Elephants are not beetles:

implications of the ivory trade for the survival of the African elephant

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The scientific community now agrees that, more than anything else, it is the killing of African elephants for the ivory trade that has caused the very dramatic declines in elephant populations witnessed over the past decade. Based on samples of ivory trade data, recent population modelling and field data, the authors discuss the implications of the ivory trade for the future survival of viable populations of African elephants.

'The point is, elephants are not beetles' (David Western, May 1989)

African elephants *Loxodonta africana* have declined by about 50 per cent in the last 10 years, from an estimated 1.3 million in 1979 (Douglas-Hamilton, 1979) to some 625,000 in 1989 (ITRG, 1989). Population surveys of elephants that have been repeated over a number of years clearly show that the African elephant is threatened with extinction in many parts of its range, even within protected areas (e.g. Serengeti: Dublin and Douglas-Hamilton, 1987; Selous: Douglas-Hamilton, 1976; Douglas-Hamilton *et al.*, 1986; Ruaha: Barnes and Douglas-Hamilton, 1982; Campbell, 1988; Tsavo: Cobb, 1976; Olindo *et al.*, 1988; Murchison Falls North and South: Eltringham and Malpas, 1980; Douglas-Hamilton, 1984; Queen Elizabeth: Eltringham and Malpas, 1980; Douglas-Hamilton *et al.*, 1980; Garamba: Savidge *et al.*, 1976; Hillman *et al.*, 1983; Bamingui: Spinage *et al.*, 1977; Douglas-Hamilton *et al.*, 1985; Koum-Gounda: Douglas-Hamilton *et al.*, 1985; Luangwa: Caughley and Goddard, 1975; Kaweche *et al.*, 1987; Burrill and Douglas-Hamilton, 1987).

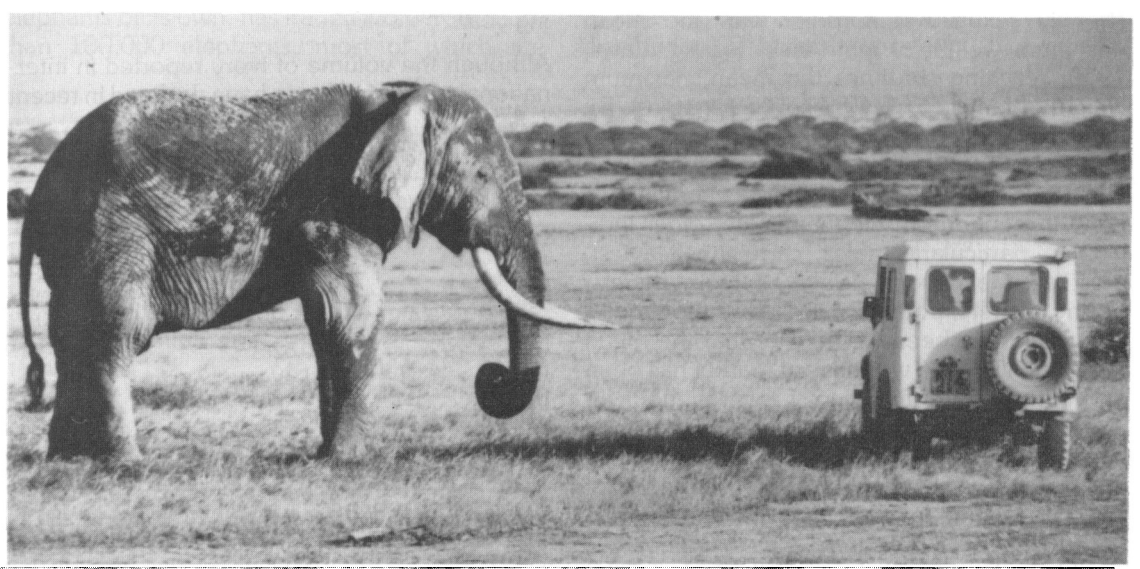
Furthermore, population models inferring hunting patterns from data about tusks in international ivory commerce have implicated the trade as the major cause of the decline in elephant numbers (Pilgram and Western, 1986; Caughley, 1988; RRAG, 1989). Caughley (1988) used the reported trade in African elephant ivory since 1950 to project future ivory production and to examine the implications of the trade for the conservation of African elephants. His model predicted that if present trends continued, the number of tonnes of 'live ivory' (i.e. ivory carried by living elephants) would dwindle to almost nil in Africa before the year 2015, and in East Africa by the year 2000. The model also predicted that the rate of decline of elephants will increase exponentially, reaching 80 per cent per annum in East Africa before the year 2000.

The most recent population models developed by the Renewable Resources Assessment Group (RRAG), using recent trade statistics on the weight of tusks in trade during the period 1985–1987, predicted that continued harvesting of elephants at any level above 4 per cent of the continental population per annum would drive the African elephant steadily toward extinction (RRAG, 1989). They concluded that if trade were allowed to continue at theoretically sustainable rates, just a 1–2 per cent extra mortality caused by undisclosed trade could have a potentially disastrous effect on the prospects of the African elephant. Because the ivory offtake consistently has been unsustainable, and since there will undoubtedly continue to be some illegal killing of elephants, a large number of scientists, trade specialists and conservation organizations now agree that the only way to save viable populations of the species is to introduce a total ivory

trade moratorium. This notion is supported by a number of African governments, such as those of Kenya, Somalia, Tanzania and Zaire, and the governments of the USA and the 12 member states of the European communities.

However, to effectively shut down the ivory trade will require unprecedented international political will and co-operation, and financial assistance to combat poaching and to monitor those traders who continue to deal illegally in ivory. In a decade when the maintenance of biological diversity is a stated conservation priority (Soule and Wilcox, 1980; McNeely, 1988), there are many who would question the wisdom of investing vast sums of money and manpower in attempting to save one particular species from extinction. Reasons for the apparent willingness to do so (e.g. AECCG, 1989; Anon., 1988; Thomsen and McShane, 1988; Anon., 1989) may lie in the simple statement that *elephants are not beetles*: elephants are not beetles, not simply because they do not look like beetles, but because they do not behave like beetles. For many different reasons, we, as humans, value elephants more than we value most other species. We value elephants because, like the great apes, dolphins and whales, they are among some of the most intelligent of species and because their complex social structure is based on strong bonds between related individuals, as in our own society (Douglas-Hamilton, 1972; Moss and Poole, 1983; Moss, 1988; Poole *et al.*, 1988). We value elephants because they play an important role as a 'keystone' species in both savannah and forest ecosystems (Western, 1989). Western (1989) suggests that the loss of elephants is likely to lead to biological impoverishment and accelerated extinctions of other species over much of Africa. Furthermore, we value the elephant as a 'flagship' species because, being one of the most charismatic animals in the world, it can be used to engender support for the conservation of large undisturbed wildlands and less charismatic species that occur within its range. Finally, we value elephants economically: alive they provide an important component of the foreign exchange earned from tourism in some African countries (ITRG, 1989) and dead they provide revenue from ivory, skins and meat (e.g. Bradley Martin, 1984; Child and White, 1988; Thomsen, 1988; ITRG, 1989).

At present, the survival of the African elephant and, therefore, of the ivory trade looks grim, precisely because this largest of land mammals does not respond to exploitation like a species of



A 47-year-old bull elephant (M22), the third ranking male in the well-protected Amboseli National Park (*Philip Cayford*).

https://doi.org/10.1017/S0030605300023012 Published online by Cambridge University Press

beetle would, and it is in this respect that we consistently have ignored several important biological parameters.

Firstly, relative to most species, elephants reproduce extremely slowly (Laws, 1969; Laws *et al.*, 1975; Moss, 1988). On *average* a female elephant may produce one calf every five years (Moss, 1988, in prep.) and, while females start to reproduce between the ages of 10 and 20 (Laws, 1969; Moss, 1983, 1988), males do not begin to reproduce until 25 to 30 years old and only reach prime breeding age between 40 and 50 years old (Poole, 1989a). Their very slow reproductive rate and the particular pattern of offtake for the ivory trade has meant that the exploitation of elephants has been unsustainable since 1950 (Caughley, 1988). The age structure of most populations is now so highly skewed toward young individuals that any further offtake above 2–4 per cent of the continental population per year will continue to drive the African elephant towards extinction (RRAG, 1989). Their slow growth and reproductive rates also mean that even if the ivory trade were stopped today it would take the heavily poached populations some 20 to 30 years to recover socially and to population carrying capacities.

Secondly, the growth of elephant tusks is strongly sexually dimorphic, with the mean maximum weight of male tusks (61 kg; Laws, 1970) reaching six times the mean maximum weight of female tusks (9.2 kg; Laws, 1970). By 20 years old the mean tusk weight for males has surpassed the *maximum* mean attained by females (Parker, 1979). Since tusks continue to grow throughout an elephant's life, older individuals, particularly males, carry the heaviest, most desirable ivory (Table 1). Ivory traders, trophy hunters, poachers and those monitoring the trade have been well aware that the mean tusk weight on the world ivory market has been dropping steadily in recent years. Without an understanding of elephant biology, traders may have assumed that the continuing decline in mean tusk weight was just a consequence of selective hunting for large tusks and that the only negative aspect of this trend was that elephants would continue to produce smaller tusks for the trade.

Thirdly, the African elephant is a long-lived, socially complex mammal and the loss of older individuals has had profound repercussions on the social and reproductive patterns of elephants in poached populations (Poole, 1989b). Behavioural patterns that affect reproductive parameters have been so altered that we can expect declines to be even steeper than population models have suggested (Caughley, 1988; RRAG, 1989). As populations become smaller and more fragmented, attention to these behavioural details will become increasingly important for the continued survival of the species. With surveys clearly indicating the demise of elephant populations (Burrill and Douglas-Hamilton, 1987), it is important to consider these factors when deciding on whether continued trade in ivory is really in the best interest of the species, as suggested by the CITES Secretariat (1989).

Effects of the ivory trade

An average tusk weight of 10.1 kg was calculated from tusks reported in international trade in 1979 from all over the African continent (WTMU, 1983). By 1988, the mean tusk weight had dropped to 4.4 kg (Table 2), suggesting that the proportion of female and sexually immature elephants that were killed to supply the ivory trade increased substantially during the intervening years.

Although the volume of ivory reported in international trade appears to have declined in recent

Table 1. Comparison of mean tusk weights for male and female African elephants by age (data extracted from Parker, 1979)

	Mean weight (kg) of one tusk	
Age (yrs)	Female	Male
5	0.52	0.92
10	1.20	2.63
15	2.00	4.87
20	2.85	7.54
25	3.90	11.77
30	5.15	17.42
35	6.10	23.08
40	6.72	28.74
45	7.15	34.40
50	7.35	40.05
55	7.25	45.71

years (ITRG, 1989), since the mean tusk weight has halved there is little indication that the number of elephants killed for the trade has decreased significantly during the past 10 years. For example, Customs statistics from the world's largest trader in raw ivory, Hong Kong, illustrate this problem: although the total volume of raw ivory traded through Hong Kong has been reduced by half over the last 10 years, the estimated number of elephants that have supplied this trade has remained largely the same (Table 3). In addition, since the drop in average tusk weight indicates that a higher proportion of breeding-age females is contributing to the ivory trade, if we take into account the number of orphan deaths, then the total number of elephant mortalities due to the ivory trade may actually have increased substantially. Poole (1989b) found that the death of any elephant mother typically results in the subsequent death of one of her calves. RRAG (1989) estimated that these 'invisible victims' constitute up to 20–30 per cent of the mortality caused by the ivory trade.

That the effect of the ivory trade on the demography of elephant populations is not only a recent phenomenon can be seen by examining ivory export figures from Burundi Customs statistics from 1965 to 1984 (Table 4). During this period, Burundi, a country that no longer has any elephants of its own, has traded ivory from more than 100,000 elephants, most of which are thought to be from populations of savannah elephants *Loxodonta africana africana*. The data show that tusks from adult males (> 10 kg) contributed 81 per cent of the total weight of ivory exported during a five-year period from 1965 to 1969. From the period 1979–1984, the figure had declined to only 13 per cent of the total weight of Burundi's ivory exports. Conversely, the proportion of tusks from adult females and immatures (< 6 kg), which contributed only 4.7 per cent of the total weight exported from 1965 to 1969, increased to 49.6 per cent during 1979–1984. These data document a dramatic slide in the age/sex structure of the harvested populations towards females and immatures. Apparently, these trends have continued beyond 1984, as can be seen from a large sample of tusks seized by the Burundi Government (Table 5).

Populations of forest elephants *Loxodonta africana cyclotis* in central Africa have been assumed to be under less pressure from poaching due to the inaccessibility of their range (Cumming and Jackson, 1984; Martin, 1985). However, their true status has been difficult to determine due to the logistical problems of censusing elephants in forests (AERSG, 1987). A recent reconnaissance survey of these populations suggests that the pressure on them from ivory poachers is significant and increasing (Barnes, 1989). An examination of the weight distribution of tusks imported by Ivory Coast

Table 2. Comparison of the yearly mean tusk weights reported in international trade

Year	Mean tusk weight* (kg)
1979	10.1
1980	6.8
1981	6.9
1982	6.2
1983	7.5
1984	7.0
1985	6.4†
1986	4.6
1987	4.9
1988	4.4

*Mean tusk weights are based on WTMU (1983, 1987, 1989), Caldwell (1984, 1987), and Caldwell and Barzdo (1985).
†Mean tusk weight for 1985 not available; estimated by using the 1984 value minus an average rate of decline of 0.6 kg/year.

Table 3. Estimated minimum number of elephants represented by Hong Kong's gross raw ivory imports, 1979–1988 (ivory data from Hong Kong Customs statistics)

Year	Weight (kg)	Number of elephants
1979	474,208	30,537
1980	494,271	46,533
1981	577,204	51,001
1982	506,348	49,969
1983	633,804	74,752
1984	378,847	44,192
1985	235,318	27,449
1986	179,033	23,927
1987	221,945	31,650
1988	269,603	32,816
Total		412,826

Mean weights of tusks imported by Hong Kong are based on Caldwell, 1984, WTMU 1983, 1989, Milliken, 1989.

https://doi.org/10.1017/S0030605300023012 Published online by Cambridge University Press

since 1978, primarily from central African countries, reveals that, like the savannah populations, younger animals make up a significantly higher proportion of the trade now than 10 years ago (Table 6). Between 1978 and 1980 tusks from adult males (> 10 kg) contributed 75.8 per cent of the total weight imported, while in 1987 and 1988, tusks from adult males made up only 11.0 per cent of the total weight imported. While tusks from females and immatures (< 5 kg) made up 5.5 per cent of the ivory imported during 1978 through 1980, by 1987 and 1988 they accounted for 16.0 per cent.

Effects of the ivory trade on elephant social structure

The loss of adult males and effects on reproductive patterns

While female African elephants may conceive as young as 10 years old, males do not begin to reproduce until very much older. Although male elephants begin to produce sperm at approximately 17 years old (Laws, 1969), males under 25 years old are generally unsuccessful at obtaining matings during the peak two to three days of oestrus, partly due to their inexperience and lack of female co-operation. By a mean age of 29 years old male elephants begin to come into a rutting period known as musth (Poole, 1987). The musth periods of these young males are short and sporadic, lasting only a few days to weeks. By 40 years old the musth periods of males are well established, occurring every year at a predictable time and lasting several months. Under natural conditions it is these older males who are the primary breeders. While females will stand to be mated by these older musth males, often initiating courtship and facilitating intromission, they will run from non-musth males and if mounted by them will struggle (Moss, 1983; Poole 1989a). It is likely that the smell of musth urine and temporal gland secretion is required to stimulate the female to co-operate.

In relatively unpoached elephant populations, adult sex ratios are only slightly biased in favour of females (Table 7). However, due to the pronounced sexual dimorphism in tusk weight (Laws, 1966, 1970) and the ease of killing lone adult males (Parker, 1979), adult sex ratios in poached populations are highly skewed in favour of females (Table 7). For example, in 1966, the adult sex ratio (taken as ≥ 15 years

Table 4. Ivory exports by weight class extracted from Burundi Customs statistics 1965–1984

	< 6 kg	6 < 10 kg	10 < 15 kg	> 15 kg	Total (kg)
1965–1969					
Ivory (kg)	113	341	487	1444	2385
% of total exported	4.7	14.3	20.4	60.6	100
1970–1974					
Ivory (kg)	38	10,228	1908	4752	16,926
% of total exported	0.2	60.4	11.3	28.1	100
1975–1978					
Ivory (kg)	50,915	92,424	31,110	49,652	224,101
% of total exported	22.7	41.2	13.9	22.2	100
1979–1984*					
Ivory (kg)	352,737	266,080		92,201+	711,008
% of total exported	49.6	37.4		13.0	100

< 6 kg, equivalent to adult females and immatures.
6 < 10 kg, equivalent to older adult females and non-breeding adult males.
10 < 15 kg, equivalent to adult but pre-musth aged males.
> 15 kg, equivalent to breeding males.
*During the period 1979 to 1984, the Burundi authorities combined the weight distributions 10 < 15 kg and > 15 kg.

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Table 5. Weight distributions of ivory seized in November 1987 by the Burundi Government (data extracted from tender document issued by the CITES Secretariat on 12 June 1989)

	≤ 4.9 kg	5–9.9 kg	10–14.9 kg	≥ 15 kg	Total (kg)
1987					
Ivory (kg)	10,288	9173	3593	4755	27,809
% of total stock	37.0	33.0	13.0	17.0	100

old) of Kenya's Tsavo East elephant population was 53.2 per cent female to 46.8 per cent male (Laws, 1969). In 1989, after more than a decade of organized poaching, the ratio had changed to 81.7 per cent female and 18.3 per cent male (Poole, 1989b). In Zambia's Luangwa Valley, Lewis (1984) reported that the sex ratio had become increasingly skewed toward females over a six-year period during which the total population had declined by 40 per cent.

In heavily poached populations, the lack of breeding males is conspicuous (Table 8). For example, while in Kenya's well-protected Amboseli National Park the ratio of breeding adults

Table 6. Ivory imports by weight class extracted from Ivory Coast Customs statistics 1978–1988

	< 5 kg	5 < 10 kg	10 < 20 kg	> 20 kg	Total (kg)
1978–1980					
Ivory (kg)	5314	18,266	60,573	13,120	97,273
% of total imported	5.5	18.8	62.2	13.5	100
1981–1983					
Ivory (kg)	12,747	45,748	17,069	863	76,427
% of total imported	16.7	59.9	22.3	1.1	100
1984–1986					
Ivory (kg)	11,892	37,383	1188	212	50,675
% of total imported	23.5	73.8	2.3	0.4	100
1987–1988*					
Ivory (kg)	4297	19,696	2619	339	26,901
% of total imported	16.0	73.0	9.7	1.3	100

< 5 kg, equivalent to adult females and immatures.
5 < 10 kg, equivalent to older adult females and non-breeding adult males.
10 < 20 kg, equivalent to pre-musth aged males and some breeding males.
> 20 kg, equivalent to breeding males.

*1988 includes only 10 months.

Table 7. Adult (≥ 15 years old) sex ratios in poached and relatively unpoached populations of African elephants

	Percentage Female	Male
Relatively unpoached		
Tsavo East, Kenya 1966 (Laws, 1969)	53.2	46.8
Murchison Falls N., Uganda 1967 (Laws, 1969)	53.8	46.2
Murchison Falls S., Uganda 1967 (Laws, 1969)	58.7	41.3
Budongo, Uganda 1967 (Laws, 1969)	56.3	43.7
Mkomasi, Tanzania 1968–69 (Laws, 1969)	57.5	42.5
Manyara, Tanzania 1966–70 (Douglas-Hamilton, 1972)	53.5	46.5
Amboseli, Kenya 1988 (Poole, 1989b)	59.7	40.3
Poached		
Kasungu, Malawi 1977 (Jachmann, 1980)	66.0	33.0
Luangwa Valley, Zambia 1981 (Lewis, 1984)	72.5	27.5*
Mkomasi, Tanzania 1988 (Olindo *et al.*, 1988)	100.0	0.0†
Tsavo East, Kenya 1989 (Poole, 1989b)	81.7	18.3
Tsavo West, Kenya 1989 (Poole, 1989b)	86.2	13.8
Mikumi, Tanzania 1989 (Poole, 1989b)	81.8	18.2
Queen Elizabeth, Uganda 1989 (Poole, 1989b)	92.0	8.0

*Lewis (1984) states that in 1966 the sex ratio in Luangwa Valley was 'near even' and that at that time the population was relatively unpoached.
†During the Tsavo total count in 1988, only 93 elephants remained in Mkomasi Game Reserve. No adult males were observed.

Table 8. Sex ratio of breeding adults (taken as females ≥ 10 and males ≥ 25 years old) in one relatively unpoached and several poached populations (data from Poole, 1989b)

	Percentage Female	Male
Relatively unpoached		
Amboseli	77.9	22.1
Poached		
Tsavo East	95.0	5.0
Tsavo West	96.2	3.8
Mikumi	99.6	0.4
Queen Elizabeth	98.7	1.3

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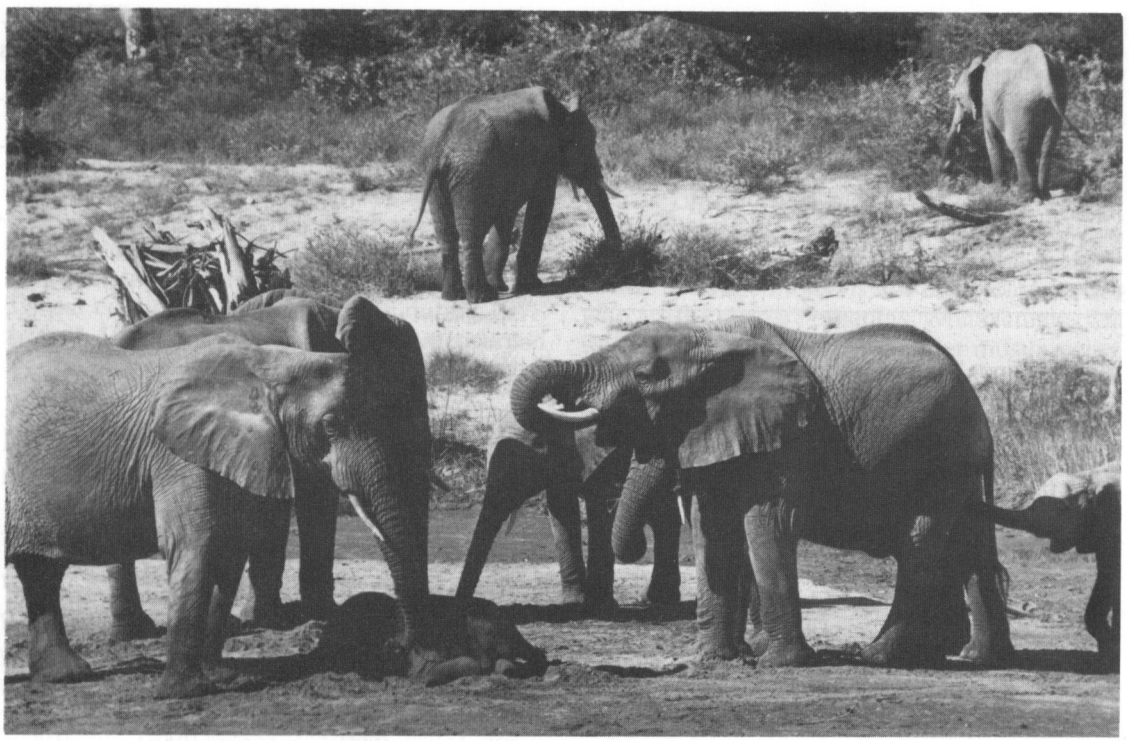

African elephants have a well-developed social organization with families composed of several related adult females and their offspring (*Norman Myers*).

was 77.9 per cent female to 22.1 per cent male, in Tanzania's poached Mikumi population the ratio was 99.6 per cent female to 0.4 per cent male (Table 8; Poole 1989b). The relatively low numbers of sexually mature males and, frequently, the total absence of musth-age males, may result in a decrease in conception rates. The probability that a female will find a sexually mature male and, in particular, a male in musth, during the two days in which conception occurs, is likely to decrease as the number of potential mates declines. In the Luangwa Valley, Lewis (1984) suggested that a decline in calving rate may have been caused by the relatively low availability of breeding males. Poole (1989b) concluded that in the Mikumi population, the low recruitment rate and relatively low proportion of pregnant or lactating adult females were due to the almost total lack of breeding-age males.

Since mate-searching success is influenced by elephant grouping patterns (Poole and Moss, 1989), the degree to which the decline in numbers of breeding males will affect conception rates may vary with habitat. In more open areas, where elephants respond to poaching by aggregating, such as has been described in Murchison Falls, Queen Elizabeth and Serengeti National Parks (Laws *et al.*, 1970; Eltringham & Malpas, 1980; Dublin and Douglas-Hamilton, 1987; R. Olivier, pers. comm.), conception rates may be less affected by poaching than in areas such as the Selous and Luangwa Valley where elephants apparently do not aggregate (Douglas-Hamilton *et al.*, 1979; Douglas-Hamilton *et al.*, 1986).

Data collected in Mikumi and Queen Elizabeth support this theory. In both populations very few breeding males remain; however, while the Mikumi population is suffering from depressed reproductive rates, the Queen Elizabeth population is breeding rapidly. In Mikumi, only 14 per cent of the population is under five years old and only 39 per cent of the adult females have developed breasts, while in Queen Elizabeth, 35 per cent of the population is under five years old

A newborn calf suckling (*Norman Myers*).

and 87 per cent of the adult females have breasts (Poole, 1989b). Since female elephants start to develop breasts after about 9 months of pregnancy (Moss, 1988) and then, typically, continue to suckle one calf until the birth of the next (Lee and Moss, 1986), the absence of breasts indicates either delayed first reproduction or unusually long inter-calf intervals. However, the Mikumi and Queen Elizabeth populations differ in two respects: in Mikumi, poaching persists and females remain in small dispersed groups, while in Queen Elizabeth, the elephants live in a large semi-permanent aggregation, despite there having been almost no poaching since 1982.

Thus, in populations that are highly skewed toward females, and where the few males can locate all or most of the receptive females, it is biologically possible for elephant numbers to increase relatively rapidly. However, this recovery is purely numerical and complete social recovery will not occur until the age structure and sex ratio have reached equilibrium.

The loss of adult females and the destruction of families

The basic unit of elephant social organization is the family, which contains up to 25 individuals and is composed of several related adult females and their offspring (Buss, 1961; Moss, 1988). Above the level of the family unit are bond groups, which are made up of several related families (Douglas-Hamilton, 1972; Moss, 1988). The bonds between family members last a lifetime. The death of any adult member of the family may affect the survival and social relationships of other members of the group (Poole, 1989b).

As the proportion of adult males in elephant populations has declined, the incentive for poachers to kill females and immatures has increased. The use of automatic weapons has

https://doi.org/10.1017/S0030605300023012 Published online by Cambridge University Press

made the family unit a less formidable target (Parker, 1979) and often whole families or groups are killed (Douglas-Hamilton, 1987).

The killing for the ivory trade has caused severe disruption of elephant families in many populations. In the well-protected Amboseli population, 74.5 per cent of the families are led by females over 30 years old and the median age of matriarchs is 41 years old (C. Moss, unpubl.). In the poached populations of Tsavo East and West, in Kenya, only 37.5 and 28.6 per cent, respectively, of the families are led by females over 30 years old. In Tanzania's Mikumi population, the figure is a mere 14.5 per cent. In Tsavo East 31.2 per cent of the families are either entirely composed of orphans or are obviously missing adult females. In Tsavo West, the figure is 46.4 per cent, while in Mikumi the figure reaches 72.4 per cent (Poole, 1989b).

Aside from the total destruction of the relationships within families and bond groups, the loss of adult females and the fragmentation of families has a profound negative effect on reproductive rates of elephant populations. Data collected in Amboseli suggest that calf mortality will be significantly higher in poached populations for several reasons.

Baby elephants under two years old have no chance of surviving without their mothers. Calves between the ages of two and five years old have a 30 per cent chance of survival in the two years following their mothers' deaths, while juveniles between the ages of six and ten years old have a 48 per cent chance of survival (Poole, 1989b). In addition, juvenile females comfort, assist and protect calves and the latter's survival is affected by the number of young nulliparous females in a family (Lee, 1987). Lee (1987) found that mortality in the first 24 months of life was highest among calves born to families with no juvenile females and that mortality declined as the number of young females in the family increased. Thus, calves raised in small families that have been fragmented by poaching have a lower chance of survival than calves raised in large, intact families with several adult and juvenile females. Consequently, increased calf mortality and an accelerated decline in numbers of individuals can be expected to occur in populations where a high proportion of females are poached for ivory and families have been fragmented.

Finally, females between the ages of 25 and 40 years old are more successful at raising their calves through the first four years of life than are younger or older females (C. Moss, unpubl.). Consequently, as middle-aged females are selected for their larger tusks, a decline in recruitment rates is likely to occur.

Conclusion

Under natural conditions, elephants live in a complex and highly structured social world. As Africa's remaining scattered populations become smaller and more fragmented, the social disruption caused by ivory poaching will impose steadily increasing limitations on the ability of elephant populations to recover. The destruction of elephant families, and the disruption of complex social and reproductive behavioural patterns, caused by poaching, is likely to lead to a decline in reproductive rates and a steady rise in calf mortality rates. The lack of breeding-aged males is likely to lead to lowered conception rates, delaying the age of first reproduction and lengthening inter-calf intervals.

While trade and biological data have become increasingly conclusive as to the effect that the killing for the ivory trade has had on elephant populations, it is clear from the Burundi ivory trade data presented here, and from population and trade data available 10 years ago (Douglas-Hamilton, 1979; Parker, 1979), that even at that time many populations were already being overexploited. In the meantime, the social disruption and fragmentation of African elephant populations have now reached such magnitude that for most populations any discussion of sustainable offtake at this stage would appear pointless.

Based on the evidence provided by biological data, population trends, population models and trade statistics, the authors believe that the killing of elephants for the ivory trade has reached such magnitude that it is destroying the very essence of the species. If our objective is to preserve African elephants as an intact species within its current range then the excessive killing witnessed over the last two decades must be

brought to a halt. It is important to stress, however, that to restore the social structure and change the current abnormal demographic profile of many populations may take up to 25 years. Thus, we believe that the objectives of a moratorium on the trade in ivory should not only consider the numerical stabilization or recovery of elephant populations, but also, and perhaps most importantly, the social recovery of these populations.

Acknowledgments

Financial and other support were provided by the African Wildlife Foundation and World Wildlife Fund. Tom de Meulenaer and the Wildlife Trade Monitoring Unit provided the raw trade data from Burundi and Cote d'Ivoire. Cynthia Moss made some of her unpublished data available and together with Jonathan Barzdo, Iain Douglas-Hamilton, Ruth Mace and E. J. Milner-Gulland made helpful comments on the draft manuscript. They all receive our sincere thanks. We thank the Wildlife Departments of Kenya, Tanzania and Uganda for having allowed us to work within their countries.

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