1491

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A BIBLIOGRAPHY RELATING TO THE ECOLOGY AND ENERGETICS OF EAST AFRICAN LARGE MAMMALS

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SUMMARY

Many investigations have made contributions to an understanding of energy flow through large mammals in East African ecosystems. This paper lists references to such works and compiles them according to their application to various segments as they appear in an energy-flow model. The first part indicates papers on pasture utilization, value of foodstuffs, animal numbers and distribution, population dynamics and secondary production. The second part assembles references dealing with individual animal species, stratifying them according to the subjects of ecology, food habits and nutrient utilization, population dynamics and growth.

INTRODUCTION

Refined wildlife management can only be achieved by a comprehensive understanding of the structures and functions of the ecosystem. Knowledge of the energy flow through the system will contribute to this understanding.

Lindemann (1942) was the first to develop the classic concept of ecological energetics or community dynamics. In describing the flow of energy through the ecosystem he grouped the organisms with similar feeding habits together in food levels or trophic levels. The energy content of each level was stated in mathematical symbols and the rate and efficiency of the energy transfer from one level to another was expressed in mathematical equations and diagrams.

Since then widespread interest has developed in the research of ecological energetics. In constructing a model with particular reference to large mammals in East African ecosystems, attention was directed to gathering information already available. This paper assembles references to that information.

Only few papers deal directly with energy relationships, but all contribute information which has a place in such a design. As a bibliography, the paper will not only be of interest for the study of energetics but also to a wide range of wildlife disciplines. The paper can be regarded as an up-to-date sequel to Talbot (1965). See also East African Agricultural and Forestry Research Organisation (1970) for a list of current research projects.

The nomenclature used through the paper follows Stewart and Stewart (1963) who relied on Ellerman, Morrison-Scott and Hayman (1953), and, for species they do not consider, Allen (1939).

1. GENERAL REFERENCES TO EAST AFRICAN MAMMALS

1.1 Classification, description, distribution and habits

These items pertaining to mammals of East Africa can be obtained from numerous standard works and publications. This list is not exhaustive but includes the more accessible publications. Some references may be outdated and/or popular, but nevertheless give introductory data.

The following papers should be noted: Ansell (1960*a*), Lydekker (1908), Maberly (1966), Meinertzhagen (1957), Percival (1928), Roosevelt (1910), Roosevelt and Heller (1915), Simon (1962) and Stevenson-Hamilton (1947).

Checklists of the mammals of Africa have been published by Allen (1939) and, especially for Tanganyika and Zanzibar, by Swynnerton and Hayman (1951). See also Ellerman

kg for a 13-months male yearling to 182 kg for an adult. Similar weights for females were 100 kg and 170 kg.

2.14 **Hippopotamus** (*Hippopotamus amphibius* (L.))

Ecology: See Bere (1959).

Food habits and nutrient utilization: Petrides and Swank (1963) calculated quantitative food intake to be 18 kg DM/day and Field (1968a and b, 1969) investigated food preferences of the hippo (a grazer). See also Laws (1968a) and Young (1966).

Population dynamics: Laws (1968b) developed ageing criteria for hippo on the basis of tooth characteristics and body measurements and also presented survivorship curves and life tables. See also Ansell (1960b), Longhurst (1957a, 1958) and Laws and Clough (1965).
Weight and growth: Ledger (1968) lists the weight of adult males as 1,490 kg (1,178-1,714 kg) and of females as 1,277 kg (1,185-1,400 kg). See also Ansell (1965), Ledger (1963c, 1964), Ledger and Smith (1965) and Maberly (1966).

2.15 **Impala** (*Aepyceros melampus* (Lichtenstein))

Ecology: See Schenkel (1966).

Food habits and nutrient utilization: Stewart (1969) found that impala ate predominantly monocotyledons (95%), but that their diet varied widely from place to place. There were strong preferences for specific grass species, changing with seasons. There were large differences between individual animals but significant differences between sex and age classes were not detected. Talbot (1962) found impala to be predominantly a grazer (56% grasses), as did Azavedo and Agnew (1968). Maloiy and Hopcraft (1969) found that heat stress and water shortage both caused a decrease in food intake (2.58 kg with free food-supply and water and at 22°C, decreasing to 1.99 kg/100 kg BW/day with a free food supply, restricted water and under heat stress). See also Dasmann and Mossman (1962d).

Population dynamics: Age-criteria from dental characteristics, horn development and skull size were described by Roettcher and Hofmann (1970). Sex and age ratios were determined by Dasmann and Mossman (1962d) in Southern Rhodesia by regular counts throughout a year. They found that yearlings averaged about 25% of the population, with few young adults and a high percentage of old individuals. In the older age classes there was a high percentage of females. See also Dasmann and Mossman (1962b) and Mossman and Mossman (1962). Dasmann and Mossman (1962d) stated that the minimum breeding age was 2 y, the gestation period between 180 and 210 days and the time of calving to be near the start of the rainy season, the beginning of December in Rhodesia. See also Dasmann and Mossman (1962a) and Kerr (1965). Pregnancy rates were indicated by Dasmann and Mossman (1962d) to be 97% in adult females and 85% in yearlings. They also gave figures on survival and mortality. See also Ansell (1960b), Child (1964) and Stewart, Grieg and Stewart (1966).

Weight and growth: Ledger (1968) gave 56.7 kg as the average for adult males and 42.0 kg for females. Talbot (1963) indicated a daily liveweight gain of 0.09-0.12 kg. See also Maberly (1966) and Sachs (1967).

2.16 **Kob, Uganda** (*Adenota kob thomasi* (Sclater))

Ecology: See Buechner (1958b, 1961) and Buechner and Schloeth (1965).

Food habits and nutrient utilization: Field (1968a and b, 1970) determined qualitative food preferences over different seasons.

Population dynamics: The study by Bindernagel (1968) includes a variety of data. Herd structure and sex and age structure were determined for about 20% of a population. Age criteria were developed. The population structure in two counts averaged: adult males 20%, immature males 19%, females 38% and calves 23%. First ovulation for females was stated by Buechner, Morrison and Leuthold (1966) to be at 13-14 months of age and may occur once or twice before conception. Sexual maturity in males occurred at one year of age, but possession of territory was first displayed later, at about 3½ y. The same authors suggested that 240 days may be used as normal gestation period. The calving season had a peak in December-January but the Uganda kob can breed throughout the year. The inter-calving

interval was calculated by Bindernagel (1968) to be 10 months. See also Ulmer (1966).
Weight and growth: Ledger (1968) gave the weight for adult males as 96.7 kg (93-108 kg) and for females 62 kg (59-66 kg). Bindernagel (1968) provided a table with weights of animals of different ages and Ledger and Smith (1964) investigated body composition of the Uganda kob. The mean dressing-out percentage was 58.5% and the lean meat content as high as 81.3% (Boran steers 54.8%). See also Ledger (1963c) and Ledger and Smith (1965).

2.17 **Kudu, lesser** (*Strepsiceros imberbis* (Blyth))

Weight and growth: Ledger (1968) gave an average weight of 92.1 kg (56-108 kg) for adult males and Maberly (1966) stated about 104 kg. See also Ledger (1964).

2.18 **Kudu, greater** (*Tragelaphus strepsiceros* (Pallas))

Food habits and nutrient utilization: Wilson (1965) did stomach analyses and found the greater kudu to be almost entirely a browser.

Population dynamics: Ageing criteria from dental characteristics were developed by Simpson (1966). Dasmann and Mossman (1962a) gave the calving period to be February-March in Southern Rhodesia and stated that maturity was reached at 2 y of age. Brand (1963) indicated that most calves were born between January and March and Wilson (1965) stated between January and April. The latter analysed the population structure for 768 animals and found a sex ratio of 1:2.4 (♂ : ♀). See also Ansell (1960b), Dasmann and Mossman (1962b) and Simpson (1968).

Weight and growth: Wilson (1965) gave average adult weights as 257 kg for males and 170 kg for females.

2.19 **Oribi** (*Ourebia ourebi* (Zimmermann))

Population dynamics: Bindernagel (1968) quoted Cade as saying that the gestation period was 217-220 days. Bindernagel (1968) also indicated that the calving season extended throughout the year, that the inter-calving interval was 292 days and pregnancy rates were nearly 100% for mature females. He also presented ageing criteria from horn development and dental characteristics.

Weight and growth: Carcass yield was found to be 58.5% and weights of adult animals to vary between 13.6 and 15.4 kg (Bindernagel, 1968).

2.20 **Oryx, fringe-eared** (*Oryx beisa callotis* (Thomas)) and **Oryx, beisa** (*Oryx beisa beisa* (Rüppell))

Food habits and nutrient utilization: Taylor and Maloiy (1969) investigated the influence of dehydration and heat stress on intake and digestibility of food of the beisa oryx. Food intake per 100 kg body weight was given for various environmental conditions. It was 2.33 kg/day at 22°C and with free water. Heat stress did not influence intake but a certain degree of dehydration lowered it considerably. This reflected a decrease in the metabolic rate under such conditions. Taylor (1968) determined the amount of water intake for beisa oryx. See also Taylor (1969a).

Weight and growth: Ledger (1968) gave the average weight for adult males as 176.4 kg (167-209 kg) and adult females as 161.5 kg (116-188 kg). Maberly (1966) stated 195 kg as average. See also Ledger (1963c) and Ledger and Smith (1965).

2.21 **Reedbuck** (*Redunca* spp.)

Food habits and nutrient utilization: Petrides and Swank (1963) calculated quantitative food intake by weight of rumen content. They found it to be 0.23 kg DM/day. Field (1970) determined the qualitative food preferences in different seasons.

Population dynamics: Dasmann and Mossman (1962b) determined sex structure in a population of *Redunca arundinum* (Boddaert) but on a very small sample.

2.22 **Rhinoceros, black** (*Diceros bicornis* (L.))

Ecology: See Klingel and Klingel (1966b), Ritchie (1963) and Schenkel and Schenkel-Hullinger (1969).

Food habits and nutrient utilization: Goddard (1968, 1970b) studied food preferences and gave lists of food plants and the relative importance of individual species. Klingel and Klingel (1966b) made observations in Ngorongoro.

Population dynamics: Goddard (1970a) developed age criteria based on dental characteristics. He also presented sex-ratios, a survivorship curve, life-tables and calculated annual recruitment and mortality for a population in Tsavo National Park. Schenkel and Schenkel-Hullinger (1969) determined both sex and age ratios. Sex ratios were 1 : 1.3 (♂ : ♀) for adult animals and 1 : 0.6 for immature. Age of maturity according to Goddard (1967a) was 6 y for males and 7 y for females (quoted from zoo records). See also Goddard (1970c) and Foster (1965). Schenkel and Schenkel-Hullinger (1969) stated 3½-4 y for females. The same authors quoted the gestation period to be 450 days. Ritchie (1963) stated 540 days and Goddard (1967a) quoted from different sources the period to be 450-480 days. The inter-calving interval was found by Schenkel and Schenkel-Hullinger (1969) to be 2½-3¼ y, while Goddard (1967a) gave 27 months for a healthy female. In his two study populations the inter-calving interval varied but the recruitment rate appeared to be 0.25 calves/female/y. Schenkel and Schenkel-Hullinger (1969) stated that reproduction ceased at an age of 30-35 y. See also Goddard (1970c). Calving occurred at any time of the year (Ritchie, 1963). See also Anderson (1966), Hamilton and King (1969) and Roth and Child (1968).

Weight and growth: Meinertzhagen (1938) indicated weights of 1,165 kg for adult males and 1,081 kg for females. Bourlière and Verschuren (1960) indicated 1,301 kg as an average. See also Maberly (1966) and Talbot (1963).

2.23 **Rhinoceros, white** (*Ceratotherium simum simum* (Burchell))

Ecology: See Cave (1963), Foster (1960) and Player and Feeley (1960).

2.24 **Roan** (*Hippotragus equinus* (Desmarest))

Ecology: See Backhaus (1959b) and Child and Wilson (1964).

2.25 **Sable** (*Hippotragus niger* (Harris))

Ecology: See Child and Wilson (1964) and Dolan (1964).

2.26 **Sitatunga** (*Tragelaphus spekei* (Sclater))

Ecology: See Owen (1969, 1970).

2.27 **Steinbok** (*Raphicerus campestris* (Thunberg))

Population dynamics: Chalmers (1963) gave the gestation period as 210 days and inter-calving interval as 8 months. See also Dasmann and Mossman (1962b).

2.28 **Topi** (*Damaliscus korrigum* (Ogilby))

Ecology: See Vesey-FitzGerald (1955).

Food habits and nutrient utilization: Talbot (1962) determined food preferences by stomach analysis and found that 97% of the stomach contents were grass. Gwynne and Bell (1968) made investigations on the part of grasses which different animals selected for food. The topi was found to take stem and leaves in equal proportions (wildebeest (*Connochaetes taurinus* (Burchell)) took mostly leaves, zebra (*Equus burchelli* (Gray)) stems).

Weight and growth: Liveweight for adult males was given by Ledger (1968) as 130.8 kg (113-141 kg) and for females as 103.9 kg (91-116 kg). Sachs (1967) indicated 130 kg for adult males and 109 kg for females.

2.29 **Warthog** (*Phacochoerus aethipicus* (Pallas))

Ecology: See Bradley (1968) and Clough and Hassam (1970), Frädrich (1965) and Geigy (1955).

Food habits and nutrient utilization: Field (1968a, 1970) made observations on food habits in Queen Elizabeth Park and Petrides and Swank (1963) calculated the quantitative intake, by the weight of rumen content, to be 0.277 kg DM/day.

Population dynamics: Ageing criteria from dental characteristics and eye-lens weight were developed by Child, Sowls and Mitchell (1965) and Child, Sowls and Richardson (1965). Sex and age ratios were found by Child. Sowls and Mitchell (1965) and Child, Roth and Kerr (1968) to vary but they used the ratio 1 : 1 as normal. Clough (1969) stated 48 : 52 (♂ : ♀) in his study. Dasmann and Mossman (1962b) gave figures from a smaller sample. Bindernagel (1968) analysed age structure. Because of difficulty in ageing immature and adult animals only the percentage for young-of-the-year was reliable and was consistently between 50 and 80 per cent throughout

the year. *Minimum breeding age:* Child, Sowls and Mitchell (1965) and Child, Roth and Kerr (1968) indicated 1½ y as the age for sexual maturity of females and 2 y for males. Clough (1969) gave 17-19 months for both sexes. Roth (1965) stated 3 y for minimum breeding age and Dasmann and Mossman (1962a) said the first litter was dropped at 2 y of age. The gestation period was found by Child, Sowls and Mitchell (1965) and Child, Roth and Kerr (1968) to vary between 150 and 170 days. Other authors gave the period to be 170-175 days (Asdell, 1946 and Clough, 1969). *Time of farrowing:* Child, Sowls and Mitchell (1965) and Child, Roth and Kerr (1968) found it varied from place to place but was generally between September and December in Rhodesia. Dasmann and Mossman (1962) found that farrowing time corresponded with the start of the green season. *Pregnancy rates:* Dasmann and Mossman (1962a) found 66-75% of all females to be pregnant (but a sample of only 7). *Litter size:* Dasmann and Mossman (1962a) stated 3-4, and Clough (1969) 3.4 to be the mean. Bindernagel (1968) quoted Clough as saying that young females only produce 1.6 young but older females produce 3.4 as an average. Maximum longevity was stated by Roth (1965) to be 20 y and average life expectation to be 3½-4 y. *Survival and mortality:* Dasmann and Mossman (1962a) indicated a high survival at 80% from 1 to 2 years and at 10% from 2 to 3 years. See also Ansell (1960b). *Weight and growth:* Weight curves for warthog were given by Roth (1965) and Bindernagel (1968). The latter also supplied figures for daily weight gain (varying from 0.77-0.123 kg) and carcass yield (58.6%). Meinertzhagen (1938) gave the weight for adult males as 70-106 kg and for females as 55-68 kg. Sachs (1967) gave 87 kg as the average for males and 53 kg for females. See also Brand (1963), Grzimek and Grzimek (1960b), Ledger (1964, 1968) and Maberly (1966).

2.30 **Waterbuck, defassa** (*Kobus defassa* (Rüppell) and **Waterbuck, common** (*Kobus ellipsiprymnus* (Ogilby))

Ecology: See Spinage (1967b) and Verheyen (1955) on defassa waterbuck.

Food habits and nutrient utilization: Kiley-Worthington (1966) found that waterbuck were predominantly grazers but that in the dry season they took a high percentage of dicotyledons. Taylor, Spinage and Lyman (1969) investigated the water relationship of the defassa waterbuck and found that it required 25% more water than Hereford steers (*Bos taurus* L.) (at 22°C). It could not tolerate water shortage for any prolonged period. Petrides and Swank (1963) calculated the daily food intake to be 1.59 kg DM.

Population dynamics: Spinage (1967a) developed age criteria for defassa waterbuck on the basis of tooth eruption, replacement and wear. Dasmann and Mossman (1962b) did an analysis on population structure in Southern Rhodesia, but on a small sample. Dasmann and Mossman (1962a) stated that the time of breeding in Southern Rhodesia was February to April. Spinage (1970) calculated sex ratios, mortality rates and lifetables for the defassa waterbuck. See also Ansell (1960b), Kiley-Worthington (1965), Spinage (1968a, 1969) and de Vos and Dowsett (1966).

Weight and growth: Ledger (1968) gave the average weight of adult males to be 238 kg (206-267 kg) and of females 181 kg (162-200 kg). Sachs (1967) gave the figures of 226 kg and 175 kg from Serengeti. See also Ledger (1964), Ledger and Smith (1965), Maberly (1966) and Meinertzhagen (1938).

2.31 **Wildebeest** (*Connochaetes taurinus* (Burchell))

Ecology: See Estes (1968), Talbot and Talbot (1963) and Watson (1967).

Food habits and nutrient utilization: Talbot (1962) and Talbot and Talbot (1963) found wildebeest to be entirely grazers (98% mono-cotyledons). Gwynne and Bell (1968) found that wildebeest fed primarily on the leaves of grasses and Casebeer and Koss (1970) and Talbot and Talbot (1963) showed that there were preferences for certain grasses. Rogerson (1966, 1968) investigated energy utilization. He found that the fasting metabolism was 104.3 k cal/kg $BW^{0.73}$/day, about 20% more than cattle. The digestibility coefficient was close to that of cattle and the proportion of food utilized as metabolisable energy was 50.8%, the same as for cattle. Utilization of metabolisable energy for maintenance was also near to that of cattle (82%), but for production it was 59.3%, compared to c. 50% for cattle. He also

diet was quite varied. Of 20 different prey species Thomson's gazelle was the most important followed by impala and reedbuck. See also Mitchell, Shenton and Uys (1965).
Weight and growth: Maberly (1966) stated an average weight between 45.3 and 54.3 kg with females weighing 9.1-13.6 kg less than males.

2.37 **Lion** (*Panthera leo* (L.))

Ecology: See Makacha and Schaller (1969) and Rudnai (1970).

Food habits and nutrient utilization: Kruuk and Turner (1967) found that wildebeest and zebra made up 49% and 26% respectively of the number of lion kills encountered on the Serengeti Plains. Buffalo formed 8% and small size prey 10% of the kills. An attempt to calculate the predation pressure of lions showed a consumption of 7,800 prey animals/y by the estimated 700 lions. The yearly ratio was assumed to be 1,800 kg of meat per lion. In Lake Manyara National Park Makacha and Schaller (1969) found that buffalo was the most important prey species (69% of kills) followed by zebra (11%). Rudnai (1970) in Nairobi National Park found the most important prey species to be kongoni, wildebeest, zebra and warthog in that order. Calculated killing rates and daily consumption indicated 30 animals per individual lion per y and an intake of 9.4 kg/day/lion. See also Mitchell, Shenton and Uys (1965) and Wright (1960).

Population dynamics: Rudnai (1970) analysed population composition and group structure in Nairobi National Park. Juveniles comprised 57-62% of the population. She also indicated sex ratios and suggested mortality rates. Age of maturity was reported to be about 24 months for both sexes and a gestation period of 100-113 days. Examples of litter size were given. Makacha and Schaller (1969) stated that juveniles made up 20-25% of the population in Lake Manyara National Park.

Weight and growth: Maberly (1966) indicated the maximum weight of a big male to be 227 kg and about 45 kg less for a female.

2.38 **Wild dog** (*Lycaon pictus* (Temminck))

Ecology: See Estes and Goddard (1967) and Kruuk and Turner (1967).

Food habits and nutrient utilization: Estes and Goddard (1967) found that Thomson's gazelle and wildebeest formed 54% and 36% respectively of the kills in the Ngorongoro Crater. The same authors stated that between 2.0 and 4.1 kg of meat were available per day per dog from kills, varying with the size of the pack. Kruuk and Turner (1967) indicated the following sequence in selection of the more important prey species: Thomson's gazelle (64%), wildebeest adult (12%), Grant's gazelle (10%). See also Kühme (1964), Mitchell, Shenton and Uys (1965) and Wright (1960).

Population dynamics: Estes and Goddard (1967) determined the sex ratios of some packs and found a disproportionately large ♂ : ♀ ratio. Litter size was on one occasion determined to be 9 pups.

Weight and growth: Maberly (1966) indicated 27.2-36.2 kg.

2.39 **Banded mongoose** (*Mungos mungo* (Gmelin))

See Neal (1970).

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REFERENCES

AGNEW, A. D. Q. (1968). Observations on the changing vegetation of Tsavo National Park (East). *E. Afr. Wildl. J.*, 6:75-80.

ALLEN, G. M. (1939). A checklist of African mammals. *Bull. Mus. comp. Zool. Harv.*, 83:1-763.

ALLSOP, R. (1970). M.Sc. thesis on bushbuck. *University of Nairobi.*

ANDERSON, J. L. (1966). Tooth replacement and dentition of the black rhinoceros *Diceros bicornis* Linn. *Lammergeyer*, 6:41-46.

ANON. (1969). Should the elephants be killed? *Oryx*, 10 (2):101-102.

ANSELL, W. F. H. (1960a). Mammals of Northern Rhodesia. *Government Printer, Lusaka.*

.....(1960b). The breeding of some larger mammals in Northern Rhodesia. *Proc. Zool. Soc. Lond.*, 134:251-274.

.....(1963). Additional breeding data on Northern Rhodesian mammals. *Puku*, 1:9-28.

.....(1965). Measurements and weights of adult hippo from Zambia. *Puku*, 3:181.

ASDELL, S. A. (1946). Patterns of mammalian reproduction. *Constable, London*, 437 pp.

AZAVEDO, J. C. S. and AGNEW, A. D. Q. (1968). Rift Valley impala food preferences. *E. Afr. Wildl. J.*, 6:145-146.

BACKHAUS, D. (1959a). A hartebeest herd in the Garamba Park. *Afr. wild Life*, 13:197-200.

.....(1959b). Beobachtungen uber das freileben von Lolwel-Kuhantilopen (*Alcelaphus buselaphus lelwel*) und gelegenheitsbeobachtungen an Sennar-Pferdeantilopen (*Hippotragus equinus bakeri*). *Z. Säugetierk*, 24:1-34.

BERE, R. M. (1959). Queen Elizabeth National Park: Uganda. The hippopotamus problem and experiment. *Oryx*, 5:116-124

BIGALKE, R. C. and ROWE-ROWE, D. T. (1969). An analysis of the results of hunting black-backed jackals over a five-year period in Natal. *Lammergeyer*, 10:70-80.

BINDERNAGEL, J. A. (1968). Game cropping in Uganda. *Uganda Game Dept.* 199 pp. (mimeo).

BLOWER, J. H. (1962). Wildlife of Uganda—5. the bushbuck. *Wild Life and Sport*, 3 (12):26-27.

BOURLIERE, F. (1961). Le sex-ratio de la girafe. *Mammalia*, 25:467-471.

BOURLIERE, F. and VERSCHUREN, J. (1960). Introduction a l'ecologie des ongules du Parc National Albert. *Inst. des Parcs Nat. du Congo Belge, Brussels.* 2 vol., 158 pp.

BRADLEY, R. M. (1968). Some aspects of the ecology of the warthog (*Phacochoerus aethiopicus* Pallas) in Nairobi National Park. M.Sc. Thesis, *University of Nairobi.*

BRAND, D. J. (1963). Records of mammals bred in the National Zoological Gardens of South Africa during the period 1908 to 1960. *Proc. zool. Soc. Lond.*, 140:617-699.

BROOKS, A. C. (1961). A study of the Thomson gazelle (*Gazella thomsonii* Günther) in Tanganyika. *Colon. Res. Publ.*, 25:147 pp.

BROOKS, A. C. and BUSS, I. O. (1962). Past and present status of the elephant in Uganda. *J. Wildl. Mgmt*, 26(1):38-50.

BROWN, C. E. (1936). Rearing wild animals in captivity and gestation periods. *J. Mammal.*, 17:10-13.

BROWN, L. H. (1963). Wild animals, agriculture and animal industry. *IUCN. New Ser. Publ.* No. 1:109-112.

.....(1969). Wildlife v. sheep and cattle in Africa. *Oryx*, 10(2):92-101.

BUECHNER, H. K. (1957). Aerial count of elephants in Tsavo National Park. *Kenya Game Dept, Nairobi* (typed).

.....(1958a). Elephant census II. *Uganda Wildl. Sport*, 1(4):17-25.

.....(1958b). Wildlife Research in Murchison Falls National Park and vicinity, Uganda. *Fulbr. Prog. Rpt 1-5. Uganda Game and Fish Dept, Entebbe* (mimeo.).

.....(1961). Territorial behaviour in Uganda Kob. *Science, N.Y.*, 133:698-699.

BUECHNER, H. K., BUSS, I. O., LONGHURST, W. M. and BROOKS, A. C. (1963). Numbers and migration of elephants in Murchison Falls National Park, Uganda. *J. Wildl. Mgmt*, 27(1):36-53.

BUECHNER, H. K. and DAWKINS, H. C. (1961). Vegetation change induced by elephants and fire in Murchison Falls National Park, Uganda. *Ecology*, 42(4):752-766.

BUECHNER, H. K., MORRISON, J. A. and LEUTHOLD, W. (1966). Reproduction in Uganda kob with special reference to behaviour. *Symp. zool. Soc. Lond.*, 15:69-88.

BUECHNER, H. K. and SCHLOETH, R. (1965). Ceremonial mating behaviour in Uganda kob (*Adenota kob thomasii* Neumann). *Z. Tierpsychol.*, 22:209-225.

BUSS, I. O. (1958a). Elephant census III. *Uganda Wildl. Sport*, 1(5):25-32.

.....(1958b). Wildlife research in Murchison Falls National Park and vicinity, Uganda. *Fulbr. Prog. Rpt. 1. Uganda Game and Fish Dept, Entebbe* (mimeo.).

.....(1959). Wildlife research in Murchison Falls National Park and vicinity, Uganda. *Fulbr. Prog. Rpt 2. Uganda Game and Fish Dept, Entebbe* (mimeo.).

.....(1961). Some observations on food habits and behaviour of the African elephant. *J. Wild. Mgmt*, 25(2):131-148.

BUSS, I. O. and BROOKS, A. C. (1961). Observation on number, mortality and reproduction of elephants in Uganda. *IUCN New Ser. Publ.* No. 1:115-122.

BUSS, I. O. and SAVIDGE, J. M. (1966). Change in population number and reproductive rate of elephants in Uganda. *J. Wildl. Mgmt*, 30(4):791-809.

BUSS, I. O. and SMITH, N. S. (1966). Observation on reproduction and breeding behaviour of the African elephant. *J. Wildl. Mgmt*, 30(2):375-388.

CASEBEERS, R. L. and KOSS, G. G. (1970). Food habits of wildebeest, zebra, hartebeest and cattle in Kenya Masailand. *E. Afr. Wildl. J.*, 8:25-36.

CAVE, A. J. E. (1963). The white rhinoceros in Uganda. *Oryx*, 7(1):26-29.

CHALMERS, G. (1963). Breeding data: Steinbok (*Raphicerus campestris* Thunberg) *E. Afr. Wildl. J.*, 1:121-122.

CHILD, G. (1964). Growth and ageing criteria of impala, *Aepyceros melampus*. *Occ. Pap. nat. Mus. Rhod.* No. 276:128-135.

CHILD, G., ROTH, H. H. and KERR, M. (1968). Reproduction and recruitment patterns in warthog (*Phacochoerus aethiopicus*) populations. *Mammalia*, 32(1):6-29.

CHILD, G., SOWLS, and MITCHELL, B. L. (1965). Variations in the dentition, ageing criteria and growth patterns in warthog. *Arnoldia*, 1 (38):1-23.

CHILD, G., SOWLS, L. and RICHARDSON, G. L. (1965). Use and limitations of eye-lens weight for ageing wart hog. *Arnoldia*, 1(39):1-2.

CHILD, G. and WILSON, V. J. (1964). Observations on ecology and behaviour of roan and sable in three tsetse control areas. *Arnoldia*, 1 (16) :1-8.

CLOUGH, G. (1969). Some preliminary observations on reproduction in the warthog, *Phacochoerus aethiopicus* Pallas. *J. Reprod. Fert.*, Suppl. 6:323-337.

CLOUGH, G. and HASSAM, A. G. (1970). A quantitative study of the daily activity of the warthog in the Queen Elizabeth National Park, Uganda. *E. Afr. Wildl. J.*, 8:19-24.

DAGG, A. I. (1960). Food preferences of the giraffe. *Proc. Zool. Soc. Lond.*, 135(4):640-642.

DARLING, F. F. (1960a). Wildlife in an African territory. *Oxford University Press, London*. 160 pp.

.....(1960b). Wildlife husbandry in Africa. *Scient. Am.*, 203(5):123-134.

.....(1960c). An ecological reconnaissance of the Mara Plains in Kenya Colony. *Wildl. Monogr., Chestertown*, 5:41 pp.

.....(1961). African wildlife as a protein resource. *Span*, 4:100-103.

DASMANN, R. F. (1963). Game ranching in African land-use planning. *IUCN. New Ser. Publ.* No. 1:223-229 and *Bull. epizoot Dis. Afr.*, 10:13-17.

..... (1964). African game ranching. *Pergamon Press, Oxford*. 75 pp.

DASMANN, R. F. and MOSSMAN, A. S. (1962a). Reproduction in some ungulates in Southern Rhodesia. *J. Mammal.*, 43(4):533-537.

.....(1962b). Abundance and population structure of wild ungulates in some areas of Southern Rhodesia. *J. Wildl. Mgmt*, 26(3):262-268.

.....(1962c). Road strip counts for estimating numbers of African ungulates. *J. Wildl. Mgmt*, 26(1): 101-104.

.....(1962d). Population studies of impala in Southern Rhodesia. *J. Mammal.*, 43(3): 375-395.

DAUBERCIES, A. (1960). Black rhinoceros survey 1959-1960. *Proc. Int. Un. Conserv. Nat. nat. Resour.*, 1960: 127-131.

DE VOS, A. and DOWSETT, R. (1966). The behaviour and population structure of three species of the genus *Kobus*. *Mammalia*, 30:30-55.

DOLAN, J. (1964). Notes on *Hippotragus niger roosevelt* (Heller, 1910). *Z. Säugetierk.*, 29(5): 309-312.

DOUGALL, H. W. (1958). Average estimates of digestible crude protein in Kenya feeding stuffs. *E. Afr. agric. J.*, 23(4):285-289.

.....(1960a). Average nutritive values of Kenya feeding stuffs for ruminants. *E. Afr. agric. For. J.*, 26(2):119-128.

.....(1960b). The gross energy content of some Kenya feeds. *E. Afr. agric. For. J.*, 26(1):21.

.....(1963a). Average chemical composition of Kenya grasses, legumes and browse. *E. Afr. Wildl. J.*, 1:120.

..... (1963b). On the chemical composition of elephant faeces. *E. Afr. Wildl. J.*, 1:123.

DOUGALL, H. W., DRYSDALE, V. M. and GLOVER, P. E. (1964). The chemical composition of Kenya browse and pasture herbage. *E. Afr. Wildl. J.*, 2:86-121.

DOUGALL, H. W. and SHELDRICK, D. L. W. (1964). The chemical composition of a day's diet of an elephant. *E.Afr. Wildl. J.*, 2:51-59.

DOWSETT, R. J. (1966a). Wet season game populations and biomass in the Ngoma area of the Kafue National Park. *Puku*, 4:135-145.

.....(1966b). Behaviour and population structure of hartebeest in the Kafue National Park. *Puku*, 4:147-154.

EAST AFRICAN AGRICULTURAL AND FORESTRY RESEARCH ORGANISATION. (1970). Survey of current wildlife research projects in East Africa. Issue No. VI, (mimeo.).

EDWARDS, D. C. and BOGDAN, A. V. (1951). Important grassland plants of Kenya. *Pitman, Nairobi*, 124 pp.

ELDER, W. H. and RODGERS, D. H. (1968). Age and growth of elephants. A study in the Luangwa valley 1965-1967. *Afr. wild Life*, 22(4):281-293.

ELLERMAN, J. R., MORRISON-SCOTT, T. C. S. and HAYMAN, R. W. (1953). Southern African mammals 1758 to 1951: a reclassification. *Brit. Mus. Nat. Hist., London*.

ERZ, W. (1964). Tooth eruption and replacement in Burchell's zebra *Equus burchelli* Gray (1825). *Arnoldia*, 1(22):1-8.

ESTES, R. D. (1966). Behaviour and life history of the wildebeest (*Chonochaetes taurinus* Burchell). *Nature, Lond.*, 212:999-1,000.

.....(1967). The comparative behaviour of Grant's and Thomson's gazelles. *J. Mammal.*, 48(2):189-209.

.....(1968). Territorial behaviour of the wildebeest (*Connochaetes taurinus* Burchell, 1823). Ph.D. thesis. *Cornell University*. 150 pp. (Xerox copy at EAAFRO library, Muguga.)

ESTES, R. D. and GODDARD, J. (1967). Prey selection and hunting behaviour of the African wild dog. *J. Wildl. Mgmt*, 31(1):52-70.

EVANS, E. M. NESBIT (1970). The reaction of a group of Rothschild's giraffe to a new environment. *E. Afr. Wildl. J.*, 8:53-62.

FIELD, C. R. (1968a). A comparative study of the food habits of some wild ungulates in the Queen Elizabeth National Park, Uganda. *Symp. zool. Soc. Lond.*, 21:135-151.

.....(1968b). Methods of studying the food habits of some wild ungulates in Uganda. *Proc. Nutr. Soc.*, 27:172-177.

.....(1969). A study of the feeding habits of the hippopotamus (*Hippopotamus amphibius* Linnea) in the Queen Elizabeth National Park. Uggada, with some management implications. *Zool. Afr.*, 5(1):71-86.

.....(1970). Observations on the food habits of tamed warthog and antelope in Uganda. *E. Afr. Wildl. J.*, 8:1-17.

FIELD, C. R. and LAWS, R. M. (1970). The distribution of the larger herbivores in the Queen Elizabeth National Park, Uganda. *J. app. Ecol.*, 7(2):273-294.

FLOWER, S. S. (1947). Further notes on the duration of life in mammals—V. The alleged and actual ages to which elephants live. *Proc. zool. Soc. Lond.*, 117:680-688.

FOOD AND AGRICULTURL ORGANIZATION (1969). Pre-investment survey report of ranching potential, Kaputiei Section, Kajiado District, Kenya. Draft report, UNDP/FAO Range Mgmt, Project, Ken 11 to *Min. of Agric., Nairobi*. 168 pp. (mimeo).

.....(1970). Range development in Taita District. Draft report, UNDP/FAO Range Mgmt. Project, Ken. 11 to *Min. of Agric., Nairobi*. 134 pp. (mimeo.).

FOSTER, J. B. (1965). Mortality and ageing of black rhinoceros in East Tsavo Park, Kenya. *E. Afr. Wildl. J.*, 3:118-119.

.....(1966). The giraffe of Nairobi National Park: Home-range, sex ratios, the herd, and food. *E. Afr. Wildl. J.*, 4: 139-148.

FOSTER, J. B. and COE, M. J. (1968). The biomass of game animals in Nairobi National Park, 1960-1966. *J. Zool., Lond.*, 155:413-425.

FOSTER, J. B. and KEARNEY, D. (1967). Nairobi National Park game census 1966. *E. Afr. Wildl. J.*, 5:112-120.

FOSTER, J. B. and MCLAUGHLIN, R. (1968). Nairobi National Park game census 1967. *E. Afr. Wildl. J.*, 6:152-154.

FOSTER, W. E. (1960). The square-lipped rhinoceros. *Lammergeyer*, 1:25-35.

FRADRICH, H. (1965). Zur biologie und ethologie des warzenschweines (*Phacochoerus aethiopicus* Pallas) unter berucksichtigung des verhaltens anderer suiden. *Z. Tierpsychol.*, 22(3):328-393.

GEIGY, R. (1955). Observations sur les *Phacochoeres* du Tanganyika. *Revue suisse Zool.*, 62:139-163.

GLOVER, J. (1963). The elephant problem at Tsavo. *E. Afr. Wildl. J.*, 1:30-39.

GLOVER, J. and DUTHIE, D. W. (1958). The nutritive ratio/crude-protein relationships in ruminant and non-ruminant digestion. *J. agric. Sci.*, 50(2):227-229.

GLOVER, J., DUTHIE, D. W. and DOUGALL, H. W. (1960). The total digestible nutrients and gross digestible energy of ruminant feeds. *J. agric. Sci.*, 55(3):403-408.

GLOVER, J., DUTHIE, D. W. and FRENCH, M. H. (1957). The apparent digestibility of crude protein by the ruminant. *J. agric. Sci.*, 48(3):373-378.

GLOVER, J. and FRENCH, M. H. (1957). The apparent digestibility of crude protein by the ruminant. *J. agric. Sci.*, 49(1):78-80.

GLOVER, P. E. and SHELDRICK, D. (1964). An urgent research problem on the elephant and rhino populations of the Tsavo National Park in Kenya. *Bull. epizost. Dis. Afr.*, 12:33-38.

GODDARD, J. (1967a). Home range, behaviour, and recruitment rates of two black rhinoceros populations. *E. Afr. Wildl. J.*, 5:133-150.

.....(1967b). The validity of censusing black rhinoceros populations from the air. *E. Afr. Wildl. J.*, 5:18-23.

.....(1968). Food preferences of two black rhinoceros populations. *E. Afr. Wildl. J.*, 6:1-18.

.....(1969). Aerial census of black rhinoceros using stratified random sampling. *E. Afr. Wildl. J.*, 7:105-114.

.....(1970a). Age criteria and vital statistics of a black rhinoceros population. *E. Afr. Wildl. J.*, 8:105-121.

.....(1970b). Food preferences of black rhinoceros in the Tsavo National Park. *E. Afr, Wildl. J.*, 8:145-161.

.....(1970c). A note on age at sexual maturity in black rhinoceros. *E. Afr. Wildl. J.*, 8:205.

GOSLING, L. M. (1966). The social behaviour of Coke's hartebeest, *Alcelaphus buselaphus cokei* Günther. *Rep. Trust. Roy. Soc. Leverhulme Schol.*

.....(1969). Parturition and related behaviour of Coke's hartebeest, *Alcelaphus buselaphus* Günther. *J. Reprod. Fert.*, Suppl. 6:265-286.

GRAHAM, A. D. and PARKER, I. C. S. (1965). East African Wild Life Society cheetah survey. Report by Wildlife Services. *East African Wild Life Society, Nairobi*. 25 pp. (mimeo.).

GRIMSDELL, J. J. R. (1969). Ecology of the buffalo, *Syncerus caffer*, in Western Uganda. Ph.D. thesis, *University of Cambridge*.

GRIMWOOD, J. R. (1960). Report of an aerial count of game in the Loita Plains. *Kenya Game Dept, Nairobi* (file, 6A 3/1/8/8 typed).

GRZIMEK, B. (1962). At what age do East African antelopes breed? *Black Lechwe*, 3:12.

GRZIMEK, M. and GRZIMEK, B. (1960a). Census of plains animals in the Serengeti National Park. *Wild Life, Nairobi*, 2(3):40-42, 48-54.

GRZIMEK M. AND GRZIMEK B. (1960b). Census of the plains animals in the Serengeti National Park, Tanganyika. *J. Wildl. Mgmt*, 24(1):27-37.

GWYNNE, M. D. and BELL, R. H. V. (1968). Selection of vegetation components by grazing ungulates in the Serengeti National Park. *Nature, Lond.*, 220:390-393.

HAMILTON, P. H. and KING, J. M. (1969). The fate of the black rhinoceros released in Nairobi National Park. *E. Afr. Wildl. J.*, 7:73-83.

HANKS, J. (1969). Growth in weight of the female African elephant in Zambia. *E. Afr. Wildl. J.*, 7:7-10.

HARTHOORN, A. M. (1958). Comparison of food intake and growth-rate of the African buffalo. *Vet. Res.*, 70:939-940.

.....(1961). Some aspects of game-cropping. In: *Int. Conf. Land Use Mgmt, Lake Manyara, Tanganyika.*

HEADY, H. F. (1966). Influence of grazing on the composition of *Themeda triandra* grassland, East Africa. *J. Ecol.*, 54:705-727.

HVIDBERG-HANSEN, H. (1969). Population ecology and productivity of Thomson's gazelle. *FAO, Kenya*, 182 pp. (mimeo.).

INNIS, A. C. (1958). The behaviour of the giraffe. *Giraffa camelopardalis* in the Eastern Transvaal. *Proc. zool. Soc. Lond.*, 131:245-278.

JENNISON, G. (1927). Table of gestation periods and number of young. *Black, London.*

JOHNSON, O. W. and BUSS, I. O. (1965). Molariform teeth of male African elephant in relation to age, body dimension and growth. *J. Mammal.*, 46(3): 373-384.

KELLAS, L. M. (1954). Observations on the reproductive activity, measurement and growth-rate of the dik-dik. *Proc. Zool. Soc. Lond.*, 124:751-784.

KENNETH, J. M. and RITCHIE, G. R. (1953). Gestation periods, a table and bibliography. *Tech. Commun. Commonw. Bur. Anim. Breed. Genet.*, No. 5.

KERR, M.A. (1965). The age of sexual maturity in male impala. *Arnoldia*, 1(24):1-6.

KILEY-WORTHINGTON, M. (1965). The waterbuck (*Kobus defassa* Ruppell, 1835 and *K. ellipsiprimnus* Ogilby, 1833) in East Africa: Spatial distribution. A study of the sexual behaviour. *Mammalia*, 29:177-204.

.....(1966). A preliminary investigation into the feeding habits of waterbuck by faecal analysis. *E. Afr. Wildl. J.*, 4:153-157.

KING, J. M. (1965). A field guide to the reproduction of the Grant's zebra and the Grevy's zebra. *E. Afr. Wildl. J.*, 3:99-117.

KLINGEL, H. (1965a). Notes on the biology of the plains zebra *Equus quagga boehmi* Matschie. *E. Afr. Wildl. J.*, 3:86-88.

.....(1965b). Notes on tooth development and ageing criteria in the plains zebra *Equus quagga boehmi* Matschie. *E. Afr. Wildl. J.*, 3:127-129.

.....(1969a). The social organisation and population ecology of the plains zebra (*Equus quagga*). *Zool. Afr.*, 4(2):249-263.

.....(1969b). Reproduction in the plains zebra. *Equus burchelli boehmi:* Behaviour and ecological factors. *J. Reprod. Fert., Suppl.* 6:339-345.

KLINGEL, H. and KLINGEL. U. (1966a). Tooth development and age determination in the plains zebra (*Equus quagga boehmi*). *Zool. Gart. Frankf.*, 33:34-54.

.....(1966b). The rhinoceroses of Ngorongoro Crater. *Oryx*, 8(5):302-306.

.....(1970). Grevy-zebra research project. *E. Afr. Wildl. Soc. sci. techn. Common. Bull.*, 31:6-10.

KRUMREY, W. A. and BUSS, I. O. (1968). Age estimation, growth and relationship between body dimensions of the female African elephant. *J. Mammal.*, 49(1):22-32.

KRUUK, H. (1966a). Clan-system and feeding habits of spotted hyaenas (*Crocuta crocuta* Erxleben). *Nature, Lond.*, 209:1,257-1,258.

.....(1966b). A new view of the hyaena. *New Scientist*, 30:849-851.

KRUUK, H. and TURNER, M. (1967). Comparative notes on predation by lion, leopard, cheetah and wild dog in the Serengeti area, East Africa. *Mammalia*, 31(1):1-27.

KUHME, W. (1964). Die ernährungsgemeinschaft der heanenhunde (*Lycaon pictus lupinus* Thomas, 1902) *Z. Naturw.*, 20:495.

LAMPREY, H. F. (1962). A study of the ecology of the mammal population of a game reserve in the acacia savanna of Tanganyika with particular reference to animals numbers and biomass. Ph.D. thesis *Oxford University*. 209 pp. (mimeo.).

.....(1963a). The survey and assessment of wild animals and their habitat in Tanganyika. *IUCN New Ser. Publ.*, No. 1:219-222.

.....(1963b). Ecological separation of the large mammal species in the Tarangire Game Reserve, Tanganyika. *E. Afr. Wildl. J.*, 1:63-92.

.....(1964). Estimation of the large mammal densities, biomass and energy exchange in the Tarangire Game Reserve and the Masai steppe in Tanganyika. *E. Afr. Wildl. J.*, 2:1-46.

LAWS, R. M. (1966). Age criteria for the African elephant. *Loxondonta a. africana. E. Afr. Wildl. J.*, 4:1-37.

.....(1967). Eye lens weight and age in African elephants. *E. Afr. Wildl. J.*, 5:46-52.

.....(1968a). Interactions between elephant and hippopotamus populations and their environments. *E. Afr. agric. For. J.*, 33 (Special issue): 140-147.

.....(1968b). Dentition and ageing of the hippopotamus. *E. Afr. Wildl. J.*, 6:19-52.

.....(1969). Tsavo research project. *J. Reprod. Fert.*, Suppl. 6:495-531.

LAWS, R. M. and CLOUGH, G. (1965). Observations on reproduction in the hippopotamus. (*Hippopotamus amphibius* (Linn.) *Symp. Zool. Soc. Lond.*, 15:117-140.

LAWS, R. M. and PARKER, I. S. C. (1968). Recent studies on elephant populations in East Africa. *Symp. zool. Soc. Lond.*, 21:319-359.

LAWS, R. M., PARKER, I. S. C. and ARCHER, A. L. (1967). Estimating live weights of elephants from hind leg weights. *E. Afr. Wildl. J.*, 5:106-111.

LAWS, R. M., PARKER, I. S. C. and JOHNSTONE, R. C. B. (1970). Elephants and habitats in North Bunyoro, Uganda. *E. Afr. Wildl. J.*, 8:163-180.

LEDGER, H. P. (1963a). The importance of stock selection for increasing the productivity of semi-arid areas. *IUCN New Ser. Publ.*, No. 1:223-229.

.....(1963b). Animal husbandry research and wildlife in East Africa. *E. Afr. Wildl. J.*, 1:18-29.

.....(1963c). Weights of some East African mammals. *E. Afr. Wildl. J.*, 1:123-124.

.....(1964). Weights of some East African mammals 2. *E. Afr. Wildl. J.*, 2:159.

.....(1968). Body composition as a basis for a comparative study of some East African mammals. *Symp. Zool. Soc. Lond.*, 21:289-310.

LEDGER, H. P., PAYNE, W. J. A. and TALBOT, L. M. (1961). A preliminary investigation of the relationship between body composition and productive efficiency of meat producing animals in the dry tropics. VIIIth *Int. Congr. Anim. Prod., Hamburg.*

LEDGER, H. P., PAYNE, W. J. A., TALBOT, L. M. and ZAPHIRO, D. R. P. (1961). The use of carcass analyses technique for investigating the meat production potential of game and domesticated animals in semi-arid areas. In: *Int. Conf. Land Use Mgmt, Lake Manyara, Tanganyika.*

LEDGER, H. P., SACHS, R. and SMITH, N. S. (1967). Wildlife and food production with special reference to the semi-arid areas of tropics and sub-tropics. *Wild Rev. Anim. Prod.*, 3:13-37.

LEDGER, H. P. and SMITH, N. S. (1964). The carcass and body composition of the Uganda kob. *J. Wildl. Mgmt*, 28(4):827-839.

LEDGER, H. P. and SMITH, N. S. (1965). A method of predicting liveweight from dissected leg weight. *J. Wildl. Mgmt*, 29(3):504-511.

LEUTHOLD, W. (1970). Preliminary observations on food habits of gerenuk in Tsavo National Park, Kenya. *E. Afr. Wildl. J.*, 8:73-84.

LINDEMANN, R. L. (1942). The trophic-dynamic aspect of ecology. *Ecology*, 23:399-418.

LITTLE, J. A. (1968). The feeding behaviour of the eland. *Roy. Vet. J.*, 124:325-341.

LONGHURST, W. M. (1957a). Wildlife Research in Uganda. *Fulbr. Prog. Rpt*, No. 1. *Uganda Game and Fish Dept, Entebbe*, 2pp. (mimeo.).

.....(1957b). Elephant census 1. *Uganda Wildl. Sport*, 1.

.....(1958). Wildlife research in Uganda. *Fulbr. Prog. Rpt*, No. 2 and 3. *Uganda Game and Fish Dept. Entebbe*, 4 and 42 pp. (mimeo.).

LYDEKKER, R. (1908). The game animals of Africa. *Rowland Ward, London.* 484 pp.

MABERLY, A. C. T. (1966). Animals of East Africa. *Hodder and Stoughton, London.* 211 pp.

MAKACHA, S. and SCHALLER, G. B. (1969). Observations on lions in the Lake Manyara National Park, Tanzania. *E. Afr. Wildl. J.*, 7:99-103.

MALOIY, G. M. O. (1963). Observations on free-ranging of Thomson's and Grant's gazelles in Kenya. *E. Afr. agric. For. J.*, 28(3): 151-160.

MALOIY, G. M. O. and HOPCRAFT, D. (1969). Thermoregulation and water relations of two East African antelopes: The hartebeest and impala. *EAVRO* (mimeo.).

MATTHEWS, L. H. (1939). Reproduction in the spotted hyaena. *Crocuta crocuta* Erxl. *Phil. Trans. R. Soc. Ser. B.*, 230:1-78.

MCCULLAGH, K. (1969). The growth and nutrition of the African elephant. II. The chemical nature of the diet. *E. Afr. Wildl. J.*, 7:91-97.

MCLAUGHLIN, R. T. (1970a). Nairobi National Park census, 1968. *E. Afr. Wildl. J.*, 8:203.

.....(1970b). Aspects of the biology of cheetahs *Acinonyx jubatus* (Schreber) in Nairobi National Park. M.Sc. thesis, *University of Nairobi.* 298 pp. (mimeo.).

MEINERTZHAGEN, R. (1938). Some weights and measurements of larger mammals. *Proc. zool. Soc. Lond.*, 108:433-439.

.....(1957). Kenya diary 1902-1906. *Oliver and Boyd, Edinburgh.* 347 pp.

MITCHELL, B. L. (1965). Breeding, growth and ageing criteria of Lichtenstein's hartebeest. *Puku*, 3:97-104.

MITCHELL, B., SHENTON, J. and UYS, J. (1965). Predation on large mammals in the Kafue National Park, Zambia. *Zool. Afr.*, 1(2): 297-318.

MODHA, M. L. (1969). The Athi Kapiti Plains. A study of the major ungulates with reference to their potential for cropping. *Kenya Game Dept., Nairobi.* 21 pp. (typed).

MOSSMAN, A. S. (1963). Wildlife ranching in Southern Rhodesia. *IUCN New Ser. Publ.*, No. 1:247-249.

MOSSMAN, A. S. and DASMANN, R. F. (1962). Game ranching handbook for Southern Rhodesia. *National Museum of Southern Rhodesia.*

MOSSMAN, A. S. and MOSSMAN, H. V. (1962). Ovulation, implantation and fetal sex ratio in impala. *Science, N.Y.*, 137 (3,533):869.

NAIK, A. H. (1967). Chemical composition of Tanzania feedstuffs. *E. Afr. agric. For. J.*, 33(2): 201-205

NAPIER BAX, P. and SHELDRICK, D. L. W. (1963). Some preliminary observations on the food of elephants in the Tsavo Park (East) of Kenya. *E. Afr. Wildl. J.*, 1:40-53.

NEAL, E. (1970). The banded mongoose, *Mungos mungo* Gmelin. *E. Afr. Wildl. J.*, 8:63-71.

NEWTON, R. F. (1958). Elephant census. *Uganda Wildl. Sport*, 1(3):28-30.

NICHOLSON, B. D. (1954). The African elephant (*Loxodonta africana*). *Afr. wild Life*, 8(4): 313-322.

NORRIS, D. and JARVIS, C. (1960). Gestation periods. *Int. Zoo Yb.*, 1.

OWEN, R. (1969). The ecology of the sitatunga—Interim report *E. Afr. Wild. Soc. sci. tech. Com. Bull.*, 30:2-7.

OWEN, R. E. A. (1970). Some observations on the sitatunga in Kenya. *E. Afr. Wildl. J.*, 8:181-195.

PARKER, I. S. C. (1964). The Galana game management scheme. *Bull. epizoot. Dis. Afr.*, 12:21-31.

.....(1968). The commercial exploitation of wildlife. *Kenya weekly News*, 2237. Dec. 27:18-19, 34, and *Proc. Anim. Prod. Soc. Kenya*, Sep. 12: 14-21 (mimeo.).

PARKER, I. S. C. and ARCHER, A. L. (1970). The status of elephant, other wildlife and cattle in Mkomazi Game Reserve, with management recommendations. Wildl. Serv. Ltd. *Report to Tanzania Govt.* 63 pp. (mimeo.).

PEARSALL, W. H. (1957). Report on an ecological survey of the Serengeti National Park, Tanganyika. *Oryx*, 4(2):71-136.

PERCIVAL, A. B. (1928). A game ranger on safari. *Nisbet, London.*

PERRY, J. S. (1952). The growth and reproduction of elephants in Uganda. *Uganda J.*, 16(1): 51-66.

.....(1953). The reproduction of the African elephant, *Loxodonta africana. Phil. Trans. R. Soc.* Ser. B., 237(643): 93-149.

PETRIDES, G. A. (1955). Report on Kenya's wildlife resource and the national parks. *Trustees of the Royal National Parks of Kenya.* 31 pp.

.....(1956). Big game densities and range carrying capacities in East Africa. *Trans. N. Am. Wildl. Conf.*, 21:525-537.

PETRIDES, G. A. and SWANK, W. G. (1963). Population densities and the range-carrying capacity for large mammals in Queen Elizabeth Park, Uganda. *Zool. Afr.*, 1(1):209-225.

.....(1965). Estimating the productivity and energy relations of an African elephant population. *Proc. Int. Grassld Congr.*, 9:831-842.

PIENAAR, U. de V., WYCK, P. VAN. and FAIRALL, N. (1966). An aerial census of elephant and buffalo in the Kruger National Park, and the implications thereof on intended management schemes. *Koedoe*, 9:40-107.

PLAYER, J. C. and FEELY, J. W. (1960). A preliminary report on the square-lipped rhinoceros *Ceratotherium simum simum. Lammergeyer*, 1:3-24.

POSSELT, J. (1963). The domestication of the eland. *Rhod. J. agric. Res.*, 1(2):81-87.

REES, A. F. (1963). Some notes on elephants and their feeding habits. *Tanganyika Notes Rec.*, 61: 205-208.

RINEY, T. (1961). The international importance of African Wildlife. *Unasylva*, 15(2):75-80.

.....(1963). Utilization of wildlife in the Transvaal. *IUCN New Ser. Publ.*, No. 1:303-305.

RINEY, T. and CHILD, G. (1960). Breeding season and ageing criteria for the common duiker. *Proc. Federal Sci. Conf. Rhod. Assn. Sci.*, 1:291-299.

.....(1964). Limitations in horn height as an index to ageing the common duiker (*Sylvicapra grimmia*). *Arnoldia*, 1(1):1-3.

RITCHIE, A. T. A. (1963). The black rhinoceros (*Diceros bicornis* L.) *E. Afr. Wildl. J.*, 1:54-62.

ROBERTSON-BULLOCK, W. (1960). Elephants eat baobab trees in Northern Rhodesia. *Wild Life*, 14(2): 143-145.

.....(1962). The weight of the African elephant, *Loxodonta africana. Proc. zool. Soc. Lond.*, 138: 133-135.

ROBINETTE, W. L. (1963). Weights of some of the larger mammals of Northern Rhodesia. *Puku*, 1:207-215.

ROETTCHER, D. and HOFMANN, R. B. (1970). The ageing of impala from a population in the Kenya Rift Valley. *E. Afr. Wildl. J.*, 8:37-42.

ROGERSON, A. (1966). The utilization of metabolisable energy by a wildebeest. *E. Afr. Wildl. J.*, 4:149.

.....(1968). Energy utilization by the eland and wildebeest. *Symp. zool. Soc. Lond.*, 21:153-161.

ROOSEVELT, T. (1910). African game trails: an account of the African wanderings of an American hunter-naturalist. *Murray, London.* 534 pp.

ROOSEVELT, T. and HELLER, E. (1915). Life histories of African game animals. *Murray, London.* 2 vol.

ROTH, H. H. (1965). Observations on growth and ageing of warthog. *Z. Saugetierk.*, 30(6): 367-380.

.....(1966). Game utilization in Rhodesia in 1964. *Mammalia*, 30:397-423.

ROTH, H. H. and CHILD, G. (1968). Distribution and population structure of black rhinoceros (*Diceros bicornis* L.) in the Lake Kariba Dam. *Z. Saugetierk.*, 33(4):214-226.

RUDNAI, J. A. (1970). Social behaviour and feeding habits of lion (*Panthera leo massaica* Neumann) in Nairobi National Park. M.Sc. thesis, *University of Nairobi.* 249 pp. (mimeo.).

SACHS, R. (1967). Liveweights and body measurements of Serengeti game animals. *E. Afr. Wild. J.*, 5:24-36.

SAVORY, C. R. (1965). Game utilization in Rhodesia. *Zool. Afr.*, 1(2):321-337.

SCHALLER, G. B. (1968). Hunting behaviour of the cheetah in the Serengeti National Park, Tanzania. *E. Afr. Wildl. J.*, 6:95-100.

SCHALLER, G. B. (1969). The hunt of the cheetah. *Anim. Kingd.*, 72(2):2-7.

SCHENKEL, R. (1966). On sociology and behaviour in impala (*Aepyceros melampus* Lichtenstein). *E. Afr. Wildl. J.*, 4:99-114.

SCHENKEL R. and SCHENKEL-HULLINGER, L. (1969). Ecology and behaviour of the black rhinoceros (*Diceros bicornis*). *Parley, Hamburg-Berlin.* 101 pp.

SCHOMBER, H. W. (1963). Beiträge zur kenntnis der giraffengazellen (*Litoeranius walleri* Brooke, 1878). *Z. Saugetierk.*, 1: 1-44.

.....(1966). Giraffengazelle und lamagazelle. *Neue Brehm-Bucherei*, No. 538, *Stuttgart.*

SHORT, R. V. (1966). Oestrous behaviour, ovulation and the formation of the corpus luteum in the African elephant, *Loxodonta africana. E. Afr. Wildl. J.*, 4:56-68.

SIKES, S. K. (1966). The African elephant, *Loxodonta africana:* A field method for the estimation of age. *J. Zool., Lond.*, 150:279-295 and 154:235-248.

SIMON, N. M. (1962). Between the sunlight and the thunder. *Collins, London.* 384 pp.

.....(1963). The Galana river game management scheme. *IUCN New Ser. Publ.*, No. 1:325-328.

SIMPSON, C. D. (1966). Tooth eruption, growth and ageing criteria in greater kudu—*Tragelaphus strepsiceros* Pallas. *Arnoldia*, 2(21):1-12.

.....(1968). Reproduction and population structure in greater kudu in Rhodesia. *J. Wildl. Mgmt*, 32(1):149-162.

SKINNER, J. D. (1967). An appraisal of eland as a farm animal in Africa. *Anim. Breed. Abstr.*, 35(2):177-186.

SKINNER, J. D. and VAN ZYL, J. H. M. (1969). Reproductive performance of the common eland in two environments. *J. Reprod. Fert.*, Suppl. 6:319-392.

SOWLS, L. K. and PHELPS, R. J. (1968). Observations on the African bush pig *Potamochoerus porcus* Linn. in Rhodesia. *Zoologica, N.Y.*, 53(3):75-84.

SPINAGE, C. A. (1967a). Ageing the Uganda defassa waterbuck, *Kobus defassa ugandae* Neumann. *E. Afr. Wildl. J.*, 5:1-17.

.....(1967b). The autecology of the waterbuck. Ph.D. thesis. *University of London.*

.....(1968a). A quantitative study of the daily activity of the Uganda defassa waterbuck. *E. Afr. Wildl. J.*, 6:89-93.

.....(1968b). The book of the giraffe. *Collins, London.* 191 pp.

.....(1969). Reproduction in the Uganda defassa waterbuck, *Kobus defassa ugandae* Neumann. *J. Reprod. Fert.*, 18(3):445-457.

.....(1970). Population dynamics of the Uganda defassa waterbuck (*Kobus defassa ugandae* Neumann) in the Queen Elizabeth Park, Uganda. *J. Anim. M. Ecol.*, 39(1): 51-78.

STEVENSON-HAMILTON, W. (1947). Wild life in South Africa. *Cassel, London.*

STEWART, D. R. M. (1963a). Wildlife census—Lake Rudolf. *E. Afr. Wildl. J.*, 1:121.

.....(1963b). Development of wildlife as an economic asset. *Bull. epizool. Dis. Afr.*, 11:167-171.

.....(1965). The epidermal characters of grasses with special reference to East African plains species. *Bot. Jb.*, 84(1): 63-116; and 84(2): 117-174.

.....(1967). Analysis of plant epidermis in faeces: A technique for studying the food preferences of grazing herbivores. *J. appl. Ecol.*, 4(1):83-111.

.....(1969). Food preferences of an impala herd. From: Survey of current wildlife research projects in East Africa. *EAAFRO* (mimeo.).

STEWART, D. R. M. and STEWART, J. (1962). Determination of food preferences by faecal analysis: experiments to test the method. *Kenya Game Dept, Nairobi* (file ref. Fru/200/3, mimeo).

.....(1963). The distribution of some large mammals in Kenya. *Jl E. Africa nat. Hist. Soc.*, 24(3):1-52.

.....(1970). Food preference data by faecal analysis for African plains ungulates. *Zool. Afr.*, 5(1):115-129.

STEWART, D. R. M. and TALBOT, L. M. (1961). Aerial census of the Serengeti-Mara-Loita Plains. *Kenya Game Dept., Nairobi* (file ref. GA 3/1/8/8, mimeo.).

.....(1962a). Serengeti survey. *Africana*, 1:24-27.

.....(1962b). Census of wildlife on the Serengeti, Mara and Loita Plains. *E. Afr. agric. For. J.*, 28(1):58-60.

STEWART, D. R. M. and ZAPHIRO, D. R. P. (1963). Biomass and density of wild herbivores in different East African habitats. *Mammalia*, 27(4):483-496.

STEWART, P., GRIEG, D. and STEWART, I. B. (1966). The use of sex and age ratios in estimating abundance and productivity of impala. *Lammergeyer*, 6:9-19.

SWANK, G. W. (1957). Summary of work completed by Fulbright scholars at Queen Elizabeth National Park, October 19, 1956 to June 15, 1957. *Uganda Game and Fish Dept, Entebbe.* 8 pp. (mimeo.).

SWANK, G. W. and PETRIDES, G. A. (1957). A study to determine the effect on vegetation and other factors of game populations in Queen Elizabeth Park. Fulbr. Prog. Rpt. *Uganda Game and Fish. Dept, Entebbe* (mimeo.).

SWYNNERTON, G. H. (1958). Fauna of the Serengeti National Park. *Mammalia*, 22:435-450.

SWYNNERTON, G. H. and HAYMANN, R. W. (1951). A checklist of the land mammals of the Tanganyika Territory and the Zanzibar Protectorate. *Jl E. Africa nat. Hist. Soc.*, 20:274-392.

TALBOT, L. M. (1961). Aerial analysis of wildlife population structures. *E. Afr. agric. For. J.*, 27(1): 42-43.

.....(1962). Food preferences of some East African wild ungulates. *E. Afr. agric. For. J.*, 27(3): 131-138.

.....(1963). Comparison of the efficiency of wild animals and domestic livestock in utilization of East African rangeland. *IUCN New Ser. Publ.*, No. 1:329-333.

.....(1964). The productivity of some African ungulates. *EAAFRO* (mimeo.).

.....(1965). A survey of past and present wildlife research in East Africa. *E. Afr. Wildl. J.*, 3:61-85.

.....(1967). The meat production potential of wild animals in Africa. *Tech. Commun. Commonw. agric. Bur.* No. 16.

TALBOT, L. M., LEDGER, H. P. and PAYNE, W. J. A. (1961). The possibility of using wild animals for animal production. *Int. Congr. Anim. Prod.*, 8:205-210.

TALBOT, L. M. and MCCULLOCH, J. S. G. (1965). Weight estimation for East African mammals from body measurements. *J. Wildl. Mgmt*, 29(1): 84-89.

TALBOT, L. M. and STEWART, D. R. M. (1964). First wildlife census of the entire Serengeti-Mara region, East Africa. *J. Wildl. Mgmt*, 28(4):815-827.

TALBOT, L. M. and TALBOT, M. H. (1961a). How much does it weigh? *Wild Life, Nairobi*, 3(1):47-48.

.....(1961b). Preliminary observations on the population dynamics of the wildebeest in Narok District, Kenya. *E. Afr. agric. For. J.*, 27(2):108-116.

.....(1963). The wildebeest in Western Masailand, East Africa. *Wildl. Monogr. Chestertown*, 12:88 pp.

TALBOT, L. M. and ZAPHIRO, D. R. P. (1961a). Aerial analysis of wildlife population structures. In: *Int. Conf. Land Use Mgmt, Lake Manyara, Tanganyika.*

.....(1961b). Aerial analysis of wildlife population structures. *E. Afr. agric. For. J.*, 27(1):42-43.

TAYLOR, C. R. (1968). The minimum water requirements of some East African bovids. *Symp. zool. soc. Lond.*, 21:195-206.

.....(1969a). The eland and the oryx. *Scient. Am.*, 220:88-95.

.....(1969b). Metabolism, respiratory changes, and water balance of an antelope, the eland. *Am. J. Physiol.*, 217(1):317-320.

TAYLOR, C. R. and MALOIY, C. M. O. (1969). The effect of dyhydration and heat stress on intake and digestion of food in some East African bovids. *Trans. 8th Int. Congr. Game Biol.* Helsinki, 1967.

TAYLOR, C. R., ROBERTSHAW, D. and HOFMANN, R. (1969). Thermal panting: A comparison of wildebeest and zebu cattle. *Am. J. Physiol.*, 217(3): 907-910.

TAYLOR, C. R., SPINAGE, C. A. and LYMAN, C. P. (1969). Water relations of the waterbuck, an East African antelope. *Am. J. Physiol.*, 217(2): 630-634.

TREUS, V. and KRAVCHENKO, D. (1968). Methods of rearing and economic utilization of eland in the Askaniya—Nova Zoological Park. *Symp. zool. Soc. Lond.*, 21:395-411.

TURNER, M. and WATSON, M. (1964). A census of game in Ngorongoro crater. *E. Afr. Wildl. J.*, 2: 165-168.

ULLRICH, W. (1963). Einige beobachtungen an wildtieren in Ostafrika: Giraffengazellen. *Zool. Gart. Frankf.*, 27:187-193.

ULMER, F. A. (1966). Gestation period of the Uganda kob antelope. *Int. Zoo. Yb.*, 6:204-205.

VAN ZYL, J. H. M. (1962). Meat production of South African game animals. 1. The Eland. *Fauna Flora, Pretoria*, 13:35-40.

.....(1964). Meat production of South African game animals. 2. The African buffalo. *Fauna Flora, Pretoria*, 15:34-40.

VERHEYEN, R. (1955). Contribution a l'ethologie du Waterbuck *Kobus defassa Ugandae* (Neumann) et de l'antilope harnachee *Tragelaphus scriptus* (Pallas). *Mammalia*, 19:309-319.

VESEY-FITZGERALD, D. F. (1955). The topi herd. *Oryx*, 3:4-8.

.....(1960). Grazing succession among East African game animals. *J. Mammal.*, 41(2):161-172.

.....(1965). The utilization of natural pastures by wild animals in the Rukwa Valley, Tanganyika. *E. Afr. Wildl. J.*, 3:38-48.

.....(1969). Utilization of the habitat by buffalo in Lake Manyara National Park. *E. Afr. Wildl. J.*, 7:131-145.

VIDLER, B. O., HARTHOORN, A. M., BROCKLESBY, D. W. and ROBERTSHAW, D. (1963). The gestation and parturition of the African buffalo (*Syncerus caffer caffer* Sparrman) *E. Afr. Wildl. J.*, 1:122-125.

WALTHER, F. R. (1964). Einige verhaltensbeobachtungen an Thomsongazellen (*Gazella thomsonii* Günther, 1884) in Ngorongoro-Krater. *Z. Tierpsychol.*, 21:871-890.

.....(1965). Verhaltensstudien an der grantgazzellen in Ngorongoro-Krater. *Z. Tierpsychol.*, 22:167-208.

WATSON, R. M. (1967). The population ecology of the wildebeest (*Connochaetes taurinus albojubatus* Thomas) in the Serengeti. Ph.D. thesis, *University of Cambridge.*

.....(1969). Reproduction of wildebeest, *Connochaetes taurinus albojubatus* Thomas, in the Serengeti Region, and its significance to conservation. *J. Reprod. Fert.*, Suppl. 6:287-310.

WATSON, R. M. and BELL, R. H. V. (1969). The distribution, abundance and status of elephants in the Serengeti region of Northern Tanzania. *J. appl. Ecol.*, 6(2): 115-132.

WATSON, R. M., GRAHAM, A. D. and PARKER, I. S. C. (1969). A census of the large mammals of Loliondo controlled area, Northern Tanzania. *E. Afr. Wildl. J.*, 7:43-60.

WATSON, R. M. and KERFOOT, O. (1964). A short note on the intensity of grazing of the Serengeti plains by plains game. *Z. Saugetierk.*, 29(5):317-320.

WATSON, R. M., PARKER, I. S. C. and ALLAN, T. (1969). A census of elephant and other large mammals in the Mkomazi region of Northern Tanzania and Southern Kenya. *E. Afr. Wildl. J.*, 7:11-26.

WATSON, R. M. and TURNER, M. I. M. (1965). A count of the large mammals of the Lake Manyara National Park: Results and discussion. *E. Afr. Wildl. J.*, 3:95-98.

WILSON, V. J. (1965). Observations on the greater kudu (*Tragelaphus strepsiceros* Pallas) from a tsetse control hunting scheme in Northern Rhodesia. *E. Afr. Wildl. J.*, 3:27-37.

.....(1966a). Notes on the food and feeding habits of the common duiker, *Sylvicapra grimmia*, in Eastern Zambia. *Arnoldia*, 2(14):1-19.

.....(1966b). Observations on Lichtenstein's hartebeest, *Alcelaphus lichtensteini*, over a three-year period and their response to various tsetse control measures in Eastern Zambia. *Arnoldia*, 2(15):1-14.

.....(1966c). Predators on the common duiker, *Sylvicapra grimmia*, in Eastern Zambia. *Arnoldia*, 2(28):1-8.

WILSON, V. J. (1968). Weights of some mammals from Eastern Zambia. *Arnoldia*, 3(32):1-20.

.....(1969). Eland, *Taurotragus oryx*, in Eastern Zambia. *Arnoldia*, 4(12):1-19.

WILSON, V. J. and CHILD, G. (1964). Notes on bushbuck (*Tragelaphus scriptus*) from a tsetse fly control area in Northern Rhodesia. *Puku*, 2: 118-128.

WILSON, V. J. and CLARKE, J. E. (1962). Observations on the common duiker, *Sylvicapra grimmia* Linn., based on material collected from a tsetse control game elimination scheme. *Proc. zool. Soc. Lond.*, 138:487-497.

WING, L. D. and BUSS, I. O. (1970). Elephants and forests. *Wildl. Monogr., Chestertown*, 19:92 pp.

WRIGHT, B. S. (1960). Predation on big game in East Africa. *J. Wildl. Mgmt*, 24(1): 1-15.

WYATT, J. R. (1970). The feeding ecology of giraffe in Nairobi National Park and the effect of browsing on their main food plants. M.Sc. thesis. *University of Nairobi.*

YOUNG, E. (1966). Nutrition of the hippopotamus (*Hippopotamus amphibius*). *Afr. wild Life*, 20(2): 165-167.

ZAPHIRO, D. R. P. (1961). The use of light aircraft in East African wildlife research and game management. *Oryx*, 6(3):190-199.

ZAPHIRO, D. R. P. and TALBOT, L. M. (1960). The use of light aircraft in East African wildlife research and game management. In: *Int. Conf. Land Use and Mgmt*, Lake Manyara, Tanganyika.

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