

# **Leopard and Lion predation upon Chacma Baboons living in the Moremi Wildlife Reserve**

by CURT BUSSE\*

## **Abstract**

Predation by lions and leopards is the main cause of adult mortality among baboons living in the floodplains near Chief's Island in the Okavango Delta. During a 30 month interval we observed 14 such predatory attacks upon baboons, including five kills. There were another four incidental records of lion and leopard predation upon adult and subadult baboons. Lions ambush baboon groups foraging along the ground during the daytime. If an ambush is unsuccessful lions will not continue the attack. In contrast, leopards hunt baboons at night and do not depend upon surprise to make kills. Leopards may hunt at a baboon roost for the entire night and two kills were made at least an hour after the initial attacks. During leopard attacks baboons seek refuge in the tallest available trees on outer, terminal branches with difficult access for leopards. Adult male baboons may harass leopards in the daytime, but no such harassment has been seen at night as one adult male baboon was killed at dusk. These observations are discussed relative to the paucity of similar observations elsewhere in Africa.

## **Introduction**

Over the past 20 years there has been much conjecture over the relationship between baboons and their natural predators,<sup>1-3</sup> with special emphasis upon whether adult male baboons defend other group members during predator attacks.<sup>4-6</sup> Throughout East and Southern Africa baboons (*Papio* spp.) live in predator-rich habitats providing relatively little cover from predators. These savanna baboons typically live in large groups of 20 to 100 or more individuals, including several adult males per group. These large, multi-male groups are uncommon among other African primates<sup>7</sup> and may reflect adaptations providing protection against predators. The advantages of gregariousness may include protection against predators by adult male group members, rapid detection of predation, increased social cover,<sup>8</sup> and a reduced need for vigilance, thereby freeing time for other activities. Extensive speculation on the adaptive bases of baboon social organization stems from only a handful of predator attacks seen during 100+ man-years of baboon observation at numerous East and Southern African field sites.<sup>2, 9, 10</sup> During a study of baboon ecology and nutrition in the Moremi Wildlife Reserve, we have observed a large number of interactions between baboons and potential predators. Here I describe these observations and discuss why such predation has rarely been seen elsewhere.

## **Study Site**

The study site is in the western edge of the Moremi Wildlife Reserve between the Boro River and the lower end of Chief's Island. This area, partially inundated from April to October, is pristine habitat sustaining large resident populations of baboons (*Papio ursinus*) and impala, plus a variety of other game animals and their predators. Observations spanned 30 months from September 1977 to February 1980 and represented approximately 2000 hours of contact with baboon groups. The two focal baboon groups, C and W, averaged 70 individuals each, including at least six adult males per group at any time. Two adjacent baboon groups, X and Z, were observed infrequently. We observe the two focal groups daily on foot and describe all

\* Curt Busse is a Ph.D. candidate in Ecology at the University of California, Davis

encounters with potential predators, i.e., leopards, lions, pythons, crocodiles, cheetahs and wild dogs. Baboon sleeping roosts are monitored regularly at night for leopard attack. Night attacks are observed with a spotlight.

### **Lions**

Baboons encountered lions 23 times during daylight and twice at dusk. On another four occasions baboons gave loud, continuous alarm barks suggesting that lions were present, but observers could not confirm this. Lions attacked the baboons during eight of these encounters. One adult male and one adult female were killed and six attacks were unsuccessful. All attacks were by a lioness with two large cubs ( $\frac{3}{4}$  size) who joined the hunt on at least two occasions. These three lions were seen frequently within the range of the two focal baboon groups. Male lions were only seen once during this interval.

There were two incidental records of apparent lion predation upon baboons near Chief's Island. On one occasion several lions were seen eating a fresh baboon kill<sup>11</sup> and on a second occasion lion spoor were found near a freshly-eaten baboon carcass.

Baboons of all age/sex categories respond to lions by fleeing up trees and giving alarm barks which persist as long as the lions are visible or in close proximity. Baboons sometimes maintain proximity to lions in low-risk situations, for example in an unbroken woodland canopy where movement between trees is safe. Baboons may follow lions up to several hundred metres until the lions have moved away from the group. This 'harassment' tends to be from adult and subadult males more often than from female and immature baboons. Baboons threaten nearby lions by shaking branches and giving alarm barks. This form of harassment involves little or no risk because it is usually done from an arboreal position and after the initial threat of ambush is over.

Seven attacks were from the front of the group, i.e., from the direction in which group members were traveling. Another attack was from behind a termite mound after several baboons and an observer had passed within a few metres. Human presence probably delayed this attack. The frontal attacks suggest that this lioness may anticipate the movement of baboon groups and wait in ambush for baboons to approach. Lions never pursued baboons for more than 100 m. and these longer chases did not appear to be at full speed. All attacks were in the daytime, an unusual time for lions to hunt. Some of the attacks may have been opportunistic if lions were resting when baboons approached.

One kill was an adult male (C troop) traveling at the front of the baboon group. Observers first saw the lioness with the kill a minute after the initial flurry of alarm barks. The kill site was grassland with scattered *Acacia erioba* trees and a fallen tree and small termite mound that would have been adequate cover for a lion ambush. The second kill was an unidentified female (Z troop) who probably was ambushed in dense woodland. Again, observers found three lions with the carcass a minute after the kill was made. Alarm barks by other baboons persisted for an hour as the lions consumed the kill in an open floodplain.

Lions may directly influence baboon travel patterns. On several occasions travel direction reversed immediately upon encountering lions. Two attacks were within 1 km of a sleeping roost, and in both cases the baboons moved no farther than 200 m from the roost the following day. This contrasts with their average daily range of several kilometers. Baboons usually show great caution when entering areas of thick cover and they frequently give false alarms. Areas of known high risk are not always avoided. On one occasion baboons sighted lions in the distance, ventured into the area three hours later and were unsuccessfully attacked.

### **Leopards**

Leopards attacked baboon sleeping roosts six times and made three kills. We were able to monitor these attacks because we sleep at or near the baboon roosts whenever possible. One of

the two baboon groups under study regularly slept in the tall *Acacia nigrescens* trees at our camp. There have been no verified leopard attacks at this camp roost, possibly because leopards are avoiding humans. There were three leopard attacks, including one kill of an adult female (X troop) during 45 nights at a roost 4 km from camp and utilized primarily by W troop. Alarm calls attracted us to three other leopard attacks upon baboons roosting near but not directly at the camp. These attacks resulted in one kill of an adult female (Z troop) and one kill of an adult male (C troop).

There were two incidental records of leopard predation upon baboons. In both cases leopard spoor were found near a fresh baboon carcass, one an adult male and one a subadult male.<sup>12</sup> Also a leopard was seen attacking a baboon roost at dusk. but the attack was disrupted by the presence of observers.<sup>13</sup>

Our records of leopards attacking baboon roosts at night are a unique set of observations and are briefly described here.

August 14, 1978. At 0400 there was an outburst of alarm barks by Z troop baboons at a roost two kilometres from camp. There was a second set of alarm barks at 0600. When the observer arrived at 0620, a leopard had a fresh adult female baboon kill 15 metres up a tall *Diospyros mespiliformis* tree. The carcass was still completely intact and the kill probably coincided with the second set of alarm barks. Approximately twenty baboons were threatening the leopard from within ten metres in the same tree. Upon seeing the observer, the leopard abandoned the kill and fled from the tree as baboons scattered in avoidance. The leopard returned later that day to consume the kill.

July 7, 1979. At 0200 an adult leopard attacked the C troop roost 600 m from camp. We arrived to find the leopard 15 metres up a tall *D. mespiliformis* tree in the middle of the roost. Numerous baboons were also in this tree and within ten metres of the leopard. The leopard was standing on a thick branch near the trunk and the baboons were on smaller, terminal branches. The leopard descended from the tree and ran away a minute after we arrived.

July 12, 1979. At dusk (1830) we were attracted again to an outburst of alarm barks near camp. When we arrived a leopard was dragging a freshly-killed adult male baboon along the ground beneath the roost. Upon our arrival the leopard abandoned the carcass, which was still completely intact except for a slashed throat. Evidence suggested that the baboon had been ambushed while sitting on or near the ground in dense cover. The baboon apparently fled up a *Croton megalobotrys* tree but was caught and pulled to the ground. We collected specimens and measurements from the carcass and returned it to the kill site. The leopard did not return to the carcass, but instead hunted baboons in the trees for another two hours, unsuccessfully.

July 29, 1979. A leopard was at the W troop roost when observers arrived at 2115. Baboons gave continuous alarm barks as the leopard remained below on the ground. The observers then moved away to avoid interfering any further. Subsequent alarm barks suggested that the leopard climbed the roost trees in attack, but this was not confirmed. The leopard remained at the roost until at least 0230 and no kill was made.

August 11, 1979. An adult and immature (2/3 size) leopard attacked W troop at 2115 and hunted baboons unsuccessfully until sunrise. The leopards made several separate attacks into different trees and one of these attacks lasted for 2 ½ hours. During this interval the adult leopard was 10 m. up an *A. nigrescens* tree in which an adult female baboon was apparently "trapped" at the end of a branch. The trapped baboon gave "fear" barks during the entire interval and remained at the branch tip out of the leopard's reach. The immature leopard was five metres up this same tree but did not actively hunt.

September 25, 1979. An adult and immature leopard attacked X troop at 0355. The baboons gave continuous alarm barks and both leopards were observed ten metres up a *Diospyrus mespiliformis* tree in the middle of the roost. The leopards descended from the tree five minutes later and slowly walked away. Observers left the roost area to avoid disturbing the leopards any further. Upon our return 1 ½ hours later the leopards had killed an adult female

baboon. They consumed part of the kill then cached it in a tree before finishing it later that day.

These preliminary observations suggest the following features of baboon-leopard interactions:

1. Leopards only attack baboons at night or at dusk. No attacks have been seen during thousands of hours of daytime observation.
2. When leopards attack a baboon roost they may remain at the roost for long intervals, and sometimes for the entire night. Two kills appeared to have been made at least an hour after leopards first attacked the roost. Thus, surprise is not a necessary element of successful attack, although one kill appeared to have been made in surprise.
3. Baboons seek refuge on the outer, terminal branches of tall trees, especially *Acacia nigrescens* and *Diospyros mespiliformis*. Leopards weigh significantly more than most baboons and may be unable to capture baboons that take refuge on small branches.
4. How leopards actually make kills is uncertain. A male baboon killed at dusk appeared to have been ambushed on the ground, but most attacks occur at night in the roost trees and none of the night kills were observed directly.
5. Earlier studies and anecdotal accounts suggest that adult male baboons may harass and attack leopards in some circumstances.<sup>4</sup> Our observations to date are inconclusive. We have seen baboons harass spotted cats on three occasions during the daytime. On one occasion a half-grown, immature leopard was chased for 200 metres by half of W troop to an isolated *Acacia hebeclada* bush where it was 'mobbed' for 20 minutes by baboons of all age/ sex categories. On two other occasions adult male baboons chased a large spotted cat, either a leopard or a cheetah. The predatory habits of these two cats are strikingly different, and specific field identifications are still needed to distinguish between baboon responses to these predators. These observations agree with the general lore that adult male baboons sometimes harass medium-sized predators. However, almost all anecdotal accounts of male baboons harassing leopards have been in the daytime. The relevance of daytime observations to the leopard's nocturnal hunting habits is unknown. Leopards appear to enter baboon roosting trees with relative impunity, and we have not yet seen any defence by adult males at night.<sup>14</sup>

### Other predators

Large pythons elicit a strong reaction from baboons,<sup>4</sup> suggesting that these snakes are a serious predatory threat. Baboons mobbed large pythons (i.e., three to five metres) on nine occasions. This mobbing was performed primarily by juvenile and adult female baboons who typically surrounded the python within distances of a few metres and threatened the snake for up to 20 minutes. The alarm call given by baboons to pythons is a sharp 'geck,' in contrast to the loud barks issued to lions and leopards. Pythons are the only snakes that elicit such a reaction.

Crocodiles are a potential threat to baboons for part of the year. During the floods, baboons regularly swim across inundated floodplains inhabited by crocodiles. Before crossing deep water baboons may survey the channel for up to an hour. Commonly, all group members cross at once in a tight file. The slow travel necessitated by swimming may also increase vulnerability to lion attacks. Vigilance at water crossings may, therefore, be a precaution against crocodile or lion attacks. Precise determination of the function of baboon vigilance at water crossings cannot be made until predatory attacks are observed. Baboons sighted crocodiles on at least five occasions, but not in the context of water crossings. They responded in all cases with alarm barks.

Baboons encountered wild dogs four times, and three of these encounters were under unusual circumstances: once the dogs were chasing impala, once they were eating an impala, and the third time a lioness was attacking the baboons. In these and a fourth encounter, the baboons reacted to the dogs with little more than a few alarm barks. Wild dogs were rarely seen in the study area and they appear to be specialized predators of impala and other medium-sized antelope. Our observations are sparse, but they suggest that wild dogs are not a major threat to

baboons.

Hyenas were encountered on numerous occasions. Baboons sometimes gave alarm barks and always avoided any close approach by hyenas, but hyenas usually were ignored unless they were in close proximity.

No alarm calls were given to any of the common raptors, e.g., fish eagles, snake eagles, and fishing owls. On a few occasions baboons sat in trees within arm's reach of fish eagles.

Hippos were seen several times in a lagoon near one of the sleeping roosts. Baboons usually responded with several alarm barks. Hippos are unlikely to be dangerous to baboons, and it seems unusual that baboons would respond to hippos in this manner.

Baboons spotted poachers on at least ten occasions. Their response, possibly specific to humans, is a soft-to-medium tone bark, issued from distances of up to 500 m. Baboons avoided any close approach by unfamiliar humans. There are no records of humans killing baboons in our area.

### **Discussion**

During the course of our study we have established no causes of adult mortality other than predation. Other possible mortality causes could include disease, old age, falls from trees, and injuries inflicted during fights between males.<sup>9, 15, 16</sup>

Twenty-five adult males disappeared from our focal groups during the study period: fifteen transferred to other groups,<sup>17</sup> two were killed by predators, and eight disappeared of unknown causes.

In contrast, females remain in their natal group for their entire lives. While some exceptions have been reported from other sites,<sup>17, 18</sup> we have detected no female emigration from the two focal groups, and there have been no female immigrations to the focal groups. If female transfer were a feature of our baboon population, we should have at least seen immigration to the focal groups. Seven adult females disappeared during the study interval. None of these individuals had any obvious physical impairments, and all of them could have been taken by predators, as have at least three adult females in adjacent groups (X and Z). Maximum annual adult mortality based upon female disappearances over the thirty month interval is estimated at 8%.

Our observations of predator attacks upon baboons are more extensive than those reported from other baboon field sites, despite the relatively short duration of our study. Several factors may account for this intersite variation in predator observations.

1. **Reduction or elimination of predator populations:** At some sites, for example Gilgil Ranch in Kenya and Gombe National Park, Tanzania, predator populations have been greatly reduced (e.g., leopards) or eliminated (e.g., lions) by human encroachment or hunting. No lion or leopard predation has been reported from these sites, and in the case of Gilgil, the baboon population is expanding rapidly.<sup>19</sup> While this expansion may stem from other causes, human disturbance has greatly reduced the opportunity for mortality through predation.
2. **No night observations:** Predation upon many primate species may occur mostly at night, and without night observations, such predation will not be seen. Our small sample of leopard attacks upon baboons is the most extensive to date, but to my knowledge there have been no other attempts to monitor baboon groups at night for leopard attack.
3. **Predator preferences for prey may vary between sites:** In some parts of East Africa baboons appear to take a more casual response to lions,<sup>20</sup> and possibly lions attack baboons less frequently at these sites. Predation rates should also be a function of population densities as well as predator preferences for prey.
4. **There are few studies of primate predators:** Predator-prey relationships can be studied more effectively from the perspective of the predator. The home range of a solitary predator usually overlaps numerous prey groups, and a predator may hunt a prey species

on a daily basis while only attacking specific groups on occasion. All attacks could be seen by observing the predator, but few attacks would be seen by observing a specific prey group. Not surprisingly, the most extensive observations of predation upon primates have been of chimpanzees killing red colobus monkeys at Gombe National Park.<sup>21, 22</sup> Here the predator, the chimpanzee, was the focus of study.

5. **Observer interference:**<sup>23</sup> The potential to observe predation is greatly reduced whenever the predator and / or prey is unhabituated to human observers. Most primate predators are wary of humans and will not attack primate groups when humans are nearby. Although lions in Moremi are relatively unconcerned about humans, observer presence has probably disrupted at least two potential lion ambushes upon baboons. Leopards are more wary of humans and may flee from observers at great distances. Leopards are primarily nocturnal hunters and our spotlight observations of leopard attacks at baboon roosts at night may nullify conditions favorable to successful attack. Presently, we avoid using a spotlight while a leopard is actively hunting.

Our observations show that predation is an important mortality factor in a contemporary baboon population and lend support to the idea that predation has been a leading selection factor in baboon evolution. Jolly<sup>24</sup> points out that few people have actually seen a primate caught by a predator and concludes that predation pressure upon adult primates is surprisingly light. However, most primate studies have not been tailored to observing predation and have been plagued by problems of observational bias. Our observations of leopard predation were possible only because we made specific efforts to monitor baboon roosts for predation at night. However, even here observational biases probably limit us from seeing predation at the level it occurs naturally.

## NOTES

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7. Other African primates forming multi-male groups include red colobus monkeys, *Colobus badius*, and vervet monkeys, *Cercopithecus aethiops*.
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10. In 1968 chimpanzees killed ten young baboons at or near the banana provisioning station in Gombe National Park, Tanzania (Teleki, G. 1973. *The Predatory Behavior of Wild Chimpanzees*. Lewisburg: Bucknell University Press). However, chimpanzees rarely attack baboons under less modified conditions (see notes 21 and 22).
11. Janine Owendale, personal communication.
12. Peter Bestelink, personal communication.
13. Lloyd Wilmot, personal communication.
14. During one attack an adult male baboon sitting 10 m from a leopard in the same tree gave "jaw-grinding" vocalizations. This occurs during some confrontations between male baboons, and appears to signify a willingness to attack.
15. An adult female fell from the roost at night during a lightning storm and appeared to be in a state of shock. She sat beneath the roost for two days before rejoining the group. Eventually she recovered fully.
16. Infant mortality is described in detail elsewhere and may stem primarily from infanticide by adult males (Busse, C., W.J. Hamilton III and S. Smith. In preparation. Infanticide and infant protection by adult male chacma baboons.)
17. Packer, C. (1979) "Inter-troop transfer and inbreeding avoidance in *Papio anubis*". *Animal Behavior*, 27: 1-36.
18. Dennis Rasmussen, personal communication.
19. Linda Scott, personal communication.
20. Stuart Altmann, personal communication.

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