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Body Size of *Smilodon* (Mammalia: Felidae)

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ABSTRACT The body masses of the three large saber-toothed machairodontines, *Smilodon gracilis*, *S. fatalis*, and *S. populator*, were estimated on the basis of 36 osteological variables from the appendicular skeleton of extant felids. A new model is introduced that takes the reliability of the predictor equations into account, since mass estimates are more reliable when computed from multiple variables per bone. At a body mass range of 55–100 kg, *S. gracilis* was comparable in size to extant jaguars, and *S. fatalis* was found to be somewhat lighter than previously assumed, with a body mass range of 160–280 kg, similar to that of the largest extant felid, the Siberian tiger. *Smilodon populator* was substantially heavier and larger than any extant felid, with a body mass range of 220–360 kg. Particularly large specimens of *S. populator* almost certainly exceeded 400 kg in body mass. The differences from previous estimates are most likely caused by differences in the databases used for mass estimation. J. Morphol. 266:369–384, 2005.

KEY WORDS:body mass; felids; *Smilodon*; allometry; %PE; %SEE

The machairodontine genus *Smilodon* was a common large predator in the Pleistocene of North and South America. Much attention has been given to studies of its cranial and dental anatomy (e.g., Simpson, 1941; Kurtén, 1954; Emerson and Radinsky, 1980; Martin, 1980; Miller, 1984; Akersten, 1985; Van Valkenburgh and Ruff, 1987; Biknevicius et al., 1996). However, the somatic proportions of saber-toothed cats *sensu lato* often appear to have differed from their extant feline counterparts, the former appearing more stocky and powerful, with proportionally shorter and stouter limb bones, especially the distal ones (e.g., Merriam and Stock, 1932; Anyonge, 1993; Turner and Anton, 1997).

The best studied of all saber-toothed cats, *Smilodon fatalis*, from the late Pleistocene of North America, is known from large samples. Akersten 1985; Kurtén and Werdelin, 1990; Turner and Anton, 1997). The more plesiomorphic *S. gracilis* appears to have been distinctly smaller than its two congenerics (Kurtén and Werdelin, 1990; Turner and Anton, 1997). Previous assessments that *S. fatalis* was comparable in size to extant lions (e.g., Kurtén and Anderson, 1980; Akersten, 1985) are probably incorrect, since proportional differences in overall build made it considerably heavier than a simple evaluation of overall body proportions would suggest (Anyonge, 1993; Turner and Anton, 1997).

This study focuses on body mass estimation in all three species of *Smilodon* based on limb bone dimensions. Craniodental variables are frequently used in mass estimation analyses but are less satisfactory due to a possible systematic bias across geological time (e.g., Damuth, 1990) and to theoretical considerations concerning the use of nonweight-bearing variables used to predict body mass (Hylander, 1985; see also Fortelius, 1990). Limb bones are directly responsible for support of mass and in stresses of locomotion and have been found to show high correlations with body mass in terrestrial mammals (e.g., Christiansen, 1999a,b, 2002a). The demands on the appendicular skeleton in terms of support of mass and stresses of locomotion in extinct animals probably did not differ markedly from the constraints observed in extant animals.

MATERIALS AND METHODS

A sample of 23 extant felids from the Zoological Museum in Copenhagen, representing 10 species, was measured for the purpose of this study (Table 1; Appendix A). In order not to confuse intra- and interspecific allometry, averages of each species with multiple individuals were used for statistical analysis, with the exception of the tiger, which was represented by two distinct subspecies, the Bengal subspecies (*Panthera tigris tigris*) and the Siberian subspecies (*P. tigris altaica*). This exception was made due to the distinct physical differences between the two subspecies (Mazák, 1981; Nowak, 1991; Sunquist and Sunquist, 2002), and the desire to include as many large taxa in the database as possible (see below).