ASM Sc. J., 11, Special Issue 3, 2018 for SANREM, 74-78

Economic Valuation of Tasik Chini Biosphere Reserve, Pahang, Malaysia

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Tasik Chini Biosphere Reserve (TCBR) is one of the recognized wetland ecosystems in Malaysia. It has valuable resources that contribute to national and community income either directly for resources with market value or indirectly for resources that have no market value. It provides a range of natural goods and services such as timbers, food sources, medicinal, and ecotourism attraction. Conservation of this ecosystem is crucial to ensure all these natural goods and services are protected and being managed well. In 2017, a study was conducted to examine the economic value of TCBR conservation by using economic valuation tools of stated preferences method. A total sample of 150 visitors was successfully interviewed. By using Contingent Valuation Method (CVM), the study found the mean willingness-to-pay (WTP) was RM8.53 per entrance (OLS model) and RM8.91 per entrance (Logistic model), which contributes to the economic value of RM155,408 and RM162,331 respectively in 2016. Other than that, choice experiment analysis also conducted to value TCBR's attributes namely lotus cover, lotus varieties, diversity of fish and TCBR's aesthetics values. The findings show the economic value of these attributes range from RM174,902 to RM734,225.

Keywords: Economic Valuation, Stated Preferences Method, Contingent Valuation Method, Choice Modeling Method, Wetland conservation

I. INTRODUCTION

Tasik Chini Biosphere Reserve (TCBR) is the second largest natural lake in state of Pahang, Malaysia and located near the mouth of the Sungai Pahang. Formed as freshwater swamp, its size varies greatly with seasonal rainfall changes (Yule CM & Hoi SY, 2012). TCBR is also one of the UNESCO Biosphere Reserve status sites in Malaysia and habitat to 138 species of flora, 300 species of non-aquatic live and 144 species of fresh water fish (A. Habibah, *et.al*, 2012). Conservation of the lake is crucial to ensure all these natural goods and services are protected and being manages well. Some of the Malaysia's protected and natural areas still threatened, though already established to conserve biodiversity and enhance ecotourism (Mohd Parid M, *et.al*, 2013). The biggest threat arises from human encroachment. Important habitats such as wetlands are not represented well and ecosystem services are always been under-valued and ignored especially in decision making process (MOSTE,1998) (Harrison RM & Hester RE,2010). To secure and safeguard these resources, appropriate conservation strategy must be put in place. Evidences to support policies for protection of biological resources can be obtained through economic valuation technique (Christie M, *et.al*,2006) (Spurgeon JPG,1998). Economic valuation also conducted to argue for increased funding and international financing to secure global benefits (Higgins SI & Turpie J, 1997) (Kumari K,1995). Therefore, in this study the economic valuation was conducted to assess the conservation value of TCBR.

II. MATERIALS AND METHODS

This method is closely related to the individual's behavior in a hypothetical setting and based on "price observed" for the goods and services to be valued through a structured questionnaire survey. For the purpose of this study, both stated preferences methods were applied. The analyses were done in Stata/SE 8.0, NLOGIT 5.0 and SPSS 14.0.

a. Sampling

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The individual visitors were chosen as respondents for interview. According to literature the optimum amount of sample size in most research are larger than 30 and less than 500. Although for medium sample size, CVM can still perform well in giving point estimates for the parameters and of the mean WTP (Sekaran U, 1992) (Calia P & Strazzera E.,2017). Due to the limited time and budget constraints, this study managed to obtain 150 responses for the analysis. Seven (7) out of 150 respondents were foreign visitors, while the remaining 143 respondents were Malaysian. Frequency analysis shows 54.7% were male and 72% of respondents were married. Other than that the highest age group was 21-30 years old (29.3%) which in line with other study by Ayob *et.al* (2002) stated that ecotourism is a youthful activity. The average monthly income of visitors was RM3700 and in term of education level 40% were university graduates, which supported by literature stated that nature tourist tent to be more highly educated than general tourist (Wight PA,1996).

b. Contingent Valuation Method (CVM)

An economic valuation technique that value the willingness-to-pay (WTP) by the public (Hanley N & Spash CL,1993). According to Camille Bann (1999) a key to produce reliable estimated value was well-structured and implemented CVM technique. There were 5 different bids (RM5, RM10, RM15, RM20 and RM25) given to different respondents randomly. Each respondent only had to say 'yes' or 'no' to the bid posed. Two models applied were logistic model due to its ability to deal with a dichotomous dependent variable and a well-established theoretical background, while OLS model due to the ability to determine the variables governing the amount of WTP for the maximum WTP figures as dependent variable. For TCBR conservation economic assessment, the payment vehicle used is the entrance fee. Currently there is no entry fee charged on visitors who visit TCBR, charges only imposed for those who are use boat service. However, there are also types of visitor that come only to see the view, sightseeing and fishing without the use of boat services. Consequently, in order to take into account all types of visitors, the payment vehicle used is to use an entrance fee.

c. Choice model (CM)

A series of multiple choices; each management option proposes differs according to the choice sets, each choice set comprised three management options (Hanley N *et.al*,2006). This method requires respondents to state their preferences on the sets of attributes and level related to the goods and services. A marginal utility estimate can be converted into WTP estimates for changes in attribute levels, and welfare estimates obtained for combinations of attribute changes by making one of these attributes a price or cost term (I. Bateman & Carson RT,2002). The approach of CM was used the choice experiment. According to Lancaster's approach consumers derive utility from a bundle of attributes rather than the good itself as it can maximize consumer satisfaction (Birol E & Koundouri P,2004). The attributes and levels were chosen related to the study site characteristics, such as species conserved, and activities available at site [17]. In this study, four (4) attributes were chosen namely lotus cover, lotus varieties, TCBR as habitat breeding and lastly aesthetic value. In this CM study, the same hypothetical scenario applied as CVM.

III. RESULTS AND DISCUSSIONS

a. Contingent valuation method

For this study, our estimations are undertaken using the single-bounded dichotomous choice models. The calculated mean values according to models estimated Table 1. Referring to positive WTP responses, mean WTP estimated through logistic model was RM8.91 and for the OLS was RM8.53. This WTP was slightly lower than logistic. In order to aggregate the WTP for the conservation of TCBR, the individual WTP obtained from the analysis was multiplied by the number of visitors to TCBR.

This estimated amount could be increased by having more of visitors and by imposing a larger admission fee. The findings show that the economic value of the TCBR was estimated to be RM 162,331 in 2016, from logistic model.

Table1. Estimated Benefits (RM) of Conservation TCBR using CVM

Year	No. of Visitors	Logistic model WTP= RM8.91	OLS Model WTP= RM8.53
2016	18,219	162,331	155,408

b. Choice Modeling Method

The estimations are undertaken using the choice experiments approach and Multinomial Logit Model (MNL) was applied in determining the values of TCBR attributes. Based on the interviews with 150 visitors, a total of 634 choice observations were used in model estimation. The marginal willingness to pay was estimated using Wald test (Table 2). Referring to the marginal values, the result shows that surprisingly public was willing to contribute more for aesthetic values compared to other variables at maximum RM40.30 per entrance. Other than that, they were also willing to contribute per entrance for the lotus cover improvement on the lake's surface at RM10.40, variety of lotus at RM17.98 and TCBR as habitat breeding at RM9.60. Therefore, from the public preferences the study can concluded that visitors put the conservation of TBCR for aesthetic value as highest priority followed by lotus variety, lotus cover and lastly habitat breeding.

Variable	Marginal Value (RM)	Year (2016) (Visitors = 18,219)
Lotus cover	10.40	189,477.60
Lotus varieties	18.00	327,942.00
TCBR as habitat breeding	9.60	174,902.40
Aesthetic value 1	25.20	459,118.80
Aesthetic value 2	40.30	734,225.70

IV. CONCLUSIONS

The study showed that public was willing to pay for the conservation of TCBR with the improvement of attributes range from RM174,902 to RM734,225. This finding provides useful evidence to support and helps the formulation of policies that protect TCBR biodiversity by quantifying the economic value associated with the protection of biological resources. It also serve as an important as a guideline to assist the protected and natural areas manager in decision-making process especially in balancing the importance of natural resources and to meet developmental needs or other economic activities.

V. ACKNOWLEDGMENT

This research was funded by Forest Research Institute Malaysia (FRIM) under The 11th Malaysian Plan (RMK11) research grants.

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