

Notes on African Crowned Eagle *Stephanoaetus coronatus* diet in savanna and forest in KwaZulu-Natal, South Africa

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Our study reports on contrasts in prey items from African Crowned Eagle (*Stephanoaetus coronatus*) nesting in forest ($n = 1$) and savanna ($n = 2$) biomes in KwaZulu-Natal, South Africa. At least 12 taxa were identified at a forest nest, of which 92.1% were neonate/juvenile. Bovids and procaviids represented 73.7% and 19.6% of the diet respectively whilst Samango Monkey (*Cercopithecus albogularis*), a common forest species, represented only 1.7% of prey items. Other species made up 5.0% and included a range of species not found in the forest (e.g. *Ourebia ourebi*, *Lepus* sp., *Ovis capra*). At the savanna nests at least four taxa were identified, of which 73.1% of prey items were adult. The majority of prey items were identified as procaviids (87.0%) with 5.6% and 7.4% of prey items represented by *C. albogularis/pygerythrus* and other remains (e.g. *Capra hircus*, *Philantomba monticola*) respectively. In South Africa, where total forest area is reduced compared to regions further north, the dietary range of African Crowned Eagles may include a wider diversity of prey from different biomes; feeding generalisation and opportunism may therefore be an important strategy for the maintenance of African Crowned Eagles populations in the region.

Keywords: Crowned Eagle, hyrax, prey diversity, primate, oribi

The African Crowned Eagle (*Stephanoaetus coronatus*) is the only eagle confined to forest in sub-Saharan Africa (Brown et al. 1982, Boshoff 1997). Dietary composition is reported for a number of sites (e.g. Jarvis et al. 1980, Struhsaker and Leakey 1990, Boshoff et al. 1994, Schultz 2002, McGraw et al. 2006, Skorupa 2008) and includes ungulates of up to 30 kg (Brown 1971, Daneel 1979, Brown 1982, Steyn 1982). Because of its widespread distribution, where prey species diversity and abundance may differ markedly, proportions of prey items may differ significantly between regions. In South Africa, African Crowned Eagles are confined to naturally fragmented forest patches, although they utilize exotic trees (e.g. *Eucalyptus* spp.) and heavily wooded savanna for nesting (Boshoff 1997, Malan and Shultz 2002, Malan 2005). The inclusion of prey from surrounding habitats (e.g. grassland) is therefore not unexpected, and has been documented in numerous studies (see Jarvis et al. 1980, Boshoff 1997). In fact, with its extension into the grassland biome because of commercial plantations and woody vegetation encroachment, the species is quite likely to include a wider variety of non-forest prey items, than populations further north in tropical Africa where natural forest and woodland are more extensive.

Our study reports on the diet of African Crowned Eagle, determined from bones collected from a single active nest in an afro-montane forest and two inactive nests in savanna in KwaZulu-Natal, South Africa. We investigate prey species and age composition and discuss the findings in relation to habitat type and studies of African Crowned Eagle diets elsewhere in Africa.

Bones of prey remains were collected from beneath an African Crowned Eagle nest in a large emergent Outeniqua Yellowwood *Podocarpus falcatus* snag (ht = c. 15 m) deep in Ngele forest (30°31'30"S 29°40'08"E, c. 690 ha) at opportunistic intervals during late-1995 to early-1996. The afro-montane forest is surrounded by a natural mosaic of grassland and forest patches and commercial afforestation (i.e. *Pinus* sp. and *Eucalyptus* sp.). During each collection period (three periods of approximately 1 h each) the gap below the nest (c. 10 m radius from tree trunk), created by the senescing tree was searched extensively for prey remains. The nest was discovered in c. 1993 and destroyed when the tree fell over in c. June 1997. Prey remains were also collected (in a final visit to the site) from the nest structure that landed on the forest floor when it was destroyed.

During early-1996 two inactive African Crowned Eagle nest sites (estimated period of inactivity <5 years) at Umgeni valley, Howick (c. 29°29'16"S 30°15'48"E; savanna site), both in live trees within 1 km of each other, and within 100 m of the river at the base of the valley, were visited. Both nests were situated in well wooded savanna dominated by *Acacia* spp. Nests were identified as African Crowned Eagle by regular visitors to the valley, although it is unclear whether they were used by separate pairs (D. Hoddinott pers. comm. 1995, who regularly visited the site and documented the use of the nests by African Crowned Eagles). All bones beneath each nest, within a c. 10 m radius of the tree main stem were collected. Searching at each nest occurred for approximately 2 h during a single visit. All bones were identified by ARA using reference collections at the Department of Mammalogy of the Ditsong National Museum of Natural History (formerly the Transvaal Museum), Pretoria.

The presence of a selective array of species highlights the importance of studies like this in identifying and documenting prey items of African Crowned Eagle. At least 12 and four prey species were identified for Ngele forest and Umgeni valley respectively. These include a variety of species representing a wide range of age classes (Table 1). At Ngele forest, bovid (family Bovidae) remains represented 73.7% of the diet whilst procaviids represented 19.6% of prey remains. Samango Monkey (*Cercopithecus albogularis*), a species common to the forest, represented 1.7% whilst other species made up 5.0% (Table 1). At the forest site, where prey species were generally larger (i.e. bovids), more neonates/juveniles (92.1%) were recorded (Table 1). At Umgeni valley (savanna site) the majority of prey items were identified as procaviid (family Procaviidae) (87.0%), with 5.6% and 7.4% of Samango/Vervet Monkey and other remains respectively. Bovid remains were conspicuously absent (Table 1). At the savanna site, where a greater proportion of prey items were of smaller size (i.e. procaviids) there was a larger proportion (73.1%) of adults (Table 1).

African Crowned Eagle has a widespread distribution in Africa and prey items are likely to differ between regions. In our study the low number of primate remains at the forest site (1.8%), where Samango Monkeys are common (and Vervet Monkey absent), contrasts to the diet of African Crowned Eagle in East and West Africa (e.g. Mitani et al. 2001, Shultz 2002, Sanders et al. 2003, McGraw et al. 2006, Skorupa 2008). This may reflect the overall availability of prey to African Crowned Eagles at the site, however, Samango Monkeys are vocal and may appear more common than many other species (i.e. bovids). Therefore, until prey densities at both sites are

known, we are unable to infer whether preferences for any specific prey type are significant. In a South African study cercopithecids made up a slightly higher proportion (8%) of the diet in both biomes, suggesting there may be unique differences in prey proportions between individual nesting sites and pairs (Boshoff et al. 1994). In forests, African Crowned Eagle may specialize in feeding on monkeys, particularly when diversity is high (Mitani et al. 2001, Shultz 2002). However, large proportions of primate prey may reflect abundance of natural primate populations rather than preference (Sanders et al. 2003). In two studies at Tai Park, Ivory Coast, where eight cercopithecoid monkey and at least two prosimian species were present, 49% (Shultz 2002) and 56% of prey items were primates (McGraw et al. 2006). In other studies, primates represented much higher proportions of African Crowned Eagle diets; 81% at Ngogo in Kibale National Park (Sanders et al. 2003), 84% in Kibale Forest (Struhsaker and Leakey 1990) and 88% in the Kanyawara area of Kibale (Skorupa 2008). In some cases temporal changes may occur in response to prey abundance (as a result of humans), such as in the Matumbi Hills of Tanzania where Blue (Samango) Monkey dietary contributions decreased from c. 80% to 20% with an increased clearing of farmlands in the vicinity of nest sites (Msuya 1993). However, despite our limited sample size, our study suggests that African Crowned Eagles are not prey specialists for primates and in southern Africa have diversified their diet (Boshoff et al. 1994).

Interpretations of diets for species are often speculative and greatly influenced by sample size. Although our data are from a limited number of nests (*cf.* Boshoff et al. 1994; $n = 34$), we stress their value in contributing to a greater understanding of African Crowned Eagle diets throughout their range. In the savanna biome, the dietary proportions in our study varied from those identified by Boshoff et al. (1994) with the majority of prey items constituting procaviids (87.0%) and, to a lesser extent, Samango/Vervet Monkey (5.6%) and other remains (7.4%). However, our results may be influenced by the selective removal of prey items beneath the nest by scavengers. Also, smaller species may be under-represented in the samples because small bones may be less detectable during sampling, become entangled in nest material, deteriorate more rapidly in a forest environment or are consumed whole by eagles (Msuya 1993; Chittenden and Myburgh 1994).

At the savanna site (Umgeni Valley NR) more time may have passed since the last nesting episode, resulting in greater removal of prey remains from beneath the

nests. However, the high proportion of procaviid samples may be associated with a period of high procaviid abundance in the region (CTS pers. obs.). Bovid remains were conspicuously absent from Umgeni valley despite nests being located in a reserve (Umgeni Valley NR) where such prey is abundant (CTS pers. obs.). At the forest site (Ngele), bovid remains represented a larger proportion of the diet (73.7%) whilst procaviids represented less (19.6%). Whether such dietary proportions represent specialist preferences or reflect prey abundance remains to be investigated. The Ngele nest was situated in a large afro-montane forest with prey dominated by small to medium sized bovinds, although some prey items may possibly have exceeded 25 kg. These large prey items may truly represent the diet of African Crowned Eagles in the region, although it is not unreasonable to assume that some may have been sourced from illegal snaring methods in the forest (Brown et al. 1982, Msuya 1993). This requires further investigation, and considering the frequency of snares found in the forest (CTS pers. obs.), needs to be recognized as a potential source of eagle prey. The Ngele forest nest bordered communal farmlands and it is not surprising that domestic livestock was recorded as part of the prey. African Crowned Eagles have been accused of stock theft and persecuted by shooting and trapping (Boshoff and Vernon 1980, Jarvis et al. 1980). Unfortunately, we were not able to monitor the responses of local residents in the study area but suspect that they are aware of African Crowned Eagle predating domestic livestock. In suburban environments, African Crowned Eagles are known to feed on domestic cats and dogs (Boshoff 1990, Chittenden and Myburgh 1994, Ken Gordon pers. comm.) and in some urban areas they may be perceived as pests. Despite being considered a true forest species, African Crowned Eagles are known to prey on a variety of animals (Oatley 1989). It is not unexpected that they prey on species outside the naturally fragmented mistbelt mixed *Podocarpus* forest of south-eastern South Africa. This may be particularly so during fluctuations in forest resources. To maximize hunting efficiency African Crowned Eagles may thus incorporate a diversity of prey into the diet and may include atypical prey items such as fish (Sharp 2002). The ability of African Crowned Eagles to efficiently utilize abundant and available prey in quite different environments may thus ensure their persistence in the region.

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Table 1: Prey species of African Crowned Eagle as determined from bones collected at Ngele forest (forest site) and Umgeni valley (savanna site). NISP = Number of Identified Specimens; a/j/n/u = adult/juvenile/neonate/unknown (given for NISP).

Species	Ngele forest						Umgeni valley					
	NISP (<i>n</i> = 179)		Skeletal part			Age	NISP (<i>n</i> = 54)		Skeletal part			Age
	Positive	Probable	Cranial	Body	Limbs	a/j/n/u	Positive	Probable	Cranial	Body	Limbs	a/j/n/u
Samango monkey (<i>Cercopithecus albogularis</i>)	3	0	1	0	2	2a/1j	0	2	2	0	0	2a
Samango/vervet monkey	-	-	-	-	-	-	1	0	1	0	0	1a
Marsh mongoose (<i>Atilax paludinosus</i>)	1	0	1	0	0	1j	-	-	-	-	-	-
Indeterminate mongoose	3	0	0	1	2	2j/1u	-	-	-	-	-	-
Tree hyrax (<i>Dendrohyrax arboreus</i>)	9	0	8	0	1	1a/6j/2u	-	-	-	-	-	-
Rock hyrax (<i>Procavia capensis</i>)	3	1	3	1	0	2a/1j/1u	32	7	38	0	1	29a/8j/2u
Indeterminate hyrax	22	0	0	18	4	2a/2j/18u	8	0	2	4	2	6a/2j
Sheep (<i>Ovis capra</i>)	1	0	0	0	1	1j	-	-	-	-	-	-
Goat (<i>Capra hircus</i>)	-	-	-	-	-	-	1	0	1	0	0	1j
Sheep/Goat (<i>Ovis/Capra</i>)	-	-	-	-	-	-	1	1	1	0	1	1j/1n
<i>Redunca</i> sp.	0	3	0	0	3	3j	-	-	-	-	-	-
Bushbuck (<i>Tragelaphus scriptus</i>)	1	6	0	0	7	1a/6j	-	-	-	-	-	-
Oribi (<i>Ourebia ourebi</i>)	1	0	1	0	0	1j	-	-	-	-	-	-
Common duiker (<i>Sylvicapra grimmia</i>)	3	2	3	0	2	5j	-	-	-	-	-	-
Blue duiker (<i>Philantomba monticola</i>)	3	0	1	1	1	1a/1j/1u	0	1	1	0	0	1j
Indeterminate bovid (small)	12	0	5	7	0	10j/2u	-	-	-	-	-	-
Indeterminate bovid (small to medium)	6	0	1	0	5	5j/1n	-	-	-	-	-	-
Indeterminate bovid (<i>Redunca</i> size)	25	0	0	3	22	1a/24j	-	-	-	-	-	-
Indeterminate bovid (> <i>Redunca</i> size)	2	0	0	0	2	2j	-	-	-	-	-	-
Indeterminate bovid (medium)	68	0	1	18	49	66j/2n	-	-	-	-	-	-
<i>Lepus</i> sp.	1	0	0	1	0	1u	-	-	-	-	-	-
Indeterminate ibis *	1	0	0	0	1	1a	-	-	-	-	-	-
Indeterminate raptor (large)	1	0	0	0	1	1a	-	-	-	-	-	-
Indeterminate bird (chicken/guineafowl size)	1	0	0	1	0	1u	-	-	-	-	-	-
	167	12	25	51	103	12/137/3/27	43	11	46	4	4	38/13/1/2

* possibly Hadedda Ibis *Bostrychia hagedash* that sometimes forages on forest floor.