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Original Research Article

Human Activity Effect to Ecology and Economy Role of Seagrass Ecosystem in Kupang Bay, West Timor, Indonesia

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Abstract: Seagrass Ecosystem is the one coastal region that important for coastal communities in Kupang Bay, West Timor, Indonesia. This study aims to determine the effect of human activity on the ecological and economic role of the seagrass ecosystem in the coastal area of Kupang Bay. The method used in this research is a direct observation method in the field. The result of this research is to find an activity which often done in the coastal area of Tablolong Village, Bolok Village and Namosain Village that influence seagrass resources are settlement activity such as waste disposal and waste that leads to the sea, industrial activity, shipping activity, sea transportation activity, seaweed cultivation activity and catching biota in intertidal (*makameting*). Furthermore, community activities in coastal areas of Kupang Bay affect the ecological role of seagrass ecosystems. According to diversity index, index of uniformity and index of dominance, known that the condition of the seagrass community structure in Bolok Village and Tablolong Village has been under moderate to severe pressure condition, while in Namosain Village has been under heavy pressure. In addition, community activities in Kupang Bay, affect the economic role of seagrass ecosystems, seen from the decline in economic value of seagrass ecosystems in 2010 until 2014.

Keywords: human, activity, ecological, economic, seagrass, ecosystem.

INTRODUCTION

Kupang Bay is a relatively protected region of large waves as it is blocked by the Semau and Kera Islands. This region has a variety of ecosystems in which one of them is a seagrass ecosystem [15]. The seagrass ecosystem is a shallow marine ecosystem dominated by seagrass vegetation. Seagrass ecosystems have an important role in the ecology of coastal areas as they become habitats, feeding places, spawning sites and nurseries for a number of marine biota [5]. Even the seagrass ecosystem in this region is the habitat of the dugong (*Dugong dugong*) which is a protected marine mammal in Indonesia. In addition to ecological functions, the seagrass ecosystem also plays an important role in the coastal community economy in Kupang Bay. Seagrass ecosystems on intertidal of Kupang Bay have been used for the economic needs of coastal communities such as fishing and catching of crabs, sea cucumbers, sea urchin, and shellfish.

There are 10 species of seagrasses in the waters of Kupang Bay: *Enhalus acoroides*, *Thalassia hemprichii*, *Thalassiodendron ciliatum*, *Cymodocea rotundata*, C. *serrulata*, *Halodule uninervis*, H. *pinifolia*, *Syringodium isoetifolium*, *Halophila ovalis*, H. *spinosa*, and H. *decipiens* [10, 13, 17]. The diversity of seagrass species in Kupang Bay is in the low to moderate category, with low to moderate productivity, ecosystem conditions are depressed to fairly balance [10]. The seagrass ecosystem in this area continues to be degraded due to the pace of development around the region. Human activities such as coastal reclamation, fishing, seaweed cultivation, catching biota, sand mining, coral mining and hotel activities) have encouraged degradation of seagrass ecosystems and other fishery resources that are associated in these ecosystems [10, 15].

Strategic efforts are needed to stop the degradation of the seagrass ecosystem and restore its function in the context of sustainable management of coastal ecosystems in the region. Therefore, this research was conducted to determine the current condition of seagrass ecosystems in Kupang Bay, and its utilization by coastal community. The results provide important information useful in the formulation of sustainable seagrass ecosystem management policy, so that ecological and economic functions are still sustainable.

MATERIAL AND METHODS

This research has been conducted for 3 months starting from May to July 2015, which is located in coastal waters of the Kupang Bay (Namosain Village, Bolok Village and Tablolong Village).

Materials and Equipment

The materials used in this research are seagrass samples, water samples and substrate samples. The equipment used includes transect quadrant, GPS, determination book, roll meter, sample bottle, refractometer, thermometer, turbidity meter, secchidisk, current ball, rope estimator, pH meter and DO meter.

Sampling Procedure

Determination of the station at the location of this study is carried out proportionally by considering the total extent of seagrass habitat distribution. Observation of seagrass vegetation can be done through several specific stages such as at each observation station, set the line transects from sea to land (perpendicular coastline) in intertidal areas. Next on each line transect, place a random plot of square plot of 1 x 1 m^2 at least 3 plot samples with squared distance on each 10 m transect. Then on each plot of specified samples, the determination of each type of seagrass and then count the number of individuals of each type of seagrass [4].

The measurement of water parameter was done directly in location, i.e. temperature using the thermometer, transparency using the secchidisk, current using the ball current, pH using the pH meter, and dissolve oxygen using the DO meter. While the measurement of turbidity, phosphate and ammonia was done in Laboratory of Marine Science and Fisheries laboratory, University of Nusa Cendana.

Determination of Respondent

Coastal community sampling is done by the random sampling technique, where all populations are considered to have equal opportunity to be sampled. One method used to determine the number of samples is to use the Slovin formula [18], as follows:

$$n = \frac{N}{1 + Ne^2}$$

Where:

n : total number of sample

N : total number of population

e : error tolerance (10%)

Based on the results of calculations using the above formula obtained the amount of respondents were Tablolong Village: 74 respondents, Bolok Village: 84 respondents and Namosain Village: 96 respondents. The interview process can be done based on the questions that have been determined in the questionnaire.

Analysis of Seagrass Vegetation

Analysis of seagrass vegetation includes relative density, relative frequency, relative closure and importance value index [4], with the following formulas:

- Relative Density:

$$RDi = \left[\frac{ni}{\sum n}\right] x\ 100$$

Where:

ni = total number of the ith spesies

∑n = total stand of all species

- Relative Frequency:

$$RFi = \left[\frac{Fi}{\sum F}\right] x\ 100$$

Where:

Fi = frequency of the ith spesies

∑F = total number of sampling plots

- Relative Closure:

$$RCi = \left[\frac{Ci}{\sum C}\right] x\ 100$$

Where:

Ci = closure of the ith spesies

∑C = total closure of all species

- Importance Value Index:

$$IVI = RDi + RFi + RCi$$

Where:

RDi = relative density

FDi = relative frequency

RCi = relative closure

Analysis of Structure Condition of Seagrass Community

Analysis of the structural condition of seagrass community has been done by calculating diversity index, uniformity index and domination index, using the formulas as follows:

- Diversity Index:

$$H' = -\sum_{i=1}^{n} pi \log 2\, pi$$

Where:

n : the total number of species

pi : the ratio of the ith species

Categorize of diversity indices are H' ≤ 1 Low diversity, H' ≤ 3 = Middle diversity and H' > 3 = High diversity.

- Uniformity Index:

$$E = \frac{H'}{H'\,max}$$

Where:
H' = the amount of Shannon-Wiener's diversity Index
H'max = the maximum amount of Shannon-Wiener's Diversity Index (ln S)
S = the number of taxon in samples

- Domination Index:

$$D = \frac{N\,max}{N}$$

Where:
N max = the maximum number of identified species
N = the total number of individuals

Analysis of Economic Value of seagrass

Analysis of the economic value of seagrass was studied pursuant to direct use value (DUV), indirect use value (IUV), option value (OV), existence value (XV) and total economic value (TEV), using formulas as follow:

Direct Use Value Analysis

Preliminary study results revealed that the biota is often used or captured in the seagrass ecosystem i.e. fish, crabs, shrimp, sea urchins, sea cucumbers and shellfish. In addition the seagrass area is also used as a seaweed cultivation area so that the value of the direct benefit of the seagrass ecosystem is calculated by the following equation [19]:

$$\text{DUV} = \sum \text{DUV} - 1$$

Where:
DUV = Direct Use Value (IDR)
DUV_1 = Direct Use of fish (IDR)
DUV_2 = Direct Use of crab (IDR)
DUV_3 = Direct Use of shrimp (IDR)
DUV_4 = Direct Use of sea urchin (IDR)
DUV_5 = Direct Use of holothurian (IDR)
DUV_6 = Direct Use of bivalvia (IDR)
DUV_7 = Direct Use of seaweed (IDR)

The *direct use value* of each obtained from the following formula (Widiastuti, 2011):

$$\text{Fishery Economic Value} = \text{economic interest x the total number of fishery household}$$

Indirect Benefit Value Analysis

The value of indirect benefits includes the value of the seagrass ecosystem as a spawning, nurturing and foraging area. This assessment uses the contingent valuation method (CVM) using survey techniques, i.e. willingness to accept (WTA) when damage occurs to resources [8]. The steps taken include making a market hypothesis of the resources to be evaluated, obtaining the auction value through auction game techniques, calculating the WTA average, estimating the auction curve and aggregating the data by analyzing the average WTA by the number of fishery household.

Analysis of Choice Benefit Value

The calculation of the optional value uses the benefit transfer method. The method is approached by calculating the amount of biodiversity value that exist in the seagrass ecosystem. The value of biodiversity reserves is US $ 15 /ha/year [16]. The value of this preferred benefit is obtained by the following equation:

$$\text{Choice Benefit Value} = \text{seagrass area (ha) x biodiversity value}$$

Analysis of the Benefit Value of Presence

The value of the benefits of existence is calculated using direct measurement techniques by asking the community about their willingness to pay for goods and services produced by natural resources. The method used is CVM. The steps taken is making a market hypothesis of the resources to be evaluated, obtaining the auction value through bidding game technique, calculating the average of willingness to pay (WTP), estimating the auction curve and stunning the data by multiplying the WTP average by the number of fishery household [8].

Analysis of Total Economic Value

The total economic value (TEV) of the seagrass ecosystem was using the following equation:
TEV = (DUV + IUV + OV) + (BV + XV)
Dimana:
TEV = Total Economic Value
DUV = Direct Use Value
IUV = Indirect Use Value
OV = Option Value
BV = Bequest Value
XV = Existence Value

T-test analysis used to determine differences between seagrass economic value in the period 2007-2010 within the period 2011-2014. The statistical analyzes performed using SPSS 16.0 software.

RESULTS AND DISCUSSION

Community Activities in Coastal Areas

The varied activities carried out in the coastal areas in these three locations are Tablolong Village, activities carried out in the form of settlement activities such as waste disposal and waste directly to coastal areas, fishing boat dock activity that anchored around the coastal waters, and Capture activity of marine biota in intertidal. Furthermore in Bolok village, the activities carried out are the activities of catching marine life in the intertidal, fishing boat activities and also there are other activities such as harbor activity because this location is located very close to the ferry port area and the naval port. Namosain urban village, the activities carried out can be domestic activities that contribute such as waste disposal and waste to the sea, fishing boat activities and catching of marine life in the intertidal.

According to the communities in the three locations that activities such as the disposal of waste and waste to coastal and marine areas are often done because the distance between the house and the area is so close that it is practical and easy to reach it compared to the garbage provided by the local government which is sufficient Away from the settlement making it a little difficult to reach. Furthermore, for the activities of fishing boats in these three locations close to residential areas for security reasons and also has been done traditionally since the first. Furthermore, the activity of catching marine life in the intertidal is a side job to be consumed by them or sold. The capture of marine biota in the intertidal is made using traditional tools such as iron scrap and wood pieces to gouge or dig substrate on certain areas and seagrass areas.

Community activities that are detrimental to the coastal environment occur due to lack of knowledge and socialization from the government or related agencies on sustainable management of coastal and marine areas. Besides, the absence of zonation in the coastal and marine areas, as well as the arrangement of coastal areas such as settlements, hotels, and industrial estates, which hinder the management of coastal and marine areas including seagrass resources and also associated biota such as fish, sea urchins and other aquatic biota in this area.

Seagrass Composition

The composition of seagrass species in the three sites is presented in Table 1.

Table 1: Composition of seagrass species in coastal waters

No	Composition of seagrass	Location (village)		
		Tablolong	Bolok	Namosain
A	*POTAMOGETONACEAE*			
1	*Cymodocea serrulata*	-	+	-
2	*Halodule uninervis*	+	+	+
3	*Halodule. Pinifolia*	-	-	+
B	*HYDROCHARITACEAE*			
1	*Halophila ovalis*	+	+	-
2	*Thalassia hemprichii*	+	-	-
3	*Enhalus acoroides*	+	+	-
	Spesies	4	4	2
	Genus	4	4	1
	Famili	2	2	1

Source: Data analized in this study
Notes: + = exist, - = no exist

The composition of seagrass species in aquatic habitat illustrates the deployment of the number of seagrass individuals of the particular class, genus and species living in the habitat. The number of species and genera of seagrass that live in a habitat, hence habitat condition a place of living of seagrass still in natural condition or have not experienced disturbance and certain pressure. Furthermore, if the number of species and genus of seagrass that live in a habitat loss, it can be said that the condition of the habitat or place of seagrass life has experienced various disturbances and pressure that cause decrease of composition seagrass in an ecosystem [20]. The number of species of seagrass that dominate the waters of East Nusa Tenggara were 11 species divided into 7 genera, so with the presence of 11 species and 7 genera of seagrass in a habitat, it can illustrate that the habitat condition is still natural or no subject to any particular pressure or disturbance [1].

Condition of Seagrass Vegetation

The condition of seagrass vegetation seen from the analysis of density, frequency, closure, and importance values in each transect of each station in the three study sites shows the high and low variations seen in table 2.

Table 2: Density, Frequency, Closure, and Important Value Index

No	Parameter	Location (village)		
		Tablolong	Bolok	Namosain
1	Density	65 - 190 ind/m²	50 - 122 ind/m²	31 - 68 ind/m²
2	Frequency	0,59 - 1,00	0,41 - 1,00	0,21 - 0,58
3	Closure	0,59 - 1,00 m²	0,41 - 1,00 m²	0,21 - 0,58 m²
4	Important Value Index	300	300	300

The values of density, frequency, closure, and important value index can illustrate the high degree of dominance of a seagrass species and also describe the condition of sea-grass vegetation in its habitat [2]. The values of density, frequency, closure of species, and important value index also illustrate the degree of adjustment of seagrass species to the habitat they grow [18]. Therefore, with reference to these two opinions, the higher density, frequency, closure of species, and important seagrass value index in Tablolong Village, compared to Bolok Village and Namosain Village indicates that the rate of adjustment of seagrass species in The Tablolong Village to changes Habitat conditions are higher than those of seagrass species in Bolok and Namosain villages.

Both of the poor growth and life of plants and biota present in the coastal ecosystem are highly dependent on the good condition of the habitats [9]. The high values of density, frequency, closure, and importance value of seagrass in a habitat are closely related to the quality of the environment as a place of life. The habitat condition occupied by the seagrass is in good condition or stable then the growth and survival of the seagrass will increase, reaching the carrying capacity so as to give a positive contribution to the increasingly stable condition of the seagrass vegetation. Vice versa if the habitat conditions occupied by the seagrass have been disturbed, the survival and growth of seagrass species will be disrupted and have an effect on the low or poor condition of seagrass vegetation [4].

Coastal areas are particularly vulnerable to certain disturbances such as land-based activities that include waste disposal and household waste leading to coastal and marine areas as well as direct activities In the coastal waters themselves, such as the activity of ships and catching biota in intertidal (makameting) which is likely to contribute negatively to the degradation of coastal and marine environments as habitats of biota and plants in coastal ecosystem like seagrass [6]. The life of marine plants such as seagrass is very dependent of good environmental conditions or parameters of water quality as a medium of life. If the condition of the environment as a habitat in good condition then the growth and survival will reach the maximum point. Vice versa if environmental conditions as habitat degradation will impact on the decrease in amount of composition, vegetation conditions and community structure of biota and water plants in seagrass ecosystem [9].

The explanation is related to activities carried out in coastal areas of Tablolong, Bolok and Namosain villages. The variation of seagrass vegetation conditions seen from the values of density, frequency, closure and important value index in the three villages, it were caused by the existence of various activities undertaken in coastal areas in these three locations. The activities in coastal areas such as garbage disposal that leads to coastal and marine areas will lead to sedimentation and then give effect on the lower waters brightness, so that photography activities that will be done by seagrass plants for growth and continuity His life will be disturbed and then will impact on the death of seagrass or the lower growth of seagrass in the waters. Activities taking place in coastal and marine areas such as residential waste disposal, oil spills in aquatic areas and fishing activities during low tide waters often trample the substrate and also use traditional tools such as scrap metal and wood pieces to dig up substrate Will contribute to the decrease of the nutrient content composition and nutrients as well as the substrate structure used by seagrasses as the medium of life as found in this study [7].

Diversity Index, Uniformity Index and Dominance Index of Seagrass

The index value of diversity, uniformity index and seagrass dominance index based on the analysis shows that there are high and low variations which can be seen in table 3.

Table 3: Index Values of Diversity, Uniformity and Dominance of Seagrass

No	Parameter	Location (Village)		
		Tablolong	Bolok	Namosain
1	Diversity Index (H’)	1,72 – 1,91	1,62 – 1,80	1,58 – 0,79
2	Uniformity Index (E)	0,20 – 0,23	0,20 – 0,24	0,08 – 0,11
3	Dominance index (C)	0,28 – 0,33	0,32 – 0,39	0,64 – 0,76

The diversity index is used to measure the abundance of communities by the number of species and the number of individuals of each species at a site. The greater number of species and the number of individuals, the more diverse the community. Furthermore, the uniformity index is used to measure the equity of species distribution and ecosystem balance in a habitat. The high value of the uniformity index if the individual spread between being the uniform species, and the low value of the uniformity index if the spread of individual species is uneven. The value of uniformity index ranges from 0 to 1 with category, if E: <0.4 = small uniformity, E: 0.4 ≤ 0.6 = medium uniformity and E: ≥ 0.6 = high uniformity. The dominance index is used to identify the most common species found in a habitat. If there is an increase in the value of dominance, then there will be a decline in the value of diversity and uniformity, where the category determination of the dominance index value has ranged from 0 -1. If C: <0.4 = low dominance, C: 0.4- <0.6, D: 0.6 - 1 = high dominance [14].

The index value of diversity index, uniformity index and domination index based on the above explanation if it is associated with the value of diversity index, uniformity index and seagrass domination index indicate that the diversity index of seagrass in the coastal area of Tablolong and Bolok villages is the medium category and Namosain Village is the low category. Furthermore, the value of uniformity index in all three locations in Tablolong, Bolok and Namosain Villages is the low category. The value of seagrass domination index based on Tablolong and Bolok villages is the low category and Namosain Village is the high category. Based on the category of diversity index, uniformity index and domination index in the three locations, it can indicate that the structure of seagrass community in Tablolong and Bolok villages is under moderate to severe conditions while the community structure of the seagrass in Namosain Village has been under pressure weight.

Environmental Parameters of Coastal Waters

The values of water parameters in Kupang Bay are in a tolerable range of plants and aquatic biota for growth and survival. The range of parameters of brightness, turbidity, velocity, ammonia and phosphate are in the range that cannot be tolerated by plants and aquatic biota [7], which the water quality range that can be tolerated by seagrass plants in a waters are temperature 27 - 32 °C, transparency 3 - 5 m, turbidity <1 NTU, current 10 - 20 m/s, salinity 27 - 32 ppt, pH 7.0 - 8,4, dissolved oxygen >4 mg / L, ammonia <0,008 mg / L and phosphate 0,5 - 1,0 mg/L (Table 4).

Table 4: Physical and Chemical Parameter Values

Parameter	Intercost Value Range		
	Namosain	Bolok	Tablolong
Temperature (^{0}C)	28 – 30	27 – 29	29 – 30
Transparancy (m)	0,5 - 0,7	1,3 - 2,3	1,2 - 2,4
Turbidity (NTU)	2,73 - 3,40	2,44 - 2,50	2,62 - 2,87
Flow (m/s)	0,43 - 0,48	0,46 - 0,53	0,52 - 0,55
Salinity (ppt)	29 – 30	30 – 32	29 – 30
pH	7.1 - 7,3	7,2 - 7,5	7,3 - 7,5
DO (mg/L)	4,0 - 4,5	5,4 - 6,9	4,3 - 5,2
Ammonia (mg/L)	2,06 - 2,09	1,02 - 1,05	1,02 - 1,03
Phosphat (mg/L)	0,01 - 0,02	0,02 - 0,05	0,02 - 0,03

The parameters of the quality of the aquatic environment both physical and chemical are important factors in supporting the growth and survival of seagrass and associated biota in it, so that by finding some parameters of water quality that have been on the ksiaran that can not be tolerated by seagrass plants and living biota In the seagrass ecosystem as described above, the good condition of vegetation and seagrass community structure in these three locations is also caused by fluctuation in some parameters that can give effect to the low growth and disruption of seagrass survival and can give effect also on death of species. Certain seagrasses have a low tolerance to the change of these parameters resulting in changes in species composition, vegetation conditions and seagrass community structures as found in this study.

Economic Value of Seagrass Ecosystem

The economic value of the seagrass ecosystem based on interviews with people in Tablolong Village, Bolok Village and Namosain Village for the years 2007-2010 and 2011-2014 can be detailed in the following description.

The result of T-test analysis showed that there was significant different (P<0.05) between seagrass economic value in the period 2007-2010 with seagrass economic value in the period 2011-2014. This gives an indication that the activities undertaken by the community that could reduce the economic value of seagrass in the past few years may impact on the declining economic value of seagrass today. This condition showed that the total value of seagrass economy in Tablolong Village in the period 2007-2010 is IDR 2,464,644,000 and in 2011-2014 it decreased to IDR 1,682,760,000, then TEV seagrass in Bolok Village in the year 2007-2010 of IDR 1,335,600,000 and in 2011-2014 it decreased to IDR 665,028,000. Next TEV seagrass in Namosain Village in the year 2007-2010 of IDR 1,030,176,000 and in 2011-2014 it decreased to IDR 515,232,000.

Tabel 5: Economic Value of Seagrass Ecosystem

Economic Value (IDR)	**Tablolong Village**		**Bolok Village**		**Namosain Village**	
	2010	**2014**	**2010**	**2014**	**2010**	**2014**
DUV	1.351.980.000	936.840.000	451.080.000	74.340.000	309.600.000	33.120.000
(IUV	13.320.000	8.880.000	10.080.000	5.040.000	5.760.000	2.880.000
OV	1.078.920.000	719.280.000	857.304.000	571.536.000	699.840.000	466.560.000
BV	2.664.000	4.440.000	2.016.000	4.032.000	3.456.000	6.912.000
XV	17.760.000	13.320.000	15.120.000	10.080.000	1.520.000	5.760.000
TEV	**2.464.644.000**	**1.682.760.000**	**1.335.600.000**	**665.028.000**	**1.030.176.000**	**515.232.000**

Keterangan:
DUV = *Direct Use Value*
IUV = *Indirect Use Value*
OV = *Option Value*
BV = *Bequest Value*
XV = *Existence value*
TEV = *Total Economi Value*

DISCUSSION

Factors affecting the depth of seagrass plants in a habitat usually come from internal factors (natural factors) as well as external factors (human). Internal factors that affect the life of seagrass are can be high and low speed of current and wave. Where the higher the velocity of the currents and waves in a seagrass habitat will affect the death of the seagrass plants that impact on the lower number of seagrass individuals in the habitat. External factors that affect the growth and life of seagrass in a habitat that can come from the activities of people from the mainland, such as waste disposal and waste to the sea and other industrial activities and anthropogenic activities [11, 12]. Furthermore, the external activity in the seagrass ecosystem is can be a sea transportation, ship lab activity, seaweed cultivation and catching biota in the intertidal.

Activities undertaken by the community from the mainland, such as the disposal of garbage into the sea directly will lead to sedimentation and will also cover the mouth of the seagrass leaves, thus giving effect on the process of photosynthesis for seagrass plant growth and survival which then impact on the death of seagrass and biota The associated sea-fishermen. Subsequent activities of waste disposal leading to coastal and marine areas will have an effect on substrate structure changes and nutrient composition for growth and survival of seagrass. Besides the existence of sea transportation activity and fishing boat port existing in the seagrass area, it will contribute negatively to the occurrence of oil spill in the seagrass habitat, which then will give effect to the change of nutrient composition for growth and survival of seagrass. Intertidal marine biota fishing activities, which use traditional tools such as iron scrap and wood pieces to gouge and dig up the substrate and activity that often trample the substrate can also affect the decrease of the substrate structure and the amount of nutrient composition and result in low water fertility and quality The environment as a seagrass habitat, so that the impact of the disruption of growth and survival of seagrass and other biota that association with them [20, 21].

The low composition of seagrass in the coastal areas in this study caused by various activities undertaken by communities that exist around the seagrass habitat, i.e. garbage disposal causing the shutting of leaflets which further affects the disruption of the photosynthesis process, the disposal of household waste into the coastal, the changes in substrate structure and low nutrient composition and also activities carried out on seagrass areas such as marine transport activities, fishing boat activities and catching biota in intertidal (makameting). All of that activities have an effect on changing the amount of nutrient composition and substrate structures that influence the decrease of water fertility and water quality of the environment resulting in the decrease in the number of individuals and the composition of seagrass species that dominate the coastal areas in the three locations as evidenced through the results of this study which shows that the composition of seagrass species in these three locations decreased the number of composition. The seagrass is one of the water plants that dominate coastal area, so its growth and survival has close relation with the condition and characteristic of coastal area [9]. The coastal area is one of the most vulnerable areas for various activities or activities around it such as daily domestic activities, which often contribute to the disposal of waste and waste leading to coastal areas and marine activities, ship's existing ship activity around coastal waters, fish search activities during low tide lows around coastal areas and other activities affecting coastal states such as industrial activity and sea transportation activities [6].

These opinions when associated with the activities undertaken by communities in these three locations that resulted in changes in the structure of the seagrass community. The activities in coastal areas such as garbage disposal that lead to coastal and marine areas will lead to sedimentation and then effect on the lower transparency, so that the photosynthesis activity of seagrass plants for growth and survival will be disrupted and then will effect on the death of seagrass or the lower growth of seagrass in the waters [7]. Further ongoing activities in coastal and marine areas such as residential waste disposal, oil spill in coastal waters and fish catches at the lowest low tide that frequently trample the substrate and also use traditional tools such as scrap iron and wood scrap to dig the substrate. It will also negatively contribute to substrate structure change, decreasing the amount of nutrient content composition or the nutrients present in the bottom of the waters as a living medium in supporting the growth of seagrass have an effect on the occurrence of habitat changes and the impact on the occurrence of certain pressures on the structure of the seagrass community as found in this study.

Seagrass is the primary productivity of waters and is also a fishery resource. In addition, the seagrass is also one of the water plants that become the living place for the aquatic biota that has a high economic value [3, 4]. Furthermore, the high and low economic value of seagrass is determined by good environmental bad as a habitat or place of life [8]. The seagrass is a type of plant that has a habitat of its life is largely located in coastal waters, so that if the occurrence of certain disturbances in the aquatic environment will result in a decrease in resource potential, and then the effect on the decline in economic value of seagrass resources itself. Coastal waters are highly susceptible to certain disturbances such as land-based activities that include waste disposal and household waste leading to coastal and marine areas as well as other activities. The activities carried out directly on the coastal zone itself, such as the ship's fishing activity and catching biota on intertidal which is likely to contribute negatively to the degradation of coastal and marine environments as biota habitat and the impact on the decline of the economic value of seagrass resources itself [6].

The declining economic value of the seagrass ecosystem is currently the result of various activities undertaken and the behavior of people in these three locations. Humans as the key to change in their environment because humans and their behavior can affect all the existing creatures. However, through the environment, human behavior is determined because of a balanced reciprocal relationship between humans and the environment. Furthermore, there needs to be an effort to cultivate environmentally friendly society's behavior in managing natural resources such as seagrass ecosystem in Kupang Bay. It is necessary for the efforts of the government and related institutions to increase public knowledge and awareness about the importance of sustainable management of coastal areas. These efforts can be done in various activities such as socialization, counseling, coastal clearing program, zoning of coastal areas, and the arrangement of surrounding areas such as residential areas, hotels, and industrial estates. Thus the problems of environmental degradation in the coastal and marine areas due to human activities can be restored, so that sustainable management of coastal and marine areas in this area can be realized.

CONCLUSION

Coastal community activity in the coastal Kupang Bay, affect the ecological role of seagrass seen from the diversity index, uniformity index and index domination of seagrass community in the villages of Bolok and Tablolong were in a state of moderate to severe pressure and Namosain Village is under severe pressure. Community activities in the coastal Kupang Bay, affect the economic role of seagrass ecosystem seen from the economic value of seagrass ecosystem in 2010 until 2014 there was a decline.

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