# VISITOR ATTITUDES AND VALUATION OF SPECIES PROTECTION – DIFFERENCES ACROSS SPECIES, POLICIES AND VISITORS

Birgit Friedl [1,2,*], Brigitte Gebetsroither [2], and Michael Getzner [3]

[1] Department of Economics, University of Graz, Universitätsstrasse 15, A-8010 Graz, Austria

[2] Wegener Center for Climate and Global Change, University of Graz, Leechgasse 25, A-8010 Graz, Austria

[3] Department of Economics, University of Klagenfurt, Universitätsstrasse 65-67, A-9020 Klagenfurt, Austria

[*] corresponding author: birgit.friedl@uni-graz.at, phone: +43 316 380 7107, fax: +43 316 380 9520

## Abstract

Protected Areas have diverse, and sometimes conflicting, purposes and aims, such as conservation of endangered species and ecosystems as well as recreation and education of visitors. Thus, any park administration tries to find a balance between conservation and nature-based tourism, ideally based on different attitudes and values for preservation of species held by visitors and the general public. In a contingent valuation survey we focus on park visitors' attitudes towards the protection of two species differing in endangerment and popularity. The rock partridge serves as an example of an unimpressive but ecologically valuable species, while the alpine ibex illustrates a species of high popularity but low degree of endangerment. We investigate the willingness to pay for a change in the species population size resulting from different conservation measures, and the acceptance of these measures, potentially restricting visitor opportunities. As a policy conclusion, we find that protection should not be limited to ecological (and legal) concerns but it has to take account the visitors' reactions to policies, both in ecological and economic terms. In the best case, an accepted conservation measure could be (at least partly) financed from contributions by preservation aware visitors.

Keywords: species conservation, willingness to pay, Contingent Valuation.

JEL codes: C13; Q26; R52

## 1. Introduction

A common and increasing problem is the financing of national parks and the associated conservation policies for endangered species and ecosystems. The decision which species and ecosystems should be protected depends – from an economic point of view – not only on the costs of conservation but on the total economic value that is attributed to the natural resources. Thus, the question whether national parks have sufficient value to contribute to citizens' welfare and therefore justify support from the governments is the (practical and policy-relevant) purpose of most contingent valuation surveys. For instance, Lee and Han (2002) investigate the use and preservation values of natural resources for national parks in South Korea in order to either receive governmental support or to justify admission fees. The importance of supporting public preferences in the light of decreasing government funding was also recognized by White and Lovett (1999) within the North York Moors National Park in the UK. A positive value for the preservation of natural amenities has been found even in developing countries, where national park administrations face strikingly severe financial constraints (e.g., Hadker, 1997; Turpie, 2003).

Irrespective of its poor reflection in market prices, national parks provide several values. First of all, particular (endangered) species may be valuable to citizens justifying their preservation. To investigate this issue, a huge amount of valuation studies for single or multiple species have been conducted in the past.[1] Second, national parks are valuable because of the natural habitats and the landscapes they contain and the recreation they provide. The value of

[1] For instance, Stevens et al. (1997) investigate the value for restoration of salmon, Loomis and Larson (1994) for the conservation of gray whales, McMillan et al. (2002) for wild geese conservation in Scotland, White et al. (1997, 2001) for the conservation of otters, water volves, red squirrels, and brown hare, and Giraud et al. (2002) for protection programs of the Steller sea lion. For a review of some of these studies see Nunes and van den Bergh (2003) or Christie et al. (2006).

natural habitats and recreational benefits are estimated in, e.g., Tsuge and Washida (2003), Nunes (2002), Scarpa et al. (2000), White and Lovett (1999), and Chase et al. (1998). Third, ecosystem functions and services are another category of values obtained and preserved by national parks. Out of the various ecosystem functions, mainly the restoration of impaired ecosystems has been evaluated in contingent valuation studies (see e.g. Holmes et al., 2004; Zhongmin et al., 2003; Loomis et al., 2000).

In the current study, we analyze visitors' attitudes and anticipated reactions towards species conservation measures having a negative side-effect on visitors (e.g. temporal access restrictions). The main purpose is to explore (i) the visitors' willingness to pay for a change in the species population size as a consequence of different protection measures, (ii) the acceptance/approval of different "extreme" policies by proposing either very strict visitor restrictions or by enlarging visitor infrastructure (hiking trails, information, picnic sites) considerably, and (iii) the differences in the willingness to pay for two species, one charismatic and well-known by visitors, and the other unknown.

The remainder of the paper is structured as follows. Section 2 gives a description of the survey design, the valuation objective and the sample. The willingness to pay for species conservation is derived in Section 3, and the determinants of high but also zero WTP values and reports on respondents' reactions on extreme protection scenarios are discussed. In Section 4 information on the validity and reliability of the CV results are gained by exploring how individual characteristics influence the WTP decision. Finally, policy implications are discussed in Section 5.

## 2. A survey on visitor attitudes towards species conservation - Data and methods

### 2.1 Valuation object, questionnaire and sample

Two contingent valuation surveys were carried out in the Hohe Tauern national park (Austria) to investigate preferences for protecting two different species within a national park. In one survey we focus on the rock partridge (*Alectoris graeca saxatilis*), a small, brown- and grey-shaded game bird living near and above the tree line. In Europe, habitats of the rock partridge can only be found in the Alps and some mountainous areas at the Balcan and in Italy. A significant reduction of breeding pairs took place within the last 10 years with a recently stagnating population in Austria of about 900 to 1,200 breeding pairs (Birdlife International, 2004 and 2005). Thus, the rock partridge has been classified as "threatened" according to the European Union's Natura 2000 regulations (Appendix 1 of the Bird Directive), implying that the ecological status of the population must not be deteriorated within the Hohe Tauern national park (Ellmauer et al., 1999). Without informing tourists about the rock partridge and its habitat they would not recognize nor perceive the species as important, as the bird cannot easily be observed (it is very shy). On the other hand, the rock partridge has some potential for a tourist attraction as the small bird carries some beauty and might be "developed" as a charismatic species.

The second survey investigates preferences for the very popular, well-known alpine ibex (*Capra ibex*), which is currently hardly under threat. Unlike the rock partridge, the alpine ibex is a major tourist attraction at the vista point "Franz-Josefs-Height", particularly due to its low flight distance of 20 meters (for a general survey on the behavior of the alpine ibex, see Lüps, 1995). Thus, ibexes could be used to generate a conservation budget available also for other, less popular, species. However, a high number of ibexes can conflict with the protection of some endangered but unimpressive plants which are not at all appreciated by tourists (for

instance in the particular area, *Carex bicolor*). Thus, the area is a priority area with a high protection status according to the Natura 2000 regulations (Ellmauer et al., 1999).

In the survey, different interview spots were chosen: for the alpine ibex it was the Grossglockner Franz-Josefs-Height (with one million visitors per year) and for the rock partridge the quiet Mallnitz Tauern Valley (visited by some 20,000 hikers per year). The two sites not only differ in the particular (charismatic or endangered) species but also in the types of tourists visiting the sites: The Franz-Josefs-Height is an easily accessible tourist point near the Grossglockner High Alpine Road whose visitors mainly come to see the glacier and are not particularly interested in climbing and sporting activities. In contrast, the Mallnitz Tauern valley (the habitat of the rock partridge) is visited mainly by tourists that are interested in hiking, climbing, and unimpaired landscapes, and typically stay for 8 days on average in that region. The surveys were carried out by four interviewers on different parking sites, at the National Park Center, and in lodges and restaurants.

The questionnaire itself comprised six main parts concerning environmental attitudes, recreation activities in the park, travel costs and other expenses (that indirectly reveal the value for natural resources), the willingness-to-pay for species conservation (as a stated valuation method), the acceptance of and reaction to extreme scenarios, and socio-economic characteristics of the respondents.

The total amount of completed questionnaires is 440 (235 for the rock partridge survey and 205 for the alpine ibex survey). The largest share of visitors came from Germany (52.3%), followed by Austria (30.2%) and the Netherlands (9.8%), the rest came from Belgium, Switzerland, the Czech Republic, Denmark and Italy. The mean of age amounts to 42 years, with 52% of the respondents falling into the age class 30 to 49 years.

The main share of respondents holds a university degree (42.7%), while 18.8% have high school degree, 27.1% have visited a vocational school and 11.5% have a primary education. The average household consists of 3.3 persons. The joint median monthly household net income lies in the interval € 1,000 to € 2,000, which is also the median interval for the alpine ibex survey. The median income for the rock partridge lies in the interval of € 2,000 to € 2,500.

### 2.2 Willingness to Pay Questions - The survey design

In order to estimate the marginal willingness to pay for species conservation, we used contingent valuation. Among the contingent valuation of non-marketed goods and services the dichotomous choice (DC) method is suggested by many authors (Arrow et al., 1993, OECD, 2002; see also Nunes and van den Bergh, 2003). Its advantages compared to an open-ended question format are that it minimizes non-responses, avoids outliers, and confronts respondents with a familiar situation as it mimics day-to-day market decisions (Kriström, 1990). However, some pitfalls can be identified like a possible starting point bias, the possibility of yea-saying bias, the path effects (which occur by bid-increasing and bid-decreasing in the follow up bid for yes and no-responses, respectively) and the problem that only interval data is available for each respondent (Bateman et al., 2002). In addition, sophisticated statistical procedures have to be used and distributional assumptions are necessary. From a policy point of view, dichotomous choice has generally revealed higher bids than open-ended questions. Several methods have been developed to overcome these pitfalls, for coping with the starting point bias see e.g. Chien et al (2005), and for path effects see e.g. Bateman et al. (2001).

At each site, respondents were asked to value a hypothetical situation for either the rock partridge or the alpine ibex, described and visualized by means of information cards (see Figure 1 for the rock partridge; see Figure 2 for the ibex). Information comprised the actual num-

ber of species, the acreage of the habitat, the predators, nutriment and the endangerment in the status quo as well as the change due to the conservation measure. The measures for the rock partridge comprise extensive agropastoral activities (to increase suitable habitat), i.e. keeping the habitat free of groves and mowing, as well as the extension of undisturbed zones (seasonal closings) and visitor management (trail restrictions, information signs etc.). The effect or the change would be an increase in the number of breeding pairs from 12 to 16, the carrying capacity in the area (Hafner, 1994). The measures for the alpine ibex at Franz-Josefs-Height encompass the removal of diseased animals from the herd, visitor management (trail restrictions, information signs etc.) and lead to a stabilization of the current population size (200 animals, Behrens et al., 2006). [2]

[Figures 1 and 2 about here]

As elicitation format we use a double-bounded dichotomous choice (DBDC) format with 5 different initial bid values, ranging from € 5 to € 25. First, the respondents are asked whether they would be willing to pay the initial bid for an increase in the species population size. Depending on the respondents' first answer (yes or no), either a higher bid level $B_H$ (for yes respondents) or a lower bid level $B_L$ (for no respondents) was asked in the follow-up question. The bid vector was therefore € 5-10-15-20-25-30-35. [3]

[2] According to slope steepness, vegetation (brushwood and small bushes are the suitable retreat area for the partridge), and human influences from existing trekking trails and skiing tour routes, the suitable habitat and maximum population size were estimated by means of two GIS models, see Chapter 6 in Behrens et al. (2006). The same model was applied to different protection measures (e.g. seasonal closings) and visitor infrastructure (new trails and outdoor activities) to estimate the impact on breeding area, overall habitat and species numbers.

[3] WTP question (version 25 €) for rock partridge, "The national park activities are currently financed by an appropriated public fund. Additional funds are only generated if society expresses its wish for more nature

People were randomly selected before or after their hiking tour or the visit of the National Park Center. The survey was self-administered and was completed by individual persons (one person per family or hiking group). Before starting with the completion of the questionnaire, interviewers gave a short introduction to the appearance and habitat of the protected species and the effects of a given nature protection measure.

### 2.3 Questions on motives and extreme protection scenarios

In addition to the question on the willingness to pay for species conservation, attitudes, the current use, the degree of information on national park aims and the relative importance of protection of habitat, species and recreation activities were evaluated. Moreover, motives for specific WTP answers as well as attitudes on extreme policies were evaluated by respondents. The first extreme policy concerns a temporary restriction on hiking trails in order to minimize visitors' disturbances and harm to the rock partridge, and the alpine ibex and its habitat (rare plants) respectively. On the other hand, the significant extension of visitor infrastructure such as hiking trails, picnic sites or events on lodges in the habitat of the rock partridge was presented to respondents.

## 3. Results

Identifying the mean willingness to pay (WTP) in a DBDC format is more complex than in an open-ended question format and conditional on the distributional assumptions made (see e.g. Kriström, 1990, for a comparison between parametric and non-parametric estimation). In order to avoid having to conjecture distributional assumptions, we thus apply a non-parametric

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protection. Assuming that you have the possibility to contribute a one-off payment for the nature protection program for the rock partridge, would you be willing to financially support this program with 25 €? (Please consider that this would increase the expenditures for your stay at the national park)."

method (which is a purely empirical approach) to estimate the mean WTP (for details, see Bateman et al., 2002, or Haab and McConnell, 2003).

Instead of revealing exact WTP information, respondents in DC surveys express that their WTP lies in an interval by accepting or rejecting offered bid levels (B). Moreover, for every initial bid level, the two answers given by the respondent in the DBDC format reveal one of four possible sequences of answers: Yes-Yes (YY), Yes-No (YN), No-Yes (NY), or No-No (NN). The distribution of the respondents across different bid intervals is given in Table 1.

[Table 1 about here]

The standard non-parametric approach to calculate the mean and median WTP with DC data is to calculate the survivor function (by using the Kaplan-Meier product limit estimator), where the estimator reflects the probability of having a WTP less or equal to a specific bid level. A complication of DBDC data is that not only the exact level at which the individual switches from being willing to pay to not being willing to pay cannot be observed, but that we have also to deal with overlapping intervals. As a consequence, the median and mean WTP can be calculated only after retrieving the survivor function by using Turnbull's self-consistency algorithm (TSCA). This procedure of attributing data to definite intervals and calculating the survivor function with several iterations is described in the appendix for the rock partridge survey. The results will be compared for the rock partridge and the alpine ibex in Section 3.1, while Section 3.2 gives some explanations on WTP levels.

### 3.1 Comparison of WTP measures for the rock partridge and the alpine ibex

The values of the mean and aggregated one-off WTP for an increase in the rock-partridge population and the maintenance of alpine ibex population are given in Table 2.

[Table 2 about here]

The WTP for the protection of the alpine ibex is higher than for the rock partridge. However, the differences in mean WTP for the different nature protection scenarios are only weakly significant with p=0.08[4]. Thus, the differences between rock partridge WTP of 6.9 and ibex WTP of 8.7 does seem to be only very small given the fact that the ibex is very popular while the rock partridge is nearly unknown and hard to observe, and that the two conservation programs are completely different with specific aims and policies involved. Due to keeping species numbers constant in the ibex scenario, our analysis is restricted to a comparison of average WTP for the total conservation program but not for an additional species.

To elicit the importance of use values (i.e. observing a species) relative to non-use values, respondents were asked about their dominant motive for nature protection. The bequest and existence value (63% and 25% respectively) are perceived much more important than the option value (13%).[5] While these numbers express the average across surveys, the existence value is more important for the ibex than for the rock partridge and the reverse holds for the bequest value.

Given the starting bid and the combination of answers, we can calculate the amount of money respondents are at least willing to pay. E.g., if the initial bid is 10 and the second bid is 15 and the sequence of answers is Yes/No, the respondent is willing to pay at least € 10. The mean and the median for the lower bounds of WTP by sequence of answers are given in Table 3 and are statistically different for each combination of answers.

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[4] This was tested only for the lower bound of the bid levels due to the DBDC design.

[5] The three options were the following: "I donate for animals and plants because they have a right to exist" (=existence value), "I donate for animals and plants to have the option of watching them in the future" (=option value), "I want to bequeath a healthy environment to my children and grandchildren" (=bequest value).

[Table 3 about here]

Although respondents of the rock partridge survey show a higher median income than respondents of the alpine ibex and their expenses at the national park are higher (€ 64.5 vs. € 51.1) their WTP is smaller for the protection of the rock partridge. These results emphasize the influence of the popularity and charisma of a species on the WTP for it.

In the alpine ibex questionnaire the perception of an additional policy was elicited. By installing salt licks to attract the alpine ibex near an observation platform for visitors the probability of being able to watch an alpine ibex would increase. Respondents were asked whether this would change their support of the overall protection program (asked in the original WTP block) and how much they would additionally be willing to pay for the increased probability. Only 10.5% of the respondents would be willing to pay an additional amount of money in order to increase the likelihood of seeing an alpine ibex while 89.5% would not. The mean WTP of these 10.5% of yes-respondents is € 12, the median € 10.

Comparing these results of additional WTP with the former WTP answers shows that 74% of those respondents, who do not want to pay an additional amount, the original WTP lies in the interval between € 0 and € 10, while the rest were willing to pay an amount between € 10 and € 35 on average. For those, who were willing to pay an additional amount, responses were equally distributed among the WTP intervals (see Table 4). The statistical significance of a relation between responses to the original and the additional WTP question was tested by chi-square test and showed a value of 0.005.

[Table 4 about here]

### 3.2 Motives and rationales for WTP answers

At least 35% of the joint respondents (rock partridge and alpine ibex) report a positive WTP for the species conservation scenario, corresponding to a Yes to the first and/or the second

bid: Yes/Yes (YY) was chosen by 8%, Yes/No (YN) by 17% and No/Yes (NY) by 11%.[6] Moreover, chi-square tests show that there is no significant correlation between the sequence of answers and the questionnaire versions (i.e. the starting bid).

What are the main reasons for No/no (NN) respondents to reject the contingent market or for all other respondents to accept the contingent market? This has been investigated by a series of control questions. The answers show that the main reason for NN respondents to reject the bid is that they see nature protection as a public concern (63.7% agreed to that statement). This reason is significantly stronger for respondents of the Franz-Josefs Height (67%) than for respondents in the Mallnitz Tauern valley (61%) and emphasizes the results that the latter subgroup is more aware of nature protection. A larger share of the Mallnitz Tauern valley visitors are members of environmental organizations (30% vs. 23%), prefer hiking and climbing, stay longer on average, and visit the park more often.

The most important motive for NN answers is the opinion that nature protection is a public concern (64% highly agree), followed by the statement that they already pay too much tax (47.1%) and that they have too little income (43.6%). On the other hand, nature protection is important for most of the NN respondents as only 10.5% agree that nature protection is of no value for them. 17% highly agree with the statement that they would like to pay for another species.

Another segment of the questionnaire comprised several statements that had to be valued by all respondents (NN respondents and others) and that should reveal reasons for different WTP answer sequences. Questions covered statements like “nature protection is important irrespective of its costs”, the personal importance of nature protection in conservation with friends, and the pre-exposure/experience with WTP formats to evaluate nature protection. When test-

[6] Results are presented separately only if there are significant differences between the two questionnaires.

ing for differences in attitudes towards theses statements across sequences of answers to the WTP question, we find a highly significant difference between NN and all other respondents: 31% of NN respondents would pay for nature protection without a majority doing so as well, while 68% of all other respondents would not do so (p=0.000 in the chi-square test). Put differently, 81.1% of those who would not pay without a majority are NN respondents.

## 4. Discussion

### 4.1 Specific attitudes on extreme protection measures for the rock partridge

Two additional, more "extreme", nature protection scenarios were valued by means of two questions on (dis)approval (but not in a contingent valuation format). They are called "extreme" because they either restrict visitors considerably in their activities or support activities that can harm species (and would be in contradiction to conservation requirements by e.g. the FFH directive).

First of all it was asked how visitors would react to a temporal restriction to hiking trails in order to protect the breeding behavior. The survey shows that visitors' behavior is only slightly influenced by the restrictions, i.e. only 8.3% of the visitors would not visit the national park any more, 23% would visit another hiking area and 6.2% would go on holidays abroad.

The second scenario proposed additional visitor facilities like hiking trails or events at lodges. Visitors were asked if they would use the additional facilities and therefore would accept possible harm to the rock partridge. The results show that 43% would not use the additional facilities (at all) and another 41% is indecisive.

### 4.2 Specific attitudes on protection measures for the alpine ibex

Like in the survey for the rock partridge respondents in the alpine ibex survey were asked about their reaction to and attitudes on additional or alternative policies. The first policy was,

as in the rock partridge survey, temporal restriction to hiking trails in order to protect the species. The results show that the majority of respondents would come to the national park despite the restrictions (53%). However, 25.7% would visit another hiking area and 6.2% would not go hiking any more. As for the rock partridge respondents, visitors are keen on hiking and would not want to forgo hiking. Not astonishingly therefore, holidays abroad are not an option for a majority of the alpine ibex respondents.

In the area of Franz-Josefs-Height, the survey area and habitat of the alpine ibex, it is also important to protect rare plants (e.g. *Carex bicolor*) that could be damaged by an increasing number of visitors. Therefore respondents were asked about their possible reactions if the access to hiking trails were temporally restricted in order to protect these rare plants.

Possible reactions to temporal hiking restrictions are similar for both, the protection of the species (alpine ibex) and endangered plants in its habitat. However, in one aspect the two results are different: in the case of protecting endangered plants a significant smaller percentage (11%) would not go hiking any more versus 37% in the case of protecting the alpine ibex. Therefore it seems as there is a relative higher valuation for the protection of the alpine ibex than for the protection of endangered plants. Yet results on the question of the relative importance of habitat, species and visitor infrastructure do not verify this attitude. Ecosystem (habitat) protection was ranked first on average (45%), followed by species protection (35%) and the provision of visitor infrastructure (20%).

### 4.3 Testing the validity of the surveys

Generally, a contingent valuation study is "valid if it measures true willingness to pay and reliable if the estimates of value for the same good remain similar over repeated applications" (Jakobsson and Dragun, 1996, 91). As we cannot test whether the current surveys are reliable – repeated surveys were out of the range of the research project – we can test for validity.

First, the design of the questionnaire was based on thorough discussion and use of questions that turned out to be good estimators of preferences. Second, the most important part of validity – construct validity – was tested with respect to the sensitivity of respondents' WTP bids to individual characteristics. However, since the sample size is small, sophisticated econometric techniques run aground as, for instance, multinomial logit or spike models need a much larger empirical base to exhibit useful results.

Thus, construct validity was tested on the basis of a simple binomial logit model. The following empirical question was estimated:

$$\Pr(y_i | x_i, \beta) = 1 - (1 - (\exp(-e^{-x_i'\beta})) \quad , \qquad (1)$$

with $x_i$ being the explanatory variables; eq. (1) thus estimates the probability that respondents answer "Yes" to the (first) bid offered to them in the questionnaire. In order to enlarge the sample, we pooled the two surveys which are identical except for the species offered to be improved in the conservation program.

As explanatory variables, the following attributes of respondents were chosen. The variable INCOME measures the net income of the respondent's household. Economic theory suggests that the coefficient for that variable is positive as individuals (households) with a higher income can afford to "buy" larger amounts of the goods offered. The second variable, WTP_BID, is the bid offered to the respondent as a contribution to the financing of the nature conservation program. The higher the bid, the lower should be the probability of a "Yes" answer. The variable INFORMATION covers the background of the respondent in terms of her/his knowledge about the aims of the national park. We can hypothesize that increasing information might increase the respondent's WTP. The variable AGE turned out to be useful (and significant) in many valuation studies. Usually, younger respondents are, ceteris paribus, willing to pay more than older respondents. Donating to environmental causes is covered by

the variable DONATION. Finally, actual behavior and knowledge about the national park is covered by the variable NP_CENTER. It takes a value of one for respondents who have enjoyed national park facilities such as the exhibitions in the national park centre.

Table 5 presents the results of a simple logit estimation that exhibits the theoretically expected coefficients. However, as the p-values (significance of estimators) show, the estimation is problematic due to the small sample. However, with the current results, we can conclude that there is some reliable confirmation of the validity of the survey with respect to theory based hypotheses.

[Table 5 about here]

## 5. Conclusions

The current study presents the results of two willingness to pay surveys carried out in the Hohe Tauern national park. It turns out that preferences for species conservation exist, expressed as a positive WTP of visitors for species protection programs. While the validity of the surveys is corroborated by econometric evidence, there are a couple of major conclusions that can be drawn from the surveys.

Mean WTP of visitors for the conservation program for the rock partridge programs amounts to € 6.9 per visitor and seems to be only slightly different for WTP for the ibex (mountain goat) program (€ 8.6 per visitor). It cannot be judged based on the underlying data whether there is some "fixed" amount of WTP of visitors for conservation programs in the Hohe Tauern national park regardless of the program offered to visitors. However, there is some indication that the *method itself* produces these results (which is highly problematic from a methodological point of view).

While the validity test shows that the WTP values elicited are in line with the theoretical expectations of WTP determinants, it is striking that answers are quite similar between two very

different programs. On the one hand, we tested for a program of an unknown, shy, gray little bird for which the observation probability is very low. The program would increase the size of the population from 12 to 16 breeding pairs in a rather large habitat of more than 1,000 hectares. On the other hand, willingness to pay for the popular and easy-to-see ibex (mountain goat) is rather similar to the rock partridge. In general, we would have expected a much larger difference between the two programs in terms of visitors' WTP.

When aggregating the individual WTP for the annual number of visitors to each of the two sites, the resulting potential conservation budget is higher than actual costs of the proposed programs, see Behrens et al. (2006). This conclusion is even stronger when compared to the potentially large WTP of all (Austrian) citizens for species conservation in the national park (non-use values such as the existence, option and bequest values of non-visitors). This, of course, holds under the assumption that the visitors' WTP can actually be transformed into a "nature conservation tax". Furthermore, it can be doubted whether the WTP figures resulting from such a CV venture can be taken at face value to calculate the amount of taxes to be paid for conservation. What the study certainly reveals is that there is a significant WTP for species and habitat conservation that might be much higher than the conservation budget needed to implement these measures. But we cannot, however, derive a reliable estimate for such a conservation tax that might rather be based on the costs of the programs and policies.

Regarding financing conservation measures, the aggregate WTP of visitors might be thus sufficient to cover the costs of the conservation programs suggested. The question remains whether visitors alone should finance all programs while the general public enjoys the non-use values as well (e.g. the Hohe Tauern national park as a national heritage). From the viewpoint of the authors, visitors can contribute with significant proportions to the conservation budgets, but as the number of visitors over time varies, financing of conservation measures

need to be based on general taxes to secure the necessary measures not only with respect to biodiversity conservation, but also regarding the sustainable regional development of a peripheral national park region in mind.

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**Appendix: Calculation of the average WTP for the rock partridge survey**

When collapsing identical intervals in Table , there are 16 possible WTP intervals according to the questionnaire design and the answers. However, there still remain some overlaps of intervals, for instance respondents answering 'no/no' to the initial bid 15 (WTP interval 0 to 10) and respondents who say 'no/no' or 'no/yes' to the initial bid 10 (WTP in the intervals 0 to 5 and 5 to 10, respectively).

In order to retrieve non-overlapping intervals only, first the yes-respondents to all intervals having at least the bid level $B_j$ as the lower boundary value, as well as the corresponding sample sizes are summed; this sum gives the updated number of respondents answering 'yes' (denoted by $n_j$) and the updated total number of 'yes' and 'no'-votes in that sub-sample (denoted by $N_j$); from that, the initial survivor function $\hat{S}(B_j)$ can be calculated as the ratio of the number of respondents answering 'yes' ($n_j$) to the size of the sub-sample ($N_j$):

$$\hat{S}(B_j) = \frac{n_j}{N_j} \quad \text{with } j = 0 \text{ to } J \tag{A.1}$$

If $\hat{S}(B_j)$ forms a monotone non-increasing sequence of proportions then this sequence provides a Distribution Free Maximum Likelihood (DFML) estimator of the probability of accepting a bid (Kriström, 1990). To ensure a decreasing function, i.e. a decreasing probability for yes-votes the higher the bid levels, the pooled adjacent violators algorithm (PAVA) is applied. Beginning with the first bid level $B_j$, the probability level of bid $B_j$ is compared with the subsequent bid $B_{j+1}$. If the probability of $B_{j+1}$ is greater than of $B_j$ the observations at the

two bid levels are pooled and the survivor function is recalculated (joint probability). This procedure is continued until the function is a non-increasing step-function.

In order to find the survivor function at each of the boundary values (the "borderlines" of the non-overlapping bids), the Turnbull's self-consistency algorithm (TSCA) method is applied by calculating the new probability fractions for the basic intervals in the following steps.

First, the probability values $\hat{S}(B_j)$ are used to calculate the fraction $f_j$ of larger intervals that are assigned to the corresponding non-overlapping interval according to $f_j = \left(\hat{S}(B_{j-1}) - \hat{S}(B_j)\right)/\left(\hat{S}(B_i) - \hat{S}(B_k)\right)$.[7] Then, these updated numbers of respondents are again used in the calculation of the survivor function. The procedure is iterated by using the updated estimates for the survivor function until the point estimates do not change (for the rock partridge survey, this took 17 iteration, see fifth column of Table 6 for the results).

[Figure 3 and Table 6 about here]

According to the Kaplan-Meier technique, the median can be read of the graph of the final survivor function for the probability of 0.5 and is zero for the rock partridge. The mean can be calculated according to $\overline{C} = \sum_{j=1}^{J} \hat{S}(B_j)\left[B_j - B_{j-1}\right]$ and equals the area under the survivor function. The bid variance is given by $\mathrm{var}(C) = \sum_{j=0}^{J} \hat{S}(B_j - \overline{C})^2 \left(\hat{S}(B_j) - \hat{S}(B_{j+1})\right)$ and the variance of the mean WTP is calculated as $\mathrm{var}(\overline{C}) = \mathrm{var}(C)/N$. For the rock partridge survey, the mean WTP is € 6.887 for 4 additional breeding pairs (see Table 6), with standard deviation 0.785.

[7] For instance, the interval (0 to 10) has to be split across the basic intervals (0 to 5) and (5 to 10). Thus, the fraction for (0 to 5) is calculated by $\left(\hat{S}(B_0) - \hat{S}(B_5)\right)/\left(\hat{S}(B_0) - \hat{S}(B_{10})\right)$ and for (5 to 10) by $\left(\hat{S}(B_5) - \hat{S}(B_{10})\right)/\left(\hat{S}(B_0) - \hat{S}(B_{10})\right)$, yielding a share of 1 for (0 to 5).

**Tables and Figures**

*Table 1: Overview of the structure of bids*

| *Initial Bid* | *Second bid* | *total* | *Total* | | *%* | |
|---|---|---|---|---|---|---|
| | | | *no/yes yes/yes* | *no/no yes/no* | *no/yes yes/yes* | *no/no yes/no* |
| 10 | 5 | 44 | 4 | 29 | 9.09 | 65.91 |
| | 15 | | 1 | 10 | 2.27 | 22.73 |
| 15 | 10 | 45 | 7 | 29 | 15.56 | 64.44 |
| | 20 | | 1 | 8 | 2.22 | 17.78 |
| 20 | 15 | 45 | 5 | 26 | 11.11 | 57.78 |
| | 25 | | 6 | 8 | 13.33 | 17.78 |
| 25 | 20 | 39 | 3 | 30 | 7.69 | 76.92 |
| | 30 | | 2 | 4 | 5.13 | 10.26 |
| 30 | 25 | 38 | 0 | 31 | 0.00 | 81.58 |
| | 35 | | 3 | 4 | 7.89 | 10.53 |

*Table 2: WTP for the rock partridge and alpine ibex*

| | rock partridge | alpine ibex |
|---|---|---|
| *Mean WTP for the change or maintenance [in €]** | 6.887 | 8.693 |
| *Standard deviation* | 0.785 | 0.885 |
| *Total sample size N* | 211 | 170 |
| *Total (estimated) number of visitors per year* | 23,000 | 800,000 |
| *Total WTP (all visitors) [in €]* | 158,400 | 6,954,400 |

*) According to Bateman et al. (2002) the estimates can be seen as lower bounds of the true values.

*Table 3: Mean and median for the lower bound of WTP (€)*

| | *all respondents* | | *rock partridge* | | *alpine ibex* | |
|---|---|---|---|---|---|---|
| | *mean* | *median* | *mean* | *median* | *mean* | *median* |
| YY | 25.8 | 25 | 26.9 | 25 | 25.0 | 30 |
| YN | 18.1 | 20 | 17.6 | 15 | 18.7 | 20 |
| NY | 12.8 | 10 | 11.8 | 10 | 13.6 | 10 |
| NN | 0.1 | 0 | 0.0 | 0 | 0.3 | 0 |

*Table 4: Correlation of initial and additional WTP*

| | *former WTP (percentage in intervals)* | | | *total* |
|---|---|---|---|---|
| *additional WTP* | *0 to 10* | *10 to 20* | *20 to 35* | |
| Yes | 74% | 14% | 12% | 89% |
| No | 35% | 35% | 29% | 11% |

*Table 5: Testing the validity of the surveys*

| *Variable* | *Coefficient* | *z-Statistic* |
|---|---|---|
| INCOME | 0.000132 | 1.672638* |
| WTP_BID | -0.015526 | -2.018850** |
| INFORMATION | 0.323088 | 1.717674* |
| AGE | -0.009833 | -2.082520** |
| DONATION | 0.002656 | 1.508275(*) |
| NP_CENTER | 0.241395 | 1.392871(*) |
| S.E. of regression | 0.435825 | |
| Sum squared resid. | 57.36303 | |
| Log likelihood | -171.8387 | |
| *n* | 308 | |

Logit extreme value estimation;
**p<0.05, * p<0.1, (*)0.1<p<0.15;
only significant coefficients are presented.

*Table 6: Survivor function after 17 iterations (rock partridge survey)*

| *bids* | *yes-respondents* | *N* | *initial survivor fct* | *survivor fct. (adjusted)* | *step size* | *mean* |
|---|---|---|---|---|---|---|
| 0 | 1 | | 1 | 1 | | |
| 5 | 80.13 | 258 | 0.311 | 0.317 | 5 | 1.585 |
| 10 | 76.13 | 235 | 0.324 | 0.317 | 5 | 1.585 |
| 15 | 51.72 | 209 | 0.247 | 0.248 | 5 | 1.237 |
| 20 | 33.17 | 190 | 0.175 | 0.175 | 5 | 0.873 |
| 25 | 20.30 | 152 | 0.134 | 0.134 | 5 | 0.668 |
| 30 | 16.31 | 122 | 0.134 | 0.134 | 5 | 0.668 |
| 35 | 6.77 | 125 | 0.054 | 0.054 | 5 | 0.271 |
| ∞ | 0 | | 0 | 0 | | **6.887** |

*Figure 1: Information card on the rock partridge and nature protection scenario*

## The Rock Partridge in the Mallnitz Tauern Valley

**Rock Partridge**
(threatened bird species
according to Natura 2000)
current population size: 12 breeding pairs

**Habitat**
of about 2,800 hectares
thereof: breeding area
of about 1,000 hectares

- **It is threatened and worthy of protection according to the Birds and Habitats Directive of the EU *(Natura 2000)***
- **It is an indicator for unimpaired alpine landscapes**
- **At the moment there are 12 breeding pairs in the Mallnitz Tauern Valley.**

**appearence:** (see illustrations above) the weight is about 600 grams and the height about 15-20 cm.

**habitat:** it is tied to high mountainous regions, mainly on rocky and craggy slopes. Shrubbery serves as hiding-place and shortens escape routes.

**nutriment:** plants or invertebrates, depending on the season, like grasses, seeds, fruits or herbs

**enemies:** e.g. golden eagle, fox or hawk. Habitat degradation and loss through tourism are very important threats for the rock partridge.

## Nature Protection Scenario

In order not to threaten the rock partridge population and to maintain its habitat, measures should be taken like **keeping the area free of wood** (as meadows and shrubbery are the rock partridge's habitat), the **expansion of rest areas**, as well as **visitor management**.

These measures would
- **increase the habitat** and breeding area of the rock partridge,
- increase the **number of breeding pairs** in the Mallnitz Tauern Valley to ***16*** and,
- **alleviate disturbances** through visitors and hikers apart from hiking trails.

*Figure 2: Information card on the alpine ibex and nature protection scenario*

## The Alpine Ibex on the Franz-Josefs-Height

**Alpine ibex**
200 on Franz-Josefs-Height

**Endangered plant species within the habitat of the alpine ibex**

- **originally native to the Alps, today potentially threatened species** (diseases)
- **As a result of very extensive hunting, the alpine ibex was extinct in the Alps at the end of the 18th century.**
- **It has been reintroduced through man in the sixties of the last century**

**appearance:** (see illustrations above) body length 100-160 cm, weight: 25-40 kg (female), 40-90kg (male),

**man:** The alpine ibex is a shy animal. The possible distance between an alpine ibex and an observer is about 20 metres. Unexpected events (especially through hikers and climbers apart from marked trails) disturb the animals and lead to a retreat of the alpine ibex in upper locations)

**food:** mainly grass an herbes, especially keen on salt licks

**habitat:** high alpine regions, rocky regions (2000-3500m above sea level). It also appears in lower locations, attracted by salt licks (with possible damage to plants).

## Nature Protection Scenario

Time and again diseases caused a threatening reduction of the alpine ibex stock. Due to wildlife management the stock of alpine ibex has reached 200 animals at the Franz-Josefs-Height. In order to maintain this stock for the long run, measures like **wildlife management** (e.g. extraction of ill animals from the pride) as well as **visitor restrictions** (e.g. prohibition and imperative signs, rest areas and observation sites)

Figure 3: Survivor function for double-bounded estimate (n = 430)