Tanzania Notes and Records no. 84 and 85

ELEPHANT CONTROL AND LEGAL IVORY EXPLOITATION: 1920 TO 1976

W. A. Rodgers and *J. D. Lobo*

Introduction

The study of elephants and ivory has gained importance in the last few years with the increasingly rapid reduction of African elephant populations for their ivory. Particularly alarming is that much of this slaughter is taking place in areas of land specifically set aside for the preservation and conservation of wildlife, Africa's national parks and game reserves. As such this destruction is illegal, although in some countries there is evidence to show that poaching has been carried out with support and backing from highly placed members of government.

Spinage (1973) has documented the size and extent of the African ivory trade through the 19th Century and into the 20th century. He shows a period of increasing exploitation from 1850 to 1900. The trade seemed to reach its peak in East Africa between 1879 and 1883 when an average of 196,000 kg per annum was exported from Zanzibar. Using an average tusk size of 8.5 kg (Spinage) this would mean some twelve thousand elephant being killed each year. An estimate of ivory reaching Zanzibar market from the East African coast from Mozambique Port to Mogadishu in 1849 puts the total at approximately 302,000 kg. (*Ministere d'Etat*). This equals some eighteen thousand elephant assuming 8.5 kg per tusk. Vincent (1895), who visited Bagamoyo ivory market, mentions "tusks of all sizes, a large one would weigh 175 lb and be worth 600 dollars each". (Note that a tusk of 175 lb would be the fifth biggest ever recorded.) Vincent states that sixty thousand elephant are being killed each year and "it looks as if the elephant will become extinct in no distant time". "What then shall we do for ivory?" he says. Records of early travellers show that in many areas elephant populations were reduced to zero in less than 25 years from the onset of exploitation, e.g. Karagwe and Kavirondo. This boom in ivory did not last beyond 1900 as elephants became increasingly scarce and colonial governments attempted to restrict elephant hunting by setting quotas, charging licence fees and setting aside game reserves (Rushby, 1965). As a consequence ivory exports decreased, for example Zanzibar in 1936 exported only some 62,000 kg. Since 1940 however, quantities have slowly increased and Dar es Salaam exported a record 251,000 kg in 1972 (East African Customs 1972/73). Note that the Zanzibar ivory market was replaced by Dar es Salaam in 1964. This quantity of ivory is equivalent to about fifteen thousand elephants being killed per annum. These figures indicate a cycle of utilisation with uncontrolled exploitation taking place up to about 1900, then a period of control and conservation up to 1968, followed by a new period of increased exploitation. This last phase is still underway today in many African countries.

During this century however, there has been considerable legal destruction of elephant, both by individual licenced hunters and by government departments undertaking elephant control for crop protection. This paper is an attempt to describe the history and extent of such elephant control in Tanzania from the start of British rule in 1920 until the present time. Facts, figures and records are drawn from files of the Tanzanian Game Division, Government and Customs Reports, Tanzania Government Archives, the Ivory Room Records and from questioning past and present game wardens who have had personal experience of elephant control in Tanzania.

Historical accounts of ivory exploitation are given by Alpers (1976) and, in more popular sensationalist versions, by Moore (1931) and Wilson and Ayerst (1976). Figure I is a map of south-east Tanzania showing place names mentioned in the text.

THE RATIONALE OF ELEPHANT CONTROL

Elephant control has taken place in Tanzania wherever human habitation and cultivation came into conflict with elephant populations. Attempts at protecting crops from elephant were made long before the start of colonial rule. Some protection would be achieved by scaring away elephant groups by noise, fire and stone throwing, and some elephant could be killed by poison, pit falls or muzzle loaders. Colonial rule introduced control by administrative officials and, under British rule the creation of a special force, the Game Department, to deal with the protection of life and property from dangerous animals.

Elephant are attracted to many crops, including the cereals rice, maize and millet, as well as fruit and vegetables such as mango, banana, cashewnut, citrus, cassava and beans. For a small settlement of some three to five families cultivating only a few hectares, the passage of a herd of elephant through the crop could destroy much of their produce and cause starvation in the coming year. In some areas of Tanzania, notably the south-east, human populations were low, with small settlements scattered along minor valley systems in dense bush. This settlement pattern was in response to the historical pressures of slaving, Ngoni warfare and German repression following the Maji Maji uprising and is discussed by Rodgers (1976) and Matzke (1975;1977). South-east Tanzania, with a low, scattered human population, coupled with adequate water and forage was well suited for large elephant concentrations. It is no accident that this area of Tanzania has suffered more elephant damage and consequently more intensive elephant control than any other region of East and Central Africa. Kjekshus (1977) however, has amassed considerable evidence that 19th century human populations were higher than previously believed, that agriculture was well developed and wildlife populations did *not* dominate the African scene.

The cessation of slaving and large scale ivory exploitation meant that elephant populations were able to increase after 1900. Human populations were freed from problems of internecine warfare and oppressive rule in the 1920s, and the people of south-east Tanzania could leave their seclusion in thickets and small valleys to congregate in the broader, more fertile, river valleys. This movement of people and the growth of elephant populations brought increased conflict and crop destruction. It also probably led to stories of elephant migration, as for example those of the Wangindo people who recall the movement of elephant from the Songea-Njombe highlands into the lower lying areas of Liwale, Kilwa and Rufiji Districts. Similar stories are told by the Wapogoro people of Ulanga District (Rodgers 1976).

To prevent increasing crop damage and consequent localised starvation or even larger scale famine, more efficient and formalised methods of control had to be achieved. This control started with the formation of a permanent Game Department in late 1919, with an initial policy of "protection of native crops and life". The department has grown slowly from the initial one ranger of 1919 to the present establishment of over three thousand employees.

What is of interest is how little the methods, distribution and amount of elephant control have changed from 1930 until the present time. It is unfortunate that we are still not able to utilise the resources of these elephant (except for ivory) any more than we were forty years ago. Every year most of the meat, hides and bones of some 2,500 elephant is wasted, the bulk of it in protein deficient south-east Tanzania. Even more unfortunate is that it now takes a far greater force of men, far more ammunition, money and time to do the same job that was done forty years ago.

METHODS OF ELEPHANT CONTROL

There are three basic ways of preventing or reducing the amount of crop damage caused by wild animals (elephant, hippopotamus, buffalo, wild pig, and baboon). These may be classified as social methods, barrier and distraction methods, and the physical control of animal populations.

Social methods concern the movement of human populations from areas of elephant concentration, usually by forming large settlement/cultivation areas out of previously scattered dwellings. It is interesting to note that such measures were suggested by game rangers as early

as 1924, long before political, social, educational and medical authorities called for the concentration of settlements. But the main periods of such population movements in southern Tanzania were not in response to crop damage, but to a major trypanosomiasis (sleeping sickness) scare in the 1940s and in response to socio-political factors in the late 1960s and early 1970s (the Ujamaa settlements). In both cases the distribution and amount of Game Department activity altered with these changes in settlement pattern.

The Game Department's requests for settlement concentration were due to the impossibility of providing game scouts for every small village, and the fact that in large villages the central areas would be free from damage, and communal efforts could afford better protection to peripheral cultivation. As settlements became concentrated game scouts could be stationed permanently in each village and could give better protection to that area.

Barrier and distraction methods consist of building barriers or fences around cultivated fields and are better suited to the control of pigs and buffalo than of elephant. Elephant can be kept out by elaborate ditches and embankments but these are expensive and not suited for small settlements (Woodley, 1965). Electric fencing can be used against elephant but again is expensive and difficult to maintain. An experimental electric fence was successfully elephant-proof for three months at Dutumi, south of Morogoro, in 1956.

Distraction methods consist of human beings driving elephant (or other animals) away from cultivation by shouting, banging drums and tins, lighting fires, throwing stones, etc. These methods do help to alleviate destruction but they are dangerous, expensive in time and energy and elephant may learn not to be distracted.

Physical control. The most realistic method of reducing crop damage is to force out or shoot the elephant populations causing the damage. This is easy in theory (and perhaps *could be* in practice) but in actual fact it has not proved successful except in small areas like the Kilombero Sugar Estate. After fifty years of physical control in south-east Tanzania the Game Division still shoots thousands of elephant per year and crops are still damaged. However, while it has not solved the problem it has alleviated it. If the one hundred thousand elephant shot between 1930 and 1975 in south-east Tanzania had not been destroyed the rate of damage to crops, settlement and life, as well as to the natural vegetation, would be far worse today.

Physical control of elephant has involved two main practices. One is the continual routine control by game scouts who follow up requests for assistance following damage by going to that area and shooting one or more elephant. If the scouts are stationed in a village, they shoot elephant in the vicinity of the village as a warning to other elephant to keep away. The other method is the planning and execution of large-scale control schemes to either exterminate local elephant populations or attempt to drive large populations of elephant away from areas of settlement. To this must be added the more carefully planned means of control such as that of Nicholson in Liwale who attempted to move young male crop raiding elephant by harassing the cow/calf herds in the vicinity. The male groups, which are peripheral to the breeding herds, would then move away with the females. Elephant are not stupid creatures and will learn. The shooting of a solitary bull has no effect on a population, but the continued harassing and shooting of animals in large breeding herds does have an effect and such groups will move away from the harassment (Nicholson, 1969).

Such policies of moving or driving elephant depend on having somewhere to move them to. It is not practical to move elephant from one district into the settlements of an adjacent district. In south-east Tanzania the Germans had created four game reserves: Mohoro (along the Rufiji), Ulanga (now part of the Selous Game Reserve), Matundu (of which part is now in the Selous), and the Mtetesi (now a forest reserve). It was realised in the 1930's that these were not large enough to contain the extensive elephant populations and so existing game reserves were enlarged and others created. It is interesting that many reserves in those days were not created for reasons of conservation but out of social necessity. They were also created as a legal barrier to prevent people moving out of large settlements (such as the sleeping sickness villages of the 1940's) and returning to their small scattered hamlets (Matzke 1975; 1977).

And so as physical control continued, staff numbers and efforts were never sufficient to solve the problems, but managed to keep on top of it. The local people and administrators (and following independence, the politicians) saw that something was being done: elephants were killed and possible motives of revenge on the crop raiders could be satisfied. But it should be noted that perhaps there was another benefit from (or motive existed for) this continual "half pressure" control. The control measures produced considerable quantities of ivory, the revenues of which accrued to government. And these revenues were considerable, as is shown in Table VIII. One wonders today (as did a member of the Game Department in 1933) if officials are not perhaps more interested in elephant control as a means of continued revenue rather than as a means of reducing crop damage. Was the loss of produce equivalent to fifty thousand pounds in 1946 or five hundred thousand shillings in 1972? It would be interesting to know.

Elephants are shot using heavy calibre rifles, which when used in dense bush and from close range can be a dangerous undertaking. Almost every year the Game Department loses staff killed by elephant while on control duties. Also a number of elephant are wounded, providing a greater menace to human society, and they will eventually die inhumanely while the resource of ivory, meat and hide will be lost. Old Game Division records from the 1950s show a wounded rate of perhaps ten percent and an average bullet use of some 2.5 to 3.5 per elephant. Laws, Parker and Johnstone (1975) in Uganda believed the Game Department there were wounding up to 25 percent, a higher rate than that recorded by the department.

Records in the Tanzania Game Division since 1970 show, in some districts, a wounding rate of up to 50 percent and a bullet use of 5 to 7 per elephant. It is thought that some of this may be due to illegal use of ammunition; after all it is easy to say "I fired ten bullets at an elephant and it ran away" and then sell the ten rounds. Observations of many young male elephant carcasses along the eastern boundary of the Selous Game Reserve are thought to be a result of high rates of wounded elephant in adjacent Rufiji District. Despite the fact that the Game Division shoots as many elephant today as it did twenty years ago (albeit with a much larger staff) there has been a marked change in the divisions' policy on control. District and regional game officers today are primarily administrators. They are responsible for wildlife education, anti-poaching and conservation measures as well as divisional and other administration. Very rarely are they personally involved in the execution or even the supervision of elephant control, due to lack of time, transport, interest and sometimes ability, in what is a very demanding and dangerous duty. Consequently elephant and dangerous game control is increasingly handled by junior, often untrained, game staff.

Thirty years ago the emphasis was very different, with elephant control duties being a major task of game rangers in south-east Tanzania. Administrative duties were fewer than those of today and more time could be devoted to field work — both development and maintenance of the Selous Game Reserve, and elephant control. Many rangers were appointed because of their ability to deal with dangerous game. To increase the overall efficiency of control specialised scout training courses were organised. The last such course was that organised by A. F. Rees, Game Ranger at Mahenge, who dealt with the Kilombero Sugar Estate elephant clearance scheme in the early 1960s. It is this shift of emphasis in divisional policy (whether planned or accidental) which resulted in better administration but no change or improvement in methods or techniques of elephant control. If anything, efficiency in control has declined, involving more staff, ammunition, and finance. At the same time a major resource of meat, hides and bone-meal lies virtually unused.

THE EARLY HISTORY OF THE GAME DIVISION

The Game Department is first mentioned under British colonial rule in the 1919/20 financial year when the sum of two hundred and forty-two pounds was spent on game matters. This was the salary of the first Game Ranger, C.F.N. Swynnerton, appointed in November 1919. If the activities of the department can be judged by money spent, Table I — A illustrates the growth from 1920 to 1930. Figures for later years are included for comparison. Up until 1927/28 the department contained the sub-department of Tsetse Research and Reclamation. The first Director, Swynnerton, left Game to head the new Tsetse Department in 1929 and the department became the Department of Game Preservation. As an example of how finances were

spent, giving a further clue to the operations of the department, Table I-B shows the breakdown of expenditure for three consecutive years in the mid-1920s. It is clear that apart from staff salaries the biggest expenditure was on elephant control for crop protection, although the department was administering the legacy of some twenty game reserves created previously by the Germans. The 1970/71 estimates for Game Division are included for comparison.

By 1923/24 the department consisted of one director, one senior ranger, four rangers, eighty-four game scouts and thirty-four trappers. Between them this force "accounted for 259 lions, 659 leopard, 70 crocodile and innumerable elephant". Rewards of some three hundred and fifty pounds were spent on vermin destruction by villagers. The following year, one ranger, a Capt. Fairweather, reportedly shot 394 elephant himself during control in south-east Tanzania (based in Liwale). In 1928/29 the department had grown to one director, one senior and five game rangers, eighty-five scouts, and since 1926, five cultivation protectors (all being in southern Tanzania). In 1929/30 the post of director was changed to that of game warden.

Through the 1920's the emphasis was on crop protection and especially in south-east Tanzania, as the following excerpts show (League of Nations Reports):

> 1923 Report: *Destruction of Native Crops by Elephant.* "Complaints by villagers of the damage done by elephant have been freely made. There is no doubt that they are often exaggerated and are sometimes made merely in the hope of obtaining a supply of powder for muzzle-loading guns, with which other game may be hunted; but some districts have certainly suffered from the attentions of these animals, particularly the southern coastal areas, where many isolated villages were driven to migrate to other localities. There in some parts, travelling before dawn is unsafe, and even at mid-day the roads are occasionally obstructed by parties of elephant while plantations are stripped and grain stores broken down. It is conjectured that as the result of promiscuous shooting during the war, when elephant meat and fat was a necessity to German commissariat and when local people freely hunted with arms and ammunition picked up in the field, the herds split up and, disturbed in their natural feeding grounds, took to invading plantations, and that many, once having acquired a taste for succulent native foodstuffs, will not willingly forego it."

"A number of special licences to shoot elephant in specific areas were issued to Europeans in the hope of driving the elephants back to the bush, but it is found that in many cases the herds merely move off to other areas which they raid until again driven off. Moreover, though every effort was made to ensure that the attentions of the licencees should be directed only to the garden-raiding elephants, the shooters, who were paid in ivory, were naturally tempted to study their own interests and frequently neglected the cows and young bulls, which create the greatest damage, for older elephants carrying heavier tusks which are not so often found in the plantations. It is yet too early to say whether the expedient will prove effective, but there are indications that there may be a repetition of the unsatisfactory state of affairs which followed the adoption of similar methods in Uganda. It may, therefore, become necessary in future to employ paid whole-time hunters, armed with heavy rifles, who, receiving a fixed wage ragardless of the elephant shot, will only fire at elephants in or near cultivated areas and teach them that cultivation spells danger, so that thereafter, if they attempt to approach, the mere discharge of musket should scare them away. Organised shooting should be accompanied by closer local settlement, as it is manifestly impossible to protect outlying plantations on the fringe of or far within the forest, but this object can only be obtained in course of time with the goodwill and not by coercion of the villager, who swiftly appreciate its obvious advantage."

> 1924 Report: *Depredations of Game.* "A systematic attempt was started to check the depredations of marauding elephants and of other game dangerous to life or destructive of crops, and a special staff of cultivation protectors was engaged for this purpose, the districts of Lindi, Songea, Mahenge and Kilwa being selected for the first operations under the new scheme."

> "Consideration must be given in the near future to the necessity of some relaxation of the present very strict preservation of game throughout the whole of the Territory, as complaints of the destruction of crops are still general. Elephants, for instance, were reported to have

caused famine conditions along the Ilindi plain in Dodoma, while no less than 134 families were removed from the Rufiji to places less exposed to the destructive wanderings of these animals. The Director of Game Preservation is hopeful that he will, with the aid of his cultivation protectors, be able to solve the problem so far as the elephant is concerned; but the situation as regards other game animals is unsatisfactory and must remain so, in the opinion of the Governor, so long as the people are deprived of the means of protecting their crops. In the past he has been charged with licence duty for his muzzle-loading gun but had been refused any powder for use in it. The Governor is taking steps to relax these restrictions which in some cases have subordinated the interest of the people to those of game preservation."

1929 Report: *Game Depredations* "The special staff of cultivation protectors again proved of great assistance in the Lindi and Mahenge Provinces against the depredation of elephant. The position with regard to smaller game destructive to crops was, however, not so satisfactory. It has accordingly been decided to modify the existing protective measures. As from the Commencement of next financial year, the local Administrations will become solely responsible for the destructions of vermin and marauding game except elephant, rhinoceros, and hippopotamus, which will continue to be dealt with by the Game Department."

Two main measures were introduced to attempt to cope with control problems. Firstly a scheme of issuing local people with fire arms and powder was tried but this was abandoned due to lack of control, although the practice was revived from time to time in the 1930s. Similarly, European hunters were given free special licences on a "one tusk for you and one tusk for government" basis, but as the 1923 report indicates above, this failed as well. The later introduction of permanent cultivation protectors did prove a success and some measure of control was achieved. Cultivation protectors also took on the task of training game scouts and in time an efficient body of men was built up (Ionides, 1966).

It is of some interst to look at human populations in these areas of south-east Tanzania and see how populations have grown. Details are shown in Table II.

GENERAL ELEPHANT CONTROL, 1920—1976

Details of elephant shot on control are given in Table III. Data for the period 1920-1931 are unreliable in some degree as figures on files and reports occasionally differ. Following decentralisation of government in 1971 control data becomes equally unreliable, especially in areas outside south east Tanzania.

No figures have been found for the war years 1939 to 1944. However, as ivory export figures are vailable throughout the war, it is possible to estimate a figure for the ratio of ivory exported to elephant shot for the 1945 to 1950 period and use this proportion to estimate the 1939 to 1944 total shot from the 1939 to 1944 export data.

Figures for south-east Tanzania are included in the table where they are known accurately. At the base of the table are five year averages for elephant shot and the percentage contribution of south-east Tanzania. It will be seen that numbers shot increased during the 1920 to 1970 period, reaching a peak of 3,765 in 1969. During the 1970s numbers fell, partly due to changing settlement patterns and also due to a frequent shortage of heavy rifle ammunition. Similarly the percentage contribution of south-east Tanzania has risen from 1950, and in recent years forms over 80 percent of all elephant shot.

Table IV shows the trend of ivory production in Tanzania, both as a function of ivory room auction sales (as published in the *Tanzania Gazette* and elsewhere) and ivory export figures. Export figures are those published by the Tanganyika and later the East African Customs reports. They do not include ivory being re-exported from Tanzania on behalf of Zambia, Ruanda, Burundi and Zaire; these figures are listed separately in customs reports. Figures for ivory auction sales and exports do of course include ivory from found tusks, confiscated tusks and tusks shot on licence and sold through the ivory room or exported commercially. Elephants shot or ivory imported illegally may also be exported "legally" if documents are obtained. This is discussed below.

Figure II shows the trend of numbers of elephant shot, ivory sold on auction and ivory exported from 1920 to 1976. Ivory revenues are also shown. There would appear to be an increasing discrepancy between elephant shot, ivory sold and ivory exported from 1965 onwards. The implications of this are discussed at the end of this paper. Ivory revenues are detailed in Table VIII.

Found Ivory is that discovered by the public or conservation staff, from elephant dead of natural causes or bullet wounds. A reward of a few shillings per kilo is paid to members of the public who bring such tusks to the administration. Rewards are 20 shs. per kg now compared with four shillings per lb in 1966. Although this appears to be an increase, note that the 1966 price was 20 percent of the ivory value and the present price only some six percent. National Parks staff are paid a larger incentive, Game Division staff none at all, which probably explains why found ivory returns in game reserves are so low.

Ivory found more than two years after death has decayed due to the effects of fire and weather and is classified at ivory sales as "rotten ivory". Ivory room records from 1954 to 1966 show an average of 232 rotten tusks per year passing through the sales, or 4.8 percent of total sales. This proportion declined from 1965 to 1970 to 1.8 percent. Rotten ivory data does not include tusks fround in good condition and so possibly reflects only some 30 percent of all found ivory. Some data from old records of southern Tanzania do show proportions of ivory shot on control to found ivory. As the bulk of ivory comes from southern Tanzania these proportions should be relevant to the whole country allowing an estimate of the amount of found ivory.

Number of tusks can be converted to number of elephant by knowing the proportions of two-tusked, one-tusked and no-tusked elephant. In 1933 a large sample of 477 elephant was classified as 410 two-tuskers,22 one-tuskers and 15 no-tuskers. As we know of no other data these ratios are assumed correct for the 1920 to 1976 period. These figures indicate that 1.88 tusks are equivalent to one elephant. Data on mean weight of found tusks are available for a number of years from southern Tanzania. Table V shows ten year averages for mean tusk weights, proportions of shot to found ivory and an estimate of found ivory per year.

Elephant Shot on Licence. The hunting and killing of elephant on licence has been legal in Tanzania from 1920 to September 1973 when all hunting was banned. During this period details of licencing, who is eligible, how many can be shot, fees payable, etc., have changed from year to year. Records of number shot and ivory weight are available for some districts for some years for the period 1920 to 1950. Thereafter few records exist up until the late 1960s. Details are shown in Table VI of elephant licences sold, number of elephant shot, mean tusk weight and the monetary value of all hunting licences. Due to the low human population and poor communications, southern Tanzania was not a favoured area for elephant hunting.

The revenue from hunting licences is quite considerable as shown in Table VI. These figures include all licences sold to visitors, residents and local people. From 1926 to 1950 villagers could hunt specified animals for no fee (not elephant). In 1930 elephant licences cost 400 shillings for the first and 600 shillings for the second after a general game licence was bought for 300 shillings. Note that licence revenue declined in 1930 due to a 300 percent increase in elephant licence fees and the general financial depression of the times. The 1965 to 1970 data show that an apparent 96 percent of licence holders shot an elephant and sold the tusks through the ivory room. This figure seems suspiciously high and probably includes ivory shot illegally. But much of the data does contain inaccuracies, figures from ivory room statistics and district records frequently not agreeing.

Confiscated Ivory. A small amount of ivory comes into government possession through the courts where tusks may be confiscated from convicted poachers and those holding ivory illegally. A very few tusks are confiscated when licenced hunters produce tusks of less than 4.9 kg (11 lb), the legal limit. Little data exists on the quantity of such ivory. Figures for 1967 and 1968 show tusks confiscated curresponding to 66 and 167 elephant. Mean confiscated tusk weight in 1968 was 17.2 kg, only slightly less than that years licenced tusk mean weight of 18.2 kg.

Ivory from Control Operations. Considerable data exists regarding tusk weight of elephant shot on control. A summary of such data is shown in Table VII. No accurate data is available on

the age and sex ratio of elephant shot. The overall small tusks size indicates a preponderance of young elephant and so tusks cannot be objectively sorted as to sex using quantitative techniques.

When Rodgers was based at Morogoro in 1966 to 1969 the opportunity arose to examine control scouts field note books and the majority of elephant were entered as males. However, questioning the scouts revealed the potential inaccuracies of data as young elephant are not easy to sex without careful examination. In 1969, G.T. Mosha, then Game Warden at Mahenge, kept records of 148 elephant shot on control in Ulanga District. Two hundred eighty three tusks from these elephant (indicating an average of 1.91 tusks per elephant) gave a mean weight of 5.4 kg per tusk. These elephant could not be sexed on the basis of tusk dimensions.

The size variation in southern Tanzanian elephant appears to prevent spatial separation of body and tusk dimensions as an aid to sexing (Rodgers, unpublished data). Of 47 intact lower jaws that could be aged, 28 were male and 15 female(four were indeterminate). The 28 males had a mean age of 23 years (13-37) and a mean tusk weight of 8.0 kg. The 15 females average 31 years (13—45) with a mean tusk weight of 3.1 kg.

Lindi Province in 1831 estimated the province population consisted of ten percent mature bulls, 45 percent cows and 45 percent immatures. Figures for 1928 to 1930 show 60 percent bulls, 35 percent cows and five percent calves in 835 elephant shot on control. 1933 reports show 70 percent of Rufiji and Lindi elephant shot were bulls. 1934 reports show Lindi shooting 50 percent bulls, Rufiji 60 percent and Mahenge 66 percent. 1976 data shows Mahenge shooting 168 males and 27 females. Combining this data gives 82 percent males. The accuracy of this data remains unknown. Judging from male totals and mean tusk weights, the majority of bulls shot would be very young. This agrees with Nicholson's comment (1969) that crop damage is primarily caused by young, not fully grown, bulls and early control and present control operations concentrated on these animals and not the breeding herds.

Comparison of Ivory Weights. Data presented here show a found weight of some 7.5kg. per tusk. This should be comparable with the population average, assuming mortality is mainly natural. Control data is considerably less, averaging 5.4 kg per tusk since 1926. This would indicate control shooting is selecting younger animals from the population. Licence hunting produces a mean tusk weight o 22.0 kg per tusk, showing selection for older bulls. Confiscated ivory data shows a similar figure of 17.2 kg, again showing poachers were able to select older animals.

An analysis of ivory weight trends from the 1920s shows a general decline in tusk weight. This decline is also shown in this decade. Annual mean weights for all tusks passing through the ivory room 1971 to 1977 show the following: 1971 5.4 kg, 1972 5.1 kg, 1973 4.7 kg, 1974 4.5 kg, 1975 4.9kg, 1976 4.6kg and 1977 4.7kg (data from Davitz, personal communication, 1977). Such a decline is an indication of a younger population, the age structure changing due to hunting pressure.

Elephant Control Schemes. Two types of physical control were previously mentioned, one being routine shooting by game scouts and one being the introduction of large scale control schemes in specified areas. Such large scale schemes were initiated in the early 1930s and this is indicated by the rapid increase in numbers of elephant shot, as shown in Figure II. The 1930s schemes covered much of southern Tanzania. Later schemes such as those of 1948 to 1952 in Nachingwea and 1962 to 1963 in Kilombero were designed to eradicate elephant from specific areas intended for intensive agricultural development. A different type of scheme, which proved unsuccessful, was the attempt in the early 1960s to drive elephant out of the coastal thickets of Lindi Region eastwards into the unsettled areas of the Selous Game Reserve.

Game Department records indicate that the 1930s scheme was initiated by Commander Blunt, Game Ranger for southern Tanzania. Extracts from his memorandum (Blunt, 1932) are quoted at length.

"A rough estimate of the elephant population in the territory is 50,000 and this number is probably increasing at a rate of 3,000 per year, piling up an annual and ever increasing adverse balance of 2,000 a year, as we kill just over 1,000. Elephant are most numerous in the

south, which is sparsely inhabited with people living in villages of 3—10 huts, which very often are separated by impenetrable thickets of up to 15 miles wide, which contain elephant. The present game reserves in the south: Selous, Matandu and Mtetesi are now far too small to contain anything like the number (some 30,000) of elephant there."

Then Blunt outlined the following scheme:

"(a) To increase our staff with an enlargement of present policy to reduce elephant numbers.
(b) To concentrate local settlement under their respective chiefs in fertile areas which can be effeciently protected by a pair of game scouts.
(c) To enlarge present reserves and form new ones.
(d) Extermination of elephants in places where they cannot be driven into reserves and where they are in the centre of large cultivated areas".

He goes on to say:

"In the detailed scheme proposed in 1924 by the late Director of Game Preservation (Swynnerton) he proposed 10 Cultivation Protectors each with 12 local hunters for southern Tanzania alone. In the 9 years since this proposal elephant in south Tanzania have increased by 9 — 12,000 and have wandered into tracts of country in which they have never been seen before!" ...

"If the primary object of elephant control is the protection of crops and not production of revenue then let us intensify the control of elephants and destruction of vermin to the limit, by investing every penny of surplus funds from sale of ivory back into the scheme towards the better protection of cultivation. Within a year permanent improvement will result with a still better revenue produced."

In 1933 the Game Department then approved the following schemes:

1. Iringa anti-elephant scheme
2. Tukuyu elephant removal scheme
3. Dar es Salaam District scheme
4. Kilwa scheme (against hippo and elephant)
5. South Mahenge scheme
6. Rufiji scheme (against hippo and elephant)

The Iringa scheme was minor and consisted of increasing the number of game scouts in badly hit areas.

The Tukuyu scheme resulted from complaints of a marauding herd of some 80 elephant. The game warden insisted that the herd should not be exterminated but driven into uninhabited areas by selective shooting. This was done successfully by shooting 20 elephant.

The Dar es Salaam scheme was centred on the area to the south-west, between the Ruvu River, the Central Railway line and the Utete Road, a fertile area with many crops. Elephant had penetrated northwards to 20 km of Dar es Salaam, an occurrence unknown for one hundred years. (In 1970, four elephant were shot a few hundred metres from the Dar es Salaam airport). Ruvu Sisal Estates reported fifty hectares of sisal were destroyed. The scheme killed some 125 elephant and complaints died down.

The Kilwa scheme spread to all areas of Southern Province and led to the shooting of considerably more elephant than in the past. However, as the later section of control in Southern Province states, "no matter how many elephant are shot, control shooting continued to increase year after year".

The south Mahenge scheme involved the posting of more cultivation protectors and game scouts and affording better protection in the Ulanga and Luhombero valleys.

The Rufiji scheme arose out of a safari by the provincial commissioner in September 1932. He was much perturbed by the ravages of elephant and hippo against crops and so the game warden was instructed to formulate a scheme to reduce elephant numbers. Such a scheme was

started in February, 1933 under a Mr. Gabbutt, Game Ranger at Rufiji, with an allocation of £460. He wrote, in the Rufiji District Book, that:

"The object was reducing elephant numbers in the district and driving them west wards to the Selous. Operations started in the Magongo hills to the north-east of Utete, the greater part of which is uninhabited thicket in which for generations elephant have made their home. By the end of 1933 a definite movement westwards was noticeable and the operation was extended to cover the whole of the cultivated area of the district except for the Matumbi and Kichi hills in the south. In 1933 alone over 250 elephant were killed in the north-east parts of the district. At the end of 1934 the total shot on this campaign amounted to 819. It was then considered that the intensive shooting that had been carried out during the past two years should cease. Control had been established and the herds driven to the west. Scouts stationed in the Magongo hills have been extended along the boundary with Dar es Salaam and all the way to the Ruvu and hence to Kisaki in Morogoro District. This strengthened line should prevent any break out by large groups back to the Magongo hills. Operations in western Rufiji have stopped as any intensive shooting there will only drive the elephants eastwards again".

Along with elephant, hippo were thinned out by the game ranger (and Mr. Barker, the "Rufiji Barker" of Dar es Salaam newspaper column fame) for control and as a commercial proposition for ivory and fat. In 1933 1,185 were shot; 1,059 in 1934; and 218 in 1935, when shooting virtually stopped. However, a temporary game ranger posted to Utete in 1937 stated that numbers were increasing again.

Gabbut wrote in 1937, "Tusks of 100 lb each used to be easily obtainable, but the area was so thoroughly shot over that today a 50-pounder is all one can expect to find. It is now a rare sight to meet with a herd of more than 30 elephant". The game warden was able to write to the chief secretary at the end of 1933 that "to date we have shot 351 elephant on the Rufiji scheme, 69 on the Dar es Salaam scheme and 81 in south Mahenge for a total profit of £2,150". In April 1934, the game warden had to write that "The allocation of £1,600 for cultivation protection schemes is almost expanded and I request a further sum of £920." This was approved—an indication of government concern at the amount of damage. In 1937 control operations lost momentum and numbers of elephant shot fell by almost 50 percent. These were the last of the large district schemes, later operations being directed at specific agricultural projects.

In 1948, the Overseas Food Corporation (OFC) of Britain embarked on their disastrous "groundnut affair". This included the clearing of several thousand acres of woodland near Nachingwea and the eradication of elephant in the vicinity. For this project the Game Department were allocated £6,580 in 1949 and £5,135 in 1950 for control operations. (Compare these figures with £1,300 and £600 for the whole province in 1928 and 1948.

In April 1949, the Game Ranger at Liwale (Ionides) wrote to the OFC and stated, "With reference to your verbal request to let you have my estimate of the elephant population of Block "A" of the groundnut scheme; I estimate there are some 300-400 based on 22 hours flying. The largest herd was 40 but the average size was 15-20 and there are several smaller groups of 5-6." (Note that this must have been one of the earliest specific aerial census flights ever undertaken in Africa, although Swynnerton used aircraft on survey work.)

Block "A" was a large horse-shoe shaped depression of lowland bamboo jutting into the Rondo plateau to the west of Nachingwea. This area was to be cleared for nut planting. Ionides used the request from OFC for elephant removal as an excuse for more staff and three assistant elephant control officers were appointed, only one of whom, Nicholson, stayed. The eradication scheme was approved and implemented, and elephant were rapidly moved out by a combination of shooting and large scale bush removal by OFC machinery. The elephant, however, moved south into the cultivated areas of Rondo and not north to the thickets of Liwale area.

At this time the OFC labour demands were so huge (port, railway, road, fuel lines and agriculture) that a high proportion of able-bodied men left their cultivation up to a hundred mile radius around Nachingwea. As a result of this and the influx of elephant, the defence of crops decreased and damage rose considerably. Nicholson recalls that this was the main problem that Game Division had to deal with, not the further eradication of elephant from plantation blocks.

In 1959 a second eradication scheme was started in Kilwa District. This scheme was intended to clear the large hill thickets of Mtandawala which stretch from north of the Matandu River to the Mbemkuru, some 30 km inland from the coast. At this time government called for a campaign for increased rice and cashewnut production on the plains inland (Matandu, Mavudji and Mbemkuru valleys) and the fertile coastal plain. The villagers apparently refused, saying they were unable to protect more than their present small acreages against severe elephant damage. Game Division devised a scheme which would reduce crop damage by intensive control and also drive the elephant out of the high ground thickets to the Selous Game Reserve some sixty km westwards. Two elephant control officers and a large force of scouts were posted to the project, directed to intensify control operations, and specifically to harass the female herd in the thicket and drive them westwards. However, there were two elephant populations in the area, one a migratory popuplation from the west, which on harassment did not return. The other consisted of long term resident herds.

Seasonality of Control. Nicolson (1969) remarked that prior to 1960 with a food-crop agriculture, elephant control was confined to the period between February and July. After 1961 greater emphasis was placed on cash-crop production, especially cashewnuts in south-east Tanzania, and crop destruction by elephant spread throughout the whole year. February to July is the growing and harvesting period for all cereal crops and September to November the main fruiting period for cashews.

Data on past month-by-month control activity is scarce and incomplete. Some records are available from Lindi Province for the 1929 to 1935 period and are shown in Table IX. Results show an increase in activity during the rainy season. Recent data from the 1970s shows a complex picture with some evidence for peaks in May (cereal crops) and October/November (cashew crop). Results for 5,093 elephant shot in the 1971 to 1975 period in Liwale, Nachingwea and coast areas are shown in Table IX. Basically, elephant are shot all the year around.

Extent of Crop Damage. There appears to be very little quantitative estimation of the actual extent of crop damage by elephant, either from the past fifty years, or being collected now. In 1933 the elephant influx into Dar es Salaam District was reported as causing damage to 20 percent of the area's crop production including young sisal, kapok, rubber and sorghum fields. A more extensive survey was compiled by agricultural inspectors in Rufiji District in 1952. Data was collected for wards, but are here shown for sub-districts for bananas (clumps of plants) and cassava gardens (approximately of one acre each). Only clumps and gardens "completely destroyed" were included:

Area	*Cultivated*	*Destroyed*	*Percent*
Mbwara	23,560 clumps	7,010	30
Mtanza	23,410 clumps	3,855	16
Ndundu	nda	nda	15 estimate
Tawi (a)	800 clumps	450	56
Tawi (b)	262 acres	103	39
Zombe	34,870 clumps	11,420	33

Note that Zombe and Tawi areas are closest to the Selous Game reserve and receive the heaviest damage. It is not known how accurate these figures are; if correct they indicate tremendous devastation close to elephant populations, which it seems would have persuaded villagers to move away (as has been done in the 1970s, see below). Allen Rees (personal communication), writing about Ulanga District, states that "The actual value of crops damaged was usually very small, but to individual farmers it could be considerable, and economics on a grander scale are difficult to balance against the great hardship caused to subsistence farmers growing nothing to spare."

THE ELEPHANT POPULATION OF SOUTH-EAST TANZANIA

Now that the effect of control shooting on the elephant populations has been documented it is of interest to describe present day elephant population size and distribution patterns, and to speculate on past patterns. The late 1920s and early 1930s proved to be fertile days for game rangers' imaginations and several guesses were put forward for the number of elephant in south east and the rest of Tanzania.

Early guesses were all very low, ridiculously so by modern knowledge, but it is highly probable that levels of 19th century exploitation were sufficient to have reduced total numbers below the one hundred thousand mark for Tanzania. Nineteenth century travellers seemed to bypass south-east Tanzania, major trade routes passing to the north via Kisaki or Morogoro, or along the Ruvuma to the south. Speke (1864) and Thomson (1868) both passed close to the Rufiji in what is now the northern Selous Game Reserve, both mention plains game, but neither mention elephant specifically. Otherwise there is a lack of recorded information until the turn of the century, when, as was mentioned earlier, Sutherland (1912) was shooting elephant (and big ones, a sign of a large population) in what is now the southern Selous, and the Germans were shooting elephant on cotton farms near Mohoro. But the Wangindo at Ngarambi claim elephant were exceptionally scarce. It is probable that elephant were distributed all over the area in the 1920s with the *exception* of the Matengo highlands bordering Lake Nyasa.

The first census for Tanganyika put the country total at 8,000 (Game Department Report, 1926; Matzke, 1977). The 1927 Southern Province report mentions 1,000 for the province and a 1931 Game Ranger guessed at 8,000 as follows: Liwale 4,000; Kilwa 2,500; Masasi 1,000; Tunduru 500; Lindi 150 and Mikindani (now Mtwara) 75.

In 1933, the acting game warden wrote to the chief secretary giving the details of a census of elephant as follows:

"'Departmental figures on elephant census compiled during the last six months show:

(1) Lindi (Southern) Province

Masasi	500
Tunduru	600
Liwale	2,500
Kilwa	1,000
Lindi	120
Mikindani	4
Newala	0
Songea	700
	5,424

(2) Kilosa, Kisaki and north Mahenge	6,500
(3) South Mahenge—Ruvuma	9,000
(4) Rufiji	9,000
(5) The rest of Tanganyika	7,000
Total census	36,924

The game warden went on, "Figures compiled by Lindi, (Mr. Harvey) are fairly accurate. The total for the territory is about 37,000. Even this is a fairly liberal estimate". Note this census was by questionaire and guesswork.

In late 1933 Commander Blunt estimated 50,000 for Tanganyika with 30,000 in south-east.

The figures for Southern Province were obviously wrong as in 1933, 1934, 1935 and 1936, the Game Department killed a total of some 5,580; more than were supposedly there in 1933.

The enormity of these errors seems to have prevented any further estimates of Tanganyika elephant numbers until 1966 when senior staff of the Selous Game Reserve believed the reserve held 50,000 elephant and 1967 when an instructor at the College of African Wildlife Management estimated 70,000 in the country. Making estimates based on rainfall and human densities, Watson, *et al.* (1972) suggested a possible 945,000 elephant in Tanzania.

In 1976 staff of the Miombo Reserch Centre of the Tanzania Game Division participated in a systematic aerial census of 76,000 sq km of south-east Tanzania, including the Selous Game Reserve and Mikumi National Park. The results have not yet been fully analysed but preliminary figures indicate an elephant population of 120,000 in this area and a possible population of 150,000 for all of south-east Tanzania (Douglas-Hamilton, Rodgers and Mbano, unpublished data).

Between 1974 and 1976 Rodgers undertook a questionnaire survey to describe the distribution of elephant (and species) in Tanzania. Data for the south-east using a 1955 baseline, indicate elephant present throughout the area except for Matengo, Newala, Mtwara and eastern Masasi Districts. (As to total elephant numbers, Rodgers, while acknowledging this will be controversial, estimates 300,000 elephant in Tanzania for 1977, of which over half were in the south-east.

Using these figures one can make more assumptions and estimates. The 150,000 elephant of south-east Tanzania may show a natural rate of increase of 3.5 percent per annum, just below the theoretical maximum of four percent (Hanks and McIntosh, 1975). If so, this gives an annual increment of some 5,250 per annum. Of this total, legal culling removes just under half, or 2,431 a year (ten year, 1966 to 1975 average), and illegal hunting takes another portion. This mortality is not evenly spread. The bulk of the population in the Selous Game Reserve (some 81,000) is relatively safe from culling, although peripheral populations do move into cultivation and are also open to illegal hunting. The bulk of the mortality takes place in those elephant populations outside the Reserve and if present control rates continue these populations must slowly decline and retreat in the face of advancing settlements.

Given that there are 150,000 elephant in the south-east now, that we know the legal hunting and control rates from 1920, and can assume that the population could grow at 3.5 percent per annum, how many elephant were there then in 1960, 1950, 1940, 1930, and 1920? What would these totals be if we assume that illegal hunting was equivalent to half the legal toll? Note these calculations exclude found ivory data as this is assumed to be natural mortality, and that figures for culling are based on five year averages. Data are given in Table X, and indicate an elephant population between 55,000 and 85,000 in south-east Tanzania in 1920.

THE ELEPHANT AS A RESOURCE

Traditionally the value of an elephant is in its ivory. But the elephant is much more than that, a big bull will weigh up to 6,000 kg and an average elephant approaching 2,000 kg. This represents a large protein resource as well as valuable hide and bone. Modern day culling operations as pioneered by Parker in Uganda, Tsave and Mkomazi show that the value of the hide (as expensive leather for seat covers, etc) can be greater than that of the ivory (Laws, Parker and Johnstone, 1975).

Elephant meat can be extremely palatable and canned elephant products, as prepared by Glees and Sachs were of a high quality and were acceptable to European markets. Unfortunately few of the people from south-east Tanzania will eat elephant meat, for reasons of religion (Islam) and tradition. Among those who are Christian in belief, however elephant meat is highly prized. People from the Uluguru Mountains, the upper Kilombero, Masasi, Songea and Mahenge, all centres of missionary activity since the early 1900s, will walk long distances and pay considerable sums of money to buy quantities of greenish badly smoked elephant meat. The Game Officer in Songea stated that people there would rather buy smoked elephant meat at six shillings per kg than similarly priced fresh beef (Lyamuya, personal communication, 1976). In some parts of Tanzania, elephant were occasionally used as famine food, e.g. Rukwa in 1938, when 40 were shot for this purpose.

Under the past and present system of elephant control virtually no use is made of the hide or meat products and these resources cannot easily be exploited. Elephant are shot almost at random; one here today and maybe another one twenty km away next week, often in dense bush with no ready access for vehicles or staff to preserve the perishable products. Only the ivory and the tail is taken.

In the late 1960s Game Officer Demian Madogo, based at Liwale (which District currently shoots more elephant than any other), started a small project in elephant meat utilisation. Carcasses in accessible areas would be sold at 300 shillings each, or, when transport was available, meat would be dried and sent to Masasi District where it would fetch prices of up to five shillings per kg. This proved profitable, but the project was run on a small scale and transport was frequently not available. Revenue from sales had to go to Treasury and could not be used for transport costs, etc. As such the scheme, although socially and financially viable, proved a drain on Game Division Liwale's funds. Recommendations for future utilisation are discussed below.

SOUTH-EAST TANZANIA PRE-1970 ELEPHANT CONTROL

As control activities were concentrated in south-east Tanzania, much of the early documente on control relate to that area. Such documents may be separated into Mahenge-Ulanga, Rufiji and Southern (or Lindi) Province.

(1) *Mahenge-Ulanga District, Eastern Province*

Ulanga District was recorded as a "bad" area for crop destruction by elephant (and hippopotamus) from the start of British colonial rule. Extracts from District *Annual Reports* note the following:

1919 Elephant do a lot of damage.
1920 Vermin (elephant, hippo, buffalo, etc.) do much damage to native crops.
1921 Elephant cause a great amount of destruction.
1927 Report by the "Cultivation Protector", a Mr. Vivers; "Mahenge is the heaviest stocked elephant country in Africa. On a 4 months foot safari I was in daily contact with elephant. I suggest elephant be shot or driven out."
1927 Letter from District Officer to Provincial Commissioner "Elephant should be treated as vermin and driven out or better still exterminated especially where rice is the main crop as in the Kilombero and Ruhuji valleys".
1928 Cultivation guards killed 197 elephant. Worst damage from February to September, mainly Rice, Sorghum and Maize. There are 8 guards in the whole valley, who are shooting with light pistols as rifles are in short supply. Elephants should be shot while raiding to teach them a lesson.
1929 Elephant troublesome along Ulanga valley and southeast of Mahenge, they raid bananas, potatoes, cassava and beans as well as cereals.
1933 South Mahenge to become a major elephant control scheme, the scheme to cost £856. Food shortages in Mahenge are partly due to elephant damage.
1939 On the plains, chiefly Luhombero and Ulanga valleys, vast agricultural possibilities exist, but human populations are small and scattered and much damage is done by game, especially elephant and hippo. This year 361 elephant shot by 9 scouts. Policy for future is for scouts to protect only larger villages.
1940 Only concentrations of the very scattered settlements will give complete protection against elephant to the cultivator.
1943 Closer settlement has very greatly reduced losses from game depredations, the hunting allowed around settlements drives the game away from the human populations.
1949 Reported that elephant are breeding prolifically and their numbers are increasing.
1951 Extensive ivory poaching believed to be carried out in and near Selous Game Reserve.
1952 Shortage of game staff made effective crop protection difficult.
1953 Much crop damage done by elephant, hippo, pig and baboon.
1956 Due to flood damage, fewer crops to protect this year, most damage done by elephant and hippo.
1956 Little evidence to prove that much poaching exists but much found ivory, found tusks from 152 elephant this year.
1957 Crop damage heavy again, poaching still a problem
1969 Nicholson reports that in the 1950-1953 period settlement was concentrated and 300 elephant were shot per year. In 1957 these settlements had dispersed and elephant control had to be increased to 800 a year and so the game scout force doubled in the early 1960s.

In 1966 Students from College of African Wildlife Management undertook control exercises in south-east Mahenge, shooting 125 in 1966, when 679 were shot by ranger staff and 84 on licence.

Game Scout Establishment: 1922 = 7, 1928 = 8, 1939 = 9, 1950 = 19, 1955 = 22, 1956 = 20, 1966 = 43 (includes staff permanently based in Selous Game Reserve), 1975 = 25 (excludes Kilombero District). Control figures are shown in Table XI.

(2) *Rufiji District and Eastern Province.*

1924, Morogoro: "An effort was made to protect crops against elephant, etc.; 25 elephants were allowed each year on licence to hunters on the understanding that 1 tusk went to the Government. The scheme was unsuccessful and resulted in gross abuse of the Game Ordinance and many dangerous wounded elephant were left roaming the country side. After 1 year the operation was stopped. To replace this, 1 officer (Arundell) and his staff stationed at Kisaki did a very good job. In 1924, 3 Europeans received the "25 elephant-licence", resulting in 143 tusks weighing 1,780 kg (average 12.5 kg) worth 60,000/-".

1928, Rufiji: Depredations by game in every area, opinion is that 5 local cultivation guards are not sufficient. Suggested that local treasuries should purchase heavy calibre rifles and engage staff locally to assist the guards. The inhabitants of Mbwara should move to the Rufiji valley, their area is sparsely populated and a well known breeding spot for elephant.

1931 Rufiji: A scheme was suggested (later turned down) for the establishment of a crop protection fund to pay compensation. The fund would be under the custodianship of the local Authority and financed from a percentage of ivory shot in defence of crops and from all found ivory revenues. People claim that compensation for crop damage is not given favourable consideration. (Note a similar request was made in Parliament in July 1977 and also turned down).

1934: Rufiji: Elephant do much damage, plentiful water and mango trees make the Rufiji a favourite haunt for elephant.They do not damage crops to the extent that is generally conceived. Millet crop suffers the greatest loss. It must be stressed that tribal units must also assist in the destruction of vermin.

1939. Rufiji: Ivory and meat poaching is carried out on a large scale by an organised gang. Estimate that £50,000 worth of ivory illegally shot per year (about 500 elephant). Steps have been taken to combat this.

1945. Eastern Province: Elephant and hippo continue to cause great damage, especially in the riverine areas where their numbers are high. Their destruction continues but is slow to counteract the high rate of damage.

1948. Bagamoyo: A few elephant shot each month, and an unending flow of damage complaints from shamba owners.

1948. Rufiji: 8 scouts shot 141 elephant. General policy is to drive such elephant away from riverine cultivation and to stop them crossing the Rufiji river from the Selous Game Reserve near Nykasiku. No shooting of elephant is allowed on the north bank west of Nyikanza nor in the Kibiti to Ikwiriri area. Isolated hamlets in the Kichi-Matumbi hills cannot claim protection since they have been warned to combine in closer settlements.

1949. Rufiji: Deprecations by elephant are severe this year and scouts too few to deal with all complaints.The small populations at Tawi and Mbwara are too scattered to be protected. People have been urged to help themselves by organising vermin drives.

1957. Eastern Province: Despite intensive control measures, elephant numbers appear to be increasing, not decreasing.

Details of control activities are shown in Table XI.

(3) *Southern (Lindi) Province.*

The former Southern Province of Tanganyika Territory has seen the heaviest activity in elephant damage and control of any area of Tanzania. We are fortunate that the story of this control has been well documented on government files and records. Southern Province also produced three of the finest Game Rangers ever to serve in Tanzania; the late C.J.P. Ionides, Game Ranger at Liwale from 1933 to 1957; B. D. Nicholson, Game Ranger, Liwale, and later Principal Game Warden, Selous Game Reserve from 1950 to 1973; and A. F. Rees, Game Ranger, Mahenge, and Principal Game Warden, Selous, from 1955 to 1972. (It has been the senior author's privilege to have known, and in the latter cases served with, these Game Rangers who were responsible for much of the Tanzanian elephant control operations.)

The early history of elephant in this province is confusing as we have the contradictory reports of Sutherland (1912) who hunted elephant intensively and successfully; compared with those of local hunters who record a major expansion of elephant from Songea in the early 1920s and the reports of Commander Blunt who record elephant penetrating into areas

where they were previously unknown in the 1930s. It is perhaps fair to summarise and reconcile these reports and say that by 1900 previous ivory exploitations would have driven elephant far away from areas of settlement and they only existed in sizeable numbers in remote areas such as the Mbarangandu river area where Sutherland hunted. Furthermore the movement of people out of thickets and intensified agricultural development in Songea and Njombe would have both caused elephant movement and brought humans into renewed conflict and contact with elephant populations.

However, whatever the history, elephant were there in numbers. Indeed early guesses at total elephant numbers in Tanzania put over half in southern Tanzania, even if the total figure was wrong, perhaps by a factor of ten times.

High elephant numbers and scattered settlement meant considerable control work as the following extracts from Provincial *Annual* File and *Report* show:

1920 Elephant are troublesome near Tunduru and indeed throughout southern Tanganyika.
1923 Elephant, pig, baboon and hippo cause much damage to villagers crops in Lindi. Newala reports that elephant have been kept down. Songea is still badly troubled by elephant.

Administrative officers were unduly optimistic about the efficiency and success of their control operations as the following reports show:

1933 "764 elephant killed" (by 34 scouts)
1934 "1,100 elephant killed (by 44 scouts) including 250 killed in the Kilwa coastal areas, we expect no elephant left there in 1935."
1935 "15,536 elephant killed, the coastal area of Kilwa is free and we expect the remainder of Kilwa and Liwale to contain some 600—700 elephant. The Matandu river area, Mtetesi, Mikindani and Newala have had most of the elephant shot out. Masasi and Lindi contain no elephant at all. We estimate that the elephant populations have been reduced by 70% since 1931." (As they had shot 4,400 since 1931 this gives an estimated population of 6,300 of which some 1,900 were still alive)
However in 1936: 2 game rangers (Harvey and Ionides) and 50 scouts on crop protection schemes killed 2,129 elephant as follows: Masasi 484, Liwale 387, Songea 360, Kilwa 282, Tunduru 262, Mikindani 12 and the remainder in the Mbarangandu-Luwegu area. So rather than having exterminated three-quarters of the elephant in southern province they were forced to shoot more and more.
1950 "The Game Department has done excellent work on elephant control and the newly appointed Elephant Control Officer (Nicholson) has killed over 100 himself."
1951 Masasi: 5 game scouts killed 76 shamba raiders.
Lindi: 3 game scouts were employed, inadequate to protect growing crops during February to July when elephant swarm across the Mbemkuru river from Kilwa district and confine themselves to a strip some 10 miles wide from the river. 44 elephant were killed in this district this year.
Tunduru: 9 game scouts killed 115 elephant, however during the peak season of May and June they were quite incapable of dealing with the elephant population and very serious depredations to crops took place.
Details of control are found in Table XI.

From 1949 to 1952 the Portuguese Government in Mozambique constructed a major road by hand labour close to the Ruvuma River. To feed the labour gangs "meat contracts" were given to Portuguese professional hunters who had to supply much meat per week. (This practice was used in Tanganyika as well, in 1932 72 such permits were issued for road labour gangs, elephant, however, could not be shot). Portugese hunters would employ up to 20 local hunters and they favoured elephant as they could keep the ivory and got more meat per hunt, hence higher returns. As a result many elephant were driven out of Mozambique across the Ruvuma into parts of west Masasi, Tunduru and east Songea District causing increased damage and necessitating increased control duties. It is worth noting that it was at this time that the extensive hippopotamus populations of the Ruvuma were destroyed to provide meat for these labour gangs.

SOUTH-EAST TANZANIA, POST-1970 ELEPHANT CONTROL

Data for the years 1970 to 1975 were collected by questionnaire sent to all district and regional game officers in 1976. Annual totals for the 14 districts involved are shown in Table XII.

The most significant factor affecting control in this period has been the amalgamation of settlement into large *Ujamaa* Villages. New villages in Rufiji District have been moved away from the Selous Game Reserve borders and this is reflected in the numbers of elephant killed, falling from 374 in 1971, to 63 in 1975. In other districts, villages were not sited in areas free from elephant and some new villages were created in areas previously abandoned e.g. Ndapata in Liwale. Large cashewnut plantations prove a major attraction to elephant in Liwale District. Villages abandoned during *Ujamaa* resettlement had their cashew trees practically demolished within one year. Ngarambe village in Rufiji District was five miles from the Game Reserve boundary. Less than a week after evacuation in late 1974 the papaya trees in the school grounds were destroyed by elephant. The noticeable decrease in elephant shot in 1973 (especially Tunduru, Kilosa, Morogoro and Liwale Districts) is largely due to a shortage of ammunition.

Growth in settlement, especially those taking up scarce dry season water sources, coupled with control shooting will eventually reduce elephant populations. There is now no control activity in Mtwara and Newala Districts and very little in Bagamoyo, Kilosa, Songea and Lindi Districts. It is apparent that these areas do not border the Selous or incorporate any other major refuge for elephant populations. Districts bordering the Selous, on the other hand, still shoot large numbers of elephant; these numbers, with the recent exception of Rufiji and possibly Kilwa, show no signs of decreasing. Within Liwale District there is a decreasing number of elephant shot per division (sub-district) with increasing distance from the Selous Game Reserve. It appears obvious that new or upgraded village settlements situated close to elephant refuges such as the Selous will continue to suffer crop damage. The re-establishment of Ngarambi Village in Rufiji District is a case in point. Methods of control as currently practiced are not sufficient to prevent this damage.

THE FUTURE

It is readily apparent that crop damage by elephant will continue in villages close to elephant population refuges such as the Selous Game Reserve. Present methods of physical control cannot prevent such damage but will help reduce it. Spatial changes in village concentration and location will also help alleviate the problem. It is probable however, that the increasing dependence on piped bore-hole water and consequent abandonment of some watered valley sites will allow new foci of elephant populations outside the Selous. Tapika valley in Rufiji District is one clear example, elephant are now year-round residents in this previously cultivated valley.

It appears obvious that any further reduction in crop damage will necessitate changes in Game Division control policy. This would involve a return to the elephant control schemes of the 1930s. Present control policy is nebulous and to some degree confused with conservation policy and philosophy. Game Division objectives are clearly spelled out by government and include the reduction of loss to life and property by wild animals, and the conservation and rational use of wildlife resources and their habitats.

Within south-east Tanzania this conservation objective is clearly fulfilled by the presence of the vast (45,000 sq km), Selous Game Reserve and adjacent Mikumi National Park. This area contains the largest recorded population of elephant in Africa, close to one hundred thousand, and its future conservation status as regards poaching and human encroachment looks secure. Habitat damage, a major problem in many smaller and more arid wildlife areas, is not serious. Recent research (Laws, Parker and Johnstone, 1975) has shown that the conservation of elephant populations requires large areas of land. There is nowhere else in south-east Tanzania capable of sustaining large elephant populations for present and future conservation purposes. The middle Ruvuma area could, perhaps, if coupled with another area on the Mozambique bank. The Kilombero Controlled area could, if given continued access to the forested areas to the north and south of the river and associated food plains, which with increasing agricultural set-

tlement is unlikely. As the present conservation areas total some 20 percent of the region's land area, it is debatable if any further conservation estate is necessary or socially desirable. From the standpoint of large mammals, all south-east Tanzania species are adequately conserved in the Selous with the exception of the puku antelope (*Kobus vardonii*) and the red colobus monkey (*Colobus badius gordonorum*) of the Kilombero valley.

The objective concerning reduction of loss to life, and property as regards elephant damaging crops, is being followed; but not efficiently or successfully, as crops are still damaged in all districts year after year. The objective concerning resource utilisation is also not being followed efficiently. (One presumes that illegal utilisation, i.e. ivory poaching, is efficient to the poacher or he wouldn't do it.) Elephant offer a resource in their ivory, meat and hides. They are also a resource in the sense of trophy hunting and considerable revenue can accrue from trophy fees and licences from both tourist and resident hunters. The closure of all hunting in September 1973 has undoubtedly led to an increase in illegal utilisation and considerable loss of revenue. Many of the people of south-east Tanzania are hunters traditionally and culturally (Alpers, 1975). It could be argued that some legal outlet for this traditional activity should be provided. Government stands to win through licence fees, ivory export gains and a reduction in excess elephant. With no legal outlet, hunters may and often do, turn to poaching, often in conservation areas and so government loses fees, and the export revenues.

Under the present control system, all hide and meat resources are wasted. Small scale utilisation schemes in Songea and Liwale are a minor exception. These small local schemes and past culling research projects in East Africa have shown there are markets for this resource,both a local social need for meat products and a rich external market for hides. The National Milling Corporation has also shown an interest in elephant products for bone and meat meal for livestock feed.

But, as has been shown above, these resources are not exploitable under present control practices. Equally crop damage cannot be prevented. Clearly if Game Division wishes to fulfill its objectives, it must change its control practice and policy. If elephant populations in the inhabited areas of south-east Tanzania are not needed for conservation then they should be exterminated, as has been pointed out in some districts since 1924. Driving elephant long distances by harassment shooting is not feasible, and the only refuge to drive them to, the Selous, has enough elephant already. Extermination should be by physical shooting and include a full utilisation of by-products. To be efficient the shooting should be a family group or herds. This means sufficient resource is available at one spot at one time to warrant using vehicles to transport the products. Sentimental arguments of "not killing babies" are invalid as young elephants losing their mothers will die a more lingering death by starvation if not shot. Conservationists should take heart in the presence of the Selous Game Reserve and not inhibit necessary utilisation programmes.

Elephant numbers are now low in areas far from the Selous: Songea, Masasi, Lindi, Bagamoyo and Kilosa Districts. Control schemes should perhaps begin there and attempt to roll up the elephant populations towards the Selous, leaving elephant free areas behind. At present, control operations cost something in the order of 1.5 million shillings per year (wages for staff, supervision, transport, ammunition and rifles). By planned exploitation schemes this cost benefit ratio can be decreased many times over and staff employed to better purposes.

In time, and possibly as long as a ten year period, depending on control intensity, elephants would be pushed back close to the Selous boundary. It is here that one can expect control operations to continue almost indefinitely. The control operations would serve to prevent elephant returning to the cultivated areas, would partly limit the number of elephant in the Selous, and would also provide a continuous and sizeable revenue. It has been argued that hunting around the edges of conservation areas causes a distinct boundary effect and rapidly teaches the elephant to stay inside, thus leading to population build-up and consequent habitat deterioration. These ideas can be countered in two ways. First, the Selous has a border well in excess of 1200 km, so control operations could be spread in time and space thus reducing the learning process. Second, if control shooting deals with complete elephant groups at one time, which it must if the resource is to be utilised, then there will be no survivors to pass on the learning process. Also, past experience of the area has shown that once humans vacate an area

favoured by elephant then elephant very rapidly move in, no matter how intensive past control operations were.

Today the Selous has one hundred thousand elephant with an apparent rapid population growth rate. In time the population will grow to a level incompatible with the environment and control will have to take place. How much better therefore to conduct the control, which is repugnant in a conservation area, in border areas. Done this way it can be planned and undertaken efficiently and take place before habitat damage begins.

Another resource inherent in the control operations is that of biological data. Throughout the period of preparing and writing of this paper, it has been woefully apparent that we have a complete shortage of data on the reasons for locality and effects of control. Questions such as:

How much damage is done to crops in acreage or financial terms?
Where, within districts, is damage and control concentrated?
How is control undertaken?
Do scouts wait for a damage report or shoot only elephant close to the settlement?
Is the scout shooting the elephant which actually causes the damage?
Which elephant groups cause the damage, breeding herds or bulls? and
How big are the groups?

are all of importance to understanding and planning efficient control. Equally important is to learn the effects of control on the elephant populations. We should be answering questions of:

What sex and age elephant are we shooting?
Is continued hunting causing unstable population structures?
Is control effecting distribution patterns? and
How far do elephant move out of the Selous?
Are elephant numbers really decreasing in areas such as Liwale, where there are major control activities?

Finally there are the resource questions of:

How best to utilize the hides and meat products?
How many can be shot?
What and where are the markets?
What are the effects of *Ujamaa* villages?

and many others.

We have found it impossible to answer these questions from the existing records. Very little quantitative data exists and what there is, is old. The aerial census of the Selous and environs in 1976 was a start in answering these questions, but this survey must be extended to other areas and repeated at intervals. The big gap in our knowledge is on the actual control operation. This can be easily rectified by instructing scouts to collect simple data in prepared note-books, and supervising them to ensure its accuracy. Biologists could concentrate activities in intensive control area such as Liwale. There is much valuable research data being wasted in two thousand dead elephant per year. These measures are easy to implement and should be carried out without delay.

POACHING AND ILLEGAL IVORY

Nicholson (personal communication) considered that illegal elephant hunting in south-east Tanzania was relatively minor until 1960 when local people had easier access to modern rifles. There was little or no permanent European settlement in the area (apart from Morogoro and Kilosa sisal estates) and civil servants were deterred from 'poaching' by threat of dismissal from the colonial service. Most elephant poaching was concentrated around the Rufiji, Kisarawe, Morogoro, Kilosa and Ifakara areas where Arab traders did have modern weapons. District and divisional reports frequently refer to such Arab poachers. Since 1960 poaching has increased, and divisional surveys have shown major localities to be the Ruaha and Wami Rivers and Rufiji and Mahenge areas. Poaching within the Selous, with the exception of the west and northern boundaries, appears to be minimal.

South-east Tanzania was (and may still be) a major route for incoming ivory from Mozambique. Two traders, Klose, a German at Ndelema in Tunduru, and Eldridge, and

Englishman at Kimbanda in Songea, dealt in Mozambique ivory from the 1930s to the 1950s. They lived near the Ruvuma River border and employed teams of buyers and hunters to bring in the ivory. As Tanganyika prices were higher than those of Mozambique, this was easily done. Nicholson estimates that these dealers handled up to one thousand elephant per year between them. Klose was eventually convicted of illegal possession of Tanganyika ivory and left the area in 1955, Eldridge followed soon after.

The law allowed the purchase of ivory from outside Tanzania by ivory dealers up to the early 1960s. As such, Klose and Eldridge's dealings were legal, but one wonders how many Tanzanian tusks found their way into this ivory route? Dealers could export this ivory direct without going through Government Ivory Room auction sales. Their exports would of course be recorded by customs. These facts do show one reason for the discrepancy between legal exports, legal ivory sales and legal elephant killed. Up until the early 1960s discrepancies were filled by non-Tanzanian ivory imported and exported by dealers. However, an examination of Figure II or Table III and IV shows an increasing discrepancy between ivory exported and elephant legally killed. This discrepancy reaches a peak in 1972 and thereafter is very much smaller. It is of interest to examine this discrepancy more closely and to speculate on its origin.

Table XIII documents the discrepancy by estimating a total legal kill composed of control, found, licenced and confiscated ivory; and comparing this with the exported ivory figure and its equivalent elephant number. To reduce minor distortion due to delays between killing and exporting, the data are given in five year averages, except that the 1970s are split into the high export and low export periods.

Two distinct periods are apparent in this data, before and after 1965. The earlier period shows low discrepancies with the assumed legal kill, and these discrepancies can be accounted for by the legal purchase of extra-territorial ivory. The period since 1965 coincides with the dramatic price increase of ivory, a great incentive to illegal activity. The estimated discrepancy of the 1966 to 1972 period totals almost 46,000 elephant, the bulk of it in the four years 1969 to 1972. Equally as dramatic is the drop in ivory export in 1973, 190,000 kg less than the 1972 figure. What reasons can be put forward to account for these alarming figures?

First of all the export figures are those published by the East African Customs. It is unlikely that figures are in error as monthly totals and annual totals agree and the breakdown of country destination and the totals agree. Customs figures are based on details of "Certificate of Legal Exports" a document given in exchange for "Certificate of Ownership" supposedly signifying the ivory is from legal sources. Ivory listed in customs documents is that exported for trade, not that as personal possessions. The bulk of the ivory goes to the major trading centres of Hong Kong, Japan and recently mainland China. We will assume the figures are correct.

Where can ivory totalling 46,000 elephants have come from? It could not have been stock piled for some years before export because exports have been more than legal ivory sources for at least eight years before the rapid rise. It probably did not come from suddenly increased poaching in Tanzania as no evidence for such slaughter has been reported from parks or game reserves. The most likely source is from neighbouring countries, probably Mozambique and Zaire. It is believed that ivory was still crossing into Tanzania from Mozambique in considerable quantities in 1977 (Lwezaula, personal communication). If this is so and the purchase of non-Tanzanian ivory is illegal, then the tusks are being passed through Customs with fraudulent certification, and on a very large scale. In 1973 greater control was placed on Tanzanian ivory trading, hunting was banned (stopping one way of getting ownership certificates for ivory) and the Kenya-Tanzania price differential increased. Kenya's ivory exports rapidly increased as Tanzania's decreased. It is probable that the flow of external ivory is now passing out of Kenya and not Tanzania.

Records of Ivory Room sales over this period (Davitz, unpublished data) add to the confusion. Sales registers from 1971 to 1973 show total sales of less than 40,000 kg per year, so where has the 251,000 kg of ivory exported in 1972 come from? Or more to the point, how has the ivory been passed through Customs without passing through the Ivory Room? It would appear as if an investigation of customs documents would be of considerable interest.

Over the 1971 to 1977 period ivory sales have been conducted through Ivory Room auctions, through the State Trading Corporation (STC), through the General Agricultural Products Export Company (GAPEX), and through the Tanzania Wildlife Corporation (TAWICO). Records of sales and ivory movements are thus confusing. There is another trend in ivory utilisation these past few years. Considerable quantities of ivory are being carved by local co-operative societies. Their purchases from the Ivory Room totalled some 23 percent of all sales by weight in 1977. This would mean that the exports in 1976 are based on a smaller quantity of legal ivory and the discrepancies should be bigger than we have stated.

This paper does not pose to be an investigation of the Tanzanian ivory trade. Public records however show such alarming trends in ivory utilisation that we believe a detailed analysis and investigation of ivory dealing in this decade could be an extremely worth-while project.

RECOMMENDATIONS

To conclude this paper we would like to put forward recommendations for the future. These may be stated as follows:

(1) Policies regarding elephant and elephant control be revised in recognition of the importance of the resource and its potential utilisation. Such new policies should stress the importance of the Selous in terms of conservation and as a reservoir for future resource utilisation.

(2) That the Wildlife Division make an all out effort to collect data relevant to control operations and to the elephant populations. This research aspect should be tackled on three fronts. First, in the field with scouts recording what, where, how, why and when they shoot. Secondly, to instigate data collection and analysis of ivory passing through the government Ivory Room. For example, records of ivory weight, length, and circumference can lead to estimates of the sex and ages of older shot elephant. Thirdly, there is scope for considerable research into the biology, ecology and behaviour of these elephant populations and the effects of control hunting on them. International funds and personnel could be attracted to such a project.

(3) Pilot schemes be started to investigate ways and means of meat and hide utilisation. Earlier schemes in Liwale and Songea should be revived and encouraged. Revenues should be used as on a commercial venture so as to prevent the drain on divisional funds.

(4) The level of efficiency of control be raised by reintroducing the practice of scout training and supervision by officer staff. Ivory production from control shooting is the biggest source of Wildlife Division revenue collections and one of the major tasks the division faces. This should be recognised and a senior officer appointed to instigate and supervise all control and data collection projects. As control involves, or should involve, hunting, resource utilisation and revenue collection, then perhaps the operations may be best supervised by the Tanzania Wildlife Corporation (TAWICO), the commercial arm of the Wildlife Division.

(5) The figures for ivory export in the 1970s are disturbing and an analysis of customs documents for the 1970 to 1975 period could reveal many loopholes in present efforts to regulate the ivory industry.

***

REFERENCES

ALPERS, E. A. *Ivory and Slaves in East Africa,* Heinemann, London, 1975.

HANKS, J. and MC INTOCH, J. E. A. Population dynamics of the African elephant, *Journal of Zoology,* London, vol. 169, 1975, p. 29.

IONIDES, C. J. P. *Mambas and Man Eaters,* Holt, Rhinehart & Winston, New York.

KJEKSHUS, A. *Ecology, Control and Development in Eastern Africa,* Heinemann, London, 1977.

LAMPREY, H. F. Elephant control in Tanganyika — a discussion, TNR 47 & 48, 1957, pp. 145-148.

LAWS, R. M; PARKER, I. S. C. and JOHNSTONE, R. C. B. *Elephants and their Habitats,* Clarendon, Oxford, 1975.

League of Nations Reports 1921 to 1924 United Kingdom reports to the League of Nations on their Trusteeship of Tanganyika Territory.

MAPUNDA, W. An analysis of Tanzanian ivory statistics: 1963–1973, unpublished ms., College of African Wildlife Management, Mweka (Moshi).

MATZKE, G. M. *Large Mammals, Small Settlements and Big Problems: a study of overlapping space preferences in southern Tanzania,*

Ph.D. Thesis, University of Syracuse, New York, 1975.
—— The development of the Selous Game Reserve, TNR 79 & 80, 1976, pp. 37–48, 7 maps.
Ministere d'Etat Affaires Culturelles, la Societie Francaise du Microfilm Ocean Indien 2(10)" partie ports au Sud et au Nord de Zanguebar.
MOORE, E. D. *Ivory, Scourge of Africa*, Harper Bros., New York & London, 1931.
NICHOLSON, B. D. Observations on the elephant problem in south-east Tanzania, *East African Agricultural and Forestry Journal*, Nairobi, vol. 33 (special issue) p.217.
RODGERS, W. A. Past Wangindo settlement in the Eastern Selous Game Reserve, TNR 77 & 78 1976, pp. 21-26.
RUSHBY, G. C. *No More the Tusker*, W. H. Allen & Sons, London, 1965.
SPEKE, H. H. *Journal of the Discovery of the Nile, London, 1863.*
SPINAGE, C. A. A review of ivory exploitation and elephant trends in Africa, *East African Wildlife Journal*, Nairobi, vol. 11, 1973, p. 281.
SUTHERLAND, J. *The Adventures of an Elephant Hunter*, MacMillan & Co., London, 1912.
Tanganyika Game Division, 1933 to 1965 *Annual Reports*, Government Printer, Dar es Salaam.
THOMSON, J. *To the Central African Lakes and Back*, Frank Cass & Co., London, 1868.
VINCENT, F. *Actual Africa*, London, 1895.
WILSON, D. and AYERST, P. *White Gold, the Story of African Ivory*, Heinemann, London, 1976.
WOODLEY, F. W. Game defence barriers, *East African Wildlife Journal*, Nairobi, vol. 3, 1965, p. 89.

Note: A great deal of information has been obtained from files and reports maintained by the Tanzania National Archives and by the Wildlife Division of the Ministry of Natural Resources and Tourism. It was not possible to include all such sources here, but the senior author has a list of major documents consulted which can be made available to interested persons.

***

Acknowledgements: The senior author has compiled this paper, and opinions in it are basically his own. J. Lobo undertook the tedious task of searching through archival material. W. Mapunda contributed data on Ivory Room statistics. Ian Douglas-Hamilton and Michael Davitz generously let us make use of their detailed ivory analysis of the 1971 to 1977 period. This paper has benefited from useful discussion with Ian Douglas-Hamilton, Brian Nicholson, Allen Rees and Ian Parker; to them our thanks.

Table I–A: Game Division total annual expenditure in Shs

1919-20	4,840	1927-28	345,600
1920-21	64,680	1928-29	319,940
1921-22	167,300	1929-30	278,060
1922-23	204,320	1940-41	325,000
1923-24	148,020	1950-51	873,200
1924-25	207,820	1960-61	2,350,120
1925-26	376,080	1970-71	12,807,000
1926-27	628,160		

Table I-B: Game Division breakdown of annual expenditure in Shs

Item	1925-26	1926-27	1927-28	1970-71
Salaries	97,000	189,660	176,980	4,000,000
Vermin control	42,900	36,560	32,200	*
Tsetse control	123,860	264,200	—	—
Elephant control	111,400	75,500	59,740	**
Upkeep of Reserves	600	1,000	1,820	4,865,000
Museum costs	—	1,000	970	nil
Rewards	—	1,500	300	100,000
Transport/travel	***	34,480	42,120	260,000
Miscellaneous	—	24,260	31,150	432,000
Utilization of Game	—	—	—	750,000
Ngorongoro Conservation Authority	—	—	—	2,400,000

* now undertaken by Ministry of Agriculture
** not specifically budgeted for
*** early breakdown does not include vehicles, first vehicle purchased 1929

Table II: Human population changes in south-east Tanzania

Area	1913	1957	1967	1976
S. E. TANZANIA* (196,250 sq km)				
Population	929,500	1,697,380	2,021,294	–
Density/sq km	4.74	8.65	10.30	–
RUFIJI DISTRICT (12,875 sq km)				
Population	89,100	118,865	121,024	132,000
Density/sq km	6.92	9.23	9.40	10.25

* South-east Tanzania here includes Lindi, Mtwara and Ruvuma Regions together with Kilombero, Morogoro, Ulanga and Rufiji Districts.

Source: 1913 data: League of Nations Report 1920
1957 & 1967 data: *Tanzania Atlas*, 1968
1976 data: Rufiji District headquarters, Utete, July 1976.

Table III—A: Numbers of elephant shot in Tanzania on control 1922-1976

Year	Total	S.E. Tanz.*	Year	Total	S.E. Tanz.*	Year	Total	S. E. Tanz.*
1921	?		1940	1,067		1959	2,594	
1922	218		1941	1,067	2nd	1960	2,497	
1923	590		1942	1,067	world	1961	3,171	
1924	422		1943	1,067	war	1962	3,250	2,875
1925	394		1944	1,067		1963	3,247	2,748
1926	576		1945	1,493		1964	2,993	2,462
1927	1,027		1946	2,272		1965	3,105	2,666
1928	450		1947	1,956		1966	3,430	2,927
1929	639		1948	1,651		1967	3,506	2,995
1930	619		1949	2,098		1968	3,580	3,028
1931	687		1950	2,075	1,883	1969	3,765	3,151
1932	604		1951	1,837	1,466	1970	2,885	
1933	1,908		1952	2,420	2,100	1971	3,525	2,349
1934	2,716		1953	2,516	1,883	1972	2,835	2,007
1935	2,694	2,482	1954	2,283	1,857	1973	3,472	1,761
1936	2,674	2,271	1955	1,923	1,523	1974	?	1,957
1937	1,481	1,392	1956	2,137		1975	?	1,965
1938	1,653	1,383	1957	2,040		1976	?	?
1939	1,067	war	1958	2,599	2,182			

Table III—B: Tanzania five-year averages for elephant shot on control

Year	1921-1925	1926-1930	1931-1935	1936-1940	1941-1945	1946-1950	1951-1955	1956-1960	1961-1965	1966-1970	1971-1975
Mean number per annum	406	658	1,722	1,936	1,150	2,010	2,196	2,373	3,153	3,433	?
Percent in S.E. Tanzania*	–	–	–	87%	–	–	80%	–	85%	89%	?

* South-east Tanzania here includes all parts of what are now Coast, Morogoro, Lindi, Mtwara and Ruvuma Regions which comprised the old Southern and Eastern Provinces. This area is 20.5 percent of Tanzania, and contains 13.5 percent of the total population.

Notes: (a) numbers shot during the war years are estimated at 1,067 per annum,
(b) Wildlife Division figures for total elephant control give 1,921; 1,200; and 1,090 elephant for 1974, 1975 and 1976 respectively. As these totals are less than the well documented S. E. Tanzania totals they are obviously wrong.

Table IV-A: Ivory auction sales and legal exports 1920 — 1976 in thousand kg

Year	Auction	Export	Year	Auction	Export	Year	Auction	Export
1920	?	13.1	1939	13.4	18.3	1950	22.8	—
1921	?	3.5	1940	25.0	—	1959	21.6	75.8
1922	25.9	10.2	1941	17.9	19.8	1960	37.5	72.7
1923	5.4	34.3	1942	6.7	21.2	1961	50.2	73.3
1924	8.0	37.1	1943	20.1	11.1	1962	38.6	65.71
1925	6.0	36.9	1944	22.3	1963	63.5	89.64	—
1926	20.1	37.8	1945	24.0	23.1	1964	54.6	79.64
1927	18.3	36.9	1946	30.5	63.1	1965	51.3	86.9
1928	10.7	15.0	1947	46.3	45.8	1966	35.3	116.5
1929	10.7	15.5	1948	27.8	46.7	1967	nda	102.0
1930	12.5	12.8	1949	32.1	47.1	1968	nda	107.2
1931	13.4	17.7	1950	26.3	42.5	1969	nda	161.2
1932	14.0	14.0	1951	14.0	40.9	1970	nda	161.3
1933	17.9	23.3	1952	30.3	35.7	1971	No	132.2
1934	44.6	33.1	1953	33.0	48.8	1972	Auction	251.1
1935	19.2	22.8	1954	37.2	55.2	1973	Sales	64.8
1936	30.8	32.3	1955	37.2	65.6	1974	Sales	39.7
1937	20.1	28.7	1956	21.2	59.8	1975	Sales	26.9
1938	11.5	28.3	1957	36.6	—	1976		37.0

Table IV-B: Five-year averages for auction sales and legal exports

Year	1921-1925	1926-1930	1931-1935	1936-1940	1941-1945	1946-1950	1951-1955	1956-1960	1961-1965	1966-1970	1971-1972
Auction sales	11.3	14.5	21.8	20.2	18.2	32.6	30.3	27.9	51.6		
Export	24.4	23.6	22.2	26.9	21.7	55.6	49.2	69.4	79.0	129.6	191.7

Notes (a) The auction of ivory may be held from one to two years after the elephant are shot, depending upon storage and transport time.

(b) The export of ivory may take place in the same year or succeeding year of the ivory auction. Exports do not include re-exports of legal Burundi, Ruanda, Zaire or Zambia ivory.

Table V: Found ivory statistics

Decade	Area	No. samples	Mean tusk weight kg	Shot found Ratio	Average No. Elephant shot per annum	Average No. Elephant found per annum
1920-30	M,S,R	9	8.30	1.30	532	409
1930-40	R,SP,E,T	6	7.21	4.96	1,829	368
1940-50	SP	2	6.20	5.68	1,580	278
1950-60	M,T	5	8.50	nda	—	303*
1960-70	T	2	8.0	10.2	3,501	328
1970-76	SGR	1	6.8	nda	—	328**

Area Key:

B	=	Bagamoyo
E	=	Eastern Province
M	=	Mahenge
MG	+	Morogoro
S	=	Songea
SGR	=	Selous Game Reserve
SP	=	Southern Province
T	=	Tanganyika Territory

* Value is mean of adjacent figures

** Value same as previous figure

Table VI: Licenced ivory statistics

Period	Area	Mean tusk weight kg	No. elephant licences per annum	No. elephant shot per annum	Value all licences Shs. per annum
1921-25	B,M,R,S	22.5	—	100*	194,000
1926-30	M,R.	20.9	(1929-1930)	50*	298,000
1931-35	SP.	22.8	34	34**	104,000
1936-40	—	22.8	41	41	82,000
1941-45	war	war	war	41	38,000
1946-50	—	22.8	280	280	256,000
1951-55	T	24.9	354	354	544,000
1955-60	T	21.8	560	560	1,262,000
1961-65	—	21.8	472	472	1,127,000
1966-1970	T	21.8	1,193	1,141	1,189,000
1971-1973	T	17.6	2,468	2,351	?

Area Key from Table V

Note: Weight of tusks shot derived from tusks passing through Ivory Room

* Estimate
** 1931-1965 Assumed kill equals no. of licences sold

Table VII: Ivory control statistics

Period	Area	Mean tusk weight kg	No. elephant shot per annum
1921-25	B,M,MG,R,S	10.3	406
1926-30	T	7.1	658
1931-35	T	6.3	1,722
1936-40	T	5.5	1,936
1941-45	S.P.	6.0	1,150
1946-50	T	6.0	2,010
1950-55	T,MG,M.	6.1	2,196
1956-60	T	6.5	2,373
1961-65	T	5.7	3,153
1966-70	T	5.4	3,433
1971-1975	T	4.4	2,800*
1976-1977	T	4.5	2,600*

Area key from Table V

* No reliable figures available, estimates only.

Table VIII: Ivory Revenue Tanzania 1920-1975 in million Shs.

YEAR	REVENUE		RATE	YEAR	REVENUE		RATE
	Export	Ivory room	Shs per kg		Export	Ivory room	Shs. per kg
1920	0.05		11.2	1949	1.26	0.95	30.9
1921	0.08			150	1.32	0.91	33.6
1922	0.22			1951			32.9
1923	1.03	0.88	27.3	1952			30.0
1924	1.33	0.41	34.3	1953	1.46	0.97	29.1
1925	1.42	0.55	17.5	1954	1.55		34.9
1926		0.41		1955			37.2
1927		0.53		1956	1.89		
1928		0.36		1957	2.14		
1929		0.29		1958	1.59		
1938		0.25		1959	2.47		
1931		0.26	22.4	1960	2.71		30.7
1932		0.30	12.3	1961	2.17		
1933		0.29	12.3	1962	2.23		
1934		0.41		1963	3.08		
1935		o.35		1964	3.09		
1936		0.47		1965	3.93		44.8
1937		0.45		1966	4.84		
1938		0.37		1967	4.14		
1939		0.26		1968	4.17		
1940		0.47		1969	6.35		82.7
1941	0.32	0.36		1970	9.11		85.1
1942	0.36	0.49		1971	09.45		197.6
1943	0.29	0.55		1972	14.39		315.2
1944	0.91	0.79		1973	16.20		320.8
1945	0'59	0.73		1974	5.13		
1946	1.96	1.06		1975	3.63		
1947	1.31	1.06		1976	5.97		
1948	1.34	0.85	26.7				

Note: Data based on export figures and Ivory Room sales.
Export revenue taken from Customs documents.
Ivory Room revenue 1923-41 taken from Tanganyika
Treasurer Annual Accounts
1942 onwards taken from Ivory Room, Gazette, Game Division records.
Price per kg is purchase price in Dar es Salaam, *not* export price.

Table IX: Seasonal pattern of control activity in south-east Tanzania

Month	1929-1933*		1971-1975**	
January	4.8%		8.3%	
February	8.8		7.2	
March	9.1		9.6	
April	10.2	Cereal peak	9.7	Cereal peak
May	16.6		10.9	
June	10.4		8.3	
July	10.1		8.2	
August	8.3		7.3	
September	5.5		6.3	
October	7.7		9.4	Cashew nut peak
November	4.8		9.1	
December	3.7		5.8	

* Data from 1,238 elephant, Southern Province.

** Data from 5,093 elephant, Liwale/Nachingwea Districts plus Coast Region.

Table X-A: Estimates of past elephant population size under different hunting regimes in south-east Tanzania.

Year	Hunting regime		
	A	B	C
1976*	150,000	150,000	150,000
1960	120,600	137,080	150,564
1950	102,040	121,991	138,164
1940	82,746	104,105	120,270
1930	71,324	92,793	109,317
1920	54,674	71,946	85,301

Table X-B: Mortality data used in estimates

Period	Control kill*	licence kill**	A	B	C
1971-75	2,007	200	2,207	3319	4193
1966-70	3,087	250	3,367	5005	6340
1961-65	2,672	200	2,872	4308	5456
1956-60	1,996	180	2,176	3264	4134
1951-55	1,760	140	1,900	2850	3610
1946-50	1,708	100	1,808	27..	3435
1941-45***	980	80	1,060	1590	2014
1936-40	1,700	80	1,780	2670	3382
1931-35	1,456	80	1,536	2304	2919
1926-30	550	100	660	990	1254
1921-25	300	100	400	600	760

* From tables III and XI ** Estimates based on table VI
*** War years

Note a 3.5 percent rate of increase per annum has been assumed throughout.
Where A is control and licenced hunting only
B is the same as A but assuming an illegal kill equal to 50% of A
C is the same as A but assuming an illegal kill equal to 90 per cent of A
1976 figure of 150,000 estimated from aerial survey of Selous Game Reserve

Table XI: Details of elephant control in south-east Tanzania 1920-1957

District	1921-1925	1926-1930	1931-1935	1936-1940	1941-1945	1946-1950	1951-1957
Ulanga	138	166	326	377	war	—	253
Rufiji	47	—	262	277	—	179	—
Kilwa	140	165	250	187	—	—	253
Songea	44	20	—	200	—	—	—
Tunduru	—	40	—	161	—	—	115
Lindi	—	170	—	8	—	—	44
Liwale	—	113	400	332	—	—	—
Masasi	—	123	—	239	—	—	76
Mtwara	—	13	—	9	—	—	—
Newala	—	5	—	0	—	—	—
Bagamoyo	—	—	150	13	—	—	—
Kilosa	—	—	—	50	—	—	82
Kisarawe	—	—	—	24	—	56	84
Morogoro	—	—	75	88	—	—	257

Table XII: Elephant control in south-east T..izania 1971-1975

Dist t	1971	1972	1973	1974	1975	1971-1975 Mean	1930-1940 Mean
Rufiji	374	351	282	183	63	251	245
Bagamoyo	12	37	23	23	16	22	81
Kisarawe	42	90	55	62	58	61	50
Coast Region	428	478	360	268	127	334	376
Songea	19	7	16	12	12	13	200
Tunduru	250	68	23	96	157	121	161
Ruvuma Region	269	75	39	108	169	134	361
Masasi (Mtwara Region)	37	38	31	57	50	43	239
Kilosa	19	42	7	40	44	30	50
Morogoro	143	259	94	198	257	190	81
Ulanga	290	288	335	325	326	351	363
Morogoro Region	452	589	436	563	627	571	494
Liwale	464	483	304	533	579	473	350
Nachingwea	90	76	107	138	49	92	
Kilwa	609	238	453	255	315	374	203
Lindi	30	30	21	35	45	32	41
Lindi Region	1,163	827	885	961	988	971	594
Total	2,349	2,007	1,761	1,957	1,965	2,053	2,064

Table XIII: Annual Ivory & Elephant Kill Statistics 1920-1976

Period	Control Kill No.	Found Elephant No.	Licenced Elephant No.	Confiscated Elephant No.	Total Legal Kill No.	Total Legal Ivory*** kg	Mean Tusk Weight kg	Ivory Exported kg	Annual Discrepancy		Total Period Discrepancy (Elephant) kg
									Ivory kg	Elephant	
1921-25	406	409	100	13**	928	19,024	10.9	24,400	-5,376	-262	-1,310
1926-30	658	409	50	7	1,124	17,385	8.2	23,600	-6,215	-403	-2,015
1931-35	1,722	368	34	5	2,129	27,022	6.8	22,200	+4,822	+377	+1,885
1936-40	1,936	368	41	6	2,351	26,984	6.1	26,900	+ 84	+ 8	+ 40
1941-45	1,150	278	41	6	1,475	18,197	6.5	21,700	-3,503	-287	-1,435
1946-50	2,010	278	280	37	2,605	39,475	8.1	55,600	-16,125	-1,059	-5,295
1951-55	2,196	303	354	46	2,899	48,751	8.9	49,200	- 449	-27	- 135
1956-60	2,373	303	560	73	3,309	59,775	9.6	69,400	-9,625	- 534	-2,670
1961-66	3,153	328	472	62	4,015	60,580	8.0	79,000	-18,420	-1,225	-6,125
1966-70	3,433	328	1,141	116	5,266	42,627	9.4	129,600	-36,973	-2,092	-10,460
1971-73	2,800*	328	2,351	200	5,879	111,762	10.5	191,700	-79,938	-3,817	-11,451
1973-76	2,600*	328	0	300	3,228	36,085	6.0	42,100	- 6,015	- 533	-2,665
											Total 41,636

* Estimated total, data unavailable

** Determined as 13 percent of licenced elephant, the ratio of 1967-68 years

*** Determined as (control kill x control tusk weight x 1.88)
+ (found elephant x found tusk weight x 1.88)
+ (licenced kill x licenced weight x 1.88)
+ (confiscated figure x licenced weight x 1.88)
where 1.88 is conversion factor of elephant to tusks.

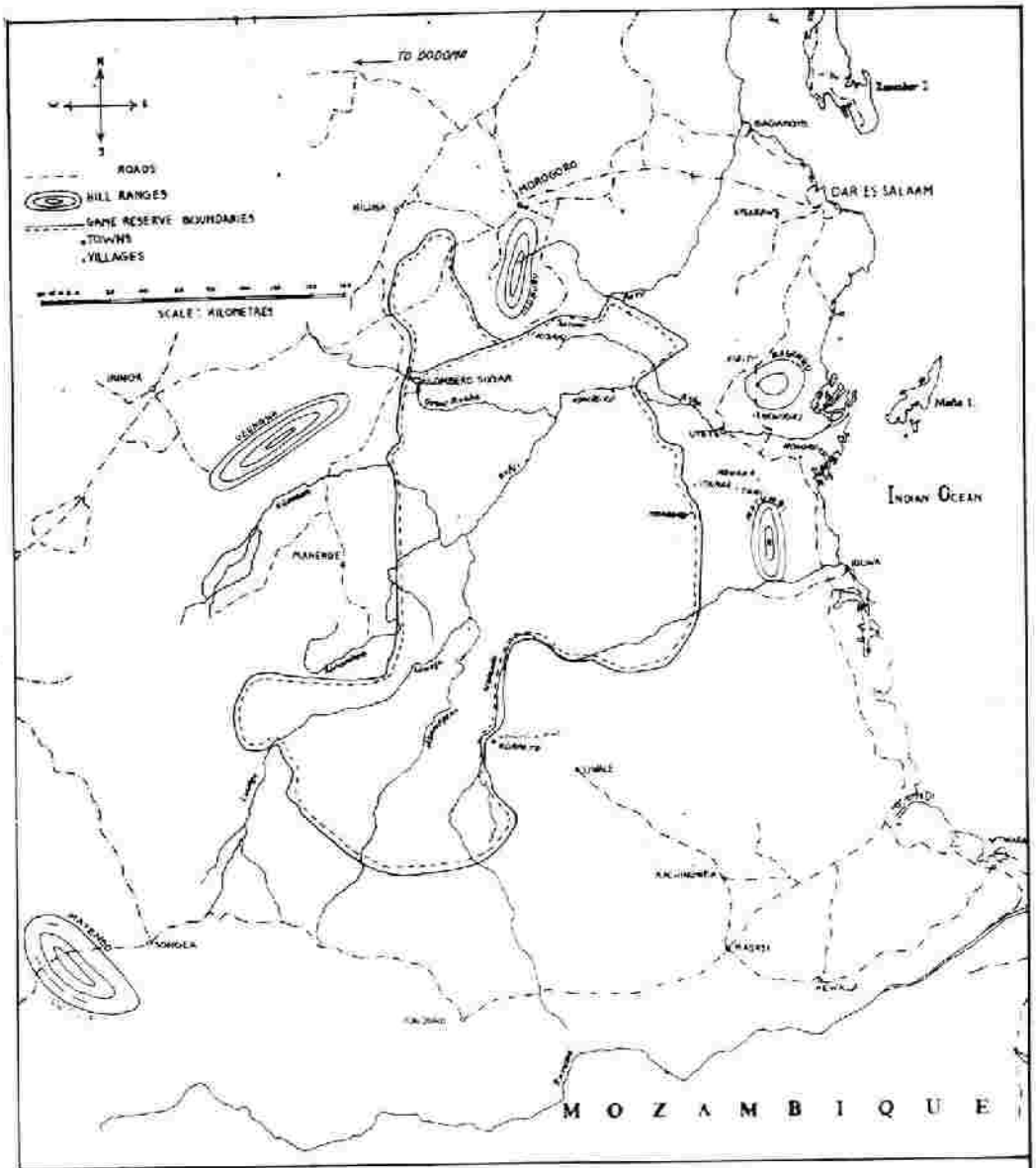

FIGURE 1. SOUTH EAST TANZANIA
SHOWING MAJOR PLACE NAMES AND SELOUS GAME RESERVE