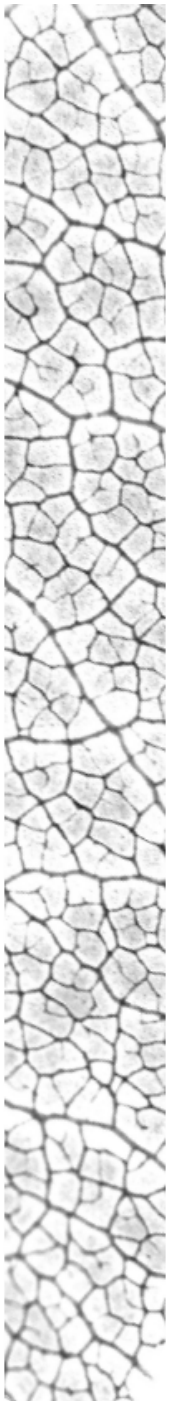


EurAsian Journal of BioSciences
Eurasia J Biosci 13, 75-82 (2019)

Strategy of the Mangrove ecosystem management in efforts to combat abrasion in the Bantan District case of the Mangrove ecosystem in Teluk Papal Village, Bantan District, Bengkalis Regency, Indonesia

Zulkarnaini [1*], Dendy Ariandi [1], Syahril [2]

[1] Environmental Sciences Program Riau University, Pekanbaru, P.O. Box 28293, INDONESIA
[2] Faculty of Teacher Training and Educational Science, Pekanbaru, P.O. Box 28293, INDONESIA
*Corresponding author: naini61gope@gmail.com

Abstract
Mangroves in the Teluk Papal Village are in a community that grow naturally. Mangrove conditions in the Teluk Papal Village in some areas have been damaged as a result of beach abrasion, land conversion into plantations, and community logging. Damage to the mangrove area is expected to increase in the future. Therefore, it is necessary to research about the mangrove damage by monitoring the change of the mangrove area and to analyze the leading factors as to why this damage is occuring. The purpose of this study is to assess the level of damage and factors which cause mangrove damage, to calculate the total economic value and formulate a mangrove management strategy for the Teluk Papal Village, in the Bantan District. The results show that mangrove vegetation in the Teluk Papal Village consists of 10 species, namely Avicennia alba, Rhyzophora mucronata, Thespesia populnea, Sonneratia alba, Excoecaria agallocha, Sonneratia caseolaris, Bruguiera gymnorhyza, Xylocarpus granatum, Rhyzophora apiculata, Nypa fruticans. Based on the results of standardized criteria and guidelines for damage to mangroves KEPMENLH 201 in 2004, mangroves in the Teluk Papal Village are in good condition (they are very solid and medium). This is based on the amount of tree density per hectare. The leading factor is coastal abrasion due to reduced mangrove vegetation in the front row, land conversion to plantation land and brick production. The estimated economic value of the mangroves is calculated by direct benefits, indirect benefits, benefits of choice and benefits of existence with a financial result of Rp 42.567.271.593.04. Based on the results of economic analysis it shows that the mangrove ecosystem in the Teluk Papal Village has a large economic value which means if there is a change in the mangrove area and its positive (increasing), then the value of the mangrove economy is positive (increased) and vice versa. This condition indicates that the mangrove ecosystem must be maintained so that its ecological, economic, social and environmental functions can be utilized sustainably.

Keywords: mangroves, sustainable management, Teluk Papal, economic valuation

Zulkarnaini, Ariandi D, Syahril (2019) Strategy of the Mangrove ecosystem management in efforts to combat abrasion in the Bantan District case of the Mangrove ecosystem in Teluk Papal Village, Bantan District, Bengkalis Regency, Indonesia. Eurasia J Biosci 13: 75-82.

PRELIMINARY FINDINGS

In general, the extent of the mangrove forest in the Bengkalis Regency continues to decline, according to Fikri (2006) and Miswadi (2014) mentioned that the change of the mangrove forested area of Bengkalis Island is 2,012,125 hectares during 1992-2002 down from 8,182,080 hectares (1992) to 6,115. 950 hectares (in 2002) or 201.213 hectares per year. Then researcher Sigit Sutikno (2014) from the Faculty of Engineering at Riau University studied the coastal abrasion rate of Bengkalis island with satellite data, the coastline on the north and east side of Bengkalis island for 83 kilometers. The worst areas affected by coastal abrasion was found at kilometer 55, while the worst abrasion area of Tanjung Jati to Muntai was at about kilmeter 22.5. The average annual abrasion area reaches 59.02 hectares and the abrasion rate reaches 32.5 meters per year. For 26 years (1988-2014) it is estimated that land lost on Bengkalis island due to abrasion reached 1,504.93 hectares.

The rate of degradation and depletion of marine resources in recent years has been higher, such as the decrease of mangrove forests and the destruction of ecosystems of some fishing areas. Ironically, coastal residents who feel they are part of this territory are increasingly powerless to compete with other parties, so

Received: October 2018
Accepted: December 2018
Printed: February 2019

Table 1. Station location of observation

Station	Coordinates				Characteristics
	X		Y		
Station 1	102 °	17'32.98"	1 °	33'9.31"	Near residential area
Station 2	102 °	17'55.27"	1 °	33'8.91"	Close to mangrove planting area
Station 3	102 °	18' 33.68"	1 °	33' 0.32"	Natural Mangrove on the island

Table 2. Tools and materials used during the study

Parameters	Unit	Tool
Water quality		
Dissolved oxygen	mg/L	DO meter
Salinity	psu	Handrefraktometer
Temperature	oC	Termometer
pH	-	pH meter
Vegetation of mangroves		
Community Structure	Ind/m2	Transek Kuadran
Identification of mangroves	-	Identification books
Observation line	m	Plastic strap
Location coordinates	-	GPS
Diameter of trees	m	meter
Documentation	-	Camera
Listing recording	-	Stationery
Instrument for interview	-	Questionnaire

they are often forced to ignore the rules of sustainability in order to meet the needs of everyday life. Currently, in some areas of Bengkalis Regency, they feel the direct impact of mangrove damage. The abrasion has entered a very alarming stage and needs very serious attention. Every year at least tens of meters of mainland Bengkalis island collapses due to being hit by waves.

In dealing with this, they cannot rely on the government alone but they need cooperation between the government and society and other elements. Strategic management of mangrove ecosystems is needed, one of which is by conducting rehabilitation and conservation of mangrove ecosystems in areas considered critical and which have a high abrasion level.

But until now the abrasion problem seems to never finish and is going to continue to increase from year to year. The need for the formulation of a management strategy that can answer the abrasion problem so that the future programs can run successfully and have a positive impact on people's lives is important. Therefore, this study aims to (1) review the level of damage and factors that caused the damage to the ecosystem of the mangroves in Teluk Papal Village (2) Estimate the economic value of the ecosystem mangroves in Teluk Papal Village.

MATERIALS AND METHODS

Time and Place of Study This research was conducted in June - August 2017 at Teluk Papal Village Bantan Subdistrict of Bengkalis Regency, in Indonesia.

Materials and tools to be used in research can be seen in **Table 2**.

The method used in this research is the survey method with a qualitative approach in accordance with research problem formulation. The data was obtained using a questionnaire and was analyzed and intensly discussed.

The type of data used in this study was primary data and secondary data. Primary data collection was done through direct observation in the field by conducting field observations to know the conditions of the research location. Secondary data was obtained from the search of various related research results. The data is sourced by the Office of Marine and Fisheries of the Bengkalis Regency, the Bengkalis District Environmental Office, the Bengkalis District Forestry Office, Bappeda Bengkalis, BPS Bengkalis, Bantan District Office, the Papal Village Office, data from non-governmental organizations (LSM) and research results related to other institutions.

Data collection techniques

1. Intake of environmental data of mangrove ecosystem

The parameters observed in this study were physical and chemical parameters that affect the condition of the mangrove ecosystem. Data retrieval was done in-situ.

2. Collection of mangrove vegetation

Transect method was used by making a transect line along 100 meters with a 10 meter width, then a plot size of 10 x 10 m (tree) determined by purposive sampling, and a plot size 5 x 5 m (seed) and 1 mx 1 m (seedlings) determined by random sampling. Each station performed 3 transect lines with 3 sample plots for each transect line.

3. Fishery production data

Fishery production data collection from the utilization results in the mangrove ecosystem obtained through direct in-depth interviews using questionnaires to the community utilizing the mangrove ecosystem as a place to find fish and secondary data from the Department of Marine and Fisheries in the Bengkalis Regency.

Data Analysis

1. Analysis of mangrove vegetation

Identification of mangrove species refers to Noor et al. (2006). The species composition and vegetation

Table 3. The formula for calculating the total economic value

TEV= UV + NUV	
TEV = (DV + IUV + OV) + (XV + BV)	
With :	
TEV	= *Total Economic Value*
UV	= *Use Value*
NUV	= *Non Use value*
DV	= *Direct use Value*
IUV	= *Indirect Use Value*
OV	= *Optional Value*
XV	= *Existence Value*
B V	= *Bequest Value*

Source : Pearce and Moran (1994)

structure were performed by analyzing the parameters referring to Natividad et al. (2015), namely:

a. The density of a type (K), calculated by the formula:

$$K = \frac{Numbers\ of\ individual}{Extensive\ example}$$

b. Relative density (KR), calculated by the formula:

$$KR = \frac{Density\ of\ a\ type}{Total\ density} \times 100\%$$

c. Frequency (F),

$$F = \frac{The\ numbers\ of\ plots\ found\ in\ a\ species}{Total\ numbers\ of\ plots}$$

d. Relative frequency (FR), calculated by the formula:

$$FR = \frac{Frequency\ of\ a\ type}{Total\ frequncy} \times 100\%$$

e. Closure Type, calculated by the formula:

$$D = \frac{\sum BA}{A}, BA = \frac{\mu DBH_2}{4}$$

f. The relative closure (DR), calculated by the formula:

$$DR = \frac{C_i}{\sum C} \times 100\%$$

g. Important Value Index:

$$INP = KR + FR + DR$$

2. Analysis of mangrove damage level

The method used to calculate the mangrove damage level was put in place by a Decree of Minister of the Environment Number 201 Year 2004 regarding Raw Criteria and Guidance of Determination of Mangrove Damage,

3. Characteristic analysis and stakeholder views on mangrove management

The social characteristics of the people living around the mangrove ecosystems of Papal Cove was obtained from respondents' data by conducting direct interviews using questionnaires. Furthermore, the data was analyzed descriptively by using tabulation and graph. The stakeholder's view on the existence and management of the mangrove ecosystem is analyzed from the results of the questionnaires to the relevant stakeholders.

4. Economic valuation analysis

According to Pearce and Moran (1994), in a mathematical equation, the total economy of an ecosystem (in this study is mangrove forest) can be presented in the formula shown in **Table 3**.

From the equation can be explained that the Total Economic Value is the sum of the value of direct use, indirect use value, choice value, the value of existence and value of inheritance. Direct use value is a result that can be directly consumed. These direct products consist of food, biomass, recreation and health. Paryono et.al. (1999) identified five direct benefits that can be taken from the mangrove forest, namely: (1) the benefits of forest products in the form of timber potential, wood firewood, charcoal, nipah leaf, and mangrove seedlings, (2) the benefits of fishery products, namely crabs, shrimp, fish and shellfish, (3) animal benefits consisting of birds, monitor lizards, monkeys and kroto, (4) tumpangsari and semi intensive farming and (6) tourism benefits.

RESULTS AND DISCUSSION

1. Teluk Papal Village Administration

Teluk Papal Village is one of the villages in the Bantan district of the Bengkalis Regency. The total area of the Teluk Papal Village is 2,073 Km2. Teluk Papal Village is in the northern part of Bengkalis island, this condition indicates that the Teluk Papal area is dominated by a specific coastal ecosystem and has a high degree of biodiversity and genetic resources. The mangrove area in Teluk Papal Village has a very important function for the protection of biodiversity and its ecosystem as well as a supporter of life. The geographical cluster of Teluk Papal village lies within the boundaries of the region as follows:

- North: Malacca Strait
- South: Bantan Air Village and Bantan Tengah Village
- East: Bantan Air Village
- West side: Mentayan Village

(Teluk Papal Village Office, 2017)

Population Profile

The population profile is an important factor in the development of a region and is the perpetrator of activities in the region. The population of Teluk Papal Village is 2,128 people consisting of 1,118 males and 1,010 females. Villagers in the Teluk Papal area consist mainly of ethnic Javanese ethnic groups as well as indigenous or local inhabitants who have inherited this area from Malay, Suku Asli and Tionghoa ethnic groups. By gender, it can be seen that the majority of the population is male.

Respondents Education Level

The level of education has a very important influence in the development process, especially in Teluk Papal Village. The level of formal education of fishermen

Table 4. Physical and chemical parameter data of study sites

Station	temperature (°C)	Salinity (psu)	DO	pH
1	27.65	25.40	4.90	6.18
2	25.20	29.00	4.40	7.40
3	28.20	29.50	5.11	7.10

Source: Primary Data (2017)

Table 5. Type of Mangroves Available in the Mangrove Forest Area in the Village of Teluk Papal

Family	Genus	Spesies	Local name
Avicenniaceae	Avicennia	*A. Alba*	Api-api
Malvaceae	Thespesia	*T. populnea*	Waru laut
Euphorbiaceae	Excoecaria	*E. agallocha*	Bebetak
Rhyzoporaceae	Bruguiera	*B. gymnorhyza*	Lengadai
Rhyzophora		*R. apiculata*	Bakau hitam
		R. mucronata	Bakau putih
Sonneratiaceae	Sonneratia	*S. alba*	Perepat
		S. caseolaris	Pedada
Meliacea	Xylocarpus	*X. granatum*	Nyirih
Arecaceae	Nypa	*N. fruticans*	Nipah

Source: Primary Data (2017)

Table 6. Percentage of Occurrence of Mangrove Types at Each Station in Teluk Papal Village Regency of Bengkalis

Station	Occurrence of Mangrove Types (%)									
	TP	AA	BG	EA	RA	RM	SA	SC	XG	NF
I	23	24	-	8	14	4	3	3	8	9
II	21	-	8	21	9	5	7	5	11	12
III	12	-	5	19	10	12	-	15	14	13
Rata-rata	18	8	4	16	11	7	3	7	11	11

Source: Data analysis (2017)

Information :

AA : *Avicennia alba* RM :*Rhyzophora mucronata*
TP : *Thespesia populnea* SA : *Sonneratia alba*
EA : *Excoecaria agallocha* SC : *Sonneratia caseolaris*
BG : *Bruguiera gymnorhyza* XG : *Xylocarpus granatum*
RA : *Rhyzophora apiculata* NF : *Nypa fruticans*

respondents was low. Most of the level of the fishermen's education was that they finished primary school (57%), junior high school (25%) and (18%) senior high school. Low-educated respondents motivation to participate in rehabilitation activities was only to benefit from wages from mangrove planting activities. The community's knowledge and understanding of the importance of mangrove forests was due to the high dependency of the community on mangrove forests related to livelihoods as fishermen (economic function) and the function of mangrove forests to protect settlements (physical and ecological functions).

Age of Respondents

The results of the study by age category, the respondents in this study were in different age groups. 68.3% of respondents were over 50 years of age and most were fishermen. Meanwhile, 28.6% of respondents were aged 26-50 years of age which is in the productive age category.

Water Quality Condition of Mangrove Ecosystems

The results of the measurements of physical parameters and water quality in the location of the study are presented in **Table 4**.

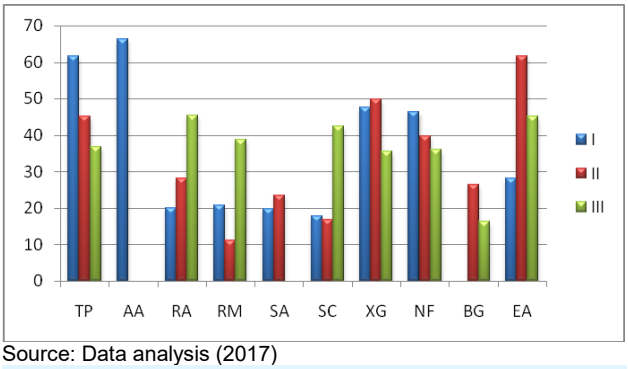
Water temperature is a factor that determines the life and growth of mangroves. The temperature of the measurement results was between 25.20 ° C - 28.20 ° C. Salinity is also a factor in the spread of mangrove plants. Salinity of measurements at the study sites ranged from 25.40 - 29.50 psu. The dissolved oxygen measured at each station ranges from 4.40 - 6.46 mg / L. The pH value of measurement shows the range of 6.18 - 7.40.

Mangrove Vegetation Structures

From the observations made, there were 10 species of mangrove vegetation from 8 families (**Table 5**).

Meanwhile, to see differences in composition and distribution of mangrove vegetation can be seen in **Table 6**.

The Important Value Index can describe the level of importance and ecological value of the plant in a community. Important Value Index is derived from the sum of Relative Density, Relative Frequency and Relative Dominance. **Fig. 1** presents the Important Value on each mangrove species in the three observation stations.



Source: Data analysis (2017)

Fig. 1. Important Value Index of mangrove vegetation in Teluk Papal Village, Bengkalis

Table 7. Index Diversity and Dominance

INDEX	ST1	ST2	ST3
H'	2.6692	3.0495	2.9238
C	0.1775	0.1389	0.1370

Source: Data analysis (2017)

The Diversity Index at Station III is 2.92 and at Station I is 2.69. Unlike the two stations, Station II has a diversity index of 3.04. This diversity also shows that the mangrove forest ecosystem is still relatively good. The value of Dominance (C) at Station I is 0.1775, Station II is 0.1389 and Station III 0.1370.

Level of Mangrove Damage

Based on the analysis of standard criteria and guidelines for damage to mangroves KEPMENLH 201 of 2004, mangroves in Teluk Papal Village were included in the good category (very solid). This is based on the amount of tree density / hectare observed in each observation station.

The density of the tree phases in the category of good (very dense) and the highest was found in station 3 which was 5401 trees / hectare, then 2 stations respectively with 4600 trees / hectare, station 1 ie 4467 trees / hectare. Based on the identification result of Station I, Station II and Station III, the highest density of Thespesia populnea with density of 1133 ind / ha (Station I), 1067 ind / ha (Station II) and 1000 ind / ha (Station III) was obtained. The lowest density value in each Station is the type S. alba 200 ind / ha (Station I), R. mucronata 150 ind / ha (Station II).

Stakeholder Perception Against The Existence of Mangrove Ecosystems

The results of the questionnaire analysis showed that 33.3% of the community around the mangrove ecosystem of Teluk Papal Village understood the mangrove ecosystem. This understanding not only with the terms, but also about the functions and benefits of the mangrove ecosystem, ie with 13.3% of the answers from the community. 33.3% of the people are rarely (1-3 times / month) find fish, crabs / shells. In contrast to the use of mangrove forests as for wood as fuel, building and charcoal, 40% of people claim to be frequent (intensity 7-9 times) and 26.7% rather often with an instensity of 4-6 times a month. The community realized that the condition of mangrove vegetation had an impact on the increase of fish, shrimp and crab caught so that 53.3% of respondents answered influential and 13.3% respondents answered very influential. However, there have been no village / custom regulations regulating the utilization of mangrove forests in Teluk Papal Village.

Regarding the condition of the mangrove ecosystem in Papal Village, responses varied by respondents, 20% of respondents answered in moderate condition 20% of respondents good condition and 26.7% of respondents in damaged condition. The condition of mangrove ecosystem influences biota / animal resources in mangrove ecosystem in Teluk Papal Village in the last 3 years with 46,7% respondents replied that it was decreasing. Besides the lack of animal resources, 46.7% of respondents stated that the size of fish, shrimp and crab species in the mangrove ecosystem remained the same. This impacts the catch of the community, so 66.7% of respondents answered less, 33.3% respondents answered just the same.

Community participation in the conservation of mangrove ecosystems is still very low, it is known that 46.7% have never participated in conservation and mangrove management (planning, implementation and evaluation) facilitated by the government or other institutions. The level of community self-reliance in mangrove planting efforts around Teluk Papal Village is still low, 76,7% of respondents have never done any mangrove planting by governmental and other institutions and 26,7% of respondents have never done any mangrove planting on their own. The community was very supportive of the management efforts in Papal Village Village, it can be known from 86.7% of respondents agreed if the government conducts training programs for the community through counseling and training the community will most likely participate in the conservation of mangrove forests.

Community empowerment activities by the government are still rarely implemented because 40% of respondents answered that the goverment never conducted counseling / training / guidance to the community about the management of mangrove ecosystem. Communities assess the policy and coordination of agencies related to the community in the field of conservation and management of the mangrove ecosystems so that they run well. Therefore, 40% of respondents would agree if there was a local regulation governing the preservation of mangrove forests.

Calculation Estimate of the Economic Value of a Mangrove Ecosystem

The calculated economic value is the economic value of the mangrove ecosystem from direct use value (fishery sector, the benefits of wood and mangrove seeds), indirect use value (non-use of aquatic ecosystem) and existence value. The economic value of

Table 8. Recapitulation of estimated economic value of mangrove ecosystem in Teluk Papal Village

No	Typology of Classification of Functions and Classification benefits	Economic Value (Rp) / year
1	*Direct use value*	19.548.439.211,34
2	*Indirect use value*	2,658,839,585.41
3	*Option value*	143.201.565,00
4	*Existence value*	3.336.545.680,00
5	*Bequest Value*	0.00
	Total Economic Value (Rp/years)	**32.718.854.759,94**

Source: Data analysis (2017)

the mangrove ecosystem in Teluk Papal Village can be seen in **Table 8**.

Total Economic Value is the sum of the value of direct use, the value of indirect use, the value of choice, the value of existence and the value of inheritance Direct use value is the result that can be directly consumed. These direct products consist of food, biomass, recreation and health. Paryono et.al. (1999) identified five direct benefits that can be taken from the mangrove forest, namely: (1) the benefits of forest products in the form of timber potential, wood firewood, charcoal, nipah leaf, and mangrove seedlings, (2) the benefits of fishery products, namely crabs, shrimp, fish and shellfish, (3) animal benefits consisting of birds, monitor lizards and monkeys, (4) intensive and semi intensive farming and (6) tourism benefits.

The decrease in the number of individuals in the research station because most people are generally more likely to exploit mangroves at the location to be taken as wood for firewood / wood for the building, the location is also close to the residential community. In accordance with the opinion of Bayan (2014), that mangrove condition adjacent to settlement and river estuary along with the development growth will change the condition of environment around mangrove that is the spread of garbage in all substrate surface which will impact on degradation of quality of mangrove habitat and resulted in unavailability of media for mangrove growth, especially at the seedling level, will ultimately impact on no sustainability of mangrove ecosystems and ends with the loss of mangrove populations in the region. The determination of the standard criteria for mangrove damage is based on the Decree of the Minister of Environment No. 201 of 2004 on standard criteria and guidelines on determining mangrove damage which states that to determine mangrove conditions are classified in three levels: (a) good (very dense) with density ≥ 1500 trees / Ha; (b) good (medium) with a density of ≥ 1000- ≥ 1500 trees / ha; and (c) damaged (rare) with a density of <1,000 trees / ha.

The number of tillers and seedlings found indicates that the substrate in each station is still quite fertile and the area is naturally still protected, so the ability of mangroves to grow back is quite high can be seen from the number of tillers and seedlings. The highest species of mangroves are Rhizophora apiculata, Thespesia populnea and Excoecaria agallocha, because the location of this research is generally dominated by the type of muddy sand substrate. So this type of mangrove has a high ability to adapt to the environment. The high level of mangrove vegetation density in the seedling phase and the seedling phase affect the ecological function (physical and biological functions) of mangrove vegetation found in Teluk Papal Village. The ecological (physical) functions in question are as wave absorbers and abrasion retention, preventing sea-water intrusion into land, as a mud retainer and sediment trap. While the biological function is the function of mangrove vegetation as a producer of detritus and shelter of marine biota such as shrimp and crab, so that will affect the catch of fishermen catch fish in the area of mangrove ecosystems Teluk Papal Village. In addition, the high level of mangrove vegetation density in the seedling phase and the seedling phase is a potential resource to cover the low level of mangrove vegetation density in the tree phase in several research sites. Management of mangrove vegetation phase of the seedling and seedling phase well within a certain time, will have an impact on the high level of tree phase density in Teluk Papal Village ecosystem.

Mangrove logging is still happening, mangrove wood taken is Rhizophora sp. and Xylocarpus sp. This kind of wood is used to fuel the brick making in Teluk Papal village. This wood is chosen because it has a high enough density. In accordance with the statement of Tumisem and Suwarno (2008), that wood with high densities will become heavier (average 0.9 m / s), hard, has a long durability and is a good fuel with sufficient heat generated high and the flames are long enough. The existence of Bed Brick beds also contribute to the reduction of mangrove area. Brick making activities trigger the rate of degradation of mangrove forest which resulted in changes in the function of mangrove forest.

Economic valuation studies have helped to increase understanding and knowledge about the value of an ecosystem. The variety of uses and benefits of an ecosystem that, even though it has been realized, but on many occasions does not seem to be taken into account. Moreover, sometimes environmental activists, the media, the government, the private sector and the public in general have on many occasions interpreted the results, values and benefits of an ecosystem inappropriately and indiscriminately (Stefano et al. 2004)

Economic valuation is not a single activity based solely on one question “How valuable is an ecosystem?”. In fact, economic valuations can be interpreted in many ways. This can be interpreted as an attempt to question how big the value of profits that flow

at this time, or about the value that will flow in the future. The meaning can also mean how the value of ecosystem conservation effort is compared with the effort of conversion of ecosystem to other usage. Some of these questions seem similar, but in reality they refer to very different things, and the answer to one question is not appropriate to use to answer another question. An example in this case is whether maintaining mangrove forests will be more economically valuable than converting those forests into ponds.

From the calculation of economic valuation of mangrove forest conducted in this study obtained the total economic value of Rp 32.718.854.759,94 for an area of 715.95 hectares. The total economic value consists of direct use value of Rp 19.548.439.211,34 indirect use value of Rp 2,658,839,585.41 value of choice of Rp 143.201.565,00 and presence value of Rp 3.336.545.680,00. From the calculation shows that the value of direct use is the component with the largest value (48.55%) followed by the value of indirect use (43.28%). The other two components of economic valuation (value of choice and value of existence) have a relatively small proportion (0.33% and 7.84%).

Based on the results of economic analysis shows that the mangrove ecosystem in Teluk Papal Village has a big economic value means if there is a change of mangrove area is positive (increasing), then the value of mangrove economy is positive (increased) and vice versa. This condition indicates that the mangrove ecosystem must be maintained so that its ecological, economic, social and environmental service functions can be utilized sustainably. Sasidhar and Rao (2015), stated that with the condition of mangrove ecosystem susceptible to pressure, so in the need of conservation efforts and sustainable management of mangroves.

CONCLUSION

Mangrove damage occurring in Teluk Papal Village is caused by coastal abrasion due to the decrease of mangrove vegetation in the front row, land conversion into plantation land and the existence of brick production located on the coast.

Economic valuation or total economic value (total economic value) which is an activity or effort to measure and declare in monetary unit (monetizing) all kinds of values that exist from a natural resource. The concept of total economic value helps policy makers to identify and measure in different types of economic value that may be possessed from a natural resource in this study is the mangrove ecosystem. Through the calculation of economic valuation of mangrove forest, it is found that mangrove ecosystem has direct use value of Rp 19.548.439.211,34, indirect use value of Rp 2,658,839,585.41, choice value Rp 143.201.565,00 and presence value of Rp 3.336.545.680,00 with total economic value of Rp 32.718.854.759,94.

ACKNOWLEDGEMENT

Acknowledgment of the authors conveyed to the Bengkalis District Fisheries Office, Teluk Papal Village Head, Papal Papal Community, RKLP Papal Village Community Groups and all parties who have helped with the implementation of this research.

REFERENCES

Alongi DM (201). Carbon sequestration in mangrove forest. J Carbon Management, 3: 313-322. https://doi.org/10.4155/cmt.12.20

Arief A (2003) Mangrove forest (its function and role). Yogyakarta (ID): Kanisius.

Armilus (2013) Community Perception and Participation in Coral Reef Management in Batam Island Sarang Island. Journal of Environmental Science, 7(2): 201-211

Baderan DW (2013) Economic valuation model as the basis for the rehabilitation of mangrove forest destruction in coastal area Kwandang District, Gorontalo Utara Regency of Gorontalo Province. [Dissertation]. Yogyakarata (ID): Universitas Gadjah Mada.

Bengen DG (2001) Synopsis of Coastal and Marine Ecosystems and Natural Resources. North Bengkulu Study Center, Bengkulu: Jakarta.

Dahuri R (2003) Marine Biodiversity Sustainable Development Assets. Jakarta: Gramedia Pustaka Utama.

Department of Fisheries and Marine Bengkalis Regency (2014) Report on the Rehabilitation and Conservation Activities of coastal areas of Bengkalis Regency. Department of Fisheries and Marine Bengkalis Regency.

English S, Wilkinson C, Baker V (1994) Survey Manual for Tropical Sea Resources. Australian Institute of Marine Sciences 2nd Edition Townsville. 367 p.

Fauzi A (2014) Economic valuation and assessment of damage to natural resources and the environment. Bogor (ID): IPB Press.

Gunarto (2004) Mangrove Conservation as a Supporter of Marine Biodiversity. JR & D Agriculture 23(1):15-21.

Huda N (2008) Strategy of Sustainable Mangrove Management Policy at. Coastal Area of Tanjung Jabung Regency East Jambi. Semarang: Thesis.

IUCN (2007) Environmental and Socio-economic Value of Mangrove in Tsunami Affected Areas Rapid Mangrove Planting Study: Panama Village on the Southeast Coast of Sri Lanka. The Spanish Ministry of the Environment and IUCN.

Kordi K, Ghufron H (2012) Ekestem Mangrove, Potential, Function and Management. Jakarta: Rineka Cipta.

Kusmana C (2008) Method of Vegetation Survey. Faculty of Forestry Bogor Agricultural University. Bogor (ID): Bogor Agricultural University.

Mangrove LPP (2008) Mangrove Ecosystem In Indonesia. (On line). Retrieved on December 10, 2014 from http://www.imred.org

Ministry of Environment (2004) Decree of State Minister of Environment Number: 201 Year 2004 regarding Quality Standard Criterion and Guidance of Determination of Mangrove Damage.

Miswadi (2014) Potential of Land Management in Mangrove Forest Area Liung River Bengkalis Island. Proceedings of the National Seminar on “Environmental Conservation & Disaster Mitigation”. Pekanbaru.

Nazir (2003) Research Methods, Salemba Four, Jakarta, 63.

Noor YR, Khazali M, Suryadiputra NN (2006) Guidance on mangrove introduction in Indonesia. Bogor (ID): Wetlands International Indonesia Programe

Nunes, et al. (2001) Economic Assessment of Biodiversity: resourcefulness or nonsense. Ecological Economics 39: 203-222. https://doi.org/10.1016/S0921-8009(01)00233-6

Pagiola S, et al. (2004) Assessing the Economic Value of Ecosystem Conservation, World Bank Department of Environment, Washington.

Pradini S (2002) Planning of interpretation of air biota in Muara Angke wildlife reserve. [Thesis]. Bogor (ID): Bogor Agricultural University.

Purba J (2002) Social Environment Management. Jakarta (ID): Ministry of Environment and Yayasan Obor Indonesia.

Schaduw JNW, Yulianda F, Bengen DG, Setyobudiandi I (2011) Management of mangrove ecosystems of small islands of Bunaken National Park are market-based. J Agribusiness 12(3): 173-1181.

Setyawan AD (2008) Biodiversity of mangrove ecosystems In Java: North and South Coastal Report of Central Java. Sebelas Maret University: Surakarta.

Sosio YP, Rahmadhani T, Nainggolan M (2014) Mangrove Siak & Meranti Islands. Jakarta (ID): Environmental & Regulatory Compliance Division of Department of Safety, Health & Environment. P. 5.

Supriharyono (2007) Conservation of the ecosystem of biological resources in the coastal and tropical regions. Yogyakarta (ID): Learning Library.

Suzana B, et al. (2011) Economic valuation of mangrove forest resources in villages of West Lupang Regency of North Minahasa. Journal of ASE - Vol 7 number 2, May 2011: 29 - 38 Bogor Agricultural University.

Vannucci M (2004) Mangrove Management and Conservation: Present and Future. Tokyo (ID): United Nations University Press.

Wullur F, Florence FV, Longdong M, Wasak (2013) The existence of farmers of Nila fish farming (Oreochromis niloticus) in the Warukapas Village of the North Minahasa Regency of North Sulawesi Province. A Scientific Acculturation 1(1): 110-118.