances (3) has a well-developed root systemand (4) capable of pollination and generative cycle in submerged seawater. (Waycott et al. 2007; Marlin, 2011). The geographical distribution of seagrasses has been grouped into two bioregions, namely: (1) bioregion temperate (2) bioregion tropis, andseagrasses in the coastal waters of Indonesia are in the Indo-Pacific bioregion (Waycott et al., 2007)**.** Seagrass has a function as a sediment stabilizer, maintaining clarity of water and holding mud through the river or in other words calledrun-off,primary productivity, shelter, and food chain builders in the marine environment (Thom dan Long, 2001;

Nienhuis et al., 2002; Jones et al., 2006), and some other marine biota associated with seagrass such as mollusk, shrimp, crab and sea cucumbers (Tsukamoto et al., 1997).

Tropical marine ecosystems, including mangroves and seagrasses that provide significant economic goods and services and contribute to the livelihoods, food security and safety of millions of people around the world (Conservation International, 2008) and segarss habitat a very important nursery function and implies that the densities of several fish species on coral reefs and degradation or loss of these habitats could have significant impacts on reef-fish stocks in the Caribbean (Nagelkerken et al., 200; Nagelkerken, et al., 2002). Moreover, over 20% of commercial fish species used multiple habitats, highlighting the importance of including different habitat types within marine protected areas to achieve efficient and effective resource management (Honda et al., 2013).

The status of seagrass conservation in the coastal waters of Lombok island, only on the area of conservation, like that Marine Park of Gili Air, Meno and Trwangan and Regional Marine Conservation Area in Gili Sulat (Syukur, 2015). Seagrass beds is very important in marine ecosystems, its existence is threatened by increased population activity in coastal areas such as port development,transfer of land into industrial area and utilization of seagrass area that tends not environmentally friendly (Syukur et al., 2017; Dahuri 2003), and has had an impact on the decrease in the area of seagrass ranging from squared meters to hundreds of square kilometers (Willams et al., 2006). In addition, other threats are storms, volcanic activity and global warming (Neckless and Frederick 1999). The continued destruction of seagrass to facilitate development will see a decline in biodiversity, increase incoastal erosion and storm impacts. Therefore, it is important that we protect and conserve what is left of these threatened ecosystems to ensure continued health and sustainability of our coastline and marine resources (Syukur et al., 2016).

Seagrass and coral reefs in the marine environment, structurally and functionally constitute a unified system of marine ecological systems.This can be seen from the tyipes of interaction between seagraas and coral reef are physical, nutrients,disolved organic matter, particulate organic matter, animal migration and human impact (Thomascik et al, 1997). Therefore, the value of seagrass existence in the marine environment is very important for coral reef health and the sustainability of marine biota using two habitats ie seagrass and coral reefs, so the selection of indicators is conceptually key factor as a tool in conducting monitoring and evaluation (Thom et al. 2001).

In addition, the abundance of seagrass and environmental conditions such as topography, nutrients and sedimentary compositions may form the basis for investigation of interconnected species interactions on a temporal scale, such as between seagrass beds and other ecosystems such as coral reefs in the tropics and ecological indicators of ecosystem structures and compositions can be used to monitor conservation areas (Izumi and Mashiro, 2000; Beyeler and Virginia, 2001). Coral reef health monitoring programs and related ecosystems (seagrass and mangrove forests) in the Nusa Tenggara Barat region are conducted outside conservation areas. Monitoring of seagrass beds in coastal waters of Sekotong Lombok Barat has been conducted from 2015 - 2016. This activity aims to assess community activities on seagrass and mangrove ecosystems that can have a negative impact on the health of coral reefs. The aspects of seagrass monitoring that are the focus of this paper include species diversity and seagrass cover percentage.

2. Materials and Methods

Monitoring of coral reefs and related ecosystems in Kecamayan Sekotong West Lombok is conducted for six months from July to December 2016. The monitoring sites are located in small islands of Sekotong Bay West Lombok, namely Gili Gede, Gili Asahan, Gili Layar, Gili Rengit, Gili Anyaran and some coastal villages in Sekotong sub-district such as Pewaringan and Lenggolong villages, which are part of the mainland of Lombok Island (Figure 1).

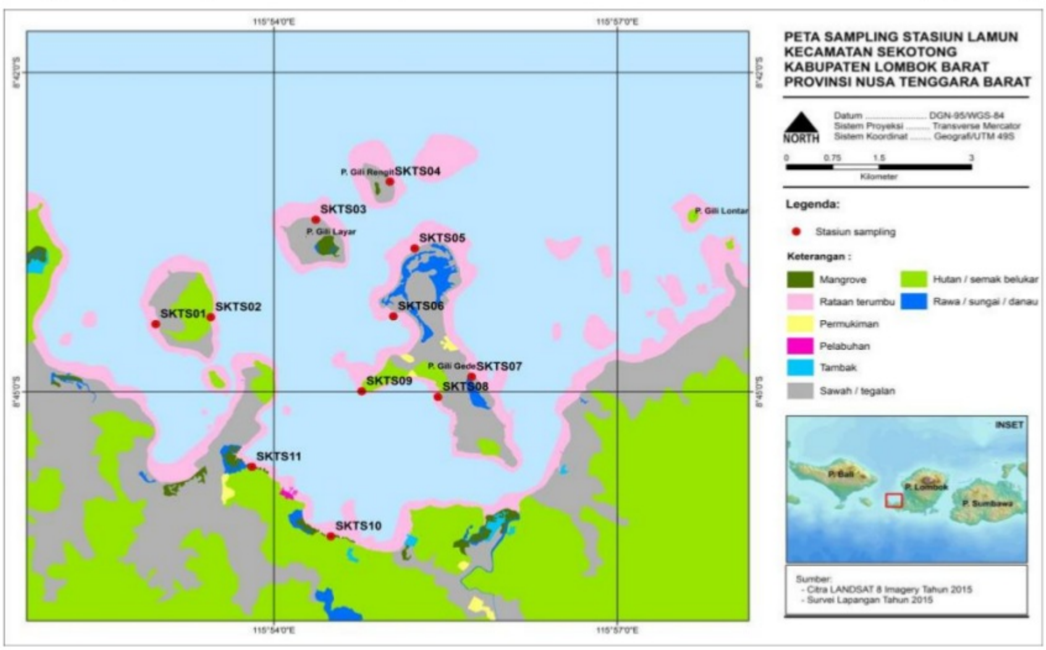

Figure 1. Research Location

The monitoring method used in accordance with the Seagrass Monitoring guide book from the COREMAP-CTI program (Rahmawati, at al., 2014). Seagrass monitoring method uses square transects that are perpendicular to the coastline. Three transect lines (100 m) with each transect spacing 50 m. However, at some locations, the transect distance is adjusted to the width of the seagrass community.The main parameters measured were the diversity of seagrass species and the percentage of seagrass cover in the 50 x 50 cm square. Data were analyzed by using simple descriptive statistics and multivariat, done to see the multi-variable relationship of location (station) and time. The multivariate test used is station groupingand inter-time based on Bray-Curtis analysis of similarities. The data used for the similarity analysis are data of abundance and presence cover of seagrass. Abundance data is more complete in showing similarities than attendance data.

3. Results and Discussion

The number of seagrass species at each location is an indicator of seagrass potential and the number of seagrass species in Indonesian coastal waters is 12 species (Fortes, 1994). In the coastal waters of Lombok Island the number of species of seagrass such as on the east coast lombok 9 species (Syukur et al., 2012) and at the Kute Bay of Central Lombok 8 species (Kiswara *et al*.,1994). Diversity of seagrass species at the study site (Figure 2) lower than the number of seagrass species in several locations in Indonesian waters. In this case, the diversity of seagrass species at a site is strongly influenced by some environmental factors as a limiting factor, such as carbon, temperature, light, salinity, water transfer, nutrient and substrate (Alongi, 2000; Dahuri 2003). However, the light level is not a major factor as the distribution barrier of *Halophila decipiens* in the intertidal region (Koch and Sven, 1996), but the reduction of light on the seagrass can indirectly affect the rate of sulfate reduction and impact on seagrass metabolism (Carlos et al., 2006).

Survey results at all monitoring stations show changes in seagrass community composition in Sekotong. The species diversity remains the same as the previous year, which is 6 species, consisting of *Enhalusacoroides* (Ea), *Thalassiahemprichii (Th), Cymodocearotundata (Cr), Halodulepinifolia (Hp), Halophilaovalis (Ho), and Syringodiumisoetifolium (Si)* (Figure 2). The abundance of seagrass in general is also not changed much, ie 26.58% (2015) and 26.10% (2016).The proportion of abundance of some species is changing. The community composition experienced slight changes in *T. hemprichii* seagrass which decreased by 3.88% and the seagrass of *E. acoroides* increased by 3.23%.

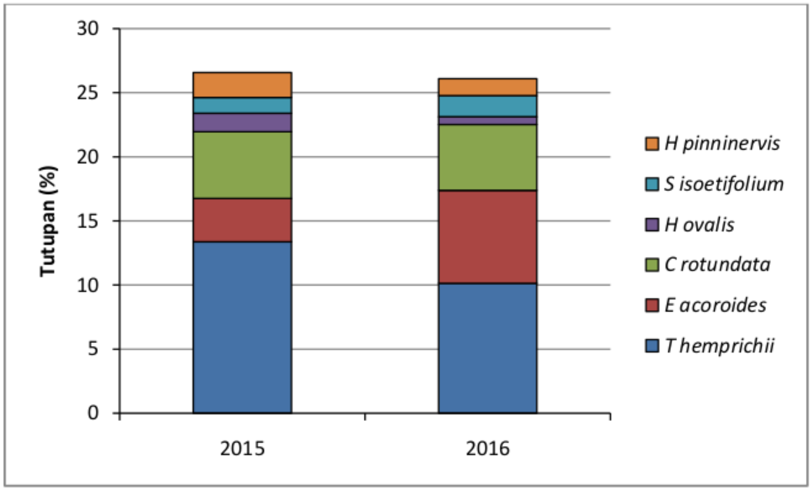

Figure 2. Changes in seagrass cover in a year in Sekotong Bay, West Lombok

Standar monitoring as indicators of potential changes in coastal conditions: 1): total (above-, and below ground) community biomass (seagrasses and algae), 2) relative dominance (above-ground biomass seagrass/above-ground community biomass) of faster-growing seagrasses (classified as “other seagrasses”, 3) relative dominance of faster growing fleshy algae, 4) above-ground biomass relative to total biomass of the seagrasses (the most abundant seagrass), 5) productivity of seagrass and 6) shoot density (van Tussenbroek et al., 2014) and the criteria for the classification did not include all relevant parameters that determine seagrass development, in the higher standing crops may be expected at sites with relief and considerable rainfall that supply nutrients for the development of larger plants (Zieman et al., 1997). Although, the results of seagrass monitoring (Figure 3) criteria used by the community are limited, it can be the basis for monitoring changes in seagrass conditions and other ecosystem health protection at study sites such as coral reef ecosystems. Where other studies stress the importance of th e seagrass canopy for shoreline protection, our study on open, low-blomass and heavily grazed seagrass beds strongly suggests th at below ground biomass also has a major effect on the immobilization of sediment (Christianen et al., 2013) and the ecosystem service is expected to becom e even more important in the near future, as storm frequencies are expected to increase and natural coastal protection structures like reefs are under on-going degradation (Hoegh-Guldberg et al., 2007).

Seagrass distribution is almost evenly distributed across observation stations, but there are a number of important changes between the two monitoring years. The change occurs because of the absence of several species from the habitat being sampled (Figure 3). In 2015, *T. hemprichii* and *C. rotundata* are found in all stations. By 2016, *T. hemprichii* are not found at SKTS10 stations and in very small abundance (0.19%) in SKTS11. The abundance of *C. rotundata*fell to very little (0.19%) in SKTS10. Besides that there are two other species of seagrass that are not found from two different stations. *S. isoetifolium* is not found from SKTS08 and *H. pinnifolia* is not found from SKTS10. It is also on *H. Ovalis* not found in SKTS07, SKTS08 and SKTS10 stations.

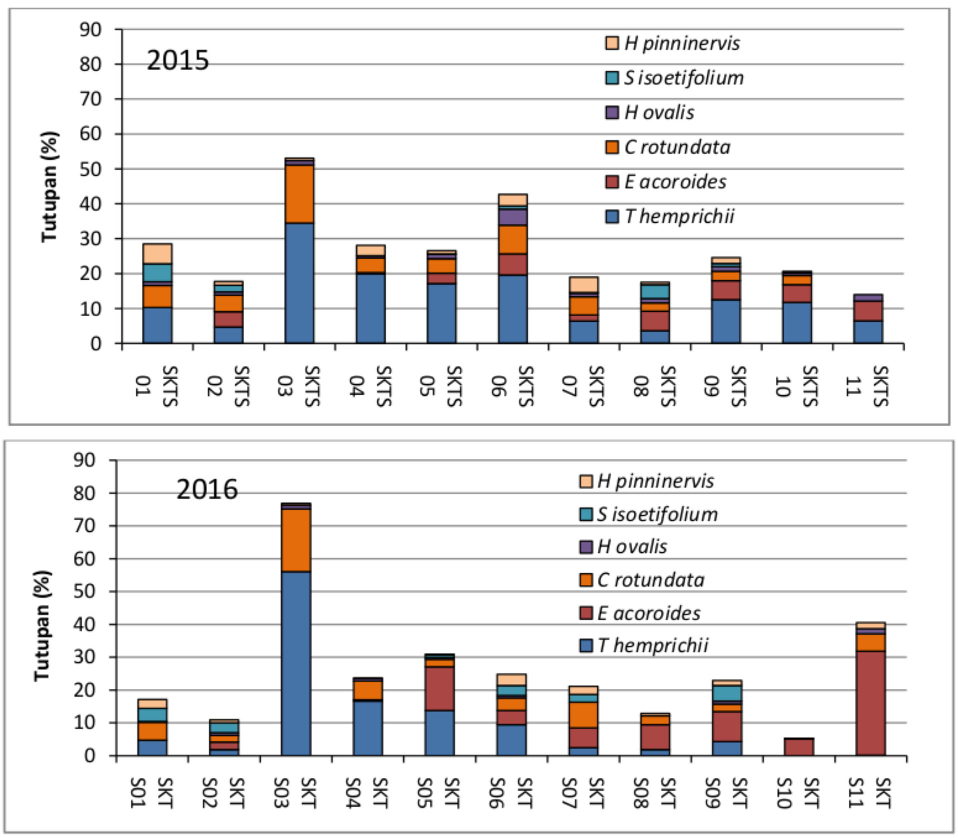

Figure 3. Changes in seagrass cover composition at each Sekotong Bay station

Within a year, in general seagrass cover in each station is relatively constant. The biggest changes occurred at SKTS03 and SKTS11 stations, which increased respectively seagrass increments respectively by 23.80% and 28.03% (Figure 4).The large seagrass cover decrease occurred at SKTS06 and SKTS10 stations, respectively decreasing 17.89% and 15.32%. Changes below 10% are considered meaningless because the standard deviation of each station is between 5-34%. SKTS03 station located on Gili Layar has the highest closing percentage that is equal to 76,83 ± 30,05%.While the lowest seagrass cover was recorded at SKTS11 station in Lenggolong Village. The highest percentage of closure at Gili Layar station and the lowest in Lenggolong Village station was also recorded in the previous year's survey which was in 2015. The lowest seagrass closure located at Lenggolong Village station was due to the very thick muddy substrate due to its proximity to the dense mangrove, thus only certain seagrass species that can grow under these conditions are *E. Acoroides*.

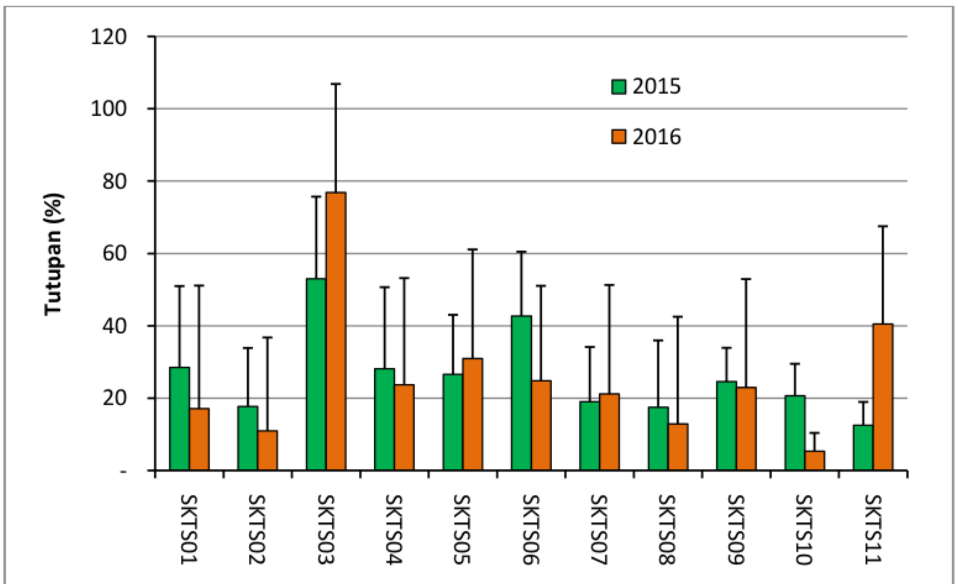

Figure 4. Changes in the percentage of seagrass cover at each Sekotong Bay station

The similarity analysis of seagrass communities in 2015 and 2016 based on the Bray-Curtis method resulted in the dendrogram as presented in Figure 5. The change of seagrass community in Sekotong Bay in the past year can be categorized into small changes (difference of 20%), moderate change (difference 20-40 %) and major changes (difference> 40%). Small community changes occurred at SKTS01, SKTS02, SKTS03, SKTS04 and SKTS05 stations. Changes are taking place on SKTS06, SKTS07, SKTS08 and SKTS09 stations.

The last two stations SKTS10 and SKTS11 are undergoing major changes, so the 2015 and 2016 community similarities are below 60%, or the difference is over 40%. The results of this similarity analysis relate to the location of the observation station. The slightly altered station is located on the outer side of the bay, a medium-changing station located in the mid-bay waters, while the most changing station is inside the bay, on the island of Lombok. The changing pattern of the seagrass community is related to the intensity of human activities in exploiting seagrass resources when the tides are low.

Observations of Enhalus acoroides did not find any particular pattern. The average density of *E. acoroides* was recorded at 2 stands per square meter (2 stands / m^2). This is because the seagrass is not present in all stations, for example SKTS01 and SKTS03 stations are not found in *E. acoroides* seagrass. The amount of seaweed E. acoroides is low in almost all stations. The number of stands of *E. acoroides* is relatively higher only at SKTS10 station which is 9 stands / m^2. The low number of *E. acoroides* stands was also recorded in the 2015 survey.

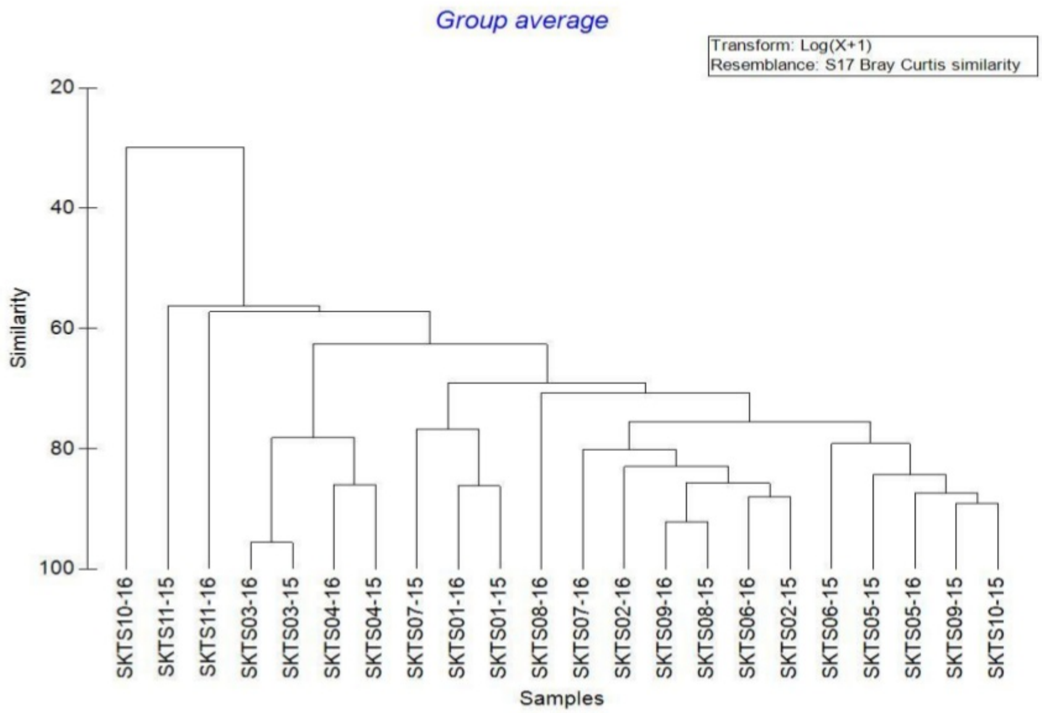

Figure 5.Dendogram analysis of Bray-Curtis resemblance to the abundance of seagrass communities in 2015 and 2016 results.

4. Conclusion

The seagrass community in Sekotong Bay has not changed much. The diversity of seagrass species is the same as the previous year. Changes in the number of species occur at the station level, which is thought to be due to a quadratic squared shift. Seagrass cover increased in 2 stations and decreased at 2 stations.

Acknowledgements

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