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Short Note

Observations on the growth of *Chinchillula sahamae* (Rodentia, Sigmodontinae) in captivity

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Rodents are the most diverse group of mammals on the planet, yet most species are totally unknown with regard to their population dynamics and basic biology. The chinchilla rat (*Chinchillula sahamae* Thomas 1898) is a small rodent species not to be confused with the chinchilla (Rodentia; Chinchillidae: *Chinchilla brevicaudata*), although both species occupy somewhat similar rocky habitats in the high Andes (3500–4800 m) of southern Peru, southwestern Bolivia, and northern Chile (Musser and Carleton 2005). The chinchilla rat is herbivorous, feeding on grass or herbs (Pearson 1958, Mann 1978); studies in southeastern Peru have found the diet to be composed of 96.57% grass and herbs and 0.01% seeds (Horacio Zeballos personal communication), and the chinchilla rat shows signs of reproductive activity in the beginning of October (Pearson 1958). *Chinchillula sahamae* is classified as endangered in both Chile and Peru (Miller et al. 1983, Eisenberg and Redford 1999, Zeballos et al. 2001, MASAG 2005).

In this paper, we present data obtained from daily observations over a 25-week period of a wild-caught, captive adult female chinchilla rat and her three offspring. Growth studies provide basic information from which generalized aspects of the life history of the species can be inferred. As data related to the natural history and ecology of *Chinchillula sahamae* are practically nonexistent, observations presented here provide valuable insight into the natural history of the growth and development of this species in captivity. However, we are aware of the small sample size and the possible bias due to kinship; therefore, we did not attempt to examine the data quantitatively or to perform other model analyses.

The adult female (CBF 3108) was captured in January 2004 in Ulla Ulla, province of Franz Tamayo, La Paz, Bolivia. While still in the trap, the female gave birth to three offspring (two females and one male). The four animals were immediately transported to the live animal room of the Colección Boliviana de Fauna (CBF) for observation. Animals were provided with 12 h/day light and fed *ad libitum* primarily with fresh clover leaves and oats. Total length (TL), length of tail (Lt), length of right hind foot with unguis (LF), and height of right ear (LO) were obtained in millimeters (mm). Body weight (W) in grams (g) was measured and recorded to the nearest 0.1 g (precision scales, Pesola Micro-Line Spring Scale, CH-6340 Baar, Switzerland, 0.1 g error). Although changes in body morphometrics were recorded in 24-h periods, we present the results in periods of 120–160 h periods (approximately 5–7 days). Measurements were collected between January and July 2004. Morphometric data from the adult female were also obtained at the time of death (due to unknown causes). The duration of data collection for each of the offspring was 88 days for the male and 180 days for each of the females.

Description of development: from day 1 (date of birth of offspring) until day 3, the newborns were toothless, pink and hairless, with ear pinnae pressed tightly against

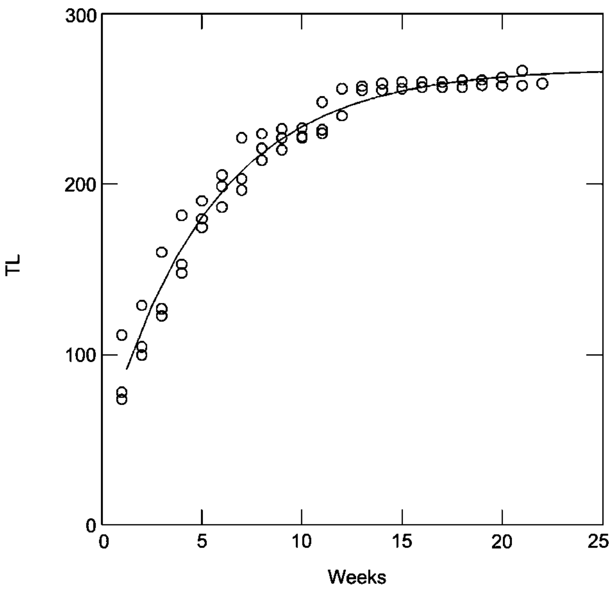

Figure 1 Growth curve of total length (TL, head to tail in mm) from three chinchilla rats (*Chinchillula sahamae*); one male (measured for 12.5 weeks) and two females (measured for 26 weeks). The line is the expected curve for the Von Bertalanffy model.

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Table 1 Standard measurement of chinchilla rats (*Chinchillula sahamae*) studied for a 22-week period in captivity (3108, N-h, B-h, E-m) compared to the adult range measures from specimens stored at the Colección Boliviana de Fauna (CBF); Museum of Natural History of the Universidad Nacional de San Agustín de Arequipa, Perú (MUSA); or reported in Anderson (1997) (SA 97) or Eisenberg and Redford (1999) (E-R 1999).

Chinchilla rat	Sex	TL	Lt	LF	LO	Weight (g)
CBF 3108	H	270	108	33	38	160
N-h	H	268	105	33	36	144
B-h	H	258	105	34	34	149
E-m	M	232	92	32	35	98
CBF	–	192–285	75–105	30–35	30–34	73–134
MHSA	–	186–280	64–115	26–39	26–37.2	45–188
SA 1997	–	253–282	94–114	34–37	35–38	110–155
E-R 1999		161	104	35	36	140

TL, total length; Lt, length of tail; LF, length of right hind foot; LO, height of right ear (in mm). Weight (g).

the head and fully unfolded. On day 4 the skin along the spine and head turned gray. Beginning on day 6, fine dark fuzz (<1 mm long) covered the spinal region, while fuzz covered the legs. Growth was constant and noticeable, and the fuzz turned finer and denser, although crawling movements remained clumsy and unstable. On day 14, the three offspring each opened one eye at different times; by days 16–17 all animals had both eyes opened. They responded to audio stimuli and became more active and curious. Body position was slightly upright, but the young did not leave the nest. At this time, it was possible to observe small incisors in both jaws, and the young began nibbling. Starting at day 20, the coloration had become more distinct and resembled that of the mother. Growth was continuous and weight increased rapidly. The young ceased nursing (day 22) and started gnawing and searching for solid food. Beginning on day 30, ears which had been slightly droopy became erect. We observed that they jumped and invested more time in self-grooming.

On day 45, they became more active, and the growth rate decreased. The coloration pattern was similar to that of the mother but slightly darker, with a defined veined pattern around the face and behind the ears. The ears were firmer and more erect, and the teeth had turned from white to yellowish. From day 90, the growth rate decreased even more and the fur became lighter in color, especially in the front of the body (face and forelimbs) although with a distinct stripe in the back (the rear portion of the body). All the changes became more subtle, and by day 100 the offspring had all of the physical characteristics of an adult in terms of coloration (buffy to tawny upper parts, blackish mid-dorsally, darker lines along the sides, white belly), pelage characteristics (smooth, long, and silky fur), tail (fully haired, around three-quarters combined length of head and body), and ears (brown, with large white pre-auricular tufts).

Data analysis was carried out by fitting the results to a Von Bertalanffy growth curve, which has previously been used in different mammal growth studies (Misra 1980, Creighton and Strauss 1986, Zach 1988, Rogowitz and Wolfe 1991). The results using this model showed an evident sigmoid growth with an exponential growth for the first 8 weeks diminishing by week 13 and reaching an asymptote at around week 15; animals grew only 10 mm (average) in the last 8 weeks of observation (Figure 1). On the contrary, the weight of the chinchilla rat showed a pattern of continual growth which did not follow the Von Bertalanffy expectation as it did not reach an asymptote (data not shown). We did not consider Lt, L, and LO because we found a strong correlation between them and TL. Due to the small sample size of the captive individuals, the data obtained should be considered carefully when comparing to individuals in their natural environment.

According to Myers and Master (1983) and as shown by Mcallan et al. (2008), factors, such as brood size, age, mother's conditions, and temperature, may have an influence on the growth rate of young individuals, although Creighton and Strauss (1986) indicate that average values on laboratory studies generally tend to approach the natural patterns of growth for typical individuals. The studied individuals showed growth patterns with sigmoid curves characteristic for all mammal species and small vertebrates studied to date (Zullinger et al. 1984, Zach 1988). Even though there are some weight differences, in general the standard measurements in our individuals did not present significant variations; therefore, we can generalize a single growth pattern for the individuals. The advantage of using a generalized exponential growth model is that more than 90% of the observed data are above the calculated asymptote and indicate the age at which a constant proportion of the total exponential growth has occurred (Creighton and Strauss 1986, Rogowitz and Wolfe 1991). Based on these observations, the growth rate in size (body length) reaches stability approximately at week 20.

Our measurements of TL, LF, and LO are within the reported ranks in the literature (Anderson 1997) and the scientific collections revised (Table 1). Nevertheless, the studied animals weighed a lot more than animals collected in nature and/or reported in the literature. Undoubtedly, the diet and captivity conditions influenced the lack of consistency in these values and may explain why they did not adjust to the theoretical curve of the Von Bertalanffy growth model. Consequently, our results are consistent with the concept that captive chinchilla rat developed "normal" sizes but not weights.

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