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# Attitudes of hunters, locals, and the general public in Sweden now that the wolves are back

Göran Ericsson[a], Thomas A. Heberlein[b,*]

[a]Department of Animal Ecology, Swedish University of Agricultural Sciences, SE-901 83 Umeå, Sweden
[b]Department of Rural Sociology, 1450 Linden Drive, University of Wisconsin-Madison, Madison, WI 53706, USA

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**Abstract**

The wolf population in Scandinavia has increased from functionally extinct to about 100 wolves since the 1970s. In 2001 we surveyed four groups of Swedes to analyze the relationship between experience, knowledge, and people's attitude toward wolves. Although all groups support the right of wolves to exist, Swedes who live in areas where wolves have been restored have more negative attitudes than the general public. Attitudes toward wolves are not strong among the general public, thus changes are possible. Experience with wolf predation leads to more negative attitudes toward wolves. Hunters in areas with wolves have the most accurate knowledge about wolves but at the same time the most negative attitudes. But within all four groups as knowledge increases attitudes become more positive. Still, the most knowledgeable local hunters have less favorable attitudes than the least knowledgeable members of the general public. High proportions of the population do not care about wolves which makes it difficult to reach them with information, but does make them susceptible to rapid changes if wolves become a media topic. With the restoration of wolves, hunters, the strongest supporters of wolves in the 1970s, are now less supportive than the general public.


*Keywords:* Attitudes; Education; Experience; Knowledge; Wolf

## 1. Introduction

When wolves *Canis lupus* were functionally extinct in Sweden the debate about the wolves' role in Scandinavian ecosystems and possible reintroduction was largely hypothetical (Andersson et al., 1977). During most of the 20th century nearly all of Scandinavia had been wolf-free with the alpine area the foothold for single wolves escaping from Russia and northern Finland (Wabakken et al., 2001). Discussions about wolves focused on the appropriateness and role of wolves in the ecosystem. At that time, Swedish hunters expressed the most positive attitude towards wolves and a potential reintroduction (Andersson et al., 1977). A majority of hunters (70%) thought that the effects of wolf restoration on the game population would not be negative, although hunters preferred to have wolves re-introduced into the high alpine areas.

In the late 1970s, a breeding pair of wolves was discovered at a new location in south-central Sweden close to the Norwegian-Swedish border, far from the former population foothold in the alpine area (Wabakken et al., 2001). The Scandinavian wolf population remained in the single-digit range until 1991(Wabakken et al., 2001). However, since then the population has been increasing at an average rate of 29% per year between 1991 and 1998 (Wabakken et al., 2001). The latest estimate is 12 family groups, and this year (2001) the Scandinavian population probably will be in the range of 80–100 individuals after breeding (Aronsson and Wabakken, 2001). The population is far below carrying capacity and it is predicted to continue its rapid increase (Wabakken et al., 2001). However, the population is geographically limited to a fairly small part of Sweden and Norway, and there are no wolves present in the alpine areas where the vast majority of active reindeer husbandry takes places (Wabakken et al., 2001).

The expanding Scandinavian wolf population has sparked an intensive debate including concerns about people's perception of wolves (Bjerke and Kaltenborn, 2000). This debate is most vivid in the South Western rural areas of Sweden, the core of the current wolf

* Corresponding author.
*E-mail address:* taheberl@facstaff.wisc.edu (T.A. Heberlein).

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population, and from which animals disperse over the whole peninsula (Wabakken et al., 2001). Globally, rural residents tend to have more negative attitudes towards wolves than the general public (Bath, 1987; Kellert and HRBS, 1990; Kellert, 1999; Bjerke and Kaltenborn, 2000). In the United States, as well in Scandinavia, ranchers and farmers consistently have more negative attitudes toward wolves (Andersson et al., 1977; Bath, 1987; Biggs, 1988; Kellert and HBRS, 1990; Bjerke et al., 1998; Duda et al., 1998).

Wolves can be seen as a symbol of urban dominance over the less populated countryside, or over minorities with strong ties to nature and the countryside. In the US and in Europe, pro-wolf urban influences are seen as forcing wolf restoration in rural areas and this has led to strong local opposition (e.g. Duda et al., 1998; Bjerke and Kaltenborn, 2000; Steen, 2000; Sharpe et al., 2001). People living in wolf areas claim that their quality of life has been reduced, and that the wolf-problem for the rural people is neglected by the urbanites and the authorities (Bjerke and Kaltenborn, 2000; Steen, 2000; Karlsson, 2001; Sharpe et al., 2001). Recently, after almost two years of analysis of large carnivores policy in Sweden, the principal investigator Sören Ekström of the government report concluded in an interview that "The wolf has become the symbol for the divide between urban and rural [people]" and "There is great frustration [out there]. Many [people] feel that the decisions are made a head of them by urban people without knowledge about [their] reality" (Nilsson and Knutsson, 2000).

A vocal and rather influential group with strong ties to the countryside is the hunters. While hunters are stereotyped as being negative toward wolves, this has not generally been the case. A review of the literature presents somewhat mixed results of what hunters' think about wolves. In nine studies that reported the relationship between hunting and attitudes Williams et al. (in press) found that in five cases hunters were more positive than non-hunters and in three cases hunters were less positive. Michigan hunters were among the most positive supporters of wolf restoration in the state (Kellert and HBRS, 1990), and in southeastern Norway close to the Swedish wolf areas hunters were more supportive than non-hunters of maintaining or increasing wolf populations (Bjerke et al., 1998). In the US, sport hunters in particular seem to appreciate wolves as predators, and do not seem to feel strong competition from wolves. US deer hunters, unlike the Swedish hunters, do not use dogs for hunting and have little personal risk from wolf encounters (Thelander, 1992; Heberlein, 2000). However, among Canadian deer hunters Lohr et al. (1996) found less than 16% support for wolves. So it cannot simply be assumed that hunters are positive or negative about wolves.

People living in wolf areas can be expected to have more direct experience with wolves than the general population. Direct experience has been demonstrated in social psychology (Petty et al., 1992) to lead to stronger attitudes, and attitudes which are more central in cognitive systems. We would expect that people living in the wolf areas to have more first-hand experience with both the negative aspects of the restored wolves as well as the more positive aspects of wolves. Thus, we would expect these experiences to influence attitudes.

Contacts with a restored wolf population should also be associated with more knowledge about wolves. It is often assumed that the more knowledge people have about wolves the more positive they will be. However, evidence for this is inconclusive from the few quantitative studies that address this hypothesis (Williams et al., in press). A survey of members of the Sierra Club in New Mexico found that more knowledgeable members were more supportive of wolves (Biggs, 1988). In 1985, Kellert found that northeastern residents of the USA with more knowledge about wolves were more supportive than those with less knowledge, but in 1999 Kellert found no relationship when addressing this in a statewide sample of Minnesotans. Furthermore, Kellert and HBRS (1990) found a negative relationship between knowledge and support for wolves in Michigan. In southeastern Norway, Bjerke et al. (1998) found no relationship in 1993. As these examples reveal, it is not clear whether more knowledge about wolves makes people more or less supportive when wolves are present. Additionally, there is a lack of data collected in European countries to examine potential links between knowledge and attitude toward wolves (Williams et al., in press).

Today, with wolves back howling in the Swedish woods, the agenda is far different from the one in 1976 (Andersson et al., 1977; Bjerke and Kaltenborn, 2000; Wabakken et al., 2001). People now experience wolves again. Our purpose is to survey the attitudes of people most directly affected by the rebounding Swedish wolf population. We do this by testing two central families of hypothesis for the conservation of wolves, the role of knowledge and the role of experience on the attitude toward wolves among four groups of Swedes. We assess attitudes toward wolves today in Sweden in relation to experience, knowledge and personal background variables. Particularly, how do people most affected by wolves—those who live in the wolf areas and hunters—feel when they have experience with wolf predation and wolf encounters. What happens as people learn more about wolves?

## 2. Methods

### 2.1. Data collection

We collected the data using a mail survey administered to representative samples of four mutually exclusive

populations; the general public and hunters in Sweden, and to the public and hunters residing in rural areas with and without wolves. We defined a wolf areas as a Swedish municipality area (Swe: *kommun*) with 10,000 or less inhabitants, with wolves present in the province (Wabakken et al., 2001). We used a mail survey instead of a telephone survey to reduce the potential bias from people giving the socially accepted answer to seemingly controversial questions about wolves (Dillman, 2000).

Sweden has a national register including all permanent residents which is continuously updated. A random sample of all Swedish citizens aged 16–65 was drawn from this register for the *Swedes, non-hunters* (i.e. the general public) sample. A random sample of people living in the rural area with wolves present was also selected from the national register, i.e. the *Non-hunters, wolf areas* (i.e. locals). Furthermore, from the register of people paying the mandatory annual hunting fee we obtained both a nation-wide and a wolf areas sample—i.e. *Swedes*, *hunters* and *hunters, wolf areas* (Table 1).

The survey was administered between December 2000 and February 2001. We used four personalized mailings and a telephone follow-up of non-respondents (Dillman, 2000). Overall, 1734 of 2216 (78%) surveys were returned by the respondents. Because of the high response rate (Table 1), and since the non-response follow-up did not reveal any significant difference between respondents and non-respondents; we did not weigh the data for non-response.

### 2.2. Measurements

Nine items on the mail survey were adopted from previous US and Swedish surveys (Andersson et al., 1977; Kellert, 1985, 1999; Karlsson et al., 1999) to assess the different dimensions of attitudes (e.g. Fishbein and Ajzen 1975; Pierce et al., 2001) toward wolves. We asked if the respondents were afraid of wolves, thought wolves were important, liked having wolves in Sweden, wanted more or less wolves in Sweden, cared if wolves existed in Sweden, cared for wolves and thought that wolves symbolize the beauty of nature and would think it was a great experience to hear a wolf howl. The exact wording and coding is in the Appendix.

Respondents were also asked to classify their residence, and where they lived the major part of their lives before they were 18 years old, on a 6-point continuum from most rural to most urban. They were also asked if they had hunted in the last 12 months. Anyone who said they hunted in the last 12 months or held a hunting license was classified as a hunter. Respondents were asked to report their gender, year of birth (which was classed into a five-level, ten-year increment variable), and educational level (four-level; elementary school, vocational, high school, university).

In addition, five questions measured the level of experience with wolves. We asked if the respondents had: (1) seen a wolf, (2) heard a wolf, (3) had an animal killed by a wolf or a bear, (4) known someone who had an animal killed by a wolf or a bear, (5) found remains of an animal predated by wolf or bear (since bears live in the area and we could not be sure that respondents could determine which had killed the animal we included bears in the questions—so strictly speaking it could be considered a negative interaction with large carnivores rather than simply wolves).

We also assessed levels of objective knowledge using five statements (True, False or Don't Know) from which we constructed a wolf knowledge sum scale (0–5). The questions were developed in cooperation with ongoing Swedish carnivore research (Jens Persson, personal communication).

### 2.3. Data analysis

Fifty-one respondents in the general Swedish sample said they hunted during the last 12 months; therefore we analyzed them as belonging to the general hunter sample (i.e. Swedes, hunters). Sixty-one respondents in the public, wolf-areas sample as well said they hunted during the last 12 months. They were added to the wolf-areas hunter population. Finally, 16 respondents in the national sample were non-hunters from the wolf areas. They were thus added to this group.

Table 1
Sample size and response rates for the four samples in the mail survey [the overall response rate was 78% (1734 of 2216) with four personalized mailings]

| | Swedes non-hunters | Non-hunters, wolf areas[a] | Hunters | Hunters, wolf areas[a] |
|---|---|---|---|---|
| Sample size | 1001 | 252 | 631 | 388 |
| Undeliverable (deceased, abroad, address unknown, handicap) | 30 | 8 | 15 | 3 |
| Effective sample size | 971 | 244 | 616 | 385 |
| Returned surveys | 707 | 175 | 520 | 332 |
| Response rate | 73% | 72% | 84% | 86% |

[a] The wolf-area samples were from the three provinces of Dalarna (Orsa 7000 inhabitants, Vansbro 7400, Älvdalen 7800, Gagnef 10,100), Jämtland (Ragunda 6500, Bräcke 7700, Berg 8300, Åre 9700), and Värmland (Munkfors 4200, Storfors 4800, Eda 8700, Grums 9700, Årjäng 9800).

Applying standard social sciences methodology, we created a single scale of all nine attitude items to measure the general attitude towards wolf, using sum scores, factor analysis, and reliability test (Cronbach's alpha) (Sirkin, 1995; Sokal and Rohlf, 1995; Siemer et al., 2001). We then use path analysis to test the causality for the general attitude towards wolves (Alwin and Hauser, 1975; Sokal and Rohlf, 1995) with knowledge, experience and background variables. From a path analysis direct, as well as indirect, effects of independent variable can be determined. Path coefficients are calculated to estimate the strength of relationship between variables in model (Alwin and Hauser, 1975; Asher, 1983). The path coefficients are identical to standardized multiple regression coefficients ($\beta$), and are calculated from a series of multiple regression analyses, based on the assumed relationship (Alwin and Hauser, 1975; Sokal and Rohlf, 1995). Thus, path coefficients are defined as the effect of one variable on another.

Two experience measures were calculated, one involving seeing and hearing wolves, and one involving the three items that reported experience or knowledge of large carnivore predation.

We used performed analysis of variance (ANOVA) and regression using generalized linear models (Kleinbaum et al., 1987; SAS Institute, 1989). The best model was chosen on the basis of partial $F$ tests (Kleinbaum et al., 1987). We entered and tested all variables manually, and we used Tukey's Studentized Range post hoc test to investigate pair-wise differences between levels of the independent variables. All statistical analyses were performed with the SAS-statistical package (version 6.12, SAS Institute, 1989).

## 3. Results

We present the attitude results for the four mutually exclusive groups: (1) the general non-hunting population which makes up 95.4% of the Swedish population age 16–65 years, (2) the non-hunters in the wolf areas which makes up 1% of the population, (3) the Swedish hunters which compose about 3.5% of the population and (4) the hunters in the wolf areas who compose 0.1% of the population between 16 and 65 (http://www.scb.se; http://www.jagareforbundet.se).

### 3.1. Single attitude items

A majority of the Swedish non-hunting population report that they like wolves (Table 2), in contrast to only one quarter of the hunters in wolf areas say they

Table 2
The marginal distribution and mean score for the nine attitude items among the four groups

| Attitude item | | Swedes, non-hunters | Non-hunters wolf areas | Swedes, hunters | Hunters, wolf areas |
|---|---|---|---|---|---|
| Feel about wolves (−2 to +2) | Like | 61% | 49% | 40% | 24% |
| | Neutral | 31% | 30% | 37% | 35% |
| | Mean score | $0.66^{ABC}$ | $0.31^{AE}$ | $0.15^{BF}$ | $-0.32^{CEF}$ |
| Personal Importance (−3 to +3) | Important | 44% | 40% | 33% | 25% |
| | Neutral | 36% | 31% | 34% | 30% |
| | Mean score | $0.22^{BC}$ | $-0.07^{E}$ | $-0.28^{BF}$ | $-0.70^{CEF}$ |
| I care a lot (−2 to +2) | Agree | 54% | 45% | 38% | 31% |
| | Mean score | $0.08^{BC}$ | $-0.21^{E}$ | $-0.39^{B}$ | $-0.61^{CE}$ |
| Afraid to meet wolf outdoors | Yes | $28\%^{B}$ | $36\%^{DE}$ | $22\%^{BD}$ | $16\%^{E}$ |
| Exist in Sweden (−2 to +2) | Agree | 90% | 79% | 77% | 65% |
| | Mean score | $1.50^{ABC}$ | $1.07^{AE}$ | $0.96^{BF}$ | $0.52^{CEF}$ |
| Population size (−1 to +2) | More | 71% | 51% | 40% | 21% |
| | As it is | 26% | 40% | 52% | 58% |
| | Mean score | $0.92^{ABC}$ | $0.64^{AE}$ | $0.51^{BF}$ | $0.08^{CEF}$ |
| Live with Wolves (−2 to +2) | Yes | 55% | 53% | 44% | 35% |
| | Don't know | 4% | 2% | 2% | 1% |
| | Means score | $0.27^{BC}$ | $0.17^{E}$ | $-0.13^{BF}$ | $-0.44^{CEF}$ |
| Wolf symbol of nature (−2 to +2) | Agree | 62% | 60% | 49% | 35% |
| | Mean score | $0.37^{BC}$ | $0.19^{E}$ | $-0.14^{BF}$ | $-0.56^{CF}$ |
| Be great to hear howl (−2 to +2) | Agree | 78% | 71% | 68% | 58% |
| | Mean score | $0.96^{BC}$ | $0.74^{E}$ | $0.65^{BF}$ | $0.25^{CEF}$ |
| Sum of Wolf attitude (−17 to 17) | Mean score | $4.8^{ABC}$ | $2.4^{AE}$ | $1.2^{BF}$ | $-2.0^{CEF}$ |

Like letters indicate a significant difference between groups (Tukey's $P<0.05$).

Table 3
Experience with wolves among the four groups sampled

| Experience item | Swedes, non-hunters | Non-hunters wolf areas | Swedes, hunters | Hunters, wolf areas |
|---|---|---|---|---|
| Seen a wild wolf | 13% | 17% | 12% | 26% |
| Had animal killed by wolf or bear | 0% ns | 1% ns | 2% | 5% |
| Know someone who had animal killed | 7% | 36% | 27% | 57% |
| Heard a wolf howl | 17% | 16% | 16% | 22% |
| Found prey-site of wolf/bear | 7% | 25% | 31% | 64% |

All pair-wise comparisons were significant (Tukey's, $P<0.05$), expect between the non-hunters living in the wolf areas and Swedish hunters in general. ns indicates that the proportion with experience did not differ from zero.

like wolves. The attitude items show a high percentage of neutral responses for all groups. When asked how important wolves were, a minority of all groups said they were important, and over 30% were neutral on this question as well. Only a quarter of the hunters in the wolf areas feel that wolves were important. Likewise less than a third of the hunters living in wolf areas said they cared a lot for wolves. From one fourth to over one third of the non-hunting population said they would be afraid to meet a wolf in the forest. The hunters were less fearful and only 16% of the hunters living in areas where there were wolves said they would be afraid to meet a wolf.

Nine out of ten of the non-hunting Swedes feel that wolves should exist in Sweden and nearly 80% of the non hunters living in the wolf areas support the idea of wolf existence, as do over three fourths of the hunters (Table 2). Even a majority of hunters in the wolf areas say that wolves have the right to exist in Sweden. Over two thirds of the non-hunting public feel that the wolf population should be increased, as did a majority of the non-hunters in the wolf areas. The hunters are less likely to support population increases and only one in five of the hunters in the area with wolves want to see more wolves. In response to a general question of willing to accept wolves where you live a majority of the non-hunters agreed—even those who lived in area where there were actually wolves. The hunters were less supportive.

For 60% of the general non-hunting public the wolf is seen as the symbol of nature (Table 2). This drops to 50% for hunters in general, and to 35% for the hunters living in wolf areas. About seven in ten Swedish hunters and non hunters say it would be great to hear a wolf howl, and even 58% of the hunters in the wolf areas would be glad to hear a wolf howl.

### 3.2. Experience with wolves

Two thirds of the Swedish non-hunting population has had no experience with wolves. Almost half of the hunting Swedes (47%) has had no experience with wolves. Among the hunters in the wolf areas 15% have had no experience with wolves (Table 3). People in the wolf areas have had significantly more experience (ANOVA, $P<0.0001$), as did hunters ($P<0.0001$), and hunters living in the wolf areas ($P<0.0001$). Tukey's test revealed that all pair-wise comparisons were significant ($P<0.05$), except between the non-hunters living in the wolf areas and Swedish hunters in general.

Although wolves are hard to observe, 13% of the non-hunting population in Sweden claims to have seen a wolf in the wild. Among the hunters who live in the wolf areas, this doubles (Table 3). Hunters in the wolf areas are much more likely than other groups to know someone who has had an animal killed by a wolf (57%) and to have seen a wolf or bear kill in the forest (64%). Although a few people in our sample claim to have had animals killed by wolves our estimates are not significantly different from zero for both non-hunter groups ($T$-test, $P>0.095$), but are significantly different from zero for the two groups of hunters ($T$-test, $P<0.003$).

### 3.3. Knowledge about wolves

Hunters in the wolf areas had the highest knowledge score (mean score 3.6, SD = 1.00), followed by Swedish hunters in general (3.4, SD = 0.99), Swedes in the wolf areas (2.9, SD = 1.10) and last the Swedish non-hunting public (2.8, SD = 1.12). The groups differed significantly among them (ANOVA, $F=60.8$, $P<0.0001$). Hunters in the wolf areas scored significantly higher on the knowledge score than the three other groups, as did Swedish hunters compared to the two non-hunting public groups (Tukey's, $P<0.05$).

### 3.4. Overall attitude towards wolves

The ranking (from most to least positive) among the groups were: I, Swedes, non-hunters; II, Non-hunters in the wolf areas; III, Swedish hunters; IV, Hunters in the wolf areas, except for attitude item measuring fear of wolf. Then the rank order was: I, Non-hunters in the wolf areas; II, Swedes, non-hunters; III, Swedish hunters; IV, Hunters in the wolf areas (Table 2). The nine wolf attitude items were all correlated ($P<0.0001$, $0.20<r_p<0.71$).

Table 4
Zero-order correlation among the dependent wolf attitude variable and independent variables in the final model

| Variable | Attitude | Live in wolf areas | Hunter | Seen/heard wolf | Predation experience | Knowledge | Urban resident | Urban upbringing | Female | Age |
|---|---|---|---|---|---|---|---|---|---|---|
| Live in wolf areas | −0.209*** | | | | | | | | | |
| Hunter | −0.266*** | 0.210*** | | | | | | | | |
| Seen/heard wolf | −0.033 | 0.113*** | 0.034 | | | | | | | |
| Predation experience | −0.283*** | 0.406*** | 0.391*** | 0.309*** | | | | | | |
| Knowledge | 0.012 | 0.147*** | 0.295*** | 0.008 | 0.150*** | | | | | |
| Urban resident | 0.135*** | −0.104*** | −0.214*** | 0.011 | −0.129*** | −0.053** | | | | |
| Urban upbringing | 0.227*** | −0.266*** | −0.323*** | 0.000 | −0.239*** | −0.078** | 0.263*** | | | |
| Female | 0.108*** | −0.090** | −0.490*** | −0.103*** | −0.199*** | −0.165*** | 0.099*** | 0.089*** | | |
| Age | −0.191*** | 0.008 | 0.140*** | −0.024 | 0.043 | 0.022 | −0.098*** | −0.166*** | −0.093** | |
| Education | 0.222*** | −0.129*** | −0.145*** | 0.006 | −0.069** | 0.068** | 0.082** | 0.291*** | 0.148*** | −0.269*** |

** $P < 0.01$.
*** $P < 0.0001$.

The measurement of the nine attitude items showed high consistency (Cronbach's alpha = 0.90). The correlation between each variable and the total of the remaining variables was $r_p > 0.64$, except for the fear item, $r_p = 0.33$. A principal factor analysis produced a single factor solution; we thus retained the first factor to index the overall attitude towards wolves (eigenvalue = 4.7; eigenvalue of factors 2–8 < 0.30). The communality estimates of the attitude items ranged 0.14–0.72, and the item loading of the retained factor was rather uniform (Personal importance = 0.78, Think about = 0.86, Population size = 0.78, Live with = 0.78, Exist in Sweden = 0.67, Care about = 0.67, Symbol = 0.77, Great experience to hear howl = 0.73, Fear = 0.35). The extracted factor ranged from −2.1 to 1.7 (mean score = 0). The correlation between the sum of the nine attitude items and the extracted factor was high and significant ($r_p = 0.993$, $P < 0.0001$); we choose to use the factor as our single scale for attitudes towards wolves.

### 3.5. The role of experience, knowledge and background variables on wolf attitude

How do residence, hunting, and experience with wolves jointly affect attitudes toward wolves? The aggregate analysis shows that those with the most knowledge of wolves have the most negative attitudes. In the combined data set the zero order correlation between knowledge and attitudes across all groups is r = 0.01 (ns; Table 4). Fig. 1 shows the relationship between knowledge scores and attitude for each group. Within each group those with greater knowledge have more positive attitudes. But the most knowledgeable hunters in the wolf areas and the most knowledgeable hunters in general (scale score 5) have more negative attitudes than the least knowledgeable (scale score 0) members of the general public. Thus, the positive effect of knowledge increases is obscured by the between group differences.

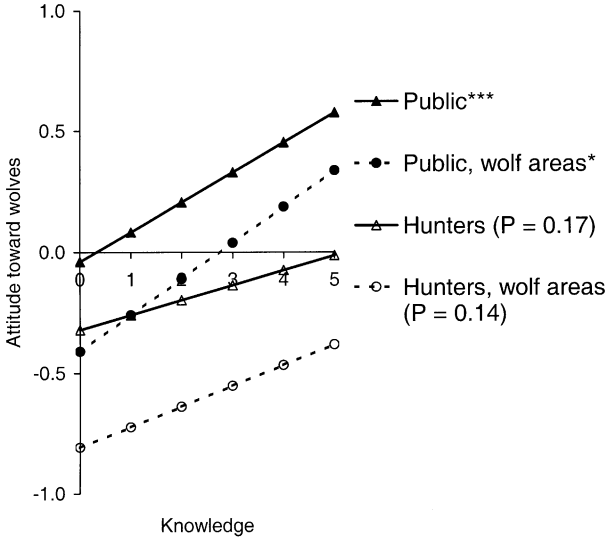


Fig 1. The effect of knowledge on attitudes for four groups of Swedes.

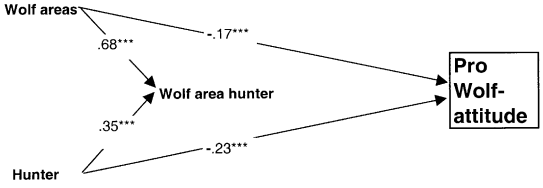


Fig. 2. The effect of hunting participation and residence on wolf attitude. *$P < 0.05$. **$P < 0.01$. ***$P < 0.0001$.

In the first path model we test the effect of hunting participation and residence along with the interaction term (being a hunter who lives in the wolf areas) on attitudes (Fig. 2). The three independent variables account for 9.4% of the variance ($R^2$adj) ($F_{\text{model } 1} = 86.2$, $P < 0.0001$). People who live in wolf areas and hunters in wolf areas are both more negative toward wolves than the public and hunters outside the wolf areas.

In path model 2 we test the role of experience and knowledge on the attitudes of these two groups (Fig. 3). Including these experience variables and knowledge significantly (Partial $F$-test, $P<0.0001$) increases the $R^2$ adj to 0.126 ($F_{\text{model 2}}=72.1$, $P<0.0001$; (Partial $F$-test, $P<0.0001$). However, people who live in the wolf areas and who are hunters still have less positive attitudes toward wolves, even when experience and knowledge are controlled for.

Can these less positive attitudes among people in the wolf areas and hunters be explained by other personal characteristics (Table 4)? In path model 3 education, gender, residence today and residence when growing up contribute thus enter the most parsimonious model (Fig. 4). The adjusted $R^2$ significantly increases (Partial, $F$-test $P<0.0001$) to 0.167 ($F_{\text{model 3}}=43.6$, $P<0.0001$). The direct negative effects of living in the wolf areas, being a hunter and having experience with wolf predation is reduced compared with path model 2, but remain statistically significant. Older people have a more negative attitude toward wolves, net of the other variables and those who grew up in urban areas and those who currently live in urban areas ($P=0.06$) have more positive attitudes toward wolves. Those who grew up in urban areas had less experience with predation and because of this had more positive attitudes. Women are less likely to say they have seen or heard a wolf than males but this experience variable still has no direct effect on wolf attitudes. Educational level has a positive effect on attitudes.

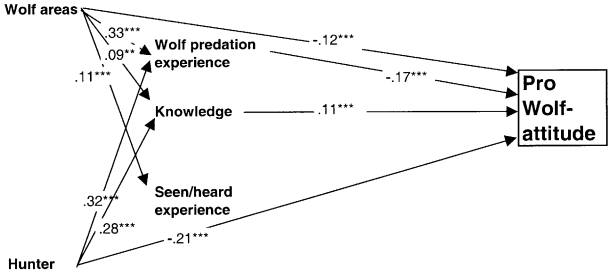


Fig. 3. The effect of experience, knowledge, hunting participation and residence on wolf attitudes. * $P<0.05$. ** $P<0.01$. *** $P<0.0001$.

In our design we over-sampled hunters and people who lived where there were wolves. Models 1–3 (above) were tested using large numbers of people who might be expected through residence and leisure time activities to have contacts and interests in wolves. In the general Swedish population survey of 1067 initially selected, we had only 57 hunters who did not live in the wolf areas, 16 non-hunters living in the wolf areas, and 0 hunters living in the wolf areas. When we test an alternative to model 3 above limited to the general population sample (95.4% of all Swedes), we get an adjusted $R^2$ of 0.081 ($F_{\text{model 4}}=16.8$, $P<0.0001$), and then only four variables significantly influence attitudes toward wolves. Older people (Age class $=-0.23$, $P<0.0001$) and women (Gender $=-0.07$, $P=0.045$) have more negative attitudes toward wolves, and those who grew up in more urban areas have more positive attitude (Urban resident as youth $=0.08$, $P=0.034$). The influence of age was non linear with those people over 65 having the most negative attitudes, and those 25–35 most positive. Knowledge had a positive effect on attitude towards wolves in the general population sample (Knowledge $=0.16$, $P<0.0001$).

## 4. Discussion

### 4.1. Group differences

Our research highlights the importance of studying the people who are most directly affected by wolves to promote wolf recovery. These groups are usually not included in general population surveys since they compose only small numbers in any society. General population

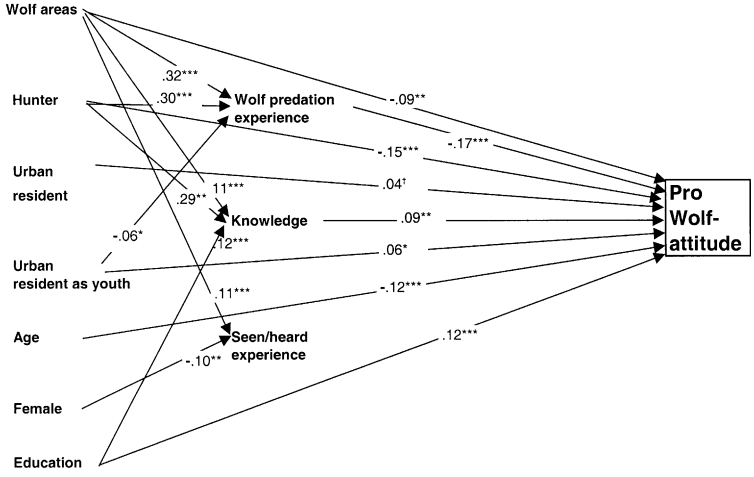


Fig. 4. The effect of personal characteristics, experience, hunting participation and residence. * $P<0.05$. ** $P<0.01$. *** $P<0.0001$. † $P=0.06$.

surveys may show strong public support, while those who live with wolves and directly may affect the well being of wolves may have very different attitudes, as shown by this study and Bjerke and Kaltenborn (2000). While Swedes in general like wolves, and all groups think they should exist, hunters and those living in areas where the wolves have been restored are more negative and most likely have become more negative during the wolf restoration.

### 4.2. The role of experience and knowledge

We found that predation experience with wolves and bears made attitudes more negative. The positive experiences with wolves that people had such as seeing and hearing was higher for those living in the wolf areas, but these experiences had no significant effect on attitudes toward wolves.

Our data show that even after controlling for the differences in knowledge and predation experience people in wolf areas and hunters still have more negative attitudes (Figs. 1–4). This means that there are other unmeasured variables working in the system. We think that wolves have a symbolic dimension that transcends biological issues (see Sharpe et al., 2001, and chapters therein). There is evidence that rural people see wolf restoration as an indication of the dominance of the larger society (Duda et al., 1998; Enck and Brown, 2000). Thus, their negative feelings may not reflect direct negative experience with wolves (i.e. predation) but rather the symbolic representation of wolves. Wolf restoration to minority groups like hunters and people who live in wolf areas may symbolize the dominance of the urban society over rural values. Wolves become just another way that the core area of a society exerts dominance over the periphery. We expect that had we measured attitudes about urban domination these would have mediated the relationship between attitudes towards wolves and living in wolf areas.

### 4.3. Changing attitudes over time

In the 25 years between 1976 and 2001, when the wolf population in Sweden went from virtually no wolves to nearly 100 wolves, the attitudes of the public and the hunters most likely have shifted. In 1976 three fourths of the hunters and the public agreed that it was important to do something for wolves, and six out of ten of both groups supported artificial reintroduction of wolves (Andersson et al., 1977). At that time the hunters were more positive than the general public in their support for a free ranging wolf population (63 vs. 51%), and for an unrestricted population of wolves (59–51%). Today, when real wolves have returned, we found that only 40% of the hunters said they liked wolves compared to 61% of the general public. Hunters today were much less likely than the general population (40 vs. 71%) to say the wolf population should increase. Seventy percent of the hunters did support the right of wolves to exist, while 90% of the non-hunting general public supported this right. While the items on the two surveys are not exactly comparable over time, it looks to us like general public attitudes toward wolves have become more positive during the last 25 years, and the attitudes of hunters have become more negative ($T > 2.63$, $P < 0.005$). Central here is that the *order* between hunters and the public had changed.

Why? In 1976 the hunters and general population thought the mountain areas and the mountain national parks in the far north were suitable places for a wolf comeback or reintroduction (Andersson et al., 1977). Less than 15% of both groups thought central and southern Sweden was appropriate for wolves. However, wolves returning to Scandinavia set up shop in south-central Sweden, not in the northern mountains. This means that that the people who live in these areas and hunters now experience wolves. Real wolves, unlike hypothetical wolves, occasionally kill livestock and hunters' dogs (Karlsson and Thoresson, 2000; Viltskadecentrum, 2001). In the rural areas where there are wolves, news of this predation spreads. Among hunters, discussions of the effects of wolf populations on hunting practices are common, and thus these groups in particular have more experience with and attend to the negative aspects of wolves (this study; Karlsson, 2001).

### 4.4. Educating the public

While attitudes do change in both positive and negative directions as we have discussed above, many conservationists and some scientists want to improve people's attitudes toward wildlife with education. We found, as did Kellert and HBRS (1990), that those groups who knew the least about wolves also had the most positive attitudes. Hunters living in areas with wolves had the most accurate objective knowledge but consistently the most negative attitudes. It is hard to believe that giving hunters more facts about wolves would make them as positive as the general population. Indeed the least knowledgeable of the general population are more positive than the hunters. It is experience with predation that affects attitude more than general knowledge.

Educating the public is difficult (Pierce et al., 2001; Shanahan et al., 2001). Our data show that a major barrier to a successful education program is that attitudes toward wolves are not very strong which is evidenced by the large fraction of Swedes being neutral to most of the attitude items, and by relatively low attitude scores (Table 2). This is line with recent findings from other parts of Europe (Croatia: Bath and Majic, 1999; France: Bath, 2000). In the list of things like friends,

family, jobs, politics that people care about, wolves are probably way down on the list. In this study, and in other wolf attitude surveys, many people have essentially neutral attitudes about wolves (Williams et al., in press). This suggests that people are not likely to be very vigilant to information about wolves. People do not seek out or attend to information about things they do not care much about (Pierce et al., 2001; Shanahan et al., 2001). The people who love wolves or hate wolves will be most likely to see any information about wolves, but will be unlikely to change their attitudes. Those who are changeable—those with neutral attitudes—care not enough about wolves to read pamphlets or be vigilant to the efforts to change their attitudes. Knowledge, information, and education are not silver bullets that will change people's attitudes about wolves and other predators.

The generally weak attitudes also suggest that large segments of the public might change attitudes rapidly to widely publicized event. This happened in the Adirondack Mountains of the United States when wolf restoration, which was initially favored, was tied to political claims of outside urban influence (Duda et al., 1988). The political and media attention changed these weak positive attitudes into stronger negative attitudes, which have persisted (Enck and Brown, 2000). Of course events (like wolf parts or genes containing some cure for a human disease) could lead to rapid pro wolf attitude shifts, but we think this is less likely than negative shifts as real wolves replace hypothetical wolves.

We believe that the shift from strong anti-wolf attitudes of the 19th century and early 20th century to the generally favorable but weaker (higher percentages of neutral) attitudes wolves is one of the factors that have allowed the natural restoration of wolves to succeed (sensu Williams et al., in press). It is only those with well-developed negative attitudes who are likely to actively hinder wolf restoration. Thus, until there is some triggering positive or negative event it is status quo for the wolves. They are no longer the hated species of the past, but they fail to have the charm of say the moose in Sweden.

### 4.5. Conservation and management

What will the future bring for wolves in Sweden? Given the high proportions of the general public and the special groups who feel that wolves have the right to exist, it is safe to conclude that the wolf population is in little threat from public attitudes in their current form. More people will be growing up in urban areas which can contribute to more favorable attitudes, and assuming the educational level of the society increases, will also contribute to more positive attitudes towards wolves. We suppose that the more negative attitudes of the oldest age class are not because their attitudes changed, as they grew older, but rather because their attitudes were formed during an earlier period in Swedish history when general attitudes toward wolves were more negative. This means that as they age and are replaced by those socialized in this more pro-environmental era public attitudes will become even more positive. The potential to improve attitudes through education remains possible, but effective means for reaching the target populations are needed; additionally careful evaluations of any education program are imperative. More knowledge will make the general public even more positive toward wolves, but it will not be sufficient to overcome direct negative experience with wolves.

Currently people's attitudes are no real threat to wolves in Sweden today. However, the analysis suggests that two factors may hinder the recovering wolf population in the future. One is the high proportion of people who do not feel strongly about wolves and who might be influenced by single events. Because many people do not feel strongly about wolves, one well-publicized negative event could sway the attitudes of many. Second, this study shows that people with experience of wolves, either from living in wolf areas or from having predation experience, are less positive. Thus, as wolf populations grow and expand over Sweden, and affect more and more people in rural wolf areas, it could increase the number of rural people who have negative attitudes. In societies like Sweden that take minority concerns very seriously this could lead to policies to reduce the growth of wolf numbers. Likewise, a continued wolf predation on dogs and changes in hunting practices to accommodate wolves may shift hunter attitudes in a negative direction. These possibilities call for the continued monitoring of attitudes toward wolves certainly among the hunters and the people living in wolf restoration areas as the current population of wolves increases in Sweden. Successful wolf restoration involves more than simply counting wolves.

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## Appendix

*Items in the Wolf Attitude Scale*

1. Are you afraid of meeting any wild animals being outdoors? We embedded the wolf alternative as the seventh choice among nine alternatives including an open-ended option at the end (no, moose *Alces alces*, roedeer *Capreolus capreolus*, brown bear *Ursus arctos*, snakes, lynx *Lynx lynx*, wolf, wildboar *Sus scrofa*, other animal).
2. How important are wolves to you personally? Seven point response scale from (−3) extremely unimportant to (+3) extremely important.
3. How do you feel about having wolves in Sweden? Five-point response scale from (−2) strongly dislike to (+2) strongly like having wolves in Sweden.
4. To which of the following statements do you agree?
   I would like to have more wolves in Sweden (+2)
   I don't care how many wolves there are in Sweden as long as they are allowed to exist (+1)
   I don't want there to be more wolves than there are today (0)
   I don't want wolves to exist in Sweden (−1)
5. Would you be willing to have wolves where you live? Five point scale. Yes, absolutely (+2), Yes, maybe (+1), No, rather not (−1), Absolutely, not (−2), and Don't know (0).
6. I may never see a wild wolf, but it is important for me to know that they are (exist) in Sweden. Four-point scale from strongly agree (+2) to strongly disagree (−2).
7. Overall, I care a lot about wolves. Four-point scale from strongly agree (+2) to strongly disagree (−2).
8. To me, the wolf symbolizes the beauty and greatness of nature. Four-point scale from strongly agree (+2) to strongly disagree (−2).
9. I think it would be a great experience to hear a wolf howl in the wild. Four-point scale from strongly agree (+2) to strongly disagree (−2).

*Items in the Knowledge Scale*

1. An adult wolf male normally weighs 85 kg (*false*).
2. It is common that people are killed by wolves today in Europe (*false*).
3. Wolves only kill sick animals (*false*).
4. Today, there are about 200 wolves in Sweden and Norway (*false*).
5. A dog and wolf can breed and have puppies (*true*).

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