Supplementary Text S1. Correlation between body masses and elbow extensor/flexor ratios of maximum moment arms and masses in each locomotor types (A–F)

To investigate whether the body size of the taxa studied for our second hypothesis (e.g., Fig. 10) had any strong relationships with the flexor and extensor muscle moment arm and mass data we presented for each locomotor type (Fig. 5), we conducted a reduced major axis (Warton et al., 2006) scaling analysis. Our *a priori* assumption was that body size did not have a strong relationship with our muscle data. We did not conduct a phylogenetically independent contrasts analysis, so this analysis carries with it the caveat that we assume evolutionary relationships are not overly biasing our analysis.

We referred to literature reports for the body masses of the study taxa (Nowak, 1999; Abe, 2000; Wingfield et al., 2000). This is not ideal but such data did not exist for our dissection specimens. The mean value of the maximum and minimum log body masses based on the literature and the average of the log extensor/flexor muscle moment arm and mass ratios in each study taxon were used for this analysis (Supplementary Tables S1, S2). We produced log-log scatterplots for each locomotor type (A–F: Supplementary Figs. S2, S3). We then calculated the correlation coefficient (r-value), the coefficient of determination (r^2 value), and the significance probability (p-value) for each type of locomotor ability (A–F: See Fig. 5) using a reduced major axis (RMA) analysis in PAST software, ver. 2.06 (http://folk.uio.no/ohammer/past/). We rejected a null hypothesis that there is no correlation between the body mass and the extensor/flexor ratio (of muscle moment arms or masses) when the p-value was less than 0.05, indicating the potential for a significant scaling relationship.

Our RMA results are listed below (Supplementary Tables S3, S4). The sample size was adequate for bootstrap analysis of the data for types A–C of extensor/flexor moment arm ratios and type A of muscle mass ratios. For all other RMA analyses our sample sizes were insufficient ($n \leq 5$) to obtain satisfactory bootstrap results. However in all but one of the former four cases the plots had a poor fit to the regression line in these locomotor types ($r^2<0.4$: Supplementary Tables S3, S4, and Figs. S2, S3) and the p-values were more than 0.3 (>>0.05); thus those three cases all lacked significant relationships between body size and our muscle data.

The one exception to the above lack of body mass correlation in our muscle data was that body mass and the extensor/flexor moment arm ratio had a significant correlation and a reasonable fit to the regression line for type C ($p<0.05$, $r^2>0.6$: Supplementary Table S3 and Fig. S2). However, the sample size ($n=7$) for this type was still small and thus we deem it somewhat inconclusive, but meriting future study. The regression slope for that scaling relationship was moderately negative (-0.15) which was a trend for some but not all of our other plots of adequate sample sizes (e.g., type B for moment arm ratio and type

A for muscle mass ratio; but not type A for moment arm ratio), so this question of size correlation in our data does deserve stronger testing with a larger dataset in the future.

Overall, our results do not demonstrate a conclusively significant correlation between the body mass and the extensor/flexor moment arms or muscle mass ratios in our sample of taxa for different locomotor types (A–F). Therefore, comparison of the elbow extensor/flexor muscle moment arm and mass ratios among the locomotor types are appropriate, even though the body mass ranges within each locomotor type vary. The exceptional case of type C (upright, suspended quadrupeds; e.g., *Nycticebus, Tamandua*; Fig. 6) is not a focus of this study so we do not consider it further here.

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Supplementary Table S1. Mean values of log extensor/flexor ratio of elbow joint muscle moment arms (Log Ex/Fl), sample size (*n*), body mass (BM), mean value of the range of log body masses (Log BM), and locomotor ability (LA) in each study taxon (See main text and Figure 5).

Taxa	*n*	Log Ex/Fl (ave.)	BM (kg)	Log BM	LA
Macropus giganteus	3	-0.147	20–90	1.63	A
Macropus agilis	1	-0.189	2–2.4	0.889	A
Tenrec	1	-0.00529	1.6–2.4	0.292	A
Setifer	1	-0.0736	0.18–0.27	-0.657	A
Hemicentetes	1	0.0365	0.08–0.28	-0.825	A
Orycteropus	2	-0.0255	40–100	1.80	A
Elephas	3	-0.115	2,720–5,400	3.58	A
Dasypus	1	0.140	1–10	0.500	A
Chaetopractus	1	-0.156	2.02	0.305	A
Tolypeutes	1	0.224	1–1.59	0.101	A
Chlamydophorus	1	0.0743	0.085	-1.071	A
Oryctolagus	1	-0.00404	1.35–2.25	0.241	A
Lepus	1	0.107	1.35–7	0.488	A
Cavia	1	0.0254	0.5–1.5	-0.0625	A
Dolichotis	1	0.0621	9–16	1.08	A
Sus	2	0.148	40–350	2.07	A
Tayassu	1	0.216	20–50	1.50	A
Giraffa	2	-0.00216	550–1,930	3.01	A
Rangifer	1	0.105	60–318	2.14	A
Bos	1	0.0684	650–1,000	2.91	A
Bubalus	1	0.0847	700–1,200	2.96	A
Enhydra	1	-0.269	15–45	1.42	A
Ursus maritimus	2	-0.190	300–800	2.69	A
Chrysocyon	2	-0.0875	20–26	1.36	A
Canis lupus (Rottweiler)	1	-0.0222	32–46	1.58	A
Mungos	1	-0.248	1–2.2	0.171	A
Tapirus	1	0.139	150–320	2.34	A
Equus caballus	2	0.0979	530	2.72	A
Equus asinus	1	0.0128	250	2.40	A
Trichosurus	1	-0.118	1.3–5	0.406	B
Phascolarctos	1	-0.179	4–15	0.889	B
Procavia	2	-0.0117	3.6–4	0.579	B
Dendrohyrax	1	-0.0312	1.5–4.5	0.415	B
Myrmecophaga	1	-0.183	18–39	1.42	B
Varecia	1	-0.397	3.2–4.5	0.579	B
Macaca	1	-0.322	18	1.26	B
Pan	2	-0.445	26–70	1.63	B
Erithizon	1	-0.289	3.5–7	0.695	B
Gulo	1	-0.196	7–32	1.18	B
Lutra	1	-0.0879	5–14	0.923	B
Ailurus	1	-0.248	3–6	0.628	B
Ailuropoda	1	-0.296	75–160	2.04	B
Tremarctos	1	-0.192	60–140	1.96	B
Melursus	1	-0.226	55–145	1.95	B
Nyctereutes	1	-0.0252	4–10	0.801	B
Helogale	1	-0.260	0.23–0.68	-0.403	B
Felis	1	-0.128	3.3–4.5	0.586	B
Pronailurus	1	-0.0243	3–7	0.661	B
Leptailurus	1	-0.241	8.7–18	1.10	B
Caracara	1	-0.0679	6–19	1.03	B
Acinonyx	3	-0.101	21–72	1.59	B
Neofelis	1	-0.151	16–23	1.28	B
Uncia	1	-0.0882	25–75	1.64	B
Panthera pardalis	1	-0.277	28–90	1.70	B
Panthera tigris	1	-0.0660	65–306	2.15	B
Panthera leo	1	-0.0983	82–250	2.16	B
Cyclopes	1	-0.292	0.175–0.357	-0.602	C
Tamandua	3	-0.294	2–7	0.573	C
Nycticebus	4	-0.524	0.375–2	-0.0625	C
Pongo	2	-0.651	30–90	1.72	C
Petaurista	2	-0.457	1–2.5	0.199	C
Glirulus	1	-0.167	0.014–0.04	-1.63	C
Graphiurus	1	-0.189	0.018–0.03	-1.63	C

(Supplementary Table S1 continued)

Tachyglossus	1	-0.0211	2.5–7	0.622	D
Amblysomus	1	0.303	0.04–0.101	-1.20	D
Mogera	1	0.253	0.0485–0.175	-1.04	D
Bradypus	2	-0.611	2.25–6.2	0.572	F
Choloepus	5	-0.587	4–8.5	0.766	F
Cynocephalus	4	-0.760	1–1.75	0.122	F
Pteropus	2	-0.380	0.4	-0.398	F
Rousettus	1	-0.460	0.081–0.171	-0.929	F

*Body mass data are based on Nowak (1999), Abe (2000), and Wingfield et al. (2000).

Supplementary Table S2. Mean values of log extensor/flexor ratio of elbow joint muscle masses (Log Ex/Fl), sample size (*n*), body mass (BM), mean value of the range of log body masses (Log BM), and locomotor ability (LA) in each study taxon (See main text and Figure 5).

Taxa	*n*	Log Ex/Fl (ave.)	BM (kg)	Log BM	LA
Macropus giganteus	1	0.237	20–90	1.63	A
Oryctolagus	1	0.411	1.35–2.25	0.241	A
Enhydra	1	0.122	15–45	1.41	A
Ursus maritimus	1	0.419	300–800	2.69	A
Canis lupus (Rottweiler)	1	0.562	32–46	1.58	A
Chrysocyon	1	0.501	20–26	1.36	A
Elephas	3	0.337	2,720–5,400	3.58	A
Equus caballus	1	0.361	530	2.72	A
Equus asinus	1	0.335	250	2.40	A
Tapirus	1	0.360	150–320	2.34	A
Rhinoceros	1	0.195	1,000–3,500	3.27	A
Hippopotamus	1	0.540	1,000–4,500	3.33	A
Giraffa	2	0.200	550–1,930	3.01	A
Bos	1	0.336	650–1,000	2.91	A
Sus	2	0.456	40–350	2.07	A
Acinonyx	1	0.535	21–72	1.59	B
Panthera	1	0.135	28–90	1.70	B
Macaca	1	0.172	18	1.26	B
Nycticebus	3	-0.00791	0.375–2	-0.0625	C
Tamandua	1	-0.0551	2–7	1.57	C
Glirulus	1	-0.0435	0.014–0.04	-1.63	C
Graphiurus	1	0.146	0.018–0.03	-1.63	C
Petaurista	1	-0.00629	1–2.5	0.199	C
Choloepus	2	-0.293	4–8.5	0.766	F
Pteropus	3	-0.116	0.081–0.171	-0.929	F
Cynocephalus	3	-0.202	1–1.75	0.122	F

*Body mass data are based on Nowak (1999), Abe (2000), and Wingfield et al. (2000).

Supplementary Table S3. Sample size (*n*), correlation coefficient (r), coefficient of determination (r^2), and significance probability (p) calculated by reduced major axis regression analysis of the relationship between body mass and elbow extensor/flexor muscle moment arm ratio in each locomotor type (A–D, and F: Fig. S2). See main text and Figure 5.

Type	*n*	slope	intercept	r	r^2	p
A	29	0.105 [-0.135, 0.141]	-0.136 [-0.221, 0.199]	0.0121	1.47E-04	0.950
B	27	-0.182 [-0.263, 0.207]	0.0315 [-0.446, 0.124]	-0.0903	8.16E-03	0.654
C	7	-0.150 [-0.222, -0.0776]	-0.399 [-0.497, -0.301]	-0.854	0.729	0.0144
D	3*	-0.174 [0, 0]	0.0854 [0, 0]	-0.998	0.996	0.0402
F	5*	-2.10 [0, 0]	-0.554 [0, 0]	-0.585	0.342	0.300

*Bootstrap failed; insufficient sample size.

Supplementary Table S4. Sample size (*n*), correlation coefficient (r), coefficient of determination (r^2), and significance probability (p) calculated by reduced major axis regression analysis of the relationship between body mass and elbow extensor/flexor muscle mass ratio in each locomotor type (A–C, and F: Fig. S3). See main text and Figure 5.

Type	*n*	slope	intercept	r	r^2	p
A	15	-0.141 [-0.212, 0.206]	0.683 [-0.158, 0.879]	-0.135	0.0182	0.632
B	3*	0.952 [0, 0]	-1.16 [0, 0]	0.197	0.0390	0.874
C	5*	-0.0772 [-0.120, 0.0275]	-0.0375 [-0.112, 0.00484]	-0.541	0.293	0.346
F	3*	-0.103 [0, 0]	-0.205 [0, 0]	-0.988	0.977	0.0975

*Bootstrap failed; insufficient sample size.

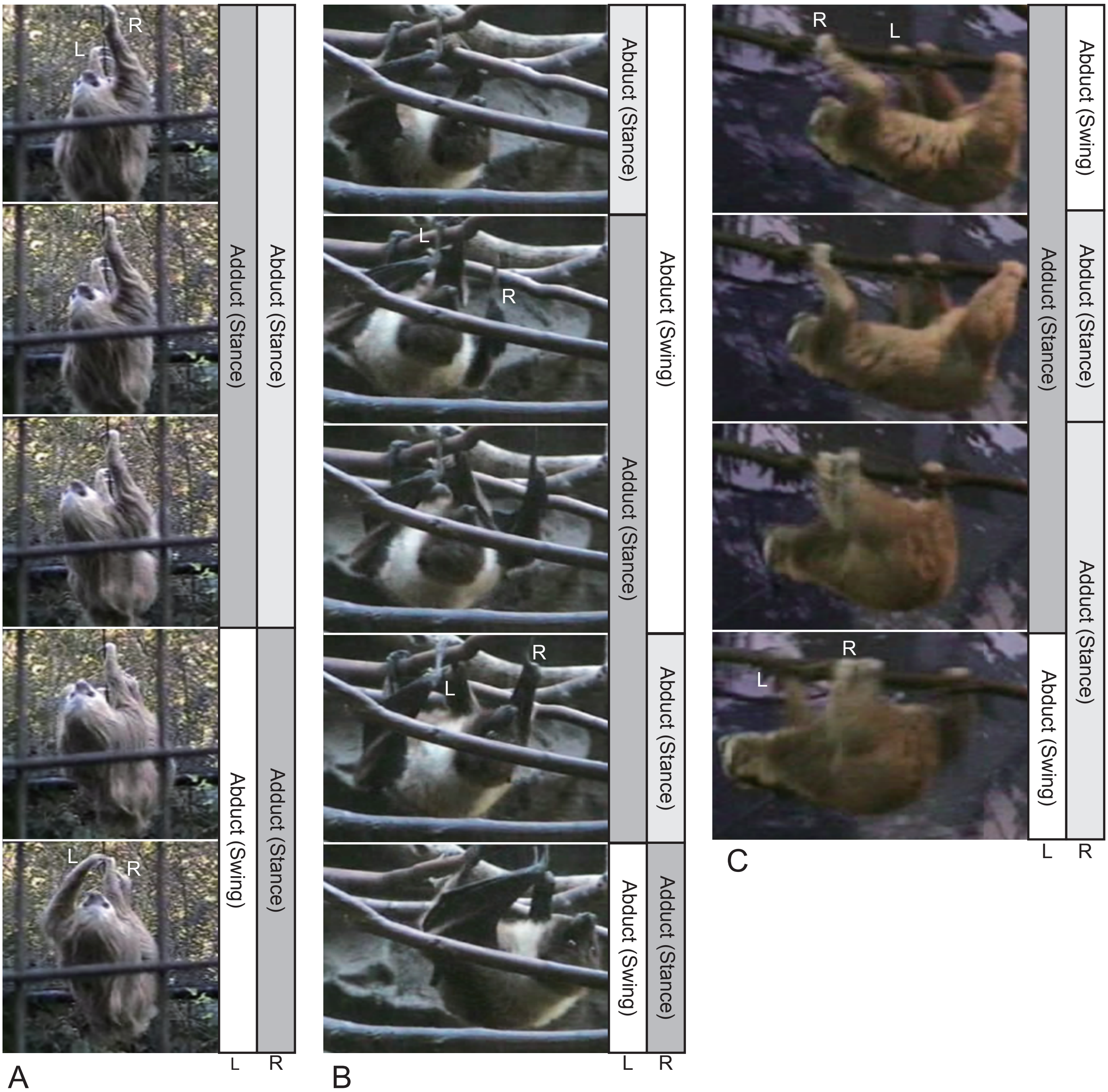

Figure S1. Images from video clips of stance phases (from top to bottom) of A) *Choloepus* and B) *Pteropus* in near-frontal views, and of C) *Nycticebus* in lateral view. Bars on the right side of each image sequence indicate the phases of humeral abduction/adduction during the stance/swing phases of right (R) and left (L) forelimbs. The image sequences are not in equal intervals. See Fig. 4E for a representative image of *Cynocephalus*.

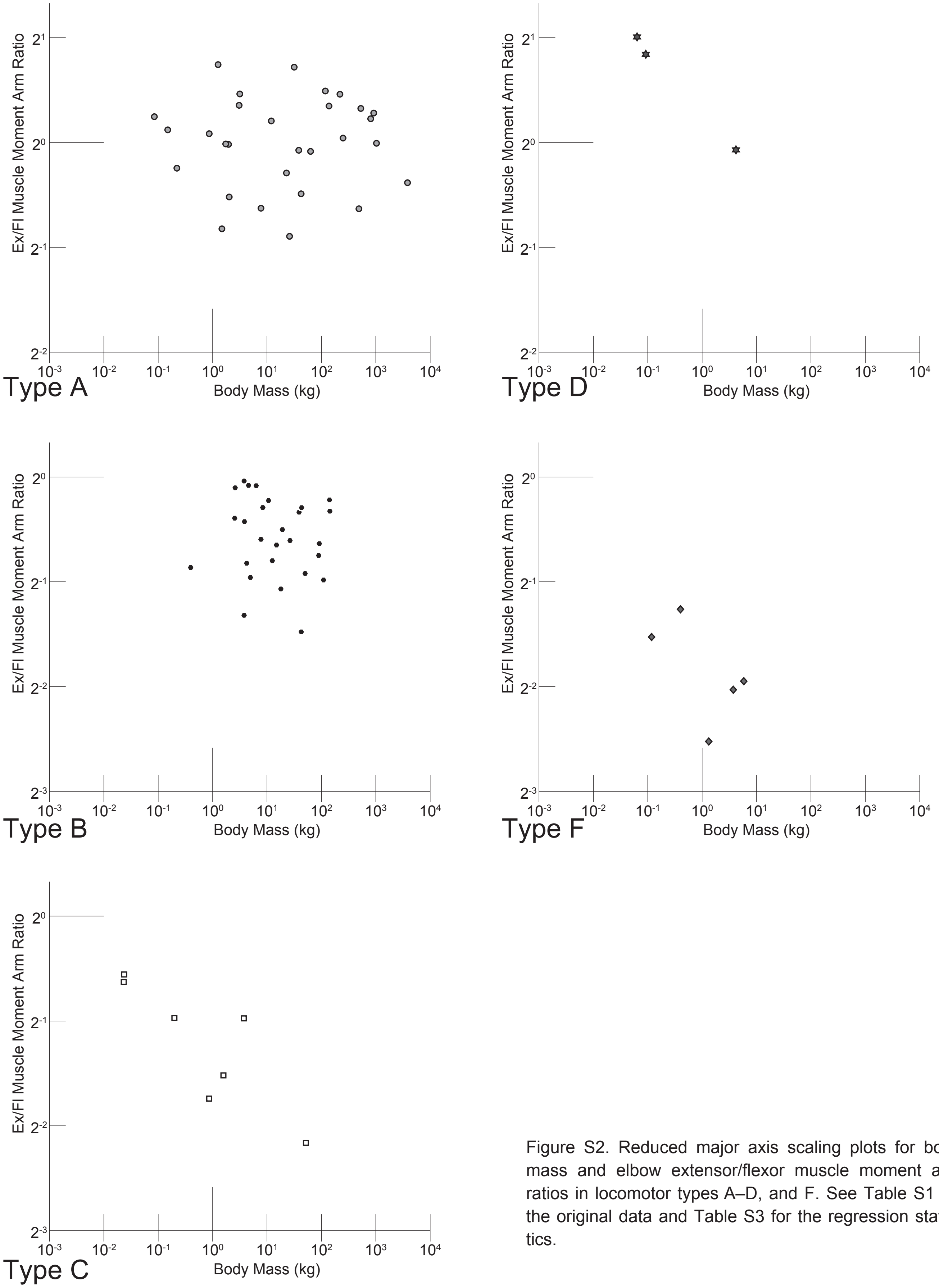

Figure S2. Reduced major axis scaling plots for body mass and elbow extensor/flexor muscle moment arm ratios in locomotor types A–D, and F. See Table S1 for the original data and Table S3 for the regression statistics.

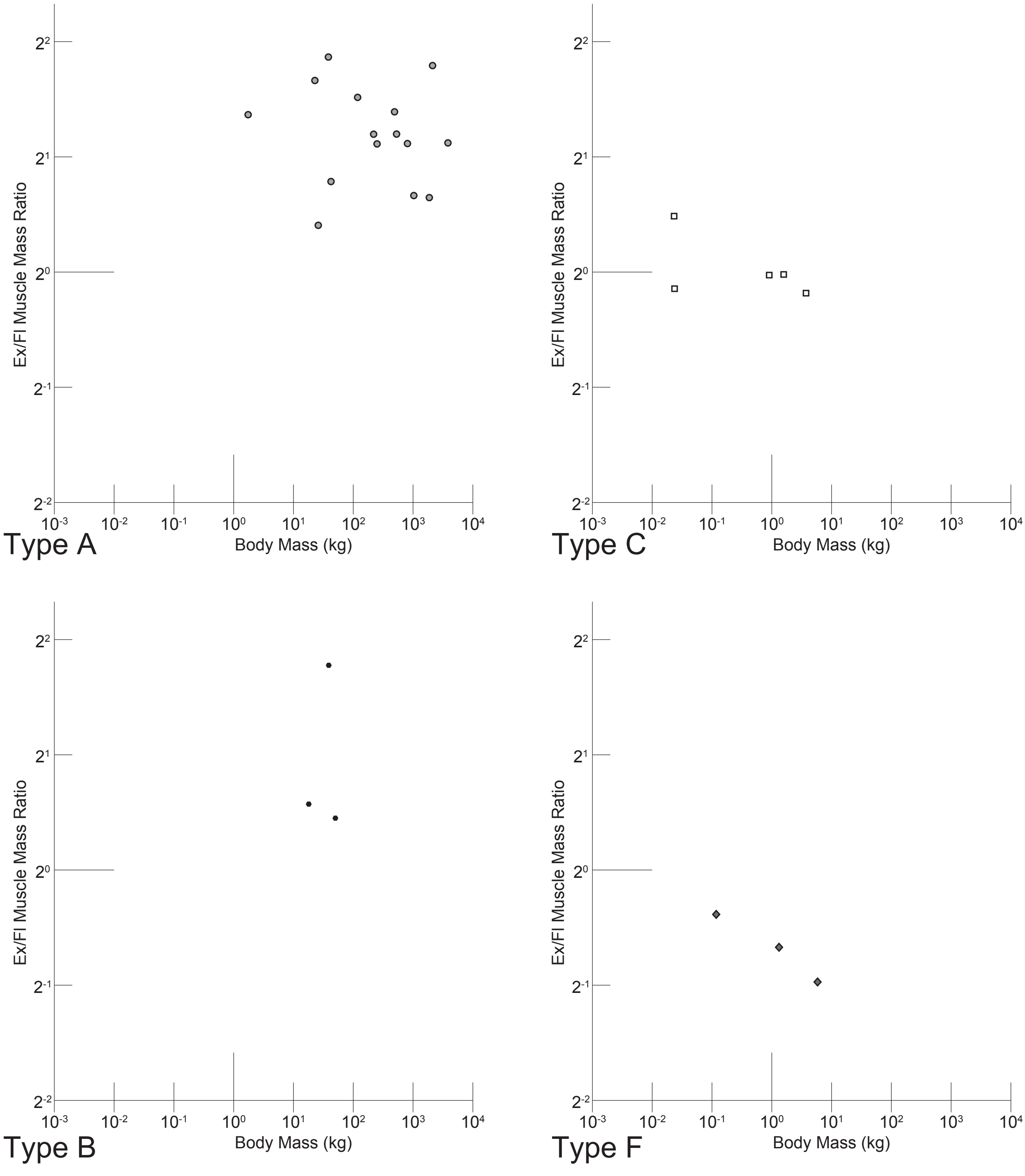

Figure S3. Reduced major axis scaling plots for body mass and elbow extensor/flexor muscle mass ratios in locomotor types A–C, and F. See Table S2 for the original data and Table S4 for the regression statistics.