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Mass estimation in Santacrucian sloths from the Early Miocene Santa Cruz Formation of Patagonia, Argentina

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Miocene deposits of the Santa Cruz Formation, Patagonia, comprise a diverse and excellently preserved vertebrate fauna, allowing detailed paleobiological and paleoecological studies based on three ecological parameters: body mass, diet, and substrate preference. In contrast to the small and arboreal extant sloths, *Bradypus* and *Choloepus*, Santacrucian sloths were much more diverse and larger, and comprised 11 genera previously characterized as arboreal or climbing forms. Here, we focus on body mass estimation based on measurements of postcranial elements. We present a morphometric database comprising 64 linear, base-ten logged variables applied to Santacrucian sloths and a wide sample of extant mammals, as well as the body mass of the extant taxa as reported in the literature. To detect any potential phylogenetical bias, we performed a variance decomposition test on our sample of extant mammals. Based on four orthogram statistics, logged body mass was found not to be dependent on phylogenetic tree topology. Predictive equations for the body mass of extant mammals were generated through multiple regression analysis, using weighting procedures to avoid taxonomic biases and stepwise analysis to discard redundant variables. Using this procedure, we derived separate equations for the scapula, humerus, radius, ulna, pelvis, femur, tibia plus fibula, astragalus, and calcaneum. These equations were then applied to estimate the body mass of our sample of Santacrucian sloths. We obtained an average body mass of about 70 kg for the megalonychid *Eucholoeops* . Among stem megatherioids, *Hapalops* ranged between 30 and 80 kg, *Analcimorphus* was estimated at 67 kg, and *Schismotherium* at 44 kg. Larger genera included the megatheriid *Prepotherium* (~123 kg), and the mylodontids *Analcitherium* (~88 kg) and *Nematherium* (~89 kg). The medium to large body size of Santacrucian sloths imposed constraints on their climbing abilities. Megalonychids and stem megatherioids were likely unable to access the finest branches, while megatheriids and mylodonts were more terrestrial forms.

Key words: Mammalia, Xenarthra, Folivora, Santacrucian sloths, body mass, substrate preference, paleobiology, Miocene, Argentina.

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