Supplementary Information

Spatial memory predicts home range size and predation risk in pheasants

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Supplementary Table 1. Comparison of AICc outputs from linear model selection on spatial memory model of core home range size.

Independent variables	k	AICc	ΔAICc	AICc weights	Cumulative AICc weights	Log-likelihood
Lifespan + Ref. memory	4	154.11	0	0.57	0.57	-72.54
Lifespan	3	156.36	2.25	0.19	0.76	-74.88
Lifespan + Ref. memory + Work. memory	5	156.51	2.4	0.17	0.93	-72.47
Lifespan + Ref. memory + Work. memory + Sex	6	158.88	4.76	0.05	0.98	-72.3
Lifespan + Work. memory*Ref. memory + Sex	7	160.96	6.85	0.02	1	-71.93

Supplementary Table 2. Comparison of AICc outputs from linear model selection on associative learning model of core home range size.

Independent variables	k	AICc	ΔAICc	AICc weights	Cumulative AICc weights	Log-likelihood
Lifespan + Sex	4	181.98	0	0.66	0.66	-86.59
Lifespan	5	184.24	2.26	0.21	0.87	-86.51
Lifespan + Assoc. learning + Sex	3	185.3	3.32	0.13	1	-89.41

Supplementary Table 3. Summary statistics of final best linear models selected from AICc model selection procedure on cognitive predictors of core home range size. P values are two-tailed and uncorrected for multiple testing.

Model	Term (contrast)	Estimate ± SE	SE	F	df	Uncorrected P
Core HR size ~ Spatial memory ($F_{2,41}=4.01$, R^2adj.=0.123, p=0.026)	Intercept	0.02	0.58	0.00	2,41	0.976
	Reference memory	-0.52	0.24	4.59	2,41	0.038
	Lifespan	0.01	0.01	3.66	2,41	0.063
Core HR size ~ Associative learning ($F_{2,52}=9.15$, R^2=0.232, p=0.001)	Intercept	-0.52	0.40	1.68	2,52	0.200
	Sex (males)	0.79	0.33	5.63	2,52	0.021
	Lifespan	0.02	0.01	10.14	2,52	0.002

Supplementary Table 4. Comparison of AICc outputs from linear model selection on spatial memory model of peripheral home range size.

Independent variables	k	AICc	ΔAICc	AICc weights	Cumulative AICc weights	Log-likelihood
Lifespan + Ref. memory	4	156.17	0	0.47	0.47	-73.57
Lifespan	3	156.85	0.68	0.33	0.8	-75.12
Lifespan + Ref. memory + Work. memory	5	158.62	2.45	0.14	0.94	-73.52
Lifespan + Ref. memory*Work. memory	6	160.55	4.39	0.05	0.99	-73.14
Lifespan + Work. memory*Ref. memory + Sex	7	163.4	7.23	0.01	1	-73.14

Supplementary Table 5. Comparison of AICc outputs from linear model selection on associative learning model of peripheral home range size.

Independent variables	k	AICc	ΔAICc	AICc weights	Cumulative AICc weights	Log-likelihood
Lifespan + Sex	4	184.57	0	0.52	0.52	-87.89
Lifespan	3	185.92	1.35	0.26	0.78	-89.73
Lifespan + Assoc. learning + Sex	5	186.27	1.7	0.22	1	-87.52

Supplementary Table 6. Summary statistics of cognitive predictors of the size of the peripheral home range. Parentheses under 'Model' column denote the number of final models selected by our AICc model selection approach that were used to calculate the averaged outputs reported here. P values are two-tailed and uncorrected for multiple testing.

Model	Term (contrast)	Estimate	SE	Adj. SE	z	Uncorrected P
Peripheral HR size	Intercept	1.34	0.61	0.62	2.15	0.032
~ spatial	Ref. memory	-0.25	0.29	0.29	0.87	0.384
Memory (x2)	Lifespan	0.01	0.01	0.01	1.89	0.059
Peripheral HR size	Intercept	0.65	0.47	0.48	1.35	0.177
~ Assoc. learning	Sex (males)	0.48	0.41	0.41	1.15	0.251
(x2)	Lifespan	0.02	0.01	0.01	3.62	<0.001
	Assoc. learning	-0.78	2.50	2.54	0.31	0.759

Supplementary Table 7. Comparison of AICc outputs from generalised linear (binomial) model selection on spatial memory variables predicting overlap of core home range with high predation zone.

Independent variables	k	AICc	ΔAICc	AICc weights	Cumulative AICc weights	Log-likelihood
Core home range	2	6.86	0	0.75	0.75	-1.2
Core home range + Ref. memory	3	9.63	2.77	0.19	0.94	-1.33
Core home range + Ref. memory + Sex	4	12.33	5.46	0.05	0.99	-1.33
Core home range + Ref. memory + Work. Memory + Sex	5	15.23	8.37	0.01	1	-1.31
Core home range + Ref. memory * Work. Memory + Sex	6	18.34	11.48	0	1	-1.26

Supplementary Table 8. Comparison of AICc outputs from generalised linear (binomial) model selection on associative learning variables predicting overlap of core home range with high predation zone.

Independent variables	k	AICc	ΔAICc	AICc weights	Cumulative AICc weights	Log-likelihood
Core HR	2	9.91	0	0.73	0.73	-2.79
Core HR + Sex	3	12.44	2.53	0.21	0.93	-2.89
Core HR + Sex + Assoc. learning	4	15.1	5.19	0.05	0.99	-2.98

Supplementary Table 9. Summary statistics from single best binomial model on spatial memory variables predicting proportion of the core home range that overlapped with the region of high predation risk. P values are two-tailed and uncorrected for multiple testing.

Model	Term	Estimate	SE	z	Uncorrected P
Proportion HR that overlaps with high-risk region ~ spatial memory	Intercept	1.61	0.43	3.72	<0.001
	Core HR size	-0.03	0.02	-1.88	0.060

Supplementary Table 10. Summary statistics from single best binomial model on associative learning predicting proportion of the core home range that overlapped with the region of high predation risk. P values are two-tailed and uncorrected for multiple testing.

Model	Term	Estimate	SE	z	Uncorrected P
Proportion HR that overlaps with high-risk region ~ assoc. learning	Intercept	3.32	0.87	3.82	<0.001
	Core HR size	<0.01	0.00	-2.20	0.028

Supplementary Table 11: Summary statistics of Cox hazards survival models selected from AICc model selection procedure on spatial memory predictors of predation by ambush predators.

Independent variables	k	AICc	ΔAICc	AICc weights	Cumulative AICc weights	Log-likelihood
Ref. memory * Work. memory	3	101.66	0	0.76	0.76	-47.55
Sex + Ref. memory * Work. memory	4	104.01	2.36	0.23	1	-47.54
Ref. memory + Work. memory	2	112.95	11.29	0	1	-54.34

Supplementary Table 12: Summary statistics of Cox hazards survival models selected from AICc model selection procedure on associative learning predictors of predation by ambush predators.

Independent variables	k	AICc	ΔAICc	AICc weights	Cumulative AICc weights	Log-likelihood
(Intercept only)	0	96.1	0	0.65	0.65	-48.05
Sex	1	97.95	1.85	0.26	0.9	-47.93
Sex + Assoc. learning	2	99.94	3.84	0.1	1	-47.85

Supplementary Table 13. Summary statistics (Cox proportional hazards models) of single best model of spatial memory predictors of predation by ambush predators. R^2= 0.552. P values are two-tailed and uncorrected for multiple testing.

Model	Term	Estimate	SE	z	Uncorrected P
Survival analysis on spatial memory	Working memory	-0.45	0.59	-0.77	0.444
	Reference memory	-1.02	0.44	-2.31	0.021
	Reference memory x Working memory	-2.98	0.90	-3.31	<0.001

Supplementary Table 14. Summary statistics (Cox proportional hazards models) of averaged best models of associative learning predictors of predation by ambush predators in pheasants (R^2 of best model= 0.015). Parentheses denote number of final models averaged to obtain summary statistics. P values are two-tailed and uncorrected for multiple testing.

Model	Term (contrast)	Estimate	SE	Adj. SE	z	Uncorrected P
Survival analysis	Intercept	1.34	0.61	0.62	2.15	0.032
~ associative learning (x2)	Sex	-0.25	0.29	0.29	0.87	0.384

References

1. Nakagawa, S. A farewell to Bonferroni: The problems of low statistical power and publication bias. *Behavioral Ecology* **15**, 1044–1045 (2004).