

Supporting Information

Attitudes towards returning wolves (*Canis lupus*) in Germany: Exposure, information sources and trust matter.

Ugo Arbieu^{a*}, Marion Mehring^{a,b}, Nils Bunnefeld^c, Petra Kaczensky^{d,e}, Ilka Reinhardt^{f,g}, Hermann Ansorge^{h,i}, Katrin Böhning-Gaese^{a,g}, Jenny A. Glikman^j, Gesa Kluth^f, Carsten Nowak^k, Thomas Müller^{a,g}

^aSenckenberg Biodiversity and Climate Research Centre, Senckenberganlage 25, 60325, Frankfurt am Main, Germany.

^bInstitute for Social-Ecological Research, Hamburger Allee 45, 60486 Frankfurt am Main, Germany.

^cBiological and Environmental Sciences, Faculty of Natural Sciences, University of Stirling, Stirling, FK9 4LA, UK.

^dNorwegian Institute for Nature Research, PO Box 5685 Torgard, NO-7485 Trondheim, Norway.

^eResearch Institute of Wildlife Ecology, University of Veterinary Medicine, Savoyenstrasse 1, 1160 Vienna, Austria.

^fLupus Institute for Wolf Monitoring and Research, Dorfau 9, 02979 Spreewitz, Germany.

^gDepartment of Biological Sciences, Goethe University, Max-von-Laue-Strasse 9, 60438 Frankfurt am Main, Germany.

^hSenckenberg Museum of Natural History Görlitz, 02826 Görlitz, Germany.

ⁱInternational Institute Zittau, Technische Universität Dresden, Markt 23, 02763 Zittau, Germany.

^jCommunity Engagement, San Diego Zoo Institute for Conservation Research, San Diego, United States of America.

^kSenckenberg Research Institute and Natural History Museum Frankfurt, Clamecystraße 12, 63571 Gelnhausen, Germany.

* corresponding author: ugo.arbieu@senckenberg.de

Accepted refereed manuscript of:

Arbieu U, Mehring M, Bunnefeld N, Kaczensky P, Reinhardt I, Ansorge H, Böhning-Gaese K, Glikman JA, Kluth G, Nowak C & Müller T (2019) Attitudes towards returning wolves (*Canis lupus*) in Germany: Exposure, information sources and trust matter. *Biological Conservation*, 234, pp. 202-210.

DOI: <https://doi.org/10.1016/j.biocon.2019.03.027>

© 2019, Elsevier. Licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International <http://creativecommons.org/licenses/by-nc-nd/4.0/>

Methods S1. Survey questionnaire translated in English, including 51 questions divided into 5 sections related to knowledge on wolves (Section A), sources of information on wolves (Section B), personal exposure and experience with wolves (Section C), attitudes towards wolves (Section D) and socio-demographic characteristics (Section E). Respondents could only give one answer to each question. Questions in red colour were not asked if answer to A1 was “no” (see Methods S2).

SECTION A: KNOWLEDGE ON WOLVES							
A1 - Did you know that there are wild wolves living in Germany?	yes	no					
Please give us your opinion on the following statements:							
A2 - Since when (how many years) did the wild wolves return to Germany?	open answer	does not know					
A3 - How many wild wolves are currently living in Germany?	open answer	does not know					
A4 - How far from your place of residence does the next wolf pack live (in km)?	open answer	does not know					
A5 - Where do wild wolves living in Germany come from?	some wolves were always present	illegal reintroduction	legal reintroduction	natural recolonization	does not know		
A6 - What do wild wolves eat in Germany?	mainly roe deer, red deer and wild boar	mainly sheep, goat and cattle	mice and other small animals	does not know			
A7 - How many men have been killed by wild wolves since 1950 in Europe?	open answer	does not know					

SECTION B: SOURCES OF INFORMATION ON WOLVES							
B1 - How well do you feel informed on the topic "wild wolves in Germany"?	very well	well	neutral	not so well	not at all		
B2 - Where does your knowledge on wolves come from?	zoos & museums	news (TV or press)	social networks	exchanges with family and friends	books and films	Nature Organizations	Wolf Information Centre
B3 - Where do you hear the most on wild wolves in Germany?	zoos & museums	news (TV or press)	social networks	exchanges with family and friends	books and films	Nature Organizations	Wolf Information Centre
B4 - How much trust do you have on these sources of information?	very good	good	neutral	not much	not at all		
B5 - How often do you hear or read on the topic "wild wolves in Germany"?	once a day	once a week	once a month	once every 3 months	once a year	never	

SECTION C: PERSONAL EXPOSURE AND EXPERIENCE WITH WOLVES							
C1 - Have you ever seen a wolf in a zoo or in captivity?	never	once	5 times	10 times	100 times		
If yes - What kind of feeling has this experience given you? (or: how did you feel about this experience?)	very positive	positive	neutral	negative	very negative	does not know	
C2 - Have you ever seen wild wolves outside Germany?	never	once	5 times	10 times	100 times		
If yes - Where have you seen these wild wolves?	open answer						
If yes - What kind of feeling has this experience given you? (or: how did you feel about this experience?)	very positive	positive	neutral	negative	very negative	does not know	
C3 - Have you ever seen wild wolves in Germany?	never	once	5 times	10 times	100 times		
If yes - Where have you seen these wild wolves?	open answer						
If yes - What kind of feeling has this experience given you? (or: how did you feel about this experience?)	very positive	positive	neutral	negative	very negative	does not know	
C4 - Have you lost a domestic animal because of a wolf attack?	yes	no	does not know				
C5 - Has any of you family member or relatives lost a domestic animal because of a wolf attack?	yes	no	does not know				

SECTION D: ATTITUDES TOWARDS WOLVES							
D1 - What is your opinion about wild wolves	very positive	positive	neutral	negative	very negative	does not know	
D2 - How do you feel about wild wolves living in Germany again?	very positive	positive	neutral	negative	very negative	does not know	
D3 - Would you enjoy seeing wild wolves or wild wolves' signs (e.g. tracks, hair, howls...) in the wild in Germany?	would enjoy very much	would enjoy	neutral	would not enjoy	would not enjoy at all		
D4 - How far from your place of residence would you tolerate the presence of wild wolves (in km)?	open answer	does not know					
D5 - How acceptable is it for you, that wild wolves live in Europe?	very much acceptable	acceptable	neutral	not acceptable	not acceptable at all		
... and in Germany?	very much acceptable	acceptable	neutral	not acceptable	not acceptable at all		
... and in your Bundesland?	very much acceptable	acceptable	neutral	not acceptable	not acceptable at all		
... and in your Landkreis?	very much acceptable	acceptable	neutral	not acceptable	not acceptable at all		
... and in your municipality?	very much acceptable	acceptable	neutral	not acceptable	not acceptable at all		
D6 - What evolution in the wild wolf population of	more wolves	as many wolves as	fewer wolves	no wolves	not important	does not know	

Germany would you wish for the future?		today					
To what extent do you agree with the following statements?							
D7 - Wild wolves have, like other animals, a right to live in Germany.	totally agree	agree	neutral	does not agree	does not agree at all		
D8 - Wild wolves should only live in Nature reserves and other Protected Areas	totally agree	agree	neutral	does not agree	does not agree at all		
D9 - The presence of wild wolves increases the value of a landscape, whether I get to see them or not	totally agree	agree	neutral	does not agree	does not agree at all		
D10 - For me, it is important to protect wild wolf populations also for future generations	totally agree	agree	neutral	does not agree	does not agree at all		
D11 - Because of the presence of wild wolves, I would be scared to walk alone in the forest	totally agree	agree	neutral	does not agree	does not agree at all		
D12 - The presence of wild wolves would negatively affect my leisure activities	totally agree	agree	neutral	does not agree	does not agree at all		
D13 - The number of wolves should be controlled by human shooting	totally agree	agree	neutral	does not agree	does not agree at all		
D14 - Only those wolves who cause problems and damages should be controlled in Germany through scaring, capturing, relocating or shooting	totally agree	agree	neutral	does not agree	does not agree at all		

SECTION E: SOCIO-DEMOGRAPHIC PARAMETERS							
E1 - Age							
E2 - Gender	woman	man					
E3 - Higher Education diploma	Hauptschule	Realschule	Oberschule	Gymnasium	Fachhochschule	Universität	Others
E4 - How much time do you spend in nature?	Several hours per day	a couple of hours per week	a couple of hours per month	a couple of times a year	never		
To what extent do you agree with the following statements?							
E5 - Men should protect nature, because animals and plants have a right to live.	totally agree	agree	neutral	does not agree	does not agree at all		
E6 - We humans have the right to shape our environment according to our needs	totally agree	agree	neutral	does not agree	does not agree at all		
E7 - How important is it for you to protect nature?	very important	important	neutral	not important	Not important at all		
E8 - Are you a hunter?	yes	no					
E9 - Do you own livestock?	yes	no					
E10 - Do you have a dog at home?	yes	no					
E11 - What is your postal code?	open answer						

Methods S2. Description of the CATI-protocol for the phone survey and details of the survey response rate.

The phone survey was outsourced to a German private company, Aproxima Gesellschaft für Markt- und Sozialforschung Weimar mbH, for the Senckenberg Biodiversity and Climate Research Centre. This company's expertise in phone survey guaranteed top quality in social data collection (45 well-trained professional interviewers took part in the survey) and fast and efficient data delivery. The survey was in the form of a Computer-Assisted Telephone Interview (CATI method) and targeted representative samples of the German population (n = 1000 respondents) and of the population in the wolf region (n = 250 respondents). The representativeness of both samples was based on the proportion of landline vs. mobile phones of the population, and the demographic structure of each population (age, sex, household size, city size and region of residence). The samples were drawn using the ADM-design (Arbeitsgemeinschaft ADM-Telefonstichproben), which is the highest quality for random telephone sample in Germany, and targeted people older than 18 years old from landline phone numbers and mobile phone numbers. Up to six contact attempts were made to reach respondents, who were selected according to the "last birthday in household" rule for landline numbers, or directly questioned for mobile phones, once reached. The interviews were conducted between the 12th of June and the 18th of July 2017 and lasted on average 15 minutes. In total, 31,024 random numbers were dialed with 25,035 failures, i.e. 19,246 were non-existent connections (62.0%), 351 were fax numbers (1.1%), 447 were company numbers (1.4%), 111 respondents did not speak German and 4880 came from Federal States that represented already sufficient number of questionnaires. Of the 5989 remaining phone numbers available for the survey, 2356 did not pick up the phone (39.3%). The survey therefore involved 3633 potential respondents, 2288 of whom declined the survey (63.0%, mostly because of a general lack of interest in phone surveys), and 96 left the survey (2.6%).

The 1250 respondents of this survey thus represented a response rate of 34.4%, which is a comparable number to other attitude surveys on large carnivores. Of these 1250 responses, 972 were associated with landline phones and 278 with mobile phones. We excluded 60 respondents unaware of wolf presence in Germany (5 in the wolf region, 55 in Germany respectively), and 344 additional questionnaires with incomplete answers (69 and 275 respectively), resulting in a final data set of 846 questionnaires suitable for analysis (176 and 670, respectively).

We applied one filter in the questionnaire to reduce its length when appropriate. Respondents unaware of wolf presence in Germany (“no” to question A1, see Methods S1) were exempted to answering questions of Sections A and B, as well as questions C3-4-5.

Table S1. Collinearity among categorical predictors (related to questions in the survey, see Methods S1) included in the multiple linear regression models, using the Cramer's V index of correlation (see Methods).

	B2	B3	C1	C2	C3	C4	C5	E2	E8	E9	E10	State	Data_set
B2	1												
B3	0.42	1											
C1	0.07	0.07	1										
C2	0.08	0.09	0.01	1									
C3	0.27	0.15	0.01	0.06	1								
C4	0.07	0.06	0.02	0.03	0.08	1							
C5	0.17	0.21	0.01	0.07	0.19	0.11	1						
E2	0.1	0.05	0	0.09	0.01	0.03	0.01	1					
E8	0.08	0.12	0.04	0.08	0.03	0	0.06	0.06	1				
E9	0.12	0.09	0.04	0.03	0.12	0.09	0.19	0.05	0.11	1			
E10	0.12	0.11	0.04	0.01	0.06	0.04	0.04	0.01	0.14	0.17	1		
State	0.18	0.14	0.13	0.14	0.33	0.06	0.24	0.14	0.16	0.17	0.15	1	
Data_set	0.33	0.17	0.02	0.02	0.33	0.04	0.24	0.03	0.06	0.11	0.05	0.87	1

Table S2. Collinearity among numeric predictors (related to questions in the survey, see Methods S1) included in the multiple linear regression models, using Pearson's coefficient (see Methods).

	Know- ledge	B1	B4	B5	E1	E3	E4	E5	E6	E7	Pop. Size	Distance
Knowledge	1											
B1	0.27	1										
B4	0.05	0.26	1									
B5	0.19	0.41	0.09	1								
E1	0.05	0.25	0.04	0.23	1							
E3	0.11	0.07	0.05	0.1	-0.01	1						
E4	0.02	0.02	-0.05	0.08	0.06	-0.02	1					
E5	0.08	0.03	0	-0.05	0	0.03	0.04	1				
E6	-0.04	0	0	0.04	0.1	-0.05	-0.04	-0.14	1			
E7	0.05	0.03	0.06	0	0	0	0.07	0.17	-0.15	1		
Pop. Size	-0.08	-0.1	0.03	-0.13	-0.06	0.07	-0.07	0.02	-0.05	0.03	1	
Distance	-0.23	-0.23	0.03	-0.28	-0.07	-0.02	-0.07	0.04	-0.09	0.02	0.16	1

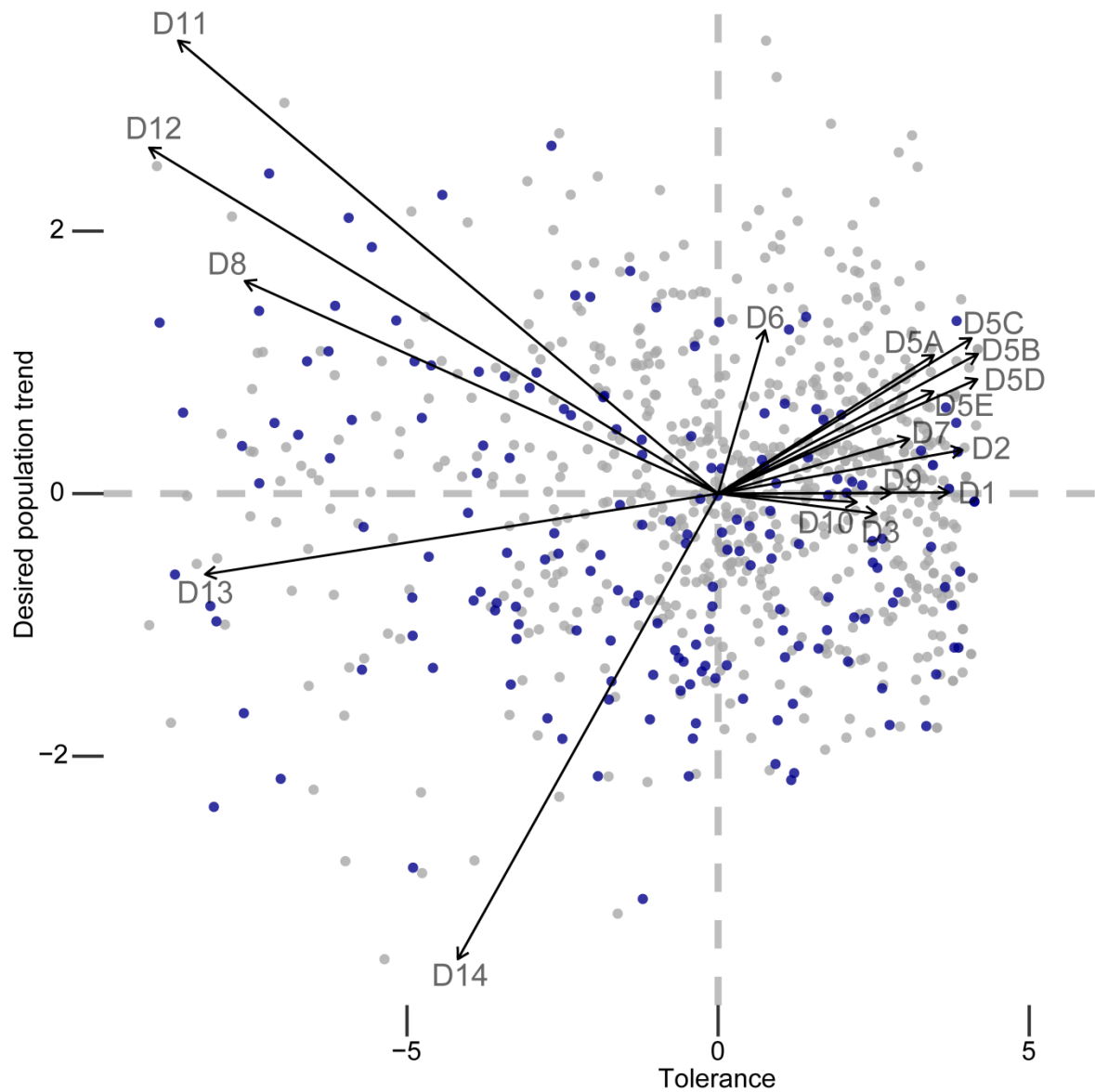


Figure S1. Principal Component Analysis biplot showing the distribution of respondents from Germany (grey colour) and from the wolf region (blue colour), along gradients of tolerance towards wolves (X-axis) and desired population trend (Y-axis). Arrows correspond to the questions related to attitudes towards wolves in the phone survey (Section D, see Methods S1).