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Human attitudes towards large carnivores in Norway

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Many factors influence human attitudes towards large carnivores. In our study we explore different factors that affect attitudes towards four such species, i.e. wolverines *Gulo gulo*, lynx *Lynx lynx*, brown bears *Ursus arctos* and wolves *Canis lupus*. We examined attitudes through a representative sample of the Norwegian population. By using 12 independent variables chosen for this study, we were able to explain around 15-45% of the variance in attitudes towards the four species. In general, people displayed more negative attitudes towards wolves and bears than towards lynx and wolverines. However, they were more positive towards increasing the small populations of the first two species than the relatively large populations of the last two. The results showed that 34-44% of the respondents reacted negatively to the question 'What do you think should be done about the size of the carnivore population?'. On the other hand, 73-87% reacted positively to the question 'Do these species have a right to exist in Norway?'. To the question 'How far do you want the carnivore species from your home?', 41-66% answered > 10 km. The most important variables explaining negative attitudes towards all the large carnivore species regarded the concern of the respondents for their own and their family's safety. People became more negative with age; those who were afraid of the carnivores were in general more negative towards them, and those who experienced financial loss (i.e. farmers) by having large carnivores in their vicinity expressed negative attitudes. On the other hand, the excitement of seeing large carnivores in their natural environment had a positive influence on attitude. People from larger communities were in general more positive, whereas those who thought they had the species in their vicinity were more negative. Big-game hunters frequently showed negative attitudes, whereas those with higher levels of education tended to be more positive. Our results indicate that attitudes towards large carnivores are complex. However, people are in general more negative towards wolves and bears, which must be taken into account in conservation programmes.

Key words: attitudes towards animals, bears, large carnivores, lynx, wolverine, wolves

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In the early 1990s, the Scandinavian wolf *Canis lupus* population began to increase from a minuscule number of individuals to its present population of more than 150 individuals. However, less than 30 individuals are found in Norway (Wabakken et al. 2001a,b). Despite the low population size, a negative opinion is still widespread among Norwegians, and political debates have been fought over the carnivore issue. This negative view is not only expressed by sheep farmers, who sometimes experience a financial loss due to predation, but a large proportion of the general public also expresses negative attitudes towards these animals (Kellert 1985, Bright & Manfredo 1996, Bjerke et al. 2001, Linnell et al. 2002, Williams et al. 2002). Negative attitudes may be reinforced by the media through their dramatic stories about how carnivores cause damage to livestock (Røskaft et al. 2003), and sometimes even to humans (Løe & Røskaft 2004). Such attitudes are often regarded as irrational by the natural resource management agencies, especially considering the low number of wolves involved. Due to negative attitudes, the resource authorities face major problems in the management of carnivore populations, especially because the public has been told by governmental agencies for years that wolves do not pose a threat to humans (Linnell et al. 2001). However, successful management depends on a reasonable level of social acceptability and public support for policies and strategies (Bryant & Wilson 1998, Bellamy et al. 1999, Naughton-Treves et al. 2003, Treves & Karanth 2003).

To understand the opposition to carnivore policy, it is necessary to gain a better understanding of the factors that influence and form attitudes. Our work analyses human attitudes towards the following large carnivore species in Norway: brown bear *Ursus arctos*, wolf, Eurasian lynx *Lynx lynx* and wolverine *Gulo gulo*. Although we recognise that the concept of attitude is complex and is defined quite differently in different disciplines (e.g. social psychology, sociology and human geography), we choose here to examine attitudes in a manner that is common in behavioural ecology (Krebs & Davies 1991, Low 1996, Beedell & Rehman 1999). In this tradition, certain behaviours can be viewed as having costs and benefits. Animals, as well as humans, should be designed by natural selection to maximise net benefit (Krebs & Davies 1991). Humans are part of nature; therefore their behaviour can frequently be analysed using the aforementioned concept and should not be reduced to culturally based rules only. However, the way we use the concept does not disclaim cultural or social psychology approaches. Rather, we see the approach in our study as complementary, an argument that so far has been given little attention in the human-carnivore debate.

An ''attitude is the product of a person's perception of how good or bad the outcome associated with a certain behaviour is'' (Beedell & Rehman 1999). An optimal output can arise when all known costs and benefits are evaluated. Of course, different individuals can perceive the costs and benefits differently, and this is influenced by various factors. This perception then produces the 'best' attitude for the person and directs the appropriate response towards a subject or an object. An advantage of an already formed attitude is that it allows one to make a rapid decision about which behaviour to adopt. The decision is rapid because only the outcome of the evaluation and not all the steps that led to it has to be remembered. The correspondence between an attitude and the behaviour towards the attitude object is often complex, however, and a voluminous literature exists on this topic (Eagly & Chaiken 1983). According to 'The Theory of Reasoned Action' (Ajzen & Fishbein 1980) the intention to behave in relation to an attitude object is the most direct predictor of a behavioural response. The behavioural intentions are hypothesised to be influenced by the attitudes, and by the subjective norms, i.e. whether significant others think that one should engage in a particular behaviour. In our study, we did not include behavioural intentions, so we focus primarily on factors influencing the higher order attitudes towards large carnivores.

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People may form a general and lasting attitude towards a range of situations or conditions. However, for each concrete situation that calls for an action, the chosen behaviour will arise out of an immediate perception of the present circumstances. The argument is that people have a subconscious 'meter', against which they measure the optimal outcome - an evolved psychology of choosing what is 'best' in a certain context. In such situations, even if a certain attitude is present, behaviour inconsistent with the attitude can arise because the present circumstances and new costs and benefits may modify the behaviour (Low 1996, Alvard 1998).

Based on this, we hypothesise that the attitude towards large carnivores is influenced, consciously or subconsciously, by 1) which negative consequences people expect from having large carnivore species in their surroundings and 2) which positive consequences they see in having large carnivores in their area or country. Our assumption is that many factors, considered to influence the probability and level of negative consequences, have a negative effect on the attitude. On the other hand, factors considered beneficial will have a positive effect on the attitude. We argue that the evolved human psychology has a predisposition to automatically register such consequences and make choices based on this subconscious analysis. Perceived consequences can differ among individuals and social groups due to different economic situations, diverse natural surroundings, or different knowledge about large carnivores. However, it is the perceived consequences that influence the attitudes, and these do not always agree with the actual situation. They can be influenced by traditions, culture and social conditions, which are all factors outside the control of the person and personal experiences. Therefore, where people live and how they personally experience large carnivores may predict patterns in attitudes towards the carnivores.

Material and methods

Sampling and data collection

A total of 3,500 respondents in Norway were recruited by telephone (using Telenor's directory) on the basis of a statistically representative sample of the population (≥15 years) in each of the 19 Norwegian counties (Røskaft et al. 2003). The family member who had his or her birthday most recently was asked to participate. In addition, we recruited 800 respondents (representative samples) living in municipalities known to hold large carnivores. The questionnaire, with a pre-stamped return envelope, was sent by post to the 4,300 recruited persons in November 2000. A reminder was sent to all the respondents 10 days later, and a second one (including a new copy of the questionnaire) was posted in December. All these initiatives resulted in a 73% response.

The questionnaire

The questionnaire held the following socio-demographic variables: gender (1,547 males, 1,495 females), age (240 people 15-24 years, 556 people 25-34 years, 731 people 35-44 years, 691 people 45-54 years, 466 people 55-64 years and 402 people > 65 years) and the educational level of the respondents (716 with lower secondary school, 1,182 with upper secondary school, 1,137 with college or university degrees). Furthermore, the population of the respondents' places of residence was taken into account (727 lived in towns with > 40,000 inhabitants, 460 in towns with 10,000-40,000 inhabitants, 408 in towns with 3,000-10,000 inhabitants, 612 in built-up places with < 3,000 inhabitants, and 868 in rural areas with < 800 inhabitants). The data comprise a representative sample of the Norwegian population provided by Statistics Norway (SSB). Of the sampled people, 685 lived in areas where large carnivores were known to be present and 2,449 lived in areas that do not hold large carnivores. In addition to questions about background characteristics, such as gender, age and education, a series of questions were asked regarding attitudes towards carnivores and preferred outdoor activities (Table 1). The large carnivore species included were brown bear, wolf, lynx and wolverine.

The attitude variable

We used three questions as general attitude variables: 1) 'How far from your home do you accept the large carnivore species?' (1 = < 1 km, 2 = 1-5 km, 3 = 6-10 km, 4 = do not know, 5 = > 10 km, 6 = do not want this species in my area; 1-3 are positive attitudes, 4 is a neutral attitude, 5 and 6 are negative attitudes). 2) 'Do these species have a right to exist in Norway?' (1 = disagree strongly, 2 = disagree somewhat, 3 = neither agree nor disagree, 4 = agree somewhat, 5 = agree strongly; 1 and 2 are negative attitudes, 3

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Table 1. Questions asked in the analyses of human attitudes towards large carnivores in Norway.

1. To see this species in the wild is very exiting for me (for each carnivore species separately: 1 = disagree strongly, 2 = disagree somewhat, 3 = neither disagree nor agree, 4 = agree somewhat, 5 = agree strongly).
2. How interested are you in wild animals, including large carnivores? (1 = not interested, 2 = somewhat interested, 3 = very interested).
3. How afraid are you of this species? (for each carnivore species separately: 1 = not afraid, 2 = somewhat afraid, 3 = very afraid, 4 = do not know).
4. To have this species near my home makes me worry about my safety (for each species separately: 1 = disagree strongly, 2 = disagree somewhat, 3 = neither disagree nor agree, 4 = agree somewhat, 5 = agree strongly).
5. Are you interested in a) big-game hunting or b) picking berries and mushrooms (1 = not interested, 2 = rather uninterested, 3 = neither interested nor uninterested, 4 = rather interested, 5 = very interested)
6. Do you have any of the carnivore species in the area where you live? (0 = none of the species, 1 = one species, 2 = two species, 3 = three species, 4 = four species).
7. Will large carnivores in your area mean that you will have financial losses? (1 = no, 2 = yes, small, 3 = yes, large).

is a neutral attitude, 4 and 5 are positive attitudes). 3) 'What do you think should be done about the size of the population?' (1 = exterminate completely, 2 = reduce greatly, 3 = reduce somewhat, 4 = leave it as it is, 5 = increase a little, 6 = increase much; 1-3 are negative attitudes, 4 is a neutral attitude, 5 and 6 are positive attitudes). The known size of the population of the various species at the time was presented to the respondents (i.e. 200 wolverines, 500-600 lynx, 26-55 bears and 20 wolves).

The following questions were asked regarding general attitudes towards management: 'What should be done if large carnivores a) kill livestock, b) kill cats and dogs, or c) threaten humans?' (for each large carnivore species separately: 0 = I do not know, 1 = nothing, 2 = scare them away, 3 = collar and monitor them, 4 = trap and move them, 5 = shoot them).

Analyses

SPSS for Windows version 11.0 was used for the statistical analyses, normally with non-parametric tests like Spearman rank correlations and χ^2 tests. The significance level was set at $P < 0.05$.

Linear regression analyses

Because attitudes were significantly related to many variables, we performed stepwise linear regressions to reveal the importance of each variable in explaining the variance in attitudes. We examined the effect of the significant independent variables on the attitude variable by using the values to determine the direction the attitude changes when the values of the variables increase. In the linear regression analyses, we included all eight questions shown in Table 1 in addition to gender, age, education level and area of residence. Therefore in Tables 3-6, + indicates a positive change in attitude and - a negative change in attitude.

Results

In general, people expressed most negative attitudes towards wolves and bears and less negative attitudes towards lynx and wolverines in response to the questions 'How far from your home do you accept the large carnivore species?' and 'Do these species have a right to exist in Norway?' (Table 2).

Table 2. Distribution of positive, neutral and negative attitudes towards the four large carnivore species in relation to the attitude questions: 1) 'How far from home do you accept the large carnivore species?' (positive attitude when closer than 10 km negative when more than 10 km, and neutral when they do not know), 2) 'Do these species have a right to exist in Norway?' (positive when agree, negative when disagree and neutral when neither agree or disagree) and 3) 'What do you think should be done about the size of the population?' (positive when increase, negative when decrease, neutral when leave it unchanged). (N > 3,000 in all cases).

	How far from home			The right to exist			Population size		
Attitudes	Positive	Neutral	Negative	Positive	Neutral	Negative	Positive	Neutral	Negative
Wolf	21.6	12.0	66.4	72.8	5.0	22.2	23.0	35.6	41.4
Bear	20.9	13.5	65.6	79.8	5.3	14.9	20.0	46.3	33.7
Lynx	46.5	12.3	41.2	86.5	5.0	8.5	8.5	47.2	44.3
Wolverine	35.4	16.9	47.7	84.3	5.6	10.1	11.9	48.0	40.1
χ^2 test: P <		0.001			0.001			0.001	

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On the other hand, the respondents were generally more positive towards increasing the small populations of wolves and bears in response to the question 'What do you think should be done about the size of the population?' (see Table 2). The attitudes were highly significantly intercorrelated among the four species ('How far from home do you accept the large carnivore species?' $0.201 < rho < 0.681$, 6 tests; 'Do these species have a right to exist in Norway?' $0.790 < rho < 0.932$, 6 tests; 'What do you think should be done about the size of the population?' $0.659 < rho < 0.797$, 6 tests). People also tended to have similar attitudes within species ($0.415 < rho_{wolverine} < 0.546$, 3 tests; $0.419 < rho_{lynx} < 0.512$, 3 tests; $0.463 < rho_{bear} < 0.607$, 3 tests; $0.020 < rho_{wolf} < 0.721$, 3 tests; $P < 0.001$ in all cases except the correlation between 'How far from your home do you accept wolves?' and 'Do wolves have a right to exist in Norway?', where rho was not significant). Thus, people tended to express a similar level of attitude towards the four carnivore species.

Individual factors that affect attitudes

Gender and age

In general, men expressed more positive attitudes towards the four carnivore species than did women. To the question 'How far from your home do you accept the carnivore species?' significantly more men than women expressed positive attitudes towards all four species (see Table 3). Positive attitudes to the question 'What do you think should be done about the size of the population?' were also most frequently expressed by men (see Table 3). However, there were less clear gender differences to the question 'Do these species have a right to exist in Norway?', the differences being mostly < 1%, except in the case of wolves towards which women were actually more positive than men (see Table 3).

The younger age groups generally expressed much more positive attitudes than did the oldest age groups. Hence, there was a strong negative relationship between the attitude level and the respondent's age regarding all four species ('How far from your home do you accept the carnivore species?'; $rho_{wolverine} = 0.246$, $rho_{lynx} = 0.172$, $rho_{bear} = 0.200$, $rho_{wolf} = 0.012$ (ns); 'What do you think should be done about the size of the population?'; $rho_{wolverine} = -0.371$, $rho_{lynx} = -0.339$, $rho_{bear} = -0.381$, $rho_{wolf} = -0.377$; 'Do these species have a right to exist in Norway?'; $rho_{wolverine} = -0.259$, $rho_{lynx} = -0.246$, $rho_{bear} = -0.266$, $rho_{wolf} = -0.273$; $P < 0.001$ in all cases except when marked with ns).

Education and population size

Strong relationships existed between level of education and attitudes towards the four carnivore species; the people with the highest level of education displayed the most positive attitudes to the questions 'How far from your home do you accept the carnivore species?' ($rho_{wolverine} = -0.168$, $rho_{lynx} = -0.151$, $rho_{bear} = -0.139$, $rho_{wolf} = -0.005$ (ns)), 'What do you think should be done about the size of the population?' ($rho_{wolverine} = 0.276$, $rho_{lynx} = 0.266$, $rho_{bear} = 0.238$, $rho_{wolf} = 0.261$) and 'Do these species have a right to exist in Norway?' ($rho_{wolverine} = 0.215$, $rho_{lynx} = 0.209$, $rho_{bear} = 0.216$, $rho_{wolf} = 0.216$; $P < 0.001$ in all cases except when marked with ns).

In general, people living in the smallest communities expressed the most negative attitudes to the questions 'How far from your home do you accept the carnivore species?' ($rho_{wolverine} = 0.121$, $rho_{lynx} = 0.032$ (ns), $rho_{bear} = 0.078$, $rho_{wolf} = -0.073$), 'What do you think should be done about the size of the population?' ($rho_{wolverine} = -0.371$, $rho_{lynx} = -0.324$, $rho_{bear} = -0.332$, $rho_{wolf} = -0.385$), and 'Do these species have a right to exist in Norway?'

Table 3. Distribution of positive attitudes towards the four large carnivore species of men and women in relation to the attitude questions: 1) 'How far from home do you accept the large carnivore species?' (positive attitude when closer than 10 km), 2) 'Do these species have a right to exist in Norway?' (positive when agree), 3) 'What do you think should be done about the size of the population?' ($N > 3{,}000$ in all cases; χ^2 tests of differences between the two sexes).

	How far from home			The right to exist			Population size		
Attitudes	Men	Women	P <	Men	Women	P <	Men	Women	P <
Wolf	28.9	15.8	0.001	70.4	75.4	0.001	26.1	20.4	0.001
Bear	27.7	14.3	0.001	79.4	80.2	NS	24.7	15.9	0.001
Lynx	56.3	37.0	0.001	86.3	86.6	NS	11.8	5.4	0.001
Wolverine	42.4	29.0	0.001	84.1	84.6	NS	15.1	8.9	0.001

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($rho_{wolverine}$ = -0.232, rho_{lynx} = -0.219, rho_{bear} = -0.245, rho_{wolf} = -0.285; $P < 0.001$ in all cases except when marked with ns).

Fear and worry

People with the strongest fear (question 3 in Table 1) for the four carnivore species also expressed the most negative attitudes towards them ('How far from your home do you accept the carnivore species?' ($rho_{wolverine}$ = 0.299, rho_{lynx} = 0.435, rho_{bear} = 0.408, rho_{wolf} = 0.184), 'What do you think should be done about the size of the population?' ($rho_{wolverine}$ = -0.185, rho_{lynx} = -0.214, rho_{bear} = -0.267, rho_{wolf} = -0.324) and 'Do these species have a right to exist in Norway?' ($rho_{wolverine}$ = -0.216, rho_{lynx} = -0.252, rho_{bear} = -0.249, rho_{wolf} = -0.307; $P < 0.001$ in all cases).

People who worried most for their own and their family's safety (question 4 in Table 1) also expressed the most negative attitudes towards the four species ('How far from your home do you accept the carnivore species?' ($rho_{wolverine}$ = 0.380, rho_{lynx} = 0.476, rho_{bear} = 0.487, rho_{wolf} = 0.131), 'What do you think should be done about the size of the population?' ($rho_{wolverine}$ = -0.301, rho_{lynx} = -0.306, rho_{bear} = -0.401, rho_{wolf} = -0.464) and 'Do these species have a right to exist in Norway?' ($rho_{wolverine}$ = - 0.325, rho_{lynx} = -0.324, rho_{bear} = -0.363, rho_{wolf} = -0.424; $P < 0.001$ in all cases).

Outdoor recreation activities

In most cases, there was a weak but significant relationship between interest in big-game hunting (question 5a in Table 1) and attitudes towards large carnivores; people most interested in big-game hunting expressed the most negative attitudes. However, they were more positive towards having large carnivores closer to their home ('How far from your home do you accept the carnivore species?' ($rho_{wolverine}$ = 0.007 (ns), rho_{lynx} = -0.070, rho_{bear} = 0.089, rho_{wolf} = 0.098), 'What do you think should be done about the size of the population?' ($rho_{wolverine}$ = -0.107, rho_{lynx} = -0.105, rho_{bear} = -0.062, rho_{wolf} = -0.148) and 'Do these species have a right to exist in Norway?'; $rho_{wolverine}$ = -0.085, rho_{lynx} = -0.072, rho_{bear} = -0.077, rho_{wolf} = -0.144; $P < 0.001$ in all cases except when marked with ns).

In most cases, there was a weak but significant relationship between interest in picking berries and mushrooms (question 5b in Table 1) and attitudes towards large carnivores; people most interested in picking berries and mushrooms expressed the most negative attitudes ('How far from your home do you accept the carnivore species?' ($rho_{wolverine}$ = 0.073, rho_{lynx} = 0.021 (ns), rho_{bear} = 0.062, rho_{wolf} = 0.054), 'What do you think should be done about the size of the population?' ($rho_{wolverine}$ = -0.163, rho_{lynx} = -0.159, rho_{bear} = -0.172, rho_{wolf} = -0.180) and 'Do these species have a right to exist in Norway?' ($rho_{wolverine}$ = -0.083, rho_{lynx} = -0.074, rho_{bear} = -0.089, rho_{wolf} = -0.112; $P < 0.001$ in all cases except when marked with ns).

Financial loss

In most cases, there was a weak but significant relationship between the potential for suffering financial loss by having large carnivores in the area (question 7 in Table 1) and attitudes towards them; people expecting the highest loss expressed the most negative attitudes ('How far from your home do you accept the carnivore species?' ($rho_{wolverine}$ = -0.109, rho_{lynx} = -0.046*, rho_{bear} = -0.066, rho_{wolf} = 0.048), 'What do you think should be done about the size of the population?' ($rho_{wolverine}$ = 0.193 rho_{lynx} = 0.140, rho_{bear} = 0.194, rho_{wolf} = 0.231) and 'Do these species have a right to exist in Norway?'; $rho_{wolverine}$ = 0.138, rho_{lynx} = 0.174, rho_{bear} = 0.142, rho_{wolf} = 0.204; $P < 0.001$ in all cases except the case marked *, which was $P < 0.01$).

Interest in nature

Significant relationships existed between the thrill of actually seeing the wild carnivores (question 1 in Table 1) and attitudes towards them; people expressing the strongest excitement displayed the most positive attitudes towards carnivores ('How far from your home do you accept the carnivore species?' ($rho_{wolverine}$ = -0.404, rho_{lynx} = -0.433, rho_{bear} = -0.444, rho_{wolf} = -0.028 (ns)), 'What do you think should be done about the size of the population?' ($rho_{wolverine}$ = 0.437, rho_{lynx} = 0.429, rho_{bear} = 0.514, rho_{wolf} = 0.532) and 'Do these species have a right to exist in Norway?' ($rho_{wolverine}$ = 0.561, rho_{lynx} = 0.563, rho_{bear} = 0.560, rho_{wolf} = 0.591; $P < 0.001$ in all cases except when marked with ns).

Strong relationships existed between general interest in animals, including large carnivores (question 2 in Table 1), and attitudes towards the four

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carnivore species; people expressing the strongest interest displayed the most positive attitudes towards carnivores ('How far from your home do you accept the carnivore species?' ($rho_{wolverine}$ = 0.134, rho_{lynx} = 0.231, rho_{bear} = 0.169, rho_{wolf} = 0.111), 'What do you think should be done about the size of the population?' ($rho_{wolverine}$ = -0.059, rho_{lynx} = -0.080, rho_{bear} = -0.093, rho_{wolf} = -0.036*) and 'Do these species have a right to exist in Norway?'; $rho_{wolverine}$ = -0.161, rho_{lynx} = -0.184, rho_{bear} = -0.154, rho_{wolf} = -0.102; $P < 0.001$ in all cases except when marked with *, which was $P < 0.01$).

Carnivores in the vicinity

Of the 3,138 people interviewed, 685 lived in areas holding large carnivores and 2,449 in areas that did not. Virtually all (99.6%) of the first group knew they had carnivores in their vicinity, and responded by saying that at least one carnivore species lived in their surroundings. However, in areas with no carnivores, 41.5% responded that carnivores lived in their area. When testing the attitudes of people, we chose to use the number of carnivores that people believed lived in their surroundings, because we estimated that this was the most important factor determining their attitudes.

Strong relationships existed between how many large carnivores people believed there were in their home area (question 6 in Table 1) and their attitudes towards the four carnivore species; people believing that carnivores lived in their home area displayed the most negative attitudes towards them ('How far from home do you accept the carnivore species?' ($rho_{wolverine}$ = 0.040*, rho_{lynx} = -0.070, rho_{bear} = 0.006 (ns), rho_{wolf} = 0.109), 'What do you think should be done about the size of the population?' ($rho_{wolverine}$ = -0.311, rho_{lynx} = -0.262, rho_{bear} = -0.291, rho_{wolf} = -0.365) and 'Do these species have a right to exist in Norway?' ($rho_{wolverine}$ = -0.177, rho_{lynx} = -0.154, rho_{bear} = -0.196, rho_{wolf} = -0.261; $P < 0.001$ in all cases, except when marked with ns or a * when $P < 0.01$).

Multivariate analyses

'*How far from your home do you accept the carnivore species?*'

Stepwise linear regression analyses with the question 'How far from your home do you accept the carnivore species in question?' as the dependent variable revealed that between 9.9% (wolves) and 34.1% (lynx) of the variation in the responses to this question was explained by the 12 variables discussed above (see Table 4). The most important variable explaining most of the variation in this attitude was the concern that people had for themselves and their family (see Table 4). Worried people wanted the carnivore further away from their home areas. Excitement about seeing

Table 4. Results of stepwise linear regression analyses between the question 'How far from home do you accept the carnivore species?' as a dependent variable in relation to various independent variables as described in Table 1. Rank is the rank order of the importance of the variable and P gives the significant value (ns = non-significant).

Independent variable	Wolverine		Lynx		Bear		Wolf	
Positive (+) or negative (-)	Rank	P ≤	Rank	P ≤	Rank	P ≤	Rank	P ≤
'To have this species near my home makes me worry about my safety' (-)	1	0.001	1	0.001	1	0.001	1	0.001
'To see this species in the wild is very exciting for me' (+)	2	0.001	2	0.001	2	0.001	3	0.001
Age of respondent (-)	3	0.001	4	0.001	4	0.001	9	ns
Fear of the species (-)	4	0.001	3	0.001	3	0.001	2	0.001
Interest in big-game hunting (+)	5	0.001	7	0.001	9	ns	10	ns
'Will you have financial losses?' (-)	6	0.001	6	0.001	7	0.018	12	ns
Education level (+)	7	0.021	9	0.011	8	0.019	11	ns
Interest in wild animals (+)	8	ns	8	0.006	5	0.010	4	0.010
Number of carnivore species in the area (-)	9	ns	5	0.000	6	0.015	7	ns
Size of community (+)	10	ns	12	ns	10	ns	6	0.028
Interest in picking berries/mushrooms (-)	11	ns	11	ns	12	ns	8	ns
Gender (+ for male)	12	ns	10	0.057	11	ns	5	0.014
R^2	0.281	0.001	0.341	0.001	0.339	0.001	0.099	0.001
Constant	2	0.001	3	0.001	2	0.001	1	0.001

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Table 5. Results of stepwise linear regression analyses of the question 'What do you think should be done about the size of the population?' as a dependent variable in relation to various independent variables as described in Table 1. Rank is the rank order of the importance of the variable and P gives the significant value (ns = non-significant).

Independent variable	Wolverine		Lynx		Bear		Wolf	
Positive (+) or negative (-)	Rank	P ≤	Rank	P ≤	Rank	P ≤	Rank	P ≤
'To see this species in the wild excites me' (+)	1	0.001	1	0.001	1	0.001	1	0.001
Age of respondent (-)	2	0.001	2	0.001	2	0.001	2	0.001
Number of carnivore species in the area (-)	3	0.001	6	0.001	3	0.001	3	0.001
Size of community (+)	4	0.001	5	0.001	7	0.001	6	0.001
'To have this species near my home makes me worry about my safety' (-)	5	0.001	3	0.001	4	0.001	4	0.001
Interest in big-game hunting (-)	6	0.001	4	0.001	5	0.001	5	0.001
Education level (+)	7	0.001	7	0.001	9	0.001	9	0.001
'Will you have financial losses?' (-)	8	0.001	8	0.002	6	0.001	8	0.001
Fear of the species (-)	9	0.009	9	0.012	8	0.001	7	0.001
Interest in wild animals (+)	10	ns	11	0.079	10	0.013	11	ns
Gender (men +)	11	ns	12	ns	11	ns	10	ns
Interest in picking berries and mushrooms (-)	12	ns	10	0.043	12	ns	12	ns
R^2	0.417	0.001	0.360	0.001	0.454	0.001	0.539	0.001
Constant	1	0.001	1	0.001	1	0.001	1	0.001

the carnivore in question in the wild was generally the second most important predictor for their attitudes; people who found it exciting to see carnivores wanted them closer to their homes (see Table 4). Other factors that in most cases were significant were the age of the respondent (more negative with increasing age), fear of large carnivores (more negative with greater fear), level of education (more positive with higher education) and whether the large carnivores caused financial loss for the respondent (more negative with higher loss; see Table 4). Interest in big-game hunting, a general interest in animals and how many carnivore species people thought were living in their area were significant in about 50% of the cases. Gender, interest in picking berries and mushrooms and size of community were in most cases insignificant (see Table 4). It is worth noting that the patterns of people's attitudes towards wolves were slightly different from those of the other three species (see Table 4).

'*What do you think should be done about the size of the population?*'

In general, stepwise linear regression analyses explained a higher percentage of the variation of the dependent variable 'What do you think should be done about the size of the population?'. Between 36.0% (lynx) and 53.9% (wolves) of the variation in people's attitudes was explained by the 12 variables discussed (see Table 5). The most important attitude variable was the excitement that people felt seeing the carnivore in question in the wild (see Table 5). Excited people wanted the carnivore population to increase. Age was generally the second most important predictor for people's attitudes; older people wanted to reduce the populations (see Table 4). Other significant factors were how many carnivore species people believed lived in their neighbourhood (the more carnivores they thought lived nearby, the more negative the attitude), the size of the community (larger communities were more positive towards increasing the populations), concern for their own safety (worried people wanted the populations reduced), interest in big-game hunting (hunters were interested in reducing the populations), level of education (more positive with higher education), fear (more negative with greater fear) and whether the large carnivores caused financial loss to the respondent (more negative with higher losses; see Table 5). Gender, interest in picking berries and mushrooms and interest in wild animals were in most cases insignificant (see Table 5). We generally found the same patterns of attitudes towards all four species, but wolves had the highest score for explanation (53.9%; see Table 5).

'*Do these species have a right to exist in Norway?*'

Stepwise linear regression analyses explained a high percentage of the variation in response to the dependent variable 'Do these species have a right to exist in Norway?'. Between 36.2% (lynx) and 46.9% (wolves) of the variation in people's attitudes was

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Table 6. Results of stepwise linear regression analyses of the question 'Do these species have a right to exist in Norway?' as a dependent variable in relation to various independent variables as described in Table 1. Rank is the rank order of the importance of the variable and P gives the significant value (ns = non-significant).

Independent variable	Wolverine		Lynx		Bear		Wolf	
Positive (+) or negative (-)	Rank	P ≤	Rank	P ≤	Rank	P ≤	Rank	P ≤
'To see this species in the wild excites me' (+)	1	0.001	1	0.001	1	0.001	1	0.001
Age of respondent (-)	2	0.001	4	0.001	2	0.001	6	0.001
Interest in big-game hunting (-)	3	0.001	2	0.001	4	0.001	3	0.001
Number of carnivore species in the area (-)	4	0.001	9	0.026	5	0.001	2	0.001
'To have this species near my home makes me worry about my safety' (-)	5	0.001	3	0.001	3	0.001	4	0.001
'Will you have financial losses?' (-)	6	0.001	5	0.001	7	0.001	5	0.001
Gender (women +)	7	0.001	7	0.002	6	0.001	7	0.001
Education level (+)	8	0.001	6	0.002	8	0.001	9	0.005
Size of community (+)	9	0.002	8	0.006	9	0.004	8	0.002
Fear of the species (-)	10	0.023	10	ns	10	0.021	10	0.015
Interest in wild animals (+)	11	ns	11	ns	11	ns	12	ns
Interest in picking berries and mushrooms (-)	12	ns	12	ns	12	ns	11	ns
R^2	0.379	0.001	0.362	0.001	0.379	0.001	0.469	0.001
Constant	2	0.001	2	0.001	2	0.001	2	0.001

explained by the 12 variables discussed (see Table 6). The most important attitude variable was the excitement that people felt seeing the carnivore in question in the wild (see Table 6). Excited people thought that the species had the right to exist in Norway. Age was generally the second most important predictor for people's attitudes, older people being less positive to the animal's right to exist (see Table 6). Other significant variables were interest in big-game hunting (hunters being more negative), how many carnivore species that people believed lived in their neighbourhood (more negative attitudes with more species), concern for their own safety (worried people being more negative), size of the community (larger communities were more positive), level of education (educated people being more positive), fear (negative with greater fear) and whether the large carnivores caused financial loss for the respondent (those with likely financial loss being more negative; see Table 6). Gender was also a very important attitude predictor, women being more positive than men. Interest in picking berries and mushrooms and interest in wild animals were in all cases insignificant (see Table 6).

Management attitudes

Although there were differences in attitudes towards the different carnivore species, people tended to express similar attitudes towards the same carnivore species independent of whether the attitude was management related or not. The management variables correlated significantly with the other attitude variables within each species (management attitudes with the other attitudes; $0.296 < rho_{wolverine} < 0.446$, 9 tests; $0.292 < rho_{lynx} < 0.447$, 9 tests; $0.340 < rho_{bear} < 0.496$, 9 tests; $0.025 < rho_{wolf} < 0.577$, 9 tests; $P < 0.001$ in all but two cases. The rho_{wolf} between 'What do you think should be done about the size of the population?' and 'What should be done if wolves kill cats and dogs?' and 'What should be done if wolves kill livestock?' was non-significant in both cases. Management variables intercorrelated; $0.522 < rho_{wolverine} < 0.631$, 3 tests; $0.514 < rho_{lynx} < 0.620$, 3 tests; $0.474 < rho_{bear} < 0.629$, 3 tests; $0.512 < rho_{wolf} < 0.664$, 3 tests; $P < 0.001$ in all cases). Between 53.4 and 60.3% wanted the animal in question to be shot if the species in question behaved threateningly towards people, but these figures were 41.0 and 45.9% if the carnivores killed livestock, and between 33.3 and 37.5% if they killed cats or dogs. Most people wanted wolves shot and fewest wanted lynx shot (Table 7).

When the questions 'What should be done if 1) carnivores kill livestock, 2) kill cats and dogs, or 3) threaten humans?' were used as dependent vari-

Table 7. Percentage of respondents who wanted to shoot the various carnivore species if they behaved threateningly towards people, killed livestock, or killed cats and dogs.

Behaviour	Wolverine	Lynx	Bear	Wolf
Threaten people	54.2	53.4	59.8	60.3
Kill livestock	41.7	41.0	44.2	45.9
Kill cats and dogs	34.1	33.3	34.9	37.5

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Table 8. Results of three stepwise linear regression analyses between the questions what should be done if wolves kill livestock, wolves kill cats and dogs, and wolves threaten humans, as dependent variables in relation to various independent variables as described in Table 1. Rank is the rank order of the importance of the variable and P gives the significant value (ns = non-significant).

Independent variable	Threaten humans		Kill dogs and cats		Kill livestock	
Positive (+) or negative (-)	Rank	P ≤	Rank	P ≤	Rank	P ≤
'To have this species near my home makes me worry about my safety' (-)	1	0.001	1	0.001	1	0.001
'To see this species in the wild is very exciting for me' (+)	2	0.001	2	0.001	2	0.001
Size of community (+)	3	0.001	10	ns	6	0.001
Number of carnivore species in the area (-)	4	0.001	3	0.001	3	0.001
Fear of the species (-)	5	0.001	7	0.010	7	0.003
Gender (male +)	6	0.044	8	ns	9	ns
'Will you have financial losses?' (-)	7	0.047	5	0.001	10	ns
Interest in big-game hunting (-)	8	0.065	6	0.001	5	0.001
Age of respondent (-)	9	ns	11	ns	4	0.001
Education level (+)	10	ns	4	0.001	8	0.007
Interest in picking berries and mushrooms (-)	11	ns	12	ns	11	ns
Interest in wild animals (+)	12	ns	9	ns	12	ns
R^2	0.146	0.001	0.162	0.001	0.221	0.001
Constant	1	0.001	1	0.001	1	0.001

ables in stepwise linear regression analyses, the results were basically very similar (Table 8) to those obtained for the attitude variables above (see Tables 4-6). We therefore only present the results for wolves. People who wanted to kill individual carnivores were regarded as having negative attitudes. The most important variable in explaining variation in the management attitudes was the concern variable (people who were concerned for themselves and their families). Worried people expressed most negative attitudes whether wolves were killing cats and dogs, livestock or threatening themselves (see Table 8). On the other hand, the second most important variable was 'the excitement of seeing wolves in the wild', which recorded a positive attitude (see Table 8). 'How many carnivore species do you think live in your area?' was the third most important variable; the more people who thought that wolves were living in their area, the more willing they were to having problem animals shot (negative attitudes; see Table 8). Fear of wolves (negative with fear) was the fourth most important variable and interest in big-game hunting (negative with interest) the fifth most important variable. The size of the community (more positive with increasing size), whether they experienced financial loss (negative with loss) and had a higher/lower education (educated people more positive), was significant in two cases each (see Table 8). The age and gender of the respondent (more negative with increasing age) were not so significant variables for explaining variations in human management attitudes (see Table 8). Picking berries and mushrooms and general interest in animals were never statistically significant (see Table 8). The 12 variables tested explained between 14.6 and 22.1% of the variation in attitudes to the management of wolves (see Table 7). The r^2 values for wolverines, lynx and bears were 15.4-20.9%, 15.2-20.2% and 16.4-23.0% as minimum and maximum explanation values, respectively.

Discussion

Attitudes towards wolves have been studied world-wide by many researchers (Kellert 1985, Bright & Manfredo 1996, Bjerke et al. 1998a,b, Kaltenborn et al. 1999, Williams et al. 2002, Naughton-Treves et al. 2003), but our study is one of the first attempts to study human attitudes to several carnivores species at the same time, and in a behavioural ecology context.

The results of our study suggest that most attitudes towards large carnivores are formed at least partly by the assessment of different consequences of having them in the vicinity. Fear of the carnivore in question and concern for themselves and their families were important motives forming negative attitudes, whereas the excitement of seeing the carnivores in the wild was very important in forming positive attitudes. People were positive towards increasing the small wolf population,

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which at the time of the survey was around 20 individuals. This positive attitude may explain why reactions to this question did not correlate with some of the other attitudes. We expect that now, when the wolf population is around 150 individuals (Pedersen et al. 2003), people would have a much more negative attitude to a potential increase in the wolf population. Therefore, such an attitude would most probably now be in accordance with the other attitudes.

Factors affecting the attitudes negatively

Although people in general were more negative towards wolves and bears than towards wolverines and lynx, the general patterns were basically similar for all four species. If people, for instance, believed that large carnivores were dangerous, they judged a confrontation to be costly. Self-reported fear and concern for themselves and their families was one of the strongest predictors of the negative variance in an attitude and may indicate the belief that large carnivores are dangerous, and those who reported high levels of fear and concern expressed a negative attitude. Furthermore, self-reported financial loss also had a negative effect on attitudes (Llewellyn 1978, Naughton-Treves et al. 2003). It has been shown that farmers and reindeer *Rangifer tarandus* owners express negative attitudes towards large carnivores (Anderson et al. 1977, Kellert 1985, Tucker & Pletscher 1989, Bright & Manfredo 1996). Similarly, Vittersø et al. (1999) showed that farmers who anticipated continued predation on sheep had strong negative attitudes towards large carnivores.

Large carnivores, like wolves, can also be competitors for hunters because they prey on their game (Eberhardt & Peterson 1999). Although it has been shown in Norway and Minnesota, USA (Kellert 1985, Bjerke et al. 1998a) that more hunters than non-hunters wanted the size of the wolf population to be maintained or increased, we found that big-game hunters expressed more negative attitudes towards the carnivore species than people who were not interested in hunting. Bear hunters in Wisconsin, USA, were also more negative towards wolves than other groups (Naughton-Treves et al. 2003). Hunters were also more negative to the question of increasing the wolf population and were in favour of lethal control. A possible reason for these negative attitudes could be that wolves kill dogs. This has become a significant problem with the increasing wolf population in Scandinavia.

Surprisingly, an interest in picking berries and mushrooms was associated with a negative attitude even though this activity is also associated with a potential for encountering large carnivores. However, this effect disappeared in the multivariate analyses. It may therefore have covaried with another attitude factor, because some factors that increase the chance of meeting a large carnivore, like living in the same areas as them, result in a more negative attitude.

When large carnivores remain in the vicinity of a person over time, the chances of encounters increase, as does the likelihood of being involved in a confrontation. In our study, people who reported that carnivores lived in their area expressed more negative attitudes towards them. The size of the human population in the area of residence was related to the perception that large carnivores are present, probably because people assumed they were less likely to meet large carnivores in towns than in sparsely inhabited areas. People from less densely populated areas therefore expressed a more negative attitude towards large carnivores than people from bigger towns. It has been shown previously that people who reside in rural areas, particularly those living near wolf populations, express negative attitudes (Llewellyn 1978, Kellert 1985, Tucker & Pletscher 1989). Furthermore, there is also evidence from Norway that the number of people preferring the wolf to be exterminated increases with the perceived number of wolves (Bjerke et al. 1998a). Again, an increase in the number of large carnivores could suggest an increase in the conscious or subconscious predisposition to automatically registering the risk of a potential confrontation. Our study demonstrates that an increase in the number of large carnivores has only an insignificant effect on the negative attitude, but in interaction with the perception of having large carnivores in the area, it contributes significantly to explaining the variance in attitudes.

People showed more negative attitudes towards carnivores with increasing age. Bjerke et al. (1998b) found that older age groups ($>$ 55 years) in Norway preferred to have the size of the wolf population reduced. This may be attributed to the greater potential for costs from a confrontation for older people, because the older people become the less able they are to defend themselves or outrun a danger. Age differences in attitudes could also be due to where people grew up. For exam-

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ple, growing up in a household with livestock is associated with a negative attitude towards wolves (Bjerke et al. 1998b). Differences in attitudes due to where people were raised rather than where they currently lived have been very pronounced in some studies (Kellert 1996). It is more likely that older generations have grown up with livestock and in rural areas, which can create negative attitudes towards large carnivores, as our study has shown. Older people may continue to be influenced by a potentially negative attitude that was prevalent in their childhood. In general, the views of older people (age groups $>$ 55 years) show a higher dominionistic, negativistic, utilitarian score and a lower naturalistic score than age groups $<$ 36 years (Bjerke et al. 1998a). The cultural explanation for the negative attitude among the elderly is supported by findings that fear of some other species like the adder *Vipera berus* (Bjerke & Bevanger 2002) is lowest among elderly, whereas these people in general have a high fear of large carnivores (Røskaft et al. 2003).

Factors affecting the attitudes positively

When people expect some thrills from large carnivores, they express more positive attitudes. People who feel excitement at the prospect of seeing large carnivores in their natural habitat tend to have a more positive attitude towards them (a positive biophilia). In fact, the excitement of seeing large carnivores was one of the strongest explanatory values of all the variables in our study. However, in some cases concern for their own safety weighed heavier than excitement.

Although the presence of large carnivores is a possible indicator of a healthy environment, the structure of general life values and hence the concepts of what constitutes a 'healthy' environment varies considerably among stakeholders in carnivore-livestock conflicts. Farmers, for instance, see this quite differently from managers and researchers (Kaltenborn & Bjerke 2002). Consequently, a positive attitude towards the environment could suggest a positive attitude on the part of the farmers towards large carnivores. For example, a positive perception about nature's rights has a positive effect on the attitude. Higher levels of education can be associated with more knowledge about the importance of protecting the environment (Kellert & Berry 1987). Higher education positively influenced attitudes in most cases in our study. Bjerke et al. (1998a,b) found that poorly educated people have higher dominionistic, negativistic and utilitarian views, whereas highly educated people show the opposite pattern.

In contrast to earlier studies (Kellert 1985, Williams et al. 2002), our results suggest that gender is not a significant variable explaining the variance in attitudes. However, gender is very important when explaining the variation in levels of fear (Røskaft et al. 2003). Other researchers have argued that there is a "major contrast in how men and women view animals and that the differences in attitudes towards animals are dramatic" (Kellert & Berry 1987). A study about preferences of different animals in 9-15-year old children showed that, in general, boys like wolves, bears, lynx and other wild animals more than do girls (Bjerke et al. 1998b). Grown men like predatory animals more than do women (Kellert & Berry 1987). Moreover, more women report fear of large carnivores than do men (Kellert & Berry 1987, Røskaft et al. 2003) and a high level of fear is associated with a more negative attitude. All these findings should indicate a more positive attitude towards large carnivores among men than among women, which is what was actually found when men and women were compared. However, what then can explain the general lack of a significant difference in attitudes between men and women in the multivariate analyses? Maybe the gender differences disappeared because of other confounding variables.

Management implications

Because our sample size was very big, it can be argued that some of the differences found in our study are due to this large sample. However, when breaking data down into all the different groups, the sample size of each of these groups is not very big. We therefore conclude that the data reflect the true variation in attitudes among different Norwegians. Our study, therefore, illustrates the importance of understanding people's attitudes towards large carnivores when questions concerning their management are raised. Our results show that attitudes are clearly related to notions about appropriate reactions towards large carnivores. People with positive attitudes are inclined to let large carnivores live in their country and in their natural environment, even though they might experience some costs, like the loss of livestock, cats and dogs, or a threat to human life. People with negative attitudes, on the other hand, are more

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inclined to prefer to have large carnivores exterminated. We cannot use attitudes to predict a specific action in a particular situation, but the results of our study suggest that we can use attitudes to predict how people expect the management authorities to act. Given the clear correlation between an attitude and a preferred action, it may be possible to modify this preference by changing an attitude. Consequently, the management authorities will benefit from focusing on perceived real costs and benefits. An education programme that emphasises the benefits of having large carnivores may be a good management strategy. This should include information about the importance of large carnivores in maintaining a healthy environment, enhance knowledge about the actual number and distribution of large carnivores, and ways of preventing financial or personal losses. Norway can learn from the experiences of Wisconsin, USA, which has had a history of wolf recovery over the last three decades that is remarkably similar to that in Norway. In Wisconsin, local people have been involved in the wolf-recovery project since the late 1980s, with an education programme in schools and the community (Thiel 1993). This has affected human fear and attitudes and has allowed the wolf population to recover with minimal conflict (Druckenmiller et al. 1999). The success has been based on the concept that carnivore conservation depends on both the socio-political and the biological landscape (Treves & Karanth 2003). However, this does not necessarily mean that people who experience financial loss do not display negative attitudes towards wolves, even if they are compensated for their loss (Naughton-Treves et al. 2003).

In Norway, the conflict between humans and carnivores is greatest in rural areas. Farmers grow up with livestock production and face the trauma of predation first-hand when they have large carnivores in their vicinity. Thus, the elderly, and rural inhabitants in general, often express more negative attitudes towards large carnivores than younger and urban people (Kellert 1985, 1991, Bjerke et al. 1998a). Conflicting economic interests are also important. Farmers fear for their future and for increasing losses. Negative expectations about the future contribute to negative attitudes towards carnivores. Likewise, the stronger the attachment farmers show to their sheep, the more negative are their attitudes towards large carnivores (Vittersø et al. 1998). However, negative attitudes are not equivalent to fear. Knowledge may reduce fear without reducing other aspects of negative attitudes. Biologists often assume that information about the very low risk of being threatened or attacked by large carnivores will reduce or even extinguish the fear of, or negative attitudes towards, these animals. Quite often, however, such information is received with great scepticism. At the moment, Norwegian farmers are compensated for their loss of livestock to carnivores. However, they remain negative towards any action to reduce their loss of livestock caused by carnivores.

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