Composition and limiting factors of a Khomas Hochland population of Hartmann Zebra *Equus zebra hartmannae*

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ABSTRACT

After an aerial census of the Khomas Hochland population of Hartmann zebra, 128 animals were shot on a random basis over a period of 12 months. The population composition of the Hartmann zebra is discussed; this includes sex ratio's for the various age classes, age structure and dynamics of the population. There was almost an equal distribution of sexes throughout the age classes. An age structure curve and a life table have been constructed. Various limiting factors are discussed showing that these animals are susceptible to drought.

I INTRODUCTION

Owing to the social organization, the difficulty of quickly and accurately sexing animals in the field, as well as the habitat the Hartmann zebra frequents, it is virtually impossible to sample a population in the field. Klingel (1965) experienced similar problems with the Burchell zebra, and he gives only the sex ratios of the foals born in marked groups. In their population study of the wildebeest, Talbot & Talbot (1963) faced the same problem.

The Hartmann zebra in South West Africa are classified Specially Protected Game and under normal conditions no permits are issued to hunt them. During some years, especially drought years when they compete with livestock, permits are issued to farmers all over the Khomas Hochland. Arrangements were made with these farmers and thanks to their friendly co-operation it was possible to collect 128 animals over a period of 12 months. The animals were shot on a random basis. The method used was modified from the one devised in the Kruger National Park by Pienaar (1969). Two sets of numbers, one to five were written on small pieces of paper, one set with the prefix R and the other with the prefix L and then folded. Before a hunt took place lots were drawn to decide which animal of a breeding or bachelor unit would be shot, for example R_2 would mean the second animal from the right or L_1 the first animal on the left.

II POPULATION COMPOSITION

During the study a reasonably accurate aerial census of the Khomas Hochland population of Hartmann zebra was carried out and found to number 5 000 animals (Joubert 1973). As already mentioned it was virtually impossible to sample a population in the field. With the abovementioned method however, a random sample of 128 animals were collected from the Khomas Hochland population. Although this sample represents only 2,5 per cent of the population in the Khomas Hochland the author is confident that the calculation based on these figures must give a picture as nearly accurate as one could hope to get of a wild population.

2.1 Sex ratios

The embryos and foeti collected during the study period, and which could be sexed, showed a male : female ratio of 1 : 1,12 (n = 18). This is ratio of 47 per cent males to 53 per cent females; it is not significantly different and can be considered equal. The male : female ratio for foals up to the age class VI (two and a half years old) are 1 : 1,08 (n = 57), thus 48 per cent males, a difference which is even less significant than the figure obtained from foeti.

The sex ratios for the various age classes from age class VIII (three and a half years) onwards are given below.

As can be seen, the sex ratios in the various age classes vary; despite this, the sex ratio of the entire sample of adult animals is 1 : 1,16 — still significant. One of the reasons for this almost equal distribution of sexes in the adult animals must be the lack of conspicuous dimorphism between the sexes.

Table 1. Sex ratios of an adult *Equus zebra hartmannae* population in the Khomas Hochland.

Age class	Age	Male	Female	ratio	nn
VIII	3½	1	2	1:2	3
IX	4	9	12	1:1.3	21
X	5-6	9	7	1:0.7	16
XI	7-9	7	10	1:1.4	17
XII	9-11	4	4	1:1	8
XIII	11-12	1	0	1:0	1
XIV	13-14	0	1	0:1	1
XV	15 years plus	1	1	1:1	2
Total		32	37	1:1.16	69

Table 2. Distribution into age classes of a random sample of *Equus zebra hartmannae* collected in the Khomas Hochland

Age class	u	Age groups	Total
I	10		
II	3		
III	6		
IV	8	1 year	27
V	15		
VI	15	2 years	30
VII	2		
VIII	3	3 years	5(30)*
IX	21	4 years	21
X	16	5-6 years	16
XI	17	7-9 years	17
XII	8	9-11 years	8
XIII	1	11-12 years	1
XIV	1	13-14 years	1
XV	2	15 years and over	2
		n	128

Correction factor for the determination of a life-table — see text.

It also shows that both sexes are equally well adapted to their environment.

2.2 Age structure and dynamics

As Allee *et al* (1949) put it, a population has certain characteristics it shares with an organism as well as others that are its own unique possession. The latter group of characteristics are largely statistical.

This sample, as has already been mentioned, was collected at random (helped to a large extent by the absence of sexual dimorphism in the Hartmann zebra). It was also possible to identify the animals into more than two age-classes — thus fulfilling the two basic prerequisites for the application of a life-table method of population analysis. To obtain more even intervals between the age classes, several of them were grouped together in age groups (see table 2). As can be see only 5 individuals of age classes VII and VIII were collected. This was at first thought to be due to certain defects in the method of sampling. As can be seen in figure 2, however, this corresponds to a drought period in the Khomas Hochland which had an adverse effect on the survival rate of foals during that year (see Limiting factors). A graph was plotted with the information in table 2 and smoothed out to give the theoretical figure for age group VIII (three years).

An age structure curve (figure 1) and life table were then constructed (Quick, 1963). To determine the number of foals born, the following procedure was used. The total population of Hartmann zebra on the Khomas Hochland numbers 5 000. Using the information in table 1 it follows that 54 per cent of the population must be females. Assuming that theoretically 1 675 mares of three years and older, dropped foals in a given year (1970), this gives one a figure of 33 per cent foals in the population. According to the sample collected in the Khomas

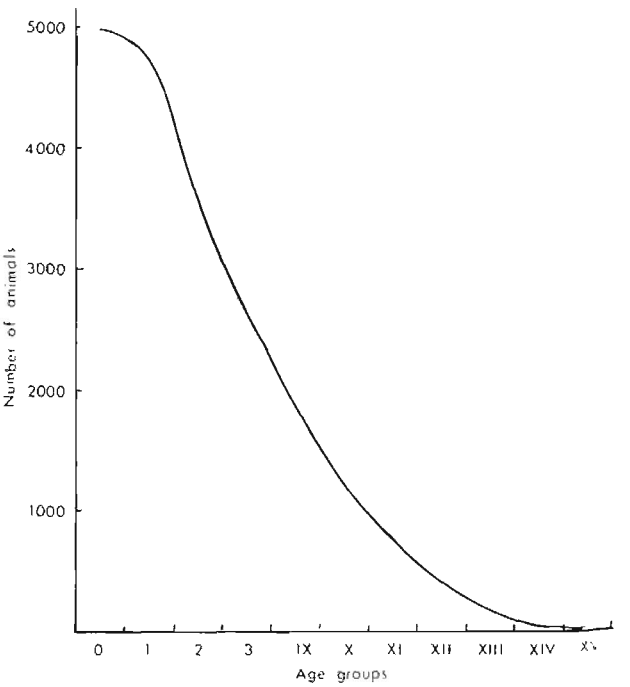

Figure 1. Age structure curve for a population of *Equus zebra hartmannae* in the Khomas Hochland.

Hochland however, one year old foals formed only 21 per cent of the population. Thus 12 per cent of the foals succumbed during their first year.

Statistical methods have been developed for the analysis of human populations and these methods have been adapted with considerable success to wildlife management. In the analysis of population dynamics the numerical and structural changes within population resulting from births, deaths and movements must be considered (Quick, 1963). For this paper, only the Khomas Hochland population of Hartmann zebra will be discussed. This population is for all practical purposes stable. As has already been mentioned 128 animals were collected on a random basis in the field. This sample was grouped into the various age classes, using tooth development and wear as parameters (Joubert, 1972). The result obtained can be seen in table 2.

The life-table above was based on a cohort of 5 000 and is thus directly applicable to the Khomas Hochland population. The headings are those commonly used in basic life-table calculations (Allee *et al*, 1949). They are:

x — age in appropriate units, stated as an interval;

Ix — the number surviving at the beginning of the age interval stated in the x column;

dx — the number dying within the age interval stated in the x column;

qx — the number dying in the age interval, divided by the number of survivors at the beginning of the interval, viz. rate of mortality;

Lx — is the mean number of individuals alive between the stated age-classes;

ex — life expectation, mean length of life remaining to each organism alive at the beginning of the age class, expressed in terms of age classes.

As can be seen by the age-specific mortality rates qx, as well as the structure curve, the survival rate for foals is quite high. This is in strong contrast with what Talbot and Talbot (1963) found in the wildebeest, but in agreement with Klingel's (1965) findings in the Burchell zebra. Up to three years of age the Hartmann zebra foals have a relative high life expectancy. This is probably due to the protection offered to the young by the breeding units.

Table 3. Life-table for the *Equus zebra hartmannae* population in the Khomas Hochland

(Age class) x	Ix	dx	qx	*Lx	ex
0	5000	608	608	4696	3,56
1 year	4392	750	854	4017	2,98
2 years	3642	835	1147	3224	2,49
3 years	2807	973	1733	2320	2,09
IX	1834	583	1484	1542	1,93
X	1251	445	1779	1028	1,61
XI	806	472	2928	570	1,22
XII	334	223	3339	222	1,25
XIII	111	29	1219	96	1,74
XIV	82	26	1342	69	1,18
XV	56	56	5000	28	0,5

* Fractions are ignored.

III LIMITING FACTORS

Owing to the broken terrain it was found extremely difficult to record mortalities in the field. Although no accurate figures are available, certain limiting factors were determined during the study period. These limiting factors are drought, accidents, predation and possibly parasites and diseases.

3.1 Drought

Although drought occurs only at irregular intervals and with variable intensity, it is one of the primary causes of known mortality. During the drought of the 1968/69 season hundreds of Hartmann zebra were found dead or dying in the Khomas Hochland. At three dry waterholes in the Kuiseb River 32 carcasses were found. On another farm in the Khomas Hochland, 21 carcasses were found of animals that had been trapped in the mud of a dam drying up. As already mentioned figure 2 illustrates the effect on survival rate of foals during periods of drought.

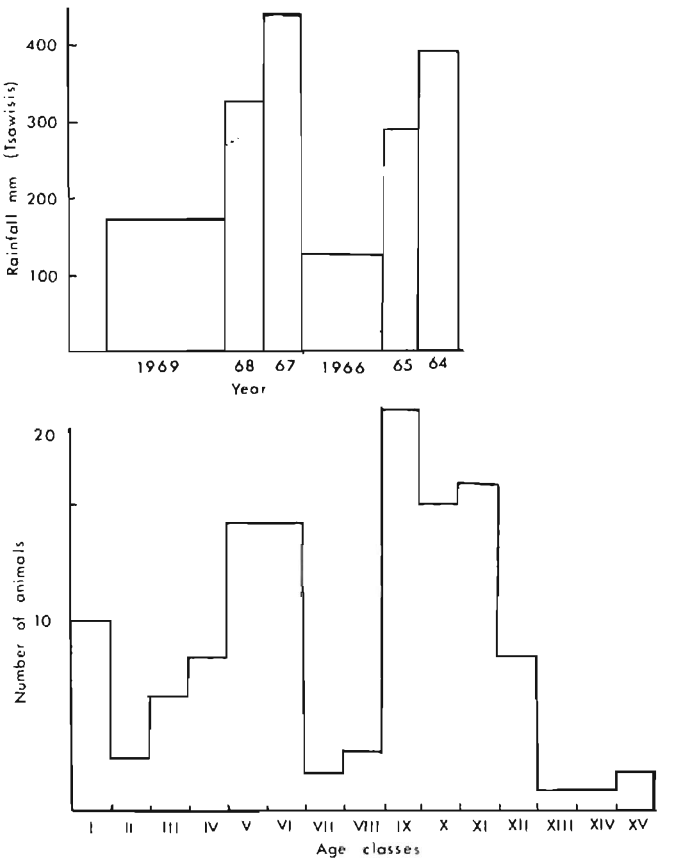

Figure 2. Population survival histogram illustrating the influence of a poor rainy season on a *Equus sebra hartmannae* population in the Khomas Hochland.

Normally the heavily hunted Hartmann zebra on the Khomas Hochland are very wild and shy and will make off whenever they spot a vehicle. During this abovementioned drought however, they wandered aimlessly around, especially around dried up waterholes and along the Kuiseb River. One could drive to within fifty yards of them. The farmers, who during this time were also hard hit, merciless shot hundreds of Hartmann zebra. The primary cause for this was that these animals were in direct competition with the livestock, not only for water, but also for grazing. A second factor was that during this period, untanned zebra hides fetched prices of up to R35 apiece, that of young foals even more. Zebra hides thus ensured a ready cash income for the farmers.

The heaviest mortality in the Hartmann zebra population during this drought, occurred amongst the newly-born to young foals and pregnant females. Strange as it may seem, a dead or dying female was found on several occasions with her young (newborn to a few months old) foal standing next to her. This might be due to the drain of lactation on the female and a shortage of food. In animals weighed during December 1969 January 1970, at the height of the last drought, it was found that the contents of their digestive systems formed only 12 per cent of their body weights. In animals weighed from July 1970, onwards, after good rains had fallen, the contents of their digestive systems formed 25,4 per cent of their body weights.

Post mortems on three females revealed signs of recent abortions. No aborted foeti, however, were found in the study area — probably because they were quickly disposed of by scavengers. Mr B. J. G. de la Bat (pers. com. 1970) informed the author that he recorded several aborted Burchell zebra foeti during severe droughts in the Etosha National Park.

3.2 Accidents

Considering the habitat they frequent it is not surprising that accidents also cause mortality, especially among the adult population. Although no figures are available from the field, eight per cent of the population at the Daan Viljoen Game Reserve died owing to accidents, during 1969 and 1970. Several deaths owing to accidents were also recorded by P. van der Westhuizen (5) and W. Piepmeyer (2) (pers. coms. 1969, 1970) from the Naukluft Mountain Zebra Park. Several carcasses with fractured bones were found under various precipices.

As already stated adults, male and female alike, are most accident prone. Accidents normally occur during play-fighting or maintenance of social hierarchy activities, probably also when fleeing from danger, real or imagined, especially around waterholes. The most common injuries are fractures of the legs and although not the actual cause of death they form the primary factor that leads to the animals death.

3.3 Predation

In the Khomas Hochland predators such as leopards (*Panthera pardus*) and cheetahs (*Acinonyx jubatus*) are still relatively common. Although they may not have a marked influence on the population they certainly remove a certain percentage, especially foals. At one very secluded waterhole in the Naukluft mountains on the farm Panorama, a large number of skeletons of primarily young animals lie scattered around. Some of them were relatively fresh, and although cause of death could not be ascertained, it seemed very likely that it was due to predation. On the same farms, the owner, Mr Visagie, told the author that during the last 10 years they lost almost 75 per cent of their horse and donkey foals to predators.

In the Namib Desert Park, in the Kaokoveld and the area west of Otjovasandu, hyenas (*Crocuta crocuta*) and wild dogs (*Lycaon pictus*) also assist in reducing the population. During 1967 68 three deaths owing to predation by lion (*Panthera leo*) were recorded by the author in the Otjovasandu area.

3.4 Parasites and diseases

Hartmann zebra, as Burchell zebra, are heavily infested with internal parasites. Apparently however, these parasites have no real detrimental effect on the animals. During years of severe drought however, the internal parasites are bound to have a certain adverse effect.

Internal parasites recorded are the following:

Gasterophilus pecorum Fabr.
G. intestinalis De Geer
R. evertsi ssp. *mimeticus* Dönitz
G. haemorrhoidalis
Rhinoestrus steyni

External parasites are mainly ticks situated in the scrotal area. No heavy infestations were ever found. Ticks recorded are the following:

Rhipicephalus oculatus Neumann
R. eversti ssp. *mimeticus* Dönitz
Hyalomma rufipes Kock

A new louse was also found from material collected during the study. This louse belongs to the *Damalinia*, but has not yet been described.

There has been several records of Hartmann zebra dying mysteriously, possibly due to diseases. Death due to disease in nature, however, is difficult to establish. In the Etosha National Park, anthrax annually kil's a number of animals, especially Burchell zebra. In the Otjovasandu area, despite strict vigilance, the collection of blood smears from all fresh carcasses, not one death due to anthrax was recorded in the Hartmann zebra population.

IV ACKNOWLEDGEMENTS

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