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Authors: Ericsson, Göran, Kindberg, Jonas, and Bostedt, Göran

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ORIGINAL ARTICLES

Willingness to pay (WTP) for wolverine *Gulo gulo* conservation

Göran Ericsson, Jonas Kindberg & Göran Bostedt

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Knowledge about people's willingness to pay (WTP) for conservation efforts is becoming increasingly important for natural resource management. We used a mail survey with four contacts to 11,418 people, aged 16-65, to investigate how much and why Swedes were willing to pay for wolverine *Gulo gulo* conservation. With the restricted distribution of European wolverines, Sweden has a key role in their management. We found that Swedes were least likely to support wolverine conservation efforts compared to wolves *Canis lupus*, lynx *Lynx lynx* and brown bears *Ursus arctos*. The amount varied between 965 and 1,233 SEK per person. Of the national representative control group, 47% expressed willingness to pay an average of 1,253 SEK per person. We found that in densely populated urban municipalities with a high proportion of university educated, high female-to-male ratio, positive attitude to the European monetary union (EMU), and a high income, people were more positive towards paying for wolverine conservation. The presence of wolves, but not the presence of any of the other large carnivores, was negatively related to peoples' WTP for wolverine conservation. This indicates that the presence and related experience of wolves might be the principal driver of people's perception of all large carnivores, including wolverines.

Key words: attitudes, carnivore conservation, experience, local scale, mail survey, values, wildlife management

Göran Ericsson & Jonas Kindberg, Department of Wildlife, Fish and Environmental Studies, Swedish University of Agricultural Sciences, SE-901 83 Umeå, Sweden - e-mail addresses: Goran.ericsson@szooek.slu.se (Göran Ericsson); Jonas.kindberg@szooek.slu.se (Jonas Kindberg)
Göran Bostedt, Department of Forest Economics, Swedish University of Agricultural Sciences, SE-901 83 Umeå, Sweden - e-mail: Goran.bostedt@sekon.slu.se

Corresponding author: Göran Ericsson

People's attitudes towards large predators are becoming increasingly important as more and more management institutions worldwide recognise the need for human dimension data. Human dimensions entail how people value wildlife in several aspects (Decker et al. 2001). It encompasses their perception of management, and how they want to interact with and be affected by wildlife and, most importantly, their attitudes and valuation. We restrict our analysis to the economic component of

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people's valuation of wolverines *Gulo gulo*, as it is a central dimension of people's general attitude towards large carnivores (e.g. Boman & Bostedt 1999, Bostedt & Boman 1996, Bostedt 1999). Our rationale for using a monetary valuation is that it is a valid proxy for attitudes towards large carnivores, such as wolverines, and that it is necessary for policy purposes, e.g. cost-benefit analyses of carnivore conservation projects (Freeman 2003, Boman et al. 2003). As identified by Kaltenborn & Bjerke (2002) personal attitudes and values are parts of a much wider socio-political complex. Thereby monetary valuation and economic interest in wolverines can be central in forming people's general attitude towards the animal (*sensu* Kleiven et al. 2004).

What are people in Sweden willing to pay for wolverine conservation? Biological conservation programs are today increasingly challenged to justify their efforts in monetary terms - especially as society always has an alternative use of the resources. Today we can say that wildlife valuation is a necessary prerequisite for social decision making concerning carnivores, and thus the integration of conservation biology and economics is fundamental (Heberlein 1991a,b, Boman et al. 2003). People's valuation of large carnivores is expected to differ depending on what species we refer to. Kellert et al. (1996) suggested that conservation efforts aiming at large carnivores should acknowledge that people feel differently about each species. We could sum up this argument by saying that a relative weight should be assigned to each species to guide conservation. As noted by Kleiven et al. (2004) in a national survey of Norwegians in 2000, the wolverine is a species for which information is sparse regarding people's social acceptability for conservation efforts. In this paper, we build on this criticism and investigate people's conservation interest for wolverines in relation to the more well known attitude objects: wolves *Canis lupus*, brown bears *Ursus arctos*, and lynx *Lynx lynx*.

In Europe, wolverines inhabit the northern boreal and arctic parts of Sweden, Norway, Finland, and the northwesternmost corner of Russia (Landa et al. 2000, Persson 2003; Naturvårdsverkets Rovdjursforum at: http://www.naturvardsverket.se/). If and what Swedes are willing to pay for wolverine conservation is thus not an isolated national matter, given Sweden's responsibility for wolverines at the European level due to the restricted distribution of the species. The distribution is further constrained by the fact that wolverines to a large extent are sympatric with reindeer *Rangifer tarandus*, inhabiting mountainous and forest areas. Currently, it is estimated that approximately 420 wolverines live in Sweden. The first national conservation goal set by the Swedish parliament is 575 wolverines corresponding to about 90 reproducing females per year.

Given the aforementioned European responsibility Sweden has for wolverine conservation, and the far-reaching integration of economics into conservation work, it is a surprise to find that only one previous study (Dahle et al. 1987) has collected data concerning willingness to pay (WTP) for conservation of wolverines. The lack of wolverine data in the literature, in terms of the human dimension, is almost universal. Attitude and valuation literature is vastly dominated by wolf studies (e.g. Bostedt & Boman 1996, Duffield & Neher 1996, Boman & Bostedt 1999, Williams et al. 2002, Chambers & Whitehead 2003, Heberlein & Ericsson 2005). During our literature review it became apparent that this may be due to either people's lack of knowledge about wolverines, given its restricted distribution to sparsely populated areas, or the limitation of human-wolverine conflicts to a small geographical area of the world, i.e. Scandinavia (e.g. Walker 1996, Persson 2003). The two rare exceptions to the information drought about wolverines and people's perception are publications from Norway, although neither focuses on wolverines *per se*. In Norway wolverines come in direct conflict with sheep farming in more densely populated areas, and reindeer husbandry in more remote areas. In a survey, Røskaft et al. (2003) compared the level of fear among the Norwegian public for brown bears, wolves, European lynx and wolverines. They found that the fear people displayed was lowest for wolverines (20% of respondents), and highest for brown bears (57%). The study by Kleiven et al. (2004) somewhat mirrors those findings.

Researchers worldwide often find relationship between people's valuation of large carnivores and socioeconomic variables. In a review of studies about attitudes towards wolves, Williams et al. (2002) found that age, rural residence and experience of farming or ranching negatively influence people's attitudes, and that education and income positively influence people's attitudes towards wolves. Some, but not all, of the studies reviewed report a gender effect with women being more positive.

A paradox, at least on first reflection, is that successful carnivore reintroductions (i.e. wolf) are likely to reduce societies' positive attitudes because

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they will experience real animals (Williams et al. 2002). However, if we widen our scope, we discover that social psychology has shown that direct personal experience leads to stronger and more central attitudes (e.g. Petty et al. 1992). Thus, besides the social setting of attitudes towards large carnivores, we have to consider the situational settings as well (Kleiven et al. 2004). Such a situational setting is actual experience of the animal, in this case the wolverine. Ericsson & Heberlein (2003a) confirmed the central role of experience as a moderator of people's attitudes to large carnivores. However, they did not find any relationship with positive experience of wolves, only with negative predation experience. Furthermore, it loops back to the socio-demographic findings (e.g. Williams et al. 2002, Kleiven et al. 2004) since negative experience mostly affect people where large carnivores predate on wild or domestic animals, and large carnivores tend to live in rural areas with low human population density. Consequently, if we want to understand why people like or dislike large carnivores such as wolverines, we need to capture the valuation in the areas where large carnivores live. Thus, to test if negative experience moderates what people think about wolverines, then focus needs to be on people in those areas (Williams et al. 2002, Ericsson & Heberlein 2003a).

Large carnivores may have symbolic dimension far beyond their biological impact (Sharpe et al. 2001). Especially among minorities in the society, e.g. in rural areas among farmers and hunters, carnivores sometimes become a symbol that the dominating society does not care for the things that are important for rural and countryside areas (e.g. Enck & Brown 2002). The conservation and management of locally controversial carnivores, like wolves and wolverines, may be viewed as one way the central power exerts dominance over the rural, peripheral areas (e.g. Enck & Brown 2002). Thus, the valuation of a carnivore like the wolverine might involve a rural protest against central authorities, in general, as well as specifically to a single attitude object. In many Swedish rural regions, the European Union (EU) may symbolise the authority that exerts this dominating control (Holmberg 2001). This became apparent in the 2003 referendum when Swedes turned down the bill to join the European monetary union (EMU). Such a protest may not be trivial. Ericsson & Heberlein (2003a) suggested that remaining variation in their studies could be explained by including information about attitudes towards the dominating society, in this case EU and the EMU-project. Thus, following this logic, we use the proportion of people being negative towards the EMU in each of 69 municipalities and nationwide as one independent way of measuring the dissent towards wolverines.

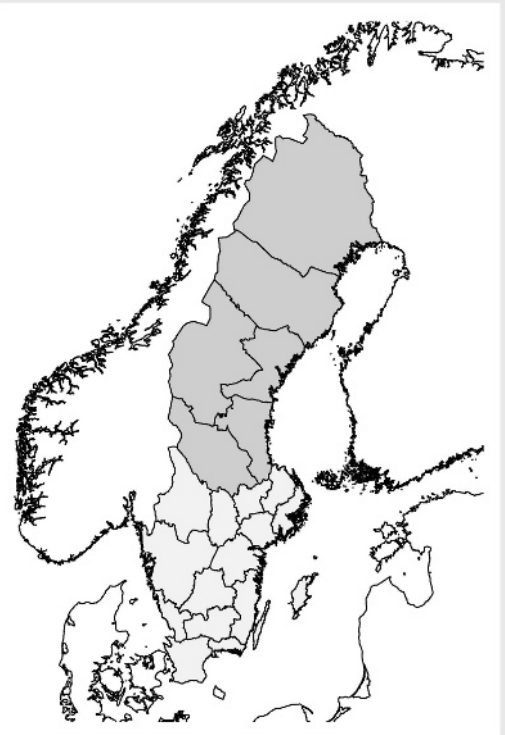


Figure 1. The study area consisted of the six northernmost counties ('län') where populations of carnivores were present (■; the carnivore area). We oversampled 150 persons in each of the 69 municipalities ('kommun') within the six counties. The rest of Sweden (■) served as a representative national control group.

The symbolic aspects of carnivore valuation is one of several cognitive problems connected to this type of valuation, another being preference uncertainty. When asked to value a public good with which the respondent has limited personal experience (such as wolverines), a question format which allows for the expression of uncertainty is needed. To this end, a multiple-bounded, discrete choice question format involving five different certainty levels was employed in the survey.

In our study, we oversampled in six Swedish counties ('län') at the municipality ('kommun') level (Swedish municipality ~ US county) where carnivores are present (the carnivore area; Fig. 1). The rationale for local oversampling is straightforward. In a classical, widely cited study, Ajzen & Fishbein (1977) showed that the association between atti-

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tudes and behaviour was stronger when measured at a corresponding level of specificity. Lately, a string of papers from e.g. Norway and Sweden have underlined the importance of oversampling in geographical areas of particular importance for conservation and management (e.g. Kleiven et al. 2004, Ericsson & Heberlein 2003a, Heberlein & Ericsson 2005).

In this paper, we focus on two aspects. First, the relative valuation of wolverines in relation to wolves, brown bears and European lynx, and secondly Swedes willingness to pay for wolverine conservation using aggregated socioeconomic data from the 69 Swedish municipalities downloaded from Statistics Sweden for 2005 (http://www.scb.se). We contrast this with a national, representative sample from the rest of Sweden. We also test the effect of experience, i.e. do presence and relative abundance of large carnivores affect people's willingness to pay for wolverine conservation to meet the national goal for the wolverine population?

Material and methods

Contingent Valuation Method

Contingent Valuation Method (CVM), a survey-based, stated preference method, is a commonly used technique to value non-market amenities (e.g. Mitchell & Carson 1989, Boyle 2003). The questions asked in CVM studies follow one of several possible formats. In 1993 the Blue Ribbon panel on Contingent Valuation, summoned by the U.S. National Oceanographic and Atmospheric Administration, NOAA (NOAA 1993), advocated the use of questions where the respondent is faced with a bid rather than asked to reveal his/her willingness to pay for an environmental amenity, so-called open-ended valuation questions. The respondent is in the simplest form of the discrete-choice format asked to accept or reject one bid, which is varied over different subsamples, essentially providing point observations on a demand function for the environmental amenity (Bishop & Heberlein 1979). However, the original format of the question is imprecise since the only information revealed to the researcher is whether individual WTP resides above or below the threshold given by the bid. Moreover, no information is provided about the preference uncertainty underlying the response. Preference uncertainty is likely to be one of the reasons behind hypothetical bias, the observation that some respondents have been shown to overstate their WTP (e.g. Lusk & Schroeder 2004, Cummings et al. 1995). The NOAA panel recommended the use of a 'don't know' alternative in discrete choice questions to control preference uncertainty and, consequently, hypothetical bias. Since the NOAA panel in 1990, researchers have devoted considerable effort to developing question formats and estimation methods that allow for expressions of uncertainty (e.g. Li & Mattsson 1995, Ready et al. 1995, Champ et al. 1997, Wang 1997, Welsh & Poe 1998, Alberini et al. 2003). It should be mentioned that in recent decades other stated preference methods have been developed, notably choice experiments (CE) and choice-based conjoint analysis (CBC). In a CE or CBC framework, survey respondents are typically confronted with several choices defined by several attributes (*cf*. Lusk & Hudson, 2004). Although a CE or CBC approach could have been chosen for the survey instrument, the CVM was chosen due to the availability of question formats that allow expressions of uncertainty.

Given that respondents may be unsure about their preferences the question becomes one of how respondents answer when confronted with a stated preference valuation question. Following Alberini et al. (2003) we postulate that the respondent answer yes to a given bid if their utility from doing so, plus some error factor, will exceed the utility from answering no. Note that this error arises from preference uncertainty and not from the researcher's inability to observe all relevant arguments. Naturally, this preference uncertainty can be accommodated for in a number of ways in the question format. Li & Mattsson (1995) combined a simple discrete-choice question with a scale from 0 to 100 percent on which the respondent was asked to state how certain he/she is of his/her answer. More recently, Welsh & Poe (1998) have devised a multiple bounded discrete choice (MBDC) question, where each respondent is faced with several bids and where the response options have increased from two (yes or no) to five (definitely yes, probably yes, unsure, probably no, definitely no).

Regardless of which type of valuation question is used in a CVM study, the researcher is usually interested in estimating mean WTP. This is due to the fact that mean WTP, when multiplied with the relevant population, becomes the theoretically appropriate estimate of aggregate benefits of a carnivore to be used in a policy setting, e.g. a cost-benefit analysis. For the simple discrete choice valuation

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question the most common way of estimating mean WTP involves utilising econometric techniques based on parametric distribution, such as the Logit or the Probit model, which is based on the logistic and the normal distribution, respectively. For the more complex MBDC question the Probit model can only be used by assuming away the preference uncertainty revealed by the five response options and recoding all responses to 'yes' or 'no'. One way to utilise all the information in the five response options is to assume that the discrete responses (definitely yes, probably yes, unsure, probably no, definitely no) are resulting from a continuous, unobserved variable, 'preference certainty'. This leads us to the random-effects ordered Probit model (suggested by Alberini et al. 2003: 45), used in this paper. The random effects part is used to account for the fact that there can be more than one response from each respondent, since each respondent is faced with the whole bid vector (e.g. Greene 1997, or Kennedy 1998 for general treatment of models).

Data collection

The survey data used in this paper comes from a large national study in 2004 with oversampling in municipalities where wolves, brown bear, lynx and wolverines are present, i.e. the 'carnivore area'; (see Fig. 1). We administered a mail survey to representative samples of the public living in the carnivore area (N = 10,350) and to a representative sample of Swedes living outside the carnivore area (N = 1,067). We chose to use a mail survey to reduce potential bias from people giving socially accepted answers to seemingly controversial questions about carnivores (Dillman 2000). The Swedish carnivore area was defined by the six northernmost counties (Dalarna 28,193 km^2, Gävleborg 18,192 km^2, Jämtland 49,443 km^2, Västernorrland 21,678 km^2, Västerbotten 55,401 km^2, and Norrbotten 98,911 km^2) in Sweden (495,000 km^2). As suggested by Ericsson & Heberlein (2003a), we sampled at the scale below the county level, i.e. at the municipal scale. In each of the 69 municipalities, within the six, above-mentioned counties, 150 persons were sampled to get representative estimates of WTP (Dillman 2000). Hence, our sampling intensity was higher in less populated municipalities than in urban municipalities. The samples were randomly drawn from the official, national and continuously updated register of all Swedish citizens, and consisted of people between the ages of 16 and 65. The survey was performed during March-April 2004. We used four personalised mailings (Dillman 2000). Overall, 7,376 of 11,301 (65%) surveys were returned by the respondents. The response rate was significantly higher from the carnivore area (63-71%) compared to the national control sample (57%, χ^2-test, $P < 0.0001$). Because of the high net response rate and because the non-response follow-up using official socio-demographic data did not reveal any significant difference between respondents and non-respondents, we did not weigh the data for non-response.

Embedded in a large multi-sectional survey instrument, we posed a question about the relative valuation of each species. The question can also be viewed as a dimensionless budget restriction question. We asked people to assign a maximum of 100 points to a conservation project about the large carnivores, i.e. wolverines, lynx, brown bears and wolves. These 100 points were to be divided amongst the four species, with low scores indicating a low conservation value and high points that they acknowledged high conservation value. Respondents were informed that they could assign 0 points to one or more of the four species, that they could maximum assign 100 points, and that they did not need to utilise all 100 points.

The first valuation question asked was whether they were willing to pay anything (yes, no; Kriström 1997) to reach the national goal for wolverine set by the Swedish parliament. The exact wording of the question was: "Now we ask you to value the presence of bears, wolverines, lynx and wolves in Sweden. To increase the number of large carnivores to meet the goals set by the Swedish parliament costs money. We would like to know your opinion about whether you are willing to pay for this. There are different reasons why one is willing to pay or not. Would you be willing to reduce your other expenses to increase the number of large carnivores (bears, wolverines, lynx and wolves)?". Thereafter, those who said that they were willing to pay for carnivore conservation were exposed to the complete bid-vector, which contained eight bids: SEK 10, 20, 50, 100, 300, 500, 1500, 3000. They were then asked to mark one of five different certainty levels, definitely yes, probably yes, unsure, probably no, and definitely no, for each bid. The exact wording of the question was: "Assume that a tax is implemented to increase the number of wolverines up to the government goal. Would you be willing to pay the following amount every year over a period of ten years?". Mean WTP for each municipality in each of the six counties in the carnivore area was estimated

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Table 1. The relative valuation of large carnivores in relation to other carnivores. Values range from 0 (min) to 100 (max). Low scores indicate low conservation value and high scored indicate high conservation value for the species in question. Respondents could assign 0 points to one or several of the four species, they could maximum assign a total of 100 points, but they did not need to assign 100 points. Values are averages for each county, brackets indicate coefficient of variation.

County	Number of municipalities	Wolverines	Lynx	Brown bears	Wolves
Dalarna	15	21* (55)	24 (50)	24 (53)	22 (66)
Gävleborg	10	21* (58)	24 (51)	23 (54)	20 (61)
Jämtland	8	21* (59)	23 (47)	24 (52)	22 (65)
Västernorrland	7	21* (49)	24 (50)	24 (49)	23 (59)
Västerbotten	15	21* (56)	26 (52)	23 (52)	23 (58)
Norrbotten	14	20* (50)	25 (49)	23 (56)	24 (58)
Rest of Sweden		20* (46)	24 (40)	24 (46)	25 (53)

* Indicates a significant difference versus the other species ($P < 0.05$, Tukey's test).

by means of county wise, random-effects, ordered Probit estimations. As shown by Cameron & James (1987), if latent WTP is normally distributed then $E(WTP) = -\beta\bar{x}/\alpha$, where β is the estimated Probit coefficients for all independent variables except the bid, evaluated at the means $\bar{x}$, while α is the coefficient for the bid variable (see also Alberini et al. 2003: Appendix A.2). Respondents in Sweden in the national control sample were treated as one 'county'. No other independent variables, except the bid, were used in the county wise estimations. This means that the resulting WTP estimates should be viewed as county means.

To test if the hypothesis reviewed above about age, rural residence, education, rural protest towards the dominating society and income influence peoples willingness to pay for wolverine conservation we received aggregate, officially verified data from Statistics Sweden for 2005 (downloaded from http://www.scb.se). For the year of the study (2004) we received data for each of 69 municipalities and for all of Sweden on mean income per capita in SEK, land area in km^2, total population, population in the age classes 0-6, 7-15, 16-18, 19-64, 65-74, 75-84, 85+, proportion of males to females, educational level, fraction of urban population in each municipality, and average reported assets for the income year 2003. We chose the municipality level as our first level of analysis as it proportionally corresponds to the survey design. To test if experience affected the valuation from each municipality we used observational data from the official Swedish monitoring program for large carnivores (http://www.jagareforbundet.se/forsk/default.asp), and population information from the national carnivore database (Naturvårdsverkets Rovdjursforum at: http://www.naturvardsverket.se/).

To analyse if the independent variables were associated, we performed a correlation analysis (Sokal & Rohlf 1995). As the logical consequence, we applied a principal component (PC) analysis to reduce inter-correlation among the independent variables (Sokal & Rohlf 1995). We then tested the relationship between the dependent and the independent PC variables using a general regression model (Proc GLM; SAS Institute 1989, Kleinbaum et al. 1987). The best model was chosen on the basis of Type III sums of squares (i.e. partial F-test), which consider all variables to be of equal importance in testing the model (Kleinbaum et al. 1987). All model selection was done manually following the procedures suggested by Manly (2001).

Results

For all six counties and the national sample, we found that people were significantly least concerned about wolverine conservation (Tukey's test: $P < 0.05$), with respondents in Norrbotten county, the northernmost county in Sweden, and in the national sample scoring lowest (Table 1). However, although rated lower than the other three species the coefficient of variation indicates that, beside wolves, wolverines might be a species for which people's attitudes show a considerable variation.

We found a large variation in people's WTP for wolverine conservation (Table 2). At the county level, it tended to be a regional difference with Swedes outside the carnivore area, as well as residents of Västernorrland, in the costal, eastern part of the carnivore region, being the most likely to say that they were willing to pay (GLM: $R^2 = 0.17$, $P_{model} = 0.07$, Fig. 2). We found that WTP (% of respondents) and the amount (SEK) tended to be positively, but weakly and non-significantly, correlated ($r_p = 0.20$, $P = 0.10$, $N = 70$). As confidence

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Table 2. Swedes willingness to pay (WTP) for wolverine conservation shown as the proportion of respondents with a positive WTP, and amount in SEK[a].

County	Number of municipalities	WTP (% yes)	Mean WTP (SEK)	WTP_{adj} (SEK)[b]
Dalarna	15	33	1115 (972-1258)[c]	373
Gävleborg	10	36	1008 (856-1160)	362
Jämtland	8	35	1114 (856-1160)	389
Västernorrland	7	41	1233 (1065-1400)	519
Västerbotten	15	35	965 (846-1084)	336
Norrbotten	14	35	1053 (916-1190)	363
Rest of Sweden		47	1253 (1060-1446)	592

[a] One SEK ≈ 0.12 USD (Nov. 2005).
[b] WTP_{adj} is the product of the share having a positive WTP and the mean WTP for each county.
[c] Figures in brackets are 95% confidence intervals. Standard errors were derived from the covariance matrix of the Probit coefficients using the delta method (Cameron 1991).

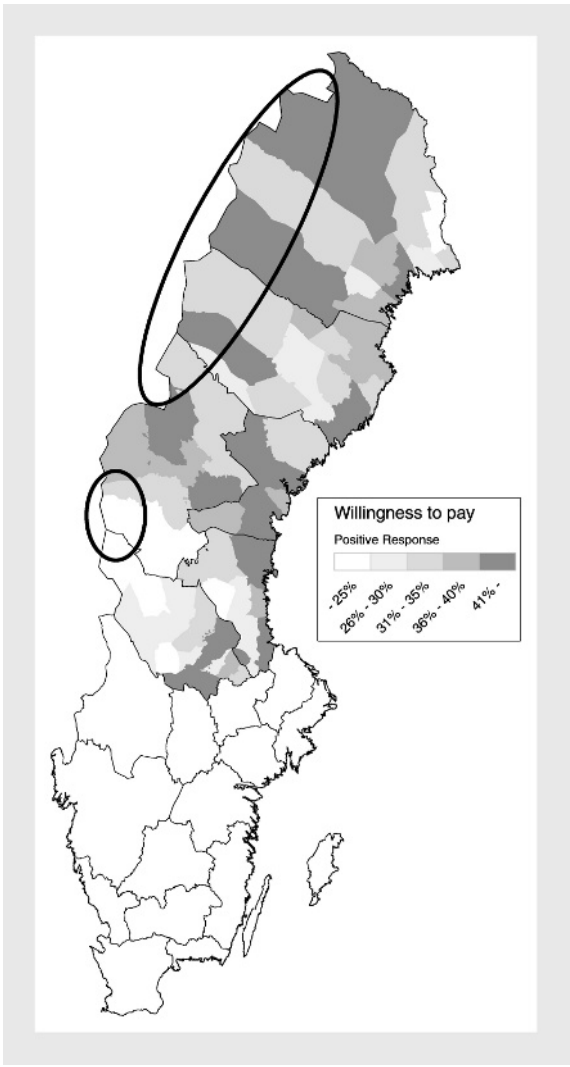


Figure 2. Percent of respondents at the municipality level willing to pay for wolverine conservation. Darker represents more positive WTP. Encircled areas show main distribution of wolverines including areas with active dens.

intervals show, there were no significant differences in mean WTP between counties (see Table 2).

The zero-order correlations (Table 3) suggest that income, educational level and human density could be key factors in determining whether people are willing to pay at all ($r_p > 0.38$, $P < 0.001$, $N = 70$). Note that the demographic variables capturing potential generational differences only weakly correlated with WTP or the amount people are willing to pay ($-0.10 < r_p < 0.29$, $P > 0.02$, $N = 70$). The correlation matrix in Table 3 suggests a negative effect on WTP in municipalities with higher proportion of males and a high fraction of people voting no in the EMU-referendum ($P < 0.02$, $N = 70$). Furthermore, people are positive in more urbanised municipalities ($r_p = 0.28$, $P > 0.02$, $N = 70$).

Due to the high inter-correlation among the independent variables: density, proportion of males, university education, income and fraction of urban population, we reduced the number of independent variables using a principal component analysis (PCA). The proportion of humans 18-44 years old showed a low intercorrelation with both the dependent and independent variables and were thus first omitted in the PCA, and then later as well in future analysis as a single variable (Table 4). The first PC captured 64% of the variation with an eigenvalue far above one (3.84). PC1 was interpretable as 'urban municipality' as it loaded equally positive for fraction urban population, income, university education and population density (0.41-0.44), and loaded equally negative for proportion of males and fraction of voters being negative to EMU (-0.40 - -0.35). The second PC was not as easily interpretable. 'Urban municipality' was highly correlated with WTP for wolverines ($r_p = 0.457$, $P < 0.0001$) whereas PC2 was not ($r_p = -0.04$, $P = 0.75$)

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Table 3. Correlation among dependent variables (WTP, amount) and the independent aggregate socio-demographic variables. *** $P < 0.0001$, ** $P < 0.001$, * $P < 0.05$.

	WTP	Population 18-44 years old	Human density	EMU 'no' voters	Males in human population	University education	Income	Urban population
Amount (SEK)	0.20	-0.10	0.17	-0.21	-0.12	0.24*	0.24*	0.19
WTP (% yes)		0.14	0.38**	-0.28*	-0.29*	0.42**	0.54***	0.28*
Population 18-44 years (%)			0.13	-0.06	-0.16	0.29*	0.30*	0.06
Human density (/km^2)				-0.63***	-0.45***	0.54***	0.60***	0.62***
EMU 'no' voters (%)					0.38**	-0.56***	-0.56***	-0.64***
Males in human population (%)						-0.55***	-0.50***	-0.54***
University education (> 1 year)							0.62***	0.54***
Income (SEK)								0.77***

We found that in our most parsimonious GLM-model ($R^2 = 37.7\%$. $F_{model} = 5.3$, $P_{model} < 0.0001$) WTP for wolverines was positively related to 'urban municipality' ($F = 18.2$, $P < 0.0001$) and that there was also a regional difference ($F = 3.0$, $P = 0.017$; see Fig. 2). Furthermore, the presence of wolves, but not the presence of any other large carnivores, was negatively related to WTP for wolverine conservation and improved the model significantly ($F = 5.3$, $P = 0.024$). In the 35 municipalities lacking wolves, 38% of respondents were willing to pay for wolverine conservation, whereas in municipalities with wolves present significantly fewer (34%; $P < 0.05$) were willing to pay.

Discussion

Our study clearly shows that Swedes value conservation efforts for wolverines lower than conservation efforts for wolves, brown bears and lynx. This general finding somewhat contradicts recent findings from Norway. Kleiven et al. (2004) found that people valued lynx and wolverines higher compared to wolves and brown bears. Most likely, this difference does not come from differences in fear of or 'hate' of wolverines among Swedes and Norwegians. National survey data from both Norway (Linnell & Bjerke 2002) and Sweden (G. Ericsson, unpubl. data.) do not support the assumption that the wolverine is a species that is either feared or hated by the general public. As expected, bears and wolves appear to be the most controversial species in terms of fear and hate (Linnell & Bjerke 2002, Kleiven et al. 2004). Given their restricted distribution we lean more towards the plausible explanation that wolverines are 'victims of human ignorance', and that is why they received significantly lower support than the other three carnivores in our study. However, in Norway, although the population size is lower than in Sweden, wolverines have probably gotten more attention in the press which might explain the differences between the Swedish and Norwegian perceptions. In Norway, wolverines appear further south. Thus, the wolverine-human interactions in Norway are not restricted to a very limited area with active reindeer herding along sparsely populated mountain regions, which is the case in Sweden. Due to the conflict with sheep farming in Norway we speculate that a wider array of social groups come in contact with wolverine related issues which help to raise people's awareness. The 'victims of human ignorance' (Walker 1996) argument may as well explain the

Table 4. Loading and proportion of variation explained in the Principal Component Analysis variable reduction.

Variable	Urban municipality (Principal component 1; 64% of variation)	Principal component 2 (11% of the variation)
Males in human population (%)	-0.35	0.78
EMU 'no' voters (%)	-0.40	-0.37
Human density (/km^2)	0.41	0.30
University education, > 2 years	0.40	-0.26
Income (kSEK)	0.44	0.05
Urban population (%)	0.44	0.12

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previous lack of interest from the scientific society to study human dimension aspects of wolverine distribution, conservation and conflicts.

Due to the lack of earlier studies looking at the relative valuation of a single carnivore species versus other species, we have a limited possibility to compare our rather novel findings. We can not compare our metrics with other studies, but we can frame our qualitative findings in a more general perspective. If we first broaden our scope to other WTP-studies about large carnivores, which exclusively concern wolves (Bostedt & Boman 1996, Duffield & Neher 1996, Boman & Bostedt 1999, Chambers & Whitehead 2003), our independent aggregated data do explain a high proportion of the variance. Our study explained 38% of the variance in people's willingness to pay for wolverine conservation. This can be compared with 37.5% and 26.5% variance explained for the Ely and St. Cloud samples in Chambers & Whitehead (2003), respectively.

Remember that, when the other independent factors were controlled for, WTP for wolverine conservation was related to the urban profile of the municipality; the more urban, the more willing people were to pay. Thus, if we restrict our comparison to socio-economic variables our study appears to confirm previous human dimension studies concerning people's perception about large carnivores (e.g. Williams et al. 2002). Nevertheless, there was a large variation in people's willingness to pay among municipalities and counties. These results underlines that there is a substantial difference in people's support for wolverines that needs to be acknowledged in management and conservation.

To just say that there is an urban-rural difference that drives people's willingness to pay is to greatly oversimplify. Our analysis shows that the urban-rural differences have several dimensions that each help to explain why some people value wolverines more than others. The first dimension is the demographic. If we take the effects of age, place of residency and gender into account, an older, male living in the countryside is more likely to engage in consumptive activities (Ericsson & Heberlein 2003b). If we control for the demographic factors, people engaging in consumptive activities are still more likely to have a utilitarian basis for their attitudes towards e.g. large carnivores, which then most likely can result in a lower support for conservation projects (Kellert 1985, Kellert et al. 1996). In our case we asked people whether they were willing to pay to increase the number of wolverines, rather than whether or not wolverines should be present in Sweden. Thus, people not willing to pay might still be positive to wolverine conservation but not willing to personally pay for the improvement. Our measure, WTP, is actually closer to the actual behaviour to pay because it captures a behavioural intention. A standard, stand-alone one-dimensional attitude question is much further away from an actual behaviour than WTP. People with a demographic profile that promotes consumptive activities, such as hunting and fishing, most likely also come in contact with carnivores and their effects on single animals and populations. That brings us to the second dimension of the rural-urban difference in wolverine valuation; what areas are most biologically suitable for carnivores.

Large carnivores are more likely to appear in rural areas. Thus, people living in a sparsely populated area where carnivores are present are more likely to gain experience of carnivores. Direct, personal experience shapes peoples attitudes. In a previous study Ericsson & Heberlein (2003a) clearly demonstrated that people with personal experience of bears and wolves were more likely to moderate their positive view towards wolves. In this study we could not detect any effect of having wolverines present in the municipality, but we demonstrated that having wolves present in the municipality made people less willing to pay for wolverine conservation. We believe that the very restricted distribution of wolverines, in many cases to Sweden's most remote areas, gives hardly anyone the opportunity to gain positive or negative experiences of wolverines. Furthermore, the negative effect of having wolverines just affects people in the reindeer herding communities and is not that well publicised which means that people in general do not notice. Instead we did have a negative effect of having wolves in a municipality on peoples' WTP for wolverines. Thus, wolves might be the biological symbol for all the negative aspects of having bears, lynx and wolverines as well around. Our study suggests that such a link exists in the valuation of the large carnivores driven by the mere presence of wolves. Consequently, given that Sweden continues to increase the numbers of wolves and their distribution, as stated by the parliament, people in general may become less positive towards the other large carnivores (Ericsson & Heberlein 2003a). Thus, a key finding is that the mere presence of wolves might be the principal attitudinal driver for the whole debate regarding large carnivore conservation and management.

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The third dimension in the rural-urban difference in valuation of wolverines is symbolic beyond biological issues (Sharpe et al. 2001). Our data shows that people living in areas with a proportion of voters negative to the European Monetary Union (EMU) also were more negative towards supporting wolverine conservation (e.g. see Tables 3 and 4). Many view EMU as a project that really symbolises the way the central powers control the periphery, i.e. urban vs rural (Holmberg 2001). Our study lends support to the hypothesis that rural peoples' attitudes towards conservation efforts of large carnivores, such as the wolverine, may involve the same type of rural protests against central authorities as with other political issues such as the EMU (Holmberg 2001, Enck & Brown 2002, Ericsson & Heberlein 2003a).

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