Suplementary material

Title: Energetics and water flux in the subterranean rodent family Bathyergidae

Running title: Rodent energetics and water flux

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Supplementary material Table 1: The statistical outputs, through the use of general linear or general linearized models, of the effects of species on body mass, daily energy expenditure (DEE. kJ/day), resting metabolic rate (RMR, kJ/day), sustained metabolic scope (SusMS), water turn over (WTO , ml/day), water economy index (WEI, ml/kJ) and body fat percent (BF).

	Body mass		DEE		RMR		SusMS		WEI		WTO		BF	
Transformation	None		None		None		Log-transformation		None		Log-transformation		None	
Final distribution	Not-normal		Not-normal		Not-normal		Normal		Not-normal		Normal		Not-normal	
	χ^2	p	χ^2	p	χ^2	p	χ^2	p	χ^2	p	χ^2	p	χ^2	p
Species	985.5	≤0.0001*	116.0	≤0.0001*	116.0	≤0.0001*	11.4	≤0.0001*	230.9	≤0.0001*	21.2	≤0.0001*	20.7	0.002*
Body mass	-	-	65.0	≤0.0001*	25.3	≤0.0001*	-	-	-	-	17.7	≤0.0001*	-	-

**** indicates*** significance ($p \leq 0.05$).

Supplementary material Table 2: Statistical outputs of post-hoc analyses using least-significant difference (LSD) for models containing body mass or sustained metabolic scope (SusMS) as the response variable and species as the predictor variable. BS - *Bathyergus suillus*; BJ: *Bathyergus janetta*; GC - *Georychus capensis*; CHN - *Cryptomys hottentotus natalensis*; FD - *Fukomys damarensis*; XI - *Xerus inauris*; RP - *Rhabdomys pumilio*.

Body mass							
	BS	BJ	GC	CHN	FD	XI	RP
BS		≤0.0001*	≤0.0001*	≤0.0001*	0.008*	≤0.0001*	≤0.0001*
BJ	0.29		≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*
GC	0.92	0.19		≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*
CHN	0.003*	≤0.0001*	≤0.0001*		0.03*	≤0.0001*	≤0.0001*
FD	0.05*	≤0.0001*	0.001*	0.006*		≤0.0001*	≤0.0001*
XI	0.05*	≤0.0001*	≤0.0001*	0.67	0.02*		≤0.0001*
RP	0.01*	≤0.0001*	≤0.0001*	0.95	0.15	0.83	
SusMS							

Supplementary material Table 3: The statistical outputs, using linear regressions between body mass and daily energy expenditure (DEE) and body mass and resting metabolic rate (RMR) for the five mole-rat species and two aboveground foraging rodents species used in this study. BS - *Bathyergus suillus;* BJ: *Bathyergus janetta*; GC - *Georychus capensis*; CHN - *Cryptomys hottentotus natalensis*; FD - *Fukomys damarensis*; XI - *Xerus inauris*; RP - *Rhabdomys pumilio*.

Species	DEE ($kJ.d^{-1}$)				RMR ($kJ.d^{-1}$)			
	Slope	y-intercept	F	p	Slope	y-intercept	F	p
BS	0,67	-127.0	61,6	0,004*	0,10	110.2	4,60	0,12
BJ	0,85	13.5	41,6	≤0.0001*	0,18	40.6	39,1	≤0.0001*
GC	0,16	110.8	1,04	0,33	0,17	33.4	10,4	0,0066*
CHN	0,43	52.8	20,5	≤0.0001*	0,32	39.2	7,45	0,01*
FD	0,54	24.2	33,4	≤0.0001*	0,23	24.1	20,1	≤0.0001*
XI	0,81	-87.6	6,78	0,02*	0,54	36.8	16,0	0,001*
RP	1,12	12.0	7,95	0,03*	0,78	9.4	46,9	0,001*

**** indicates*** significance ($p \leq 0.05$).

Supplementary material Table 4: Statistical outputs of post-hoc analyses using least-significant difference (LSD) for models containing mass-corrected daily energy expenditure (DEE) or mass-corrected resting metabolic rate (RMR)as the response variable and species as the predictor variable. BS - *Bathyergus suillus*; BJ: *Bathyergus janetta*; GC - *Georychus capensis*; CHN - *Cryptomys hottentotus natalensis*; FD - *Fukomys damarensis*; XI - *Xerus inauris*; RP - *Rhabdomys pumilio*.

DEE							
	BS	BJ	GC	CHN	FD	XI	RP
BS		≤0.0001*	≤0.0001*	0.04*	0.16	≤0.0001*	0.62
BJ	0.14		0.04*	≤0.0001*	≤0.0001*	0.002*	≤0.0001*
GC	0.86	0.07		0.02*	≤0.0001*	0.62	≤0.0001*
CHN	0.24	0.90	0.02*		0.08	0.31	≤0.0001*
FD	0.91	0.01*	0.32	≤0.0001*		0.07	0.05
XI	≤0.0001*	≤0.0001*	≤0.0001*	0.01*	≤0.0001*		≤0.0001*
RP	0.79	0.02*	0.27	≤0.0001*	0.61	≤0.0001*	
RMR							

Supplementary material Table 5: The statistical outputs, using linear regressions between body mass and daily energy water turn over (WTO) for the five mole-rat species and two aboveground foraging rodents species used in this study. BS - *Bathyergus suillus;* BJ: *Bathyergus janetta*; GC - *Georychus capensis*; CHN - *Cryptomys hottentotus natalensis*; FD - *Fukomys damarensis*; XI - *Xerus inauris*; RP - *Rhabdomys pumilio*.

Species	WTO ($ml.d^{-1}$)			
	Slope	y-intercept	F	p
BS	0.039	52.6	0.39	0.58
BJ	0.56	-112.7	5.26	0.051

GC	0.016	17.2	0.18	0.677
CHN	0.085	8.77	20.95	≤0.0001*
FD	0.123	12.97	18.31	≤0.0001*
XI	0.074	-2.15	8.46	0.01*
RP	-0.54	34.0	0.94	0.37

Supplementary material Table 6: Statistical outputs of post-hoc analyses using least-significant difference (LSD) for models containing water economy index (WEI) or water turn over (WTO) as the response variable and species as the predictor variable. BS - *Bathyergus suillus*; BJ: *Bathyergus janetta*; GC - *Georychus capensis*; CHN - *Cryptomys hottentotus natalensis*; FD - *Fukomys damarensis*; XI - *Xerus inauris*; RP - *Rhabdomys pumilio*.

WEI							
	BS	BJ	GC	CHN	FD	XI	RP
BS		0.27	0.40	0.93	≤0.0001*	0.01*	0.13
BJ	0.04*		0.02*	0.14	≤0.0001*	≤0.0001*	≤0.0001*
GC	0.97	≤0.0001*		0.08	≤0.0001*	0.04*	0.29
CHN	0.90	≤0.0001*	0.53		≤0.0001*	≤0.0001*	0.01*
FD	0.37	0.02*	0.01*	≤0.0001*		≤0.0001*	≤0.0001*
XI	0.54	≤0.0001*	0.48	0.67	0.03*		0.17
RP	0.09	≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*	0.03*	
WTO							

Supplementary material Table 7: Statistical outputs of post-hoc analyses using least-significant difference (LSD) for models containing body fat percent (BF) as the response variable and species as the predictor variable. BS - *Bathyergus suillus*; BJ: *Bathyergus janetta*; GC - *Georychus capensis*; CHN - *Cryptomys hottentotus natalensis*; FD - *Fukomys damarensis*; XI - *Xerus inauris*; RP - *Rhabdomys pumilio*.

	BS	BJ	GC	CHN	FD	XI	RP
BS							
BJ	0.03*						
GC	0.24	≤0.0001*					
CHN	0.50	0.001*	0.01*				
FD	0.70	≤0.0001*	0.02*	0.41			
XI	0.75	0.002*	0.04*	0.54			
RP	0.90	0.06	0.21	0.64	0.84	0.88	
BF							

Supplementary material Table 8: Statistical outputs of post-hoc analyses using least-significant difference (LSD) for a model containing aridity index (AI) as the response variable and the various sites/ location where the study species were captured from as the predictor variable.

AI

	Darling	Glengarry	Goegap	Hotazel	Kamieskroon	S. A. Lombard Nature Reserve
Darling		0.07	≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*
Glengarry			≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*
Goegap				0.06	0.45	≤0.0001*
Hotazel					1.00	0.02*
Kamieskroon						0.001*
S. A. Lombard Nature Reserve						

Supplementary material Table 9: Statistical outputs of post-hoc analyses using least-significant difference (LSD) for models containing as the temperature of the air 2m above the soil surface (T_{air}) or temperature of the soil in layer 1 (depth 0 – 7cm) (T_{s1}) as the response variable and the various sites/ location where the study species were captured from as the predictor variable.

T_{air} (°C)						
	Darling	Glengarry	Goegap	Hotazel	Kamieskroon	S. A. Lombard Nature Reserve
Darling		≤0.0001*	1.00	≤0.0001*	1.00	≤0.0001*
Glengarry	≤0.0001*		≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*

Goegap	≤0.0001*	≤0.0001*		≤0.0001*	1.00	≤0.0001*
Hotazel	≤0.0001*	≤0.0001*	0.01*		≤0.0001*	≤0.0001*
Kamieskroon	0.02*	≤0.0001*	1.00	≤0.0001*		≤0.0001*
S. A. Lombard Nature Reserve	0.03*	≤0.0001*	1.00	≤0.0001*	1.00	
T_{s1} (°C)						

Supplementary material Table 10: Statistical outputs of post-hoc analyses using least-significant difference (LSD) for models containing as the temperature of the soil in layer (depth 7 – 28cm) (T_{s2})or temperature of the soil in layer 3 (depth 28 – 100cm) (T_{s3}) as the response variable and the various sites/ location where the study species were captured from as the predictor variable.

T_{s2} (°C)						
	Darling	Glengarry	Goegap	Hotazel	Kamieskroon	S. A. Lombard Nature Reserve
Darling		≤0.0001*	≤0.0001*	≤0.0001*	0.03*	0.03*
Glengarry	≤0.0001*		≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*
Goegap	≤0.0001*	≤0.0001*		0.004*	1.00	1.00
Hotazel	≤0.0001*	≤0.0001*	0.001*		≤0.0001*	≤0.0001*
Kamieskroon	≤0.0001*	≤0.0001*	0.46	≤0.0001*		1.00
S. A. Lombard Nature	≤0.0001*	≤0.0001*	0.57	≤0.0001*	1.00	

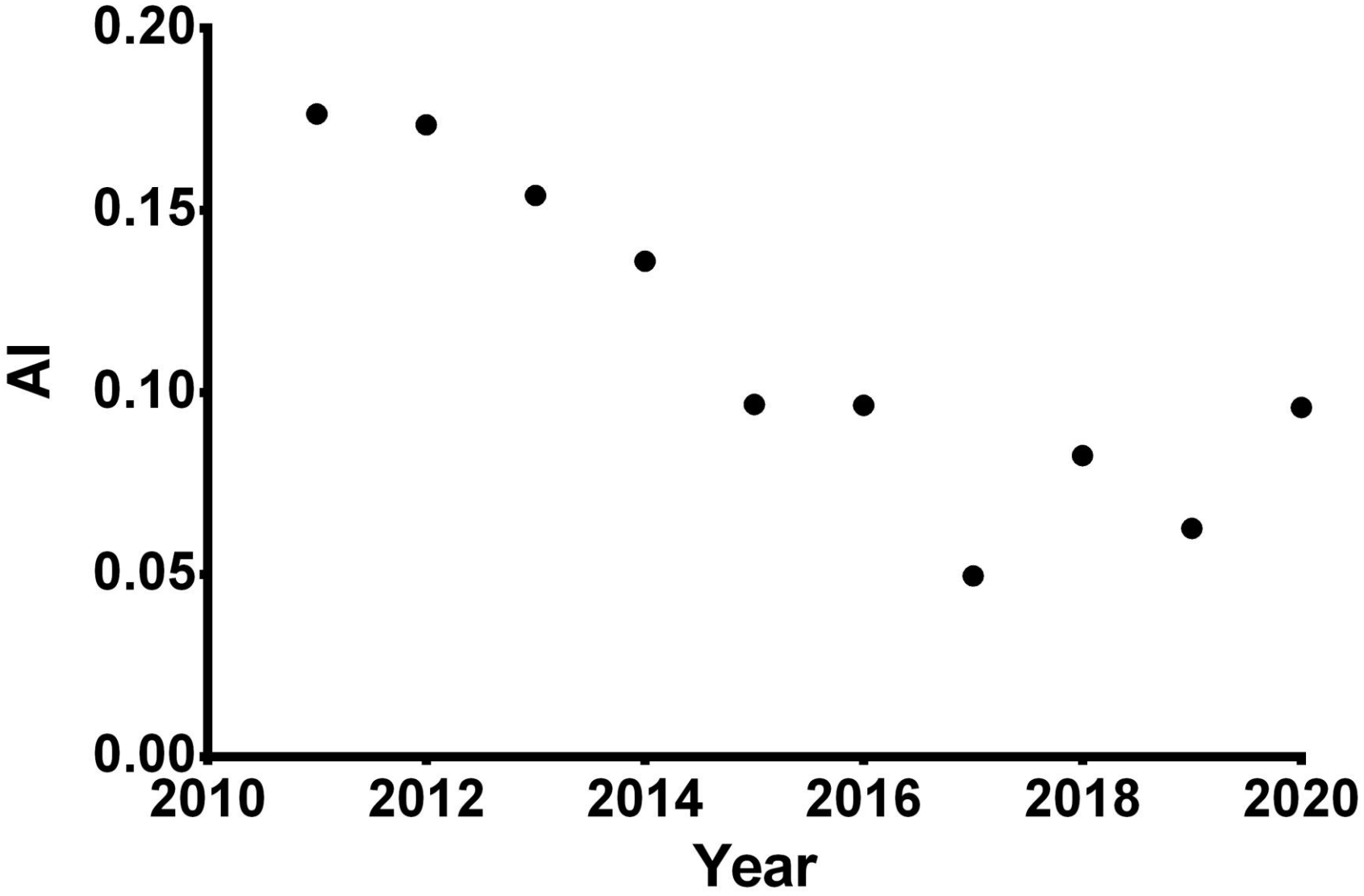
Reserve						
T_{s3} (°C)						

Supplementary material Table 11: Statistical outputs of post-hoc analyses using least-significant difference (LSD) for models containing accumulated liquid and frozen water that falls to the Earth's surface (T_p) or volumetric soil moisture content of the soil in layer 1 (depth 0 – 7cm) (M_{s1}) as the response variable and the various sites/ location where the study species were captured from as the predictor variable.

Tp (cm)						
	Darling	Glengarry	Goegap	Hotazel	Kamieskroon	S. A. Lombard Nature Reserve
Darling		≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*	1.00
Glengarry	≤0.0001*		≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*
Goegap	≤0.0001*	≤0.0001*		≤0.0001*	0.07	≤0.0001*
Hotazel	≤0.0001*	≤0.0001*	≤0.0001*		0.01*	≤0.0001*
Kamieskroon	≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*		≤0.0001*
S. A. Lombard Nature Reserve	≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*	1.00	
M_{s1} (m^3 m^{-3})						

Supplementary material Table 12: Statistical outputs of post-hoc analyses using least-significant difference (LSD) for models containing volumetric soil moisture content of the soil in layer 2 (depth 7 – 28cm) (M_{s2})or volumetric soil moisture content of the soil in layer 3 (depth 28 – 100cm) (M_{s3}) as the response variable and the various sites/ location where the study species were captured from as the predictor variable.

M_{s2} (m^3 m^{-3})						
	Darling	Glengarry	Goegap	Hotazel	Kamieskroon	S. A. Lombard Nature Reserve
Darling		≤0.0001*	0.003*	≤0.0001*	≤0.0001*	≤0.0001*
Glengarry	≤0.0001*		≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*
Goegap	≤0.0001*	≤0.0001*		≤0.0001*	≤0.0001*	≤0.0001*
Hotazel	≤0.0001*	≤0.0001*	≤0.0001*		≤0.0001*	≤0.0001*
Kamieskroon	≤0.0001*	≤0.0001*	0.14	≤0.0001*		≤0.0001*
S. A. Lombard Nature Reserve	≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*	≤0.0001*	
M_{s3} (m^3 m^{-3})						


0.20
0.15
0.10
0.05
0.00
AI
2010
2012
2014
2016
2018
2020
Year

Supplementary Fig 1: The aridity index (AI) of Kamieskroon, Northern Cape, South Africa, from 2011 to 2020. A clear indication of a downward trend in AI can be obsevred from 2011 to 2021, indicating the area is becoming drier (desertification).