
Supplementary information

Climate change increases predation risk for a keystone species of the boreal forest

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Climate change increases predation risk for a keystone species of the boreal forest

Nature Climate Change

Michael J. L. Peers¹, Yasmine N. Majchrzak¹, Allyson K. Menzies², Emily K. Studd², Guillaume Bastille-Rousseau³, Rudy Boonstra⁴, Murray Humphries², Thomas S. Jung^{5,6}, Alice J. Kenney⁷, Charles J. Krebs⁷, Dennis L. Murray⁸ and Stan Boutin¹

¹ *Department of Biological Sciences, University of Alberta, Edmonton, Alberta, Canada*

² *Department of Natural Resource Sciences, McGill University, Montreal, Quebec, Canada*

³ *Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, Colorado, USA*

⁴ *Department of Biological Sciences, University of Toronto Scarborough, Toronto, Ontario, Canada*

⁵ *Department of Environment, Government of Yukon, Whitehorse, Yukon, Canada*

⁶ *Department of Renewable Resources, University of Alberta, Edmonton, Alberta, Canada*

⁷ *Department of Zoology, University of British Columbia, Vancouver, British Columbia, Canada*

⁸ *Department of Biology, Trent University, Peterborough, Ontario, Canada*

Corresponding Author: Michael J L Peers (michaiejpeers@gmail.com)

This Supplementary Information includes:

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Supplementary Table 1. Proportion of mortalities during the winter from each cause of death for all individuals and separated by age-class. Not included are four mortalities suspected to have occurred from starvation. Values in brackets for each predator represent the proportion of mortalities where cause of death could be identified.

Group	Canada lynx	Coyote	Goshawk	Great-horned owl	Unknown Predator
All mortalities (153)	0.41 (0.59)	0.18 (0.25)	0.07 (0.09)	0.04 (0.06)	0.31
Sub-adult (47)	0.36 (0.52)	0.23 (0.33)	0.06 (0.09)	0.04 (0.06)	0.30
Adult (69)	0.51 (0.67)	0.19 (0.25)	0.03 (0.04)	0.03 (0.04)	0.25

Supplementary Table 2. Model selection of Cox proportional hazard models on overwinter hare survival showing the number of parameters (k), change in AIC_c from the best ranked model (ΔAIC_c), and Akaike model weights (w).

Model	k	ΔAIC_c	w
Temp + SD + SH + SD:SH	4	0	0.38
Temp + SD + SH + SD:SH + DSF	5	1.53	0.18
Temp + SD + SH + SD:SH + Days Since	5	1.89	0.15
Temp + SD + SH	3	2.76	0.10
Temp + SD + SH + SD:SH + DSF + Days Since	6	3.24	0.08
Temp + SD + SH + DSF	4	4.07	0.05
Temp + SD + SH + Days Since	4	4.46	0.04
Temp + SD + SH + DSF + Days Since	5	5.44	0.03
~1	0	17.89	0.00

Weather variables are: average daily temperature (Temp), snow depth (SD), sinking depth of the penetrometer (SH), daily snowfall (DSF), days since snowfall (Days Since), and an interaction between snow depth and hardness (SD:SH).

Supplementary Table 3. Model selection of Cox proportional hazard models stratified by mortality risk from lynx and coyote showing the number of parameters (k), change in AIC_c from the best ranked model (ΔAIC_c), and Akaike model weights (w).

Model	k	ΔAIC_c	w
Temp + SD + SH	6	0	0.63
Temp + SD + SH + DSF	8	1.87	0.25
Temp + SD + SH + Days Since	8	3.95	0.09
Temp + SD + SH + DSF + Days Since	10	5.57	0.04
~1	0	26.72	0.00

Supplementary Table 4. Model selection of Cox proportional hazard models stratified by age showing the number of parameters (k), change in AIC_c from the best ranked model (ΔAIC_c), and Akaike model weights (w).

Model	k	ΔAIC_c	w
Temp + SD + SH	6	0	0.60
Temp + SD + SH + Days Since	8	2.10	0.21
Temp + SD + SH + DSF	8	3.19	0.12
Temp + SD + SH + DSF + Days Since	10	4.63	0.06
~1	0	9.30	0.01

Supplementary Table 5. Modelled hazard ratios and 95% confidence intervals for each weather variable from the top all-cause and cause-specific models based on AIC_c. Bolded values indicate significant effects and italicized represents P values < 0.1.

Variable	All-Cause	Coyote	Canada lynx
Temp	0.987 (0.959, 1.016)	1.008 (0.917, 1.108)	<i>0.960 (0.920, 1.001)</i>
SD	1.019 (0.957, 1.077)	0.866 (0.776, 0.967)	0.992 (0.959, 1.025)
SH	1.233 (1.053, 1.445)	1.244 (1.060, 1.456)	0.998 (0.938, 1.063)
SD:SH	0.995 (0.991, 0.999)	NA	NA

Supplementary Table 6. Modelled hazard ratios and 95% confidence intervals for each weather variable on sub-adult and adult mortality risk from the top age-specific model based on AIC_c. Bolded values indicate significant effects and italicized represents P values < 0.1.

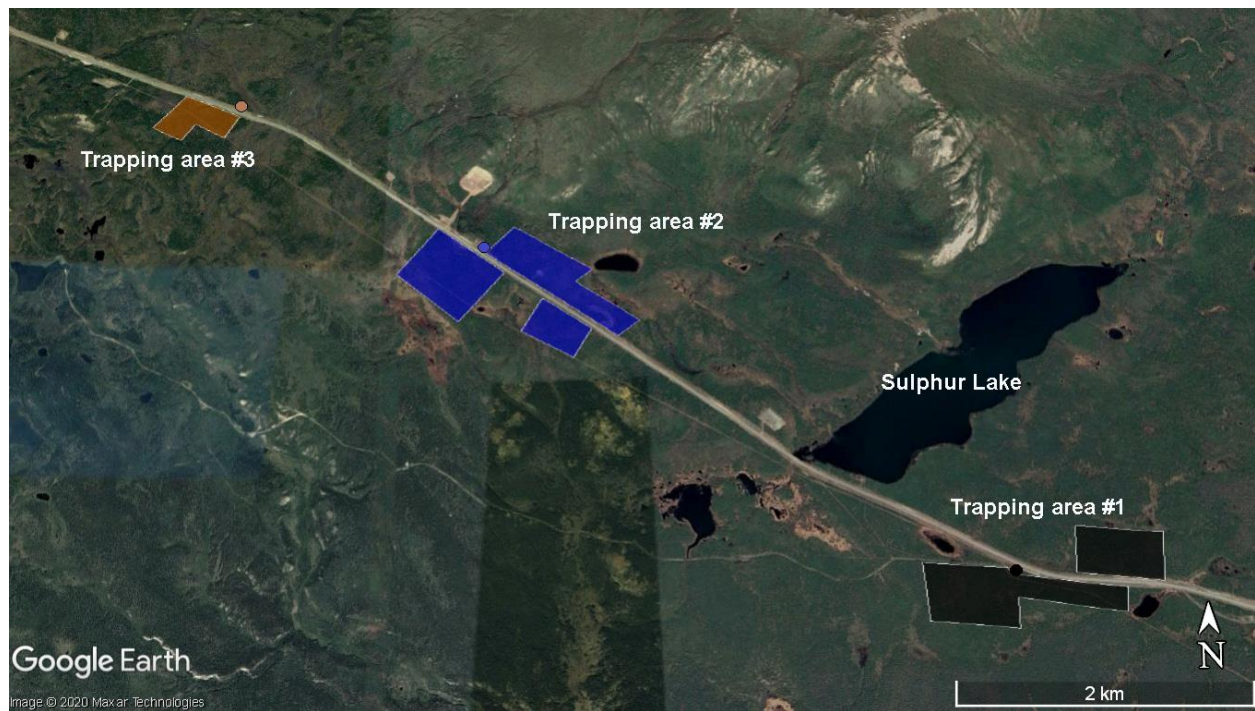
Variable	Sub-adult	Adult
Temp	0.974 (0.922, 1.028)	0.984 (0.944, 1.025)
SD	0.935 (0.889, 0.984)	<i>0.969 (0.938, 1.002)</i>
SH	1.035 (0.951, 1.125)	1.044 (0.986, 1.106)

Supplementary Table 7. Modelled hazard ratios and 95% confidence intervals for each weather variable from the top all-cause model treating missing individuals as mortality events, and cause-specific model that included unknown mortalities. Bolded values indicate significant effects and italicized represents P values < 0.1.

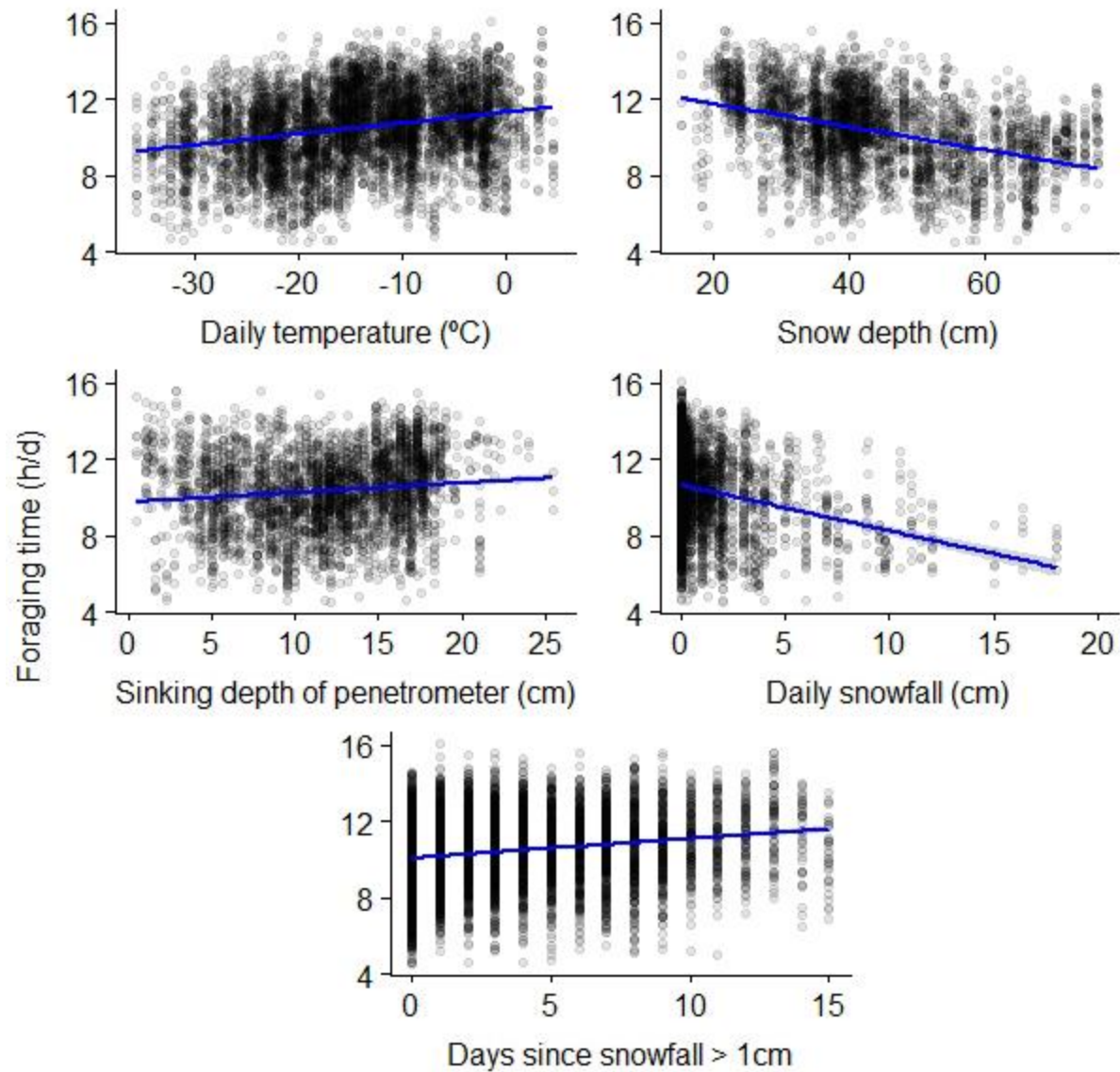
Variable	All-Cause	Coyote	Canada lynx
Temp	<i>0.974 (0.947, 1.001)</i>	1.008 (0.917, 1.108)	<i>0.960 (0.921, 1.001)</i>
SD	1.020 (0.968, 1.074)	0.867 (0.778, 0.968)	0.992 (0.960, 1.025)
SH	1.260 (1.084, 1.464)	1.242 (1.060, 1.457)	0.999 (0.938, 1.063)
SD:SH	0.995 (0.991, 0.999)	NA	NA

Supplementary Table 8. Model selection of Cox proportional hazard models on overwinter hare survival that consider weather variables from the top model, year, or cycle phase. Displayed are the number of parameters (k), change in AIC_c from the best ranked model (ΔAIC_c), and Akaike model weights (w).

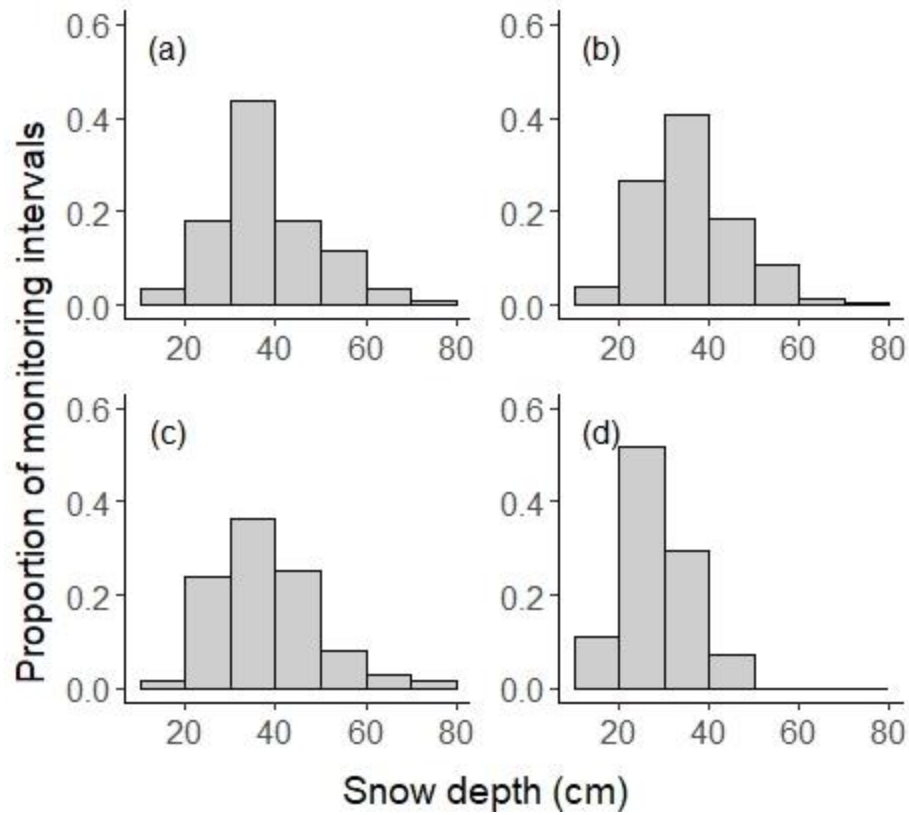
Model	k	ΔAIC_c	w
Weather variables	4	0	1.0
Cycle phase	2	11.51	0.0
Study year	3	13.08	0.0
~1	0	17.89	0.0



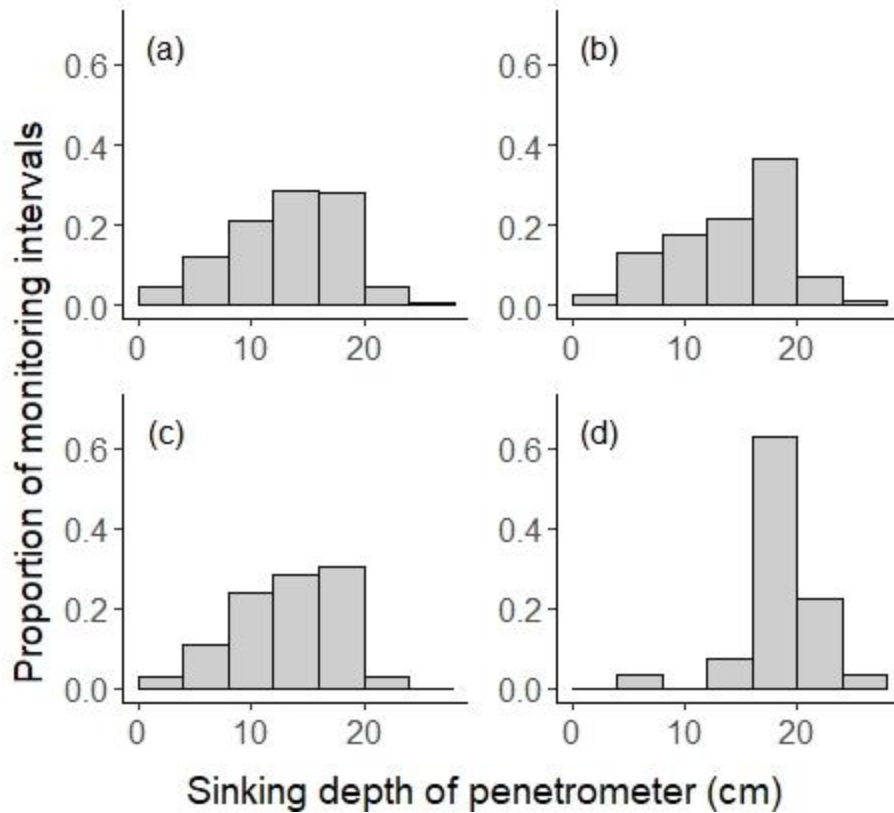
Supplementary Figure 1. Location of the three trapping areas in the Kluane lake region, Yukon (Lat: 60.9 N, Long: -138.0 W). Shaded areas (brown, blue, black) represent the three locations where snowshoe hares were monitored for survival, and the corresponding coloured dot represents the locations where snow conditions were measured for each trapping area.



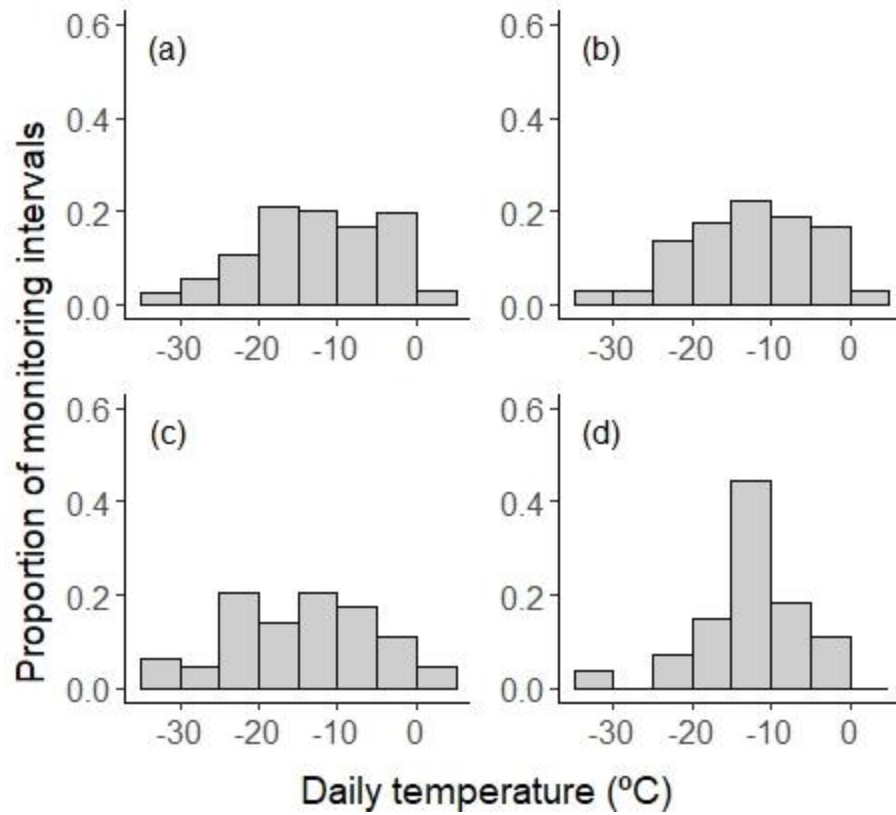
Supplementary Figure 2. Influence of each weather variable on daily foraging time (hours) for snowshoe hares in the Kluane Lake region, Yukon, across the three study years.



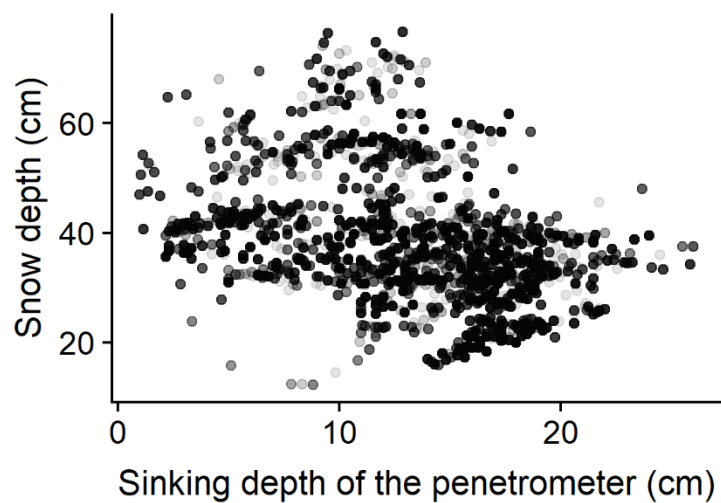
Supplementary Figure 3. Proportion of monitoring intervals that resulted in a) survival, b) death, c) death from Canada lynx, and d) death from coyote, over snow depths.



Supplementary Figure 4. Proportion of monitoring intervals that resulted in a) survival, b) death, c) death from Canada lynx, and d) death from coyote, over snow hardness which is measured as the sinking depth of a penetrometer.



Supplementary Figure 5. Proportion of monitoring intervals that resulted in a) survival, b) death, c) death from Canada lynx, and d) death from coyote, over the daily temperature.



Supplementary Figure 6. Snow conditions (i.e. snow depth and snow hardness) for each monitoring interval (n=14736) in our survival data.