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Review

# Targeting human fear of large carnivores — Many ideas but few known effects

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ABSTRACT

This paper reviews the peer-reviewed scientific literature on interventions aimed to reduce human fear of large carnivores in human-large carnivore conflicts. Based on psychological theories, a wide definition of fear was adopted, including fear as an emotion, as a perception and as an attitude. Four major categories of interventions were identified: information and education, exposure to animal and habitat, collaboration and participation, and financial incentives. Each of these categories may have a potential to reduce fear responses. The scientific literature on the effect of interventions addressing human fear of large carnivores is scarce and partly contradictory, which makes it difficult for wildlife managers to rely on current research when designing appropriate interventions.



**Contents**



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## 1. Introduction

Large-carnivore populations, such as brown bear (*Ursus arctos*), wolf (*Canis lupus*), lynx (*Lynx lynx*) and wolverine (*Gulo gulo*), have increased in recent decades in Scandinavia (Chapron et al., 2014). This has intensified the debate about the presence of the large carnivores, and also about large-carnivore policy and management (Sandström et al., 2014). To some people, the presence of large carnivores may be associated with positive feelings such as interest and joy (Jacobs et al., 2014) while, for others, the presence of large carnivores evokes negative feelings such as disgust, is considered stressful (Manfredo, 2008; Johansson and Karlsson, 2011; Jacobs et al., 2014), and generates concern about perceived safety (Ericsson et al., 2010). However, people differ in terms of the extent to which they report fear of attacks on humans, pets or livestock, and the expression of fear varies in strength between people as well as between situations (Frank et al., 2015). Despite individual differences, fear reactions always reduce the capacity to varying extents to perform tasks not directly related to handling the threat (Flykt and Bjärtå, 2008). In this sense, for people who report that they fear large carnivores, the presence of these animals in their vicinity constitutes an environmental stressor that may affect quality of life (Moser, 2009) and well-being (WHO, 2014).

There is a range of potential management measures aimed at reducing the number of interactions between humans and large carnivores, such as fencing livestock, removing attractants, and hunting (Shivik, 2014). The acceptability of such measures, in particular lethal management, is partly associated by human emotions, including feelings of fear (Jacobs et al., 2014; Lute et al., 2014; Pohja-Mykrä and Kurki, 2014). However, evaluations of the effectiveness of these management measures rarely address the social or human aspects, such as the potential to reduce individual feelings fear (Treves et al., 2009; Maheshwari et al., 2014; Frank et al., 2015). In the literature, interventions are frequently proposed for addressing negative human responses to large carnivores, but little is known about the actual potential to reduce people's fear (Gore et al., 2006; Gusset et al., 2008). In this paper we review the scientific literature on interventions put forward to reduce human fear of large carnivores, with the objective of summarising the current state of knowledge. We define interventions as any action to mitigate human-large carnivore conflict that may be initiated or used by an individual person, an organisation or an authority. In this context we consider conflicts as any undesired interaction, direct or indirect, between human and large carnivore. The specific aims are to identify the interventions proposed and evaluated, and to describe the potential of these interventions to reduce human fear responses.

### 1.1. Central concepts: emotion, perception and attitude

In the literature on wildlife management, human fear of animals is inconsistently defined, both theoretically and operationalised, so in this review we have chosen to apply a broad and inclusive view of the concept of fear as outlined below.

*Fear as an emotion towards large carnivores* (e.g. Jacobs et al., 2012a; Johansson et al., 2012; Flykt et al., 2013). Three components of emotions are commonly accepted by most psychologists, namely the subjective experience, physiological reactions, and behavioural expression (Lang, 1984). Some psychologists also include other components of emotion, such as appraisal (Scherer, 2001; Kappas, 2006) and action readiness/tendencies (Frijda et al., 1989; Flykt, 2006). In studies involving large carnivores, fear is most commonly captured by self-reports as either a general affective experience, often in the form of negative valence, or as a discrete emotion of fear (Jacobs et al., 2012b).

Fear of animals that is disproportionate and incapacitating is defined as 'specific phobia'. To fulfil the criteria for the Diagnostic and Statistical Manual of Mental Disorders 4th edition (DSM-IV) diagnosis 'Specific phobia', there should be regular strong fear reactions to a specific stimulus category which is incapacitating for daily life (American Psychiatric Association, 1994). Previous research suggests that fear responses towards large carnivores are commonly not so strong and that the term 'phobia' should not regularly be used for people having fear responses towards large carnivores (Johansson et al., 2012; Flykt et al., 2013; Frank et al., 2015). In this review we have excluded interventions developed to address fear of or phobia regarding snakes, spiders, and birds, but have been open towards interventions that address dogs and other animal species (real or imaginary) that are more similar to large carnivores.

*Fear as component in the perception of or attitude towards large carnivores* (e.g. Gore et al., 2009; Thornton and Quinn; 2009; Zajac et al., 2012). Perception of environmental features can be described as a person's gathering of information from the surroundings by his/her senses (Ittelson et al., 1974; Gifford, 1997). In the wildlife management literature perception of a large carnivore species is defined in several ways: as a general or global concept, encompassing people's relation to large carnivores (Goldman et al., 2010; Lescureux et al., 2011) or, more specifically, to denote a risk perception related to the perceived consequences of an interaction with large carnivores on human health, safety, property, or economy (Gore et al., 2009). The latter concept has a more specific theoretical basis in risk psychology, and emotions play a role in risk perception because fear influences how people perceive a certain risk (Slovic and Peters, 2006). Operationalisations of fear in studies on risk perception of wildlife usually include self-reports on fear (e.g. Zajac et al., 2012).

In social psychology, attitude is defined as a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour (Eagly and Chaiken, 1993). This entity could be a person, object, or action, and the attitude could be explicit, formed from deliberate thought and processing, or implicit, formed more automatically and not necessarily consciously. In wildlife research the focus so far has been on explicit attitudes towards various species, captured by self-reports (Decker et al., 2012). Cognitive, affective, and behavioural processes are involved in the formation of attitudes (Eagly and Chaiken, 1993). This has been captured in self-report measures of general attitudes towards wildlife species (e.g. Lohr et al., 1996; Ericsson and Heberlein, 2003; Espinosa and Jacobson, 2012) and in some (e.g. Sakurai and Jacobson, 2011; Sakurai et al., 2013; Treves et al., 2013), but not all, studies departing from major attitude theories aiming to predict behaviour such as Theory of Reasoned Action or Theory of Planned Behavior (Ajzen, 1991; St John et al., 2010).

## 2. Method

### 2.1. The search protocol

The purpose of the search was to identify possible effects of interventions (any action to mitigate human-carnivore conflict) on human (any individual who may be exposed to large carnivores) fear response (self-reported, physiological or behavioural), and in relation to large carnivores (any species of large carnivore that attack or threaten humans).

The review process was defined by a literature search protocol developed by an interdisciplinary research group, including psychologists and biologists. The protocol stated that the scope of the literature review was a) peer-reviewed scientific papers that could be retrieved from internationally available electronic databases, b) in English language, c) that suggest and/or evaluate interventions aimed at reducing human fear of large carnivores either directly, assessing human fear responses, or indirectly, assessing human fear responses as part of the broader concepts of emotion, perception or attitude (Littell et al., 2011).

The research group also broadly defined the search terms in four groups to facilitate the development of a Boolean search string — 1) carnivore (e.g. carnivor*, wolf), 2) human (e.g. people, hunter), 3) fear response (e.g. emotion, fear, perception, attitude), and 4) intervention (e.g. management, information) (Table 1).

**Table 1**
Search terms and Boolean search strings employed.

| Large carnivore | Fear response | Intervention for human response | Human |
|---|---|---|---|
| **Included** | | | |
| Carnivor* | Emotion[1] | Intervention | Human |
| Predator | Fear[1] | Mitigation | People |
| Wolf (*Canis lupus*) | Perception[2] | Action | Person |
| Brown bear (*Ursus arctos*) | Attitude[2] | Information | Hunter |
| Eurasian lynx (*Lynx lynx*) | | Management | Farmer |
| Wolverine (*Gulo gulo*) | | Participation | Local |
| | | Coexistence | Community |
| | | Interaction | Shepherd |
| | | Education | Resident |
| | | Legislation | Native |
| | | | Stakeholder |

**Final Boolean search string [template]**
[1](human OR people OR person OR hunter OR farmer OR local OR community OR shepherd OR resident OR native OR stakeholder) AND (carnivor* OR predator OR wolf OR "canis lupus" OR "brown bear" OR "ursus arctos" OR "eurasian lynx" OR "lynx" OR wolverine OR "gulo gulo") AND (fear OR emotion) AND (intervention OR mitigation OR management OR interaction OR action OR information OR participation OR coexistence OR education OR legislation)
[2](human OR people OR person OR hunter OR farmer OR local OR community OR shepherd OR resident OR native OR stakeholder) AND (carnivor* OR predator OR wolf OR "canis lupus" OR "brown bear" OR "ursus arctos" OR "eurasian lynx" OR "lynx" OR wolverine OR "gulo gulo") AND (perception OR attitude) AND (intervention OR mitigation OR management OR interaction OR action OR information OR participation OR coexistence OR education OR legislation)

### 2.2. The search process

Preliminary scope searches were run by combining the search terms in different ways, defining a Boolean search string. The final search string was used in the comprehensive literature search up to December 2014 using the four electronic databases Web of Science (ISI), Scopus, EBSCO (PsycInfo and SocINDEX with Full Text) (Booth et al., 2012) (see Table 1). The search resulted in 230 relevant hits.

The abstracts of the identified papers were read by two researchers. Articles that did not mention an intervention were excluded at this stage. Articles not written in English were also excluded. Full-text versions of the remaining articles were retrieved and read. Eighteen additional articles were identified in the reference lists during reading; these were retrieved and assessed for eligibility by full-text reading. At this stage, articles only assessing human perceptions of general risks posed by wildlife, articles dealing with general attitudes without including a fear or emotion component (e.g. "general opinion of presence of bears in Norway"), and articles suggesting interventions targeting emotions in relation to herbivores, were also excluded. This resulted in a final set of 37 eligible articles subject for further thematic analysis.

## 3. Results

### 3.1. Articles included in the review

The 37 articles, dated from 2001 to 2014, include two literature reviews and 35 articles published in peer-reviewed international scientific journals, primarily within the fields of psychology, conservation, and human dimensions of wildlife. The majority of studies are based on research in Europe ($N = 16$), and North America ($N = 12$), while others are based on research in Africa ($N = 5$), Asia ($N = 3$) and South America ($N = 2$); the study by Jacobs et al., 2014 included empirical data from both Europe and North America (Table 2).

Two major groups of articles can be identified. The first group comprises articles that describe fear as a factor in human-large carnivore interactions and propose, but do not evaluate, interventions ($N = 26$). The second group comprises studies that evaluate interventions introduced to reduce fear of large carnivores (or in some cases other animals) ($N = 11$).

### 3.2. Group 1: studies that propose interventions

The articles in Group 1 propose interventions based on descriptions of human-large carnivore interactions. The articles can serve to identify relevant interventions, but little can be concluded regarding effects of the interventions. The studies in group 1 have a clear management perspective, i.e. that fear of large carnivores (or other animals) should be addressed primarily to overcome conflicts between people and large carnivores. The empirical studies are largely based on cross-sectional research designs and correlational analyses in real-world contexts.

The articles can be further divided into two sub-groups: those that explicitly focus on the concept of fear and interventions proposed to reduce fear ($N = 7$) (Group 1A, Table 2); and articles that address fear indirectly as a component of a general perception, risk perception or attitude and, in some cases, also behaviour, towards large carnivores, and interventions proposed to address negative perceptions or attitudes towards large carnivores ($N = 19$) (Group 1B, Table 2).

#### 3.2.1. Interventions proposed to reduce fear (Group 1A)

These studies explicitly assess the public's self-reported fear of large carnivores (brown bears, wolves, lynx and wolverines), mostly in a Scandinavian context. The studies analyse possible antecedents of fear, including socio-demographics, knowledge and personal experience of large carnivores, or of living in areas with presence of large carnivores (Zimmermann et al., 2001; Røskaft et al., 2003; Majic et al., 2011). They analyse perceived physical conditions (Prokop and Fancovicová, 2010) and psychological variables, e.g. appraisal of a potential encounter with the species in terms of the perceived danger, unpredictability of the animal's behaviour and the uncontrollability of the personal reaction (see the Cognitive Vulnerability Model, Armfield, 2006). Others consider social trust in authorities (Cvetkovich and Winter, 2003; Johansson and Karlsson, 2011; Johansson et al., 2012).

Based on the variables explaining variance in self-reported fear, these studies suggest that education (through information campaigns) and experience of the animal species (through exposure activities) would reduce fear of large carnivores among the public (Røskaft et al., 2003; Prokop and Fancovicová, 2010; Johansson and Karlsson, 2011). The study by Prokop et al. (2011) shows that school children who more frequently watched natural history films and walked in nature were less fearful of wolves. These researchers also propose educational activities, including nature visits, for children. Outreach projects involving public and local authorities in an effort to increase social trust is proposed as a useful tool in reducing people's fear of wolves and bears (Majic et al., 2011; Johansson et al., 2012). Information and exposure combined with local participation in livestock loss prevention actions and compensation schemes have also been suggested (Zimmerman et al., 2001).

**Table 2**
List of articles included in the review presented in chronological order of publication year. Articles in bold have evaluated the intervention/s discussed.

| Year | Author/s | Title | Journal | Intervention | Group |
|---|---|---|---|---|---|
| 2001 | **Field et al.** | ***Who's afraid of the big bad wolf: a prospective paradigm to test Rachman's indirect pathways in children.*** | **Behaviour Research and Therapy** | **Information about animal**<br>**Modelling of behaviour** | **2A** |
| 2001 | **Hoffman & Odendaal** | ***The effect of behavioral therapy on dog phobia response patterns*** | **Anthrozoös** | **Behavioural therapy, including animal exposure**<br>**Modelling of behaviour** | **2A** |
| 2001 | Zimmermann et al. *review* | *Human-carnivore interactions in Norway: How does the re-appearance of large carnivore affect people's attitudes and levels of fear?* | Forest, Snow, Landscape Research | Information campaign<br>Exposure via presence of animal in vicinities<br>Local participation in monitoring<br>Livestock loss prevention<br>Financial compensation | 1A |
| 2003 | Conforti & de Azevedo | *Local perceptions of jaguars (Panthera onca) and pumas (Puma concolor) in the Iguaçu National Park area, south Brazil.* | Biological Conservation | Long-term education for children<br>Local participation and economic profit via ecotourism<br>Participation in planning and implementation<br>Financial compensations for prevention of predation | 1B |
| 2003 | **Hoffman & Human** | ***Experiences, characteristics and treatment of women suffering from dog phobia.*** | **Anthrozoös** | **Behavioural therapy, including animal exposure**<br>**Modelling of appropriate behaviour** | **2A** |
| 2003 | **Muris et al.** | ***Fear of the beast: a prospective study on the effects of negative information on childhood fear*** | **Behaviour Research and Therapy** | **Information about animal**<br>**Animal exposure** | **2A** |
| 2003 | Røskaft et al. | *Patterns of self-reported fear towards large carnivores among the Norwegian public* | Evolution and Human Behavior | Education<br>Exposure via close contact with carnivore habitat | 1A |
| 2007 | Bisi et al. | *Human dimensions of wolf (Canis lupus) conflicts in Finland* | European Journal of Wildlife Research | Information<br>Power to local authorities & NGO's<br>Improvement of compensation system<br>Damage prevention actions<br>Hunting | 1B |
| 2007 | Røskaft et al. | *Human attitudes towards large carnivores in Norway* | Wildlife Biology | Education on benefits of having large carnivore nearby (relevance, number and distribution and prevention to loss). | 1B |
| 2008 | **Dunn et. al** | ***Safety education in bear country: Are people getting the message?*** | **Ursus** | **Information by brochures, posters adhesive signs with messages about how to be safe around animal.** | **2B** |
| 2008 | **Gore et al** | ***Evaluating a conservation investment designed to reduce human-wildlife conflict*** | **Conservation Letters** | **Information**<br>**– Peripheral communication material: posters, magnets, billboard information, lawn signs**<br>**– Centrally oriented communication material magazine, article, brochure** | **2B** |
| 2008 | **Gusset et al.** | ***Conflicting human interests over the re-introduction of endangered wild dogs in South Africa*** | **Biodiversity Conservation** | **Education**<br>**Co-management**<br>**Financial incentive schemes** | **2B** |
| 2009 | Thornton & Quinn | *Coexisting with cougars: public perceptions, attitudes and awareness of cougars on the urban-rural fringe of Calgary, Alberta, Canada* | Human Dimensions of Wildlife | Proactive education<br>Compensation programmes | 1B |
| 2010 | Goldman et al. | *Maintaining complex relations with large cats: Maasai and lions in Kenya and Tanzania* | Human Dimensions of Wildlife | Collaborative interactions between conservationists and community | 1B |
| 2010 | Prokop & Fancovicová | *Perceived body condition is associated with fear of a large carnivore predator in humans* | Annales Zoologici Fennici | Information about animal's role in ecosystem<br>Exposure by visits to habitat | 1A |
| 2011 | **Baruch-Mordo et al.** | ***The Carrot or the Stick? Evaluation of education and enforcement as management tools for human-wildlife conflicts.*** | **PLOSone** | **Education**<br>**Signs on site + website link**<br>**Personal home visits + educational material**<br>**Law enforcement**<br>**Daily patrolling**<br>**Patrolling with notice application** | **2B** |
| 2011 | Johansson & Karlsson | *Subjective experience of fear and the cognitive interpretation of large carnivores* | Human Dimensions of Wildlife | Communication based on awareness of the cognitive interpretation of the animal<br>Exposure to animal to enable people to learn more about own reactions. | 1A |
| 2011 | Lescureux et al. | *Fear of the unknown: local knowledge and perceptions of the Eurasian lynx Lynx lynx in western Macedonia* | Fauna & Flora International, Oryx | Education<br>Local involvement in cooperative research programme | 1B |
| 2011 | Majic et al. | *Dynamics of public attitudes toward bears and the role of bear hunting in Croatia.* | Biological Conservation | Public participation in management, including hunting and decision-making | 1A |
| 2011 | **Meguro & Inoue** | ***Conservation goals betrayed by the uses of wildlife benefits in community-based conservation: the case of Kimana Sanctuary in Southern Kenya.*** | **Human Dimensions of Wildlife** | **Community-based conservation programme** | **2B** |
| 2011 | Prokop et al. | *Good predators in bad stories: cross-cultural comparison of children's attitudes towards wolves* | Journal of Baltic Science Education | Information natural history films<br>Exposure by nature walks in habitat | 1A |
| 2011 | Sakurai & Jacobson *review* | *Public perceptions of bears and management interventions in Japan* | Human–Wildlife Interactions | Education and outreach programmes Compensation programmes | 1B |
| 2012 | **Espinosa & Jacobson** | ***Human-wildlife conflict and environmental education: evaluating a community program to protect the Andean Bear in Ecuador*** | **Journal of Environmental Education** | **Five-year educational and collaborative programme**<br>**Workshops**<br>**Radio programmes**<br>**Newsletter**<br>**Teacher training**<br>**Training of community members as para-biologists** | **2B** |
| 2012 | Glikman et al. | *Residents' support for wolf and bear conservation: the moderating influence of knowledge* | European Journal of Wildlife Research | Education campaigns<br>Participation | 1B |

**Table 2** (*continued*)

| Year | Author/s | Title | Journal | Intervention | Group |
|---|---|---|---|---|---|
| 2012 | Johansson et al. | *Factors governing human fear of brown bear and wolf* | Human Dimensions of Wildlife | Trust building actions authorities-locals<br>Exposure under controlled conditions and guidance. | 1A |
| 2012 | Zajac et al. | *Learning to live with black bears: A psychological model of acceptance* | Journal of Wildlife Management | Information focusing on building trust Increasing personal control over human-carnivore conflict | 1B |
| 2013 | Draheim et al. | *Attitudes of college undergraduates towards coyotes (Canis latrans) in an urban landscape: management and public outreach implications* | Animals | Outreach programme and education focusing on what to do when encountering the animal | 1B |
| 2013 | Hermann & Menzel | *Predicting the intention to support the return of wolves: a quantitative study with teenagers* | Journal of Environmental Psychology | Education that includes affective views in socio-scientific issues | 1B |
| 2013 | Sakurai et al. | *Public perceptions of risk and government performance regarding bear management in Japan* | Ursus | Education<br>Participation in reducing conflicts to increase perceived control, | 1B |
| 2013 | **Slagle et al.** | ***Building tolerance for bears: A communications experiment*** | **Journal of Wildlife Management** | **Information and outreach material about benefits of animal and on how to avoid conflict** | **2B** |
| 2013 | Sponarski et al. | *Heterogeneity among rural resident attitudes towards wolves* | Human Dimensions of Wildlife | Education dispelling myths about the animal and clarify policy | 1B |
| 2013 | Treves et al. | *Longitudinal analysis of attitudes towards wolves* | Conservation Biology | Regulated hunting | 1B |
| 2014 | Almeida et al. | *Attitudes towards animals: A case study of Portuguese children* | Anthrozoös | Direct contact with animals through outdoor activities, in educational centres or in classroom | 1B |
| 2014 | Bhattacharjee & Parthasarathy | *Coexisting with large carnivores: A case study from western Duars, India* | Human Dimensions of Wildlife | Awareness programme on understanding human-animal conflict<br>Compensation<br>Translocation<br>Habitat restoration<br>Livestock protection. | 1B |
| 2014 | Jacobs et al. | *More than fear: role of emotions in acceptability of lethal control of wolves* | European Journal of Wildlife Research | Consideration of emotions in choice of management strategy | 1B |
| 2014 | Pohja-Mykrä & Kurki | *Strong community support for illegal killing challenges wolf management* | European Journal of Wildlife Research | Experience<br>Information<br>Education<br>Trust building | 1B |
| 2014 | Lute et al. | *Identity-driven differences in stakeholder concerns about hunting wolves* | PLOSone | Mitigation of perceived risk by strategic risk communication | 1B |

*3.2.2. Interventions proposed to reduce negative perceptions or attitudes (Group 1B)*

The interventions proposed in Group 1B may apply to changing perceptions, risk perceptions, attitudes, or even behaviour, rather than specifically reducing fear. Most of the studies concern local people in areas with presence of the investigated species. Stakeholder groups are commonly identified and contrasted (e.g. Bisi et al., 2007; Gusset et al., 2008); two studies involve students (Drahei et al. 2013; Hermann and Menzel, 2013) and one study involves children (Almedia et al., 2014). Several different species are considered but approximately half of the studies consider human interaction with wolves and/or bears, in different parts of the world (Norway: Røskaft et al., 2003, Finland: Bisi et al., 2007, Pohja-Mykrä and Kurki, 2014, Japan: Sakurai and Jacobson, 2011, US: Zajac et al., 2012, Germany: Hermann and Menzel, 2013, Brazil: Sakurai et al., 2013, US: Treves et al., 2013, Lute et al., 2014, Italy: Glikman et al., 2012, Netherlands + Canada, Jacobs et al., 2014).

Among the studies that focus on a general perception of large carnivores, a few apply anthropological or other qualitative approaches, and identify danger and fear as one aspect reflected in local peoples' perception of, for example, lions and lynx (Goldman et al., 2010; Lescureux et al., 2011). Some studies use quantitative approaches and consider the fear, threat or danger associated with the animal as a risk perception (Thornton and Quinn, 2009), also integrating fear-related variables in models of wildlife acceptance (Zajac et al., 2012; Glikman et al., 2012).

Other studies have primarily aimed at understanding public attitudes towards large carnivores. Here fear has been conceptualised as the emotional or evaluative component of an attitude referring to Ajzen and Fishbein's (1980, 1991) Theory of Reasoned Action and Theory of Planned Behaviour (Sakurai and Jacobson, 2011; Sakurai et al., 2013; Treves et al., 2013). Fear has also been integrated as an additional part of Protection Motivation Theory (Gardner and Stern, 1996), aiming to understand people's pro-environmental behaviour (Hermann and Menzel, 2013).

Killing large carnivores is controversial (Treves et al., 2009) and in most countries and situations lethal control is considered to be the last resort, when all else fails. Some studies consider emotions including fear specifically in relation to attitudes towards lethal management interventions (Lute et al., 2014; Pohja-Mykrä and Kurki, 2014; Jacobs et al., 2014). However, fear as part of a perception or an attitude has sometimes been introduced without any clear reference to a social science theoretical basis (Bisi et al., 2007; Draheim et al., 2013, Sponarski et al., 2013; Bhattacharjee and Parthasarathy, 2014).

Educational activities are by far the most commonly proposed interventions. Such activities include campaigns and outreach projects providing information and training to increase people's knowledge of the species' biology, behaviour, habitat use and potential benefits, as well as behavioural strategies for humans to avoid conflict. A few studies propose education as a universal intervention to prevent human-large carnivore conflict, thereby reducing perceived risk and feelings of fear (Røskaft et al., 2007; Glikman et al., 2012; Zajac et al., 2012; Almedia et al., 2014). Lute et al. (2014) stress the importance of delivering identity-specific as well as strategic risk communication to decrease fear. It has also been proposed that fear should not be independently addressed; instead, the full range of emotions must be considered (Jacobs et al., 2014; Pohja-Mykrä and Kurki, 2014). Røskaft et al. (2007) suggest that education, including information about benefits of carnivores and loss prevention, may reduce fear, but also argue that education should be combined with other interventions.

Some authors propose collaboration between authorities and local residents (e.g. villagers, hunters or farmers) and local participation in management as a means to developing trust and preventing conflict (Bisi et al., 2007; Goldman et al., 2010; Lescureux et al., 2011; Sakurai

et al., 2013; Draheim et al., 2013; Bhattacharjee and Parthasarathy, 2014; Pohja-Mykrä and Kurki, 2014). In a study of a Maasai community in Kenya, Goldman et al. (2010) suggest collaborative interactions, based on Maasai narratives about the problem, between community and conservationists in participatory projects to solve human-lion conflicts.

Financial incentives or loss compensation are also proposed as measures complementing education and collaboration in promoting favourable attitudes or acceptance of large carnivores (Bisi et al., 2007; Thornton and Quinn, 2009; Sakurai and Jacobson, 2011). However, financial schemes are also criticised for being ineffective (Røskaft et al., 2007), since negative perceptions of wild predators may have other reasons than purely financial (Goldman et al., 2010; Lescureux et al., 2011). A recent study in India emphasises the use of financial compensation as a short-term measure, in combination with livestock protection and education, to increase awareness, as tools to reduce human-leopard conflicts (Bhattacharjee and Parthasarathy, 2014).

### 3.3. Group 2: studies that evaluate interventions

The second group of articles comprises studies that evaluate interventions to directly or indirectly address human fear. These articles can also be further divided into two sub-groups: studies that evaluate the impact of an intervention on fear ($N = 4$) (Group 2A, Table 2) and studies that evaluate the impact of an intervention on perceptions, risk perception, attitude and, in some cases, also behaviour towards large carnivores ($N = 7$) (Group 2B, Table 2). These two groups largely differ in their point of departure, theoretical approach, research design, and species investigated.

#### 3.3.1. The effect of interventions on fear (Group 2A)

We found no articles specifically evaluating the effect of interventions directly addressing human fear of large carnivores. The articles in Group 2A depart from a therapeutic perspective and aim to understand and change human fear responses towards dogs or hypothetical creatures. The studies take a behavioural learning approach, referring to authors such as Rachman (1977), who distinguishes between three different etiological pathways for phobias: i) having been attacked or directly exposed to an animal (direct conditioning), ii) having observed another person being attacked/harmed (vicarious acquisition), and/or iii) having been informed by a credible source that specific animals are dangerous in some respect (i.e. instruction). These studies use experimental research designs in laboratory environments (Field et al., 2001; Hoffman and Odendaal, 2001; Hoffmann and Human, 2003) or school settings (Muris et al., 2003). Field et al. (2001) find that, among children, positive and negative information about novel stimuli (a monster doll) changes their fear beliefs about the doll. Positive information has little effect on self-reported fear beliefs — the fairly neutral initial fear beliefs are only slightly lowered after positive information, whereas negative information has a substantial effect in increasing fear beliefs.

Direct verbal information from an adult is more efficient in changing fear beliefs than observational learning, i.e. vicarious acquisition (watching a film of a woman interacting positively or negatively with the doll). Similarly, Muris et al. (2003) assess children's fear of an unknown (doglike) imaginary creature before, immediately after, and one week after positive or negative information was presented, and find that negative information increases self-reported fear of the beast, as well as fear of dogs and predators, while positive information reduces the fear, immediately and one week after.

Hoffman and Odendaal (2001) evaluate systematic desensitisation (exposure to sequence of phobia stimulus, e.g. dogs) and instructional learning (pictures of fighter dogs and explanation on how to act in an encounter) among women with dog phobia. The evaluation includes physiological, observational and self-report measures of fear. The participants in the treatment group can walk closer to dogs and report less anxiety after the intervention, whereas no effect can be identified for the physiological measure. No significant changes are reported in the control group. A follow-up eight months later indicates a significant improvement in interactions with dogs for 75% of the participants in the treatment group (Hoffman and Human, 2003).

#### 3.3.2. The effect of interventions on perception or attitude (Group 2B)

In this group all articles have a management perspective and show a high diversity in theoretical and conceptual approaches, but all the interventions are evaluated in field settings. Most studies are carried out in the US, with a focus on black bears (Dunn et al., 2008; Gore et al., 2008; Gusset et al., 2008; Baruch-Mordo et al., 2011; Slagle et al., 2013). The exceptions are Espinosa and Jacobson (2012), who evaluate interventions in relation to Andean bear in Ecuador, and the study by Meguro and Inoue (2011) that concerns a wildlife programme in Kenya.

In a quasi-experimental study based on the Elaboration Likelihood Model (Petty and Cacioppo, 1981), Gore et al. (2008) find that various types of written information about behaviour that can reduce human-black bear interactions (e.g. risk-reducing behaviour) may change risk perceptions via peripheral processing of information, but are not likely to change behaviour. Dunn et al. (2008) refer to the Theory of Planned Behaviour (Ajzen, 1980) and find that written information (brochures, posters, and signs) about bear safety, including black bear attractants and appropriate behaviour when encountering a black bear, help to increase knowledge, i.e. changed beliefs. In a study of the effects of different information packages on black bears in an area with a recently established bear population in Ohio (USA), participants who were informed by a written online message on how to avoid bear problems (for example, by bringing birdfeeders or waste bins inside during the night) report a lower acceptance for bears compared to persons who were informed on both how to avoid bear problems and the potential benefits of having bears (Slagle et al., 2013).

Baruch-Mordo et al. (2011) evaluate the BeAware campaign, which combines written educational material (signs at waste skips informing about bears feeding from waste), personal contact with verbal information about how to reduce black bear attractants and conflict, and proactive enforcement (i.e. daily patrolling and application of further measures in areas with waste skips). The educational part shows no significant effect despite the presence of factual, emotional, moral and non-verbal elements in the information, but the proactive enforcement can change people's preventive behaviours (Baruch-Mordo et al., 2011). Espinosa and Jacobson (2012) evaluate a long-term educational programme aimed at increasing knowledge, changing attitudes and strengthening behavioural intentions towards conserving the Andean bear (*Tremarctos ornatus*) habitat. Face-to-face surveys and group discussions suggest that the local people's knowledge is somewhat increased and behavioural intention becomes more positive, but attitudes towards the presence of bears become more negative.

Gusset et al. (2008) survey the effect of an educational programme on attitudes to wild dogs in South Africa. They find the programme to be successful in changing people's opinion of wild dogs, but negative attitudes increase and their perceived value for local ecotourism decreases from the end of the one-year programme to three years later. Meguro and Inoue (2011) analyse the impact of efforts of a community-based conservation project in Kenya aimed at increasing the understanding of the value of wildlife to the local ecosystem and thereby more favourable attitudes towards wildlife conservation. The evaluation suggests that awareness of the economic benefits of wildlife conservation has increased.

## 4. Discussion

This review shows that the internationally available scientific peer-reviewed literature provides many ideas for interventions to target the human dimension of human-large carnivore conflicts. However, data on the effects of such interventions on human fear are sparse. Most of the interventions suggested or evaluated by the studies in the

review included information and education; mixed interventions combined information and education with exposure to species in the wild or in a laboratory. Other interventions involved public participation, and collaboration in species management and conservation, and/or financial schemes. Although our perspective was on the individual level, focusing on fear responses to large carnivores using a very broad definition, we found only eleven studies that scientifically evaluated interventions relevant to reduce human fear of large carnivores. None of the studies specifically tested the effect of an intervention on fear of large carnivores. This result is quite surprising considering the public concern about the presence of large carnivores in their vicinity (Ericsson et al., 2010). Our search strings may not have been efficient enough, but we searched several databases, covered reference lists, and deliberately broadened the search string to include the concepts of perception and attitude.

Our results are in line with previous studies, concluding that evaluations of interventions addressing human-large carnivore interactions are scarce (Dunn et al., 2008; Sakuri and Jacobson, 2011), and that the existing studies often do not capture relevant outcome measures for human dimension factors (Gore et al., 2006). Evidence-based knowledge on human dimension factors is lacking and urgently needed (Ericsson and Heberlein, 2003; Baruch-Mordo et al., 2011). The categories of interventions identified also largely reflect those identified in a global survey of approaches to resolving human-bear conflict (Can et al., 2014). In the next section, the different types of interventions are discussed in relation to the possible effect of reducing human fear of large carnivores.

### 4.1. Information and education

Information and education is relatively easy to develop and implement, and is also the universally most frequently suggested and tested intervention to change individuals' emotions, perception or attitudes towards large carnivores (Decker et al., 2012). The experimental studies in this review suggest that verbal information may have both a positive and negative impact on children's emotions (Field et al., 2001; Muris et al., 2003). Studies on dog phobia show similar findings, i.e. providing phobic individuals with accurate information about the animal and training them how to react to the dog through direct contact reduced fear and increased coping with dog encounters (Hoffman and Odendaal, 2001; Hoffmann and Human, 2003).

In field studies, information and education about the biology and the habitat of the animal, as well as strategies to deal with and avoid conflict (e.g. remove food attractants), have also been successful in changing peoples' risk perception (Gore et al., 2008). These approaches have also increased knowledge and improved conflict avoidance behaviours (Dunn et al., 2008; Espinosa and Jacobson, 2012; Slagle et al., 2013), but the effect on attitudes seems less evident (Gusset et al., 2008; Espinosa and Jacobson, 2012). The experiment by Slagle et al. (2013) stressed the importance of providing information on benefits of black bears to increase an accepting attitude, but it is difficult to infer what the specific effect on fear responses would be. Using social identify theory, Lute et al. (2014) suggest that such strategic risk communication must also be adapted to the concerns of a particular social group.

There is a large variation in theoretical causes of fear, as well as design and distribution, context, and time frame of interventions. Several information channels are sometimes simultaneously introduced and evaluated, and information/education is often combined with other interventions. This generates many questions with regard to the set-up of the intervention.

A tentative conclusion is that information might have a potential to change fear responses, but it should be considered that information and education might decrease as well as increase fear responses, and must therefore be highly context-specific (Field et al., 2001). Verbal information about non-harmfulness of evolutionary fear-relevant animals such as snakes and spiders is not expected to have any impact on phobic responses. The reason is because this kind of processing would not be compatible with the information processing system maintaining the fear reactions (LeDoux, 1996).

One relevant question will then be whether information about non-harmfulness can be efficient in reducing fear of large carnivores with a shorter common evolutionary history with humans. Another remaining question is the extent to which the efficiency of information and education is dependent on the simultaneous introduction of exposure, i.e. personal direct experiences and role modelling of relevant behavioural strategies when exposed to large carnivores.

### 4.2. Animal and habitat exposure

Proposals for education programmes sometimes suggest the use of animal or habitat exposure to increase predictability of animal behaviour and reduce uncontrollability of human reaction during an encounter (Røskaft et al., 2003; Prokop and Fancovicová, 2010; Johansson et al., 2011; Almeida et al., 2014), but no studies were found that tested the effect of exposure to large carnivores. In an experimental study, Randler et al. (2012) showed that fear of mice, snails and wood lice decreased among school children who were exposed to these animals in class. In a similar way, Ballouard et al. (2012) showed a reduction of fear to snakes in school children after they have been handling non-venomous snakes on a field trip. Exposure is also the key to treatment of animal phobia.

Suggestion to change text: Treatment of specific phobia that has proved efficient is exposure in vivo (i.e. exposure to the actual object of fear) in combination with behaviour modelling (i.e. behaviours provided by a human role model to get a behaviour repertoire to use when confronted with the feared object, Öst, 1989; Hellström and Öst, 1995). The behaviour modelling aspect seems to be an important part, not only for the modelling itself, but also because the presence of other individuals might be a social support (Hellström and Öst, 1995). Much of this research on interventions is concerned with fear of snakes and spiders. Studies on dog phobia have shown that providing phobic individuals with accurate information about the animal and training them how to react (i.e. behaviour modelling) to the dog through direct contact reduced fear and increased coping with situations of dog encounter (Hoffman and Odendaal, 2001; Hoffmann and Human, 2003). Habitat exposure has not been sufficiently evaluated to draw any further conclusions. Further studies on exposure to large carnivores and their habitats, also testing for the combined effect with modelling of appropriate behaviour close to large carnivores, would be needed.

### 4.3. Collaboration and participation

The large-carnivore management literature mostly stresses mixed interventions combining education-information and public participation and/or financial schemes. Stimulating public participation (i.e. co-participation) is also increasingly regarded as a complement to education, specifically in relation to fear (Zimmerman et al., 2001; Johansson et al., 2012). This may be especially relevant in situations where lack of trust in managing authorities is associated with fear responses (Slovic and Peters, 2006; Johansson et al., 2012; Zajac et al., 2012; Pohja-Mykrä and Kurki, 2014).

Participation and collaboration in the Scandinavian context is primarily introduced to address conflicts between local residents and authorities or between stakeholder groups (Pohja-Myrkä and Kurki, 2014; Lundmark and Matti, 2015). In other parts of the world, educational programmes have integrated collaboration and participation (i.e. authorities/associations and public working together in management/conservation actions). For example, the programme developed to conserve an Andean bear habitat also included participatory components, recruitment and training of community members to work as para-biologists to assist in the research. Expected effects were obtained for knowledge and intention, but not attitudes (Espinosa and Jacobson, 2012). Another example is the community-based conservation project

evaluated by Meguro and Inoue (2011), which showed that people's opinions about wildlife were more positive after the project's implementation for other reasons than conservation itself, mainly economic benefits resulting from the implementation of the project.

### 4.4. Financial incentives

Financial incentives can be aimed at compensating for direct costs or overcompensating to provide benefits of large-carnivore presence (Zabel et al., 2008). In terms of human fear, the result may be a potential for exposure and desensitisation that may not otherwise have been possible. Financial incentives in this sense have the potential for an indirect effect on human fear on a large scale, temporally and spatially, but the feature of exposure under controlled conditions is lacking in reality. In the articles analysed there is a decreasing tendency to use financial schemes (e.g. compensation, incentives) as a short-term measure combined with long-term education-information (e.g. campaigns, information signs) to overcome people's fear and change negative perceptions of large carnivores.

The most recent studies have emphasised the importance of combining education with co-participation, and the few who still rely on compensation as a complementary short-term measure suggest it should be integrated with public participation in a conflict mitigation process. Interestingly, compensation and other financial schemes (e.g. incentives for species conservation) as a complement to information campaigns are used in Asia (Sakurai and Jacobson, 2011; Bhattacharjee and Parthasarathy, 2014), whereas in South America and Africa these are supplemented or replaced by collaborative actions in which public and authorities work together to mitigate conflicts (Conforti and de Azevedo, 2003; Gusset et al., 2008). A recent study on human-leopard coexistence in rural India proposed the use of financial compensation to affected areas and animal translocation as short-term measures to end the conflict, but only if combined with long-term strategies such as accurate education on preventive actions in order to increase awareness of the conflict and how to cope with it (Bhattacharjee and Parthasarathy, 2014). Zimmerman et al. (2001) proposed compensation schemes in the Scandinavian context and, in a recent review, Treves and Bruskotter (2014) concluded that financial benefits on human-large carnivore conflicts must probably be combined with social change. No evaluations with regard to the effect on fear-related variables are available.

## 5. Conclusions

There seem to be two separate research lines discussing interventions directed towards reducing human fear of large carnivores. One line is based on the human individual aspect and applies psychological perspectives. These studies use well-founded theoretical frameworks from social psychology, risk psychology, environmental psychology, emotion psychology, and analogous operationalisation of fear, making it possible to grasp the effect of the intervention. Sometimes these studies lack validity, both with regard to the setting and the animal, thereby reducing the generalisability to the context of large carnivores in the wild.

The second line has a clear management approach based on conservation or management goals for the large carnivores. These studies rely on real cases of human-large carnivore interactions and provide thorough contextual descriptions and, regardless of the suggested interventions, suggest that each is specific to the context in which it is applied, the people (e.g. villagers, farmers or hunters) and animal species involved (e.g. bears, wolves, wild dogs). However, the theoretical foundation is often limited to a brief reference to risk perception or attitude, and fear is generally not specifically addressed. Jacobs et al. (2012a) also noted that a majority of studies on human emotion towards large carnivores have gaps in the conceptualisation and operationalisation of emotion. The interventions proposed and evaluated may be well designed for the context, but it is hard to draw conclusions regarding their effect on human fear or what possible antecedent of fear could be expected to change.

The review highlights four major categories of interventions. Each may have a potential to reduce fear-related variables, but the present evidence of the effect of these interventions on fear of large carnivores is rather weak and partly contradictory. This makes it difficult for wildlife managers to rely on the present scientific findings when designing appropriate interventions to address human fear of large carnivores. Further research evaluating interventions to address human fear of large carnivores should involve design studies that use a strong theoretical approach to study ecologically valid cases (St John et al., 2010, see also for example Gore et al., 2008; Espinosa and Jacobson, 2012; Slagle et al., 2013).

Research should also integrate conceptualisations and assessments that directly focus on fear (Johansson et al., 2012; Jacobs et al., 2012a; Flykt et al., 2013), as well as the use of control or reference groups (Hoffman and Odendaal, 2001; Muris et al., 2003; Slagle et al., 2013). It would be advisable that any further large-scale interventions launched to meet the public's fear of large carnivores are combined with a thorough evaluation based on an appropriate theoretical approach and relevant outcome variables. These evaluations should preferably be part of an adaptive wildlife management scheme where managers and researchers in close cooperation design the evaluation of an intervention before it is launched, evaluate the effect and, if necessary, adjust the intervention accordingly. The outcomes of such evaluations should be considered in relation to the individual, collective and societal level (Sjölander-Lindqvist et al., 2015).

## Conflict of interests

The authors have no conflict of interests to declare.

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## References

Ajzen, I., 1991. The theory of planned behaviour. Organ. Behav. Hum. Decis. Process. 50, 179–211.
Ajzen, I., Fishbein, M., 1980. Understanding Attitudes and Predicting Social Behavior. Prentice-Hall, London, UK.
Almeida, A., Vasconcelos, C., Strecht-Ribeiro, O., 2014. Attitudes towards animals: a study of Portuguese children. Anthrozoös 27, 173–190.
American Psychiatric Association, 1994. Diagnostic and Statistical Manual of Mental Disorders. fourth ed. American Psychiatric Association, Washington, DC, USA.
Armfield, J.M., 2006. Cognitive vulnerability: a model of the etiology of fear. Clin. Psychol. Rev. 26, 746–768.
Ballouard, J.-M., Provost, G., Barre, D., Bonnet, X., 2012. Influence of a field trip on the attitude of schoolchildren toward unpopular organisms: an experience with snakes. J. Herpetol. 46, 423–428.
Baruch-Mordo, S., Breck, S.W., Eilson, K.R., Broderick, J., 2011. The carrot or the stick? Evaluation of education and enforcement as management tools for human-wildlife conflicts. PLoS One 6, e15681.
Bhattacharjee, A., Parthasarathy, N., 2014. Coexisting with large carnivores: a case study from western Duars, India. Hum. Dimens. Wildl. 18, 20–31.
Bisi, J., Kurki, S., Svensberg, M., Liukkonen, T., 2007. Human dimensions of wolf (*Canis lupus*) conflicts in Finland. Eur. J. Wildl. Res. 53, 304–314.
Booth, A., Papaioannou, D., Sutton, A., 2012. Systematic Approaches to a Successful Literature Review. Sage, London, UK.
Can, Ö.E., D'Cruze, N., Garshells, D.L., Beecham, J., Macdonald, D.W., 2014. Resolving human-bear conflict: a global survey of countries, experts, and key factors. Conserv. Lett. 7, 501–513.
Chapron, G., Kaczensky, P., Linnell, J.D.C., von Arx, M., Huber, D., Boitani, L., et al., 2014. Recovery of large carnivores in Europe's modern human-dominated landscapes. Science 346, 1517–1519.
Conforti, V.A., de Azevedo, F.C.C., 2003. Local perceptions of jaguars (*Panthera onca*) and pumas (*Puma concolor*) in the Iguaçu National Park area, south Brazil. Biol. Conserv. 111, 215–221.
Cvetkovich, G., Winter, P.L., 2003. Trust and social representations of the management of threatened and endangered species. Environ. Behav. 35, 286–307.

Decker, D.J., Riley, S.J., Siemer, W.F.E., 2012. Human Dimensions of Wildlife Management. second ed. John Hopkins University Press, Baltimore, Maryland, U.S.A.
Draheim, M.M., Patterson, K.W., Rockwood, L.L., Guagnano, G.A., Parsons, E.C.E., 2013. Attitudes of college undergraduates towards coyotes (*Canis latrans*) in an urban landscape: management and public outreach implications. Animals 3, 1–18.
Dunn, W.C., Elwell, J.H., Tunberg, G., 2008. Safety education in bear country: are people getting the message? Ursus 19, 43–52.
Eagly, A.H., Chaiken, S., 1993. The Psychology of Attitudes. Harcourt BraceFort Worth, USA.
Ericsson, G., Heberlein, T.A., 2003. Attitudes of hunters, locals, and the general public in Sweden now that the wolves are back. Biol. Conserv. 111, 149–159.
Ericsson, G., Sandström, C., Kindberg, J., Stoen, O.-G., 2010. Om svenskars rädsla för stora rovdjur, älg och vildsvin. Swedish University of Agricultural Sciences, Umeå, Sweden [In Swedish]. Report 2010:1.
Espinosa, S., Jacobson, S.K., 2012. Human-wildlife conflict and environmental education: evaluating a community program to protect the Andean bear in Ecuador. J. Environ. Educ. 43, 55–65.
Field, A.P., Argyris, N.G., Knowles, K.A., 2001. Who's afraid of the big bad wolf: a prospective paradigm to test Rachman's indirect pathways in children. Behav. Res. Ther. 39, 1259–1276.
Flykt, A., 2006. Preparedness for action: responding to the snake in the grass. Am. J. Psychol. 119, 29–44.
Flykt, A., Bjärtå, A., 2008. The time course of resource allocation in spider-fearful participants during fear reactions. Cognit. Emot. 22, 1381–1400.
Flykt, A., Johansson, M., Karlsson, J., Lindeberg, S., Lipp, O., 2013. Fear of wolf and bear. Hum. Dimens. Wildl. 18, 416–443.
Frank, J., Johansson, M., Flykt, A., 2015. Managing human fear of brown bear and wolf. Wildl. Biol. 21, 122–130.
Frijda, N.H., Kuipers, P., ter Schure, E., 1989. Relations among emotion, appraisal, and emotional action readiness. J. Pers. Soc. Psychol. 57, 212–228.
Gardner, G.T., Stern, P.C., 1996. Environmental Problems and Human Behavior. Allyn and Bacon, Boston, USA.
Gifford, R., 1997. Environmental psychology: Principles and practice. 2nd ed.Allyn & Bacon, Boston, USA.
Glikman, J.A., Vaske, J.J., Bath, A.J., Ciucci, P., Boitani, L., 2012. Residents' support for wolf and bear conservation: the moderating effect of knowledge. Eur. J. Wildl. Res. 58, 295–302.
Goldman, M.J., de Pinho, J.R., Perry, J., 2010. Maintaining complex relations with large cats: Maasai and lions in Kenya and Tanzania. Hum. Dimens. Wildl. 15, 332–346.
Gore, M., Knuth, B.A., Curtis, P.D., Shanahan, J.E., 2006. Education programs for reducing American black bear–human conflict: indicators of success? Ursus 17, 75–80.
Gore, M.L., Knuth, B.A., Scherer, C.W., Curtis, P.D., 2008. Evaluating a conservation investment designed to reduce human-wildlife conflict. Conserv. Lett. 1, 136–145.
Gore, M.L., Wilson, R.S., Siemer, W.F., Wieczorek Hudenko, H., Clarke, C.E., Hart, P.S., Muter, B., 2009. Application of risk concepts to wildlife management: special issue introduction. Hum. Dimens. Wildl. 14, 301–313.
Gusset, M., Maddock, A.H., Gunther, G.J., Szykman, M., Slotow, R., Walters, M., Somers, M.J., 2008. Conflicting human interests over the re-introduction of endangered wild dogs in South Africa. Biodivers. Conserv. 17, 83–101.
Hellström, K., Öst, L.-G., 1995. One-session therapist directed exposure vs 2 forms of manual directed self-exposure in the treatment of spider phobia. Behav. Res. Ther. 33, 959–965.
Hermann, N., Menzel, S., 2013. Predicting the intention to support the return of wolves: a quantitative study with teenagers. J. Environ. Psychol. 36, 153–161.
Hoffman, W.A., Human, L.H., 2003. Experiences, characteristics and treatment of women suffering from dog phobia. Anthrozoös 16, 28–42.
Hoffman, W.A., Odendaal, J.S.J., 2001. The effect of behavioral therapy on dog phobia response patterns. Anthrozoös 14, 29–37.
Ittelson, W.H., Prohansky, H.M., Rivlin, L.G., Winkel, G.H., 1974. An Introduction to Environmental Psychology. Holt, Rinehart and Winston Inc., USA.
Jacobs, M., Vaske, J.J., Roemer, J.M., 2012a. Toward a mental systems approach to human relationships with wildlife: the role of emotional dispositions. Hum. Dimens. Wildl. 17, 4–15.
Jacobs, M.H., Fehres, P., Campbell, M., 2012b. Measuring emotions toward wildlife: a review of generic methods and instruments. Hum. Dimens. Wildl. 17, 233–247.
Jacobs, M., Vaske, J.J., Dubois, S., Fehres, P., 2014. More than fear: role of emotions in acceptability of lethal control of wolves. Eur. J. Wildl. Res. 60, 589–598.
Johansson, M., Karlsson, J., 2011. Subjective experience of fear and the cognitive interpretation of large carnivores. Hum. Dimens. Wildl. 16, 15–29.
Johansson, M., Karlsson, J., Pedersen, E., Flykt, A., 2012. Factors governing human fear of brown bear and wolf. Hum. Dimens. Wildl. 17, 58–74.
Kappas, A., 2006. Appraisals are direct, immediate, intuitive, and unwitting and some are reflective. Cognit. Emot. 20, 952–975.
Lang, P.J., 1984. Cognition in emotion: concept and action. In: Izard, C.E., Kagan, J., Zajonc, R.B. (Eds.), Emotions, Cognition, and Behavior. Cambridge University Press, Cambridge, UK, pp. 192–226.
LeDoux, J.E., 1996. The Emotional Brain. The Mysterious Underpinnings of Emotional Life. Simon & Schuster, New York, USA.
Lescureux, N., Linnell, J.D.C., Mustafa, S., Melovski, D., Stojanov, A., Ivanov, G., Avukatov, V., von Arx, M., Britenmoser, U., 2011. Fear of the unknown: local knowledge and perceptions of the Eurasian lynx in western Macedonia. Fauna & Flora International Oryx Vol. 45, pp. 600–607.
Littell, J.H., Corcoran, J., Pillai, V., 2011. Systematic Reviews and Meta-analysis. Oxford University Press, Oxford, UK.
Lohr, C., Ballard, W.B., Bath, A., 1996. Attitudes towards gray wolf reintroduction to New Brunswick. Wildl. Soc. Bull. 24, 414–420.
Lute, M.L., Bump, A., Gore, M.L., 2014. Identity-driven differences in stakeholder concerns about hunting wolves. PLoS One 9, e114460.
Lundmark, C., Matti, S., 2015. Exploring the prospects for deliberative practices as a conflict-reducing and legitimacy-enhancing tool: the case of Swedish carnivore management. Wildl. Biol. 21, 147–156.
Maheshwari, A., Midha, N., Cherukupalli, A., 2014. Participatory rural appraisal and compensation intervention: challenges and protocols while managing large carnivore–human conflict. Hum. Dimens. Wildl. 19, 62–71.
Majic, A., de Bodonia, A.M.T., Huber, D., Bunnefeld, N., 2011. Dynamics of public attitudes toward bears and the role of bear hunting in Croatia. Biol. Conserv. 144, 3018–3027.
Manfredo, M.J., 2008. Who Cares About Wildlife? Social Science Concepts for Exploring Human-Wildlife Relationships and Conservation Issues. Springer, New York, USA.
Meguro, T., Inoue, M., 2011. Conservation goals betrayed by the uses of wildlife benefits in community-based conservation: the case of Kimana Sanctuary in Southern Kenya. Hum. Dimens. Wildl. 16, 30–44.
Moser, G., 2009. Quality of life and sustainability: toward person-environment congruity. J. Environ. Psychol. 29, 351–357.
Muris, P., Bodden, D., Merckelbach, H., Ollendick, T.H., King, N., 2003. Fear of the beast: a prospective study on the effects of negative information on childhood fear. Behav. Res. Ther. 41, 195–208.
Öst, L.-G., 1989. One-session treatment for specific phobias. Behav. Res. Ther. 27, 1–7.
Petty, R.E., Cacioppo, J.T., 1981. Attitudes and Persuasion: Classic and Contemporary Approaches. William C. Brown, Dubuque, Iowa, USA.
Pohja-Myrkä, M., Kurki, S., 2014. Strong community support for illegal killing challenges wolf management. Eur. J. Wildl. Res. 60, 759–770.
Prokop, P., Fancovicová, J., 2010. Perceived body condition is associated with fear of a large carnivore predator in humans. Ann. Zool. Fenn. 47, 417–425.
Prokop, P., Usak, M., Erdogan, M., 2011. Good predators in bad stories: cross-cultural comparison of children's attitudes towards wolves. J. Balt. Sci. Educ. 10, 229–242.
Rachman, S.J., 1977. The conditioning theory of fear acquisition: a critical examination. Behav. Res. Ther. 15, 375–387.
Randler, C., Hummel, E., Prokop, P., 2012. Practical work at school reduces disgust and fear of unpopular animals. Soc. Anim. 20, 61–74.
Røskaft, E., Bjerke, T., Kaltenborn, B., Linnell, J.D.C., Andersen, R., 2003. Patterns of self-reported fear towards large carnivores among the Norwegian public. Evol. Hum. Behav. 24, 184–198.
Røskaft, E., Händel, B., Bjerke, T., Kaltenborn, B.P., 2007. Human attitudes towards large carnivores in Norway. Wildl. Biol. 13, 172–185.
Sakurai, R., Jacobson, S.K., 2011. Public perceptions of bears and management interventions in Japan. Hum. Wildl. Interact. 5, 123–134.
Sakurai, R., Jacobson, S.K., Ueda, G., 2013. Public perceptions of risk and government performance regarding bear management in Japan. Ursus 24, 70–82.
Sandström, C., Ericsson, G., Dressel, S., Eriksson, M., Kvastegård, E., 2014. Attityder till rovdjur och rovdjursförvaltning. Department of Wildlife, Fish, and Environmental Studies. Swedish University of Agricultural Sciences, Sweden [In Swedish] Report 2014: 1.
Scherer, K.R., 2001. Appraisal considered as a process of multi-level sequential checking. In: Scherer, K.R., Schorr, A., Johnstone, T. (Eds.), Appraisal Processes in Emotion: Theory, Methods, Research. Oxford University Press, New York, USA, pp. 92–120.
Shivik, J., 2014. The Predator Paradox: Ending the War with Wolves, Bears, Cougars, and Coyotes. Beacon Press Publishing, Boston, USA.
Sjölander-Lindqvist, A., Johansson, M., Sandström, C., 2015. Individual and collective responses to large carnivore management: the roles of trust, representation, knowledge spheres, communication and leadership. Wildl. Biol. 21, 175–185.
Slagle, K., Zajac, R., Bruskotter, J., Wilson, R., Prange, S., 2013. Building tolerance for bears: a communications experiment. J. Wildl. Manag. 77, 863–869.
Slovic, P., Peters, E., 2006. Risk perception and affect. Curr. Dir. Psychol. Sci. 15, 322–325.
Sponarski, C.C., Semeniuk, C., Glikman, J.A., Bath, A.J., Musiani, M., 2013. Heterogeneity among rural resident attitudes towards wolves. Hum. Dimens. Wildl. 18, 239–248.
St John, F.A.V., Edwards-Jones, G., Jones, J.P.G., 2010. Conservation and human behaviour: lessons from social psychology. Wildl. Res. 37, 658–667.
Thornton, C., Quinn, M., 2009. Coexisting with cougars: public perceptions, attitudes and awareness of cougars on the urban-rural fringe of Calgary, Alberta. Hum. Wildl. Interact. 3, 282–295.
Treves, A., Bruskotter, J., 2014. Tolerance for predatory wildlife. Science 76, 344.
Treves, A., Wallace, R.B., White, S., 2009. Participatory planning of interventions to mitigate human–wildlife conflicts. Conserv. Biol. 23, 1577–1587.
Treves, A., Naughton-Treves, L., Shelley, V., 2013. Longitudinal analysis of attitudes toward wolves. Conserv. Biol. 27, 315–323.
WHO, World Health Organization, 2014. Suicide Prevention. (Retrieved from http://www.who.int/mental_health/suicide-prevention/world_report_2014/en/).
Zabel, A., Holm-Muller, K., 2008. Conservation performance payments for carnivore conservation in Sweden. Conserv. Biol. 22, 247–251.
Zajac, R.M., Bruskotter, J.T., Wilson, R.S., Prange, S., 2012. Learning to live with black bears: a psychological model of acceptance. J. Wildl. Manag. 76, 1331–1340.
Zimmermann, B., Wabakken, P., Dötterer, M., 2001. Human-carnivore interactions in Norway: how does the re-appearance of large carnivore affect people's attitudes and levels of fear? Forest, Snow, Landsc. Res. 76, 137–153.