

Patterns of self-reported fear towards large carnivores among the Norwegian public

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Received 3 December 2001; received in revised form 10 March 2003

Abstract

In this paper, we analyse self-reported fear of four large carnivore species in a representative sample of the Norwegian population. People reported the most fear of the two largest and most dangerous carnivores, brown bears and wolves, and less fear of lynx and wolverines. Women expressed significantly more fear of these species than did men, and expressed fear increased with age in both sexes. Human population density had very little effect on the degree of self-reported fear of large carnivores, but people living in rural areas with one carnivore species in their vicinity expressed less fear of this species than people from rural areas where this carnivore species was absent. Activities related to experience with, or knowledge of, the large carnivores also effected fear patterns. People with higher education and those who expressed interest in outdoor activities like small game hunting and mountain hiking generally reported less fear than did respondents with lower education and no interest in outdoor activities, respectively. We argue that a good management strategy is to develop educational programs where people learn about the biology and habits of the large carnivores and are encouraged to gain first-hand outdoor experience in areas with large carnivores © 2003 Elsevier Science Inc. All rights reserved.

Keywords: Fear of animals; Wolves; Carnivores; Sex differences in fearfulness

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1. Introduction

Conflicts over management of large carnivores exist in many countries. Such conflicts frequently reflect diverging economic interests, but this is only one part of the large carnivore debate. The human–large carnivore conflict is complex and requires analysis of cultural, social, and political factors in order to achieve a fuller understanding of this escalating problem. People have always been concerned about their own health and safety, and they have evolved both positive (biophilic) and negative (biophobic) responses to animals: biophobic responses towards species that represent a threat and biophilic responses towards species that offer advantages (Diamond, 1993; Ulrich, 1993). It is thus unsurprising that biophobic responses to some animals are also found among people whose material interests are unaffected by the presence of such animals. Fear of animals may often appear to be irrational and unrealistic under present circumstances, yet it has had adaptive value in our evolutionary past.

Many wildlife managers underestimate the significance of these fears. During recent years, it has become evident that effective environmental management depends heavily on the social acceptability and participation of people who are affected by the decisions made by official state agencies (Bellamy, McDonald, Syme, & Butterworth, 1999; Bryant & Wilson, 1998), so in order to avoid further loss of the Earth's biodiversity, it is important to gain a better understanding of (both positive and negative) attitudes toward wild animals and to explore the biological and cultural factors that influence such attitudes. This is especially important in Europe, where large carnivores are being conserved in multiple-use landscapes with high human densities (Linnell, Andrén, et al., 2001; Linnell, Swenson, & Andersen, 2001).

Until recently, large carnivore species like wolves (*Canis lupus*), brown bears (*Ursus arctos*), lynx (*Lynx lynx*), or wolverines (*Gulo gulo*) were not included in studies of humans' fear of animals. In the last decades, large carnivore populations have increased markedly in Scandinavia. The wolf population has, for instance, increased from only a few individuals in 1990 to more than 100 individuals today (Wabakken, Sand, Liberg, & Bjärvall, 2001). Protests from farmers and the fear expressed by people residing in areas where wolves have naturally reestablished themselves have caused considerable political debate.

In this paper, we analyse self-reported fear of the four large Norwegian carnivores as a function of carnivore species and sex and age of the respondents. Because increased nonthreatening experience with an animal to which we might develop an animal phobia may reduce this phobia (Diamond, 1993), we also analyse the material with respect to whether the respondents live in areas with or without large carnivores. Other aspects of experience with, or knowledge of, the carnivores in question, such as level of education and the respondent's interest in different outdoor activities, are also considered. Finally, we relate self-reported fear patterns to the real danger posed by the carnivore species in question.

2. Methods

2.1. Sampling and data collection

Respondents were recruited by telephone (Telenor's directory) on the basis of a statistically representative sample of the population (15 years and older) in each of the 19 Norwegian counties. The family member who had his/her birthday most recently was asked to participate. A total of 3500 respondents were recruited in this way, and an additional 800 respondents (representative samples) living in municipalities where large carnivores exist were also recruited. The questionnaire with prestamped reply envelopes was sent by post to the 4300 recruited persons in November 2000. Ten days later, a reminder was sent to all respondents, and a second reminder (including the questionnaire) was posted in December. Seventy-three percent of the recruited persons completed and returned the questionnaire.

2.2. The questionnaire

In addition to sociodemographic variables, the questionnaire asked respondents about their outdoor activities, environmental value orientations, cultural value orientations, basic values in life, political preferences, and their opinions about the acceptable population size and distribution of the large carnivores (bear, lynx, wolf, and wolverine), about acceptable behaviours of these animals, about acceptable wildlife management actions, about the connotative meanings of the four carnivore species, and about fears of various species. Specifically, the analyses presented here are focused on responses to the following question: "To what degree would you say you are afraid of the following animals?" The list included 12 species, including bear, wolf, lynx, and wolverine. Options were "not afraid" (coded 1), "a little afraid" (coded 2), "very much afraid" (coded 3), and "don't know" (which very few respondents ever selected, and which responses are henceforth ignored).

For present purposes, ages are grouped as 15–24, 25–34, 35–44, 45–54, 55–64, and 65 years and older). Human population density was coded: (1) living in a city above 40,000 inhabitants; (2) a city of 10,000–40,000; (3) a town of 3000–10,000 inhabitants; (4) a smaller community; and (5) a sparsely populated rural area. Respondents were also asked to indicate whether one or several of the four large carnivore species lived in their home area. The answers allowed a comparison with regard to self-reported fear between groups with or without one (or several) large carnivore species in their vicinity. In these comparisons, population density categories 4 and 5 were used.

Education was coded: (1) up to 9 years of schooling; (2) 10–12 years; and (3) more than 12 years of education. Finally, we asked about the respondent's interest in outdoor activities: small game hunting, mountain hiking, and mushroom or berry picking.

2.3. Data on how dangerous the Norwegian carnivores are towards humans

Data on how dangerous the four Norwegian carnivores are towards people are from three recent reports (Linnell et al., 2002; Swenson et al., 1996, 1999). Numbers of deaths caused by

these four carnivores in Norway and Sweden from 1727 to 2000 are used as index of relative danger. (Rabies has been absent from Scandinavia during this period, so these attacks all represent predatory attacks.) Data on the relative danger that large carnivores pose for males and females were taken from Swenson et al. (1999) for bears and Pousette (2000) for wolves: The bear attack data are from Norway and Sweden, 1800–1906, and the wolf attack data are from Sweden (1820–1821) and Russia (1944–1953). The average body weights of each species are from Semb-Johansson (1990).

2.4. Analyses

All analyses were conducted in SPSS for Windows version 10.0. Because the data represent categories with some intrinsic order (not afraid, a little afraid, very much afraid), we have mostly used ordinal tests.

3. Results

Levels of fear of the different species were positively correlated across respondents (wolf/brown bear, Spearman $\rho = .690$, $N = 2903$; wolf/lynx, $\rho = .684$, $N = 2882$; wolf/wolverine, $\rho = .582$, $N = 2720$; brown bear/lynx, $\rho = .576$, $N = 2865$; brown bear/wolverine, $\rho = .511$, $N = 2711$; lynx/wolverine, $\rho = .700$, $N = 2712$; all P 's $< .001$), indicating that people with fear of one species also feared the other three species.

More people have been killed by brown bears ($N = 27$) in Scandinavia during the last 250 years than by wolves ($N = 17$); we have found no records of people killed by either lynx or wolverines. When an attack occurs, the probability of it being fatal is significantly higher for females than for males (62% vs. 29% for bears, 65% vs. 39% for wolves; Linnell et al., 2002; Swenson et al., 1999). There was a perfect rank correlation between the mean body weight of a carnivore species and the percentage of the respondents reporting themselves to be very much afraid of that species (Spearman $\rho = 1.00$, $N = 4$). There was also a positive correlation between the percentage “very much afraid” of a species and the number of people killed by that species (Spearman $\rho = .949$, $N = 4$).

3.1. Self-reported fear, carnivore species, and sex

Overall, 57% of the respondents reported that they were very much afraid of bears, while the figures for wolves, lynx, and wolverines were 48%, 27%, and 20%, respectively. There were significant differences among carnivore species in the frequency of saying that one was “not afraid,” “a little afraid,” and “very much afraid” ($\chi^2 = 1429$, $df = 6$, $P < .001$), and there was a significant effect of sex (Table 1): Women professed to be more afraid of all four carnivores than did men ($P < .001$ by ordinal test).

Table 1
Percentage of respondents reporting different levels of fear of bears, wolves, lynx, and wolverines by sex and age group

		Age groups (years)												P , ordinal test (ρ)
		15–24		25–34		35–44		45–54		55–64		65 +		
		Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	
Bears	not afraid	3	17	3	11	5	17	5	11	4	13	2	8	< .001
	a little afraid	34	47	34	50	31	49	18	46	21	46	16	41	
	very much afraid	64	36	64	39	64	34	76	42	76	41	82	51	
Wolves	not afraid	6	30	7	18	10	24	5	16	6	19	3	11	< .001
	a little afraid	35	48	33	48	28	51	27	53	25	52	13	43	
	very much afraid	59	22	60	34	63	25	67	31	69	30	85	46	
Lynx	not afraid	15	43	15	42	19	55	19	53	16	54	13	40	< .645
	a little afraid	49	42	48	44	45	35	42	38	43	35	30	38	
	very much afraid	36	15	37	14	36	9	39	9	41	10	57	22	
Wolverines	not afraid	19	39	21	38	20	49	17	45	18	52	16	39	< .016
	a little afraid	57	57	57	55	50	46	52	46	41	38	33	46	
	very much afraid	24	4	22	7	30	5	30	9	41	10	51	15	

There were 2697–2921 respondents for each carnivore species. The ordinal tests indicate differences between age groups.

3.2. *Experience and fear of carnivores*

3.2.1. *Fear and age*

There were significant differences in frequencies of self-reported fear (“not afraid”, “a little afraid”, “very much afraid”) among the different age groups for all four carnivore species (ordinal tests, Table 1). The proportion “very much afraid” increased with age for three carnivores, but not for lynx (ordinal tests, Table 1).

3.2.2. *Fear in rural areas with or without carnivores*

First, rural respondents who reported that one of the four carnivore species lived in their home area were compared to rural respondents who reported that this species did not. (Rural groups may have one, two, or three of the carnivore species in their home area. No area has all four species). For each species, the proportion “very much afraid” was lower in areas with the species than in areas without it (lynx 11% lower, $\chi^2=91.7$, $df=3$, $P<.001$; wolves 3% lower, $\chi^2=17.5$, $df=3$, $P<.001$; bears 12% lower, $\chi^2=66.2$, $df=3$, $P<.001$; wolverines 5% lower, $\chi^2=40.4$, $df=3$, $P<.001$).

Secondly, rural respondents who reported that one or more of the species lived in their home area were compared to rural respondents who reported that none did so. As above, the proportion “very much afraid” of large carnivores was in three of four cases (except wolves) lower in areas with large carnivores than in areas without them (ordinal tests, Table 2).

3.2.3. *Fear and outdoor activities (small game hunting, mountain hiking, berry picking)*

People interested in small game hunting reported that they were “very much afraid” of all four species less frequently, and “not afraid” more frequently, than those who were less interested in small game hunting; the same was true for those interested vs. not interested in mountain hiking (ordinal tests, Table 3). There was also a significant relationship between interest in picking berries and being “very much afraid” or “not afraid” of wolves, but no such relationship was found for the other carnivore species (ordinal tests, Table 3).

3.2.4. *Fear and education*

There was a significant reduced tendency to be “very much afraid” and increased tendency to be “not afraid” of the four carnivore species with increasing education level (ordinal tests, Table 4).

3.3. *Fear and human population density*

With decreasing size of the community, respondents were significantly less likely to be “very much afraid” and more likely to be “not afraid” for lynx and wolverines, but no such effects of community size were found for bears or wolves (ordinal tests, Table 2).

Table 2
Percentage of respondents reporting different levels of fear of bears, wolves, lynx, and wolverines in relation to the size of their community and in relation to whether they live in areas with (one or more) carnivore species or in areas with none

		Community size (number of inhabitants)					Small communities		<i>P</i> , ordinal test (rho)	
		> 40,000	10,000– 40,000	3000– 10,000	500– 3000	< 500	With carnivores	Without carnivores	Community size	Small communities
Bears	not afraid	7	7	6	10	10	12	8	< .052	< .001
	a little afraid	36	36	38	38	36	39	35		
	very much afraid	57	57	56	52	54	49	57		
Wolves	not afraid	12	12	11	15	13	16	13	< .268	< .487
	a little afraid	42	42	39	37	36	35	37		
	very much afraid	47	45	51	49	52	50	50		
Lynx	not afraid	29	31	28	35	40	41	35	< .001	< .014
	a little afraid	41	44	43	43	37	39	40		
	very much afraid	30	25	29	22	23	20	24		
Wolverines	not afraid	28	31	28	32	40	40	34	< .001	< .008
	a little afraid	52	50	52	51	41	45	45		
	very much afraid	21	20	20	17	19	16	21		

Only areas with fewer than 3000 inhabitants are included in this sample. There were 2723 < *N* < 2905 respondents for each carnivore species in the total sample and 1304 < *N* < 1399 respondents for the subsample comparing small communities with or without carnivores. The ordinal tests indicate differences between community groups.

Table 3

Percentage of respondents reporting different levels of fear of bears, wolves, lynx, and wolverines in relation to their interest in small game hunting (a), berry picking (b), or mountain hiking (c)

		Uninterested			Neither–nor			Interested			Ordinal test (rho)
		a	b	c	a	b	c	a	b	c	
Bears	not afraid	6	8	7	7	9	6	16	8	9	$P_b = .067$
	a little afraid	32	39	29	42	39	39	50	35	37	
	very much afraid	62	53	64	51	51	55	34	57	54	
Wolves	not afraid	10	14	9	10	13	12	23	12	14	$P_b = .378$
	a little afraid	37	43	33	40	42	41	46	36	40	
	very much afraid	53	42	58	50	45	47	31	52	47	
Lynx	not afraid	26	35	28	34	31	30	58	33	35	$P_b = .288$
	a little afraid	44	40	37	42	45	42	32	40	41	
	very much afraid	30	25	35	24	24	28	10	27	23	
Wolverines	not afraid	26	31	26	32	34	31	53	32	34	$P_b = .288$
	a little afraid	51	51	47	53	49	52	39	47	48	
	very much afraid	23	18	27	15	17	18	8	21	18	

There were 2673 < N < 2926 respondents for each carnivore species. Differences between those that reported different interest levels were tested for each carnivore species with ordinal tests ($P < .001$ unless otherwise stated).

3.4. Multivariate analysis

A general lineal model (GLM) analysis with self-reported fear as the dependent variable and sex, age group, education level, living with carnivores in the area or not, and interest in small game hunting as independent variables, and with carnivore species as a covariate, was statistically significant for all independent variables, explaining as much as 91.4% of the

Table 4

Percentage of respondents reporting different levels of fear of bears, wolves, lynx, and wolverines in relation to their education level

		Education level			N	P , ordinal test (rho)
		Primary school	High school	College/university		
Bears	not afraid	7	9	9	2868	< .001
	a little afraid	29	37	41		
	very much afraid	65	55	50		
Wolves	not afraid	12	13	13	2865	< .001
	a little afraid	30	37	46		
	very much afraid	58	50	41		
Lynx	not afraid	28	33	37	2841	< .001
	a little afraid	39	41	43		
	very much afraid	33	27	20		
Wolverines	not afraid	28	33	34	2692	< .001
	a little afraid	46	49	50		
	very much afraid	26	19	16		

The ordinal tests indicate differences between education groups.

variation in self-reported fear patterns (adjusted $r^2 = .914$; Model: $F = 6086$, $df = 19$, $P < .001$; carnivore species: $F = 1186$, $df = 1$, $P < .001$; sex: $F = 823$, $df = 1$, $P < .001$; interest in small game hunting: $F = 133$, $df = 2$, $P < .001$; education level: $F = 45.9$, $df = 2$, $P < .001$; living in areas with or without carnivores: $F = 26.6$, $df = 1$, $P < .001$; age group: $F = 10.1$, $df = 5$, $P < .001$; interaction between age and sex: $F = 4.7$, $df = 5$, $P < .001$). This indicates that all the tested variables independently affect the level of self-reported fear to all four carnivore species. None of the other variables (interest in mountain hiking, interest in picking berries, human population density) increased the explanation level.

4. Discussion

We have shown that Norwegians are more afraid of bears than of the other three large carnivore species and, in general, are most afraid of the largest and most dangerous species: 57% reported that they were “very much afraid” of bears, and 48% said the same for wolves. These numbers are higher than previously found in Norway (Bjerke & Kaltenborn, 2000), perhaps because of increased negative attitudes towards large carnivores in the mass media, as well as methodological differences between the studies. Recent surveys on attitudes toward wolves indicate that approximately one third of those sampled express fear of this species (Finland (Lumiaro, 1998); Sweden (Karlsson, Bjärvall, & Lundevall, 1999); Lithuania (Balčiauskienė & Balčiauskas, 2001); southeast Norway (Bjerke & Kaltenborn, 2000)).

The level of self-reported fear is surprisingly high in some groups. In a previous study in southeastern Norway, for example, 74% of all women and 80% of those aged 65 and above partly or completely agreed with the statement, “I would become more careful when walking in the field and forests,” if wolves were living in the region (Bjerke & Kaltenborn, 2000). Results in the present study are similar to previous studies in that people are more afraid of bears than wolves, and that the smaller lynx and wolverines are not regarded as threatening (Balčiauskienė & Balčiauskas, 2001). Because both bears and wolves have been reported to kill humans (Linnell et al., 2002; Swenson et al., 1996, 1999), fear of these animals is realistic and adaptive. The high level of self-reported fear of wolves in Europe has possibly affected human attitudes towards this animal, which have been negative for centuries (Boitani, 1995).

4.1. Sex and age

Generally, women, the elderly, persons with less formal education, and rural inhabitants have, in previous studies, expressed more negative attitudes towards large carnivores than other sociodemographic groups (an exception being that the urban vs. rural difference was not found in Sweden). In the present study, women in all age classes expressed more fear of the carnivores than did men. The same has been found in surveys regarding other carnivores in other parts of the world as well as in Europe (Costello, 1982; Öhman, 1986). The present study did not include children under the age of 15, but previous studies have shown that young girls also express more fear of animals in general than do boys (Arrindell, 2000). Our data do not

allow us to explain the sex difference, but historical data do indicate that the risk of a bear or wolf attack being fatal is higher for women than men in this region, a result that is common in carnivore attack studies from both the Western and the developing world (Beier, 1991; Treves & Naughton-Treves, 1999). One point that came up during this survey was that women might fear not only for their own safety, but for the safety of their children as well. Our data suggest that this consideration does not explain the sex difference, although children are indeed far more vulnerable to carnivore attack than adults (Beier, 1991; Linnell et al., 2002), because the sexes differ across all age groups. We might expect self-reported fear to decline with age (Costello, 1982), given that elderly people have built up knowledge and experience of their natural surroundings, but previous findings are inconsistent in this respect; the age effect on fear is sometimes positive, negative, or absent (Davey, 1994; Kirkpatrick, 1984).

Why the results in our study show a significant age related pattern in the opposite direction of what we would expect may be due to several factors. First, in Norway, the mass media have recently been presenting negative attitudes towards the large carnivores, writing several articles indicating that bears and wolves are dangerous to people. Such stories may affect human fear, and because elderly people maintain the negative attitudes toward large predators that were widespread until recently, they may be affected more than younger age groups by these media representations. Secondly, humans exercise less with age, particularly high-risk exercise (Løge Hagen & Løge Hagen, 1997), and younger people are more fit, making them less vulnerable, hence, less fearful; moreover, elderly people tend to be cautious generally, and fear of animals may be related to other types of anxiety. Thirdly, elderly people perform outdoor activities less than younger people, so they may not have the same close knowledge of nature (although their different knowledge of nature might also entail a real difference in the experienced prevalence of large carnivores during younger days; see Løge Hagen & Løge Hagen, 1997). Fourthly, young men in particular perform high-risk outdoor activities (Løge Hagen & Løge Hagen, 1997), and this age class of men may also report less fear because it gives status to show less anxiety. In some species, dominant individuals and/or males are the ones that mob predators, which may have positive effects on status, and these are the animals who are most fearless (Hamilton, Buskirk, & Buskirk, 1975; Iwamoto, Mori, Kawai, & Bekele, 1996; Passamani, 1995; Slagsvold, 1984, 1985; van Schaik & van Noordwijk, 1989). Such an argument could also be relevant for humans.

A difference between the two sexes' fear of carnivores can be predicted from the "environment of evolutionary adaptedness" hypothesis or EEA, according to which men were hunters and therefore had to deal directly with many dangerous animals (Hawkes, O'Connell, & Blurton Jones, 1991). Women, on the other hand, probably stayed in the close vicinity of their camps because their parental duty was to raise and care for the children. Thus, women more easily evolved fear towards animals of threat. An additional hypothesis that could predict sex-based differences in fear is if women are at a greater risk of being killed in a large carnivore attack than men (Treves & Naughton-Treves, 1999), which is supported by our results.

This evolutionary predisposition may become reinforced by the differential socialisation of girls and boys. Relative to boys, girls are often encouraged to be emotional, maternal, and responsible, so women may more easily admit that they are afraid. This pattern of differential socialisation (and the widespread sex-role stereotypes) show a high degree of pan-cultural

similarity (Barry, Bacon, & Child, 1957; Williams & Best, 1982) and may be viewed as a self-reinforcing cultural adaptation to biological differences between the sexes (Bjerke, 1992).

4.2. Factors relevant for a positive biophilia

Our results are in line with predictions related to natural experience of nature. When comparing rural areas of similar population density with or without carnivores in their vicinity, we found that people living in areas where carnivore populations exist expressed less fear towards these animals than people in areas with no carnivores. The differences between the two groups are not large, however, amounting to 3% (wolves) and 12% (bears). According to Zimmerman, Wabakken, and Dötterer (2001), both fear and other aspects of negative attitudes towards large carnivores will be reduced with exposure to them; these authors claim that people tend to be less afraid and have more positive attitudes towards carnivores the longer carnivores have been present in the area, which is in accordance with our findings and is in support of the biophilia hypothesis.

According to the biophilia hypothesis, we would furthermore expect that people performing outdoor activities like small game hunting, mountain hiking, or picking of berries would show less fear of carnivores because their general knowledge of, and experience with, nature should reduce their fears and phobias. Generally, our data do support these predictions, although not for all outdoor activities as, for example, the interest in picking berries/mushrooms, which is a typical female activity (Løge Hagen & Løge Hagen, 1997). However, a selection effect cannot be excluded, because people that are anxious about wild animals probably would practise outdoor activities like hunting less often than those who do not fear wild animals.

According to the biophilia theory, first-hand knowledge about a threat should reduce the fear of it (Diamond, 1993). Living near carnivores, taking part in outdoor activities, and general education are therefore factors increasing knowledge about animal threats. Knowledge about the relevant general biology and behaviour of the animals, their danger towards people, and first-hand experience with them in the wild are factors likely to reduce fear of these animals. Consequently, we would expect that people living in areas where carnivores exist should show less fear of these animals than people living farther away, because of their direct knowledge and experience of such animals, even though these people in general show more negative attitudes towards these animals because of the animals' direct economic impacts (Bjerke & Kaltenborn, 1999; Kaltenborn, Bjerke, & Vittersø, 1999). Evolutionary thinking might therefore be a useful tool to analyse self-reported fear patterns in humans (Marks & Nesse, 1994).

4.3. General discussion and conclusion

We have shown that many factors may affect people's self-reported fear of wild carnivores in Norway. Several studies have shown that females express a higher level of fear to animals than do males (Arrindell, 2000; Costello, 1982; Kellert & Berry, 1987; Kirkpatrick, 1984), but females also value wild animals more as objects of affection and express more concern regarding the exploitation of wildlife (Kellert & Berry, 1987). Different fears of wild animals between men and women may be explained by different sex-roles in our evolutionary past, women being more

attached to the vicinity of the camps while men were hunters, and the fact that the consequences of an attack on women are more likely to be fatal. Animal phobia is greater when people have lost contact with the animals in question (Diamond, 1993). Interest in outdoor activities such as hunting and mountain hiking is also an important predictor of animal fears.

In Norway, the conflict between humans and carnivores is greatest in rural areas. Farmers grow up with livestock production and face the trauma of depredation first-hand when they have large carnivores in their vicinity. Thus, the elderly people, and rural inhabitants in general, often express negative attitudes toward large carnivores, relative to younger and urban people (Bjerke, Ødegårdstuen, & Kaltenborn, 1998; Bjerke, Reitan, & Kellert, 1998; Kellert, 1985, 1991). Conflicting economic interests are further implicated in the findings that the personal consequences for future sheep farming if depredation continues predict attitudes toward large carnivores: The stronger the attachment that farmers show to their sheep, the more negative are their attitudes toward large carnivores (Vittersø, Kaltenborn, & Bjerke, 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 or negative attitudes of these animals. Quite often, however, such information is received with great scepticism.

Wisconsin (USA) has had a remarkably similar history of wolf recovery over the last three decades to that in Norway. There, it was decided in the late 1980s to involve the local people in the wolf recovery project, 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 less conflict than in Norway (Druckenmiller, Miller, Meyer, & Solberg, 1999). In the present paper, we have shown that education and experience are important factors in reducing fear of carnivores. Future management regimes should therefore make use of the insight from this kind of research when they develop management strategies for recovering carnivore populations. The emphasis should both be on providing education and on getting people out into carnivore habitat to acquire benign or positive experiences.

Lastly, we emphasise that our data are based upon people's *self-reported* fears of large carnivores. Fear has at least three components: (1) the experience of fear (including both emotional and cognitive components); (2) physiological reactions; and (3) behaviour (avoidance, defence). These three components need not manifest themselves or change in synchrony: A person may express fear without reacting physiologically or reacting behaviourally, and one may deny being fearful, but still react physiologically (Marks, 1987). Thus, our analyses do not allow generalisation from self-reported fear to the additional two components of the fear complex without further investigations.

Acknowledgments

This project received financial support from the Norwegian Research Council and the Norwegian Ministry of the Environment. We are indebted to two anonymous reviewers for comments, improving a previous draft of the paper, and to Ketil Skogen for cooperation in the administration of the survey.

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