

Measuring Economic Value for Endangered Korean Goral

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Abstract : The purpose of this paper is to examine willingness to pay (WTP) for endangered species, the Korean goral, of Woraksan National Park in South Korea. The median of the WTP is adopted to estimate the value because it will not be affected by the extreme values. The estimated household median WTP using a logit model for Korean goral conservation in Woraksan National Park was 15,221 won. The estimated value of the WTP in relation to the Korean goral has some policy implications, especially in terms of implementing policy to protect the Korean goral. The result shows that the public conservation program does have a positive WTP for the conservation of the Korean goral. This implies that the Korean goral is an important species that needs to be maintained, the government has been expended a large sum of money in an attempt to protect it.

Key words : endangered species, Korean goral, reintroduction program, dichotomous choice contingent valuation

Introduction

The Korean goral, *Naemorhedus caudatus*, has been classified by the Korea Ministry of the Environment (KMOE) and listed on CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendix I as an endangered wildlife species. Also, it has been designated by the Korea Cultural Heritage Administration (KCHA) as the Natural Monument No. 217.

The Korean goral is known from only about 700 surviving the Korean Demilitarized Zone (DMZ) and several high mountain national parks near the tracks of the Bukbu Line that have been searched. All sites are now in the DMZ and national parks where the threatened goral habitats are protected. However, a number of goral species that occupy high mountain habitat jeopardized the fragmentation of the habitat by human activities such as driving on roads, hiking on trails, and growing on agricultural land.

The Korean National Park Service (KNPS) has established an 'Ecology Conservation Plan' in order to preserve precious natural assets and provide an ideal habitat for ecosystems. The plan is aimed at providing guidelines for conservation-oriented park management, including various kinds of resource protection and research projects.

As a part of this plan, KNPS scientists conducted reintroduction programs of the Korean goral from the DMZ to Woraksan National Park in 1994-2007. Reintroduction has been encouraged as an extinction prevention strategy for animal species, however, effective reintroductions that result in self-sustaining populations are limited. Therefore the main goal of the reintroduction programs is to increase the total number of Korea gorals living in Woraksan National Park from its current critical level (10-15) to 50 in about 10 years. A threshold of 50 was the minimum viable population (MVP) according to recent biological studies (Choi and Park, 2005).

The recovery programs by conducting KNPS have been designed following the recommendation of previous feasibility studies for the local population of the Korean goral, and similar restoration programs applied in the MOE. The reintroduction program plans contained the following actions: reintroduction of Korean gorals in Woraksan National Park, an effective surveillance (via video-cameras) and the creation of a comfortable habitat for their growth and reproduction. The creation of such habitat would imply reductions of stricter regulations in terms of poaching activities, as well as diseases from other animals such as the wild goat. This recovery objective would be reached via four basic restoration actions: 1) creating protected areas including core and buffer zones, 2) restricting visitors' access in the designated protected area, 3) constant surveillance of existing and new colonies (via cameras and radio telemetry), 4)

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the analysis of the home-range and core habitat zone feces, monitoring by using radio telemetry.

In a large multi-year collaborative effort, the KNPS augmented the species' single wild population and reintroduced the Korean goral to Woraksan National Park.

In this context the aim of this paper is to determine how the willingness to pay (WTP) for conservation of the Korean goral varies with the reintroduction and conservation programs supported by KNPS. The analyses in this paper are based on data gathered from a contingent valuation survey of a sample of Woraksan National Park visitors.

The Values of Endangered Species

The value of the Korean goral, as for many other endangered species, resides in its varied economic, ecological, ethical, moral, and socio-cultural attributes.

Krutilla (1967) introduced the notion that economic value may accrue to individuals not actually using wildlife. There are three values depending on how fine a distinction one wants to make between the public's motivations for wilderness preservation.

The first one is related to option value which in an uncertain world nonuser may pay to retain the possibility of future use. This value is much like the payment of an insurance premium to maintain the opportunity of visiting the endangered wildlife species in the future. The second one is related to existence value. Krutilla (1967) argues that people often value natural resources that they have no desire to ever actually use. According to his definition, this value is derived from the knowledge that the natural environment, including its unique features and wildlife habitat, is protected. That is, some people derive enjoyment and satisfaction from simply knowing that the endangered wildlife species exist, even if they never plan to visit them. The third one is related to bequest value. This value is derived from the knowledge that endangered wildlife species should be preserved for future generations. Taking all three values together is often referred to as preservation value or nonuse value.

Many of the economists' valuation surveys pertain to measurement of the benefits of preserving endangered species. Loomis and White (1996) reviewed this literature and report, for example, that individuals are willing to pay as much as \$254 for the continued existence of bald eagles, \$33 per year to protect gray whales, and \$29 annually for sea otters. Other studies (Rubin *et al.*, 1991; Stoll and Johnson, 1984) have found that American households were willing to pay an average of \$15 to \$37 annually to ensure the survival of the northern spotted

owl and between \$7.13 and \$16.33 for the option and existence benefits associated with the preservation of whooping cranes.

Method

1. Dichotomous choice contingent valuation method

The dichotomous choice contingent valuation (DCCV), first introduced by Bishop and Heberlein (1979), has been widely used to elicit WTP for recreation, option, existence, and bequest values (Hanemann, Loomis, and Kanninen, 1991; Hanemann, 1994). In the DC approach, respondents are asked only to accept or reject a suggested price under a hypothetical market situation. That is, they need answer only a "yes" or "no" when presented with a randomly selected price. This methodology facilitates respondents' decision-making because they are familiar with discrete choices in market transactions (Hanemann, 1994). The DC format is generally considered to be the superior elicitation method (Lockwood and Tracy, 1995).

Respondents were given information in the questionnaire about the Korean goral and recovery program. They were then presented with the following passage:

The Korean goral population is distributed in several areas (Seeing Figure 1). Management efforts on behalf of endangered wildlife partly sponsored by KNPS have helped to preserve several wildlife species from the brink of extinction. For example, at least 10 of the Korea gorals have been preserved in Woraksan National Park. Supposing that budget cuts eliminate this program, and a non-government trust fund is required to manage and preserve the Korean goral, would your family contribute X won (Korean currency) for this fund once?

In the blank, only one fund amount was placed, which was randomly selected from a predetermined range of offers. Respondents were asked to provide a single 'yes' or 'no' answer to the above contingent scenario. A set of seven different offers were selected on the basis of pre-test results, which asked visitors to Woraksan National Park to provide their maximum WTP per household using an open-ended question. The results of the pre-test survey indicate that WTP ranged from a low of 1,000 to a high of 50,000 won (Korean currency). Based on the pretest, the predetermined funds were 1,000, 2,000, 5,000, 10,000, 20,000, 50,000 and 100,000 won (US\$1 is equivalent to approximately 1,023 won). In this way, respondents were asked whether they would donate a specific amount to help preserve the Korean goral.

2. Payment vehicle

Selection of a realistic payment vehicle, i.e. how the WTP amount would be paid by the respondents, is

important in the CVM (Lee and Han, 2002). Payment vehicles associated with preservation values may include taxes and/or donations. Champ *et al.* (1997) argue that donations for contingent valuation are more useful payment vehicles because they offer a plausible means of estimating the economic value of small-scale public goods, while survey respondents may object to mandatory payment schemes such as taxes or entrance fees. Many Koreans are accustomed to donations towards actions on major environmental issues, such as those undertaken by the Foundation of Wildlife Species. Thus, donations were selected for the purposes of this study as the most realistic and appropriate payment vehicle.

3. Data

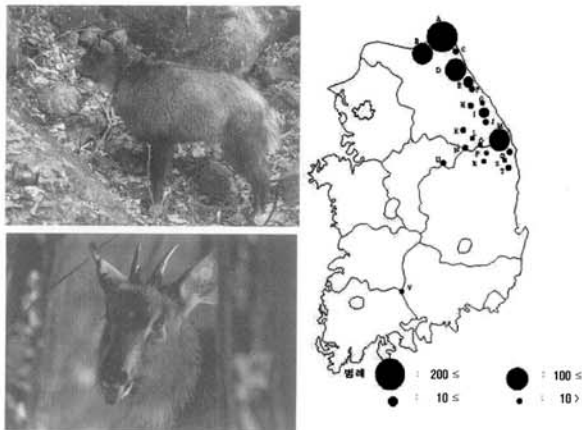
The surveys were carried out on weekends in July 2008 to randomly selected respondents at Woraksan National

Park. Of 300 questionnaires, 33 were not usable, because several important parts associated with WTP or demographic variables were omitted. A total of 267 questionnaires were usable, representing 89% of the total.

The survey structure was devised with specific sections. The initial section contained information about species conservation and the status of the goral in Woraksan National Park. This written information was complemented by graphics that detailed the current situation and location of the local colonies of goral in South Korea (Figure 1).

The second section presented the current situation of the Korean goral in Woraksan National Park. Then a reintroduction and conservation program was introduced to maintain its habitat and to ensure a favourable condition. Respondents were told that funds are needed to implement the proposed reintroduction and conservation program and that the general public's support would be needed to establish a "trust fund". The money raised by the fund would be used only for Korean goral reintroduction and conservation activities in Woraksan National Park. That was followed by the WTP question and some debriefing question regarding respondents' certainty about their answers to the WTP questions and their reasons why they were or why they were not willing to pay. Each respondent was presented with a single randomly assigned amount of these seven payment levels.

The third section collected socio-demographic characteristics of all respondents, such as age, education and income.



A, DMZ; B, Yanggu & Hwacheon Gun; C, Inje Gun Seohwamyeon Maebongsan; D, Seoraksan; E, Yangyang Gun Seomyeon Michungol; F, Odaesan; G, Sukbyungsan; H, Nochusan-Jogobong; I, Gojuckdae; J, Dukhangsan; K, Baekunsan; L, Mokoosan; M, Uljin Gun-Samcheok Si-Bonghwa Gun; N, Sobaeksan; O, Taebaeksan; P, Dohwadong-Jorokbawibong; Q, Tonggosan-Wangpicheon; R, Huinbaengi-Gangsigol; S, Geumjongsan; T, Baekamsan; U, **Woraksan**; V, Jirisan

Figure 1. The Distributions of Korean goral.

Empirical Results and Discussion

A logit model was used to analyze the responses to the WTP question, where:

$$Prob(WTP_i = 1) = \frac{e^{\beta'x_i}}{1 + e^{\beta'x_i}} \tag{1}$$

$$\beta'x = \beta_0 + \beta_1 BID + \beta_2 KNOW_i + \beta_3 MENV_i + \dots \tag{2}$$

Table 1. Definitions of variables.

Variable	Definition	Mean value
BID	The bid used (1,000)	
GEN	Dummy variable, 1 if the respondent's male; 0 female	.54
AGE	Age of respondents	35.17
INC	Total monthly household income (10,000)	340.09
EDU	1: high school or less, 2: collage or university, 3: graduate school	1.53
FAM	Total number of household members	4.07
KNOW	Dummy variable, 1 if the respondents' have read or heard anything about the endangered Korean goral in Woraksan National Park; 0 otherwise	.23
MENV	Dummy variable, 1 if a member of any environmental organizations; 0 otherwise	.09

Table 2. Probabilities of dichotomous bids.

Bid Amount	N	Response		Prob. "Yes"
		Yes	No	
1,000	38	27	11	.711
2,000	38	23	15	.605
5,000	38	21	17	.553
10,000	38	18	20	.474
20,000	38	14	24	.368
50,000	38	7	31	.184
100,000	39	3	36	.077
Total	267	113	154	

Table 3. Results of the Logit.

Bid Amount	Parameter Estimates	Standard Error	Wald-value
Constant	-2.601	.600	18.805**
BID	-.051	.009	29.922**
INC	.004	.001	15.053**
EDU	.653	.278	5.532*
GEN	.951	.322	8.707**
KNOW	1.051	.412	6.503*
MENV	2.917	.848	11.823**
-2 Log-Likelihood		234.537	
% of Right Prediction		76.7	
Nagelkerke's R2		.500	
N		267	

**significance at 1% level, *significance at 5% level

In this specification, the dependent variable WTP_i is the dichotomous variable representing the individual response to the WTP question. The explanatory variables include the BID amount, and a series of socio-economic variables, representing a respondent's characteristics that are suspected to affect individual preferences for the conservation program. These socio-economic variables include the KNOW variable that if the respondents have read or heard anything about the endangered Korean goral in Woraksan National Park. The variable MENV indicates whether the individual engages in environmental organizations; while GEN indicates the respondents' gender, and INC the monthly household income level. Summary statistics and complete variable definitions are presented in Table 1.

As noted earlier, each respondent was asked to accept or reject a suggested donation bid under the hypothetical setting. Table 2 presents the probabilities of a yes answer for seven different bids in hypothetical conditions. The results also show that, in general, the higher the donation bid, the less the willingness to pay.

Table 3 summarized the parameter estimates based on Hanemann's linear utility model. The signs of all coefficients conform to prior expectations. The estimated

coefficients of the BID, INC, GEN, MENV were found to be statistically significant at a 1% level. On the other hand, the estimated coefficients of EDU and KNOW appeared to be statistically significant at a 10% level.

Employing the coefficients reported in Table 3, calculate the median WTP estimate Hanemann (1984) for each of the j samples is calculated, such that:

$$WTP_i = \exp\left(\frac{-\alpha}{\beta}\right) \quad (3)$$

where is the grand constant term, which is defined as the cross-product of all the estimated coefficients (except the one associated with the bid amount) times their respective means; and β is the coefficient estimate associated with the bid amount. It should be noted that the median is a more accurate representation of the central tendency of the WTP distribution, while it is less sensitive to outliers.

The median WTP estimates for the recovery program are computed as 15,221 (US\$14.88) per household.

Conclusions

This article provides an approach to estimate the value of an endangered species - the Korean goral. Since market prices for endangered wildlife species rarely exist, an estimate of economic value for a policy analysis is often made. The valuation of the Korean goral of Woraksan National Park in South Korea is discussed. To increase the validity and accuracy of WTP, the dichotomous contingent valuation method based on hypothetical payments was used.

The median of the WTP could be calculated because it will not be affected by the extreme values. The estimated result in regard to the willingness to pay per household to prevent a reduction in average Korean goral,

The median WTP using logit model was 15,221. To estimate the total aggregate preservation value, median WTP was multiplied by the number of households to Woraksan National Park. Considering 152,825 households (622,000 visitors) to Woraksan National Park reported by KNPA in 2007, the total preservation value was estimated as about 2,326 million won (US\$2.27 million dollars). It could be deduced that there was a substantial willingness to pay for the preservation of endangered wildlife.

The estimated value of the WTP in relation to the Korean goral has some policy implications, especially in terms of implementing policy to protect the Korean goral. Meanwhile, some environmental scientists have devoted much research to understanding the habitat and biological factors of the Korean goral in order to maintain a suitable living environment for them. However,

such efforts demonstrate that, since people recognize that the Korean goral is an important species that needs to be maintained, the government has expended a large sum of money in an attempt to protect it.

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