Koedoe 23:163–170 (1980)

CUB MORTALITY IN THE KALAHARI LION *PANTHERA LEO VERNAYI* (ROBERTS, 1948)

F. C. ELOFF

Department of Zoology
University of Pretoria
Pretoria
0002

Abstract – The extent and possible causes of cub mortality in the Kalahari lion are discussed. It is concluded that starvation is a major cause of death among cubs, largely due to the Kalahari lion's dependence on small mammals as a source of food. Other important mortality factors are abandonment of the cubs, diseases, the harsh desert environment and possibly predation.

Introduction

In the course of a research project on the ecology of the Kalahari lion, I had the opportunity of making a few observations on the mortality of lion cubs and the purpose of this paper is to discuss the extent and possible causes of cub mortality in the Kalahari lion.

The work was carried out in the northern part of the Kalahari Gemsbok National Park, in a study area of about 2 000 km^2. All lions within the study area were immobilised and marked with a hot branding iron to ensure future identification.

The study area was visited once or twice a year. On every occasion all the lions within the area were tracked down and identified. Any new arrivals were captured and marked. In this way a complete record of emigrations, immigrations, births and deaths of the lion population within the study area was compiled. It is obviously not a complete record of the population turnover because any births or fatalities that occurred between our periodic visits to the study area were never recorded. Actual deaths were seldom observed but if a lioness had given birth to a litter and she was without cubs 12 months later, they were regarded as dead because cubs are dependent on the adults for food until at least 16 months old and usually for at least the first 2½ years of their life (Schaller 1972).

It is known of course that cubs may suckle from other lactating females in the pride. Should their own mother die or abandon them, they therefore stand a chance of surviving if any lactating females are available (Moss 1976). In the present case, however, there were no other lactating females who could have taken over the rearing of the cubs if abandoned by their

own mother. The three prides in question lived a solitary existence and never associated with other prides during the study period.

Observations

Two prides of lions, called A and B, were followed over a period of two and three years respectively. A third pride, called C, was followed for a period of 10 days.

Pride A consisted of a young adult lion and lioness. They were joined for a short period by a second lioness in what appeared to be a very loose association. She later died from injuries inflicted by a porcupine.

Over the two years that pride A was kept under observation, only two births were recorded but it is possible that other births occurred.

On the last occasion that this pair was seen alive, we found on our arrival a dead cub at a water hole in the pride's usual activity zone. It must have died during the previous night. The cub was thin and emaciated and its swollen joints indicated rickets. The tracks of a lioness and a cub led away from the water hole. The cub was observed to be dragging its feet and the lioness picked him up from time to time carrying him over long distances. When the lioness and the cub were overtaken the lioness fled and left her cub of about six months behind. It was in a bad condition and clearly suffered from rickets. We left the cub, which was later rejoined by its mother who was identified as the lioness of pride A.

During the night the lioness was joined by her mate and the three of them wandered around, the lioness carrying her cub from time to time. This continued for another day and on the morning of the third night since we followed the lioness the cub was found to have been eaten by one or both of his parents. Only the lower jaw and part of the feet and skin were found. It is unknown whether the cub was dead or alive when it was eaten. After this gruesome meal, the lion and lioness went off hunting and killed an adult gemsbok bull *Oryx gazella,* weighing about 200 kg.

Pride B, consisting of six lionesses, has a checkered history. Over the three years that they were studied they were associated with at least five different males. Although the lionesses mostly stayed together over this period they did split up on occasion, when they either had cubs or when they were mating.

During the study period five visits at intervals of six to twelve months were made to the study area. Each visit lasted from 10–12 days during which time the pride was followed continuously to establish, amongst other factors, births and deaths within the lion population of the study area. During the total period of three years that they were kept under observation, 11 births were recorded. It is a fair assumption that the actual number of births over the whole period was much higher but due to the long intervals between successive visits went unrecorded. However, of the 11 cubs known to be born over the study period, only one cub lived longer than 12 months. On the last occasion that the six lionesses were

seen together, this cub was 18 months old and apparently over its most vulnerable stage.

Pride C consisted of a big male and two adult lionesses. From the condition of the one lionesses's teats she appeared to have cubs. Yet she stayed with the other members of the pride for four consecutive nights during which period they killed three porcupines *Hystrix africaeaustralis*. On the fifth night she went off on her own, killed a young aardvark *Orycteropus afer,* and spent the night alone. On the sixth night her tracks led to a witgat tree *Boscia albitrunca*, under which we found two dead cubs and one live one which was in a pitiful state. The cubs were between three and four weeks old.

Of the two dead cubs one was badly decomposed and must have been dead for at least 48 hours. The other deceased one probably died at least 24 hours later. A dissection revealed that its stomach was completely empty and it is clear that both cubs died of starvation.

For the next two days the mother stayed with the surviving cub, which now appeared to be well fed and looking much stronger. After two nights, however, the mother went off again. She walked more than 17 km on the first night and made two unsuccessful hunting attempts. She did not return to her cub that night and was last seen about 15 km away.

In this case, therefore, two out of three cubs died of starvation, the mother having stayed away from them for at least five consecutive nights. The surviving cub's future is also in jeopardy because big game was scarce and a mother living on small prey like porcupines and aardvark can hardly sustain her milk production.

Taking the two prides together it means that of 16 cubs known to be born, one was still alive at approximately four weeks while one survived beyond the age of 12 months. It gives an exceptionally high mortality rate, probably the highest rate in Africa, and yet the actual mortality rate would be much higher if all the births over the study period were recorded.

Whatever the actual mortality rate, the important point is that the total recruitment to a healthy and mature population of eight lionesses over a period of say two years, was at best two individuals but most probably only one. At this recruitment rate the lion population can hardly survive.

Discussion

Cub mortality has been studied or at least estimated in other parts of Africa. According to Stevenson-Hamilton (1954) probably not more than half the number of cubs born arrive at maturity while Cowie (1966) estimated that over 50% die before they are one year old. Pienaar (1960) maintains that only 40% of cubs at Etosha reach maturity.

In two prides studied on the Serengeti over a period of four years Schaller (1972) found that 56 of 79 cubs known to have been born, died. This gives a mortality figure of 67%. In some prides cubs had a higher

death rate, while in others the survival rate was higher. He concludes by saying that the survival rate of cubs is affected by many factors but "in general, I would estimate that about half of the young die from one cause or another".

In the central part of the Kruger National Park (KNP) Bryden (*pers. comm.*) calculated a mortality rate of 29%. This is very low in the light of observations elsewhere in Africa. The lowest mortality rate, however, comes from Nairobi National Park where cub mortality during 1968–1969 was estimated at 15% (Rudnai 1973). For this low mortality she suggests two possible reasons, namely the scarcity of hyenas and the almost total absence of transient lion males, due to the very limited access to the Park.

It seems fair to say that in most parts of Africa more than 50% of the cubs born never reach maturity and that in some areas, where food as well as climate could be severe limiting factors, the juvenile mortality rate reaches astounding proportions.

The causes of cub mortality has received considerable attention. One of the very first observations on the high rate of cub mortality came from Andersson (1873), who in a book published after his death observed that "many (cubs) are said to die during dentition, more especially females". That more females than male cubs die is probably incorrect but the effects of dentition on cub mortality is supported by Guggisberg (1961) who goes as far as to say that the period of tooth replacement is probably the most dangerous period in a young lion's life. According to him males seem to be especially vulnerable.

The preponderance of females in the KNP (1 male: 1.8 females) may, according to Pienaar (1969), be the result of greater mortality amongst male cubs than females. As causes of cub mortality in the KNP Pienaar (1969) mentions predation by hyaenas, floods, severe bush fires, army ants and infectious diseases. He also refers to the occasional propensity of males to devour cubs due to intolerance.

Pienaar (1969) also mentions poisonous snakes as a cause of cub mortality in the Kruger National Park. Snakes may take their toll in the KGNP but the extent to which this happens is unknown. A more important factor in this regard may be the numerous scorpions occurring in the Kalahari. There is probably no other area in southern Africa with a higher density of scorpions than the sandy dunes and flats of the Kalahari. Young cubs are bound to come into contact with scropions which become active at night. No fatalities due to scorpions have been recorded but according to the game rangers young cubs have been found dead in their shelters in situations where only poisonous snakes or scorpions could have been responsible. Although smaller carnivores are supposed to be immune against scorpion venom, its effects on young cubs is unknown. It is known that dogs are highly susceptible to scorpion venom and scorpions may therefore be a real hazard to lion cubs in the Kalahari.

Abandonment, violence by adult lions, predation and starvation are the main causes of death among Serengeti cubs according to Schaller (1972). He goes on to say that in areas where starvation is not a factor, the death

rate of cubs is nevertheless high, suggesting the death rate may be somewhat intercompensatory in a stable population, so that on the average about half the cubs die before independence.

Although he has no data to support it he regards abandonment by mothers as the most important cause of death among cubs. In one particular area 28% of the cubs died of starvation and most of them, six to twelve months old, an age where they do subsist partly on milk and partly on meat provided by the parents. Any neglect on the part of the mother to provide them with meat may cause starvation and this happens frequently when no large prey is available. Small kills may simply be appropriated by the males (Schaller 1972) or the lioness may refuse to share it with her cubs.

Lions have been found affected by a variety of parasitic and other diseased conditions by both Schaller (1972) and Young (1975). Although any disease condition may contribute to the mortality rate, directly or indirectly by lowering an animal's resistance or weakening his condition, information on most of these infestations is largely incomplete. Lions are known to have died of anthrax, sarcoptic mange and other diseases and parasitic infestations but the true impact of these on cub mortality is still unknown.

Due to the difficulty of obtaining direct evidence it is impossible to evaluate the relative importance of the different factors known to influence cub mortality in the Kalahari lion.

Although I have no data to prove it, starvation is probably one of the most important mortality factors due to the Kalahari lion's way of life and the nature of its habitat.

In a study on lion predation in the KGNP (Eloff 1973), it was shown that small mammals and juvenile animals make up more than 50% of known lion kills. In the KNP, on the other hand, small mammals comprise less than 1% of all lion kills recorded over a period of almost 25 years (Pienaar 1969). The same holds true for the Serengeti area (Kruuk & Turner 1967; Schaller 1972).

The Kalahari lion's apparent predilection for small mammals is probably forced upon it by the relative scarcity of larger prey species in some parts of the Kalahari. Particularly during lean times the Kalahari lion is compelled to depend on small mammals to a greater degree than elsewhere in Africa.

In our study area it was found that small-sized prey animals are usually entirely consumed by the adult lions, leaving virtually nothing for cubs accompanying the pride. According to Schaller (1974) "when only small gazelle are available, cubs get little or no food". This is very true of the Kalahari lion and if only small prey is available, it means that the cubs may have to go without food for long periods. Furthermore, a lioness with young cubs to feed, needs more than a small portion of a porcupine or other small mammal to keep up her milk supply. Under these circumstances young cubs solely dependent on the mother's milk supply or older cubs partly dependent on meat to supplement their food supply, will

starve to death and due to the special conditions pertaining to the Kalahari, it is a mortality factor of major importance.

Due to the scarcity of food in the Kalahari, lions have to travel very far in search of food, often travelling more than 35 km a night without success. Instances are known where prides or individuals have gone without food or water for more than 7 days. This is bound to affect the mother's milk supply.

If lionesses with cubs are unsuccessful in their hunting efforts, or have to share a small prey with other lions, they often do not return to the cubs the same night. This has been found to happen frequently and in the case of pride C, recounted earlier, the mother stayed away from her cubs for at least five nights and two of her three cubs died of starvation.

In another instance a lioness was found to have stayed away from her two 10 week-old cubs for three nights in succession, never returning to them during that period. On the first night she killed two young porcupines, devoured them completely and then joined up with another pride consisting of three males and one lioness. The pride hunted together for two nights, killing one porcupine during this period. On the fourth day the tracks were obliterated by heavy rain and wind and it is not known whether the lioness returned to the cubs or simply abandoned them. A thorough search of the area where the cubs were last seen did not yield anything and it is possible that they died of starvation.

The only disease known to affect cubs in the Kalahari is rickets, a deficiency disease in young mammals, but due to circumstances pertaining in this desert habitat it could play a major role in juvenile mortality. As mentioned earlier two cubs are known to have died of rickets and other cases are reported by the game ranger (E. A. N. Le Riche *pers. comm.)*.

According to Young (1975) rickets can be experimentally induced if lion cubs are fed on deboned meat alone or when they are witheld from direct sunlight. Sunshine is not a scarce commodity in the Kalahari but cubs may get very little boned meat to eat for long periods. Their only hope of getting sufficient food is when a large prey animal is killed and even then they may have to feed on scraps or hard bones which only a hyaena can crunch.

Rickets has frequently been diagnosed in free living cheetahs *Acinonyx jubatus* in the KNP and although young cheetahs appear to be more susceptible to the development of rickets than are other species (Young 1967) it could be an important mortality factor in the Kalahari lion due to its dependency on small mammals.

Lions are cannibals and cubs are killed by males for a variety of reasons. It could be transient males as observed by Schaller or males of the pride to which they belong. Le Riche (*pers. comm*) found a male and two young cubs of about six months together in the Park. The cubs were in bad condition and must have been abandoned by the mother or she may have been killed. However, the male acted as godfather to the cubs and protected them when they were threatened by black-backed jackals. On the following day, however, the male killed the two cubs and devoured

one of them. Although this incident did not occur under natural conditions, males, in several different guises, may have a significant decimating effect on cubs and young lions.

Predation on lion cubs may be an important mortality factor. When young cubs accompany the pride on a hunt they are left behind at a certain point to be fetched later, after a kill had been made. On almost every occasion that this had happened, the cubs were left in fairly open spots, sometimes very sparsely covered with short grass, in a situation where they are very vulnerable to attack from marauding predators like the brown hyaena *Hyaena brunnea,* the spotted hyaena *Crocuta crocuta,* the leopard *Panthera pardus* and the honey badger *Mellivora capensis.*

Young cubs left alone by the mothers during daytime were observed to crawl around within the limits of their shelter, almost invariably a dense *Boscia albitrunca,* where they are well protected against the sun and attacks from predatory birds. Cubs were, however, also seen to crawl outside their shelter exposing themselves to attack from large birds of prey like the martial eagle *Polemaetus bellicosus* and others, which abound in the park.

Although cubs are usually left behind when the adults go hunting, it is not invariably so. One incident will illustrate this. A young cub of about eight weeks old accompanied his mother on all her hunting exursions and over a period of nine days covered 68.4 km, doing more than 13 km on one particular night.

This cub could be aged quite accurately because a lioness with three young cubs of known age occurred in another part of the study area at the same time. The lioness with its cub belonged to a pride consisting of a male and three adult lionesses.

Over the nine days that they were observed during a period of intense heat, the pride drank water three times and killed a young gemsbok, two porcupines and a Kori bustard *Ardeotis kori,* which is meagre fare for four adult lions.

The sturdy little cub kept up with the pride at all times. One night the pride went on a trot and kept this up for about 2 kilometres. The cub stayed with them all the time. When they came to a standstill, however, the cub stayed behind. The pride went on and killed a young gemsbok 3.5 km further on. The cub rejoined the pride at the kill. The tracks showed that this tiny cub walked the distance of 3.5 km on its own, on a course parallel to that of the adults, running part of the time, crossing numerous sand dunes and winding its way through dense grass and shrubs.

When cubs are left behind on an occasion like this, the mother usually returns for them. In this case the mother did not return for her cub. She probably called him as lionesses usually do, although normally at short distances only. Responding to this call, or acting on its own initiative, the cub walked 3.5 km, exposing itself to predatory attacks and all the other dangers of a hostile environment.

Although this lone cub has survived what is perhaps the most critical period of its life, its future still hangs by a thread. Single births are unusual and this cub is probably the sole survivor of a bigger litter, the

other members of which have already succumbed to exhaustion, starvation, thirst, predation or some other factor to which desert animals are daily exposed.

In conclusion it may be said that lion cubs in the Kalahari are exposed to all the hazards peculiar to a harsh environment like the Kalahari.

REFERENCES

ANDERSSON, C. J. 1873. *The Lion and the Elephant.* L. Lloyd London: Hurst and Blackett.

COWIE, M. 1966. *The African Lion.* New York: Golden Press.

ELOFF, F. C. 1973. Lion predation in the Kalahari Gemsbok National Park. *J. South Afr. Wildl. Manage. Assoc.* 3(2): 59–63.

GUGGISBERG, C. 1961. *Simba.* Cape Town: Howard Timmins.

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

MOSS, C. 1976. *Portraits in the wild.* London: Hamish Hamilton.

PIENAAR, U. DE V. 1960. Annual Report of the Biologist, 1958/1959.*Koedoe 3:* 1–205.

PIENAAR, U. DE V. 1969. Predator-prey relations amongst the larger mammals of the Kruger National Park. *Koedoe* 12: 108–176.

RUDNAI, J. A. 1973. *The Social Life of the Lion.* Lancaster: MTP Co. Ltd.

SCHALLER, G. B. 1972. *The Serengeti Lion.* Chicago: The University of Chicago Press.

SCHALLER, G. B. 1974. *Golden Shadows, Flying Hooves.* London: Collins.

STEVENSON-HAMILTON, J. 1954. *Wild Life in South Africa.* London: Cassell.

YOUNG, E. 1967. The hand-rearing of the young of the cat tribes. *Afr. Wild Life* 21(1): 21–27.

YOUNG, E. 1975. Some important parasitic and other diseases of lion, *Panthera leo,* in the Kruger National Park. *J. South. Afr. vet. Assoc.* 46(2): 181–183.