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Trophic niche divergence reduces survival in an omnivorous rodent

APPENDIX

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Table S1 Stable carbon and nitrogen isotope values of potential food sources for *Apodemus semotus*. The tissues used for isotope analysis were fruiting body for fungi, leaves for plants and whole body for arthropods. The number of individuals sampled from each grid is listed under the column "N" in parenthesis; the letters A, B and C denote the three trapping grids. The isotope values of the fungi and C3 plants plotted in Fig. 4 in the main article were calculated at the level of taxa. For example, the mean isotope values of the fungi were the means of the eight morphospecies listed here.

Type	Taxon	N	$\delta^{13}C$ (± SE) ‰	$\delta^{15}N$ (± SE) ‰
Fungi	sp.1	A (1), B (1)	-21.5±1.0	0.1±1.2
	sp.2	A (1), B (1)	-24.8±0.6	-2.0±1.4
	sp.3	A (1), B (1), C (1)	-22.8±0.9	-0.4±0.5
	sp.4	A (1), B (1), C (1)	-22.6±0.2	0.1±0.8
	sp.5	A (1), B (1), C (1)	-21.8±0.6	3.0±2.8
	sp.6	B (1), C (1)	-23.2±0.4	1.5±2.0
	sp.7	B (1), C (1)	-23±0.7	5.3±2.9
	sp.8	B (1)	-22.4	7.7
C3 plant	*Ailanthus altissima*	A (1)	-30.8	-2.9
	Cynanchum boudieri	A (1), B (1)	-30.7±0.8	-3.0±0.8
	Rhamnus parvifolia	A (1)	-31.1	-4.7
	Arundo formosana	A (1), C (2)	-28.5±0.8	-2.4±0.6
	Clematis grata	A (1), C (1)	-29.1±0.1	-3.3±0.1
	Elaeagnus thunbergii	A (1), C (1)	-29.6±1.0	-1.2±0.2
	Rubus croceacanthus	C (1)	-28.3	-2.7
	Pinus taiwanensis	A (1), B (1), C (1)	-28.6±0.3	-3.9±0.6
	Prunus taiwaniana	B (1), C (1)	-29.1±0.1	-1.9±3.5
	Senecio scandens	B (1), C (1)	-33.2±0.1	-4.4±0.1
	Spiraea prunifolia	B (1)	-31.5	-4.2
	Rosa taiwanensis	B (1), C (1)	-29.2±0.7	-4.4±0.2
	Quercus variabilis	B (1)	-27.9	-2.7
	Rubus niveus	C (1)	-30.0	-5.5
	Ulmus uyematsui	C (1)	-26.9	-4.8
	Celastrus kusanoi	C (2)	-32.0±0.1	-6.1±0.0
	Deutzia pulchra	A (1), B (1), C (1)	-30.4±0.5	-2.9±0.3
C4 plant	*Miscanthus* spp.	A (1), B (1), C (1)	-12.9±0.2	-3.4±0.1
Arthropod	Aranae	A (7), B (8), C (6)	-23.2±0.3	4.8±0.4
	Collembola	A (1), B (1), C (1)	-25.2±0.3	0.2±0.6
	Formicidae	A (1), B (1), C (1)	-23.1±0.5	4.1±1.9
	Isopoda	A (6), B (6), C (6)	-23.9±0.2	0.7±0.4
	Oligochaeta	A (1), B (1), C (1)	-23.7±0.6	2.1±0.7
	Tetrigidae	A (1), C (1)	-26.9±1.6	-0.9±0.8

Table S2 Capture history of *Apodemus semotus* from August 2010 to June 2011 and stable carbon and nitrogen isotope values of their hair tissues. The majority of the individuals were captured in only one of the three trapping grids (labeled as A, B and C) throughout the study. The number "1" or "0" indicates that an individual was captured (1) or not captured (0) during a trapping session. The ear tag numbers of the 100 individuals analyzed in this study are marked with asterisks.

Ear tag	Aug.	Oct.	Dec.	Feb.	Apr.	Jun.	Grid	$\delta^{13}C$ ‰	$\delta^{15}N$ ‰
706	1	1	1	1	1	1	C	-22.3	3.9
714	1	1	1	1	1	1	C	-24.8	7.3
715	1	1	1	1	1	0	B	-22.8	6.5
922	1	1	1	1	1	1	C	-24.6	4.3
959*	1	1	1	1	1	1	B	-22.0	2.9
976*	1	1	1	1	1	0	C	-23.8	6.6
958	1	1	1	1	0	0	B	-22.5	5.4
995*	1	1	1	1	0	0	C	-23.6	7.8
785*	1	1	1	0	0	0	A	-23.0	7.3
971*	1	1	1	0	0	0	A	-23.6	10.8
980	1	1	0	1	1	1	C	-23.2	3.9
723*	1	1	0	0	0	0	A	-	-
729	1	1	0	0	0	0	A	-20.8	3.3
782*	1	1	0	0	0	0	A	-	-
784	1	1	0	0	0	0	A	-22.9	3.4
903	1	1	0	0	0	0	B	-23.4	4.5
916	1	1	0	0	0	0	C	-	-
917	1	1	0	0	0	0	C	-24.0	4.0
918	1	1	0	0	0	0	C	-	-
920	1	1	0	0	0	0	C	-21.8	3.4
984*	1	1	0	0	0	0	B	-	-
957*	1	0	0	1	0	0	B	-	-
712	1	0	0	0	0	0	C	-	-
758	1	0	0	0	0	0	C	-23.7	7.2
770*	1	0	0	0	0	0	B	-23.6	7.9
772*	1	0	0	0	0	0	B	-25.0	12.7
774*	1	0	0	0	0	0	B	-	-
777*	1	0	0	0	0	0	A	-	-
779*	1	0	0	0	0	0	A	-	-
780*	1	0	0	0	0	0	A	-23.5	2.5
781	1	0	0	0	0	0	A	-24.9	2.6
783	1	0	0	0	0	0	A	-24.4	2.2
786	1	0	0	0	0	0	A	-	-
788	1	0	0	0	0	0	A	-24.8	2.1
789*	1	0	0	0	0	0	A	-22.5	2.9
791*	1	0	0	0	0	0	B	-22.4	5.3
792	1	0	0	0	0	0	B	-24.2	2.3
793	1	0	0	0	0	0	B	-20.0	3.5

Ear tag	Aug.	Oct.	Dec.	Feb.	Apr.	Jun.	Grid	$\delta^{13}C$ ‰	$\delta^{15}N$ ‰
794*	1	0	0	0	0	0	B	-23.7	4.1
795*	1	0	0	0	0	0	B	-	-
797	1	0	0	0	0	0	B	-	-
798	1	0	0	0	0	0	B	-	-
800	1	0	0	0	0	0	C	-23.9	7.4
881	1	0	0	0	0	0	B	-23.7	2.6
904*	1	0	0	0	0	0	B	-	-
905	1	0	0	0	0	0	B	-	-
907*	1	0	0	0	0	0	A	-	-
908*	1	0	0	0	0	0	A	-	-
910	1	0	0	0	0	0	C	-	-
911*	1	0	0	0	0	0	C	-	-
912*	1	0	0	0	0	0	C	-24.7	11.8
915	1	0	0	0	0	0	C	-21.7	7.4
923*	1	0	0	0	0	0	C	-	-
949*	1	0	0	0	0	0	C	-23.6	3.2
950*	1	0	0	0	0	0	B	-24.3	8.2
954	1	0	0	0	0	0	A	-	-
955	1	0	0	0	0	0	A	-25.2	11.9
956*	1	0	0	0	0	0	B	-	-
960	1	0	0	0	0	0	B	-	-
962*	1	0	0	0	0	0	A	-	-
963	1	0	0	0	0	0	A	-	-
964*	1	0	0	0	0	0	B	-	-
967*	1	0	0	0	0	0	B	-	-
968	1	0	0	0	0	0	A	-23.6	10.4
970	1	0	0	0	0	0	A	-24.1	0.9
977*	1	0	0	0	0	0	C	-22.8	6.5
981*	1	0	0	0	0	0	C	-	-
982	1	0	0	0	0	0	B	-	-
983*	1	0	0	0	0	0	B	-21.0	5.0
987*	1	0	0	0	0	0	B	-23.5	8.0
988*	1	0	0	0	0	0	B	-	-
990*	1	0	0	0	0	0	B	-	-
992*	1	0	0	0	0	0	A	-	-
994*	1	0	0	0	0	0	C	-	-
999*	1	0	0	0	0	0	C	-	-
653	0	1	1	1	1	1	A	-	-
656	0	1	1	1	1	0	C	-23.4	3.4
679	0	1	1	1	1	0	C	-	-
696*	0	1	1	1	1	0	B	-22.9	5.1
953*	0	1	1	1	1	0	B	-23.7	7.4
972*	0	1	1	1	1	1	BC	-23.4	7.5
975*	0	1	1	1	1	0	C	-22.9	6.3
651*	0	1	1	1	0	0	A	-24.9	2.4
685*	0	1	1	1	0	0	B	-23.9	6.8
938*	0	1	1	1	0	0	B	-23.8	5.0
608	0	1	1	0	0	0	B	-25.4	1.3
694	0	1	1	0	0	0	B	-24.2	8.1

Ear tag	Aug.	Oct.	Dec.	Feb.	Apr.	Jun.	Grid	$\delta^{13}C$ ‰	$\delta^{15}N$ ‰
796*	0	1	1	0	0	0	B	-23.1	6.4
965*	0	1	1	0	0	0	B	-23.7	7.1
991*	0	1	1	0	0	0	A	-25.3	4.4
687	0	1	0	1	1	0	B	-	-
993*	0	1	0	1	1	0	C	-22.9	4.9
607*	0	1	0	1	0	0	B	-	-
969*	0	1	0	1	0	0	AB	-22.7	3.0
603	0	1	0	0	0	0	C	-	-
605	0	1	0	0	0	0	B	-24.6	2.1
610	0	1	0	0	0	0	B	-	-
611*	0	1	0	0	0	0	B	-	-
612*	0	1	0	0	0	1	B	-	-
613	0	1	0	0	0	0	B	-	-
615*	0	1	0	0	0	0	B	-	-
617*	0	1	0	0	0	0	B	-	-
618	0	1	0	0	0	0	A	-24.1	8.3
624	0	1	0	0	0	0	C	-23.8	9.7
652	0	1	0	0	0	0	A	-	-
655*	0	1	0	0	0	0	C	-23.8	7.5
659	0	1	0	0	0	0	C	-23.6	6.5
660*	0	1	0	0	0	0	C	-24.2	9.8
662	0	1	0	0	0	0	C	-	-
663*	0	1	0	0	0	0	C	-	-
664*	0	1	0	0	0	0	C	-	-
668*	0	1	0	0	0	0	C	-	-
670	0	1	0	0	0	0	C	-	-
673	0	1	0	0	0	0	A	-25.1	1.5
675	0	1	0	0	0	0	A	-	-
676	0	1	0	0	0	0	C	-	-
677	0	1	0	0	0	0	C	-	-
678*	0	1	0	0	0	0	C	-20.3	4.3
682	0	1	0	0	0	0	C	-	-
684	0	1	0	0	0	0	B	-	-
686	0	1	0	0	0	0	B	-	-
688	0	1	0	0	0	0	B	-	-
695	0	1	0	0	0	0	B	-	-
698*	0	1	0	0	0	0	A	-23.9	3.0
699	0	1	0	0	0	0	A	-25.0	2.4
700*	0	1	0	0	0	0	A	-23.8	8.3
727	0	1	0	0	0	0	A	-20.8	3.4
799	0	1	0	0	0	0	C	-23.5	5.3
926*	0	1	0	0	0	0	BC	-22.6	7.9
928	0	1	0	0	0	0	B	-	-
929	0	1	0	0	0	0	B	-24.2	2.2
930	0	1	0	0	0	0	B	-	-
931*	0	1	0	0	0	0	B	-	-
932*	0	1	0	0	0	0	B	-24.7	6.4
933*	0	1	0	0	0	0	B	-	-
934*	0	1	0	0	0	0	B	-	-

Ear tag	Aug.	Oct.	Dec.	Feb.	Apr.	Jun.	Grid	$\delta^{13}C$ ‰	$\delta^{15}N$ ‰
936*	0	1	0	0	0	0	B	-23.8	4.9
939	0	1	0	0	0	0	B	-23.5	6.1
941*	0	1	0	0	0	0	B	-	-
942*	0	1	0	0	0	0	B	-	-
943*	0	1	0	0	0	0	A	-24.2	3.0
944	0	1	0	0	0	0	A	-	-
945	0	1	0	0	0	0	A	-	-
948	0	1	0	0	0	0	A	-23.9	6.5
504*	0	0	1	1	1	0	C	-	-
697*	0	0	1	1	1	0	B	-25.5	2.1
702*	0	0	1	1	0	1	C	-23.9	6.3
502*	0	0	1	0	0	0	C	-24.2	7.2
506*	0	0	1	0	0	0	C	-	-
508	0	0	1	0	0	0	C	-	-
511*	0	0	1	0	0	0	B	-	-
515	0	0	1	0	0	0	B	-24.5	3.0
518	0	0	1	0	0	0	C	-	-
521	0	0	1	0	0	0	C	-	-
523*	0	0	1	0	0	0	C	-22.9	4.9
524	0	0	1	0	0	0	A	-23.5	2.0
525*	0	0	1	0	0	0	A	-	-
527*	0	0	1	0	0	0	A	-	-
528	0	0	1	0	0	0	A	-23.5	10.2
550	0	0	1	0	0	0	A	-25.5	2.1
551	0	0	1	0	0	0	B	-	-
552	0	0	1	0	0	0	B	-23.6	2.6
555	0	0	1	0	0	0	A	-23.3	10.4
556*	0	0	1	0	0	0	A	-	-
558*	0	0	1	0	0	0	C	-	-
575	0	0	1	0	0	0	B	-22.9	2.0
627*	0	0	1	0	0	0	B	-	-
628*	0	0	1	0	0	0	B	-	-
630	0	0	1	0	0	0	A	-	-
631	0	0	1	0	0	0	A	-24.2	6.0
632*	0	0	1	0	0	0	A	-23.5	2.8
634	0	0	1	0	0	0	A	-	-
636	0	0	1	0	0	0	A	-	-
637	0	0	1	0	0	0	A	-	-
638*	0	0	1	0	0	0	A	-	-
639	0	0	1	0	0	0	A	-	-
640*	0	0	1	0	0	0	A	-23.5	4.3
642	0	0	1	0	0	0	C	-24.5	10.6
644	0	0	1	0	0	0	B	-	-
645*	0	0	1	0	0	0	B	-21.8	5.2
646	0	0	1	0	0	0	B	-	-
648	0	0	1	0	0	0	B	-	-
650*	0	0	1	0	0	0	B	-	-
665*	0	0	1	0	0	0	B	-23.3	5.9
666*	0	0	1	0	0	0	B	-	-

Ear tag	Aug.	Oct.	Dec.	Feb.	Apr.	Jun.	Grid	$\delta^{13}C$ ‰	$\delta^{15}N$ ‰
703	0	0	1	0	0	0	C	-23.7	6.5
769	0	0	1	0	0	0	A	-22.7	5.8
776*	0	0	1	0	0	0	A	-24.1	6.8
787	0	0	1	0	0	0	A	-23.7	4.1
973*	0	0	1	0	0	0	C	-24.0	4.1
979	0	0	1	0	0	0	C	-24.3	9.0
505-543*	0	0	1	0	0	0	C	-23.4	3.3
535-633*	0	0	1	0	0	0	A	-23.6	4.9

Table S3 Maximum likelihood estimates of the coefficients in the logistic regression model of *Apodemus semotus* survival. The null model included the intercept and individual differences from the population mean in $\delta^{13}C$ and $\delta^{15}N$ values (carbon and nitrogen differences respectively). The remaining factors, trophic divergence (i.e. Euclidean distance between an individual and the population mean on the $\delta^{13}C$-$\delta^{15}N$ bi-plot), seed dry weight, arthropod dry weight, trapping session and grid, were subject to forward selection at the 0.05 significance level. Trophic divergence was the only factor entering the model after the intercept, carbon and nitrogen differences were included.

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	*P*
Intercept	1	0.40	0.46	0.74	0.39
Carbon difference	1	0.05	0.21	0.05	0.82
Nitrogen difference	1	-0.03	0.10	0.13	0.72
Trophic divergence	1	-0.44	0.18	5.56	0.02

Table S4 The fit of the four logistic regression models of *Apodemus semotus* survival. The null model is the intercept-only model. The four models that were evaluated include the intercept plus: carbon difference, nitrogen difference, carbon and nitrogen differences, or trophic divergence. The carbon and nitrogen differences are individual differences from the population mean in $\delta^{13}C$ and $\delta^{15}N$ values respectively. Trophic divergence is quantified by Euclidean distance between an individual and the population mean on the $\delta^{13}C$-$\delta^{15}N$ bi-plot. The Akaike Information Criterion (AIC) of each model, as well as the likelihood ratio test between each model and the null model, are listed here.

Model	AIC	Likelihood Ratio		
		Chi-Square	DF	*P*
Intercept	131.489	-	-	-
Intercept + Carbon difference	133.073	0.42	1	0.52
Intercept + Nitrogen difference	132.936	0.55	1	0.46
Intercept + Carbon and nitrogen differences	134.582	0.91	2	0.64
Intercept + Trophic divergence	126.387	7.10	1	0.008

Fig. S1 Receiver Operating Characteristic Curves (ROC) of the four logistic regression models of *Apodemus semotus* survival. The four models that were evaluated include the intercept plus: carbon difference, nitrogen difference, carbon and nitrogen differences, or trophic divergence. The carbon and nitrogen differences are individual differences from the population mean in $\delta^{13}C$ and $\delta^{15}N$ values respectively. Trophic divergence is quantified by Euclidean distance between an individual and the population mean on the $\delta^{13}C$-$\delta^{15}N$ bi-plot. The gray diagonal line denotes ROC = 0.5 (i.e. a random guess). The 95% confidence limits of ROC are 0.47-0.71 for the model with carbon difference (red line), 0.40-0.63 for the model with nitrogen difference (green line), 0.42-0.66 for the model with carbon and nitrogen differences (brown), and 0.55-0.77 for the model with trophic divergence (blue line).

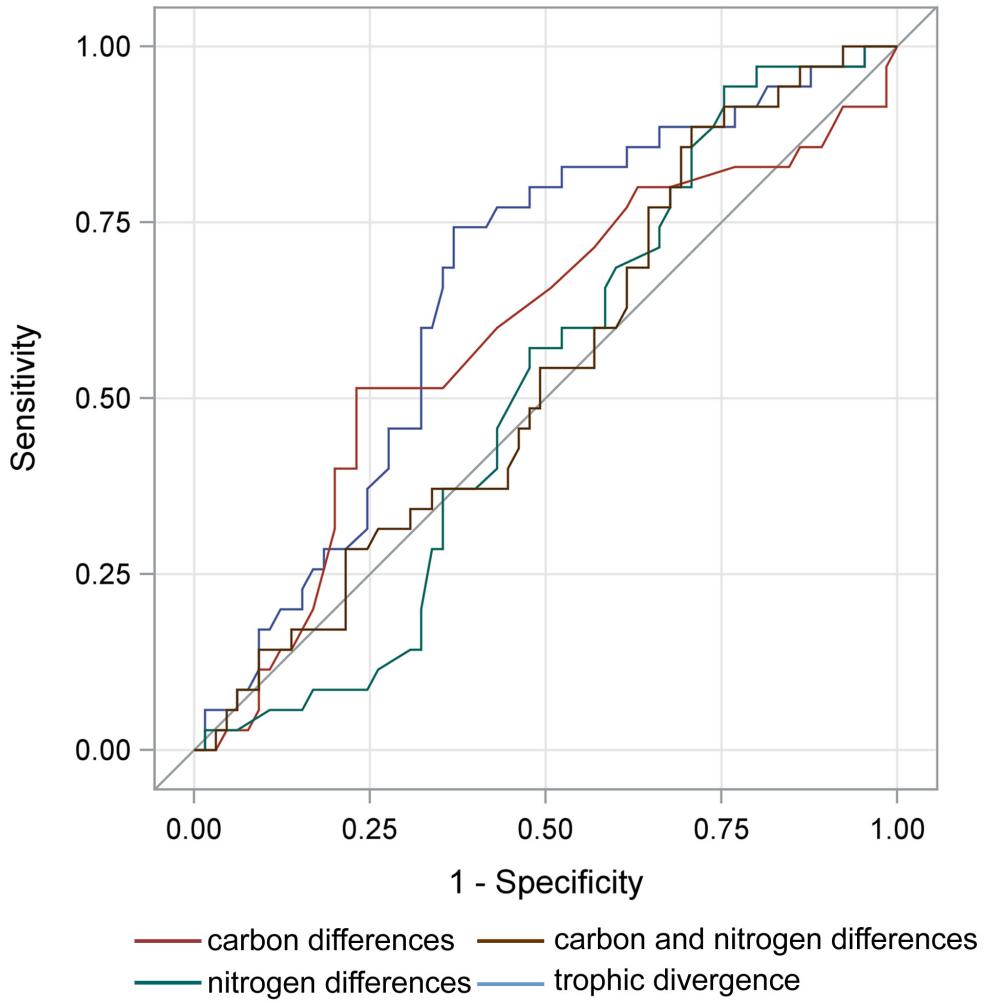

Fig. S2 The survival of *Apodemus semotus* as a function of trophic divergence. The survival function (a) is identical to Fig. 5d in the main article but actual observations are shown here with different symbols for the August (blue circles), October (green triangles) and December (orange diamonds) trapping sessions. The actual observations for each of three trapping sessions are also shown separately in b, c and d. Trophic divergence is quantified by Euclidean distance between an individual and the population mean on the $\delta^{13}C$-$\delta^{15}N$ bi-plot, in units of ‰. The solid and dashed lines (a) denote predicted mean survival and its 95% confidence limits. Although different trapping sessions are represented by different symbols for visual display, the regression line was constructed with all individuals pooled.