Short communications

Black rhinoceros (*Diceros bicornis*) calf succumbs after lion predation attempt: implications for conservation management

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Received 30 January 2009. Accepted 22 June 2009

Actual observations of black rhinoceros predation are rarely reported and are limited to two incidences involving subadults. Nevertheless, some authors attribute tail and ear deformities in up to 7.1% of some populations to predation attempts. In August 2008 we observed a mother with dependent *c.* 8-month-old female black rhinoceros calf in Hluhluwe-iMfolozi Park, South Africa. The calf had a recently amputated tail, wounds to the anogenital region, right posterior flank and right side of the neck resembling a lion attack. Thirteen days later and on three subsequent occasions, the mother was sighted alone, suggesting that the calf had succumbed to its injuries. This incident provides evidence to suggest a link between attempted lion predation and tail amputation in black rhinoceros. Significantly, it implies that amputated tails and ears throughout Africa may represent failed depredation attempts and that calf predation may be more prevalent than previously appreciated. Predation is seldom considered in the management of black rhinoceros but should be when attributing cause to poor population performance of this critically endangered species.

Key words: *Diceros bicornis minor*, predation, tail amputation, conservation management.

Reports of black rhinoceros (*Diceros bicornis*) predation are rare. Owing to the large size of adults, they are largely immune to non-human predation (Schenkel & Schenkel-Hulliger 1969; Owen-Smith 1988; Berger 1994), but young black rhinoceros may be vulnerable to predation by spotted hyaenas (*Crocuta crocuta*) and lions (*Panthera leo*) (Skinner & Smithers 1990). The only documented case of lions killing black rhinoceros are three subadults depredated at a waterhole in Etosha National Park, Namibia (Brain *et al.*1999). Elliot (1987) also presents circumstantial, but persuasive, evidence that a lion killed a two-year-old black rhinoceros in Hluhluwe-iMfolozi Park (HiP). Other evidence presented in support of calf predation is limited to observations of unsuccessful attempts, apparently healthy and nutritionally dependent calves not sighted again with their mother, and particularly ill-formed or missing parts of ears and tails (Goddard 1967; Kruuk 1972; Hitchins & Anderson 1983; Sillero-Zubiri & Gottelli 1991). Ill-formed or missing ears and tails can be common in black rhinoceros populations (e.g. HiP: 3.7–4.0% of individuals, Hitchins 1990; Emslie 1999; uMkhuze Game Reserve (uMGR): 7.1% of individuals, D. Kelly, pers. comm.) and might indicate, therefore, the potential for high calf mortality. Missing calves and apparent mutilations, however, might not be injuries from predators but caused by accident, disease or parasitic and genetic deformities, and failed attempts do not necessarily indicate other successful depredations. Thus, there is uncertainty about how important predation is in black rhinoceros population dynamics.

Uncertainty about the frequency of juvenile black rhinoceros predation means that it is rarely considered in the conservation management of this critically endangered species (IUCN 2008). When comparing black rhinoceros population performance in different reserves, relatively poor fecundity and low population growth is usually

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attributed to over-stocking and habitat deterioration (Emslie *et al.* 2001; Reid *et al.* 2007), although the reserves compared differ in their densities of large predators. Some reserves do not have large predators, but in others predators occur at remarkably high densities and could contribute to poor population growth (Balfour 2001). Between 1990 to 2003, four out of seven calf deaths in the Ngorongoro Crater, Tanzania, were due to predation (Amiyo 2003), suggesting that for some populations predation can severely limit population growth.

In this context, the disappearance of a maternally dependent black rhinoceros calf after a predation attempt that amputated its tail and left it with multiple wounds, resembling a lion attack, indicates that predation of juveniles may be more common than previously appreciated. We detail this observation and discuss the potential importance of predation in the management of black rhinoceros.

Observations

Observations of adult female, ear notch sequence number 321 and identification code C441, were made from July to September 2008 as part of a project investigating the reproductive performance and ecology of black rhinoceros in HiP (described in Plotz *et al.* 2008). Observations were made with the unaided eye or assisted using binoculars (Nikon 8 × 40) and field spotting scope (Bushnell 20 × 60).

C441 had been regularly sighted by field rangers in the Masinda and Nqumeni sections of HiP since 4 November 2003, when she was first ear notched and her age estimated as between 3.5 and seven years old. On 26 September 2007 she was captured for translocation but instead released at the capture site because she was assessed as pregnant. C441's sighting record indicates that the subsequent female calf, her first documented, was born between 9 and 30 December 2007. We first sighted C441 when her calf was aged about seven months (21 July 2008). The calf was injury free on that occasion.

On 14 August 2008 field ranger Bom E. Ndwandwe and R.D.P. were walking in the Nqumeni section monitoring a different female black rhinoceros fitted with a horn-implant radio-transmitter, when they sighted female C441 accompanied by her female calf with injuries. The calf's injuries included tissue trauma to the anogenital region with an amputated tail, claw or canine puncture wounds to the neck region and skin lesions resembling claw marks to the rump and right posterior flank (Figs 1 & 2). On four subsequent occasions, 27 August, 9, 14 and 22 September 2008, C441 was sighted without her calf. Observations after 22 September 2008 were not possible as she was translocated to another reserve.

Discussion

Eight-month-old black rhinoceros calves are still nutritionally dependent on their mothers and so the confirmed disappearance of C441's calf suggests that the calf succumbed to its injuries. We did not witness the lion attack or recover the calf's carcass and so spotted hyaena cannot be ruled out as a potential cause of the calf's wounds or ultimate disappearance. However, three characteristics about the record of sightings and photographic evidence are consistent with an attack by at least two lions (1) Puncture and tear wounds at the calf's neck suggest one lion attempted to suffocate the calf in the fashion typical of lion attacks on ungulates (Skinner & Smithers 1990). Elliot (1987) and Brain *et al.* (1999) report similar puncture wounds to the neck in subadult black rhinoceros killed by lions. (2) Tissue trauma, severed tail, and claw marks suggest that another lion attempted to feed from the anogenital region. Brain *et al.* (1999) witnessed a lioness beginning to feed between a subadults back legs during an attack, while Elliot (1987) discovered a subadult carcass with anogenital wounds consistent with this feeding behaviour. (3) Hyaena claws are unable to make the skin lesions at the rump and along the back and flank of the calf, all of which were characteristic in spread and size of lion claws and canines (Skinner & Smithers 1990). In addition, the tissue damage, including amputated tail, was still red and weeping with dipteran maggots embedded within the tissue. This implies that the wounds were inflicted relatively recently (i.e. 1 to 2 days prior) and concomitantly, thus making it highly unlikely that spotted hyaena were able to inflict these wounds either before or after this particular lion predation attempt.

In this predation attempt the calf's tail was amputated to approximately a third of its original length. Berger (1994) states that 97% of ear and tail deformities in black rhinoceros throughout Africa (Goddard 1969; Hitchins & Anderson 1983; Hitchins 1986, 1990) can be interpreted as the scars of historical predation attempts, although there are other possible explanations such as genetic or

Fig. 1. Black rhinoceros calf (*c.* eight months old) in Hluhluwe-iMfolozi Park with recent tissue trauma to the anogenital region, an amputated tail, and puncture and tear wounds on the neck consistent with a lion attack. Note also claw marks (dark grey lines) on rump and flank and what appears to be dipteran maggots (white) embedded in raw tissue on tail and anogenital area (photograph by R.D.P.).

Fig. 2. The anterior right flank of the calf showing one of two weeping puncture wounds on the neck consistent with the canine of a lion (other puncture wound obscured by reeds and shadow) (photograph by R.D.P.).

parasite-induced deformities during development. Until now, however, there has been no direct link between these deformities and amputation during a predation attempt. Our observations suggest that tail and ear mutilations might indeed represent failed predation attempts. In 2007/08 we observed five of 93 different black rhinoceroses in HiP (5.4%) with mutilated tails or ears, similar to historical mutilation rates in the same reserve (i.e. 3.7 to 4.0%, Hitchins 1990; Emslie 1999). Importantly, in nearby uMGR where spotted hyaenas occur but not lions, five of 70 identifiable black rhinoceroses have missing ears and tails (i.e. 7.1%, D. Kelly, pers. comm.), so spotted hyaenas can also be implicated in black rhinoceros predation. These values and Ngorongoro Crater's documented 56% calf predation rate (Amiyo 2003), indicate that predation of juvenile black rhinoceros may be more common than previously appreciated.

Predation on black rhinoceros juveniles might be under-reported because both births and carcasses are rarely detected. Neonatal black rhinoceros calves are cryptic and difficult to sight. Not only are they small but mothers tend to be sedentary in densely vegetated habitat during the calves' first months of life. Thus, unless individual adult females are intensely monitored (e.g. pregnancy detection and radio telemetry, Plotz *et al.* 2008; MacDonald *et al.* 2008), parturition and neonatal mortality will typically be undetected, especially in large populations and reserves like HiP. Moreover, on the few occasions that field rangers recover black rhinoceros calf carcasses the cause of death is rarely determinable. A good illustration of this difficulty was the rescue of an ill and abandoned six-month-old black rhinoceros calf that died in the Ezemvelo KwaZulu-Natal Wildlife (EKZNW) Game Capture holding pens. The carcass was placed outside the game capture compound and on the following morning the EKZNW veterinarian could find almost no evidence that the calf had been there. Searching revealed only small pieces of its horn and jaw (D. Cooper, pers. comm.). Juvenile predation could, therefore, be common even though the evidence is not.

Black rhinoceros mothers have killed lions that threaten their calves (Goddard 1967; Owen-Smith 1988, P126–7). C441 was a young mother and maternal inexperience may have contributed to her calf's vulnerability. The offspring of inexperienced mothers tend to incur higher mortality rates (Tardif *et al.* 1984; Novak *et al.* 2000, Barber-Meyer & Mech 2008, P15). Nevertheless, our observation also indicates that maternal defence is not always sufficient to deter predators.

Conservation managers rarely factor in predation when managing a black rhinoceros population for improved productivity, although predation's role in HiP's black rhinoceros population performance has been debated before (Balfour 2001; Fanayo *et al.* 2006). Poor population performance has largely been attributed to density dependence but evidence suggests that predation of black rhino juveniles may also, at least in part, account for longer inter-calving intervals, low numbers of calves per adult female, and poor population growth. It might not be realistic to expect a black rhinoceros population living with high densities of lions and spotted hyaenas to grow as fast as one in a reserve without large predators. When attributing cause to poor population performance the presence of large predators should be considered.

We especially thank Bom Ndwandwe for his invaluable efforts in the field and are grateful for the information provided from personal communication with Dave Cooper, Head Veterinarian Ezemvelo KwaZulu-Natal Wildlife (EKZNW) Game Capture, and Dennis Kelly, Section Ranger uMkhuzi Game Reserve, EKZNW. Graham Kerley, Rosalyn Anderson-Lederer and Benjamin Pocock are also thanked for their assistance. The comments from an anonymous reviewer improved the manuscript. We are indebted to EKZNW for their support of our ongoing research (research permit no. ZC/101/01). The research was made possible through granted funds from the Australian Geographic Society, International Rhino Foundation, Rufford Small Grants (ref: 15.10.07), and U.S. Fish & Wildlife Service administered Rhinoceros and Tiger Conservation Act of 1994 (grant agreement numbers 98210-6-G102, 98218-8-G690).

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Responsible Editor: G.N. Bronner