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Mangrove Woods Damage Based On Time of Water Absorption Rate of Woods

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ABSTRACT : *Mangrove forest was a main ecosystem supporting lives in littoral and sea areas. A mangrove forest has various advantages, such as fish, shrimps, crabs, and woods for a number of household needs. Littoral people tend to use mangrove woods to construct boats. The woods used are taken from mangrove trees in their own surrounding since the mangrove woods are considered strong, hard, and durable. The woods damage in sea occurs because the woods structures are not good enough and the amount of the extractive substances contained inside the woods is small. So, the woods structures are easily attacked by sea borer animals, which cause woods damage. The present study of mangrove woods damage based on time of water absorption rate of woods was conducted in Tuada village, sub district of Jailolo, West Halmahera. The purpose of the study was to examine the rate of water absorption on each type of woods and the damage level on each wood. This study employed an experimental design. The experiment woods used in this study were Rhizophora apiculata, Bruguiera gymnorrhiza, Osbornia octodonta, and Xylocarpus moluccensis. The measurement was conducted by: (1) preparing several mangrove boards sizing length 250 cm, width 30 cm, and thickness 4 cm. The boards were immersed 1 m or 2 m depth for about 15 months. The distances between the sea side and the immersed boards were 30 m and 50 m. (2) the rate of water absorption of the immersed board was measured. The data obtained were analysed by using anova and followed by Duncan Multiple Range Test (DMRT). The findings of the study showed that the rate of water absorption on the X. moluccensis was 5,698/second, which was the fastest rate compared to the other wood types. The rate of water absorption on the R. apiculata and B. gymnorrhiza was about 16,523-24,418/second, which was considered as moderate rate, while the slowest rate was found in O. octodonta 90,668/second. The faster the water absorbed by the woods, the higher the woods damage, vice versa.*

Keywords: *woods damage, water absorption rate, mangrove*

I. INTRODUCTION

Mangrove forest is a main ecosystem supporting many lives in littoral and sea areas. It has several ecology functions to provide nutrients for various sea biota, care for sea creatures, protect from abrasion, shield the sea side from hurricane and tsunami, absorb wastes, and prevent water intrusion to land. In addition, mangrove forest also has several economic functions such as provides woods, leaves for traditional ointments, and others (Dahuri, 2001).

Considering the importance of mangrove forest for the balance of littoral ecology, the existence of mangrove forest needs to be protected. The development of mangrove forest function as a protector of an environment sustainability is done by maintaining and even improving the existence including its wide and also its ability as wind and wave shield, wastes filter, and a habitat for numerous sea creatures like shrimps, fish, crabs, etc (Theo, 2010).

North Mollucas Province, especially West Halmahera regency including Jailolo is one of areas that has a wide potential mangrove forest. The width of the mangrove forest in Jailolo, based on Landsat Image 7 ETM+ in 1990, 2001, until 2007 and also based on the field verification result in 2010, was 625 ha. Based on the data, it is obtained that the width has decreased into 533 ha in 2013. It means that within 3 years the mangrove forest decreases 92 ha. This decreasing is caused by many factors, such as the local people activities around the forest (BP DAS Akemalamo, 2010).

Based on the survey conducted by Tolangara and Sundari (2013) in Jailolo, West Halmahera, related to the mangrove composition in this area, it is found that there are 7 types of mangrove vegetation composing the mangrove forest. The vegetation are *R. apiculata, Soneratia caseolaris, B. gymnorrhiza, X. moluccensis, O. octodonta, Aviccenia lanata and Finlaysonia maritima*. Out of the seven types of mangrove vegetation, many local people especially those who live near sea, tend to utilize four types of mangrove vegetation, namely *R. apiculata, B. gymnorrhiza, X. moluccensis,* and *O. octodonta*. These four mangrove trees are used to construct boats or parts of boats. The woods are obtained by cutting the mangrove trees.

The utilization of the mangrove woods by the local people to construct boats or parts of boats is reasonable, since those mangrove woods are considered strong, hard, and durable. The constructed boats must be used every day, and whenever the fishermen go home from sea, the boats must be anchored 10-30 m from the sea side. Thus, it makes the outer body of the boats immersed into sea water and are possible to get damaged. The woods damage of the boats shows that the durability of the woods is low. It is in line with Da Costa, Rudman, and Gray's (1985), Backer's (1975) in Tarumingkeng (2007) explanation that woods durability level is a level in which a certain wood might endure from wood attacker organisms. A particular wood that endure from the wood attacker might also endure from borer animal attack. There is a notion that the heavier the woods the more endure the woods. Yet, based on some finding on some studies, the key factors that determine the durability of woods is the existence of extractive substances which functions as poisonous substance. Extractive substance which might be poisonous for a certain organism, might not affect to other attacker organisms. Thus, the natural durability of woods is relative, depends on the organisms that attack, and mostly it depends on the location of the woods. A factor that causes woods damage can be seen from the water rate that pass through the woods fibre. According the fishermen's understanding, the construction of boat by using mangrove woods will make the boats stronger and more durable. This understanding needs to be proven through an experimental research.

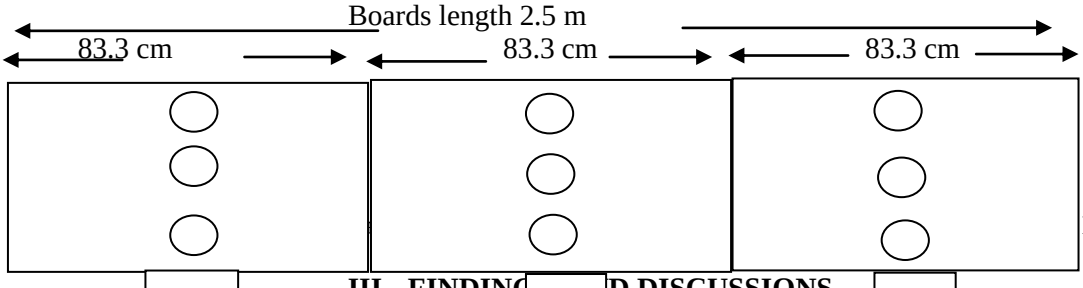
II. RESEARCH METHOD

The study was conducted by employing an experimental method. The type of mangrove woods experimented in this study were *R. apiculate* (soki*), B. gymnorrhiza*(dao), *O. octodonta* (pos-pos bo), and *X. moluccensis* (buah kira-kira). The experimental study was conducted in Tuada village sub district of Jailolo, West Halmahera because there is a wide area of mangrove forest in this village and the local people tend to used mangrove woods to make boats.

The circumference of the cut down mangrove trees for the purpose of this study was about 200 cm; all of the woods used have the similar life span. The trees were cut down to be made boards with length 250 cm, width 30 cm, and thickness 4 cm. In this study, the researchers need 8 boards of mangrove woods. The boards were dried for about 1 month, and rubbed by using a sandpaper and painted until the boards were similar to a boat body. The boards were tied and given loads (4 bricks on each board) and also 2 jerrycans as the buoy, so instead of drowning to the sea, the boards would remain floating in sea water. The boards were immersed in sea water in 1 m or 2 m depth. The distance between the boards and the sea side is about 30 m and 50 m. The boards were left in sea water for about 15 months.

The damage observation on each experiment woods were done by using a graduated glass 100 ml and 50 ml water; each water volume were poured on each board to 9 particular spots in order to measure the rate of water absorption. The time measurement of the water was counted by using a stop watch. The data in form of the time of the rate of water absorption on each experiment wood were analysed both quantitatively and qualitatively. The quantitative data were analysed by using anova from computerized software named SPSS 17 for Windows. The results were used to answer the research questions related to the rate of water absorption on each type of woods and the level of woods damage of each experiment wood.

The measurements of each experiment wood were done by measuring the rate of water absorption on the woods in a particular time unit and in every observed area. The measurement was illustrated as Figure 1 below.



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III. FINDINGS AND DISCUSSIONS

Table presents the data of the experimental study in form of the average of the rate of water absorption in time unit on each type of experiment woods.

Table 1. The Data of the average of the water absorption/time unit on each type of experiment woods.

No	Types of Wood (S)	Emergence distances (J)	Emergence depths (K)	Means of repetition of each depth	
				1 (cm/second)	2 (cm/second)
1	(S1)	(J1)	(K1)	12.07	19.23
	(S1)	(J1)	(K2)	12.33	19.07

	(S1)	(J2)	(K1)	15.17	19.57
	(S1)	(J2)	(K2)	15.17	19.57
2	(S2)	(J1)	(K1)	25.10	22.47
	(S2)	(J1)	(K2)	29.60	19.33
	(S2)	(J2)	(K1)	15.13	23.47
	(S2)	(J2)	(K2)	30.17	30.07
3	(S3)	(J1)	(K1)	5.07	5.07
	(S3)	(J1)	(K2)	7.07	6.01
	(S3)	(2J)	(K1)	9.07	5.16
	(S3)	(J2)	(K2)	3.00	5.13
4	(S4)	(J1)	(K1)	79.67	94.00
	(S4)	(J1)	(K2)	90.67	95.33
	(S4)	(J2)	(K1)	80.67	10. 67
	(S4)	(J2)	(K2)	83.33	101.00

Keterangan: S1 = *R. apiculata* wood S2 = *B. gymnorrhiza* wood
S3 = *X. moluccensis* wood S4 = *O. octodonta* wood
J1 = Emergence distance 30m J2 = Emergence distance 50m
K1= Emergences depth 1m K2 =Emergence depth 2m

The above data were analysed by anova to test the rate of water absorption through the experiment woods and the damage level of each experiment wood based on the rate of water absorption in a time unit. The analysis results in form of Duncan Multiple Range Test (DMRT) with the significant level of α 0.05 and the notation were presented in Table 2.

Table 2.DMRT Test of the Effect of Types of the Experiment Woods towards the Rate of Water Absorption on Woods

Types of the experiment woods	Water absorption rate (cm/second)	**DMRT Notation**
3=*Xylocarpus moluccensis*	5,698	a
1=*Rhizopora apiculata*	16,523	b
2=*Bruguiera gymnorrhiza*	24,418	c
4=*Osbornia octodonta*	90,668	d

Sources: A study by A.R. Tolangara, 2014

Based on the above DMRT, it can be seen that the fastest rate of water absorptionon the experiment woods occurs to *X. moluccensis*; the velocity was 5,698 cm/second. It is the fastest rate compared to other types of woods, while the moderate rate of water absorption occurs to two kinds of woods, namely *R. apiculata* and *B. gymnorrhiza*. The slowest experiment woods to absorb water is *O. octodonta*; the velocity was 90,668 cm/detik.

Regarding the rate of water absorption on the experiment woods above mentioned, it can be said that the faster the experiment woods absorb water, the faster the mangrove woods damaged. Based on the above analysis results, mangrove woods that suffer from detriment were divided into three levels, they are: the highest damage level of a mangrove wood which is experienced by *X. moluccensis*, moderate damage level of mangrove woods which can be seen in *R. apiculata* and *B. gymnorrhiza*, and the last one is the lowest damage level of mangrove wood, or it might be said that there was no single damage, experienced by *O. octodonta*.

Based on the test result of the rate of water absorption on each type of experiment woods, it can be seen that the damages of each wood are different. The faster the water emerges a particular wood, the most damages the woods experience. It is in line with Muin, et al.'s (2012) explanation that woods detriment might be caused by physical factors such as humidity and water. A wood that is immersed in water can also be damaged since its extractive substances contained inside the wood might be entangled, so the woods durability lessen and the wood can be easily damaged.

The damages experienced by the experiment woods is assumed to be closely related to the wood fibre structures. Gropingly, the researchers found that a type of wood named *X. moluccensis* has a rough fibre structure, besides it is also quite light. This kind of wood structure is assumed as having low durability and sustainability so it is easily destroyed. Through the same act, the researchers found that mangrove woods named *R. apiculata* and *B. gymnorrhiza* both have a rough fibre structure, the fibre cells are not tight, and both are quiet heavy to be lifted. Mangrove woods with such characteristics are also easily destroyed. The mentioned

conditions were different from that of *O. octodonta* which has a smooth fibre structure, strong, hard, slick, and very heavy to be lifted. Mangrove woods with such characteristics are considered good in terms of the quality and can hardly to be destroyed. Wahyudi (2005) states that the physical characteristics of woods is closely related to the trees' age, in which the older the trees the more solid and harder the woods. In addition, the woods might have a very solid texture and structure of the fibre, these are the characteristics of good woods.

A good quality wood is generally hard in nature, has smooth texture, slick, and endure to borer animals, like *O. octodonta.* Muslich and Sumarni (2008) explain that a durable wood is usually out of sea borer organisms attack. Southwell and Bultman (1971) state that a wood might be extremely durable since it contains silica. When the wood is placed in a wet condition, the silica will decreases and the wood will be easily broken.

Muslich (1988) states that the amount of silica in a wood might increase its sustainability, yet it does not only depend merely on the silica, but also on the wood's density and the amount of the extractive substance. Similarly, Kathiresan (2001) also states that a mangrove wood type *O. octodonta* is rich of phenolic compound, which makes the mangrove wood more sustainable and durable even in sea environment, while other types of mangrove woods poor of phenolic compound, which contributes to the detriment of the woods.

Based on the experimental study, especially on the data analysis result related to the experiment woods damages for being immersed in sea water for about 15 months and the above discussions, it can be assumed that the damage level of *X. moluccensis* is the highest. It is significantly different from the damage level of *R. apiculata, B. gymnorrhiza,* and *O. octodonta.* Based on this findings, the most logic factual impact is that *X. moluccensis* is the easiest mangrove wood to be damaged.

IV. CONCLUSIONS

Based on the result of the study, it can be concluded that:

1. The rate of water absorption of *X. moluccensis* is 5,698 cm/second. It is considered as the fastest water absorption rate compared to that of other types of mangrove woods. The moderate water absorption rate is found in *R. apiculata* and *B. gymnorrhiza*, that is 16,523-24,418 cm/second. Meanwhile, *O. Octodonta* is a kind of mangrove wood that can absorbs water very slowly. The rate of water absorption of this kind of wood is 90,668 cm/second.
2. The highest damage level of mangrove wood occurs to *X. moluccensis*, the moderate damage level of mangrove wood is experienced by two kinds of woods, namely *R. apiculata* and *B. gymnorrhiza*, while the lowest damage level or in other words the most durable mangrove wood is *O. octodonta*.

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