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An Assessment of Ecosystem Services Offered by Negombo Estuary to Adjacent Hotels

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ABSTRACT

This study identifies the different types of ecosystem services a hotel facility located adjacent to the Negombo estuary received from it, and in turn, evaluates the value of payment such a hotel, in general, is willing-to-pay for obtaining such services. Four major ecosystem services were considered in this context, including view (i.e. full view, partial view and no view), provisioning (i.e. products such as fish, crabs and prawns), regulating (i.e. prevention of soil erosion, cleaning of pollute lagoon water by mangrove and reduction of flood damage by mangrove) and supporting (i.e. sediment stabilization by mangrove, nutrient recycling by mangrove and biodiversity around mangrove). The data were collected by means of a structured questionnaire-based personal interview carried out with an administrative unit of the hotels adjacent to the Negombo Estuary (n=34) during February to March 2016. The outcome of analysis based on the Choice Experiment (CE) techniques carried out suggest that the hotels possesses the highest marginal willingness-to-pay (MWTP) value for the regulating of reduction of flood damage by mangrove of ecosystem service, and only the view service had significant effect in this respect. It implies that those hotels would like to come up with program to conserve the lagoon view as part of their business promotion and social responsibility. It implies how hotels value the mangrove based lagoon environment to attract customers based on aesthetic value attached to the view and protect their property from potential environmental damages.

KEYWORDS: Choice experiment, Ecosystem services, Ecotourism, Hotel industry, Negombo estuary

INTRODUCTION

Negombo lagoon is a large estuarine, located in the South - West Sri Lanka with a surface area of 35.02 km^2, to which the Ja-Ela, Dandugama oya and the old Dutch canal act as primary inflows, while the Indian ocean is the primary outflow (Wattage , 2002). The estuary receives water from Attanagalu oya (Ja-Ela and Dandungam oya) drainage basin and performs a dominant morphological feature of the watershed (Devendra, 2002).

The Muthurajawela marsh - Negombo estuary wetland system has served multiple uses including fishery, agriculture, trade and shipping, and habilitation from times preceding the colonization of the maritime province in 1,505 (Joseph, 2011).

The brankish water mass is 32.39 km^2 with an average depth of 1 m and considered to be the estuarine part of the contiguous wetland system of the Muthurajawela marsh Negombo lagoon marsh (Final report for APN-Asia Pasific Network for globle change project). Seagrass beds cover 22% of the Negombo lagoon area and are highly productive, providing habitats for a variety of brankish water organisms including many commercially important shrimps, crabs, *etc* (Silva *et al.*, 2013). The estuary receives fresh water from the Attanagalu oya which empties as Ja-Ela and Dandungama oya at its southern end (Joseph, 2011).

In addition the Hamilton canal is the connecting water course of the Kelani estuary and the Negombo lagoon running parallel to the west coast from the north to the south along the Muthurajawela Marsh (Devendra, 2003). Development of Fishery and Management Plan (DFMP) for Negombo lagoon (2012) shows that there are 11 species of true mangroves in the Negombo lagoon, and the extension has been reduced by 10% during the period between 1981 and 1992. Lagoon ecosystem can provide a variety of ecological functions that directly or indirectly translate to economic services and values (Kallasoe *et al.*, 2008); yet for many of these including those of importance to industries such as fishing and tourism, efficient management and sustainable exploitation of which have been the exception rather than the rule.

This study was aimed to identify different types of ecosystem services a particular hotel located adjacent to the Negombo estuary obtained, and then to evaluate the value of payment a hotel, in general, is willing-to-pay for such services. It, in particularly, focusses on the extent to which those hotels value the view services obtained from Negombo estuary.

METHODOLOGY

The hotels adjacent to the Negombo estuary were selected as the sites to gather information to carry out this analysis. A pilot survey was carried out to identify the levels of

eco system services (ESS) that are crucial for the hotels adjacent to the Negombo estuary. In this research by using Rank Order Logit (ROL) regression, stated preference where the consumption of these ecosystem services are priced, assessed by Choice Experiment (CE).

Theoretical Framework Based on Choice Modelling

The conceptual foundations of CE rely on two main theories a) Lancaster's Theory of value (Lancaster, 1966), and b) Random Utility Theory (Thurstone, 1927). Choice Modeling (CM) is a research technique that belongs to the family of Stated Preference methods in environmental valuation, where the information about preferences of decision makers are elicited using specifically designed questionnaire. The ability of this approach to decompose the values of environmental services into implicit values associated with particular attributes has made it attractive for economic analysis of environmental issues (Adamowicz *et al.*, 1998). On this rationale, this study has used the choice methods to develop the analytical framework, which is based on the Random Utility Theory (McFadden, 1973).

The overall utility associated with the i^{th} alternative can be divided into the contributions, that are observed by the analyst and those that are not observed by the analyst. To denote these sources of (relative) utility respectively by V_i and ε_i and utility of the option i (Ui) can be obtained as,

$$Ui = V_i + \varepsilon_i$$

However, since the overall utility is random and $p\{i\ chosen\} = p\{\ V_i + \varepsilon_i > V_j + \varepsilon_i\ \}c$ Where c is the choice set.

The probability of an individual choosing an alternative *i* is such as:

$$P[i] = e^{vi} \Big/ \sum_{j\varepsilon c} e^{vi}$$

V_j is assumed to be linear and additive functions in the attributes (Zs or Xs). Let represent an individual and then v_j can be written as;

$$v_{iq} = \sum_{k=1}^{k} \beta_{jkq} X_{jkq}$$

β_{jk} = Estimates of the weight of attribute in the utility expression vj of alternative j and v_{iq} Estimates of the (relative) utility U_{iq} of the individual. The development stages of Multinomial Logit (MNL) model can be expressed as;

$$V_{iH} = ASC_H + \beta_K X_K + \propto_{mH} Z_{mH} + \varepsilon_H$$

Where, V_{iH} = Probability that the individual H will choose the i^{th} option in the choice set; ASC_H Altertnative specific constant; x_k = of the ecosystem services; Z_{mH} = Characteris of the individual; β_k = Coefficients of the attributes (X_k); α_{mH} = Coefficients of the Z_{mH} interacted with x_k; ε_H = error term.

Once the parameter estimates have been obtained, WTP compensating variation welfare measure that conforms to demand theory can be derived for each attribute usig the formular given by (Hanemann, 1984; parsons and Kealy, 1992) where V^0 represents the utility of the initial state and V^1 represents the utility of the alternative state. The coefficient by gives the marginal utility of income and is the coefficient of the cost attribute.

$$WTP = b_{y^{-1}} \ln[\frac{\sum_i \exp(v^1 i)}{\sum_i \exp(v^0\ i)}]$$

Identification of Choice Alternatives

Negombo lagoon provides four major ESS for humans, animals and environment which are *provisioning*- products generated through the lagoon such as prawns, fish and crabs, *cultural* - non material benefits people obtain from lagoon through spritual enrichment, cognitive development and recreation, *regulating* - benefits obtained by regulating lagoon ecosystem processes, and *supporting* - necessary for the production of all other lagoon ecosystem services.

Under the cultural component it includes esthetic value or the view. It may cause to generate the positive influence to the mainly hotel industry adjacent to the lagoon of Negombo. This study conisted of four attributes and the annual payment and each attribute contains three levels (Table 1). Statistical Package for the Social Sciences (version 16) was used to combine these attributes and levels into a limited number of choice sets made up of optimal combinations.

Orthogonolization procedure was adapted to recover only the main effects consisting 27 lagoon profiles and these profiles were randomly blocked to nine different versions, each with three different lagoon alternatives as presented in Table 1.

Table 1. Choice sets with in the study

Ecosystem Service	Option 1	Option 2	Option 3
View services	Full view	Partial view	No view
Provisioning services	Fish	Crabs	Prawns
Regulating services	Prevention of soil erosion by mangrove	Cleaning of polluted lagoon water by mangrove	Reduction of flood damage by mangrove
Supporting services	Sediment stabilization by mangrove	Nutrient recycling by mangrove	Biodiversity around mangrove
Annual payment	Less than Rs. 5,000 per year	Rs. 5,000 per year	More than Rs. 5,000 per year

Data Collection and Analysis

Focused group discussions were arranged to identify the choice alternatives. Data collection was carried out within two phases and during the 1st phase of this research program; a pilot survey was conducted to identify the annual payment range that hotel sector can bear. The pilot survey participants of hotel identified the average (Rs. 5000 per year) could contribute for the lagoon ecosystem conservation activities. The CE survey was carried out by collecting primary data from persons of administrative units of 34 hotels (Figure 1.) adjacent to the Negombo lagoon by using standard questionnaire in face-to-face interview during February to March 2016.

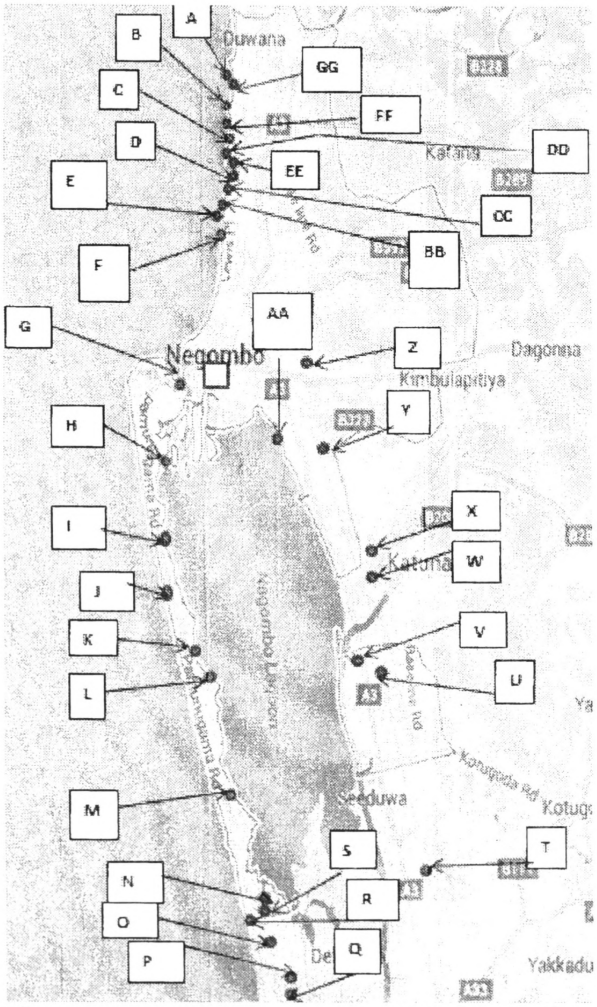

Figure 1. Locations of hotels adjacent to the study sites around the Negombo estuary

Note: A-*Jetwing Sea*; B-*Goldi Sands*; C-*Jetwing Blue*; D-*Araliya Blue Beach*; E-*Weding House Beach*; F-*Camelot Beach*; G-*Choy's*; H-*Villa Hundira*; I-*Jetwing Lagoon*; J-*Travellers Lagoon*; K-*Ziegler cottage*; L-*Hotel lagoon paradise*; M-*Villa Sea Breeze*; N-*Palms Village*; O-*Reefs Edje Resort*; P-*Sea Shine Beach*; Q-*Hotel by the c*; R-*Inlak Hotel*; S-*Garden Star Hotel*; T-*Ramada*; U-*Hotel Honors club*;V-*Onreech Hotel*; W-*Hotel Cockpit*; X-*Full Moon*; Y-*Eagles Lagoon View*; Z-*Grandeeza*; AA-*Amagi Lagoon*; BB-*Catamaran*; CC-*Ceylonica*; DD-*Paradise Beach*; EE-*Beach All Suite*; FF-*Jetwing Beach*; GG-*Rainbow Beach.*

The choices provided by respondents of hotels adjacent to the Negombo estuary were coded and used to estimate the coefficients of variables used in the empirical model to calculate the MWTP for each level. The ROL regression was employed to assess the relationships between the choice and attributes (view services, provisioning services, regulating services and supporting services) using the STATA (version 11).

RESULTS AND DISCUSSION

The descriptive statistics of the hotels which located adjacent to the Negombo lagoon shown in Table 2, elaborate that the 7 out of 34 hotels have full lagoon view (20.6%), 5 out of 34 hotels have partial lagoon view (14.7%) and 22 out of 34 hotels have no lagoon view (64.7%). Majority of the sample were without proper view towards the lagoon. The highest and same annual payment ranges were more than Rs. 5,000 and nothing any monetary payment (26.5%). Majority of foreigners attract to estuary for making photos or video (91.7%) and relaxation, swimming, beach (75.0%). Foreigners not highly interact with Negombo estuary for picking shells, algaea and take sands (33.0%). Further they represent same percentages for both sports fishing and motor boat/leisure boat rides as the reasons for the attraction to the Negombo lagoon (Table 2).

According to the outcome of the ROL regression as shown in Table 3, the levels of Full view and Partial view levels in view was significant at 0.05% of Confidence Interval. This denotes that hotels adjacent to the

Table 2. Descriptive Statistics of hotels which considered

Parameter	Percentage (%)
Lagoon view	
Full view	20.6
Partial view	14.7
No view	64.7
Payment (Rupees per year)	
0	26.5
5000	32.3
<5000	14.7
>5000	26.5
Activities involving	
Sports fishing	41.7
Picking shells, algae, take sands	33.0
Relaxation,swimming beach	75.0
Making photos or video	91.7
Motor boat/leisure boat rides	41.7

Negombo lagoon mainly consider about the view of the lagoon than other ESS (provisioning, regulating and supporting) offered from it.

Positive coefficients for the attribute imply that the hotels preferred those strategies and regulating services, prawns in provisioning services and biodiversity around mangrove in supporting services have acquired positive coefficient. The MWTP was calculated in order to disclose the attributes which hotels adjacent to the Negombo estuary willing-to-pay most. According to the MWTP values obtained, hotels hesitate to pay Full view, Partial view (view services), crabs (provisioning services) and nutrient recycling by mangrove (supporting services). The two highest willingness to pay were recorded as Rs. 3,910 per year for reduction of flood damage by mangrove and Rs. 2,448 per year for cleaning of pollute lagoon water by mangrove (Table 3). With reference to the MWTP values obtained, the hotels adjacent to the Negombo estuary are not willing to pay entirely for the lagoon view. The obtained MWTP value was Rs. -4,499 per year (negative denotes that willing-to-accept) for Full view. But hotels with full lagoon view they recommend their room rates according to the view and they proposed that there were direct relationship with lagoon view and room rate. Hotel sector gives priority to regulating services, because it was the very important attribute that affect to them short term as well as long term. Only the prawns in provisioning services acquired the positive MWTP (Rs. 831 per year). Specially foreigners wish to take prawns like sea foods in hotel industry. The obtained MWTP value was Rs. 632 per year for biodiversity around mangrove in supporting services. That means through other supporting services this particular one is more beneficial for customers. Because of that they like to conserve the lagoon by various conservation programmes with the involvement of government as monetary and labour services. Further some like to contribute this by organizing refreshments programmes to help to protect this valuable resource. It shows that hotels adjacent to the Negombo lagoon get benefits from the ESS directly or indirectly. Because of the pollution level of the lagoon there were poor provisioning services at present and they went away from it to fulfil this service. Further, hotels not willing to pay for the nutrient recycling by mangrove (supporting Services).

Table 3. Outcome of Rank Order Logit (ROL)

Levels of attributes	Coefficient	Std. Error	P value	MWTP
View services				
No view	*	*	*	*
Full view	-0.812	0.363	0.025	-4498.79
Partial view	-0.861	0.395	0.030	-4771.91
Provisioning services				
Fish	*	*	*	*
Crabs	-0.591	0.518	0.254	-4781.47
Prawns	0.149	0.710	0.833	830.62
Regulating services				
Prevention of soil erosion	*	*	*	*
Cleaning of pollute lagoon water by mangrove	0.441	0.768	0.566	2447.63
Reduction of flood damage by mangrove	0.705	0.603	0.242	3910.31
Supporting services				
Sediment stabilization by mangrove	*	*	*	*
Nutrient recycling by mangrove	-0.159	0.670	0.812	-881.84
Biodversity around mangrove	0.144	0.358	0.750	632.02

Note: Number of Observations = 102; MWTP- marginal willingness-to-pay

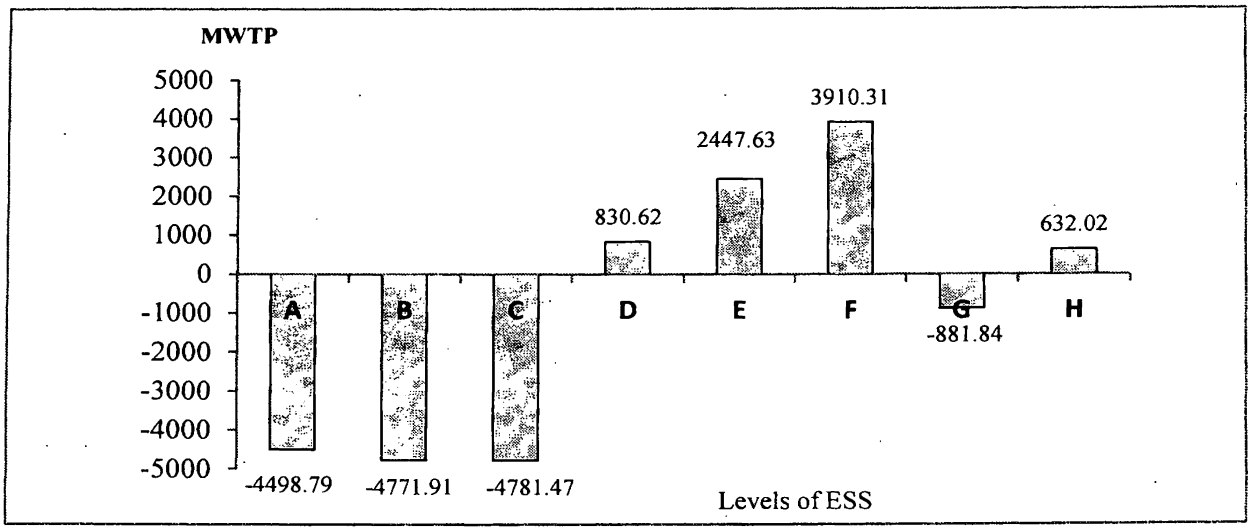

Figure 2. Marginal willingness-to-pay (MWTP) values for eco system services (ESS). *A = Full view, B = Partial view, C = Crabs, D = Prawns, E = Cleaning of pollute lagoon water by mangrove, F = Reduction of flood damage by mangrove, G = Nutrient recycling by mangrove, H = Biodiversity around mangrove*

CONCLUSIONS

Choice experiment suggested that survey identified that hotels which were adjacent to the Negombo lagoon, the most preferred ecosystem service is regulating followed by supporting followed by provisioning and view services. Respondents of hotels concluded that without good and maintained culturing and supporting services, lagoon view was useless. There was good possibility to develop hotels adjacent to the Negombo lagoon due to the specially in regulating services and conservation programmes to protect this valuable resource.

Visitors, specially foreigners preferred to get benefits from lagoon by swimming, going motor boats and *etc.* If there is enhancing lagoon view by applying various methods Sri Lanka can earn more foreign exchange by attracting more foreigners to the country. To enhancing view, conservation programmes are an essential thing. If government enrolling this effectively it may success. As a result of enhancing regulating, supporting and provisioning services ultimately without applying effort lagoon view may enhancing and protecting.

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