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Willingness to Pay for Different Degrees of Abundance of Elephants

Abstract

This paper presents an application of the contingent valuation method (CVM) to determine how the willingness to pay (WTP) for conservation of Asian elephants varies with hypothetical variations in their population. Results from a CVM survey of a sample of urban residents in Colombo, the capital of Sri Lanka are used for this purpose. We find, consistent with the basic principles of consumer demand theory, the marginal change in the respondents' WTP amounts is positive but appears to diminish in parallel to the increases in the current wild elephant population (CWEP). In contrast to theoretical expectations, however, we find that the WTP for preserving this species increases at an increasing rate in relation to decreases in the CWEP. This is probably because respondents perceive that extinction becomes more imminent as the abundance of the elephant is reduced and therefore it becomes more urgent to act. However, this adds a new complication to the interpretation of the WTP findings.

KEYWORDS: Asian elephant, contingent valuation, Elephant conservation, Sri Lanka, total economic value, willingness to pay.

Willingness to Pay for Different Degrees of Abundance of Elephants

1. Introduction

The Asian elephant *(Elephas maximus)* in Sri Lanka is the most prominent symbol of conservation, a 'true flagship species' [18]. Ensuring its continued existence in the wild is supported by the majority of Sri Lankans who consider it to be a valued resource [7]. The significance of the elephant, as for many other endangered species, resides in varied economic, ecological and socio-cultural attributes. Substantial economic benefits, as estimated by Gunathilaka and Vieth [21] and Tisdell and Bandara [41], are obtained from the elephant-based tourism and recreational activities. Ecologically, elephants are the dominant herbivores that exert the most profound impact on the other wild species and plants in the areas in which they dwell [38]. From socio-cultural and religious perspective, De Silva [17] describes the elephant as an important icon in many countries in Asia. More recently, Bandara and Tisdell [8] use the total economic valuation framework to assess the relative importance of these values of the elephant. They found that the majority of the survey respondents gave most weight to the non-use values of the elephant.

Langford *et al.* [30] found that people mostly choose to pay for conservation of endangered species to secure their existence primarily because it ensures a variety of other benefits that could be obtained not only for themselves but also for future generations. Kotchen and Reeiling [29] believe that such attitudes towards the species protection are often associated with the people's ethical motivation rather than their socio-economic interests. These authors also noted that stronger pro-environmental attitudes usually yield significantly higher probabilities of responding 'yes' to contingent valuation questions. Among others, a study by Bateman *et al.* [9] provide a useful account of how the contingent valuation methods (CVM) can be applied to measure the economic value of the non-marketed commodities such as the conservation of elephants.

Bulte and Van Kooten [11] summarise the findings of the contingent valuation analyses completed on the African elephant (*Loxodonta africana),* concluding that the bulk of these studies are directed at the willingness to pay (WTP) for conserving the current population of this species. Analyses undertaken on the Asian elephant are similarly focused (e.g., [5]). However, none of these previous analyses of either the African or Asian elephant examined how changes in the elephant population (abundance) might influence the people's WTP for the conservation of this species. Thus, the aim of this study is to use CVM to determine how the WTP for conservation of the elephant varies with hypothetical variations in the population of elephants. It also examines how well WTP reflects the TEV of this species in relation to variations of its abundance. It will provide some new insights into relevance of economic theories about economic valuation of wildlife. Additionally, it has policy relevance because the population levels of wildlife species is often a controlled management variable.

The analyses in this paper are based on the part of the data gathered from a contingent valuation survey of a sample of urban residents chosen form three housing schemes in Colombo, the capital of Sri Lanka. This survey was primarily undertaken to elicit their WTP for the conservation of current wild elephant population (CWEP) in Sri Lanka. Additionally, it assessed the possible impact on the initial WTP amounts that the respondents surveyed agreed to pay for the conservation of CWEP in relation to six different hypothetical population scenarios (i.e. increase/decrease in CWEP by 25%, 50% and 75%) by presenting alternative WTP elicitation questions.

The paper first reviews relevant literature on non-market valuation of endangered species and then outlines the WTP elicitation procedure used in assessing response to the proposed hypothetical changes in CWEP in Sri Lanka. The nature of the survey sample and the methods and materials used in data collection process are reported and followed by analysis and discussion of the results.

2. The Changes in Population Density and Economic Value of Conserving Endangered Species: A Review of the Literature

The economics of conserving endangered wildlife species has received significant attention over the last few decades (see [11, 39]). During this period, a number of non-market valuation techniques have been developed and experimentation into their capability to estimate the total economic value (TEV) of conserving these species has been undertaken (e.g., [29, 30]*)*. Bateman et al. [9] provide a useful discussion about these techniques and their possible application into the estimation of TEV. Moreover, among others, Nelson [3] and Carson et al. [12] discuss most of the issues that may emerge with the application of the TEV framework, particularly in classifying the TEV components and the reliability of the use of individual WTP contribution in assessing their relative importance. However, except for the work of authors such as Whitehead [45], Loomis and Larson [31], Fredman [20], and Tisdell and Wilson [40] there has been no systematic discussion to examine how changes in the population density of endangered species might influence the people's WTP contribution, particularly for conservation of the large terrestrial mammals such as the Asian elephant.

Whitehead [45] explores the theoretical validity of the CVM in estimating TEV under the condition of supply and demand uncertainty of the population density of a loggerhead sea turtle in coastal North Carolina. He found that the estimations of TEV under uncertainty for wildlife species such as sea turtle are theoretically valid from the perspective of basic principles of consumer demand theory. Thus failure to include the specification error may lead to erroneous conclusions about the validity of TEV for wildlife resources. In practical term, the analysis by Loomis and Larson [31] clearly incorporate the issue of uncertainly by using two hypothetical increases (i.e. 50 and 100%) in the current gray whale population along the California coast to assess the consistency of an individual's WTP for conserving this species. They conclude that carefully performed CV studies yield results consistent with principles of demand theory for reasonably large changes in the quantity of a public good. From another viewpoint, judging from the responses to the survey of visitors to Mon Repos turtle rookery in Bundaberg, Australia, Tisdell and Wilson [40] noted that demand to engage in turtle-watching could decline with a decreased population of turtles on the beach. Thus, unless the visiting turtle population is saved early enough from significant collapse, both tourist numbers and the public support for turtle conservation could diminish. Nonetheless, they did not rule out the opposite possibility that in some cases a reduced population of a species might result in increased social support for their conservation (p. 1535).

The analysis by Fredman [20] uses both increases and decreases in the population density of the white-backed woodpecker, an endangered species in Sweden to assess the possible impact on the individual WTP for conservation of this species. According to Fredman the TEV of a wildlife species:

$$TEV = EXV + ONUV + UV \qquad (1)$$

where the EXV is the existence value, the ONUV is the other non-use value, and UV is the use value. Moreover, TEV is also a function of population density of the population (Z). Thus:

$$\begin{aligned} TEV &= F(Z) + g(Z) + h(Z) \qquad (2) \\ &= a + g(Z) + h(Z) \end{aligned}$$

where 'a' is constant. This implies that the existence value of a wildlife species is independent for all Z > MVP. Hence, in this situation, a zero marginal WTP as a function of Z is suggested. However, this result contradicts the findings of a number of other studies. For example, Kotchen and Reiling [29] and Langford, et al. [30] argued that, although theoretically the disjoint classification of the components in the TEV may be possible, in practice, many of these components are interconnected or overlapping. Moreover, Tisdell and Wilson [40] point out that the many individuals in the society appreciate the existence value of most wildlife species with the collective desire of obtaining their conservation benefits for future generations (bequest value), and also keeping the option to use these species in the future (option value) which is not fully taken account of in conventional markets.

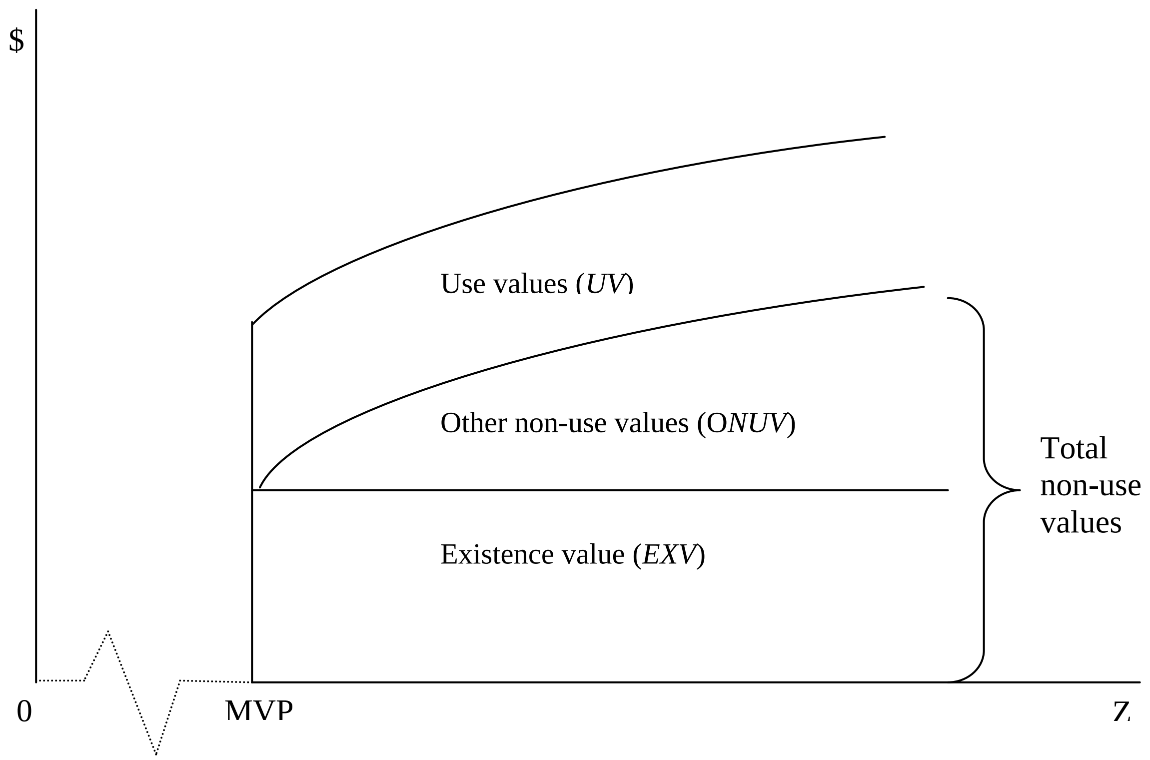

Figure 1: Value components of wildlife as a function of population density (Source; Fredman, 1995, p. 311)

Figure 1 presents the nature of the relationships that Fredman hypothesised between the value components in the TEV and changes in the Z where it was assumed that the species would become extinct if Z < MVP, the minimum viable population, since the population is too small for survival in the long run. Hence, by definition, all Z < MVP have no existence value but may be able to obtain UV and ONUV. Thus, it seems that he claims that $g'>0$ and $g''<0$. Similarly, consumer theory predicts that $h'>0$ and $h''<0$. Therefore the difference between the top line and the second line down in this Figure should increase with Z and not be a constant difference as illustrated by Fredman. Moreover, it is also possible that UV falls to zero for a value of Z>MVP. It could do so precipitously and have important implications for public WTP for survival of the species.

As Tidell and Wilson [40] have observed, social support for survival of species may collapse before population falls to MVP. This is because the biological safe minimum (BSM) differs from the social safe minimum standard (SMS) of conservation of wildlife species (see [15,10,35,25]). More recently, Seidl and Tisdell [37] provide a useful analysis of core features of the safe minimum standard of conservation by emphasising the difference between BSM and SMS. They argued that the fundaments of the SMS often have been neglected, de-emphasized or poorly interpreted by the analyses completed with application of this concept. Moreover, different ensuing interpretations and developments of this concept aimed at giving it a theoretical basis and operationalizing it are scrutinized. Definitions of features used in these analyses, such as irreversibility, uncertainly, threshold and critical zone involve a socio-economic and institutional of this concepts rather than biological ones. Therefore, using MVP in contingent valuation of non-marketed commodities, such as conservation of endangered species, may need more attention on the practical applicability of the SMS concept.

Fredman [20] did not provide much detail initially about the nature of the relationship that he presumed existed between the population densities below the MVP and the TEV components in his initial discussion. However, later in his article he observed that there is increase in the WTP amount by the respondents to avoid the extinction of the population of the white-backed woodpecker in Sweden for all Z < MVP (P. 324). As he explained, this is because a decrease in the population density below the MVP implies extinction, i.e. the expenditure function is discontinuous at the MVP, and therefore the WTP for the non-use value to avoid such a change in population density increases. Thus in this situation, the curve, ‘ONUV’, in Figure 1 should be turned upward at MVP with the positive WTP to avoid the extinction of the species.

This raises several questions. Is it necessary that this cusp or apparent asymmetry should occur at MVP and, if not, where does it occur? Maybe there will also be cases where a cusp is not present at all. This is because as Tisdell and Wilson [40] point out that the economic support for conservation of a species does not necessarily depend on its UV nor on whether it is a keystone species in an ecosystem of economic value to mankind. Furthermore, if a wildlife species has economic value in itself for ecotourism or for the non-use value of TEV, conserving it may still be socially worthwhile from an extended utilitarian economic perspective, even if the species in question is not a keystone one. Thus any decision in favour of conservation of a wildlife species should consider perspective based on both non-anthropocentric and anthropocentric utilitarian economic arguments. Moreover, as Carson et al. [12] point out, most of the existing procedures in non-market valuation are still evolving. Thus the issues encountered with non-market valuation need to be resolved with sound empirical justification prior to reaching the conclusion whether the WTP measures are consistent with the economic fundamentals. With these methodological and practical difficulties in mind, in this study we examine the possible impact on the initial WTP amounts that survey respondents agreed to pay for the conservation of the CWEP in Sri Lanka in relation to six different hypothetical population scenarios.

3. Contingent Valuation Procedure and the Nature of the Questions Asked

The economic value of wildlife species, such as the Asian elephant is not readily apparent. Thus, prior to the contingent valuation questions being presented, a hypothetical market was established to assess the respondents' WTP to conserve the CWEP in Sri Lanka and also to assess the possible impact of the hypothetical changes in the CWEP on the initial WTP amounts that they agreed to pay for the elephant conservation. In this process, the respondents were informed that the elephant population in Sri Lanka has been in decline since the mid-nineteenth century. As a result, IUCN [26] has declared the Asian elephant in Sri Lanka to be an endangered. At present, on average about 100 elephants die every year in Sri Lanka because of their interference with agriculture [44]. Today most estimates place the size of Sri Lanka's present elephant population at between 3,000-5,000 elephants [6]. Of this, the largest portion consists of scattered small groups of less than 50 animals which are not genetically viable in the long run [18].

Respondents were then asked to assume that an autonomous body, reputed for its efficient and honest work, would introduce an appropriate programme so that the current downward trend in the elephant population could be halted while addressing other elephant related issues. Then they were told that finance was required for the proposed programme and that the support of the general public would be needed to establish a 'trust fund' to undertake it. In this process, we adopted non-obligatory, specific voluntary contribution mechanisms (VCM) to determine the survey respondents' likely contributions to the proposed trust fund. A number of recent CV studies, for example, Champ *et al.* [13], Chilton and Hutchinson [14] have used this mechanism to motivate respondents to tell the truth.

After a contingent valuation market was established, the survey respondents were presented the initial WTP elicitation question where they were asked: *For the next five years, would you be willing to pay Rs X from the monthly income of your household, that is Rs X per year, starting from January 1st 2002, towards the establishment of the proposed trust fund to implement the above mentioned programme to conserve the elephants in Sri Lanka?"*. The dichotomous choice format with a set of optional follow-up questions was used as a WTP elicitation technique. This format was initially proposed by Hanemann *et al.* [24]. FAO [19] reports that, in the recent past, this method has become a widely used elicitation format, particularly in developing countries.

In the present study, a bid vector with five different bid values (i.e. Rs. 500, 250, 100, 50, and 25) was offered to elicit the survey respondents' likely WTP contribution for the proposed scheme. The initial WTP elicitation question is presented with the highest bid value in the bid vector, which in the present study, was Rs. 500. The follow-up question is conditional on the respondent's response to the bid value offered in the initial question: the amount offered is lower if the response is 'no'. This process is continued by reducing the bid value offered on each occasion, if the respondent's response is 'no', until the lowest bid value in the bid list is reached.

The respondents who responded positively to the initial contingent valuation questions were presented a follow-up question: *If the number of elephants inside and outside the protected* *areas in the country was X percentage below/above the current level, would this change (i.e. increase, decrease or remain unchanged) your WTP amount?* This question was repeated six times in relation to three different hypothetical population scenarios (i.e. 25%, 50% and 75%) below/above the CWEP. Respondents responses for this question were recoded as 'I would increase the initially agreed WTP amount' (coded as 2), 'I would decrease the initially agreed WTP amount' (coded as 1), or I would not change the initially agreed WTP amount' (coded as 0). On each of these occasions, the respondents who either positively or negatively answered to these questions were also asked to indicate the change that they would therefore wish to make as a % of their initially agreed WTP amount. Respondents' responses were recorded under five separate % changes (i.e. 10%, 25%, 50%, 75%, and 100%).

4. Dealing with Biases

Given the presence of numerous biases associated with contingent valuation studies, it was necessary to either control them through the survey procedure itself, or in the subsequent analytical stage. However, in many cases, the biases can be econometrically removed if they have been captured by a proxy variable (see [28, 9]). In the present study, the bid value, the rupee value offered from the initial WTP questions which were used to elicit respondents' WTP contribution for the conservation of CWEP, was highly significant and implies that estimated mean WTP may be influenced in the elicitation process by the bid values offered in optional follow-up questions. This indicates the possibility of respondents suffering from anchoring effects, also known as starting point bias. However, in this study, respondents were given seven separate opportunities to decide their WTP amount. In addition to this procedure, in order to remove this effect further, in the subsequent estimates of mean WTP we removed the insignificant bids (bid values of less than Rs.25) and 'protest' responses setting their WTP contribution equal to zero.

On the other hand, the hypothetical population scenarios presented with the alternative WTP questions to assess possible impact on the initial WTP amounts that the respondents agreed to pay for the conservation of CWEP may be caused hypothetical bias. This is because respondents surveyed may have found it hard to imagine what large percentage changes in the population of the elephant would mean. However, in this study, prior to the contingent valuation questions being offered the respondents were presented the necessary information about the current size of the elephant population in Sri Lanka. Moreover, the information gathered on level of education of the respondents reveals that 99.3 % of the sampled respondents are literate, and 90% of the respondents had at least 10 years of formal schooling. Furthermore, about 17 % of the sample had obtained a Bachelor's degree or higher and 31 % had completed their education at the Diploma level. These findings are quite consistent with the national averages of the level of education of the urban population in Sri Lanka [16]. Thus, the respondents would not have had difficulties in understanding the hypothetical changes proposed in the CWEP. Moreover, in CVM mechanisms to tackle hypothetical bias are not yet fully developed [9].

5. Sample, Data Source, and Collection Procedure

The data presented in this analysis were collected as part of a contingent valuation survey of a sample of 300 urban residents in three selected housing schemes (i.e. *Jayanthipur*a, *Jayawadanagam*, and *Anderson Flats*) in Colombo, the capital of Sri Lanka. The Urban Development Authority of Sri Lanka (2001) classifies these schemes into three broader categories of income earners i.e. high, mid and low. A hundred residents were chosen from each of these housing schemes so as to provide a stratified sample.

An interview schedule (IS) in five separate sections was used as the main survey instrument. In section one, the respondents were presented with a number of questions to gather the information about their social, economic and demographic characteristics and also to establish conversational rapport. In section two they were presented two questions: one was to assess their awareness about human-elephant conflict (HEC) related issues and the other was to evaluate the attitudes towards conserving elephants in their natural state. A hypothetical programme for conserving the elephant and mitigating HEC was presented in section three. Sections four and five presented contingent valuation questions.

In administrating the IS, face–to–face surveys were conducted in *Sinhala*, a major language in Sri Lanka. Nine graduate students from the Faculty of Graduate Studies of the University of Colombo acted as interviewers. Hadker [22] describes the value of this method in the context of India and the situation in Sri Lanka is comparable: mail surveys have a low response rate and suffer from self-selection biases; and telephone surveys are ruled out because the facility is not available to every signal household chosen for the samples. Further, in face-to-face surveys trained interviewers interact with respondents, clarifying their doubts to minimise non-response rates, and judging their sincerity. Consequently, the quality of the data generated improves.

6. WTP for the Conservation of the CWEP: Preliminary Findings

Of 300 respondents in the sample, 266 (88.7%) answered positively to WTP elicitation questions and only 34 (11%) protested against all the bid values offered in the bid vector. Of these 34 respondents, 14 offered a positive amount of less than Rs. 25 and the remains gave 'protest' bids or zero bids. Hence, both these zero and insignificant bids were excluded from the calculation of WTP based estimates undertaken in this study. This approach is similar to that of Hanemann [23]. Table 1 summary of the descriptive statistics of the respondents' response for the WTP elicitation questions is presented in Table 1.

Table 1

Descriptive statistics of the respondents' response for the initial WTP elicitation questions

Variable description	Statistic
Protest and insignificant bids[a]	34 (11.3)[b]
Number of non-protest bids	266 (88.67)
Mean monthly WTP (in Rupees)	110.17
Standard deviation	41.91
Conf. inter. estimate for the mean monthly WTP[c]	94.24:126.10

Note: a. Insignificant bids refer to the WTP amounts less than Rs. 25; b. Bracketed values refer to the percentage of total respondents in each sample; **c.** 95% level of confidence estimated for the mean monthly WTP.

As indicates in Table 1, non- protest respondents on average are willing to pay Rs. 110.17 per month for the proposed scheme to conserve the elephant in Sri Lanka. This amounts to an annual value of Rs 1322.04. As the payment will be made over a period of five years, the total present discounted value of these annual amounts at a 5% real rate of discount equals Rs. 6,009.75.

7. Respondents' Responses to Changes in the CWEP: Preliminary Findings

Respondents' responses to changes in the CWEP were assessed by presenting six alternative WTP elicitation questions in relation to six hypothetical population scenarios. Whitehead [45] points out why it is necessary to consider such influences in the estimation of total economic value (TEV) of endangered wildlife species. Metrick and Weitzman [32] also argue that the non-inclusion of the possible impact of unexpected alteration of an environmental amenity into the TEV estimations process may result in specification error. Indeed, Kotchen and Reiling [29] found that provision of adequate flexibility in the TEV framework to assess such impact makes consumer choice in valuing non-marketable commodities more certain.

Analysis of responses received for the WTP elicitation questions which were presented in relation to hypothetical population reveals that about 82% of the respondents were willing to adjust the WTP amounts that they initially agreed to pay for the conservation of CWEP for scenarios below the CWEP. This was 64% for the hypothetical scenarios presented above the CWEP. Overall about 73% of the respondents on average in the sample were prepared to adjust their agreed WTP amounts in relation to population scenarios proposed, but the rest of the respondents showed no interest in such an adjustment.

8. Increases in CWEP and Its Impact on the Respondents' Initial WTP Contribution

Three hypothetical population scenarios above the CWEP (i.e. 25%, 50% and 75%) were used to assess the specific impact on the respondents' initial WTP contribution which they had agreed to pay for conservation of the elephant at the current population level. Table 2 presents the summary of the calculated WTP estimates in relation to these hypothetical population scenarios.

Table 2

Summary of WTP estimates undertaken in relation to the hypothetical increase in the elephant population above the CWEP (n = 266)

Population scenario	Mean monthly WTP (in Rs)	Marginal WTP change	Conf. inter. estimate for mean monthly WTP[b]
WTP for the CWEP	110.17 (8.09)[a]	----	94.24:126.10
For 25% increase in the CWEP	116.27 (8.43)	6.10	99.66:132.88
For 50% increase in the CWEP	119.87 (8.65)	3.60	102.82:136.92
For 75% increase in the CWEP	121.69 (8.77)	1.89	104.42:138.96

Note: a: The respective standard error values are presented in brackets, b. The confidence intervals were estimated for 95% level of confidence.

As shown in this Table, there is a slight increase in the estimated monthly WTP values corresponding to these hypothetical increases in the population of wild elephant above the current level. However, the marginal change of the respondents' WTP amounts appears to be diminishing. This is consistent with the expectations from basic principles of consumer demand theory. This result also indicates that some respondents who responded positively to the initial WTP elicitation questions in the sample are not prepared to pay for the conservation of the elephant if this species' long term survival is not threatened or endangered. This is understandable because the increase in CWEP would certainly avoid the threatened long-term survival of the elephant in Sri Lanka.

Three different hypothesis tests were performed at three different levels in order to examine whether the initial WTP amount that respondents were agreed to pay for the conservation of the elephant would be statistically different from zero with the increase in the CWEP. The first test was carried out at each proposed percentage increase in the current elephant population in order to see whether the incremental valuations are statistically different from zero where we could reject the hypothesis of equality with zero for each of these hypothetical changes. The results of this analysis indicate that the incremental change in WTP in relation to the proposed hypothetical change in the elephant population is significant at the 5% level.

In the second hypothesis test, two separate paired *t*-tests were performed in order to examine whether the respondents' expressed WTP amounts for the increase in the CWEP between 25% - 50%, and then 50% -75% are different from zero. That is, by forming the WTP difference D1 = WTP50 – WTP25 and then D2 = WTP75 – WTP50 where we test whether $Di \leq 0$. The results of these tests reported in Table 3, are significant at the 5% level, indicating that the incremental valuations from 25% to 50% and then from 50% to 75% are statistically different from zero.

Table 3

Hypothesis tests concerning WTP for the increases in the CWEP

Null hypothesis (H_0)	***t*-value**	**Decision**
$WTP_{25} = 0$ (for 25% increase in the CWEP)	13.90	Reject H_0
$WTP_{50} = 0$ (for 50% increase in the CWEP)	14.11	Reject H_0
$WTP_{75} = 0$ (for 75% increase in the CWEP)	14.14	Reject H_0
$WTP_{25} = WTP_{50}$	15.86	Reject H_0
$WTP_{50} = WTP_{75}$	14.96	Reject H_0
WTP gain for 1st 25% increase in CWEP = WTP gain for 2nd 25% increase	16.74	Reject H_0
WTP gain for 2nd 25% increase in CWEP = WTP gain for 3rd 25% increase	17.86	Reject H_0

Note: a. For one sample test $\propto = 0.05$, df: n-1; **b.** for two sample test $\propto = 0.01$, df: $n_1 + n_2 - 2$

The third test was undertaken to examine whether the WTP gain from the second proposed increase in the CWEP (i.e. WTP_{50}) was of less value than the first increment (i.e. WTP_{25}) and also the test whether the WTP gain from the WTP_{75} (for 75% increase in the current elephant population) was of less value than the WTP_{50}. That is, by forming paired t-tests of: WTP gain for WTP_{50} < WTP gain for $WTP_{25} > 0$ and WTP gain for WTP_{75} < WTP gain for $WTP_{50} > 0$ where we reject the null hypothesis that the valuation for $WTP_{50} \geq WTP_{25}$ or $WTP_{75} \geq WTP_{50}$. Nevertheless, our results indicate that the WTP gain for the initial 25% increase in the current elephant population is greater than the WTP gain for the second 25% increase in the population as well as the third incremental change.

In summary, the result indicates that the overall marginal valuation of increases in Sri Lankan elephant population above the current level is positive but decreasing with increases in the projected elephant population. Thus total utility increases but at a diminishing rate.

9. Decreases in the CWEP and Its Impact on the Respondents' Initial WTP Contribution

Randall [34] believes that people do not like disturbance of environmental amenity mainly because of their altruism. Concentrating on use values, Alexander [3] found that the people who consider the African elephant to be valued resource would be prepared to pay for increase in its population even if it is a pest for the rural poor, because it ensures better opportunities for them to enjoy the larger herd of elephant in the wild. For example, opportunities to see more species in a single herd or for fewer number of trips increases. More recently, Tisdell and Wilson [40] noted that in some cases a reduced population of a species might result in increased public support for their conservation when their population falls below some threshold.

To exploit this theoretical possibility, we undertook a contingent valuation of decreases in the current population of Sri Lankan elephants. The possible impact of a decrease in the elephant population on initial WTP contributions by the survey respondents was assessed in relation to three hypothetical population scenarios (i.e. 25%, 50% and 75%) below the CWEP in Sri Lanka. Table 4 summarises the result.

Table 4

Summary of WTP estimates undertaken in relation hypothetical reduction in the elephant population below the CWEP (n = 266)

Population scenario	Mean monthly WTP (in Rs)	Marginal WTP change	Conf. inter. estimate for mean monthly WTP[b]
WTP for the CWEP	110.17 (8.09)[a]	--	94.24:126.10
For 25% reduction in the CWEP	117.19 (8.57)	7.02	100.31:134.07
For 25% reduction in the CWEP	127.39 (9.04)	10.20	109.58:145.20
For 25% reduction in the CWEP	141.17 (9.74)	13.78	122.01:160.34

Note: a. The respective standard error values are presented in brackets, **b.** The confidence intervals were estimated for 95% level of confidence.

As shown in Table 4, with decrease in the density below the CWEP in Sri Lanka by 25%, 50% and 75%, the corresponding mean WTP for the conservation of elephant by the respondents in the survey increased at an increasing rate: for the initial 25% of decrease in CWEP, the mean WTP was increased by about 28 %; from there, for a further 25% decrease in CWEP, the mean WTP was increased by about 41 %; finally the mean WTP was increased by about 55% for a 75% decrease in CWEP. As a result, the marginal change of the respondents' WTP amounts appears to be increasing with the decreases in CWEP.

It should be noted that the above finding is apparently at odds with the theoretical expectation of consumer demand theory. Moreover, one might have some doubt about whether empirical WTP actually does provide an accurate measure of TEV. This is because the TEV of elephants in this case appears to be subject to 'strategic' influence. The survey respondents seem to believe that it is increasingly more crucial to contribute to a scheme to save elephants as their abundance is reduced. This is probably because they perceive that the extinction of elephants becomes more imminent as their abundance is reduced and therefore it becomes more urgent to act. Therefore, they tend to be willing to pay more to ensure the continuing existence of elephants as elephant numbers decline.

The WTP for existence of a species does not therefore seem to be independent of the population density of the species. This either means that WTP is not a very accurate indicator of existence value and TEV, or that the TEV relationship specified by Fredman [20] does not apply in practice. Moreover, it also seems to reflect heightened concerns about the likelihood of non-use values being lost and generally about irreversibility as the population of a species decreases.

10. Respondents' Responses for the Alternative WTP Elicitation Questions: A Comparative Analysis

As briefly discussed in section 6, at the aggregate level 73% of the respondents who responded positively to the initial contingent valuation questions (i.e. 266) were willing to adjust their WTP amounts in relation to hypothetical changes presented in the elephant population of Sri Lanka. This was 82% of respondents for an elephant population below the CWEP and 64% for an elephant population above the CWEP. Figure 2 presents the distribution of number of respondents who willing to adjust their initial WTP amounts in relation to hypothetical changes proposed both in the below and above the CWEP in this study.

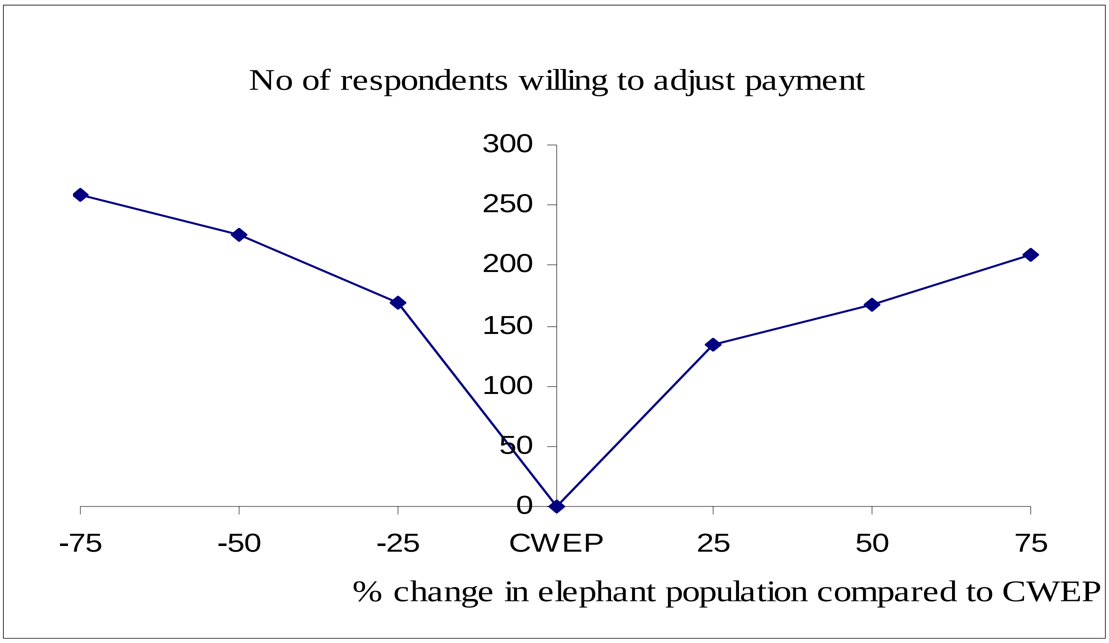

Figure 2: The distribution of number of respondents who willing to adjust their initial WTP amounts in relation to hypothetical changes in CWEP.

It can be observed that the greater the reduction in the elephant population the larger is number of respondents willing to increase their contribution to the conservation of elephants but the number rises at a decreasing rate. Similarly the numbers willing to increase their contribution to elephant conservation rises as the hypothetical size of elephant population increases. It is found that the average bid per respondent increases at an increasing rate as the hypothetical elephant population is decreased in comparison to CWEP. It increases at decreasing rate as the elephant population is raised in relation to CWEP. Those relationships are evident from the Table 2 and 4. These tables imply the relationship graphed in Figure 3.

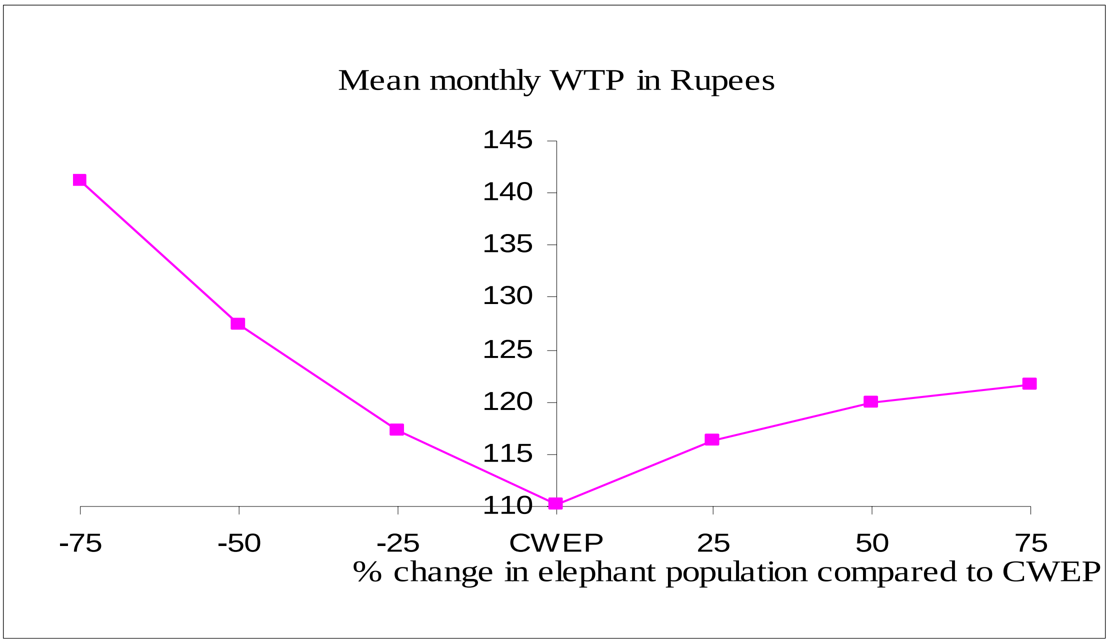

Figure 3: The distribution of mean monthly WTP contribution in relation to hypothetical changes in CWEP

From the graph in figure 3, mean willingness to contribute to the conservation of wild elephants is asymmetrical about the CWEP. The relationship does not accord with what one might expect on the basis of usual utility analysis. The reasons for this are considered in the concluding section.

To examine what factors may have influenced the respondents' responses to the alternative WTP elicitation questions presented in relation to increases and decreases in the elephant population, two separate ordered probit models were estimated. The approach adopted specifying these models are similar to that of Aldrich and Nelson's [2] pioneering study. Seonghoon and Adams [36] describe the advantages of these models in relation to their ability to capture the multiple response choices. Jekanowski *et al.* [27] also found that ordered probit models are statistically more efficient than the binary logit or probit models. Furthermore, our review of the recent literature on the application of this model (see [1,43]) has revealed that this model offers a better fit for the analysis of multiple responses. Therefore, the ordered probit model is employed in this study and the following equation summarises the model we used.

$$Y_i^* = \beta_o + \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots\ldots\ldots\ldots \beta_k x_{ki} + \varepsilon \qquad (3)$$

where ε is the error term which is assumed to be normally distributed with zero mean (μ = 0), β_i represent vectors of unknown parameters, and x_1, x_2 ….x_k represent vectors of explanatory variable used (see Table 5) in the model. Y_i^* is the dependent variable which is an ordered choice with three categories. Response choices to the alternative WTP elicitation questions which were presented in relation to hypothetical population scenarios below and above the CWEP are classified as 'I would increase the initially agreed WTP amount' (coded as 0), ' I would decrease the initially agreed WTP amount' (coded as 1), or I would not change the initially agreed WTP amount' (coded as 2).

Table 5

Variable included in the preliminary ordered probit models

Variable	Definition	Mean
AGERE	Age of the respondent in years	44.02 (10.8)[a]
CONSE	Awareness about the current elephant conservation issues; 1=not aware, 2 = aware 3 = very aware	2.37 (0.68)
BQVOE	The bequest value of the elephant; 1 = not valued, 2 = some what valued, 3 = moderately valued, 4 = highly valued.	3.91 (0.43)
GREEN	Pro-conservation perception; 4 = supportive, 3 = neutral, 2 = not supportive, 1 = strongly not supportive	3.42 (1.12)
PERIN	Personal income in Rupees	12986.6 (8692.0)
EXVOE	The existence value of the elephant; 1 = not valued, 2 = some what valued, 3 = moderately valued, 4 = highly valued.	3.687 (0.48)
NCUVE	Non-consumptive use values 1 = not valued, 2 = some what valued, 3 = moderately valued, 4 = highly valued.	2.16 (0.298)
USRER	1 if the respondent had visited national park(s) to see the elephants or wildlife in general; 0 otherwise	0.39 (0.49)
YRSCH	Years of schooling	12.54 (3.12)

Note: Respective standard deviation values are presented in the brackets.

Table 6 presents the results of the estimated models. In addition, this table also reports the results of three goodness-of-fit measurers, which were estimated at each of these hypothetical changes introduced. One measure is the log-likelihood ratio. A second measure used is the pseudo-R^2. A third measure examines how well the model classified the respondents correctly based on estimated probabilities. These measures indicate that the estimated model has satisfactory explanatory power and fits the data reasonably well.

Table 6

Estimates of the ordered probit models: factors influencing the respondents' reponses for the alternative WTP questions (n = 266)

Variable	Model estimated for the changes above the CWEP		Model estimated for the changes below the CWEP	
	Coefficient	***t*-value**	**Coefficient**	***t*-value**
Constant	-2.014	-3.098	-2.971	-3.103
AGERE	- 0.872	-1.971	-1.591	0.154
CONSE	0.983	0.861	2.639	3.682
BQVOE	1.618	1.410	2.981	3.961
GREEN	1.792	0.657	2.902	2.817
PERIN	3.678	4.351	1.691	4.811
EXVOE	1.931	0.987	2.982	3.879
NCUVE	1.750	2.161	0.104	0.767
USRER	2.101	3.591	0.871	0.014
YRSCH	1.981	2.761	1.561	2.981
Log-likelihood ratio	42.19		44.11	
Pseudo-R^2	71.01		69.24	

Note: Dependent variable: Probability of saying 'I would increase the initially agreed WTP amount', 'I would decrease' or I would not change' to the alternative WTP questions were presented in relation to each hypothetical change below and above the CWEP.

As indicate in table 6, the overall ability of these models to the yield correct prediction on respondents' responses for alternative WTP questions presented in relation to below and above the CWEP were 69% and 71% respectively. Furthermore, except for variables such as *AGERE (*age of the respondents*),* *USER* (respondent who visit national park(s) to see the elephants or wildlife), *NCUVE* (non consumptive use value of elephant), all the other explanatory variables are significant in the model estimated for elephant populations below the CWEP either at the 0.01 or 0.05 level of significance. Although some of these variables were significant in this model, they were not significant in the model when it was estimated for elephant population above the CWEP. The variables significant in the model estimated for population above the CWEP include *USER*, *NCUVE*, *PERIN* (personal monthly income) and *YRSCH* (years of schooling).

Most of the estimated coefficients which were significant in these two models had a positive influence on the respondents' response for the alternative WTP elicitation questions presented. For example, the positive sign for the *CONSE* (awareness about the current elephant conservation issues) variable supports the hypothesis that if the elephant population is below the CWEP, the probability of saying 'I would increase my initially agreed WTP amount' would increases as the degree of awareness about the current elephant conservation issues increases. Moreover, the positive signs of the variables developed in relation to the total economic value of the elephant such as *BQVOE* and *EXVOE* suggest that as the respondents' appreciation about these values of the elephant increases, the probability of saying 'I would increase my initially agreed WTP amount' would increase. The positive coefficient of *USRER* suggests that a respondent who visits national park(s) to see the elephants would contribute more if the elephant population increases above its current population level. Similar situation could be observed with the variable *NCUVE.* As might be expected, the coefficient for the *PERIN* and *YRSCH* were positive and significant in both models estimated.

11. Concluding Remarks

This paper used part of the data gathered from a contingent valuation study of a sample of urban residents chosen form three housing schemes in Colombo in order to examine how changes (i.e. increase/decrease in CWEP by 25%, 50% and 75%) in the CWEP in Sri Lanka would influence the initial WTP amounts that respondents agreed to pay for the conservation of this species of wildlife.

Analysis undertaken in relation to increases in population levels found that with increases in the elephant population above CWEP, there appears to be a statistically significant positive but diminishing marginal valuation at the individual respondent's level. This result seems consistence with principles of diminishing marginal utility.

The analysis undertaken in relation to hypothetical population scenarios below the CWEP reveals that the respondents at the aggregate sample level were willing to increase the initial WTP amounts that they had agreed to pay for the elephant conservation at an increasing rate. This suggests that the respondents' WTP amounts are influenced by the urgency of required action (increasing imminence at extinction in the absence of action) and the utility from a target level of population. The finding seems to reflect heightened concerns about the likelihood of non-use values being lost and generally about irreversibility. However, the results add a new complication to the interpretation of the WTP findings.

In addition, the results of the ordered probit analysis which were undertaken to examine the factors that influenced the respondents responses to the WTP elicitation questions which were presented in relation to hypothetical population scenarios reveal that they are influenced by both socio-economic and attitudinal variables.

To conclude: this research provides robust evidence that a contingent valuation study can provide useful information with practical importance to policy analyses. Nevertheless, it must be noted that the analysis undertaken in this study was based on the assumption that CWEP in Sri Lanka should at least need to be maintained in order to ensure the long-term existence of this species. Thus, if the actual safe minimum population of the elephant is smaller than the CWEP, the conclusions reached in this study could have been different to a considerable extent. Moreover, it is also important to emphasise that the conclusions reached in this study are valid only for this particular species and may or may not be applicable in the context of another endangered species. Thus it requires more empirical analysis in this nature.

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82. Visitors' Reaction to Pinnawala Elephant Orphanage in Sri Lanka: A Survey by Clem Tisdell and Ranjith Bandara, August 2003.
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84. Wildlive-Based Recreation and Local Economic Development: The Case of the Pinnawala Elephant Orphanage in Sri Lanka by Clem Tisdell and Ranjith Bandara, August, 2003.