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Willingness to Pay For Mangroves Conservation By The Local Communities in Salut Mengkabong Lagoon, Tuaran Sabah

Andy R. Mojiol[1)], Kuan Yen Hong[2)] & Ejria Saleh[2)]
Faculty of Science and Natural Resources, Universiti Malaysia Sabah, 88999, Kota Kinabalu, Sabah Malaysia. Email: andy@ums.edu.my

ABSTRACT

This research aimed to investigate the Willingness to Pay (WTP) for mangrove conservation of local communities at Salut Mengkabong Lagoon, Tuaran based on the amount of fees imposed on them. The content is based on questionnaire survey provided to local communities from Mangrove Forest Produce (MFP) to their perception in conservation programme. The survey was conducted with a priod of 7 month started from September 2016 until March 2017. Contingent Valuation Method (CVM) was used to calculate the Willingness to Pay (WTP) whereby 100 respondents were asked to complete the questionnaire. From the analysis, it showed that the WTP of local communities were affected by their monthly income. Regression model analysis with WTP = -0.087* (monthly income) + 1.789 has been formed. Whereas, the value of mangrove forest produce (MFP) in Salut Mengkabong Lagoon has been calculated with a total of RM728 for the direct product while for the non-direct products such as crab, bivalves, seashells and fishes cost about RM721 to RM2472 in a year. The study documented mangrove forest contribution to local communities in Salut Mengkabong Lagoon such as timber; *Rhizophora mucronata* and *Avicennia spp,* Seafood; *Scylla serrata*, *Geloina coaxans,* various type of fishes and seashell. From the result, it was hope that this study can promote a win-win situation to both local community and stakeholders to come out with an effective supervision to ensure the long-lasting dependency of local communities to the mangrove forests without undermining their socio-economic wellbeing.

Keywords: Salut Mengkabong Lagoon, Mangroves Forest Produce, local community

INTRODUCTION

Mangroves are dicotyledonous woody shrubs or trees, virtually confined to the tropics. There are 114 species of true mangroves in this world that belongs to 66 genera (Tomlinson, 1986). In Malaysia, there are about 577,500 ha of mangrove forests and the state of Sabah holds the highest mangrove forests area with around 341,000 ha which equivalent to 59% of total land area (Mojiol *et al*., 2011). From that, 281,374.56 ha have been gazetted as Mangrove Forest Reserve Class V, and 57,174.56 ha was gazetted as Virgin Jungle Class VI & Protected Forest Reserve Class I (Sabah Forestry Department, 2014). Sabah's mangrove forests usually found along the north to the east coast Sabah, facing the Sulu-Sulawesi Sea. These mangrove forests cover 73% of its 1800km coastline and extended into estuaries in Klias and

Padas Rivers (Abdul Shukor and Abdul Hamid, 2004).

Mangrove forests that are reserves under class V will provide mangrove timber and other product to meet the domestic demands. There is lack of data regarding species diversity in Sabah. However, in Kota Kinabalu Wetlands, there are more than 12 species of mangrove flora has been recorded which comprises from genus Avicenna, Sonnertia, Rhizophora and Bruguiera. The most dominant species is *Rhizophora apiculata*. In addition, mangrove support more than 90 species of resident and migratory birds, 21 species of fishes, 19 crustacean species, 13 mollusk species, 44 insects' species and 6 reptiles' species, 2 chelicerates species and 1 species of cnidarian can be found here (Guslia *et al*, 2015).

Contingent Valuation Method (CVM) is a technique to find out the economic benefits of non-use values especially nature ecosystem (Alex and Jim, 2015). It is usually done by making a hypothetical valuation in which respondent can value the ecosystem based on the hypothetical scenario that been stated (Carson, 2000). Primary objective of CVM is to find out the maximum value of individual willingness to pay (WTP) or maximum value of individual willingness to accept (WTA). A set of data from respondent demographics such as gender, age, monthly income and family size was use as variables in this method. The aims of this study were to determine the contribution of Mangrove Forest Produce (MFP) to the local communities in Salut Mengkabong Lagoon and their Willingness to Pay (WTP) for conservation of mangrove forest.

MATERIALS AND METHODS

Study Area

Tuaran is located in the west coast of Sabah, Malaysia covers an area of 1,166 km^2 which is equivalent to 116,600 hectares. The Salut Mengkabong Lagoon, Tuaran is a small area in Tuaran division. The whole area consists of seven villages, namely Kampung Tembiluk, Kampung Jembulang, Kampung Buansa, Kampung Mempelam, Kampung Pensurun, Kampung Gerinsing and Kampung Soang Krumuan. Most of the areas located near to Mengkabong lagoon mangrove forest with a GPS location of latitude 6°8.38" and longitude 116°12.04". It is situated 28.9 km and 39 minutes driving from Kota Kinabalu via Sulaman road and consists mostly Bajau's and Dusun's ethnic (Aayati, 2017. pers. com). Kampung Mengkabong is located in the latitude 6° 8' 38.8" and longitude 116° 12' 16.9" with 480 households in that area as shown in figure 1 below. According to Praveena et al., (2008) the Mengkabong lagoon in Tuaran District has experienced a 15% decrease of mangrove forest from 1991 to 2000. In 1991, the mangroves covered about 12.6km^2 while in 2000 it was 10.7km^2. Most of the mangroves have been lost due to the spread of rural development such as housing, aquaculture projects and surrounded by an industrial zone, Kota Kinabalu Industrial Park (KKIP) (Environmental Indicator Report, 2003).

Sampling and Data Collection Method

There are three variables was used in this study such as respondent demography, mangrove product contribution and Willingness to Pay

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(WTP) for conservation. In each village, household sampling was used to get the data. This is done by interviewing the head of the family, Head of the village and representative for Village Development Committee (JKKK). Besides, their daily activities is also been observed using DSLR digital camera.

Questionnaire Survey

The questionnaire survey data collections were done using household convenience sampling with the aid of semi-structured questionnaire. This questionnaire was divided into three parts. Section A which consists of the socio-demographic backgrounds such as gender, age, ethnic group, monthly income, number of people in a house and their origin. The second section, B is made up of the question regarding mangrove forest produce (MFP) and its contribution such as forest dependency, frequency collection of mangrove's products and the importance of mangrove forest product in term of products and uses to the local community. While section C consisting of the community perception and their willingness to pay (WTP) for mangrove conservation at Mengkabong lagoon mangrove forest based on monetary value.

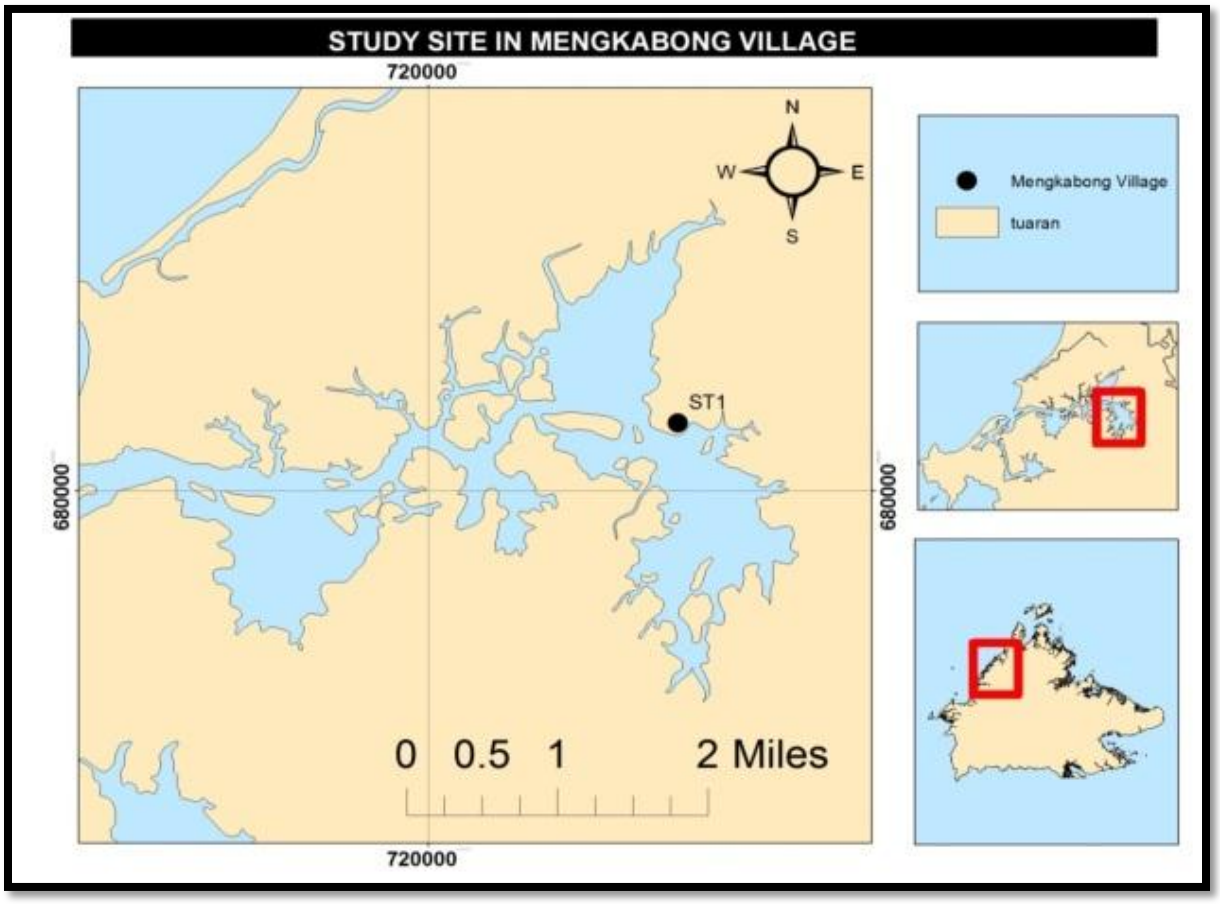

Figure 1. The location of study area in Mengkabong lagoon where started at Station 1 (ST1)

Interviews and Observation

The interviews approach was done by interviewing the head of the family, head of the village and the representative for Village Development Committee (JKKK). The interviews were conducted in Bahasa Malaysia with the aids of a translator if the respondents can't hardly speak in Malay or prefer to use their native languages. Whereas, observation on the daily basis activities of the local communities in the aspects of dependency to mangrove ecosystem was observed and recorded through the DSLR camera.

Data Analysis

Descriptive analysis was used to get the data about respondents demographic and the willingness to pay. Other than that, regression analysis was also run to analysis their willingness to pay (WTP) using SPSS software. A set of data from respondent demographics such as gender, age, monthly income and family size were use as variables in WTP analysis. The R^2 analysis was used to measures the goodness of a general linear model to fit in a set of data. The R^2 value was between 0 and 1. If the R^2 value is closer to 1, the variables are significant and vice versa (Rohana *et al*, 2013). The formula of WTP model is;

$WTP_¡ = a + b1 + c2 + d3 + e4 + \varepsilon_¡$
Whereas:
a, b1, c2, d3, e4 = variables
εi is a random error, assumed to be normally distributed with mean zero and common variance σ^2 $\varepsilon i \sim N(0,\sigma^2)$.

Besides that, the free listing technique by the respondents was also used to determine the contingent valuation (CV) of important of mangrove product economic benefits either by the non-forest product within mangrove ecosystem or the forest product itself. The free listing technique can be divided into five points as shown in Table 1 below. The value were calculated using following equation variables such as the cost of the product until the amount of product obtained. If they sell the product, the market price was implemented but if for personal usage, the surrogated price was used (Mojiol *et al*, 2016).

The equation of MFP value = Total net income from the use of local communities.

MFP value = $\sum P_¡Q_¡-C_¡$,
Where:
$P_¡$ = Price of the product
$Q_¡$ = the amount of product obtained
$C_¡$ = the cost of obtaining the product

Table 1. The free listing technique for the dependency of local communities to the mangrove product

Ranking Point	Dependency/ Perception
1	Strongly Not Depend/ Important/Frequent
2	Not Depend/ Important/Frequent
3	Medium Depend/ Important/Frequent
4	Depend/ Important/Frequent
5	Strongly Depend/ Important/Frequent

RESULTS AND DISCUSSION

Mangrove forest produce (MFP) based on respondents' opinion

Figure 2 shows the importance of mangroves forest based on the respondents' opinion in Mengkabong

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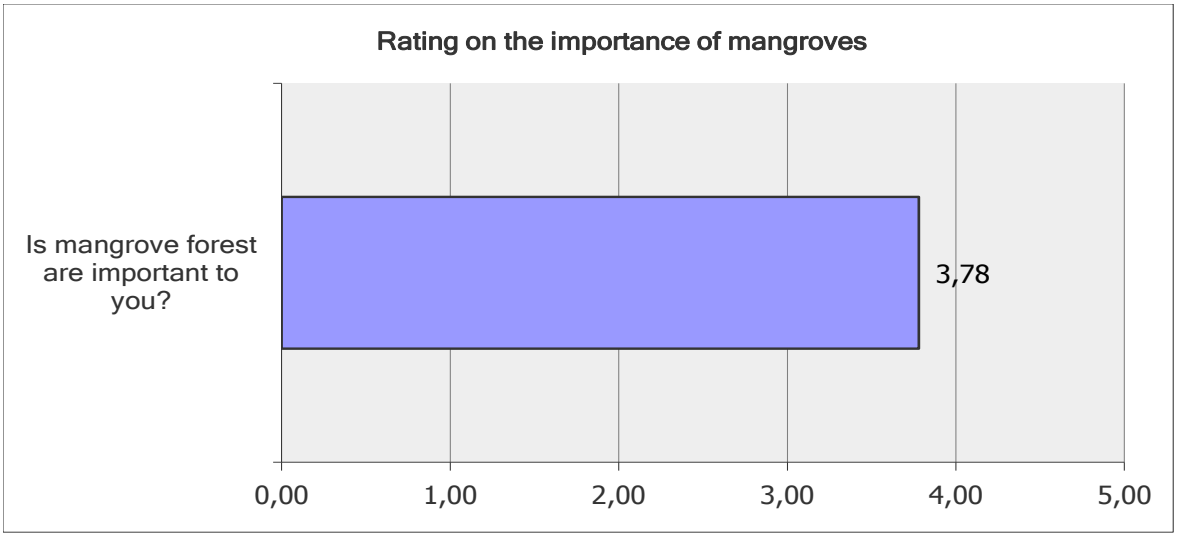
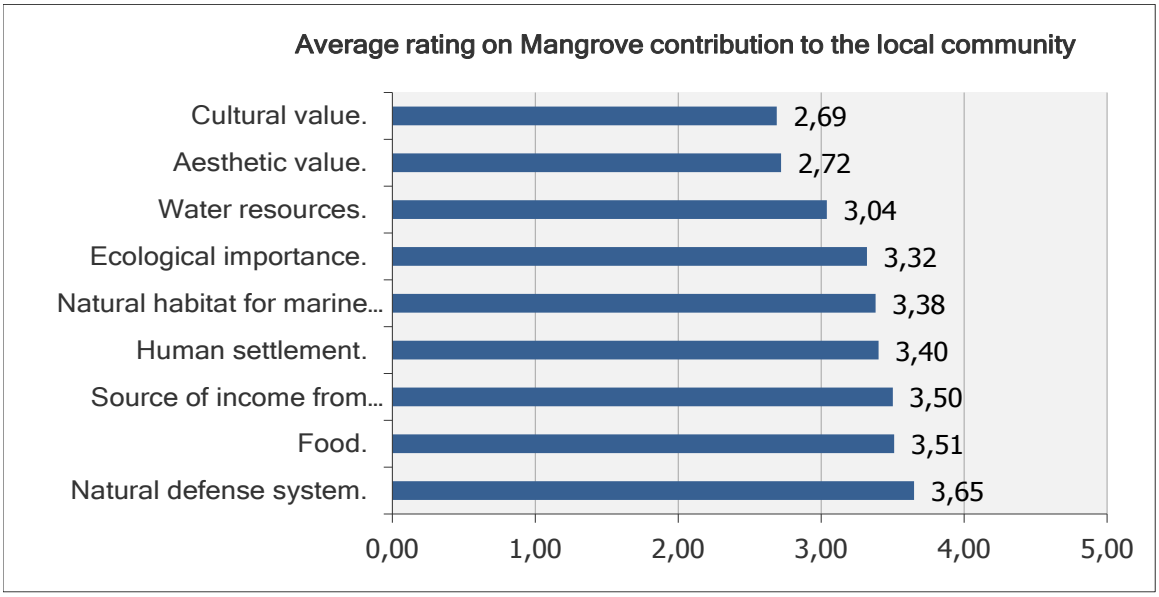
Lagoon mangrove forest, Tuaran. From the graph below, we can conclude that overall rating average is 3.78. This shown that the mangroves forests were important to the villagers.



Note: *1=Strongly not important; 2=Not Important; 3=Medium; 4=Important; 5=Strongly Important*

Figure 2. Overall rating importance of mangroves forest



Note: *1=Strongly not important; 2=Not Important; 3=Medium; 4=Important; 5=Strongly Important*

Figure 3. The average rating on mangrove contribution to the local community

This analysis shown the mean score for villagers in Salut Mengkabong Lagoon, Tuaran based on the classifications. From the figure above, it can conclude that respondents depend highly on mangroves for natural defense system with mean score 3.65. This is because their houses were located along the lagoon and easily get flooded during extreme high tide and monsoon. Mangroves also help to sustain food sources to the community such as fishes, shrimp and other seafood's 3.51 score while the lowest mean recorded, showed that mangroves was less important in providing aesthetic value that 2.72 and cultural value 2.69 as opined by the respondents.

Value of mangrove = Total net income from the use of local communities =
$\sum P_i Q_i - C_i$,
where;
P_i = Price of the product
Q_i = the amount of product obtained
C_i = the cost of obtaining the product

The analysis of contingent valuation as shown in Table 2 above displays the prices for both *Rhizophora mucronata* and *Avicennia spp*. are the same, RM 728. These mangroves species involved in domestic and construction such as aquaculture piling, fuelwood, building house, bridges and even to repair their boat. In a year, they collected about 104.00 kilograms of mangrove trees for their usage.

Table 2. The Contingent Valuation Method Analysis

Product	Scientific name	Uses category	Price per kilogram, RM (Pi)	The amount of product obtained per year, kg (Qi)	The cost of obtaining the product, RM (Ci)	Estimate Value of mangrove (RM)
Bakau kurap	*Rhizophora mucronata*	Co; Fl Do*	7.00 per kg	104.00	N/A**	728
Bakau api-api	*Avicennia spp.*	Co; Fl Do*	7.00 per kg	104.00	N/A**	728
Crab	*Scylla serrata*	Fd*	5.00 per kg	156.00	N/A**	780
Bivalve	*Geloina coaxans*	Fd*	3.50 per kg	206.00	N/A**	721
Fishes	Various species	Do; Fd*	5.00-12.00 per kg	206.00	N/A**	1030-2472
Seashell	Various species	Fd*	2.00-5.00 per kg	206.00	N/A**	412-1030

*Notes: Construction (Co), Domestic (Do), Fuel (Fl), Foods (Fd), Not Available (N/A)
**Notes: All products was taken on their own and without cost

Mangrove Forest Produce (MFP) utilization and Contingent Value

The value of the mangroves can be calculated by using formula as below:

In term of non-direct products, fishes and seashells are more valuable compared to the crab and bivalves. This is due to the amount of product obtained per a year, as an example, one respondents managed to

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collect 206.00 kilograms of marine fishes which cost around RM 5.00 – RM 12.00. Seashells and bivalve weighted the same but their prices are vary. Thus, this makes the seashells more valuable than bivalves.

Opinion on Willingness to Pay (WTP) for Mangroves Conservation

It showed that 20 respondents were willing to pay for the conservation of mangroves forest while another 80 respondents disagree to it (Figure 4).

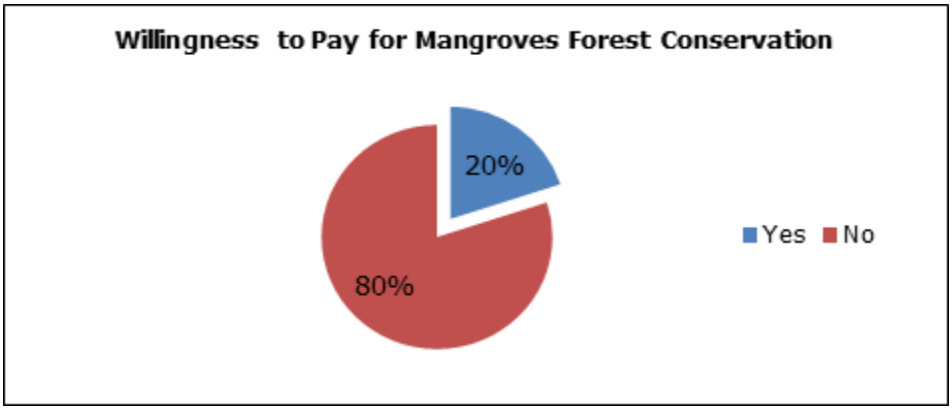

Figure 4. The respondent's Willingness to Pay (WTP) for mangroves forest conservation

Respondents opined that the mangroves forest can sustain for a long period of time and it can rehabilitate naturally by it self. While for conservation such as replanting and seed planting were not a necessary. In addition, few of them said that villagers did not take much mangrove product such as timber from that area. Thus, it will not destroy the mangroves. However, those 20 respondents that agree to pay were because they wanted to improve their residential areas and surrounding mangroves so that younger generation was able to feel the aesthetic value of mangroves. Most of them are more educated and work in various government organization.

Regression Analysis for Willingness to Pay (WTP)

From the analysis, the R^2 indicate the value of 0.187 (18.7%) of the variance and R value is 0.432, in the dependent variable is explained by a moderate correlation (See table 3). Based on the analysis, it can be conclude that the Willingness to Pay (WTP) of the local communities was solely depended on monthly income with a significant value* of $P < 0.05$ (See Table 4).

Whereas, based on Yamano (1985), the regression model analysis for willingness to pay equation can be derived as a model that was shown as: WTP = -0.087* (*Monthly income*) + 1.789, whereas the p-value of the factors are monthly income ($p = 0.020$).

Table 3. Model summary of the regression analysis

Model	R	R Square	Standard Error of the Estimate	F
WTP	0.432	0.187	0.4537	2.616

Table 4. Regression analysis on the willingness to pay

Model	Unstandardized Coefficients		Standardized Coefficients	
	B	Standard error	Value of t	Significant value
Constant	1.789	0.447	4.023	0
Age	-0.072	0.088	-0.816	0.417
Ethnic group	-0.020	0.034	-0.592	0.555
Educational	-0.045	0.041	-1.105	0.272
Occupation	0.022	0.042	0.516	0.607
Monthly income	-0.087	0.037	-2.370	0.020*
Marital status	0.056	0.109	0.516	0.607
Family size	0.013	0.058	0.218	0.828
Period of settlement	0.031	0.047	0.660	0.511
Type of ownership	0.059	0.073	0.798	0.427

*Note: The significance value is at $p<0.05$

CONCLUSION AND RECOMMENDATION

As a conclusion, the natural defense system is rated as the most important function of mangroves forest with the mean score 3.65 (*as medium important*) in Mengkabong lagoon mangrove forest. The respondents' Willingness to Pay (WTP) is only 20% from the total respondents while the other 80% opposed to it. The WTP of local communities were affected by their monthly income and a regression model analysis with WTP = -0.087* (monthly income) + 1.789 has been formed. The value of mangrove forest produce (MFP) has been calculated with a total of RM728 for the direct product while for the non-direct products such as crab, bivalves, seashells and fishes cost about RM721 to RM2472 in a year. The idea from this economic valuation, as proposed of WTP payment scheme is a new ideas for most of the respondents' and most of them think that the mangrove conservation program is still unimportant and very low. Other recommendation in this study whether, it is to think on the other way round by meaning if giving a payment scheme to the respondent for their effort in a conservation program, are they agree to be involved in this program?.

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