SUPPORTING INFORMATION - APPENDIX 1

Fig S1. Map showing the home ranges (as minimum convex polygons) of all individuals in the

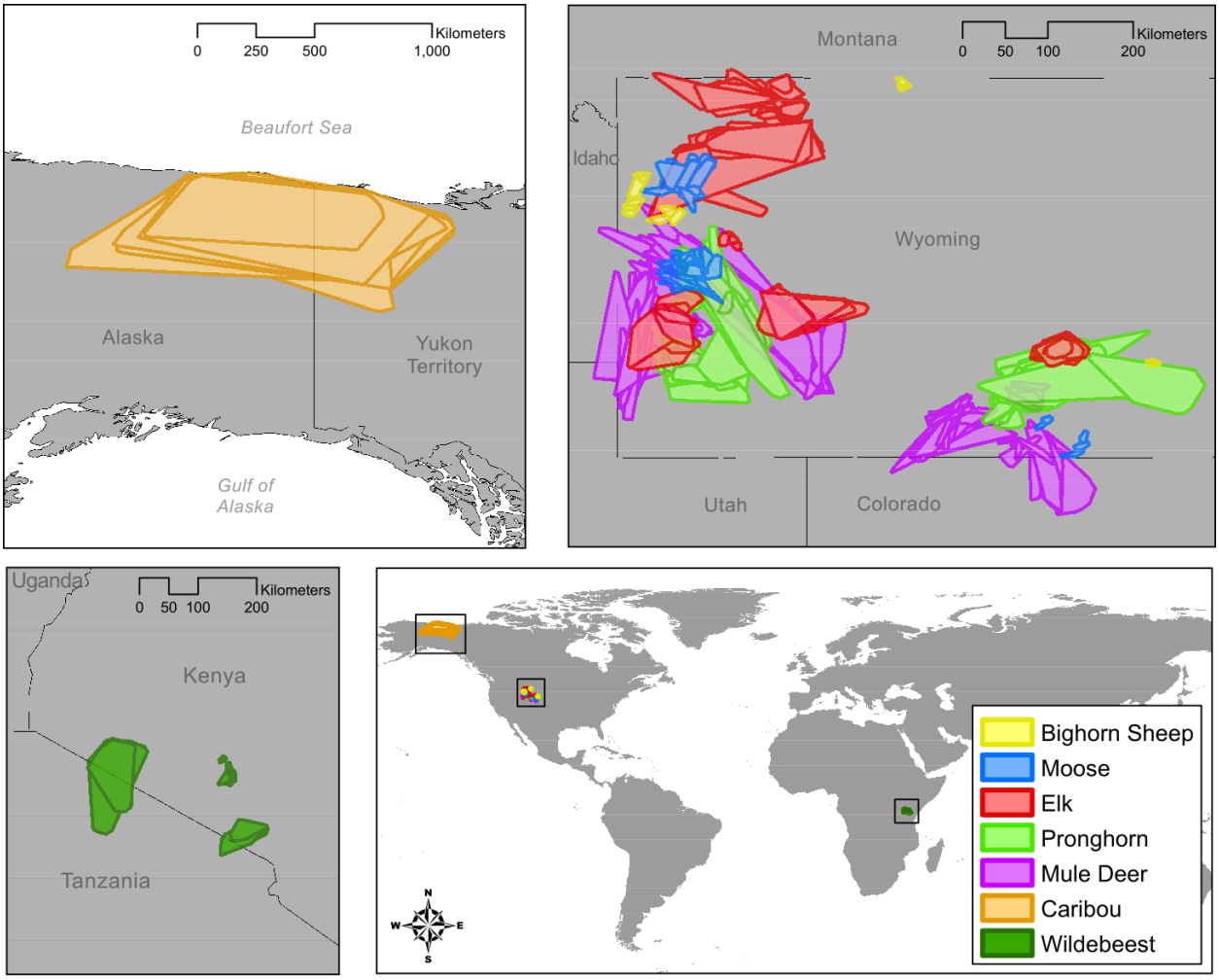
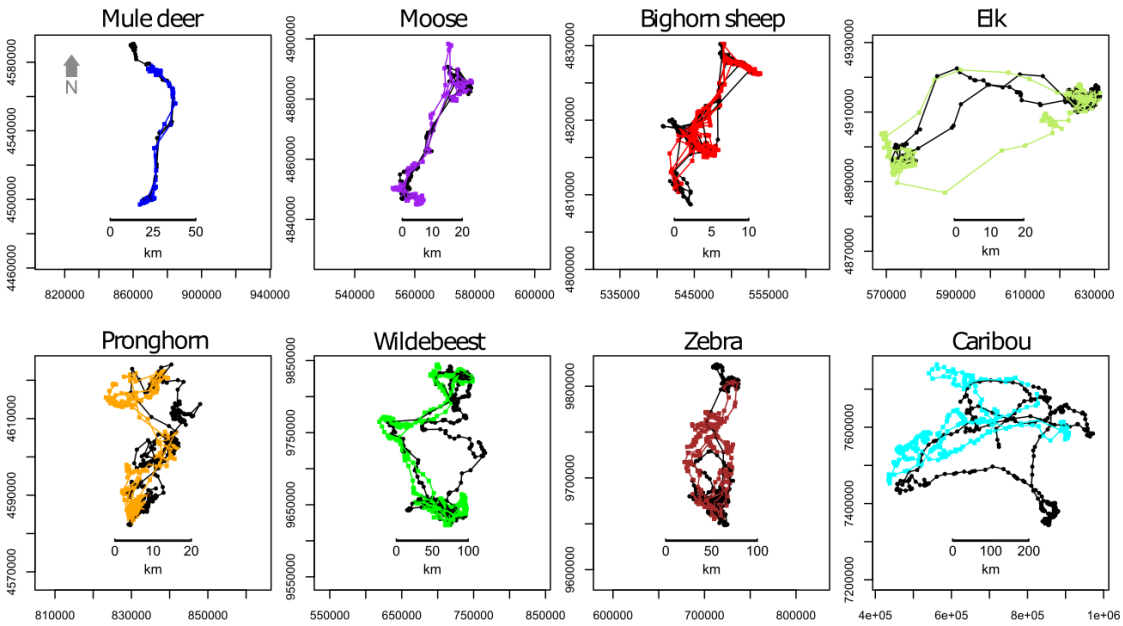


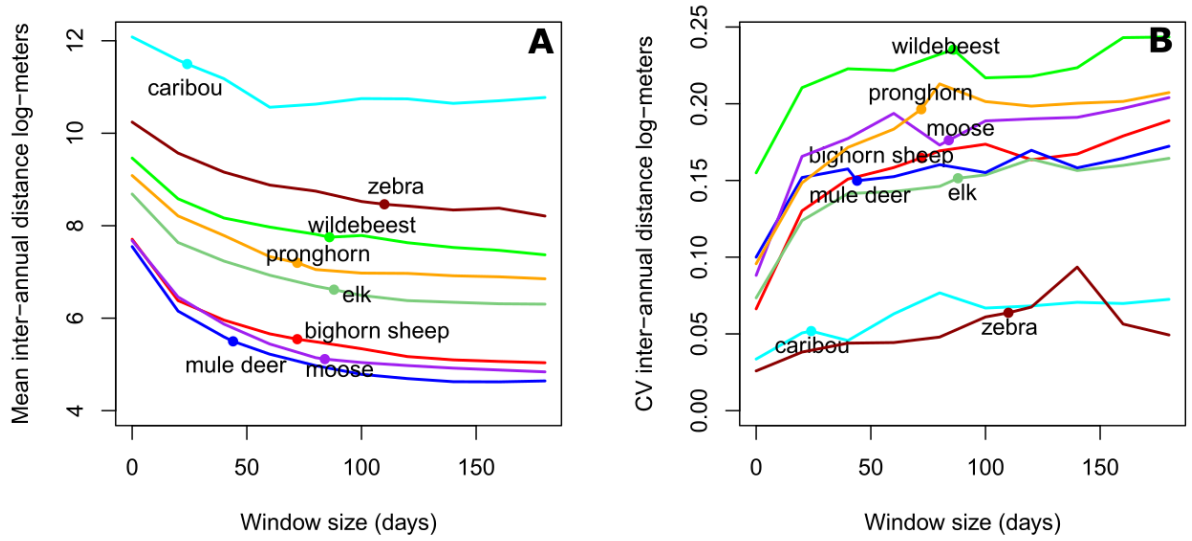
Fig. S2. Example trajectories illustrating variation in the strength of inter-year site fidelity across two years. Data come from a representative individual mule deer, moose, bighorn sheep, elk, pronghorn, wildebeest, zebra and caribou. Trajectories are shaded black in year 1 and coloured in year 2.



Sensitivity of site fidelity metric to inter-annual variability

Our analysis of site fidelity attempted to account for variation in the timing of movements across years by calculating fidelity within a moving window of time. We examined the sensitivity of our metric of site fidelity (inter-annual distance log-meters) to variation in the size of the window across the eight ungulate species (Fig. S1). We varied the size of the window over which the focal location in year$_t$ was compared to the set of locations in year$_{t\text{-}1}$, and calculated the mean inter-annual distance per individual, then the mean of all individuals across species.

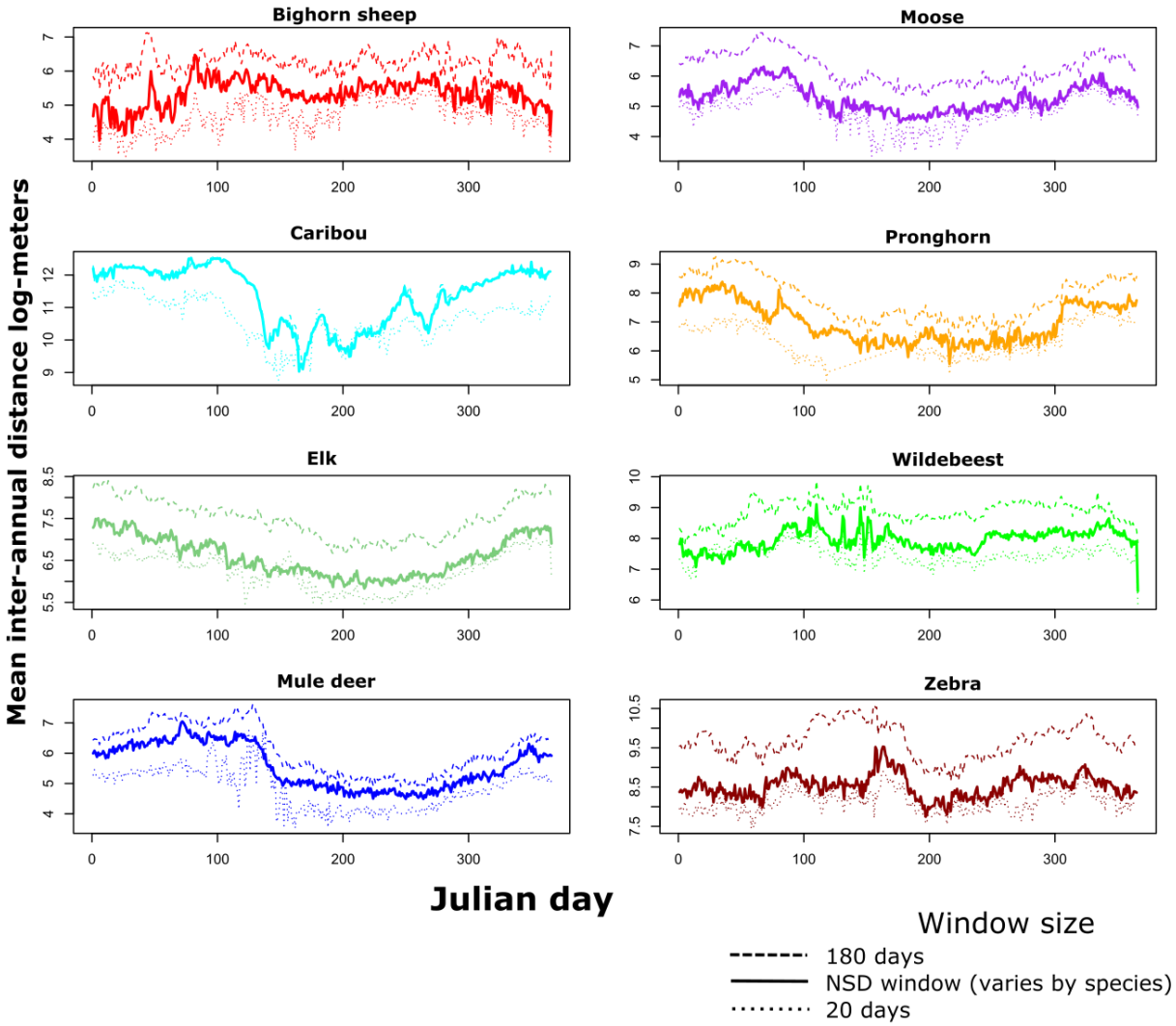
Our results show that inter-annual distances were relatively insensitive to changes in the window size, particularly for window sizes larger than roughly >25-40 days. The proportional change in inter-annual distance between the selected window and the maximum window (180 days) was relatively small: bighorn sheep (0.092), caribou (0.063), elk (0.047), mule deer (0.156), moose (0.054), pronghorn (0.048), wildebeest (0.049) and zebra (0.030). Caribou inter-annual distances increased slightly at larger window sizes because of sampling variance caused by relatively small sample sizes (i.e. number of individuals) at large window sizes. The coefficient of variation also saturated after roughly 25 days, except in bighorn sheep and elk. Relative patterns of site fidelity across Julian dates were generally insensitive to variation in window sizes (Fig S2).



28

29 **Fig. S3.** Sensitivity of the site fidelity metric (inter-annual distance log-meters) across a range of
30 temporal window sizes. (A) mean inter-annual distances across individuals and (B) coefficient of
31 variation of inter-annual distances across individuals. The large dots indicate the window sizes
32 used in the study for each species, and reflect the mean variability (SD) in movement timing
33 across consecutive years, as identified by fitting models of net squared displacement to
34 movement data and estimating phenological parameters associated with saltatory movements
35 (see Methods in main text; Table 1).

36



37

38 **Fig. S4.** Site fidelity (inter-annual distance log-meters) as a function of Julian date, across three
39 window sizes: 180 days (dashed lines), 20 days (dotted line) and species-specific window sizes,
40 identified by net-squared displacement.

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Sensitivity of model results to window size

We re-ran the five linear mixed effects models to determine if main results of our study (*c.f.* Table 2) were sensitive to window size decisions. We chose two window sizes (40 days and 120 days) and re-ran all models using a similar approach as the main study. We chose window size of 40 days because the site fidelity metric (*IYD*) stabilized after 25-40 days, as noted above. Window sizes larger than 120 days became data limiting, as larger window sizes required longer GPS datasets for each individual.

Window size did not qualitatively change the main results of the study (Tables S1 & S2), with the exception of Model 4 that tested whether site fidelity was related to *Days from peak IRG*. Similar to the main study findings, the strongest driver of *IYD* across all window sizes was *Temporal periodicity* which showed a strong negative effect on *IYD* with no significant interactions with species. *Temporal constancy* also had no effect on *IYD* in either window size, while *Spatial constancy* was negatively related to *IYD*. The effect of *Spatial constancy* interacted with species in a similar way as the findings from the main text: elk, mule deer and moose were predicted to increase with *Spatial constancy*. The effect of *Days from peak IRG* on *IYD* was not detectable as an interaction with mule deer, suggesting this result is not as robust as those involving predictability metrics. Finally, we found no effect of *Age* on *IYD* in any window size.

Table S1. Summary of coefficient estimates (β) and standard errors (SE) from general linear mixed-models of inter-year site fidelity for Window size of 40 days applied to all species. Confidence intervals of β that did not overlap zero at the 0.05 (bold) levels.
*Model selection with AIC suggested *Age* model lacked an age effect.

	Model	1. *Constancy time*		2. *Constancy space*		3. *Temporal contingency*		4. *Days from peak IRG*		5. *Age*	
		β	SE	β	SE	β	SE	β	SE	β	SE
	(Intercept)	**3.74**	**1.08**	**5.29**	**0.50**	**6.63**	**0.89**	**4.84**	**0.89**	**5.19**	**0.72**
Focal variable	Constancy time	2.08	3.52								
	Constancy space			**-8.33**	**4.01**						
	Periodicity					**-3.85**	**1.59**				
	Days from peak IRG							-0.03	0.02		
	Age									-0.05	0.09
Species	Caribou	2.93	2.64	**2.97**	**1.25**						
	Elk	1.04	1.18	-0.52	0.54	-0.47	1.46	-1.04	1.16	**-1.00**	**0.56**
	mule deer	-0.48	1.13	**-1.76**	**0.52**	-1.36	1.79	-0.62	1.36	-1.36	0.52
	moose	-0.38	1.42	**-1.66**	**0.59**	0.09	2.99	-1.47	1.15	**-1.55**	**0.63**
	pronghorn	0.18	1.34	0.56	0.62	-1.31	20.13	0.57	1.37		
	wildebeest	3.21	2.37	2.79	2.44	2.52	2.14				
	zebra	-0.38	6.77	1.52	1.22	-3.19	7.09				
Focal x species interactions	Focal variable x caribou	0.09	11.64	0.72	9.94						
	Focal variable x elk	-1.95	3.98	**9.41**	**4.40**	2.10	2.47	0.05	0.04	0.14	0.10
	Focal variable x mule deer	-0.31	3.72	**10.62**	**4.22**	1.93	2.84	0.03	0.06	0.03	0.10
	Focal variable x moose	1.18	5.75	**12.72**	**5.00**	0.31	4.63	0.05	0.05	0.10	0.10
	Focal variable x pronghorn	0.82	3.99	5.71	4.42	3.23	31.03	-0.02	0.06		
	Focal variable x wildebeest	-7.64	13.19	-4.45	16.91	-3.18	5.28				
	Focal variable x zebra	15.07	44.93	3.45	8.25	12.17	20.12				
	Home range (log-km)	0.42	0.06	0.40	0.06	0.37	0.07	0.52	0.11	0.42	0.10
Random effects	sd_(Intercept).pop	0.23		0.28		0.32		0.66		0.21	
	sd_Observation.Residual	0.81		0.80		0.78		1.12		0.81	

Table S2. Summary of coefficient estimates (β) and standard errors (SE) from general linear mixed-models of inter-year site fidelity for Window size of 120 days applied to all species. Bold indicates 95% confidence intervals of β do not overlap zero.

Model		1. *Constancy time*		2. *Constancy space*		3. *Temporal contingency*		4. *Days from peak IRG*		5. *Age*	
		β	SE	β	SE	β	SE	*B*	SE	β	SE
	(Intercept)	**2.09**	**1.34**	**5.19**	**0.61**	**7.57**	**1.11**	**3.62**	**0.88**	**3.79**	**0.78**
Focal variable	Constancy time	5.45	4.30								
	Constancy space			**-13.38**	**4.53**						
	Periodicity					**-6.41**	**1.98**				
	Days from peak IRG							-0.02	0.02		
	Age									-0.09	0.11
Species	Caribou	-6.83	9.63	**-6.19**	**4.43**						
	Elk	1.64	1.44	**-1.24**	**0.69**	-0.60	1.75	-0.09	1.29	-0.98	0.60
	mule deer	0.29	1.42	**-2.57**	**0.66**	-1.67	2.08	0.16	2.33	**-1.18**	**0.55**
	moose	0.57	1.74	**-1.99**	**0.75**	-2.35	3.54	-1.23	1.15	**-1.44**	**0.66**
	pronghorn	0.47	1.70	0.59	0.99	3.05	22.82	-1.55	1.72		
	wildebeest	**5.44**	**2.82**	4.24	3.09	2.47	2.53				
	zebra	2.30	7.44	0.46	1.42	-5.46	8.05				
Focal x species interactions	Focal variable x caribou	48.14	43.84	**76.88**	**33.87**						
	Focal variable x elk	-3.46	4.80	**16.27**	**5.08**	2.94	2.97	-0.03	0.05	0.18	0.12
	Focal variable x mule deer	-3.35	4.63	**16.36**	**4.80**	2.76	3.33	-0.11	0.14	0.05	0.12
	Focal variable x moose	-1.46	6.91	**16.59**	**5.72**	4.71	5.51	0.03	0.05	0.18	0.13
	Focal variable x pronghorn	0.44	5.00	**10.87**	**5.60**	-2.63	35.17	0.08	0.09		
	Focal variable x wildebeest	-17.95	15.44	**-12.39**	**21.01**	-3.11	6.17				
	Focal variable x zebra	0.07	49.23	11.75	9.05	17.89	22.81				
	Home range (log-km)	**0.40**	**0.07**	**0.37**	**0.07**	**0.28**	**0.08**	**0.64**	**0.15**	**0.56**	**0.12**
Random effects	sd_(Intercept).pop	0.36		0.51		0.44		0.45		0.00	
	sd_Observation.Residual	0.89		0.87		0.89		1.12		0.90	