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GROWTH AND DEVELOPMENT OF THE IMPALA *AEPYCEROS MELAMPUS*

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Introduction

Growth and development of the prenatal impala has been described by Fairall (1969) and Roettcher, Hoffman and Kayanja (1970) while weights and measurements of the mature animal have been reported by Sachs (1967) and Talbot and McCulloch (1965). Child (1964) has investigated growth in this species.

This paper serves as a baseline for comparison of future changes in morphology of the species, as the animals were all obtained at the beginning of the culling programme.

Material and Methods

Impala became available in the Kruger National Park as a result of culling operations and for a separate study project on the reproductive physiology of this animal (Fairall 1972). Mass and measurements of 300 animals were analysed and this information was used to quantify growth and size for this species from the Park.

All animals were shot and transported to a central point where they were weighed. Some measurements were taken in the field, the majority were, however, taken when the animals were weighed.

Mass was determined with the aid of a spring balance. Standard measurements taken were: length of vertebral column from the atlas joint to the sacrococcygeal joint; heart girth measured directly behind the shoulder; and shoulder height taken from the tip of the hoof to the highest point of the shoulder. Measurements were all taken along the body curves.

The lambing season of the impala in this area is very clearly defined (Fairall 1968, 1972). Ages of immature animals were, therefore, deduced from the months in which they were shot. Females can be accurately

aged up to two years and males up to three years by using horn size and shape as additional ageing criteria.

In attempting to derive a method to determine mass from body measurements, regressions of each separate measurement and multiple regressions of all combinations were tested using standard methods.

Results

Mean mass and measurements are shown in Table 1 and growth is illustrated graphically in Fig. 1. The standard deviation of mass should be noted, as this shows a deviation of between 6 to 11 percent. The breaks in the growth curves at about eight months are also interesting and can be compared with the curves presented by Child (1964).

Simple linear regression using heart girth as independent variable, was found to give as accurate a representation of the relation between mass and measurement as any combination; it was, therefore, used. The growth curves in Fig. 1 show that it would be unrealistic to fit one linear equation over the whole curve. Separate regressions for ages under and above 12 months were therefore calculated. There is very little difference between the sexes of the immature animals and the linear function for both is adequately represented by mass = 0,8744 Heart Girth – 31,1218. This has a coefficient of determination of 0,86. Mature growth differs between the sexes and two linear functions describe the relationship: for males the line is defined by mass = 0,9746 Heart Girth - 30,7913 and for females by mass = 0,5180 Heart Girth + 0,2926; the coefficient being 0,71 and 0,93 respectively.

Table 2 is an attempt to use this information in a practical manner. For any measured heart girth the equivalent mass may be determined directly.

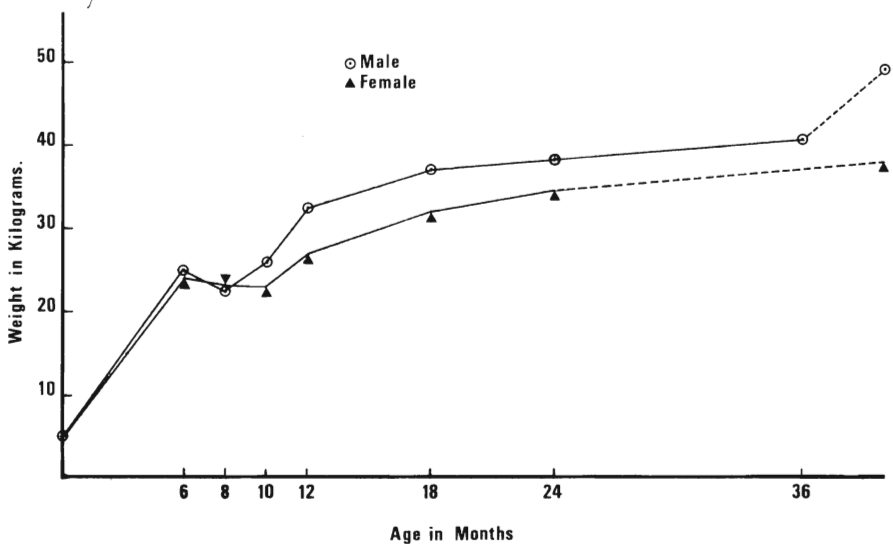

Fig. 1. Growth curves of Kruger National Park impala.

Table 1

Mean mass and measurements of Kruger National Park impala with their standard deviations

AGE	MALE IMPALA								FEMALE IMPALA							
	Mass	±	Length	±	Shoulder Height	±	Heart Girth	±	Mass	±	Length	±	Shoulder Height	±	Heart Girth	±
6 months	25,00	2,19	77,69	2,18	74,65	1,90	64,64	2,97	24,32	1,63	78,1	1,57	73,03	1,51	63,33	1,88
8 months	22,47	3,65	79,48	8,72	74,46	3,28	65,42	9,70	23,00	2,31	75,78	4,34	72,63	3,12	63,33	3,29
10 months	25,93	2,99	81,02	1,72	75,28	3,21	64,15	2,95	23,03	3,63	80,73	4,39	75,48	3,22	62,36	3,12
12 months	32,59	1,07	87,78	1,16	80,50	0,74	71,26	0,91	27,34	1,01	85,16	1,57	78,42	0,93	67,93	1,41
18 months	35,24	4,33	91,04	3,03	83,16	1,96	72,41	2,18	31,89	1,95	88,45	2,75	80,24	1,55	69,43	1,36
24 months	36,72	1,76	90,00	2,06	83,22	1,12	73,00	1,21	34,52	1,33	91,00	2,84	80,43	1,93	70,43	1,25
36 months	40,58	2,21	89,39	8,68	85,772	1,52	76,05	1,52								
Mature	49,22	1,02	96,81	0,74	88,51	0,62	82,15	0,71	38,30	1,79	91,12	5,57	83,69	0,58	75,43	2,24
Old	47,80	2,19	96,99	2,06	88,44	0,83	81,03	1,49	41,83	3,44	99,57	4,97	84,29	1,57	77,57	2,87

Table 2

Mass estimates from heart girth measurements for different classes of impala

IMMATURE		MATURE FEMALES		MATURE MALES	
Heart Girth	Mass	Heart Girth	Mass	Heart Girth	Mass
55	16,9	65	34,0	70	37,4
56	17,8	66	34,5	71	38,4
57	18,6	67	35,0	72	39,4
58	19,5	68	35,5	73	40,4
59	20,4	69	36,0	74	41,3
60	21,3	70	36,6	75	42,3
61	22,1	71	37,1	76	43,3
62	23,0	72	37,6	77	44,3
63	23,9	73	38,1	78	45,2
64	24,7	74	38,6	79	46,2
65	25,6	75	39,1	80	47,2
66	26,5	76	39,7	81	48,2
67	27,4	77	40,2	82	49,1
68	28,2	78	40,7	83	50,1
69	29,1	79	41,2	84	51,1
70	29,9	80	41,7	85	52,1
		81	42,3	86	53,0
		82	42,8	87	54,0
		83	43,3	88	55,0
		84	43,8	89	56,0
		85	44,3	90	57,0

Discussion

Measurements quoted by Sachs (1967) show that impala from the Serengeti region in Tanzania are heavier and larger in all body measurements. Talbot and McCulloch (1965) confirm this fact for East African animals. They derive a regression of mass = 3,09 Heart Girth –149 when using mass in pounds and measurements in centimeters. When our data is treated in this way we derive an equation Mass = 3,01 Heart Girth –140,8 for all age classes and both sexes combined. These equations are amazingly similar considering the difference in size of the two races of impala.

McCulloch and Talbot (1965) studied the relationship between mass and body measurements of various African ungulates. After extensive statistical tests using various linear and non-linear models they confirm that the simple relationship between heart girth and mass is as accurate as any other.

The growth curves follow the normal pattern for large ungulates, the break at 8 months most likely being caused by the fact that the animals are weaned at about this time which coincides with a low nutritional value of the vegetation.

The information in Table 2 can be used to construct a mass tape for the impala. In an attempt to assess the accuracy of this information deviations from the mean and deviations from the estimated value were determined. These indicate an accuracy of 4 per cent for the mean and 6 per cent for the estimate. Therefore, while individual estimates could deviate up to 10 per cent, the estimates of any sample should be as accurately determined as with a balance.

As mass determination by means of a tape is much easier and more practical in the field, it is felt that in most studies data from more animals could be obtained in this way with an eventual accuracy equal to that obtained by the conventional method.

The estimates were applied to data from Wankie National Park in Rhodesia and from the Serengeti supplied by Dr. Jarman and worked well on our original data. This, taken together with the close relationship between our regression and that of Talbot and McCulloch (1965) seems to indicate that this information may have a universal applicability.

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