

Conference Paper

Connectivity Pattern of Socio-Ecology System of Youtefa Bay Community in Utilizing Seagrass Ecosystem

Selvi Tebaiy

Fisheries Departement, Papua University, Manokwari, Indonesia

Abstract

This study was conducted on August 2012 in Youtefa Bay, Jayapura – Papua, and aimed to investigate connectivity of fisheries resource utilization pattern by local community toward species composition and distribution of seagrass. Data in this study comprised primary and secondary data. Collecting primary data was used structured questionnaires to local people. Respondents were chosen by simple random sampling. Data of species composition and species distribution were done by randomly structured method using quadratic transect on three observation station. Seagrass ecosystem on Tobati and Enggros I station composed by pioneer species (*Halophila ovalis* and *Halophila minor*) and climax species (*Enhalus acoroides* dan *Thalassia hemprichii*), while that of in Enggros II station consisted only by climax species. Utilization type by local community comprised fishing, collecting shellfish, cucumbers collecting, and crab collecting. Tobati and Enggros I had a higher percentage in utilizing fisheries resource (about 50 – 100%) than Enggros II (approximately 20%). A higher percentage of utilization by local people related closely to potential of seagrass ecosystem that gave environment services as habitat for association of biota.

Keywords: Tobati, Enggros, Utilization of community, seagrass potency

Corresponding Author:
 Selvi Tebaiy; email:
 Selvite-
 bay1976@gmail.com

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1. Introduction

Youtefa community is coastal community who lives together in Youtefa bay and fulfills their needs from resources in this bay area. This community has socio-economically characteristics relating to economic resource coming from sea area (Prianto, 2005), and likewise, livelihood types that utilize natural resource and environmental services availability in bay area. The most livelihood of local people in Youtefa bay is fisherman. Coastal people dominated by fisheries business mostly still exist on poverty line. They have no alternative livelihood, lower level of education, and are unaware to natural resource as well as environment sustainability (Lewaherilla, 2002). Natural environment surroundings people will form their characteristic and behavior. Physics and biology environment influence social interaction, social role distribution, characteristics of value, social norm, attitude, and perception that institutionalize in community. It is also added that environmental change could alter family concept Usman (2003). Lower life quality of fishermen community figured in poverty profile is very corresponding to

internal and external factor in community. Internal factors could be as following, high population growth rate, lacking boldness to take risk, and satisfied. On the contrary, external factor is production element impacted by capitalists or boat owners (Kusnandi, 2003). Natural richness on marine resource sector generally gives a positive impact for coastal community particularly fishermen in Youtefa bay. Fisheries resource actually could be utilized potentially for enhancing living standard and welfare of local community. In fact, most people are alive in a non-better economic condition because they cannot increase their catching product as result their income does not escalate. Welfare level of fishermen is greatly influenced by their catching fish. If their fish catchment is better, their income will be better, and vice versa.

Seagrass ecosystem provides benefits by generating goods and services that might be consumed directly as well as indirectly. On seagrass habitat, there are some families of commercial fish as fisheries product contributor, as follows Serranidae, Siganidae, Scaridae, Lethrinidae dan Lutjanidae. Some other important biotas are cuttlefish (*Sepia*, *Sepiateuthis*), sea urchin (*Diadema*, *Tripneutes*), shellfish (*Trochus niloticus*), octopus (octopus), giant clam (*Tridacna*, *Hippous*), cucumbers (*Holothuria*), blood clam (*Anadara*) and so on. Seagrass ecosystem plays ecologically roles for sustaining fish resource as nursery ground, spawning ground, and feeding ground (Kikuchi, 1974 in DKP 2008). Due to wide distribution of seagrass ecosystem mostly in Indonesia waters and its important role in coastal area, seagrass ecosystem becomes an object of targeted waters conservation (DKP, 2008).

Result of Citra Landsat TM analysis showed that seagrass in Youtefa bay in 1973 covered 243.53 ha and in 2012 wide area of seagrass cover decreased to 103.67 ha. Decreasing seagrass cover during 39 years reached 57.43% with decrease rate as many as 2% each year (Tebaiy, 2014). Previous study done by Unipa (2006) found 7 species of seagrass and following study conducted by Tebaiy (2014) only found 4 species of seagrass distributing in Youtefa bay. Community in Youtefa bay utilizes fisheries resources (fish and associated biotas) in seagrass ecosystem, as known *fas* in Enggros language. Local people in Youtefa bay utilize seagrass habitat as place for catching fish, shellfish, crab, and cucumbers. They understand that seagrass or knows as *fas* in Enggros language is a home for fishes. Pattern of utilizing resource exists on traditional category (Tebaiy, 2013). This pattern is very simple and traditional which can be seen as follows catching gears, time used for fishing, and processing product. Utilizing this resource is done by women in Youtefa bay. Reversely men catch fish by netting in the far area from village. Sharing task in utilizing fisheries resource in Youtefa bay can be clearly seen in structure (Tebaiy, 2013).

Basically in each community even including traditional community, there is a process for being smart and knowledgeable. This relates to a desire to maintain and to continue life, thereby local community will spontaneously think ways for doing or creating something including the steps for making food, the way for making tools needed to manage natural resource for sustainability. Interaction between community in Youtefa

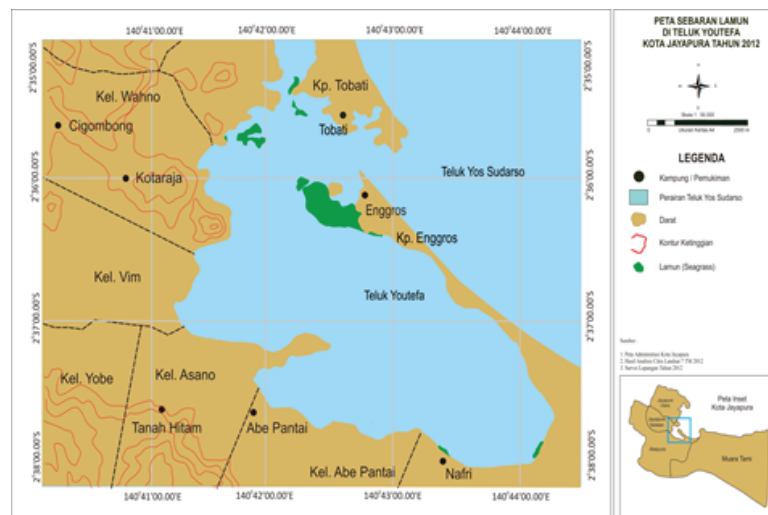


Figure 1: Study sites.

bay and seagrass resource as catching site leads to interdependence. Decreasing seagrass cover affects to associated biota inside and also impacts to interaction between social and environmental services providing by seagrass ecosystem.

This needs to investigate potential of seagrass ecosystem in terms of socio-ecological study, as follows: 1) to know species composition and distribution of seagrass existing in Youtefa bay waters; 2) to know utilization type by local community on seagrass ecosystem; and 3) Relationship between species distribution and level of utilization by local community to seagrass ecosystem

2. Methods

2.1. Site and Time Study

This study was conducted on August 2012 in Youtefa bay, Jayapura Papua. Observation site comprised 3 sites, Tobati, Enggros I, and Enggros II. Tobati waters geographically located on between $02^{\circ} 35' 18.66''$ S and $140^{\circ} 042' 11.80''$ E, Enggros I waters was between $02^{\circ} 35' 52.47''$ S and $140^{\circ} 42' 14.10''$ E, and Enggros II waters was between $02^{\circ} 36' 15.22''$ S and $140^{\circ} 42' 39.60''$ E, as can be seen on Figure 1. Object of study was seagrass ecosystem.

2.2. Study Approach

This study comprised seagrass potential study (species composition and density of seagrass) and social study (pattern of seagrass use by local community). The two mentioned studies were inter-corresponding toward existence of seagrass resource in Youtefa bay. This study was an explorative study, which collecting data done directly in the field against variables as study object. Nevertheless, data obtained from each variable were analyzed based on referred approaches.

2.3. Method of Collecting Data

Method used in collecting seagrass sample was randomly structured method using quadratic transect due to corresponding to analysis of separating seagrass from density and biomass in a waters (Duarte *et al.*, 2001; Pringle, 1984 cited by Setyobudiandi *et al.*, 2009).

Collecting data was done directly by interview referring to questionnaires. Respondents as study unit were chosen by purposive sampling. This sampling meant that selected respondents were local people who inhabited inside bay area and were fishermen or predominantly did catching effort, and women who collected shellfish. Respondents were determined based on length of stay, fishermen, and also customary people in Youtefa bay. Selected respondents were 20 people.

3. Analysis of Data

3.1. Analysis of Density and Relative Density of Seagrass Species

Fonseca (1990) stated that species density describes number of species occupying a certain space in an ecosystem. Formula of density and relative density referred to (Setyobudiandi *et al.* 2009).

$$\text{Absolute density of species } i = \frac{\text{total individual number of species } i}{\text{total wide area of sampling}} \quad (1)$$

Relative density is ratio between absolute density of species *i* and total density of all species.

$$\text{Relative density (\%)} = \frac{\text{absolute density of species } i}{\text{total density of all species}} \times 100 \quad (2)$$

3.2. Analysis of Utilization by Local Community

Result of interview and questionnaires were analyzed quantitatively using descriptive analysis for obtaining comprehensively description about utilization type of local community against seagrass ecosystem in Youtefa bay. Relationship between seagrass species and percentage of utilization by local people in each study site was analyzed using statistics analysis of simple regression.

4. Results

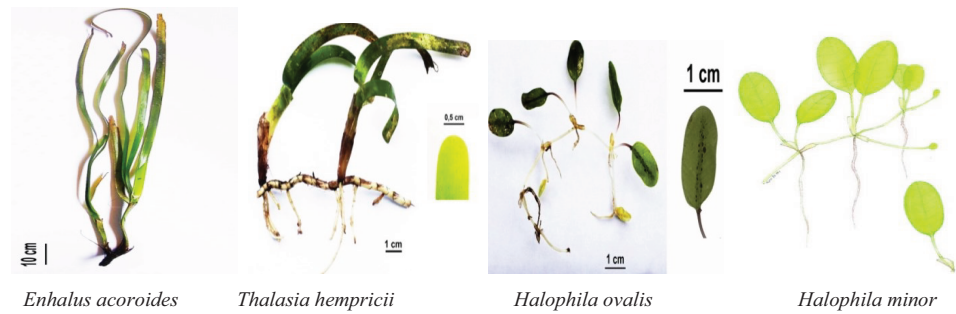


Figure 2: Seagrass species found in Youtefa bay in 2012.

| | Seagrass species | Year (2012) | | | Seagrass species | Year (2006) | | |
|---|----------------------|-------------|-----------|------------|----------------------|-------------|-----------|------------|
| | | Tobati | Enggros I | Enggros II | | Tobati | Enggros I | Enggros II |
| 1 | <i>T. hemprichii</i> | + | + | + | <i>T. hemprichii</i> | + | | |
| 2 | <i>E. acoroides</i> | + | + | + | <i>E. acoroides</i> | + | + | + |
| 3 | <i>H. ovalis</i> | + | + | | <i>H. ovalis</i> | | + | |
| 4 | <i>H. minor</i> | + | | | <i>H. minor</i> | | + | |
| 5 | | | | | <i>H. pinifolia</i> | | + | |
| 6 | | | | | <i>T. ciliatum</i> | + | | |
| 7 | | | | | <i>C. rotundata</i> | + | + | + |

Description :+= found in study site; -= not found in study site

TABLE 1: Species composition (seagrass species distribution) in 2012 and 2006.

4.1. Composition and Distribution of Seagrass Species

According to study result done in Youtefa bay waters in 2012, seagrass species in three study sites comprised 4 species from 3 genera including to family Hydrocharitaceae. Seagrass species found were categorized into mixed vegetation type because seagrass species on each quadrant were found two or more seagrass species which distributed.

Seagrass species distribution in Youtefa bay has changed in number of species between 2006 and 2012, as can be seen on Table 1. Seven seagrass species were recorded in 2006 in Youtefa bay (Unipa, 2006), whereas 4 species were only found in 2012 (Tebaiy et al. 2012). Tobati waters had 4 seagrass species, while Enggros I and Enggros II were 3 and 2 seagrass species, respectively.

4.2. Density of species

Based on study result, average of absolute density of seagrass species in station III (Enggros II) was higher than that of in either station II (Enggros I) or station I (Tobati), as seen in Figure 3.

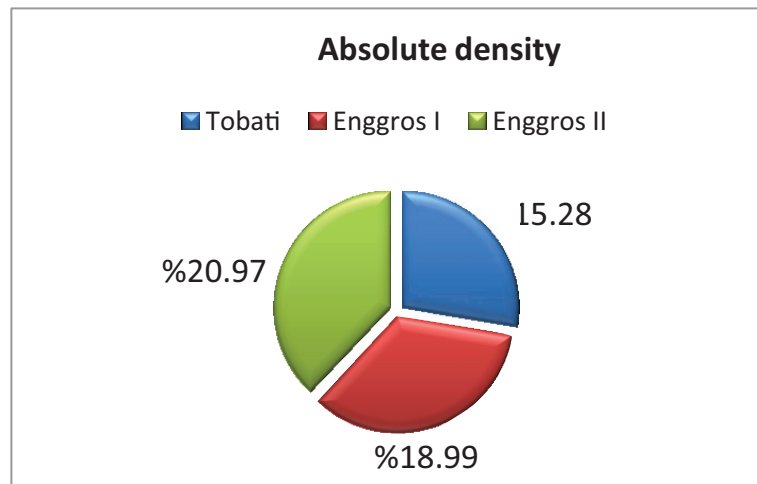


Figure 3: Total value of absolute density of seagrass species.

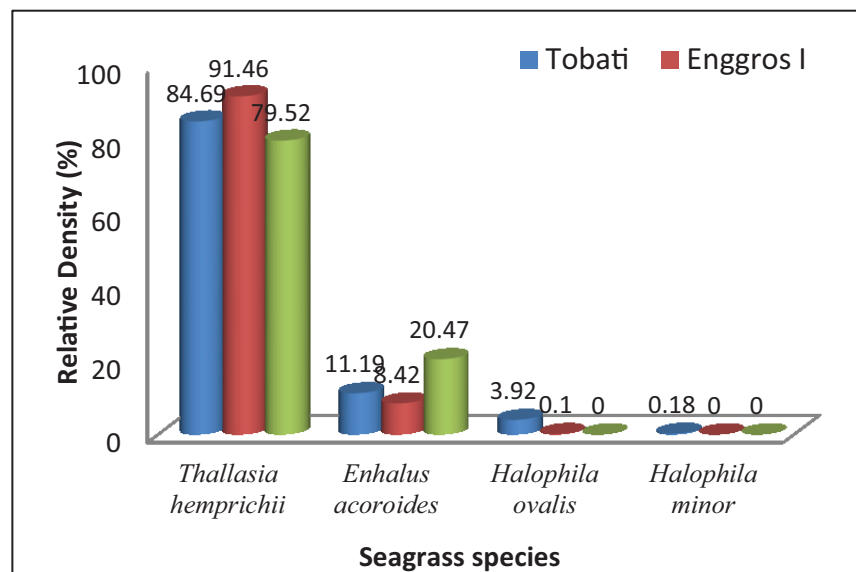


Figure 4: Relative density of seagrass species on each site.

Average value of relative density of seagrass species on three study sites, as shown in Figure 4, showed that the highest relative density value was *Thalassia hemprichii*, whereas the lowest relative density value was *Halophila minor*.

4.3. Utilization Pattern by Youtefa Bay Community

Direct utilization by Youtefa bay community in seagrass ecosystem was as following: fishing, collecting shellfish, crab, and sea cucumbers. Local people greatly utilized station I (Tobati) and station II (Enggros I) as many as ranging between 50 and 100% for each station. In contrast, station III (Enggros II) was only 20% for being used by local people, as shown in Figure 5.

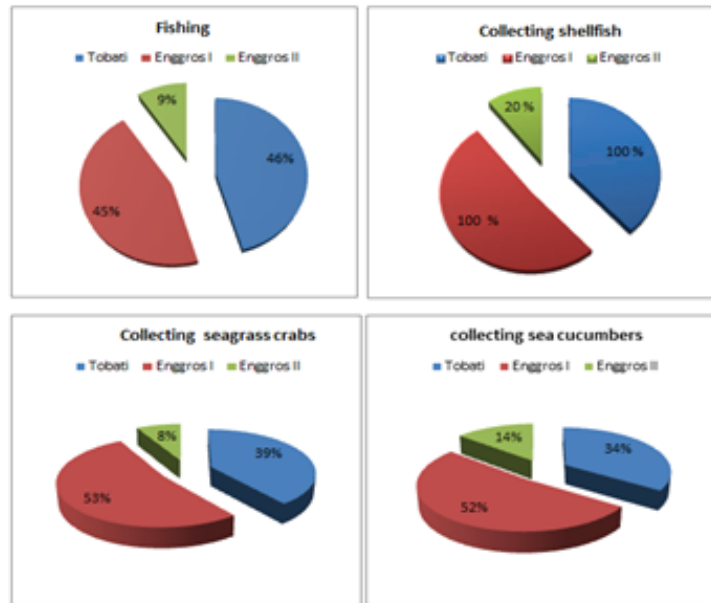


Figure 5: Pattern of seagrass utilization by Youtefa bay community.

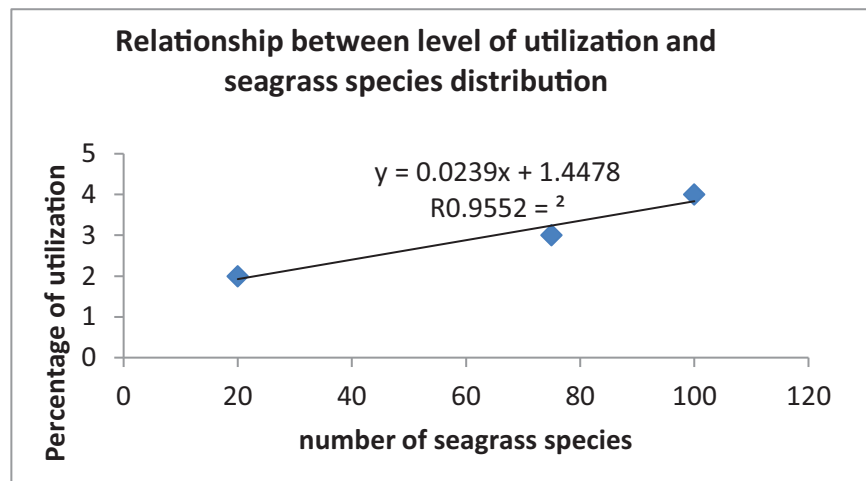


Figure 6: Relationship between level of utilization and seagrass species distribution.

4.4. Relationship between Species Distribution and Level of Utilization by Local Community to Seagrass Ecosystem

Seagrass ecologically plays important roles as habitat for fish and associated biota, nursing ground, and feeding ground. Seagrass also provides ecosystem services for local people who use it. Many benefits relate to the magnitude of ecosystem services. In Youtefa bay, seagrass provides directly ecosystem services. By using simple regression analysis, seagrass species number distributing in observation station affected positively to percentage of utilization by local people on seagrass ecosystem, as can be seen in Figure 6.

5. Discussion

5.1. Density and Distribution of Seagrass Species

Seagrass species found in Youtefa bay were classified into mixed vegetation type because seagrass species on each quadrant were found two or more seagrass species which distributed. Station I (Tobati) had higher seagrass species as many as 4 species than both station II (Enggros I) and station III (Enggros II), which were only found 3 and 2 species, respectively. Characteristic of seagrass belt in tropical and sub tropical region including Indo-Pacific had high species diversity and categorized into mixed vegetation type (Duarte, 2001). Zonation of seagrass distribution starts from beach to edge and is mostly continuous, and its difference existing is only on species composition (Dahuri *et al*, 1996). Distribution zonation and habitat characteristic of seagrass in Indonesia coastal waters can be grouped based on water puddle, depth, brightness, species composition, and substrat type.

Seagrass bed on station I (Tobati) and station II (Enggros I) was composed by pioneer species (*H. ovalis* and *H. minor*) and climax species (*E. acoroides* and *T. hemprichii*), whereas station III (Enggros II) was only occupied by climax species. Climax species tend to have low growth rate, low longevity, and mostly inhabit relatively stable habitat (Duarte, 1991). Reversely, pioneer species, relatively small size, tend to have fast growth rate, short longevity, and are particularly first group occupying a certain site after being disturbance (Duarte *et al.*, 1997).

Degradation of seagrass species (Nontji, 1993) was also caused by disturbances or natural disasters, namely tsunami, volcano eruption, and cyclone. These causes can impact to beach destruction, including even seagrass. Anthropogenic disturbances from upper land use contribute mostly sedimentation into bay, and also intrusion of bins from household activities found in the base of waters when study done. Upper intertidal area was often found small size species, namely *H. ovalis* and *H. minor*. However, station I (Tobati) and station II (Enggros I), station having flat coral reef and sandy, were also found large size seagrass species, such as *T. hemprichii* and *E. acoroides*. *E. acoroides* grows mostly in sandy or muddy sediment, high bioturbation area, to be monospecific field, on an intermediate size as well as hard size of substrate, and often inhabits together with *T. hemprichii* (Nienhuis *et al*, 1989). Nevertheless, this species mainly occupies on base substrate of sandy and often exists on base comprising mix dead coral fraction (Sangaji, 1994). Bengen (2001) underlined that this species often dominates seagrass community.

Station III (Enggros II) was mainly found large size seagrass species, namely *T. hemprichii* and *E. acoroides*. Most of seagrass species have low capability of life tolerance on dry condition, so they cannot grow on intertidal zone. Even though only small size seagrass species that can hold water among their leaves and can occupy this zone, however, some that cannot survive on dry condition can survive in intertidal zone. Existence of large size seagrass species in intertidal zone correlates to their capability to tolerate dry condition. This capability strongly relates to morphological

characteristic that can minimize dry pressure (Bjork *et al.*, 1999). Philipz and Menez (1988) stated that small size seagrass species, *H. ovalis* and genera *Halodule*, are eurybiotic and eurythermic. Seagrass species existing on intertidal zone correlate to their characteristic of leaves supported by flexible and thin petiole so it helps them to survive on moisture substrate. Of 4 seagrass species, *T. hemprichii* and *E. acoroides* found in all study sites showed that both species can survive and tolerate on different substrate.

Density is comparison between number of individual and meter square. Data analysis of density of a species in a community aims to calculate population or number of individual in a certain wide unit (Odum, 1998). Average value of relative density of seagrass species on three study sites showed that *T. hemprichii* had the highest relative density, as shown in Figure 4. *T. hemprichii* had a higher capability to tolerate and to compete in disturbing environment than other seagrass species in one site. This species had the highest frequency so this species distributed widely if compared to others. This was because this species tended to inhabit a certain habitat such as sandy substrate and dead coral fraction.

5.2. Utilization Pattern by Youtefa Bay Community

Local people in Youtefa bay have interacted hereditarily to seagrass resource distributing inside Youtefa bay. Through indigenous knowledge, they understand that seagrass (*fas*) is home or habitat for fishes. This has been proven that there is an interaction between local people (utilization pattern) and environmental services from seagrass as habitat for fishes and associated biota. Utilization patterns of fisheries resources (e.g. fishes, crabs, squids, shellfish, and cucumbers) by Youtefa bay community were done traditionally (restricted utilization). This can be seen from catching gears used, length of utilization period, and also yield management done. Most of fishermen in Tobati, Enggros, and Abe Pantai village were full fisherman, which fisherman as main livelihood.

In Tobati and Enggros village, fishing activity was usually done by men, whereas collecting shellfish, cucumbers, and crabs was done by women. Most of catching yields usually were sold and the remaining yields were for household consumption. In Nafri village, however, fisherman was a part time job so the catching yield was mostly consumed by household (Tebaiy, 2013). Resources collected by fisherwomen were shellfish, crab, and cucumbers for 1 or 2 hours, and the sites for collecting resources were close to the village. They searched resources for consumption and sale. They usually do this activity everyday due to not only for household consumption but also supporting household economy in small scale. Seagrass bed in station I (Tobati) was used by local people as fishing site and collecting shellfish, cucumbers, and crab. Based on interview result, 50 – 100% respondents did utilization activity to fisheries resources. Seagrass bed in station II (Enggros I) was utilized by local as similar as station I (Tobati). In station III (Enggros II), less than 20% of local people used fisheries resource.

5.3. Relationship between Species Distribution and Level of Utilization by Local Community to Seagrass Ecosystem

This trend showed that change of utilization by local people was in line with change of seagrass species distribution. Each increasing of seagrass species number as many as a unit will improve percentage of utilization as many as 0.023 unit of seagrass species abundance, and reversely each decreasing of seagrass species number as many as a unit will lessen percentage of utilization as many as 0.023 unit of seagrass species abundance. According to Significant test (F test), variable of seagrass species number in each observation station did not influence significantly on confidence level 5%. P value (0.13) was greater than 0.05 or F test value was greater than F table. However this could be significant on confidence level 15%. R square value was 0.9552 which meant that 95.52% of change happening on seagrass species number was influenced by percentage of utilization, whereas 4.48% was influenced by other variables that did not been observed in equation. Overall, this model was better.

6. Conclusions

1. Seagrass species distributing in Youtefa bay were 4 species, namely *T. hemprichii*, *E. acoroides*, *H. ovalis* and *H. minor*.
2. Station I (Tobati) comprised 4 species (*T. hemprichii*, *E. acoroides*, *H. ovalis* and *H. minor*), station II (Enggros I) was 3 species (*T. hemprichii*, *E. acoroides*, and *H. ovalis*), and station III (Enggros II) was 2 species (*T. hemprichii* and *E. acoroides*).
3. Average value of relative density of seagrass species on three study sites the highest relative density value was *Thalassia hemprichii*, whereas the lowest relative density value was *Halophila minor*.
4. The density of all species of seagrass on three study site, as shows Enggros II (site III) has the highest percentage (20.97%) and the lowest percentage is Tobati (site I) has 15.28%
5. High percentage level of utilization by local people was influenced by seagrass species distribution in Youtefa bay. This was showed by p value 0.13 with significant test (F test) on confidence level 15%.

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