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NOTES ON AGE DETERMINATION, GROWTH AND MEASUREMENTS OF BROWN HYAENAS *HYAENA BRUNNEA* FROM THE KALAHARI GEMSBOK NATIONAL PARK

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Abstract — Brown hyaenas were aged on the basis of tooth eruption and wear and five age-classes were recognised. Weights and seven different body measurements were recorded from 38 immobilised hyaenas. Full size is reached at the age of 30 months, but age-class 5 animals were significantly lighter than were animals from the other adult age-classes. This was probably due to the worn down premolars of old animals resulting in less efficient bone chewing. With a few puzzling exceptions the sizes of brown hyaenas from different parts of their distribution range are similar.

Introduction

No published information on age determination and little on growth (Lang 1958; Schultz 1966) and measurements (Roberts 1951; Smithers 1971; Skinner 1976; Smithers & Wilson 1978; Skinner & Ilani 1979) exist for the brown hyaena *Hyaena brunnea.* This is important basic information for many field studies particularly those concerned with population dynamics. In this paper a simple method of age determination as well as some basic growth and measurements data for the brown hyaena are presented as a first step to filling this gap. The data were collected in the Kalahari Gemsbok National Park, Republic of South Africa.

Materials and Methods

Age determination

As no known-age skulls were available it was not possible to use sophisticated ageing techniques such as the examination of incremental growth lines in the teeth, or the closure rate of the pulp chamber of the canines. Animals were, therefore, aged on the basis of tooth eruption and wear.

As much as possible of the eruption sequence of the deciduous and permanent teeth was determined by examination of immobilised or dead animals whose approximate ages (within 1-2 months) were known. Tooth wear was subjectively measured by the amount of wear on the principle bone crushing teeth, particularly P_3, in a similar manner to Kruuk's (1972) method on spotted hyaenas *Crocuta crocuta*.

Growth and measurements

Immobilised brown hyaenas were weighed in a weighing net with a 0-200 kg Salter Weigher calibrated in 1 kg divisions. The mass was read off to the nearest 0,1 kg. All animals were weighed after being caught in a baited drop-door trap (Mills 1977), and were therefore reasonably full as they had recently eaten the bait.

Body measurements were taken "over the curves" (Ansell 1965) (except for shoulder height) as this method is easiest to apply in the field and gives the best assessment of the animal's condition (Smuts 1974). The animal was layed on its side and a steel tape was used. Readings were taken to the nearest millimetre. Wherever possible the following measurements were taken:

a) Total length: from the tip of the nose to the end of the vertebrae of the tail;
b) Tail length: from the sacro-coccygeal joint to the end of the vertebrae of the tail;
c) Ear length: from the notch of the ear to the furthest extremity of the ear;
d) Hind foot: from the heel to the end of the longest claw;
e) Heart girth: the circumference of the chest measured immediately behind the forelegs;
f) Neck thickness: the circumference of the neck measured as close to the skull as possible;
g) Shoulder height: from the top of the scapula to the end of the longest claw. The leg was held rigid and the shortest distance between the two points was measured.

Results

Age determination

The dental formula of adult brown hyaenas is as follows:

$I\frac{3}{3}, C\frac{1}{1}, P\frac{4}{3}, M\frac{1}{1} = 34$

Brown hyaenas are apparently born without teeth, the incisors having appeared by the fourth week of life (J. Anderson *pers. comm.)*. The youngest animal immobilised was approximately eight months old. I^1, I_1, I^2 and I_2 had erupted and i^3 and i_3 were either loose or had fallen out. All the deciduous premolars had fully erupted and the molars had broken through the gums (Fig. 1a). Two approximately 10-month old animals had I^3 erupting and I_3 fully erupted. The permanent premolars and the molars were erupting, P^1, P^4, P_4, M^1 and M_1 being almost fully erupted. The other permanent premolars were not as far advanced and could be seen below the deciduous premolars. By 12 months the permanent canines begin to erupt and P^1, P^2, P^4, M^1, P_2, P_4 and M_1 have completely erupted. The third premolars and the canines are the last teeth to erupt completely, and at approximately 15 months of age a brown hyaena has its full permanent dentition (Fig. 1b).

Brown hyaenas with erupting teeth were placed into age-class 1 and considered as cubs. The dentition of animals in the remaining four age-classes are illustrated in Figs 1b, c, d and e.

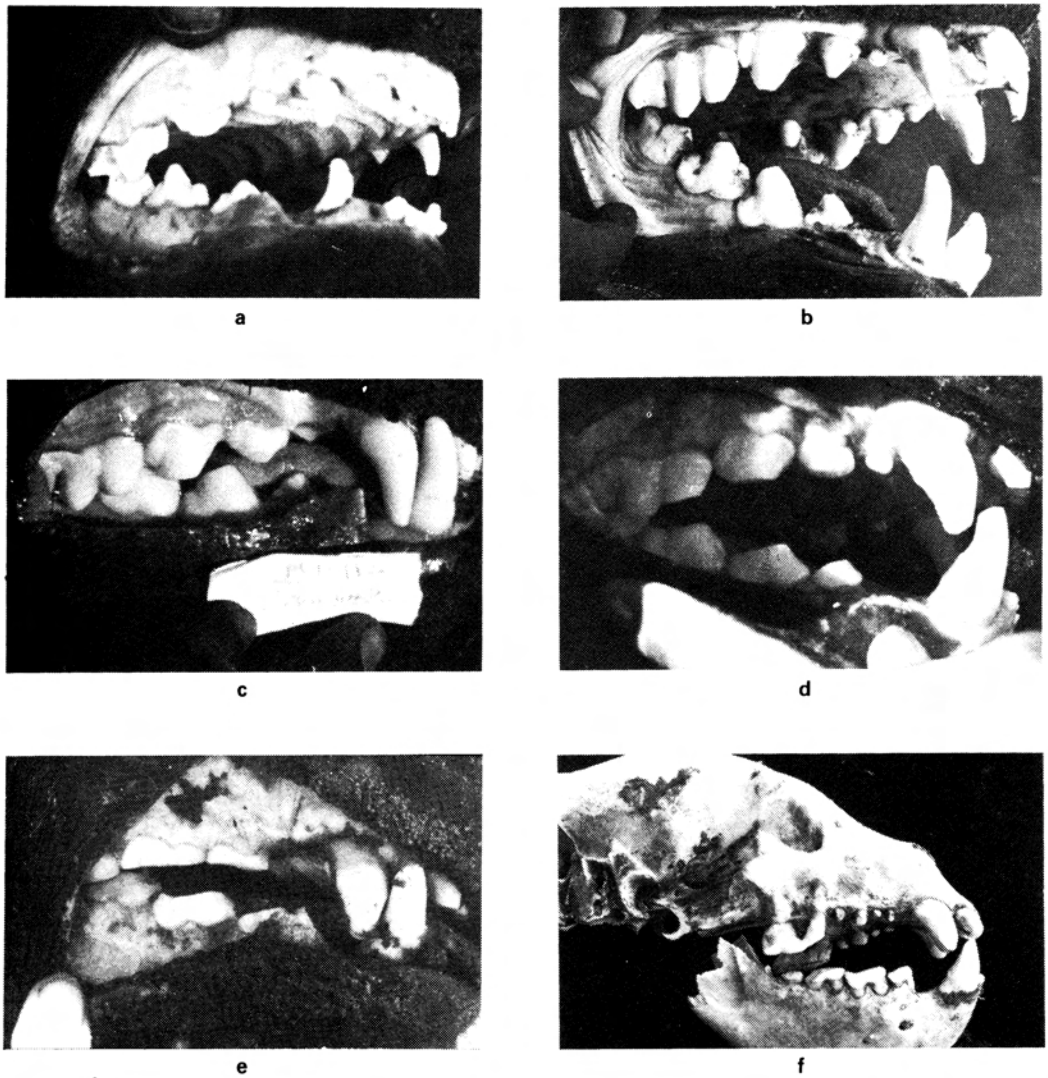

Fig. 1. The teeth of brown hyaenas from five age-classes based on tooth eruption and wear. (a) Age-class 1, teeth still erupting. (b) Age-class 2. (c) Age-class 3. (d) Age-class 4. (e) Age-class 5. (f) The same animal as in (e) taken three years later, showing considerable wear on P^2 and P^3.

Brown hyaenas were regarded as subadults from the time they received their full permanent dentition until they were 30 months old, after which they were considered adults. At 30 months they reached full size (see later). It is sometimes possible, therefore, to differentiate age-class 2 animals into subadults (age-class 2a) and adults (age-class 2b).

From long term observations on the dentition of certain known individuals it has been possible to obtain an indication of the absolute ages of some of these age-classes.

Brown hyaenas move from age-class 2 to age-class 3 in their fourth year. A female which was just placed in age-class 3 in February 1973 was still in this age-class in December 1974. In January 1976 she was placed in age-class 4. Thus she passed into age-class 4 when she was approximately six years old.

These observations agree with those of Kruuk (1972) for spotted hyaenas in East Africa. Kruuk says that East African spotted hyaenas pass into age-class 5 at 16 years of age. Whether this is the same for brown hyaenas or not remains to be established. It is possible that differences in the amount of bone chewing done by the two hyaena species may cause different tooth wear patterns. Alternatively the abrasive action of the sand on the teeth during feeding could cause the teeth of Kalahari hyaenas to wear down more rapidly. Smuts, Anderson & Austin (1978) recorded that the incisors of lions *Panthera leo* in the Kalahari wear down more rapidly than they do in other areas and suggest that this might be caused by sand inadvertently ingested during feeding.

Once in age-class 5 the premolars of a brown hyaena wear down rapidly. Figures 1e and f are photographs of the same brown hyaena's teeth taken three years apart, Fig. 1f being taken after he was found dead. The premolars in the upper jaw have worn considerably in the three year period and P^2 and P^3 have become non-functional. Another brown hyaena female which was in age-class 4 when caught was found dead five years later. Her premolars in the upper jaw were also badly worn and non-functional. She had spent approximately four years in age-class 5.

Shoemaker (1978) recorded many brown hyaenas living 12-15 years in captivity and Crandall (1964) recorded longevities of over 20 years.

Growth and measurements

The mean mass of 13 brown hyaenas less than 24h old which were born in captivity (Lang 1958; Schultz 1966; J. Anderson *pers. comm.*) has been calculated as 693,2 g ± S.E. 17,6. At four weeks the mean mass of eight of these animals was 1,94 kg ± S.E. 0,08, at eight weeks the mean mass of four was 3,49 kg ± S.E. 0,13, and at 10 weeks the mean mass of three was 4,78 kg ± S.E. 0,12.

The youngest brown hyaena weighed during the present study was approximately eight months old and weighed 19,9 kg. Two litter mates of approximately 10 months old weighed 24,9 kg and 29,9 kg respectively. From Fig. 2 it can be seen that brown hyaenas are full grown at approximately 30 months of age, although certain parameters such as ear length, tail length and hind foot length, show little variation after 10 months of age.

The mean mass of 11 adult male brown hyaenas weighed was 40,2 kg ± S.E. 0,9 (Range: 35,0 — 43,3 kg). The mean mass of eight non-pregnant adult females was 37,7 kg ± S.E. 1,1 (Range: 28,0 — 47,5 kg). The mean mass of an individual was used in the above calculations if it was weighed more than once. Contrary to the findings of Skinner (1976), therefore, there was no significant difference between the mean mass of males and females ($t = 1,77$; $df = 17$; $p>0,05$).

There was a large amount of variation in the weights of different adults of the same sex. The amount of variation between the two sexes as shown by the co-efficient of variation, which for males was 7,4% and for females was 8,9% was, however, similar. Although variables such as inherited characteristics and the number of good meals eaten in the recent past obviously play a role as far as these differences in mass are concerned, the data in Fig. 2 suggest that this phenomenon might also be related to age. Although the sample sizes are small, age-class 5 animals were found to be significantly lighter than were adults from the other age-classes combined ($t = -2,97$; $df = 18$; $p<0,01$).

Brown hyaenas from most other areas are similar in size to those from the southern Kalahari. From the southern and northern Transvaal, Skinner (1976) gives the mean mass of five males as 43,9 kg ± S.E. 2,4 (Range: 38,0 — 47,5 kg) and that of

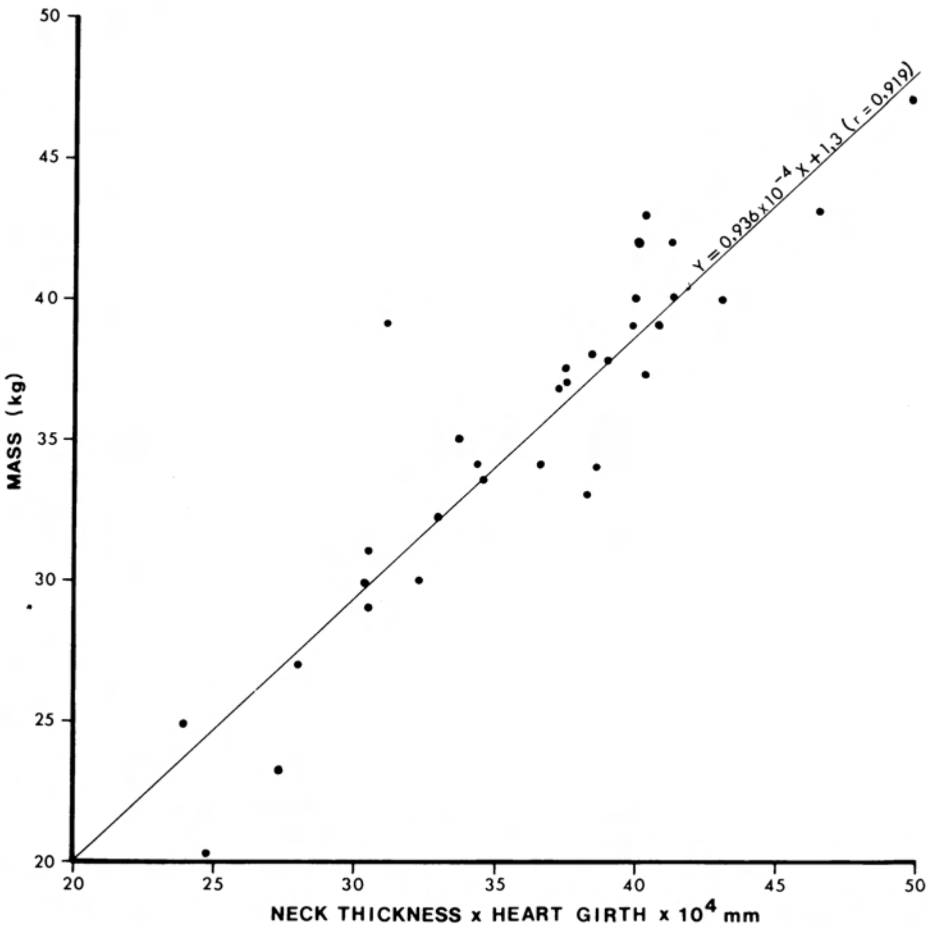

Fig. 3. The relationship between mass and neck thickness x heart girth in brown hyaenas.

three females as 40,9 kg ± S.E. 2,5 (Range: 37,0 — 42,1 kg). I have calculated the mean mass of 10 brown hyaenas collected from various parts of southern Africa; the northern Cape (R. Liversidge *pers. comm.)*, the Orange Free State (C. Lynch *pers. comm.)*, Zimbabwe (Smithers & Wilson 1978) and Botswana (Smithers 1971) as 41,0 kg ± S.E. 1,2 (Range: 36,3 — 46,3 kg). A female brown hyaena from Bedford in the eastern Cape, however, is reputed to have weighed 67,6 kg (P. Swanepoel *pers. comm.*) and Roberts (1951) gives the mass of two unsexed brown hyaenas from the eastern Transvaal lowveld as 72,6 kg and 59,9 kg.

Various combinations of body measurements and their logarithmic equivalents were tested on a computer in order to obtain the best correlation between a set of linear measurements and body mass (P. Retief *pers. comm.*). The highest correlation coefficient ($r = 0{,}919$; $p<0{,}001$) was obtained when body mass was ploted against neck thickness x heart girth (Fig. 3).

Discussion

It is extremely difficult to accurately age a brown hyaena in the field. There are no pelage changes, as for example in the spotted hyaena, or secondary sexual characteristics, as in male lions which may be used as indicators of age.

However, the large and robust teeth of the brown hyaena provide a simple and, for most field studies, an adequate means of ageing brown hyaenas provided that the teeth can be suitably examined by the researcher. This can be accomplished by immobilisation and by examination of dead animals and even on occasions by observations of free-ranging individuals.

Adequate growth data are still lacking for the brown hyaena and it is not yet possible to describe body growth by the fitting of Von Bertalanffy growth curves to the data (see, for example, Smuts, Robinson & Whyte 1980). However, the age of attainment of full size was established, as was a significant decrease in mass in old animals. One possible reason for this phenomenon is that old animals, with their worn down teeth, have more difficulty in consuming bones than younger ones do. Once, for example, an old adult male was observed to spend half an hour attempting unsuccessfully to consume a leg bone of a springbok *Antidorcas marsupialis*, something which a young adult would achieve in under five minutes. Bones are an important component of the brown hyaena's diet (Mills & Mills 1978) and older animals therefore do not have access to as wide a range of food as younger ones do. In lions a similar drop in body size with age for similar reasons has been proposed by Smuts *et al.* (1980).

The much larger than average weights of three brown hyaenas (two from the lowveld and one from the eastern Cape) are difficult to explain. In the case of the animal from the eastern Cape, it may be that the animal was living in a situation of abundant food, free from competition of conspecifics and other carnivorous animals.

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