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McNab B K. Bioenergetics and the determination of home range size. *Amer. Naturalist* 97:133-40, 1963.
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The home range area of a mammal is proportional to the species' body mass raised to a power *b*. Because the power *b* is statistically indistinguishable from 0.75 and because basal rate of metabolism is proportional to mass raised to the 0.75 power, home range is proportional to rate of metabolism. Much of the residual variation in home range size around the mean curve fitted to mass is associated with food habits, home range being large in species that are carnivores and seedeaters ("hunters") and small in species that graze or browse ("croppers"). Therefore, rate of energy expenditure and the ecological factors influencing energy availability have a significant impact on home range size in mammals. [The *SCI*® indicates that this paper has been cited in over 205 publications.]

The Scaling of Ecological Phenomena

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Although several field studies of the natural history of mammals had, by 1962, estimated home range size, no quantitative analysis had been made of these data. This paper was the first attempt to do so, and it was one of the earliest to bring the concept of scaling (i.e., the correlation of quantitative data on an animal with its body size) to ecology. This transference occurred, not because of any particular insight by me, but because I brought this viewpoint from graduate studies in Dr. Peter R. Morrison's laboratory of comparative physiology at the University of Wisconsin (Madison) in the late 1950s. By that time the concept of scaling was well established in comparative physiology. Such a transference of ideas from one microculture (comparative physiology) to another (ecology) is fostered by cross-cultural exchange and is a powerful argument in favor of combining traditional fields, or at least in favor of a broad, interdisciplinary graduate education. The first response to this paper was a description of the scaling relation of home range in birds[1,2] and in reptiles.[3]

The analysis that made this paper attractive to other biologists was finding a scaling relation between home range area and body mass that was parallel to that found between (basal) rate of metabolism and body mass. The shadow of this paper has followed me, for even in a tropical rain forest of Queensland (Australia) I was asked whether I was *The McNab* who described the relation between home range size and body mass! In spite of its popularity, this analysis had, in retrospect, several flaws. One was that the collection of additional data on home range area has shown that the power relation between home range area and body mass is much steeper than originally thought: *b* is usually greater than 1.0.[4] But an even more fundamental criticism is that a parallelism between one scaling relation and another is, itself, inadequate proof of a causal connection, as was seen recently in the analysis of the parallelism of scaling relations of brain mass and basal rate of metabolism in mammals.[5] Furthermore, S.L. Lindstedt and colleagues[6] have made the dimensional argument that home range area should be proportional to energy, not power (energy/time). Consequently, area should be proportional to power × time, which, given that "ecological" time is proportional to mass raised to the 0.25 power, means that home range area should be proportional directly to mass. Some problems exist with this modification of the original argument, but empirically it is closer to the observed relation than the original analysis.

Aside from the technical question whether the original analysis was, or was not, in some sense "correct," the ideas contained helped to bring to the attention of ecologists that many aspects of the physiology and ecology of animals can be described as a power function of body mass and that body size is one of the most important characteristics of an animal, an idea that gains prominence with the passage of time.[7]

1. **Armstrong J T.** Breeding home range in the nighthawk and other birds: its evolutionary and ecological significance. *Ecology* 46:619-29, 1965. (Cited 25 times.)
2. **Schoener T W.** Sizes of feeding territories among birds. *Ecology* 49:123-41, 1968. (Cited 195 times.)
3. **Turner F B, Jennrich R I & Weintraub J D.** Home ranges and body size of lizards. *Ecology* 50:1076-81, 1969. (Cited 60 times.)
4. **Harestad A S & Bunnell F L.** Home range and body weight—a reevaluation. *Ecology* 60:389-402, 1979. (Cited 80 times.)
5. **McNab B K & Eisenberg J F.** Brain size and its relation to the rate of metabolism in mammals. *Amer. Naturalist* 133:157-67, 1989.
6. **Lindstedt S L, Miller B J & Buskirk S W.** Home range, time, and body size in mammals. *Ecology* 67:413-8, 1986. (Cited 10 times.)
7. **Peters R H.** *The ecological implications of body size.* Cambridge, England: Cambridge University Press, 1983. 329 p. (Cited 225 times.)

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