FOSTER

E. Afr. Wildl. Journ. 3 1965

Mortality and ageing of black rhinoceros in East Tsavo Park, Kenya

In 1961 the long rains failed over most of East Africa. The resulting drought was one of the worst recorded for decades and caused extensive mortality of those game species which depend on regular watering. The black rhinoceros (*Diceros bicornis* L.) was one such species since it must drink at least once every two days (Ritchie, 1963, E. Afr. Wildl. J., 1, 54-62).

In the area to the west of the Yatta Plateau and bordering the Athi River in East Tsavo National Park a large population of rhino was reduced by some 300 animals (Sheldrick, pers. comm.). Many died in the river bed, some half submerged in the water, suggesting that they gained some relief in this way. These carcasses were swept away by the floods which followed the drought, but many others on higher ground were left to become cleaned and bleached. By 1964 the bones were showing the degrading effects of long weathering so I spent a few days gathering skulls with substantial assistance from the Warden, Mr. D. L. W. Sheldrick. These skulls were added to those already collected by the Warden to make a total of 49.

Attempts to find a criterion for determining the sex of the skulls by making nine measurements on each were unsuccessful. Examination of the size and shape of the birth canal, useful in sexing some cervids, did not help in the present case.

Age criteria were determined by the sequence of eruption and wear on the molars. Incisors and canines are absent or vestigial in the black rhino, while the adult normally has four premolars and three molars, the sequence of eruption being from anterior to posterior. The milk dentition (premolars) is shed from second to fourth as the second molar is appearing. The first premolar is apparently shed and replaced at a very early age, and may have disappeared entirely from older animals.

The skulls were divided into seven age groups of unequal length; only in the first three is there any attempt to qualify the age groups by years, because there is no known-aged series of rhino skulls from animals raised in the wild which could be used to age more accurately unknown skulls. Zoo animals are unhelpful since the artificial diet may promote both atypical growth rate and tooth wear. Even the rhino "Bruce", which died in Nairobi National Park's Orphanage at four years of age and which had been fed on a selection of local herbage, had an unusual skull showing dietary deficiencies and it proved impossible to use the skull as an age standard for wild rhino. However, live rhinos can be aged roughly up to four years old, about the time at which they leave the cow, and yield approximately aged skulls. Beyond this the age categories are more arbitrary.

The age groups are as follows: 1: 0-2 years old, first molar just appearing, sutures of skull open; 2: 2-4 years old, second molar just appearing and sutures still open; 3: 4-6 years old, third molar just appearing and sutures mostly closed; 4: subadults with the third molar only slightly worn; 5: adults with all teeth worn; 6: old adults with the premolars flattened almost to the roots of the teeth; and 7: very old adults with all teeth flattened.

The 49 skulls fall into the seven groups as follows: 1: 0, 2: 7, 3: 5, 4: 8, 5: 16, 6: 8, 7: 5. No skulls of group 1 were found since they were too fragile to survive. Age groups 4, 5, 6 are thought to comprise the breeding population. Those in group 7 were probably becoming inefficient at chewing browse and might have died of starvation within a few more years. The distribution of animals among the age groups suggests that the population was healthy before the drought occurred.

I have attempted to use these age criteria on live (but drugged) rhino and was surprised to find the buccal cavity and extent of movement of the lower

1451

jaw to be too small to permit the passage of a hand to feel the extent of wear on the molars. Premolars may be examined though it is important to determine whether they are of the milk or permanent dentition.

At present I am attempting to age the skulls more accurately by cutting sections through the molar teeth. Facilities for sectioning the teeth have been kindly provided by Prof. I. Loupekine, Department of Geology, University College, Nairobi.

This technique seems to show promise of being useful: dark and lighter bands can be more or less clearly seen in the dentine and might correspond with seasonal environmental changes which, in Tsavo, are quite marked. The period of good nutrition resulting from the rains is from approximately December to May and is alternated with a rainless period of June to November. This suggests that there might be one pale and one dark growth ring in a normal year. In areas where the seasonal change is less marked (Ngorongoro Crater, for example) the bands may well appear less distinct. As it is there is considerable subjectivity in deciding whether a band is distinct enough to warrant being counted. The plane of the section is important: all sections have been made vertical, often through a root. Some sections are impossible to read due to their passing through enamel folds in the middle of the tooth. The best sections are obtained from a longitudinal median section, transverse to the tooth row. With time, the dentine fills the tooth cavity and no further layers are deposited. This was found to have occurred frequently in the first molar of old animals, but it has never been observed in a third molar. Hence the third molar, if erupted, is the best tooth to section. About five years would have to be added to the age of the animal after counting the growth rings in this tooth. Only teeth of the upper tooth row have been examined so far, but presumably teeth from the lower jaw would be equally satisfactory.

The next stage of the research will be to examine teeth from a rhino which has recently died in Tsavo and watch for a major growth check that could have been caused by the drought of 1961. If one is seen about four light (or dark) bands in from the pulp cavity we shall have a measure of the meaning of the growth rings. It is possible that other species which suffered in the drought will show major growth checks in their teeth, horns, or horn cores, and I hope that workers attempting to age East African species will watch for this clue.

Since the Athi River kept flowing even during the drought, and most skulls were recovered within a few miles of it, it is assumed that the animals did not die due to a lack of drinking water. Much debate has centred on the probable reasons for their death. Autopsies were performed on animals which died of natural causes but, as little comparative work has been done on healthy rhinos, the proximate (contributory) causes of death have generally remained uncertain. Parsons and Sheldrick (1964, E. Afr. Wildl. J., **2**, 78-85) note the high population of biting flies around some dying rhinos and agree that they could contribute to the stress and eventual death of the animals. The ultimate cause of death was probably lack of sufficient quantity and/or quality of food due to the massive destruction of the vegetation by elephants which concentrated along the rivers during the drought. With the resistance of the rhino thus lowered, they succumbed to a variety of proximate causes.

J. B. Foster, *P.O. Box 30197, Nairobi.*

Marking a leopard

A medium-sized male leopard (*Panthera pardus* L.) weighing 105 lbs was caught in a box trap on a farm at Gilgil, central Kenya on 26th April, 1963. On 27th April it was drugged with sernyl and tagged on one ear with a metal eartag (made by Ketchum Manufacturing Co., Tadworth, Surrey, England). The leopard was released in Nairobi National Park on 29th April.

On 16th August, 1964 the leopard was caught, again in a box trap, on a farm