

Trust in researchers and researchers' statements in large carnivore conservation

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Abstract

1. Human–wildlife interactions occur when humans and wildlife overlap in the same landscapes. Due to the growing human population, the number of interactions will continue to increase, and in some cases, develop further into social conflicts. Conflicts may occur between people disagreeing about wildlife conservation or arguing over which wildlife management measures should be taken. Social conflicts between humans are based on different attitudes, values and land-use aspirations. The success of solving these social conflicts strongly depends on building trust between the public, stakeholders, authorities and researchers, as trust is fundamental to all communication and dialogue.
2. Here we have examined how trust in large carnivore research differs within a geographically stratified sample of the Norwegian population. The comprehensive survey, including 2,110 respondents, allows us to explore how people perceive factual statements about large carnivores depending on the source of these statements. Specifically, the respondents were given multiple statements and asked to judge them in terms of meaning and authenticity depending on whether the statements were made by a politician, the Norwegian farmers' association, the Norwegian Fish and Game association or a large carnivore researcher. Based on the variations in perceptions, we inferred that trust in large carnivore researchers and their research results varied with people's attitudes, values and direct experience of large carnivores.
3. In general, respondents perceived 60% of the statements to be genuine when given no information of who had made them. Although this increased to 75% when informed that the statements were made by a large carnivore researcher, there was still a 25% probability that the statement was perceived as manipulative or political. Age, environmental values and negative experiences of carnivores increased the probability of perceiving research statements as manipulative or political. People living in areas with high proportions of hunters showed particularly polarized views, either more strongly perceiving the statements as political, or in contrast as research.

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4. This study provides a novel perspective in understanding the role trust plays in social conflicts related to human–wildlife interactions.

KEYWORDS

geographically stratified survey, human dimensions, human–wildlife interactions, large carnivores, new environmental paradigm, trust in research

1 | INTRODUCTION

Wild species and their natural habitats are under pressure from multiple anthropogenic stressors (Wittemyer et al., 2008) and climate change (Dawson et al., 2011; Tilman et al., 2017; Vitousek, 1994), resulting in the most dramatic threat to biodiversity ever (Barnes et al., 2014; Ceballos et al., 2017; Diaz et al., 2019; Hampicke, 1994). A key challenge is the loss and degradation of wild habitats, driven by the need for land for food production, human infrastructure and economic development (Barraquand & Martinet, 2011; Gordon et al., 2018; Haines-Young, 2009).

Species such as large carnivores, which require large areas, are particularly vulnerable to land use pressure and interactions with humans, as conservation of large tracts of land is difficult and affects many different land use interests, owners and stakeholders (Gangaas et al., 2015; Pedersen et al., 2020). Human–carnivore interactions create social conflicts between people with differing attitudes, values and tolerances of sharing landscapes with these species. Different kinds of effort have been made to try to understand and mitigate these social conflicts, but it has not been an easy task (Gangaas et al., 2013; Persson et al., 2015; Treves, 2009). Trust is key to enabling sincere and constructive dialogue between different interest groups, in order to achieve understanding and agreement in how such conflicts develop or get resolved (Hendriks et al., 2020; Young et al., 2016). While trust in management authorities has been widely discussed in the literature (Hare et al., 2017; Lute & Gore, 2014; Sjolander-Lindqvist et al., 2015), trust related to wildlife research, has received limited attention. However, there is a growing interest in the role of the public's trust in science and the role played by science in society (Durant et al., 2019; Miller, 2001; Myers et al., 2017). In this study, we have investigated trust in large carnivore research in Norway, and how it may impact on the social conflict related to large carnivores (wolves *Canis lupus*, bears *Ursus arctos*, lynx *Lynx lynx* and wolverine *Gulo gulo*). Our main aim has been to see how people's trust in researchers and their research results may vary depending on people's attitudes, values or personal experiences of living in areas with large carnivores and further, to see whether people change their perception of the research results (presented as statements) depending on who makes claims about research results.

Nature conservation in Norway, including large carnivore management, is steered by an overall political framework set by central government, with the national nature management authorities (e.g. Norwegian Environment Agency; www.environmentagency.no)

ensuring the implementation of this policy. While state governance and national management authorities get professional advice and recommendations from researchers and research institutions, national political parties are heavily influenced by local democratic processes and local politicians (Falleth & Hovik, 2009). Local government and local democracy have strong traditions in Norway, where controversy and conflicts within nature conservation contribute to the tension between local and national governance (Falleth & Hovik, 2009). Large carnivore management has been delegated to local county boards, with the goal of enabling a balance to be made between local interests and use of natural areas, and national commitments to biodiversity conservation (Hovik & Hongslo, 2017). Their decisions are still expected to be based on professional recommendations from research and central management authorities (Eklund et al., 2020a). Yet, local politicians and stakeholders often question these professional recommendations and express distrust in the research recommendations as they also disagree with national commitments and political decisions (Falleth & Hovik, 2009; Lute & Gore, 2014). Hence, social conflicts related to large carnivores are as much about the symbolic value of central authorities that override local democracy as they are about the actual abundance of the animals (Ericsson et al., 2008; Eriksson, 2017; Linnell et al., 2017; Wilson, 1997). This is particularly the case for wolves in Norway, but is also found in several other countries (Skogen & Krange, 2003; Wilson, 1997).

People living in areas with large carnivores may find themselves negatively affected by having large carnivores in their area, for example, by being financially and emotionally affected by experiencing livestock predation, feeling anxiety when carnivores approach close to where they live, or being dissatisfied by reductions in hunting quotas of game species (Stormer et al., 2019; Weladji et al., 2003). This may lead to feelings that large carnivore policy is unfair (Eklund et al., 2020; König et al., 2020). A lack of trust in researchers and research statements may also arise due to a disagreement in the preferred knowledge base, in particular if the knowledge that is disseminated from science and from local experience diverges (Durant et al., 2019; Lute & Gore, 2014; Mallory et al., 2006). While researchers advocate science as their knowledge base (Lute & Gore, 2014; Peuhkuri, 2002), local people and stakeholders may oppose this and instead express greater trust in local knowledge (Lute & Gore, 2014; Mallory et al., 2006; Peuhkuri, 2002). In democratic processes, people trusting local knowledge may impact on political decisions in a direction that tends to deviate from professional research-based

recommendations. Such mistrust and social conflict are not specific to Norwegian nature conservation, but have been debated in relation to the wolf's reestablishment in human-dominated landscapes worldwide (Linnell et al., 2017; Skogen & Krange, 2003).

Trust facilitates communication and dialogue between people both at individual and collective levels, that is, between individuals, stakeholders, interest groups and institutions (Kelman, 2005; Sjolander-Lindqvist et al., 2015). However, trust strongly depends both on how people accept or relate to the issue (e.g. acceptance of carnivores in Norway), and how they trust the communicator of the message (here, the carnivore researchers communicating research results; Corner et al., 2015; De Cruz, 2020; Myers et al., 2017). In studies related to nature management, social trust, defined as *the willingness to rely on those who have the formal responsibility to develop policies and take actions* (Cvetkovich & Winter, 2003), has often been used. Social trust also emphasizes the importance of trusting the operation of government and other organizations in democratic societies (Cvetkovich & Winter, 2003). An important feature of the development of social trust is the emphasis of shared values and knowledge base between people (Balliet & Van Lange, 2013; Johansson et al., 2017; Stern & Coleman, 2015).

To better understand people's values and attitudes relating to wildlife (Manfredo et al., 2016; McCleery et al., 2006; Vaske & Donnelly, 1999), the new environmental paradigm (NEP) has been widely used (Klain et al., 2017). The NEP can be considered an environmental value orientation that gives a relatively stable expression of how one evaluates the environment (Fransson & Garling, 1999; Milfont & Duckitt, 2010; Schultz & Zelezny, 1999). The original NEP scale was developed by Dunlap and Van Liere in 1978 (Dunlap & Van Liere, 1978), and revised in 2000 (Dunlap et al., 2000). It includes 12–15 standardized questions that align in an ecocentric to anthropocentric frame. Previous studies have shown that people living in rural areas with large carnivores traditionally express more negative attitudes towards large carnivores and values tend to be more anthropocentric compared to those of people in urban areas with no or very low carnivore abundance (Eklund et al., 2020b; Skogen & Krange, 2003; Sponarski et al., 2013). The NEP is rooted in individual basic values, having both emotional and cognitive (knowledge) components (Dunlap, 2008). We have therefore chosen to use it to explore how people's environmental value orientation may relate to their trust in researchers and research statements. High NEP-scores correlate with pro-environmental values, also called ecocentrism, where nature is seen to have an intrinsic value regardless of human utilitarian needs (Dunlap et al., 2000; Kortenkamp & Moore, 2001). Low NEP-scores correlate with anthropocentrism, where humans value nature that is beneficial to humans and believe that nature is to be utilized (Kaltenborn et al., 2008; Rauwald & Moore, 2002). We expect that low NEP-scores will associate with lower trust in large carnivore researchers, while high NEP-scores are expected to positively associate with high trust in researchers (Ardahan, 2012; Dunlap, 2008; Weladji et al., 2003).

Hunters and hunting traditions have also come to the fore regarding conservation of large carnivores (Ericsson & Heberlein, 2003;

Treves, 2009). Hunters often report negative attitudes towards carnivores, and in particular towards wolf establishment, in addition to representing a strong voice in social debates about wildlife management (Agarwala et al., 2010; Karlsson & Sjoström, 2007; Naughton-Treves et al., 2003; Torres et al., 2020). Researchers, on the other hand, often pinpoint how the politically set management goals for wolves are too low to achieve an ecologically sustainable population, that hunting of wolves should be restricted and these low population sizes will lead to negative factors like inbreeding depression (Akesson et al., 2016; Nilsson, 2004). In Norway, hunting is traditionally a strong part of people's identity in many rural societies, and the option to participate in big game hunting teams is inherited between generations (Herman, 2014; von Essen et al., 2019). We expect that areas associated with strong hunting traditions or with high numbers of hunters, would also express lower trust in research compared to areas with lesser hunting traditions, as carnivores, and wolves in particular, compete with hunters for game or prey species and, in addition, wolves may kill hunting dogs.

A sustainable long-term conservation strategy requires a multidisciplinary understanding of spatial, ecological and social sciences (Andreassen et al., 2018; Johansson et al., 2016; Trouwborst et al., 2017). This study contributes to a better understanding of the social conflict related to the role of trust in research, and how researchers are perceived by the public as providers of knowledge. As people's acceptance of new knowledge usually decreases with age and increases with higher education (Williams et al., 2002), we would expect that trust in large carnivore researchers follows the same pattern. We also expect that people living in rural areas with strong traditional values and experience of losing free-ranging sheep to large carnivores would express a lower trust in large carnivore researchers compared to people living in areas where these values and direct experiences are not so prominent.

2 | MATERIALS AND METHODS

The study is based on a survey conducted over the telephone by a data collection agency (NORSTAT; www.norstat.no) between April and June 2019 and contained approximately 40 questions (see Appendix 1). NORSTAT collects data by interviews with a sample of people, based on existing, publicly available registers. The respondents had given a written agreement to the survey company NORSTAT to participate voluntarily in such surveys, and all participated voluntarily. Our study is based on a sample size of 2,110 respondents.

To obtain responses distributed evenly throughout Norway and independent of population density, we used geographically stratified sampling by surveying 5 people (aged 15–99 years old) in each of the 422 municipalities throughout the country. As the sample represents a very small proportion of people living in high-density areas such as cities and towns, it does not measure the general opinion of people living in a specific region (i.e. county or country).

We used data from the Norwegian large carnivore data base (www.rovdata.no) for the number of carnivores registered in each county, and from Statistics Norway (www.ssb.no) for information such as numbers of hunters (hunter ratio) and free-ranging sheep per municipality (sheep density). In line with earlier studies, we defined rural areas as areas characterized by free-ranging sheep, loss of sheep to large carnivores and strong traditions of big game hunting (Gangaas et al., 2013).

2.1 | Questionnaire

The questionnaire was in Norwegian and included demographic variables like age, gender, home municipality, and final level of education. We assessed respondents' general trust in large carnivore research by asking the extent of their agreement with the statement 'I have confidence in large carnivore research in Norway', 'I think large carnivore researchers hold a high level of expertise', and 'I think large carnivore researchers seem to have high credibility'. The respondents were also given questions about their attitudes towards large carnivores, and whether they found current carnivore numbers to be 'too many', 'appropriate' or 'too few' in relation to each carnivore species. We also asked questions related to whether or not respondents had experienced predation of sheep or other domestic animals by large carnivores, and whether or not they presently lived in an area they perceived to hold strong traditions of big game hunting. We used a seven-question version of NEP (Table 1; Bjerke & Kaltenborn, 1999; Dunlap, 2008; Kaltenborn et al., 2008), translated into Norwegian (see Gangaas et al., 2015; Kaltenborn et al., 2012) to measure different aspects of the respondents' environmental values (Table 1). The NEP-score for each respondent was estimated as the mean of the seven answers where highly disagree was given the value 1 (highly anthropocentric), and highly agree given the value 5 (highly ecocentric). Question 3, 5 and 7 were reversed when estimating the mean value.

TABLE 1 The seven questions used to estimate the new environmental paradigm answered in a five interval Likert-type scale

New environmental paradigm
(1) The balance in nature is delicate and easily upset
(2) Humans are severely abusing the environment
(3) The so-called 'ecological crisis' facing humankind has been greatly exaggerated
(4) Plants and animals have the same rights to life on earth as humans
(5) The balance of nature is sufficiently stable to withstand the impacts from a modern industrial society
(6) If things continue on their present course we will soon experience a major ecological catastrophe
(7) Human ingenuity will ensure future life and living conditions on Earth

2.2 | Piloting the survey

The questions in the whole survey were piloted and tested on a small sample of researchers and colleagues, and their feedback was taken into account before finalizing the questionnaire.

2.3 | Trust in researchers and their statements

Trust in research statements was measured by respondents' perception of five different statements that were all genuine research results from the Scandinavian wolf research project Skandulv (Table 2). First, all five statements were presented without any information about their origin, and respondents were asked if they perceived the statement to be *a research result, a political claim, conjecture, a manipulative statement or do not know*. In the second step, respondents were presented with exactly the same genuine research statements as before, but now were given information that the statements were presented by each of four different communicators (a large carnivore researcher, the Norwegian Fish and Game associations, the farmers associations and by a politician). The respondent was then asked to again evaluate how their perception of each statement might vary with the specific communicator: that is do you perceive the same statements as *a research result, a political claim, conjecture, a manipulative statement or do not know*.

The respondents got one statement and communicator combination presented at a time and had to finish considering this before they were presented with a new combination. The order of the communicators was presented randomly. In total, each respondent had then been given 25 different combinations of statement and communicator (the same five genuine statements in combination with all four specified communicators in addition to the same five statements with unspecified communicators to start with). However, to keep the current focus and interpretations as simple as possible we only analysed differences in perception between an unspecified communicator and a large carnivore researcher communicator. When respondents changed their perception of the statements from being a *research statement* to instead be a *political claim, conjecture or a manipulative statement* when informed that the statement was

TABLE 2 The five different statements presented to our respondents who interpreted the statements as *a research result, political claim, conjecture, a manipulative statement or do not know*

Statements
(1) The wolf in Scandinavia is most likely of Finnish–Russian origin
(2) The wolf in Scandinavia has the capacity to migrate from Finland/Russia down to southern parts of Scandinavia
(3) Up to 95% of the Scandinavian wolf diet consist of moose
(4) A total of 5 Swedish migratory wolves have been identified in and outside the wolf zone this year (2018)
(5) The large carnivores tend to have home ranges of hundreds or thousands of square kilometres

claimed by a researcher, we interpreted this as a mistrust in the large carnivore researchers.

2.4 | Response variables

In this paper, we have focused on: (a) the public trust in large carnivore researchers and (b) how trust in research results may change depending on who makes these statements. As wolf research in Scandinavia has been going on for a long time, and represents almost every perspective of the ongoing debate about trust in large carnivore research (Linnell et al., 2017; Skogen & Krange, 2003; Wilson, 1997), we have chosen to use research statements from Scandinavian wolf research in this study.

2.5 | Predictor variables

The main predictor variables in our study are: the respondent's attitudes towards having large carnivores in Norway, their environmental value orientation measured by NEP, the presence of carnivores in their municipality (found in the Norwegian register; www.rovdata.no), their personal experience with large carnivores represented by loss of sheep, and rural traditions in their area represented by big game hunting traditions (defined in Table 3).

2.6 | Statistical analyses

To explore variations in how the statements were perceived among the respondents and how this perception changed when the respondents were told that the statements came from a large carnivore researcher, we set up two multinomial logit models. The first model explored how the statements were perceived (i.e. the probability of falling into each of the five categories across all five statements: *research*, *political*, *conjecture*, *a manipulative statement* or *do not know*) for the unspecified setting while the second model focused on the large carnivore researcher communicator setting. In both models, perception was analysed as a function of the different variables describing the individual respondent. We used an information theoretic approach (Burnham & Anderson, 2002) to objectively decide which variables were meaningful to include in the final models. Based on prior knowledge, age, education and NEP-score were always included in the candidate models (Gangaas et al., 2015; see Table 3). We did, however, explore whether sheep density, loss of sheep to carnivores, big game hunting traditions, trust in large carnivore research and local presence of large carnivores in general, or wolves in particular, were meaningful predictor variables to include in the model (see Table 3). The latter variables were thus either included or excluded as additive effects in different candidate models. We also included a candidate model with only age as a predictor variable, in total testing 10 models against each other in the model selection procedure. As each respondent

TABLE 3 Variables included in model selection. Hunter ratio and sheep density are data from Statistics Norway (www.ssb.no), and carnivore presence are data from Rovdata (www.rovdata.no). Variables in the grey section were always included in the model selection, while variables in the white section were considered in the model selection procedure

Variable	Description
Background	
Age	Continuous, individual specific age of respondent
Education	Highest level of education for the respondent. Categorized into; primary education, high school, vocational school, lower degree university (~bachelor) or higher degree (~master or PhD)
NEP-score	The NEP score for each respondent was estimated as the mean of the seven answers (see Table 1)
Specifics	
Trust in carnivore research	Categorical, 'Agree', 'Do not know' or 'Disagree'
Loss to carnivores	Categorical, 'yes', 'no'
Carnivore presence	Continuous, presence of established groups/individuals of either lynx, bear, wolf or wolverine in the municipality
Sheep density	Continuous, The density of free ranging sheep in the municipality
Hunter ratio	Continuous, the ratio between number of registered big game hunters and number of inhabitants within the municipality
Big game traditions	Categorical, 'yes', 'no'

considered multiple statements, this produced repeated choices made by the same individuals. We therefore implemented mixed-effect multinomial models, treating respondent ID as a random effect (random intercepts only) for all candidate models. The models were constructed using the mlogit-library (Croissant, 2020) in the statistical environment R (R Core Team, 2021). The predictor variables included in the most supported models were the same for the two multinomial logit models.

The most supported models were used to predict the individual respondent's probability of having a specific perception of all the genuine research statements, varying only the communicator setting (unspecified or large carnivore researcher). To better visualize and compare how the mean predicted perception probability varied between the two models/communicator settings, we produced figures showing the difference between the predicted probabilities for large carnivore researcher and unspecified communicator. Thus, by comparing the difference in the mean individual perception probability between the two models, we were able to deduce the level of trust in carnivore researchers and how this trust potentially varied as a function of the variables in focus.

2.7 | Ethics statement

The interviews followed a strict protocol as dictated by standard research ethics of the Norwegian Social Science Data Service (Ross et al., 2016). Neither the Inland Norway University of Applied Sciences (INN) nor the data collection agency are required to seek permission for this kind of data collection from the Norwegian Social Science Data Service (NSD; Ross et al., 2016). NSD is the institution reviewing research proposals for data collection, but an ethics review and permit are only required in cases where the researchers and/or the data collection agency retain a register of respondents for purposes such as reminders or follow up surveys. This was not the case for our study, and we have no register or any other kind of information that can be used for linking individuals to the data set.

3 | RESULTS

Altogether, 2,110 respondents completed the study, corresponding to a response rate of 11%. A response rate of between 10% and 20% has been shown to be typical of these kinds of surveys in Norway (NORSTAT 2020). Out of these 2,110 respondents, 1,204 (57%) were men and 906 (43%) women, and the mean age was 45.6 years old (age range 15–92). The distribution of education level among our respondents was 47.9% with a completed university degree (30.8% bachelor's and 17.1% master's), and 52.1% with high school or junior high as their highest completed educational level (43.0% and 9.1% respectively).

The most supported models from the model selection (second most supported model had $\Delta AIC = 12.2$ compared to the most supported) included all considered predictor variables, except for sheep density (Table 3). In addition, the model included a variable for carnivore presence in general, rather than wolf in particular, suggesting that the probability of changing the perception of the statements was not species specific in regard to the local presence/absence of carnivores.

3.1 | Attitudes towards large carnivores

When asked the question 'how do you find the large carnivore situation in Norway', more than 50% of the respondents felt that there were too few or an appropriate number of carnivores (Table 4;

wolves; 50.4%, bears; 65.2%, lynx; 65.6%, wolverine; 52.8%), though the wolf situation stood out by showing that more respondents (781; 37.0%) felt there were too many wolves than any other species (Table 4).

3.2 | Trust in large carnivore researchers and wolf research statements

When the respondents were presented with the statement 'I think large carnivore researchers seem to have high credibility', 18% of the respondents highly disagreed or disagreed, while 58% answered that they highly agreed or agreed (24% did not know). On the similar statement 'I think large carnivore researchers hold a high level of expertise', 55% reported that they highly agreed or agreed, while 15% highly disagreed or disagreed (29% did not know).

For the unspecified communicator setting, our model predicted a nearly 60% probability that a respondent would perceive the statements as *research results*. Furthermore, we found an almost 20% probability that the statements were perceived as *conjecture*, and less than a 10% probability of their being perceived as *political claims* or a *manipulative statement* (Figure 1).

Thus, the pattern showed that the respondents in general perceived the statements as *research results*, regardless of the context in which the statements were presented. The probability of statements being perceived as *research results* increased to almost 75% when it was claimed that the statements were communicated by researchers, while the chance of the statement being perceived as *conjecture* declined to <10% (Figure 1). The probability of the statements being perceived as a *manipulative* or *political claim* was relatively unchanged.

3.3 | Perception of statements related to environmental value orientation (NEP-scores)

The probability of a respondent reconsidering the statements as *research results* when being informed that they were made by a researcher, increased markedly with increasing ecocentric values (high NEP-scores). Correspondingly, the probability of reconsidering the statements as *conjecture*, a *manipulative statement* or *political* decreased with increasing ecocentric values (Figure 2). By contrast, respondents that leaned towards anthropocentric values (low NEP-scores), showed a higher probability of interpreting the statements

Large carnivore situation in Norway	Numbers of respondents (%)			
	Wolf	Bear	Lynx	Wolverine
Too few	416 (19.7)	429 (20.3)	507 (24.0)	302 (14.3)
Appropriate	648 (30.7)	947 (44.9)	877 (41.6)	812 (38.5)
Too many	781 (37.0)	292 (13.8)	339 (16.1)	438 (20.8)
Don't know	265 (12.6)	442 (20.9)	387 (18.3)	558 (26.4)

TABLE 4 Distribution of attitudes towards large carnivores in Norway when respondents were asked if they found the carnivore situation to be too many, appropriate or too few related to each carnivore species (percentages presented in brackets)

as *manipulative* or *political*, and a lower probability of perceiving them as *research results*, when they were informed that the statement was made by a large carnivore researcher (Figure 2).

3.4 | Hunter ratio

The probability of perceiving the statements as *research results* when stated by a researcher showed a general increase with hunter ratio (number of registered hunters per inhabitant in the municipality). Furthermore, the probability of changing the perception of the statements as *political* were also significantly higher when they were informed that the statements were claimed by a researcher (Figure 2), and the probability of perceiving the statements as *conjecture* decreased.

3.5 | Age and education

Older people were more prone to change their perception of the statements to being *manipulative* or *political* when the statement was made by a researcher, no matter what they had answered in the unspecified setting. The probability of perceiving the statements as *research results*, were higher in younger age classes when informed that the statements were made by a researcher (Figure 2). We did not find any obvious effect on the probability of changed perception among our respondents in relation to education level.

3.6 | Trust in large carnivore research in general

Respondents who expressed trust in large carnivore research in general increased their perception of the statements being research results when informed they were made by a researcher, while respondents who did not trust carnivore research in general did not change their perception very much, and still perceived the statements as political or manipulative (Figure 3).

3.7 | Direct experience with large carnivores

Among respondents who had experienced loss of, for example, livestock to large carnivores, we found a slightly higher probability of perceiving the statements as *manipulative* when informed that the statement was claimed by a large carnivore researcher (Figure 3). People living in areas inhabited by large carnivores did not show any obvious change in how they perceived the statements depending on who the communicator was, and neither did respondents who lived in areas they themselves described as areas with strong big game hunting traditions (Figure 3).

4 | DISCUSSION

In general, our findings show that among the respondents, large carnivore researchers were well trusted as there was a 75% probability

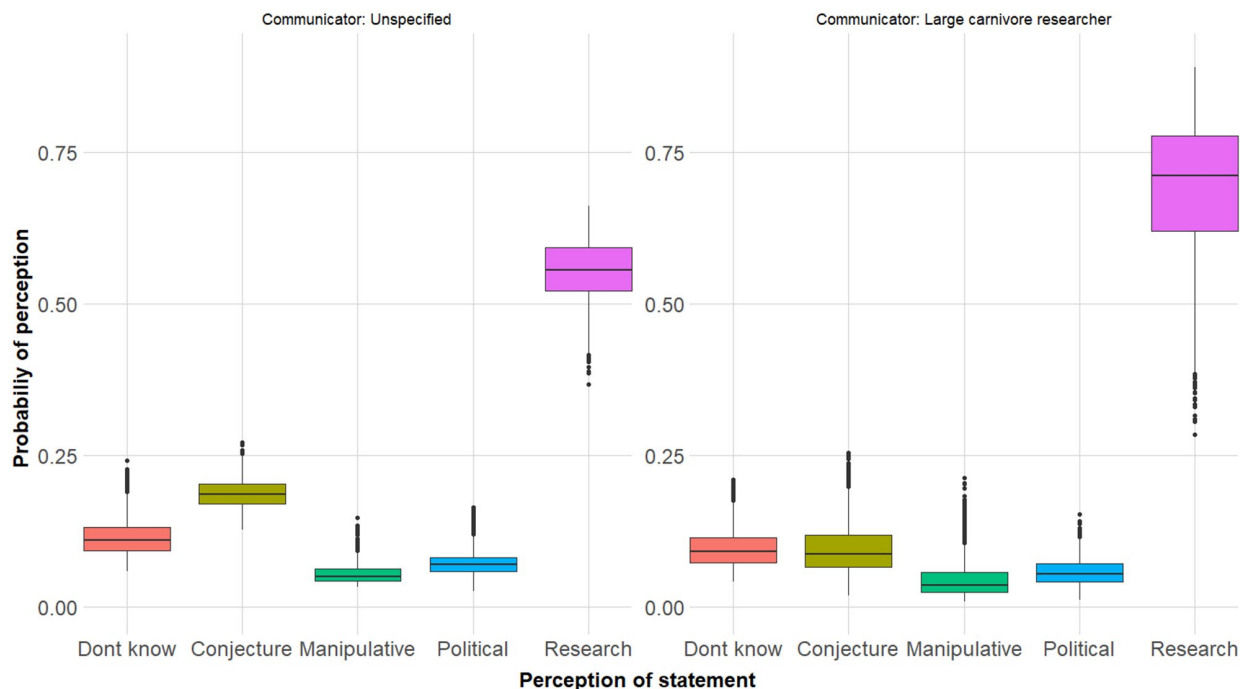


FIGURE 1 Boxplot of the fitted probabilities for the respondents of having a specific perception of wolf research across all five statements, as obtained from the multinomial models exploring variations in the probability of perception given an unspecified communicator setting (left panel) and given a setting where the statements were made by a large carnivore researcher (right panel)

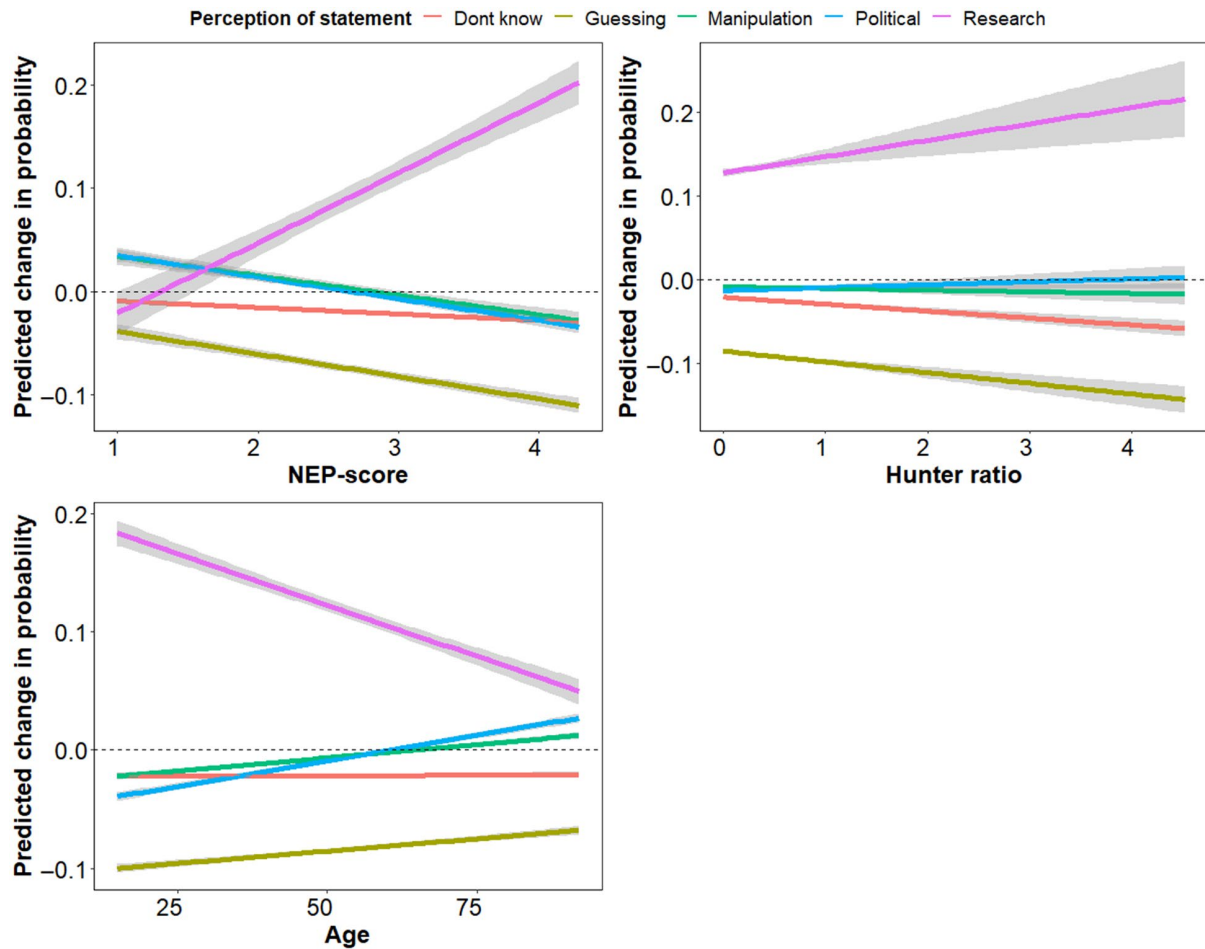


FIGURE 2 Predicted change in the probability (y-axis) of a specific perception of the statement as functions of NEP-score (top left), hunter ratio (top right) and age (bottom left) of the respondents. The change is the difference between a respondent's perception when switching from a setting with an unspecified communicator to a setting with a large carnivore researcher communicator. Positive values on the y axis (i.e. when the trend lines are above the dashed line at zero) indicates that there is an increase in the probability for the respective perception, while negative values (below the dashed line) indicates that there is a reduction in probability of the respective perception. The different lines represent the linear smoothed means of the predicted change as functions of the different variables, and the grey shading indicates 95% confidence interval around the smoothed mean

of the statements attributed to researchers being perceived as *research results*. Furthermore, our results point to how expressing a positive environmental value orientation, and trust in large carnivore research in general, associate with positive perceptions of large carnivore research statements.

Interestingly, trust in researchers' statements increased among respondents living in areas with a high hunter ratio, though we also revealed that respondents living in these high hunter ratio areas also expressed a slightly higher probability of perceiving the statements as *political* when claimed by a researcher. This implies that there might be a wider diversity of views among people in areas with high hunter ratios.

The probability of expressing lower trust in researchers increased with the respondents' age, loss of sheep and with increasing anthropocentric value orientation (low NEP-scores). People with anthropocentric values are generally skeptical of wildlife conservation, deny that climate change is caused by anthropogenic activities, and deny that there is an ecological crisis going on. Older people perceived

research results as *manipulative* or *political* when being informed that the statements were expressed by a researcher. This is consistent with studies of attitudes towards large carnivores, as older people usually show less acceptance of having large carnivores than young people (Bostedt et al., 2008; Roskaft et al., 2007).

Overall, loss of sheep, hunter ratio, and anthropocentric values are all highly associated with rural area characteristics (Andreassen et al., 2018; Kaltenborn & Bjerke, 2002), while the presence of carnivores is no longer specific to rural areas in Norway (e.g. both wolves and lynx have established in areas with high human population density; Kränge et al., 2017). The lower trust among respondents associated with these rural area characteristics may also be an expression of either having more trust in local knowledge, or less trust in the authorities, here represented by researchers as their professional recommendations impact on the livelihoods of local people. This is because it is not the presence of carnivores per se that is important so much as their impact on people's livelihood by, for example, killing sheep. For urban people,

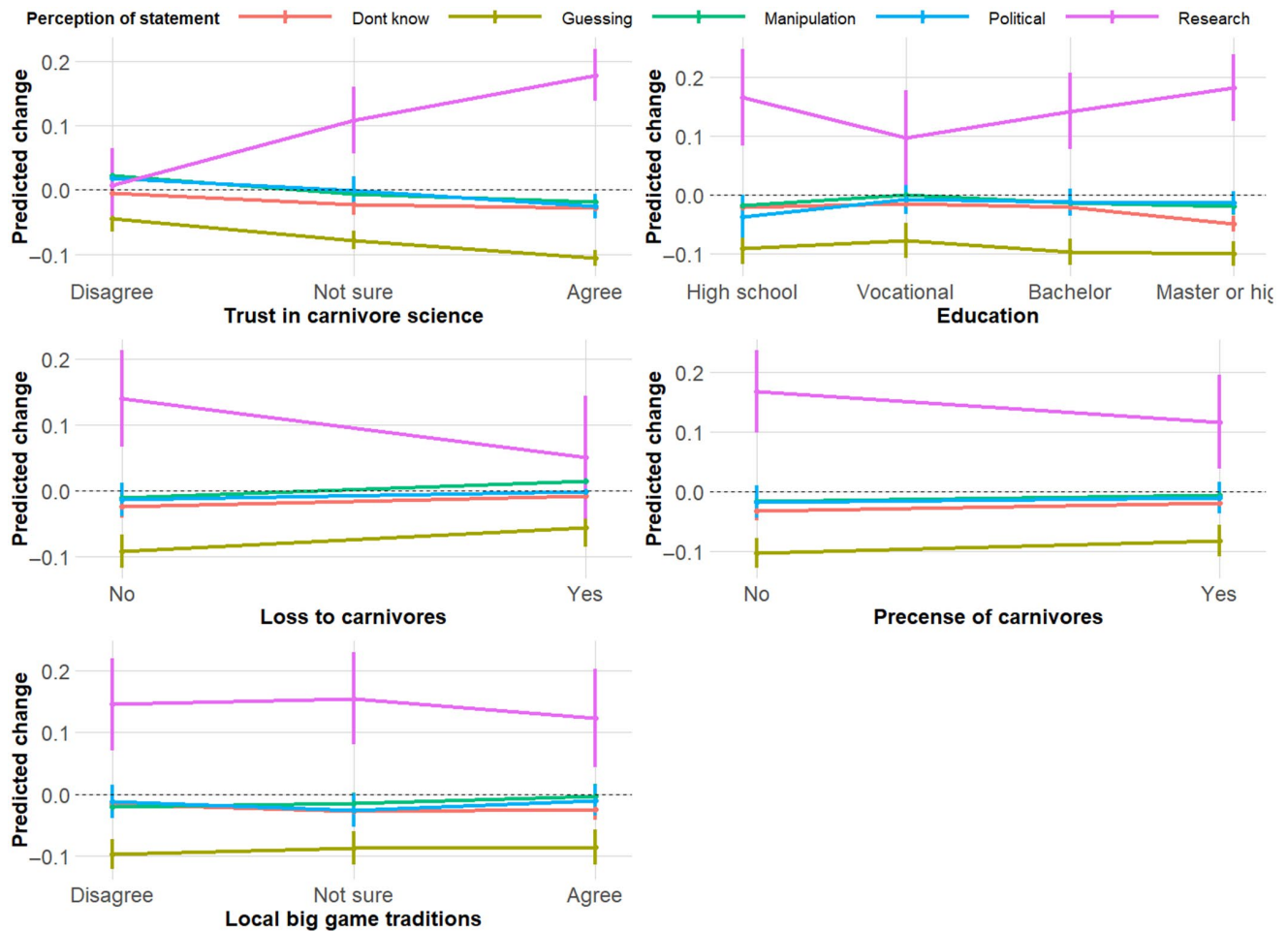


FIGURE 3 Predicted change in the mean probability (y-axis) for respondents having a specific perception of all the statement as functions of trust in carnivore research (top left), education level (top right), experience of loss to carnivores (mid left), presence of carnivores locally (mid right) and perceived traditions for big game hunting in the local area (bottom left). The change is the difference between a respondent's perception when switching from setting with an unspecified context to a setting where the statements were provided by a carnivore researcher. Positive values on the y axis (i.e. when estimated means are above the dashed line at zero) indicate that there was an increase in the probability of the respective perception, while negative values (below the dashed line) indicate that there was a reduction in probability of the respective perception. The fitted lines connect the perception-specific mean estimates for the different levels of the variables, while the vertical lines indicate the standard deviation around the respective mean estimates

living in the presence of carnivores may not be a problem as their livelihoods tend not to be impacted. Lower trust in researchers may also be associated with a respondent's belief or experience of how researchers' recommendations can impact on management decision that directly affect their livelihood. This has been shown in earlier studies, where attitudes towards wildlife species become increasingly negative when people are directly affected (Ericsson & Heberlein, 2003; Eriksson et al., 2015). This strengthens our impression that trust in large carnivore researchers fits well with the definition of social trust (Cvetkovich & Winter, 2003). The views of respondents who expressed lower trust in researchers by perceiving their statements as *manipulative* or *political*, may well impact on societal development. In democracies, trust between the public and the authorities facilitates and improves the performance of important decision-making, for example implementation of critical management measures regarding conservation of wildlife.

The hunter ratio we used was derived from a national database of hunters registered in an area (www.ssb.no) and did not relate to whether a respondent was a hunter or not. In Norway there is a strong tradition of hunting, with approximately 10% of the Norwegian population being registered as hunters. The areas with the highest density of registered hunters have up to 14% of inhabitants who hunt, and these are typically rural districts where there are strong big game hunting traditions. So, even within an area with a high hunter ratio, the majority of inhabitants are still non-hunters. Hunters and hunting associations are particularly important with respect to wildlife conservation as they are one of the most pronounced interest groups to have strong political power both at local and national levels (Cervený et al., 2019; Luchtrath & Schraml, 2015; Pohja-Mykra & Kurki, 2014; Treves, 2009). Hunters are known to express negative attitudes towards having large carnivores, but they also have the most accurate knowledge of carnivores

(Ericsson & Heberlein, 2003; Treves, 2009). However, our findings may reflect the fact that rural areas, including areas with high hunter ratios, in general have become more heterogeneous with people representing a variety of values, livelihoods and attitudes, as in more urban areas (Konig et al., 2020; Sponarski et al., 2013). If these results are represented by hunters versus non-hunters, the reasons behind these differences warrant attention in further studies.

Our study cannot pin-point the reasons why certain people mistrust researchers and their research statements, but it could be that they fear the research results will have a negative impact on their everyday life and livelihood. It could also arise from a generally low trust in researchers, representing a social elite that seems alienating and untrustworthy. The battle over power between central authorities and local society is well known both in Norway and in other countries (Linnell et al., 2017; Lute & Gore, 2014). Traditional top-down wildlife management may be associated with managers in central positions who focus on restrictive conservation and associate with researchers who are their knowledge providers. Local governance, on the other hand, is strongly influenced by local politicians, who focus on local communities and how the residents should benefit from nature (Hovik & Hongslo, 2017). There are important issues to discuss around the role that researchers, as knowledge providers, are expected to play in political decisions or policymaking. Kotcher et al. (2017) looked at how climate scientists could engage in advocating certain statements about climate change and still maintain their credibility and integrity as scientists (Kotcher et al., 2017). However, Beall et al. (2017) argue that this depends on whether or not the public interpret the researchers' information as being motivated to serve or to persuade the public (Beall et al., 2017). In Norway, there is a common expectation that researchers are non-political (Ministry of Education & Research, 2005), particularly in controversial topics like conflicts related to large carnivores. We believe that it is important that researchers manage to build confidence and trust among the public. Earlier studies have emphasized the importance of bridging the gap between conservation managers and ecological scientists (Bertuol-Garcia et al., 2018; Durant et al., 2019). We think that it is also important to understand how to bridge the gap between researchers and local people in rural districts as this may contribute to lessening conflict over social power. Trust in knowledge providers, here represented by large carnivore researchers, is important in order to gain local people's support of management decisions in nature conservation (Liu et al., 2018; Taye et al., 2018). Our results challenge researchers and research institutions to improve relationships and build trust in scientific knowledge. Researchers' role as trusted knowledge providers has the potential to strongly influence conservation management and the political decisions taken.

5 | CONCLUSION

This study shows that in general, most people express trust in large carnivore researchers and their research results. However, there are still some people who express low trust in large carnivore

researchers, and this low trust is primarily associated with inhabitants living in areas with negative experiences of large carnivores, including predation of livestock. Over the last decade, there has been a general decline in trust in research worldwide and the public is increasingly questioning their trust in researchers (Iyengar & Massey, 2019; Johansson et al., 2017). These changes are likely to have a significant impact on both local and national politics, and political decisions may be left to feelings, traditions, or political ideology rather than professional recommendations. This may not benefit forward-looking conservation of nature or resolving difficult issues such as large carnivore conflicts or halting climate change. A general lack of trust in research, together with the growing societal trends of creating 'alternative realities' or 'fake news' are highly problematic and contribute to an increased political polarization, further preventing crucial nature conservation measures, fueling conflicts and disagreements instead (Brandtzaeg et al., 2018; Iyengar & Massey, 2019). We recommend increasing efforts to investigate the reasons and causes of the lack of trust in researchers and scientific knowledge, in order to contribute to a better understanding of what is driving the lower trust. We also recommend implementing trust building measures that benefit research as the knowledge provider of future nature and biodiversity conservation.

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CONFLICT OF INTEREST

All authors have been great contributors, and there are no conflict of interests in this work.

AUTHORS' CONTRIBUTIONS

K.E.M. and M.B. contributed to study concept and design; K.M.B. and K.E.M. contributed to analysis and perception of data; K.E.M., K.M.B., M.B. and M.J. contributed to drafting of the manuscript; M.J. contributed to contribution of psychological theories and concepts; K.M.B. contributed to statistical analysis.

DATA AVAILABILITY STATEMENT

Our data are archived and made available at Dryad Digital Repository at <https://doi.org/10.5061/dryad.6hdr7sr21> (Mathiesen et al., 2021).

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