DETERMINATION OF FACTOR IN WILLINGNESS TO PAY FOR FIREFLY CONSERVATION IN KUALA SELANGOR, MALAYSIA USING CONTINGENT VALUATION METHOD

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ABSTRACT

Firefly is an ecotourism icon in Kuala Selangor, Malaysia and benefits the local community, especially as a source of income. The beauty of fireflies in producing light has made firefly watching activities increasingly popular around the world. Unfortunately, land conversion to agriculture activities and oil palm plantation has caused their habitat loss. Firefly was categorized under non-market value, which by using WTP concept, it able to estimate the economic value of firefly conservation. Therefore, a face-to-face interview to identify factors that affect Willingness to Pay (WTP) for firefly conservation in Kuala Selangor, Malaysia. Double Bounded Dichotomous Choice (DBDC) and an open-ended survey were conducted involving 330 visitors of Kampung Kuantan Firefly Park. The logit regression model, specifically the Contingent Valuation Method (CVM), was applied to investigate the factors that determine the visitors WTP. The results indicate that the WTP of visitor's was significantly influenced by initial bid level, age, household number, income, awareness, attitude and perception. The findings of the study are capable of helping policymakers and the Kuala Selangor District Council to design and improve a more efficient strategy to conserve the firefly population for the future.

Keywords: Contingent valuation method, willingness to pay, firefly, conservation

ABSTRAK

Kelip-kelip adalah ikon ekopelancongan di Kuala Selangor, Malaysia dan memberi manfaat kepada penduduk tempatan, terutama sebagai sumber pendapatan. Keindahan kelip-kelip dalam menghasilkan cahaya telah menjadikan aktiviti melihat kelip-kelip semakin popular di seluruh dunia. Malangnya, pertukaran tanah kepada aktiviti pertanian dan ladang sawit telah menyebabkan kehilangan habitat mereka. Oleh itu, temu ramah secara bersemuka dilakukan untuk mengenal pasti faktor yang mempengaruhi Kesanggupan Membayar (WTP) untuk pemuliharaan kelip-kelip di Kuala Selangor, Malaysia. *Double Bounded Dichotomous Choices*

(DBDC) dan tinjauan terbuka dijalankan yang melibatkan 330 orang pelawat di Kampung Kuantan *Firefly Park*. Model regresi logit, khususnya Kaedah Penilaian Kontinjen (CVM), diterapkan untuk menyelidik faktor-faktor yang menentukan WTP bagi pelawat. Hasilnya menunjukkan bahawa WTP pelawat dipengaruhi secara signifikan oleh nilai bid awal, umur, jumlah isi rumah, pendapatan, kesedaran, sikap, dan persepsi. Hasil kajian ini dapat membantu para penggubah dasar dan Majlis Daerah Kuala Selangor untuk merancang dan menambahbaik strategi yang lebih cekap untuk memulihara populasi kelip-kelip untuk masa depan.

Kata kunci: Kaedah penilaian kontinjen, kesanggupan membayar, kelip-kelip, pemuliharaan

INTRODUCTION

Malaysia is a country with a developing economic status, but it is not in line with the conservation and protection of declining biodiversity resources (Mohd Shahwahid et al. 2016). The introduction of the firefly in tourism attractions started since 1980 (Syed et al. 2001) and it is an important species, not only for the economic benefits of the locals but also as a symbol of ecotourism in the Southeast nation (Sartsanga et al. 2018). Firefly is a small beetle that displays flashes of light synchronously while congregating in large number on certain trees and it consists of more than 2000 species (Nada & Kirton 2004). Flashing has been found to occur in colonies of the firefly, which were uniquely recorded to be most widespread in the region of South-East Asia (Hogarth 1999). It has also been discovered that certain species of firefly such as *Pteroptyx tener* will only mate in a particular habitat that is dominated with Berembang tree, *Sonneratia caseolaris* (Nada et al. 2012).

According to Hazmi and Sharifah (2017), the main habitat for fireflies is the Berembang tree (*S. caseolaris*) which is vegetation for mangrove forests. Mangrove has the most productive ecosystem on earth (Das & Crepin 2013), and it is also essential to humans in terms of economic, ecological, and social value. However, the firefly population in Kuala Selangor, Malaysia is declining due to land-use change to shrimp farming, oil palm plantation and water pollution (Sharmilla 2010). In addition, due to the exclusive behaviour and specified preference for the mating environment, fireflies have been threatened from destruction and pollution on its habitat (Mahadimenakbar et al. 2009; Wan Jusoh et al. 2010). Lewis et al. (2020) attributed the factors such as habitat destruction, use of artificial light, and pesticides in agriculture. Although, globally, the firefly has been neglected in its conservation efforts relative to other invertebrate groups.

The conservation of fireflies is an essential sign of appreciation by human for the value of fireflies and its habitat. Conservation value serves to create awareness on the need for decisions to optimize proper ecosystem resource management (Amiri et al. 2015). The valuation is included in the hypothetical scenario in the absence of price and its value can be estimated using the Contingent Valuation Method (CVM). This economic value is a benchmark for awareness to conserve nature (De Groot et al. 2012). Also, CVM is a technique used to place prices for non-market goods or services of ecosystems (Ajzen & Driver 1992), including insects and wildlife. In the CVM survey, respondents will be asked about Willingness to Pay (WTP) to improve goods or services of the ecosystem and the answer only consists of ‘Yes’ or ‘No’.

According to Rasul (2009), the main method used to determine Willingness to Pay (WTP) or Willingness to Accept (WTA) for goods and services of the ecosystem is CVM. The advantages of accurate estimators have popularised the CVM method in the valuation of the

ecosystem, despite its share of criticism. Economic value is an essential measure of an ecosystem in terms of human resources, as the ecosystem can be a source of income that provides various benefits through services and goods to the community. This valuation is crucial when the market neglects to give it a certain price or market (Newcome et al. 2005).

WTP is a concept introduced to determine consumer's preference to pay for the demand for goods and services (Wertenbroch & Skiera 2002). The estimation of WTP plays a major role in defining economic value for the conservation of the ecosystem, and it can be derived from three major valuation methods – CVM, Conjoint Analysis and Choice Experiments (Emerton & Bos 2004). Brander and McEvoy (2012) state that each method has different ways for assumption and each will be dependent on the situation of the study. Common WTP assessment uses preferences approach, indicated via the survey method. This assessment will make it easier to estimate use and non-use values of ecosystem service based on personal acceptance (Rambonilaza & Dachary-Bernard 2007). According to Langford et al. (2001), people are willing to pay when natural resource conservation provides benefits to the community and future generations, especially in socio-economic aspects.

Previous studies have used CVM to derive the economic value of the ecosystem resources. For example, Kamri (2013) carried out research based on WTP value of environmental conservation in Gunung Gading National Park using CVM. The WTP value was RM16.14 for international visitors and RM7.38 for the local visitor. These WTP values were influenced by several factors such as gender, education level, and income. In another study that aimed to determine the WTP of conservation fee in Matang Mangrove Forest Reserve in Perak, Fatin (2017) found that the visitor's WTP was valued at RM17.60 and four variables that significantly influenced WTP, notably ethnicity, marital status, pay, and income. For the fisherman, the value was RM8.38 and it was influenced by income and ethnicity. Besides, Jin et al. (2018) also used WTP to estimate the value of marine turtle conservation in China and found that the value of WTP was USD 1.22 per household per month which was influenced by bid value, household income, and years of education.

The economic value will provide guidance to the Kuala Selangor District Council (KSDC) to strategize their action in ensuring the sustainability of resources in the mangrove area with the purpose of directly protecting the firefly. It is also useful in ensuring sustainable forest management to meet the needs of future generations (Zaiton et al. 2012), as well as a guide to assist management in generating funds from various sources. Although these valuations may not be adequate to guarantee the ecosystem or absolutely be free from extinction, they can assist in finding alternatives in improving the management practices and policies on the ecosystem in order to maximize the benefits (Carrasco et al. 2014). Thus, this study applied CVM integrated with the WTP concept to estimate economic value of conserving fireflies and their habitat and to determine the factor influenced WTP.

Limited research has been done on the estimation of WTP and influencing factors in the conservation of firefly and its habitat. Therefore, the main objective of this study is to investigate factors influencing WTP on firefly conservation in Kuala Selangor. This is a critical issue since knowledge on the factors determining WTP can be used to design a proper development of an effective strategy to maintain the sustainability of the firefly population.

MATERIALS AND METHODS

Study Area

The study was conducted in Kampung Kuantan Firefly Park (KKFP), Kuala Selangor, Selangor, Malaysia. Kuala Selangor is hugely famous with firefly watching activity (Nada 2015) since 1980 (Syed et al. 2001) with the potential for commercialization as a tourism attraction. There is a mangrove area located approximately 20 km from the upper reaches of the Selangor River. It is partly converted into agricultural and municipal areas (Jamil & Suzana 1997). This mangrove forest has a crucial value as the habitat of the firefly, wildlife conservation, and ecotourism revenue for the tourism industry in Malaysia. Although several other areas have firefly attractions in Malaysia, KKFP was selected as a study area mainly because it is hugely famous compared to other areas (Nada 2015) and has been operating for over 40 years.

Sampling and Data Collection

This study consists of primary and secondary data. The primary data were collected using a questionnaire from the survey via face-to-face interviews with visitors. Stratified sampling was used in sample selection. The target respondents are visitors of international and domestic of KKFP. Stratified sampling is the division of population groups into small groups that share characteristics (Sharma 2017). It differs from purposive sampling in that it only selects samples through a number of predefined features (Zikmund et al. 2013). The questionnaire was divided into four sections: (A) the socio-demographic characteristics, (B) awareness, (C) perception, and attitude of firefly conservation, based on a 5-point Likert-type scale for assessment where 1 represents “strongly disagree,” and 5 was “strongly agree”. Section D pertains to WTP for firefly conservation.

The total number of visitors to KKFP in 2018 is 57,368 (Kuala Selangor District Council 2019). The information obtained was utilized as secondary data. Based on the total population, a total of 330 respondents were selected to undergo a face-to-face interview, specifically 330 visitors of KKFP. Before the actual survey, a pilot study was conducted in the study area which involved 30 respondents. It is considered as a rehearsal of the actual study and helps in ensuring the study runs smoothly and determines the reliability of the questionnaire (Chua 2011).

This study applied DBDC because it is more effective to elicit WTP than Single Bounded (Hanemann et al. 1991). The previous study by Krishnan et al. (2017) indeed used DBDC in CVM to estimate the economic value of the watershed protection function of the Langat Basin. CVM is a flexible, simple method (Ciriacy-Wantrup 1947) to evaluate goods or services that do not have a market price. It is conceptualized as to the question of how much are willing to pay directly to individuals for the conservation of natural resources at present or otherwise (Amiri et al. 2015). This study uses Double Bounded Dichotomous Choices (DBDC), which depends on the initial bid response. For example, are you willing to pay RM3 to conserve firefly in Kuala Selangor? When the answer is 'Yes', the bid value will increase to RM5, and if 'No' the bid value will decrease to RM1.The set of prices used in this study consisted of RM1, RM3, RM5, RM7, and RM10. The data collected were analysed using STATA software version 14.2 to identify the parameters of the logit regression model.

Logistic Regression Model

The dependent variable in this study elicited ‘Yes’ or ‘No’ as a response to the conservation fund for firefly conservation. Logistic regression was utilized to examine the relationship

between dichotomous characteristic of dependent variables i.e., WTP and independent variables such as income, age, and gender. Pampel (2000) states that the logistic regression model is an "S" shape distribution function, and the dependent variable is not necessarily normally distributed. According to Hanemann et al. (1991), the estimation probability is

$$\mathbf{P_i = 1 / [1 + \exp(-\alpha - \beta X)]}$$

Where, P_i = the probability that the event A occurs and α = the coefficient on the constant and β = the coefficients on variables, A and X = the explanatory variables (Age, Gender, Income, Level of education, Occupation, Awareness, Perception, Attitude). The exponential function (exp) is a standard logistic distribution.

Table 1. Summary of the variables used in the survey

Variable	**Descriptions**
WTP	Willingness to pay, 1=willing to pay, 0=not willing to pay
BID1	First bid value (Five set of bid offer: RM1, RM3, RM5, RM7 and RM10)
WTP1	The answer for first bid offer, 1=Yes, 0=No
BID2	Second bid value, follow-up bid assigned: RM0.50, RM3, RM5, RM7, RM10 and RM12
WTP2	The answer for second bid offer, 1=Yes, 0=No
Gender	Gender (1=Male, 0 =Female)
Age	Age of the respondent (Years)
Status	Marital status, 1=Single, 0=Married
Householdno	Household number
Education	Level of education, 1= Informal school, 2= Primary school, 3=Secondary school, 4=Certificate, 5= Diploma/Degree, 6=Master/PhD
Occupation	1=Government, 2=Private, 3=Business, 4=Student, 5=Housewife, 6=Retired, 7=Self employ
Income	Household monthly income (RM)
Awarenessmean	Mean of awareness
Attitudemean	Mean of attitude
Perceptionmean	Mean of perception

This model adopted for logistic regression analysis. The variables used in this survey were listed in Table 1.

Visitors Model: First bid value + all variables (Table 1) for visitors

$$WTP = 1/ \{1 + \exp [-(\alpha + \beta 1 BID1 + \beta 2\ BID2 + \beta 3\ WTP1 + \beta 4\ WTP2 + \beta 5\ Gender + \beta 6 Age + \beta 7 Status + \beta 8 Education + \beta 9 Occupation + \beta 10 Income + \beta 11 Awarenessmean + \beta 12 Attitudemean + \beta 13 Perceptionmean + \beta 14 Householdno]\}$$

RESULTS AND DISCUSSION

Table 2 summarized the socio-demographic profiles of the respondents for this study. The gender composition of the visitors who participated in this study comprised of 58.5% female. More than half of respondents were married, averaging from 31 to 40 years old. The household size had an average of three to five persons. Among the respondents who possessed higher education, with about 61.8% were reported to hold a diploma/degree. In terms of occupation, most respondents (45.8%) have a career as a private staff. The income level of respondents comprised of 19.1% earning more than RM5000 per month.

Table 2. Socio-demographic characteristics

	VISITORS (N=330)	
Gender		
Male	137	41.5
Female	193	58.5
Marital status		
Single	155	47
Married	175	53
Age (years)		
20 & below	6	1.8
21-30	142	43
31-40	112	33.9
41-50	42	12.7
51-60	22	6.7
61-70	5	1.5
More than 70	1	0.3
Household size		
1	50	15.2
2	57	17.3
3 to 5	167	50.6
6 to 8	51	15.5
9 & above	5	1.5
Education		
Informal School	5	1.5
Primary School	6	1.8
Secondary School	38	11.5
Certificate	20	6.1
Diploma / Degree	204	61.8
Master / PhD	57	17.3
Occupation		
Government Staff	66	20
Private Staff	151	45.8
Business	44	13.3
Housewife	17	5.2
Retired	7	2.1

Self-Employ	45	13.6
Monthly Income (RM)		
1000 & below	25	7.6
1001-2000	44	13.3
2001-3000	52	15.8
3001-4000	31	9.4
4001-5000	27	8.2
More than 5000	63	19.1

Determinants of Factors Affect Willingness to Pay

The estimation of mean WTP for visitor was RM12.93 per person per year, which slightly higher to the entrance fee of KKFP. Meanwhile, Table 3 showed factor that determines visitors WTP for the conservation of fireflies and habitats. Based on results, more than half of the variables have significant differences ($p < 0.05$) against WTP. The bid price has a negative relation with the WTP. The higher the bid value proposed, the higher the probability of the respondent to reject it and this is in line with the study by Fatin (2017), Kaffashi et al. (2015); Mamat et al. (2013) & Kaffashi et al. (2011). Meanwhile, the age, household number, income, awareness, perception and attitude positively and significantly influenced the initial bid offered. Thus, it indicates that older visitors were more willing to pay compared to the younger age class. According to Surendran and Sekar (2010), elderly people usually make their contribution to the future with making the conservation of natural resources as a satisfaction to conciliate their past life. Also, age is usually significantly related to WTP as found by Adamu et al. (2015) and Lan et al. (2015). The household number has a positive relationship and is significant at 10%. This is in accordance with the study of Kamaludin et al. (2017) who found that when the household number increases, the willingness to pay for conservation also increases. Also, respondents with high income were willing to pay more for firefly conservation, and Kamri (2013) attributes income as a factor that influences WTP. The relationship between incomes towards WTP is positive, where visitors with a high level of income tended to accept the proposed bid. Previous study by Fatin (2017) has indeed proved that the income level affects the WTP for Matang Mangrove Forest Reserve in Perak, Malaysia. According to Lalika et al. (2017), individual with high income can bear the basic cost of living including for conservation activities.

Next, the awareness was positively related to WTP; respondents who have a high awareness of protecting the environment are willing to pay more to conserve fireflies. According to Abd Rahman and Asmawi (2016), awareness for biological and economic is important for issues related to the environment, especially in improving the quality of the environment. Studies on tourist's WTP for biodiversity conservation and environment protection in Dalai Lake protected area concluded that age, gender, household number, and visitor's awareness had influence on WTP (Wang & Jia 2012). The visitor's attitude has a positive sign, showing that respondents supported the conservation of fireflies in Kuala Selangor. Jin et al. (2018) also found that the respondent's attitude was the determinant factor of WTP. Lastly, positive perception significantly influenced the WTP. Respondents who perceive positively are willing to pay more for conservation interests. This is linear with the finding by Faisal et al. (2019). According to Ashaari and Johari (2016), the more positive the individual perceived, the higher the sense of sympathy for the fauna and support for conservation efforts.

Table 3. Interaction for logit regression models

Variables	**Std. Err.**	**P> |z|**
_cons	3.372	0.006***
Bid1	0.066	0.048**
Gender	0.426	0.913
Age	0.033	0.018**
Marital Status	0.500	0.116
Household no.	0.076	0.060*
Education	0.249	0.691
Occupation	0.107	0.241
Income	0.000	0.002***
Awareness	0.247	0.003***
Attitude	0.564	0.044**
Perception	0.228	0.004***
Pseudo R^2	0.224	
Log likelihood	-85.520	
No. of obs (n)	330	
Mean WTP	12.93	

Notes: ***significant at 1%, **significant at 5% and *significant at 10%

CONCLUSION

This study was designed to investigate the factors that may affect the WTP for firefly conservation in Kuala Selangor. Based on the findings, the estimated WTP value for the visitor's WTP valued at RM12.93, which was consistent with the fees (RM12.50) imposed by KSDC. As a suggestion to KSDC, the entrance fee can be increased and set aside RM1 from the fee for the conservation fund. The funds able being used for activities related to firefly conservation in Kuala Selangor in the long term. For example, the number of visitors to KKFP in 2018 was 56378 according a report by KSDC in 2019, if a total of RM1 had been taken from each individual present, approximately RM56,378 of conservation funds would have been available to support firefly conservation efforts.

There were seven variables that were significant against WTP namely initial bid, age, household number, income, awareness, attitude, and perception. The level of income awareness and perception of each respondent is highly important, as evidenced by the highly significance on WTP at 1%. When individuals have high levels of income, awareness and positive perception, will make a positive contribution to the protection of natural resources. The results also discovered that there are other motivations that encourage the respondents willing to pay for nature, which is to preserve the mangrove area and biodiversity in the KKFP. The present study further revealed that the main reason for the respondents not willing to pay was because they felt the responsibility of financing the conservation effort should be borne by the government.

In conclusion, the WTP value being as a guideline to KSDC on suitable fees to be charged that will satisfy the visitors, and this guideline will further enhance the efficiency of the management system. Besides, the findings also help the government to develop a conservation policy that ensures the sustainability of firefly by providing provisions and laws

in protecting it. The outcomes of this study add new information to academicians regarding firefly conservation, as seen from the perspective of the economic evaluation.

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