<u>Electronic Supplementary Material</u>

<u>Thorley et al. (2018) Reproduction triggers adaptive increases in body size in female mole-rats</u>

<u>Details of the study population</u>

In addressing the principle aims of the study we used information from several different sources, including X-ray data from both captive and wild Damaraland mole-rats. The Damaraland mole-rat is a subterranean cooperative breeder that inhabits the red arenosols of the Kalahari in groups of 2-41 individuals (Jarvis and Bennett 1993). Our study population is located around the Kuruman River Reserve in the Northern Cape of South Africa (S26.98706° E21.81229°). A captive population was founded at this location using animals sourced from the local population between February and September 2013, and these founding animals were either maintained in their original group or selected to create new groups, achieved through the pairing of a nonbreeding female with a nonbreeding male. Groups are housed in artificial tunnel systems constructed of PVC pipes and are provided *ad libitum* access to sweet potato and cucumber (additional details of the study system and animal husbandry can be found in Zöttl et al. 2016). The captive animals from which X-rays were taken therefore represent animals that were initially caught in the wild and were brought into captivity, or the lab-born offspring of wild-caught animals.

We also took X-rays from individuals living permanently in the local wild population where a long-term mark recapture study is ongoing. Groups were trapped periodically (6 or 12-month intervals) using modified Hickman traps that were positioned into tunnel systems by digging. Traps were baited with sweet potato. After trap setting, traps were checked every 2-3 hours throughout the day and night. On capture, animals were placed into a closed, sand-filled box with other group members, and provided food and shelter. Intermittently, individuals were transported back to the laboratory where they were X-rayed, weighed, and had their total body length measured manually. Two people measured body length from the front of the snout to the tip of the tail to an accuracy of 1mm using a tape measure. Total body length was taken as the average of the two measures; the human measurement of body length is referred to as ‘Total body length’ to distinguish it from the ‘Skeletal body length’ measured from X-rays (below). When transporting animals from the field to the lab, traps were temporarily disabled to prevent individuals being kept in the traps for long periods. After sampling, groups were housed temporarily in tunnel systems in the laboratory (see methods below), and once a whole group was captured, as evidenced by an absence of activity for 24hrs, the animals were all returned to their natural burrow system.

Figures and Tables

Table S1. Proportional trait contributions (a) and trait loadings (b) to the first five principal components from a PCA of skeletal measures in captive adult female mole-rats (> 100g)

a) Proportional Contribution

Trait	PC1	PC2	PC3	PC4	PC5
Rostrum	3.4	0.42	11.94	0.98	20.6
Ulna	6.99	1.86	2.69	8.86	8.14
L5 Vertebra	15.74	26.35	1.08	12.66	27.97
Pelvic Girdle	10.75	22	18.39	24.72	20.21
Pelvis Length	6.02	0.04	40.93	39.57	11.19
Femur Length	31.43	41.89	16.31	2.12	3.81
Tibia Length	6.54	2.3	1.55	5.45	0.18
Skeletal Body Length	10.41	4.83	1.99	4.31	0
Skull Width	8.72	0.3	5.14	1.33	7.88

b) Trait Loadings

Trait	PC1	PC2	PC3	PC4	PC5
Rostrum	0.0271	-0.0058	0.0252	0.0065	0.0247
Ulna	0.0389	-0.0123	0.0119	0.0195	0.0153
L5 Vertebra	0.0584	0.0463	-0.0075	0.0232	-0.0285
Pelvic Girdle	0.0483	0.0423	-0.0313	-0.0325	0.0242
Pelvis Length	0.0361	0.0019	0.0466	-0.0411	-0.018
Femur Length	0.0825	-0.0583	-0.0294	-0.0095	-0.0105
Tibia Length	0.0377	-0.0137	0.0091	0.0153	0.0023
Skeletal Body Length	0.0475	0.0198	0.0102	0.0135	0.0005
Skull Width	0.0435	0.0049	0.0166	0.0076	0.0146

Table S2. Bivariate scaling relationships of skeletal size measures in captive female mole-rats; SBL = Skeletal Body Length. SW = Skull Width. All linear traits were log-transformed. Bold, underlined terms represent slopes that differ significantly at α = 0.05 (*), 0.01 (**), 0.001 (*). Significantly different slopes were determined by the interaction between Trait$_2$ and Class. Significantly different intercepts are taken from the model including the interaction if it was significant, otherwise they derive from a simpler model in which the interaction term was removed. Note that the difference in intercepts for relationships with an interaction are estimated at length zero, so they lie outside the bounds of the data. Difference in intercepts represent an in-group nonbreeder relative to the queen. Note that total head width here refers to the skull width as measured on the anaesthetised animal with digital callipers (i.e. not from X-rays).

Trait$_1$	**Trait$_2$**	**β Queen**	**β nonbreeder**	**diff Slopes**	**diff Intercept**
Rostrum Length	SBL	0.561 ± 0.161	0.594 ± 0.189	0.033, n.s.	0.013, n.s.
Ulna	SBL	0.314 ± 0.154	0.774 ± 0.181	**0.460, ***	**-2.26, ***
L5 Vertebra	SBL	0.586 ± 0.160	0.912 ± 0.189	0.326, n.s.	**-0.112, *****
Pelvic Girdle Width	SBL	0.205 ± 0.238	0.566 ± 0.281	0.362, n.s.	**-0.076, *****
Pelvis Length	SBL	0.619 ± 0.234	0.627 ± 0.276	0.008, n.s.	0.018, n.s.
Femur Length	SBL	0.490 ± 0.334	1.039 ± 0.394	0.549, n.s.	0.017, n.s.
Tibia Length	SBL	0.449 ± 0.148	0.625 ± 0.174	0.176, n.s.	0.001, n.s.
Skull Arch	SBL	0.510 ± 0.116	0.914 ± 0.137	**0.404, ****	**-1.99, ****
Head Width	SBL	0.402 ± 0.216	1.281 ± 0.254	**0.880, *****	**-4.31, *****
Weight	SBL	0.424 ± 0.120	0.951 ± 0.014	**0.527, *****	**-2.60, *****
Rostrum Length	SW	0.566 ± 0.172	0.557 ± 0.196	-0.009, n.s.	0.012, n.s.
Ulna	SW	0.730 ± 0.144	0.689 ± 0.163	0.041, n.s.	0.012, n.s.
L5 Vertebra	SW	0.228 ± 0.193	0.756 ± 0.219	**0.530, ***	**-1.89, ***
Pelvic Girdle Width	SW	0.420 ± 0.251	0.548 ± 0.285	0.129, n.s.	**-0.076, *****
Pelvis Length	SW	0.381 ± 0.248	0.681 ± 0.282	0.300, n.s.	0.018, n.s.
Femur Length	SW	0.457 ± 0.354	1.015 ± 0.402	0.559, n.s.	0.017, n.s.
Tibia Length	SW	0.482 ± 0.155	0.601 ± 0.177	0.119, n.s.	0.001, n.s.
Head Width	SW	1.257 ± 0.187	1.261 ± 0.212	0.004, n.s	**0.056, *****
Weight	SW	0.749 ± 0.115	0.883 ± 0.131	0.134, n.s.	0.001, n.s.

Table S3. Full model outputs for linear mixed effects models exploring the influence of body length on three fitness: a) Litter size, Poisson errors) b) Total neonate mass, normal errors c) Individual pup mass, normal errors. Significance of fixed covariates were estimated from likelihood ratio tests comparing models with and without the fixed effect of interest.

	Fixed Terms					Random Terms		
	Term	**Estimate**	**Standard Error**	**LRT (χ^2_1)**	**p value**	**Term**	**Variance**	**Standard Deviation**
a) Litter Size	Intercept	-1.06	0.92			Mother	0	
	Total Body Length	0.12	0.05	5.81	**0.016**			
	Primiparity (YES)	-0.3	0.17	3.57	0.059			
b) Total Neonate Mass	Intercept	-39.52	23.02			Mother	37.7	6.1
	Total Body Length	3.83	1.23	8.89	**0.003**	Residual	82.49	9.1
	Primiparity (YES)	-5.65	2.52	5.05	**0.025**			
c) Individual Pup Mass	Intercept	5.25	3.17			Mother	0.81	0.9
	Total Body Length	0.36	0.17	4.12	**0.040**	Litter	0.84	0.92
	Primiparity (Y)	0.45	0.33	1.77	0.183	Residual	1.24	1.11
	Litter Size	-0.6	0.08	47.76	**< 0.001**			

Figure S1 – Bimonthly change in a) L5 lumbar vertebra and b) Skull width of captive females experimentally manipulated to follow different social trajectories.

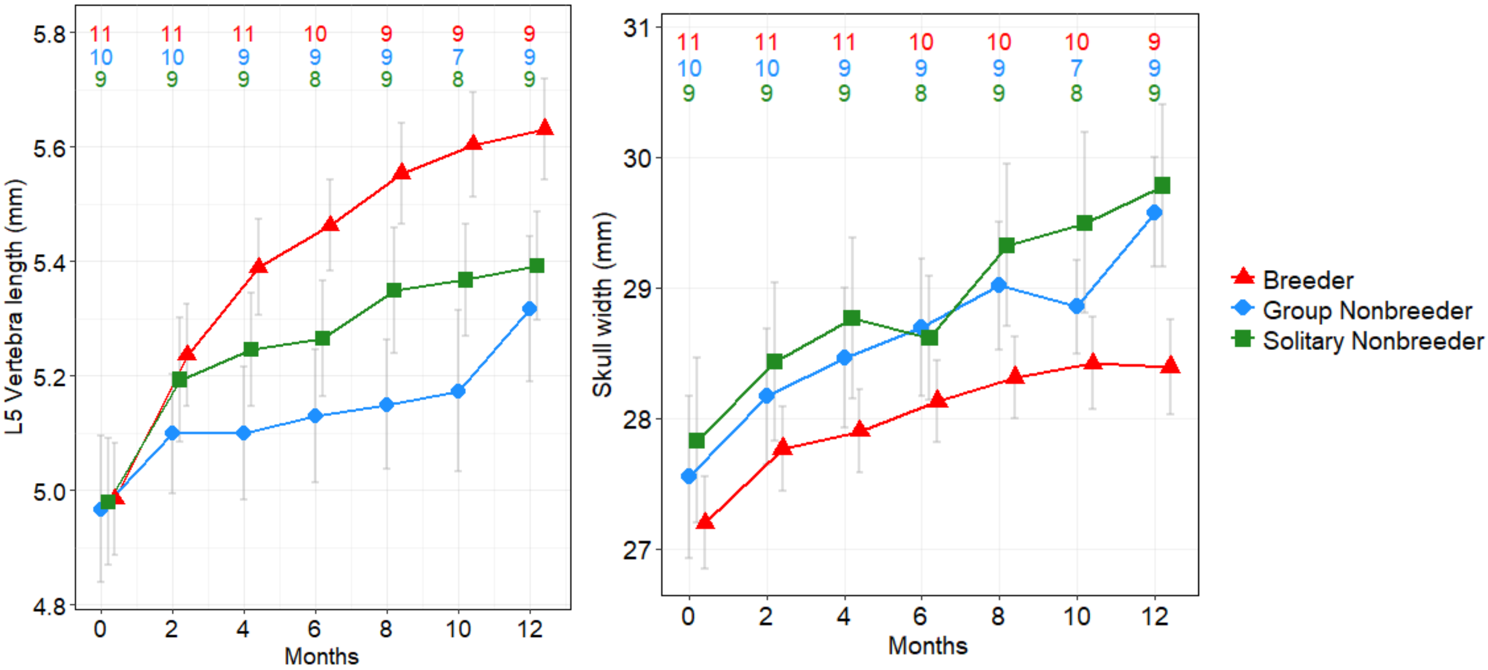

Figure S2 – Growth of L4 (a) and L6 (b) vertebrae of captive female mole-rats experimentally manipulated to follow different social trajectories.